Monetary Policy, Risk-Taking, and the Macroeconomy[1]

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Keywords: financial conditions, risk-taking channel, monetary policy, structural vector autoregressions

JEL Classifications: E43, E52, E58

1 Introduction

How does monetary policy affect the economy? Traditional models, including those used by most central banks, posit that that monetary policy works primarily through what Boivin, Kiley, and Mishkin (2010, Table 1) have called *neoclassical channels*. These channels include cost-of-capital effects (higher interest rates dissuade capital investments by firms and purchases of houses and durables by consumers); wealth effects (higher interest rates reduce wealth and thus spending by increasing the discount rate applied to future returns); and exchange-rate effects (higher interest rates strengthen the currency, depressing net exports).

While each of these standard channels is important, they share the limitation of placing little or no weight on the roles of risk and risk attitudes and, in particular, on the possibility that changes over time in people's willingness to take risks affect their economic decisions. However, considerable evidence suggests that the propensities of lenders, borrowers, investors, and other economic actors to take risks do indeed vary over time. Moreover, the willingness to take risks appears to be influenced by (among other factors) the stance of monetary policy, with easier policy associated with a greater appetite for risk and tighter policy linked to reduced risk appetite. The tendency of monetary policy to affect macroeconomic conditions by changing risk appetite, risk perceptions and risk-taking has been dubbed the *risk-taking channel* of monetary transmission (Borio and Zhu 2012).

The study of the risk-taking channel has proceeded along two broad lines. First, some researchers have focused on risk-taking by financial institutions, including the effects of monetary policy on intermediary balance sheets, deposits, and the supply of credit. According to Adrian and Shin (2010),

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lower short-term rates increase lenders' profitability, the size of their balance sheets, and ultimately their risk appetite and volume of lending. In this classical definition of the risk-taking channel, the impact of monetary policy on term spreads and net interest margins is of central importance. Borio and Zhu (2012) define the risk-taking channel more broadly as encompassing various effects of monetary policy on risk perceptions and risk appetite, emphasizing the increasing importance of risk pricing and risk management in contemporary regulatory practices. They argue further that, owing to both perceptual errors and distorted incentives, managers of financial institutions tend to "reach for yield" (see below), taking greater risks when safe interest rates are low. Available evidence generally supports the existence of a risk-taking channel working through financial institutions. For example, Paligorova and Santos (2017) found that banks offer more-generous terms to risky borrowers when monetary policy is easy. Other work has documented that easier U.S. monetary policy tends to stimulate risky cross-border lending while leading international banks to increase the leverage in their own balance sheets (Adrian and Shin 2014; Bruno and Shin 2015).[2] Monetary policy also appears to affect bank lending and risk premiums via its effects on the liquidity premium and the growth of bank deposits (Drechsler, Savov, and Schnabl 2018).

A second line of research studies the links between monetary policy and risk appetite in asset markets. As we discuss further below, easier monetary policy may increase investors' risk appetite by making the economic environment appear more favorable or, alternatively, by affecting investors' attitudes towards or perceptions of risk. Greater risk appetite in turn leads to lower compensation for bearing risk (lower risk premiums) and higher asset prices. Evidence bearing on these linkages includes the work of Bernanke and Kuttner (2005), who found that monetary easing raises stock prices, not only by lowering the risk-free discount rate and raising expected future dividends, as in the traditional analysis, but to an important degree by reducing the risk premium that investors demand to hold stocks. Hanson and Stein (2015) documented a surprisingly large response of long-term real bond yields to changes in the policy rate and argued that this can only be explained if monetary policy affects bond risk premiums. Gertler and Karadi (2015) showed that monetary policy affects credit costs in large part through its effects on term premiums and credit spreads, rather than through changes in the safe rate of interest. Using financial data, Bekaert, Hoerova, and Lo Duca (2013) developed proxies for the levels of

[2] On the other hand, Chodorow-Reich (2014) found that easy monetary policy after the 2008 financial crisis, including unconventional monetary policy, made key financial institutions more stable on net and reduced financial vulnerabilities.

risk and uncertainty perceived by investors and found that both, but especially risk, respond to changes in the stance of monetary policy. Miranda-Agrippino and Rey (2020) found that easier U.S. monetary policy increases the return to risky assets globally. Taken together, this body of evidence supports the view that monetary policy has an immediate and strong impact on risky asset prices, and that some of this impact likely arises from changes in risk premiums and risk appetite.

Gaining a better understanding of the risk-taking channel is an important research program in monetary economics. This article focuses on the empirical effects of monetary policy on risk appetite in asset markets, in the tradition of the second line of research above. Our approach relies on event studies of Federal Open Market Committee (FOMC) announcements—the current state of the art in monetary economics—using high-frequency (e.g., daily) indicators of risk-taking. Empirically, this approach allows us to identify the effects of monetary policy on risky asset prices and risk appetite, and the macroeconomic consequences of those effects. From a theoretical perspective, our focus on financial markets encompasses a broader range of actors than only financial intermediaries, and the risk appetite observed in markets is in some sense "foundational" to a broad range of risk-taking behaviors.

We begin with a brief overview of the factors that determine risk appetite and why monetary policy might be one of those factors. We then turn to the event studies to estimate the responses of selected risky assets to unanticipated changes in the stance of monetary policy ("monetary surprises"), revisiting and extending the event study evidence in Bernanke and Kuttner (2005), Gertler and Karadi (2015) and related papers. Consistent with the risk-taking channel, we find that an unexpected monetary easing leads to "risk on" changes in financial markets, including higher stock returns, lower stock market volatility, tighter credit spreads, and a weaker dollar. Notably, some of these effects, especially those on credit spreads, only become fully apparent in the days or weeks following a monetary surprise and are quite persistent.

Monetary policy affects risky assets through multiple channels, and our goal is to quantify the importance of the risk-taking channel by identifying the effects of monetary policy on risk appetite. To accomplish this, we measure risk appetite as the common component of fourteen financial risk indicators. We study changes in risk appetite around FOMC announcements and, consistent with our results for individual assets, find that high-frequency monetary policy surprises—unexpected changes in risk-free rates around policy announcements—have effects on risk appetite that are strong, persistent, and increasing over time.

The finding that monetary policy has significant effects on the returns to risky financial assets supports the existence of a risk-taking channel but says nothing about the empirical importance of this channel for the broader economy. To study the macroeconomic effects of the risk-taking channel, we turn to a structural vector autoregression (SVAR) approach, in which monetary shocks are identified by high-frequency instruments (Gertler and Karadi 2015; Bauer and Swanson 2022a). Importantly, monetary policy may have effects on risk-taking not picked up by high-frequency changes in risk-free interest rates, by communicating information about, for example, the Fed's own risk assessment or reaction function. Thus, the conventional approach may be insufficient, and we therefore include changes in risk appetite as a second external instrument to identify a risk-taking monetary policy shock. Our estimates suggest that the risk-taking channel plays a quantitatively important role in the transmission of monetary policy to the broader economy, as well as to financial markets.

A particularly consequential but also very difficult question is how the existence of the risk-taking channel should affect the optimal conduct of monetary policy. Some have argued that, if easy money promotes risk-taking, and if increased risk-taking in turn raises the odds of a future crisis, then monetary policy should be less aggressive in responding to downturns, effectively sacrificing near-term economic stabilization goals in the interest of longer-run financial stability (Adrian and Duarte 2016; Adrian and Liang 2018). While this tradeoff may be valid in principle, quantitative guidance for policymakers depends on calculation of the costs and benefits of particular strategies. Unfortunately, we know too little about critical quantities—including the share of the variation in risk appetite attributable to monetary policy; the relative contributions of monetary, regulatory, institutional, and other factors to bouts of financial instability; and the long-run costs of financial instability—to do reliable cost-benefit analyses, and attempts to do such analyses have not provided clear answers (Svensson 2017; Gourio, Kashyap, and Sim 2018; Ajello and Pike 2022).[3] Moreover, the costs and benefits of alternative policy strategies may vary with economic and financial conditions.[4] Our empirical finding of the important role of changes in risk-taking and risk appetite for the financial and macroeconomic effects of monetary policy is relevant for the calculation of both the costs and the benefits of leaning-against-the-wind

[3] Boyarchenko, Favara, and Schularick (2022) survey what is known about the relationship between monetary policy and financial stability, concluding that, given the variety of factors affecting stability, clear links are difficult to identify. See also Bernanke (2022, Chapter 14).

[4] Indeed, there may be times—perhaps following a period of crisis or recession—when the risk appetites of lenders, investors, and entrepreneurs are too low to promote healthy growth. In that situation, an easing of monetary policy that is more aggressive than justified by macroeconomic conditions alone might be warranted.

policies. Therefore, our article contributes, at least indirectly, to this ongoing debate. Ultimately, however, we take no position on the broader question of how much, if at all, optimal monetary policy strategies should be modified in light of the risk-taking channel.

2 Time variation in risk appetite

A key premise of the risk-taking channel is that the *risk appetite* of investors and other economic agents changes over time. In this section we briefly discuss why such changes might occur and why monetary policy might be a source of such changes.

The returns to risky financial assets include risk premiums, the extra compensation that investors receive for bearing the risk of that asset at a point in time. In standard asset-pricing models, the risk premium on a given asset can be usefully conceptualized as the product of the price of risk and a quantity of risk. In an efficient market, the *price of risk* is common to all real and financial assets.[5] Roughly speaking, the price of risk at a given time depends both on the marginal investor's willingness to bear risk and the overall outlook for the economy—more precisely, the distribution of future marginal utilities of consumption.

Unlike the price of risk, the *quantity of risk* is asset-specific and depends on the distribution of the particular asset's possible future returns and, in particular, on the anticipated co-movement of the asset's payoffs with the marginal utility of consumption at future dates. Since assets differ in their characteristic quantity of risk, risk premiums differ across assets even though the price of risk at a moment in time is the same for all assets.

Our concern in this article is the economy-wide price of risk or its inverse, which we refer to as risk appetite. The risk-taking channel of monetary policy is based on the idea that monetary policy can change risk appetite, which in turn affects risk premiums, asset prices, financial conditions, and the risk-taking behavior of borrowers, lenders, and investors.

Risk appetite can vary over time, for two broad reasons. First, the economic or financial outlook can change, in a way that changes future consumption opportunities. For example, risk appetite is likely to improve if the economic outlook become more favorable, say by raising the mean or reducing the variance of future consumption. Risk appetite may also reflect the financial health of lenders and borrowers: Because of asymmetric information and other frictions in credit markets, stronger lender and

[5] This statement applies to models, like the consumption-based capital asset pricing model, in which non-diversifiable risk is captured by a single factor (Cochrane 2005).

borrower balance sheets are associated with increased credit extension and more-rapid economic growth—the so-called credit channel (Bernanke, Gertler, and Gilchrist 1999). While the credit channel is always in operation, in more extreme situations, like the 2008-2009 financial crisis, widespread concerns about the solvency of lenders (including critical financial institutions) and borrowers (including both households and firms) can cause a sharp decline in risk appetite.[6]

Alternatively, risk appetite can change because of shifts in investors' underlying attitudes towards risk. It is commonly observed by both finance practitioners and researchers that investors appear to alternate between bouts of optimism and pessimism ("risk on, risk off" behavior). Such changes in sentiment are often cited as explanations of violent swings between inflows to and outflows from emerging-market economies (Chari, Stedman, and Lundblad 2020; Forbes and Warnock 2021), of periodic "flights to safety," (Baele et al. 2020), and of a global risk cycle in financial assets (Miranda-Agrippino and Rey 2022).

Modeling and predicting swings in investor attitudes is a challenging task. In an influential paper, Campbell and Cochrane (1999) formalized time-varying risk aversion by assuming habit formation in consumption. In their framework, people become accustomed to their recent levels of consumption and become very risk-averse to gambles that could result in current consumption falling close to or even below habitual levels. In this setup, effective risk aversion changes over time as consumption levels change, with people's willingness to bear risk increasing as their consumption rises relative to its habitual level. Habit formation is normally a gradual process, so whether the habit model can explain the relatively frequent changes in investor risk aversion observed in some studies is debatable. However, subsequent research has shown that the Campbell-Cochrane setup can be adapted to model other potential sources of variation in risk attitudes, including spontaneous changes in sentiment on the part of "moody" investors (Bekaert, Engstrom, and Grenadier 2010; Bekaert, Engstrom, and Xu 2022).

Variation over time in risk appetite has also been explained by the idea that, in periods of low interest rates, investors sometimes "reach for yield," accepting greater risks to gain a chance to earn what they perceive as their customary or target return. For financial institutions, reach-for-yield behavior might be motivated by distorted regulatory incentives, as when a bank faces severe and discontinuous penalties if its capital falls below a specified level; or by contractual obligations to provide customers a specified return, a feature of defined-benefit pension programs or certain insurance

[6] Gertler and Kiyotaki (2015) provide a model of periodic financial crises in the spirit of the literature on the credit channel.

contracts (Becker and Ivashina 2015). For individual investors, the tendency to reach for yield likely has a significant behavioral component. For example, it might reflect a strong preference for consuming only the current return to wealth, rather than drawing down accumulated savings (Lian, Ma, and Wang 2019; Campbell and Sigalov 2022). Overall, though, the reach-for-yield phenomenon is not well understood. Notably, we do not know if, in deciding whether to reach for yield, investors are most influenced by the current level of the nominal interest rate, the level of the real interest rate, or the current rate relative to historical norms.

This discussion suggests that monetary policy could affect risk appetite through various mechanisms. Easing the stance of monetary policy (or, perhaps, reassuring communications by policymakers) could increase risk appetite by improving the perceived economic and financial environment, for example, by upgrading the economic outlook, reducing economic uncertainty, or strengthening the balance sheets of borrowers and lenders. In this relatively benign interpretation, the extra risk-taking induced by monetary ease is a byproduct of the benefits of supportive monetary policy for the economy. The alternative possibility is that easier monetary policy increases risk appetite by acting on the underlying risk preferences of investors, perhaps in ways that could increase the economy's overall financial vulnerability. In the Campbell and Cochrane (1999) setup, monetary policy could raise risk appetite by increasing current and expected consumption relative to the consumption habit. In an environment in which investors reach for yield, the low interest rates associated with easy monetary policy—and a widening gap between target rates of return and market rates—would make investors effectively less risk-averse. Better understanding the mechanisms underlying the risk-taking channel of monetary policy would improve our ability to monitor its effects and should be an important objective for future research.

3 Monetary policy surprises and the prices of risky assets

We begin our empirical analysis by examining the effects of the FOMC's monetary policy announcements on a representative set of risky asset prices. To do so, we must take account of the fact that efficient financial markets incorporate publicly available information, so changes in asset prices that occur after an FOMC announcement should generally reflect only changes in policy that were *unanticipated* by investors. But how to distinguish unanticipated from anticipated monetary actions?

In an important paper, Kuttner (2001) showed how to measure unanticipated changes in policy by using data from the market for federal funds futures, in which investors make bets on future values of the funds rate, the Fed's principal policy instrument. By comparing the target for the funds rate announced by the FOMC on a given day to the target expected by traders in the futures market, Kuttner was able to estimate the part of each policy announcement not anticipated by investors. This *monetary policy surprise* can then be used in *event studies*, in which changes in particular asset prices in a short window of time around FOMC announcements are regressed on the surprise components of the announcements, providing an estimate of the impact of unanticipated policy changes.[7]

Kuttner's insight has been extended by much recent research, with a number of alternative measures of monetary surprises now available. In another important contribution, Gürkaynak, Sack, and Swanson (2005) incorporated information from federal funds and Eurodollar futures contracts, which capture market expectations for interest rates beyond the current meeting and collectively span market expectations for the funds rate from the current meeting to as far as a year out.[8] They showed that the monetary surprise at each FOMC meeting could usefully be divided into two parts: news about the current target for the funds rate (a "target factor") and news about the funds rate's expected future path (a "path factor"). The latter captures the Fed's forward guidance about the policy rate and often played a large role in determining asset prices. Nakamura and Steinsson (2018) used the same futures contracts but measured the policy surprise series as the first principal component (i.e., common component) of the futures rate changes around the FOMC announcement. Similarly, Bauer and Swanson (2022a) constructed a monetary surprise measure, equal to the first principal component of the first four Eurodollar contracts, but they revised and extended the dates and times of FOMC announcements back to 1988.

The event-study literature has significantly enhanced our understanding of monetary policy, including its effects on risky asset prices and risk premiums (e.g., Bernanke and Kuttner 2005; Gertler and Karadi 2015; Gilchrist, López-Salido, and Zakrajšek 2015; Hanson and Stein 2015). In what follows, we revisit and extend this evidence, before turning to a key underlying driver in the next section, namely changes in the common price of risk (risk appetite).

[7] The financial market reaction to FOMC announcements may also reflect non-conventional effects, including so-called information effects, which occur if the central bank's announcements reveal private information about the state of the economy (Nakamura and Steinsson 2018; Cieslak and Schrimpf 2019; Jarociński and Karadi 2020), misperceptions about the Fed's systematic response to economic conditions (Bauer and Swanson 2022a; 2022b), or new information about how the central bank interprets or forecasts economic conditions (Byrne et al. 2021). Similar to Bauer and Swanson (2022a), we found that accounting for these effects did not affect our high-frequency event-study results.

[8] Eurodollar futures contracts allow traders to speculate on future values of the London interbank offer rate (LIBOR), a short-term interest rate that moves closely with the federal funds rate.

Using the event-study method, we estimate the effects of monetary policy surprises on the prices of five daily measures of financial risk: (1) the S&P 500 stock market index; (2) the CBOE S&P 500 volatility index (VIX); (3) the spread of long-term Baa-rated corporate bond yields over ten-year Treasury yields; (4) a high-yield corporate bond option-adjusted spread over Treasuries (HY OAS); and (5) the trade-weighted U.S. dollar exchange rate against advanced foreign economies, constructed by the Federal Reserve (Dollar). Our prior is that a tightening of monetary policy, and the resulting reduction in risk appetite, should lower stock prices, increase the volatility of equities, increase the two corporate spreads, and strengthen the dollar (a safe-haven currency). We use three measures of monetary surprises, described above: the monetary policy surprise series of Bauer and Swanson (2022a), which we will refer to as MPS; the target and path factors of Gürkaynak, Sack, and Swanson (2005), which separately capture news about the current target and the expected future path of the funds rate; and the surprise measure of Nakamura and Steinsson (2018), NS.[9]

[9] The Bauer-Swanson MPS measure is normalized to have a unit impact on the fourth Eurodollar contract, while the NS surprise is scaled to induce a move of 1 percentage point on the one-year Treasury yield. The target and path factors are normalized so that the former has a unit effect on the current fed funds rate and the latter has a unit effect on the fourth Eurodollar futures rate.

Table 1: Within-day asset price responses to a surprise monetary tightening

	(1) S&P 500	(2) VIX	(3) Baa spread	(4) HY OAS	(5) Dollar
(A) Bauer-Swanson (2022)					
MPS	-6.82	6.41	-0.22	-0.07	1.23
	(-4.86)	(3.37)	(-5.53)	(-0.35)	(3.01)
N	315	267	315	193	315
R^2	0.13	0.06	0.09	0.00	0.03
(B) Gürkaynak-Sack-Swanson (2005)					
Target factor	-4.14	1.59	-0.08	0.02	0.82
	(-2.49)	(0.80)	(-1.43)	(0.12)	(2.00)
Path factor	-5.02	7.68	-0.22	-0.14	0.88
	(-2.92)	(3.88)	(-4.32)	(-0.67)	(2.14)
N	259	259	259	188	259
R^2	0.11	0.08	0.11	0.00	0.03
(C) Nakamura-Steinsson (2018)					
NS surprise	-9.40	7.97	-0.28	-0.08	1.78
	(-3.95)	(2.63)	(-3.97)	(-0.29)	(2.47)
N	259	259	259	188	259
R^2	0.11	0.04	0.08	0.00	0.03

Notes: Regressions are estimated at the daily frequency, with monetary policy surprises calculated over the 30-minute windows surrounding FOMC announcements. The S&P 500 and Dollar are measured as daily log returns, the VIX as daily changes in index points, and the Baa spread and HY OAS as daily changes in percentage points. Sample periods are determined jointly by the availability of the policy surprises and asset prices. For the policy surprises, MPS are available from Jan. 1988 to Dec. 2019, while the target and path factors and the NS surprise are available from Jan. 1990 to June 2019.[10] The S&P 500, Baa spread, and Dollar extend the entire sample, while the VIX and HY OAS begin in Jan. 1990 and Jan. 1997, respectively. Huber-White heteroskedasticity-robust t-statistics are in parentheses.

Table 1 shows the results for regressions of daily changes in the financial risk indicators on monetary policy surprises on FOMC announcement days. For the stock and foreign exchange markets, the estimates are in line with our priors. On FOMC meeting days, an unanticipated tightening of

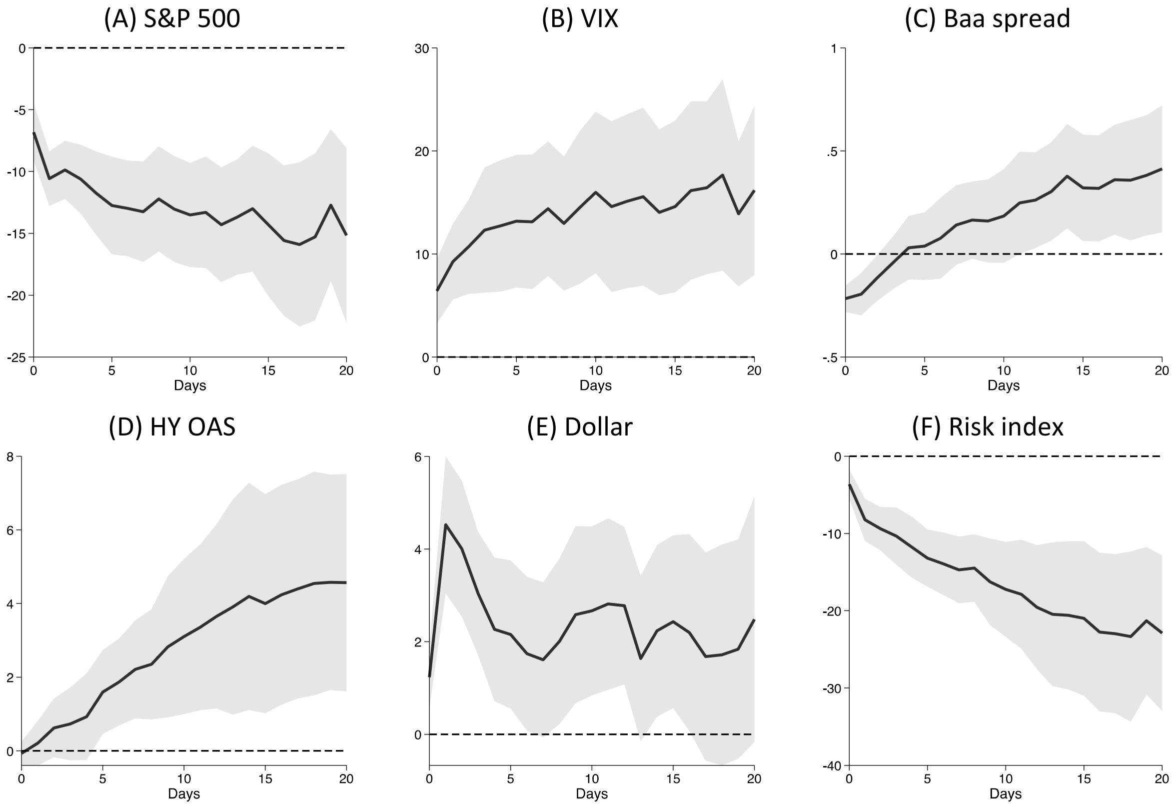
[10] As noted, the end dates were dictated by the availability of data on monetary surprises. We also thought it advisable to avoid the highly unusual COVID shock. Some previous studies have considered changes in asset prices in a short window (e.g., 30 minutes) around the FOMC announcement. Short-window data is only available for a few of the variables we will consider, so we look at daily returns for all variables. Using daily returns could add noise to the estimates, as factors other than monetary policy affect asset returns over FOMC days. On the other hand, a thirty-minute window may be too short for markets to fully digest the news conveyed by a policy announcement and subsequent communications.

monetary policy reduces stock prices, increases stock volatility, and strengthens the dollar. However, contrary to our expectation, the two credit spreads shrink in response to a surprise policy tightening.[11]

Mechanically, the reason for the negative response of credit spreads is that, on FOMC days, Treasury yields move more strongly in response to monetary surprises than corporate bond yields do. The relatively sluggish responses of corporate bond yields to FOMC announcements may reflect the lower liquidity and transparency of corporate bond markets. To check the possibility that credit spreads respond as expected but with a lag, we estimated dynamic responses by regressing multi-day changes, starting from the day before the FOMC meeting, in each of the five asset prices on MPS. The coefficients for the responses on the day of the FOMC announcement and up to 20 trading days thereafter are shown in Figure 1, as are 90-percent confidence intervals based on Huber-White standard errors. (Ignore Panel F for now.)

[11] Lower risk appetite resulting from a tightening should increase credit spreads as investors back off from riskier assets. Conventional channels of monetary transmission should also induce higher credit spreads, since tighter policy would cause a deterioration of the economic outlook, higher expected rates of corporate default, and thus higher spreads.

Figure 1: Cumulative responses to a surprise monetary tightening



Notes: Plots show the estimated slope coefficients from regressions of the cumulative changes in asset prices over 0-20 trading days, with the FOMC announcement occurring on day 0, on the Bauer and Swanson (2022a) monetary policy surprise measure. The S&P 500 and Dollar are measured as daily log returns, the VIX as daily changes in index points, and the Baa spread and HY OAS as daily changes in percentage points. The sample period for all regressions is Jan. 1988 to Dec. 2019, except for the VIX and HY OAS, which are available beginning in Jan. 1990 and Jan. 1997, respectively. Shading depicts 90% confidence intervals based on Huber-White heteroskedasticity-robust standard errors.

Figure 1 confirms the hypothesis that, once a lagged response is allowed, credit spreads do respond to monetary surprises as expected, increasing over the days following a surprise monetary tightening. Interestingly, the upward drift movement is not confined to the first few days; instead, there is an evident upward drift in spreads for some weeks after the announcement.[12] For the Baa spread, the initially negative response turns positive after four days and becomes statistically significant after twelve days. In addition, there appears to be some drift in the responses of S&P 500

[12] Because of the delayed response of spreads, Gertler and Karadi (2015, Table 1) regress two-week cumulative changes in credit and mortgage spreads on monetary policy surprises.

and the VIX, although in those cases the drift is smaller and less statistically significant.[13] Economically, the effects of monetary surprises on our chosen variables are reasonably large. For example, after ten days, a hypothetical surprise monetary tightening that raises the one-year-ahead funds rate by 25 basis points (one-fourth of the normalization assumed in Table 1 and Figure 1) is estimated to lower stock prices by 3.4 percent, raise the VIX by 4.0 index points, increase the Baa and HY spreads by 0.05 percentage points and 0.8 percentage points respectively, and strengthen the dollar by 0.7 percent.

So far, consistent with the economics of the risk-taking channel, we have shown that a surprise tightening of monetary policy depresses the prices of selected risky assets and increases financial risk. The effects appear quantitatively large and persistent and, somewhat surprisingly, credit spreads show considerable drift, rising steadily for several weeks after a hawkish monetary surprise. However, while these results are suggestive, they are qualified by the fact that the risk indicators we examined depend on other factors besides risk appetite. For example, a surprise monetary tightening presumably lowers stock prices not only by reducing risk appetite, but also by lowering expectations for future profits and raising the rate at which future dividends are discounted. To get a stronger test of the risk-taking channel, we need a cleaner measure of investors' risk appetite.

4 Changes in risk appetite around monetary policy announcements

To isolate the effects of the risk-taking channel, we construct a new index of financial risk appetite. Quite a few indexes of financial risk and financial conditions already exist (see Coudert and Gex 2008 and Datta et al. 2017 for overviews). To cite a few prominent examples: the Fed Board makes use of a "global risk-on/risk-off index" based on the average of daily returns of fifteen risky assets (Datta et al. 2017); the Federal Reserve Bank of Chicago's weekly financial conditions index, which is based on about one hundred financial indicators (Brave and Butters 2011), has a so-called risk subindex that includes the most risk-sensitive indicators; Miranda-Agrippino and Rey (2020), in their study of the global financial cycle, applied a dynamic factor model to extract a single factor from 858 monthly series of risky asset prices from around the world; and Bekaert, Engstrom, and Xu (2022) constructed a model

[13] The drift of the Baa spread and the HY spread are both statistically significant, in that the t-statistics for the difference between the twenty-day responses and the FOMC-day responses are 3.6 and 2.8, respectively. The analogous t-statistics for the S&P 500, the VIX, and the dollar are lower, equal to -1.8, 2.1, and 0.7 respectively.

of stock and bond returns, which they combined with data on corporate cash flows and macroeconomic developments to estimate daily measures of risk aversion and uncertainty.[14]

With many empirical measures of risk-taking and risk aversion already available, why construct a new index? We had several motivations. First, as our event studies use measures of unanticipated changes in monetary policy on days of FOMC meetings, we needed a measure of risk appetite at a daily frequency (or higher). (The need for daily data also dictated our use of financial variables, rather than alternative measures of risk such as capital outflows, credit growth, or leverage, which are typically available only at lower frequencies.) Second, our emphasis on measuring the short-run effects of FOMC announcements suggested a risk index focused on daily *changes* in risk appetite, as opposed to the common approach of measuring the *level* of risk-taking. Third, as the monetary surprise measures we use begin in 1990 or earlier, we wanted an index of risk appetite that covers a longer period than most. Fourth, recognizing that factors other than risk appetite affect the returns to risky assets, we sought to measure risk appetite based on a sufficiently large number of risk-sensitive indicators. Finally, we wanted our measure to be transparent, simple, and easy to replicate. We are not aware of an existing index of risk appetite that meets all these conditions.

Our new risk appetite index is based on fourteen risk-sensitive financial indicators, listed in Table 2. A number of the indicators overlap with those in the Board of Governors index (Datta et al. 2017), while others were added to push the start date of the index back to 1988. All the indicators used are available at a daily frequency, with start dates listed in the table. Our indicators include two equity indices (measured in daily log-differences), four market-based measures of volatility in stock and bond returns (daily changes in index points), six private credit spreads (daily changes in percentage points) spanning a range of key markets, and two exchange rates (daily log-differences): a broad dollar exchange rate and the exchange rate between the Swiss franc and the euro.[15] Exchange rates are included to capture safe haven effects. Of the fourteen variables included in the index, eleven are available daily back to 1997, eight are available from 1990, and six from at least 1988.

[14] In addition, various financial conditions indexes, including those maintained by Bloomberg and Goldman Sachs, aim to measure the degree to which financial conditions support economic activity and thus reflect factors in addition to risk-taking, such as the safe rate of return and market liquidity.

[15] We include among the measures of volatility the equity variance risk premium estimate of Bekaert and Hoerova (2014), which those authors find to be a good indicator of risk aversion.

Table 2: Components of the daily risk appetite index

Mnemonic	Variable	Start date	Index loading
Equity indices			
S&P 500	S&P 500 stock index	Mar. 1957	0.42
NASDAQ	NASDAQ composite stock index	Feb. 1971	0.39
Volatility			
MOVE	ICE/BofA MOVE index	Apr. 1988	-0.17
TYVIX	CBOE 10-year Treasury note volatility	May 1985	-0.15
VIX	CBOE S&P 500 volatility index	Jan. 1990	-0.41
VRP	Bekaert-Hoerova equity variance risk premium	Jan. 1990	-0.29
Credit spreads			
Baa spread	Moody's Baa corporate bond spread	Jan. 1986	-0.16
IG OAS	ICE/BofA US investment-grade corporate option-adjusted spread (OAS)	Jan. 1997	-0.27
HY OAS	ICE/BofA US high-yield corporate OAS	Jan. 1997	-0.34
CP spread	3-month commercial paper spread	Apr. 1997	-0.14
EM spread	J.P. Morgan emerging markets bond index (EMBI+) spread	Jan. 1998	-0.29
MBS spread	Bloomberg OAS for US fixed-rate mortgage-backed securities	Aug. 2000	-0.13
Exchange rates			
Dollar	US dollar exchange rate versus advanced foreign economies	Mar. 1973	-0.06
Swiss-Euro	Swiss franc-Euro exchange rate	Jan. 1999	-0.17

Notes: The loading column shows the components of the first eigenvector of the correlation matrix of the 14 variables. Equity indices and exchange rates are transformed as daily log returns, volatility indices are daily changes in index points, and credit spreads are daily changes in percentage points. The index is signed such that an increase corresponds to an increase in risk appetite. For more details on sources, see the online appendix.

All of the variables listed in Table 2 are widely viewed as being sensitive to changes in risk appetite.[16] At the same time, these variables represent different asset classes and are determined by diverse factors other than risk appetite. Thus, it is reasonable to assume that the comovement in these series is mainly driven by changes in risk appetite. Based on this assumption, our *index of risk appetite* is constructed as their common component. We calculate it using an iterative procedure that essentially amounts to taking the first principal component but deals with missing data (Stock and Watson 2002; Brave and Butters 2011).[17] Our index accounts for about 30 percent of the common variation in the 14

[16] Daily and cumulative responses to MPS of the nine component variables not shown in Figure 1 are provided in the online appendix.

[17] Specifically, we began by estimating the first principal component of the subset of data extending the full sample period. We then filled in the missing data on the assumption that the missing data have the same correlation with the estimated principal component as in the periods in which those data are available. With the

component variables, which suggests a substantial amount of comovement given the variety of different assets and indicators we include.[18] We sign the index so that an increase in the index corresponds to an increase in risk appetite. The index has mean zero by construction, and we normalize it to have a standard deviation of one.

Table 2 shows the loading of each variable on the index of risk appetite. Since the components were standardized, these loadings also reflect the individual contributions to the index. The sign of the loading indicates whether the variable moves in the same or the opposite direction as the index when risk appetite changes, and all loadings have the expected signs: Greater risk appetite, as measured by our index, is associated with higher equity returns, lower volatility of bond and stock returns, tighter credit spreads, and depreciation of the dollar and Swiss franc (the safe haven currencies). Variables related to the stock market—the two stock indexes, the VIX volatility index, and the equity variance risk premium—have the greatest influence on the index, although all the component variables have nontrivial weight.

By construction, our index captures daily changes in risk appetite. As a reality check, we can cumulate the index to produce a measure of the overall level of risk appetite at each point in time, represented by the thick black line in Figure 2.[19] Expressing the risk appetite index in levels makes it easier to see how it lines up with key historical events. As Figure 2 illustrates, large risk-off days can usually be identified with specific adverse events, such as the Lehman failure in 2008, the COVID shock in 2020, and the bursting of the dotcom bubble from 2000 to 2002. The largest daily "risk-on" events are in most cases part of reversals of large "risk-off" shocks, but upward trends in risk appetite can be seen in the latter part of the 1990s, in the period between the bursting of the dot-com bubble and the beginning of the housing crisis, between the 2011 U.S. credit downgrade and the COVID shock (with interruptions), and after the March 2020 COVID-induced financial crisis. Overall, large daily changes in risk appetite are most often to the downside. Of the 25 largest (in absolute value) changes in our sample, 20 were downward, and the distribution is skewed towards large declines, with a skewness coefficient of -1.58. In contrast, changes in risk appetite on FOMC announcement days were positive on average, with a mean of 0.25, and skewed in the positive direction, with a skewness coefficient of 0.54. Clearly, risk appetite

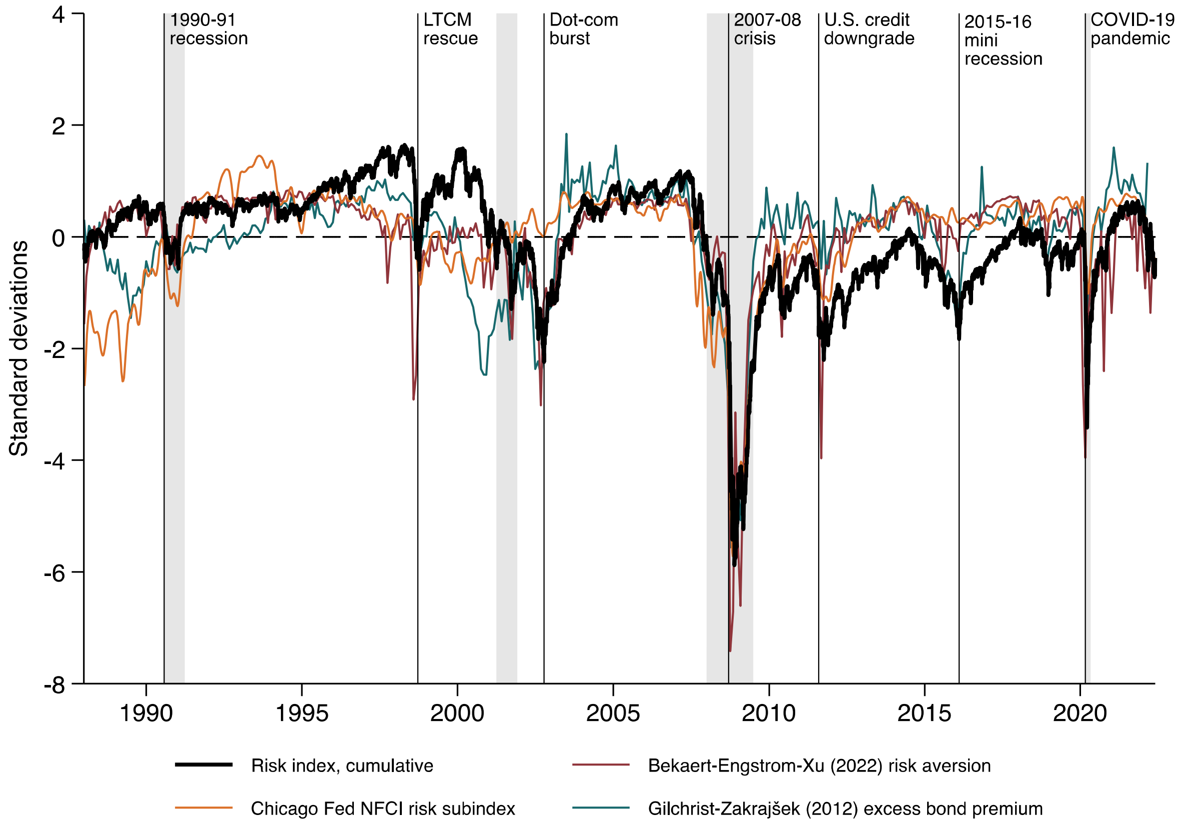
estimated proxies for the missing data, we re-estimated the first principal component, repeating the procedure until the estimated principal component was the same (within a convergence criterion) in successive iterations.

[18] For comparison, the index of Miranda-Agrippino and Rey (2020) explained 21.5% of the variation in their panel of 858 risky asset prices.

[19] Note that the level index in Figure 2 is the cumulation of the common factor of standardized, zero-mean series, and therefore by construction has no trend.

behaved quite a bit differently on days with FOMC announcements, a first sign of the effects of monetary policy.

Figure 2: Comparison of selected risk indices and market events



Notes: For visual comparison, all series are standardized to have zero mean and unit standard deviation from Jan. 1988 to May 2022. Our risk appetite index is signed such that an increase corresponds to an increase in risk appetite, while the signs of the three other series are reversed to align with our measure. Shading denotes NBER recessions.

For comparison, Figure 2 also shows three other risk indicators from the literature, based on varying approaches, all of which span the period covered by our index. These are the daily risk aversion index developed by Bekaert, Engstrom, and Xu (2022), the Chicago Fed's weekly risk sub-index, and the monthly excess bond premium constructed by Gilchrist and Zakrajšek (2012). As can be seen in the figure, the three alternative indexes give risk histories that are qualitatively quite similar to ours.[20] In

[20] To compute correlations with the Chicago Fed index and the Gilchrist-Zakrajšek excess bond premium we used weekly and monthly averages of our levels index, respectively.

levels, the correlation of our index with the Bekaert et al. index is 0.60, the correlation with the Chicago Fed risk sub-index is 0.60, and the correlation with the Gilchrist-Zakrajšek excess bond premium is 0.64.[21] Other risk indicators from the literature also give similar patterns; for example, the correlations of our index with our replication of the Board of Governors index (Datta et al. 2017) and with the Bloomberg financial conditions index, both daily measures, are 0.88 and 0.72 respectively. Correlations with other major indexes in daily changes are also generally high.[22]

Table 3: Cumulative response of the risk appetite index to a surprise monetary tightening

	Cumulative response of index				
	Same-day	5-day	10-day	15-day	20-day
(A) Bauer-Swanson (2022)					
MPS	-3.64	-13.19	-17.24	-20.99	-22.90
	(-3.11)	(-5.85)	(-4.61)	(-3.46)	(-3.75)
N	315	315	315	315	315
R^2	0.06	0.10	0.09	0.08	0.07
(B) Gürkaynak-Sack-Swanson (2005)					
Target factor	-2.20	-6.79	-11.10	-16.29	-19.36
	(-1.33)	(-2.65)	(-2.89)	(-2.70)	(-2.70)
Path factor	-2.43	-12.76	-13.85	-14.67	-13.77
	(-1.73)	(-4.79)	(-3.03)	(-2.32)	(-2.44)
N	259	259	259	259	259
R^2	0.05	0.11	0.10	0.09	0.08
(C) Nakamura-Steinsson (2018)					
NS surprise	-4.81	-18.84	-25.50	-33.14	-36.60
	(-2.32)	(-4.58)	(-4.20)	(-3.27)	(-3.56)
N	259	259	259	259	259
R^2	0.04	0.10	0.09	0.09	0.08

Notes: Results show the estimated coefficients and t-statistics from the regressions $y_{t+j-1} - y_{t-1} = \alpha + \beta mps_t + \epsilon_t$ where t denotes the day of FOMC announcements, j the number of trading days thereafter, y the cumulated (levels) risk index, and mps_t the monetary policy surprise calculated over the 30-minute window around the FOMC announcement. The sample period for MPS is Jan. 1988 to Dec. 2019, while the sample period for the alternative surprises is Jan. 1990 to June 2019. Huber-White heteroskedasticity-robust t-statistics are in parentheses.

[21] The daily version of the Bekaert, Engstrom, and Xu (2022) index has some extraordinarily large negative spikes in late 2008, reaching 25 standard deviations below its average. For readability, we display their aggregated monthly series in Figure 2. If we trim their index to exclude the top and bottom 1% of days in levels since 1990, the correlation with our index rises to 0.68 in both levels and daily differences.

[22] Correlations with alternative indicators of risk, economic and financial conditions, sentiment, and uncertainty are provided in the online appendix.

Using our new index, we can now examine how risk appetite is affected by monetary surprises. Table 3 shows the estimated responses of the risk appetite index at several horizons: on the day of the FOMC announcement and the cumulative responses over 5, 10, 15, and 20 trading days. The estimated responses are statistically and economically strong. Likely reflecting the weak or even “wrong-signed” FOMC-day responses of credit spreads, the same-day response of the index is smallest, but it is still negative and, for the MPS and the NS surprises, statistically significant at the 5%-level. Over longer horizons the estimated effects are larger in magnitude and even more highly statistically significant. Figure 1, panel F above gives a visual representation of the cumulative effects of MPS on the risk appetite index, with 90-percent confidence intervals. The drift in the response of the index mirrors that of the components, some of which are also seen in Figure 1. For all policy surprises, the cumulative drift of the index, when measured as the difference in the 20-day response and the one-day response, is economically large as well as statistically significant (t=-3.47 for MPS). Most of this drift occurs in the first five days, in that the additional cumulative response of the index between five and twenty days after the FOMC meeting tends to be smaller and of at best marginal statistical significance. This post-FOMC drift is an intriguing result that is worth further investigation.[23]

How important economically is the response of the risk appetite index shown in Table 3 and Figure 1? Since MPS is normalized to have a one-percentage point effect on the fourth Eurodollar contract, we can divide the estimated responses by four to gauge the effect of a 25-basis-point surprise. As noted, the standard deviation of our index has been normalized to 1.0, while the standard deviations over the whole sample (including non-FOMC days) of ten-trading-day and twenty-trading-day changes are 3.8 and 5.6, respectively. With this information, simple calculations show that the response of the index to a 25-basis-point monetary surprise is -0.9 index standard deviations on the day of the FOMC announcement. After ten trading days the cumulative response is -1.1 standard deviations, and after twenty trading days it is -1.0 standard deviations. Thus, the effects of monetary policy surprises on risk appetite seem relatively large, compared to the historically normal fluctuations in the index.

Importantly, event-study regressions using monetary policy surprises cannot completely capture the effects of the risk-taking channel, as they only estimate the response of risk appetite to *changes in risk-free rates* around FOMC announcements. Monetary policy changes could affect risk

[23] The online appendix provides additional results on the significance of this post-FOMC drift for the risk appetite index and the asset prices in Figure 1.

appetite through channels that are not fully captured by changes in risk-free rates.[24] Among the possible channels are central bank communication about the perceived balance of risks around the expected policy path; about changing uncertainty or skewness around this path (Bauer and Chernov 2021; Bauer, Lakdawala, and Mueller 2022); about how policymakers assess and forecast the economy (Byrne et al. 2021); about the likelihood of unconventional policies (Kuttner 2018) or backstopping a deterioration in financial conditions, i.e., a "Fed put" (Cieslak and Vissing-Jorgensen 2021); or about the policy reaction function (Eusepi and Preston 2010; Bauer, Pflueger, and Sunderam 2022).

The notion that monetary policy actions and communication can affect risk appetite independently of changes in risk-free rates is supported by our estimates in Table 3: No matter how we measure monetary policy surprises and how much delay we allow, we can only explain up to about 10 percent of the daily variation in risk appetite. To be sure, part of this daily variation in risk appetite is driven by news unrelated to monetary policy, and we could increase the explanatory power of our event-study regressions by measuring intradaily changes in risk appetite over tight windows around FOMC announcements. Nevertheless, it is hard to argue that all, or even most, of the remaining 90 percent of the daily variation in risk appetite is unrelated to monetary policy, given the importance of monetary policy for financial markets. More plausibly, a significant portion of changes in risk appetite on FOMC days appears to be orthogonal to changes in risk-free rates, but nevertheless driven by monetary policy announcements. This view is supported by text analysis linking financial market reactions to the content of FOMC statements (Gardner, Scotti, and Vega 2021), by the fact that stock prices often move in the opposite direction than one would expect based on changes in short-term risk-free rates (Cieslak and Schrimpf 2019; Jarociński and Karadi 2020), and by related event-study evidence on "FOMC risk shifts" (Kroencke, Schmeling, and Schrimpf 2021).

In conclusion, our event-study analysis suggests, first, that monetary policy surprises have significant effects on risk appetite which build even further over the days following FOMC meetings, and second, that monetary policy announcements also affect risk appetite independently of changes in risk-free rates. In the next section, which examines the effect of the risk-taking channel on macroeconomic dynamics, we will account for both types of effects of monetary policy on risk appetite.

[24] Kroencke, Schmeling, and Schrimpf (2021) argue that "monetary policy surprises extracted from changes in risk-free interest rates alone will necessarily lack an important part of the information contained in monetary policy announcements."

5 The risk-taking channel and macroeconomic dynamics

The effects of monetary policy on asset prices are of independent interest but they are only the first stage of monetary transmission. Our ultimate goal is to understand the importance of changes in risk appetite and risk-taking for the transmission of monetary policy to the broader economy.

Our analysis is based on the estimation of a structural vector autoregression. Vector autoregressions (VARs) are a popular method for summarizing the dynamics of macroeconomic variables, and Structural VARs (SVARs) add identifying assumptions that allow researchers to estimate the macroeconomic effects of (economically interpretable, independent) structural shocks, such as monetary policy shocks. A variety of methods have been used to identify structural shocks and their macroeconomic effects; for an excellent survey see Ramey (2016). We will use here an approach called the method of external instruments. An external instrument is a variable that is not included in the SVAR (hence "external") but is (1) correlated with the structural shock of interest (instrument relevance) and (2) not correlated with other structural shocks (instrument exogeneity). These properties allow us to use the external instrument to identify the structural shock and, with the aid of the estimated SVAR, to trace the responses of the variables in system to that shock.[25]

For identification of monetary policy shocks—changes in the stance of monetary policy that are not anticipated based on all available economic data—high-frequency monetary policy surprises are an appealing choice. To understand why they plausibly satisfy the required assumptions, consider a monthly time series that cumulates interest-rate surprises around FOMC announcements within each month (with zeros in months without announcements). This series does not fully capture the overall monetary policy shock for that month, but it would likely be correlated with it, and thus satisfy instrument relevance. In addition, it would likely be uncorrelated with other structural shocks affecting the economy in that month, thus satisfying instrument exogeneity.[26] Based on these considerations, Gertler and Karadi (2015) used changes in fed funds futures around FOMC announcements as external instruments for monetary policy shocks and estimated the dynamic effects of monetary policy on various macroeconomic and financial variables, including the excess bond premium of Gilchrist and Zakrajšek (2012) and the term premium in long-term interest rates.

[25] The method of external instruments is due to Stock and Watson (2012) and Mertens and Ravn (2013). It is described in detail in Stock and Watson (2018) and Montiel Olea, Stock, and Watson (2021).

[26] Bauer and Swanson (2022a) discuss practical problems with each of these two critical assumptions and propose ways to improve inference about monetary policy shocks using monetary policy surprises in externally-identified SVARs.

In the following, we will estimate the macroeconomic effects of monetary policy using the VAR specification of Bauer and Swanson (2022a, Section 5.1), who closely follow Gertler and Karadi (2015). The VAR includes four variables: log industrial production, log CPI, the two-year yield, and the Gilchrist-Zakrajšek excess bond premium (EBP) as a measure of risk. We will use high-frequency changes around FOMC announcements for identification via external instruments. However, as we discussed in Section 4, monetary policy affects financial markets, and in particular risk appetite, in ways that may not be adequately captured by changes in risk-free rates alone. Thus, conventional monetary policy surprises are likely insufficient as external instruments for monetary policy shocks that fully capture the risk-taking effects of monetary policy on the macroeconomy. Our proposed solution to this problem is to separately identify two different monetary shocks, using two high-frequency instruments.

The first type of monetary policy shock we call a *pure risk-free rate shock*, that is, a structural shock transmitted to the economy only through current and expected future values of the federal funds rate and other safe interest rates. To help identify this shock, we use the Bauer and Swanson (2022a) monetary policy surprise, MPS, cumulated over each month, as an external instrument. Recall that MPS is based on changes in current and expected future values of the federal funds rate. The second type of shock is a *risk-taking shock*, defined as the portion of the overall monetary policy shock operating through changes in risk appetite. As the external instrument for this shock, we introduce a new variable called *RISK*, which is the monthly sum of changes in our risk index on FOMC days; as such, it should capture the broader effects of FOMC communications on risk appetite.[27]

Our definitions of these two separate shocks implies that the risk-free rate shock does not affect risk-taking, while the risk-taking shock does not affect risk-free rates. By distinguishing these two shocks, our aim is to separately identify the effects of exogenous changes in monetary policy transmitted to the economy through risk-free rates and effects transmitted through changes in risk appetite. Compared to the monetary policy shock of Gertler and Karadi (2015), our risk-free rate shock is narrower, since it excludes effects on risk-taking, but together our two shocks capture a broader set of macroeconomic effects, since they include policy-induced changes in risk appetite unrelated to changes in risk-free rates.

[27] The exogeneity assumption is somewhat more plausible for MPS, which is based on 30-minute rate changes around FOMC announcements, than for RISK, which is based on daily asset prices that could be affected by other news, such as data releases that are informative about non-monetary shocks. However, FOMC announcements are major news for financial markets, so the assumption that other news on those days are of minor importance seems defensible. Future work may refine our approach by using intraday proxies for risk appetite.

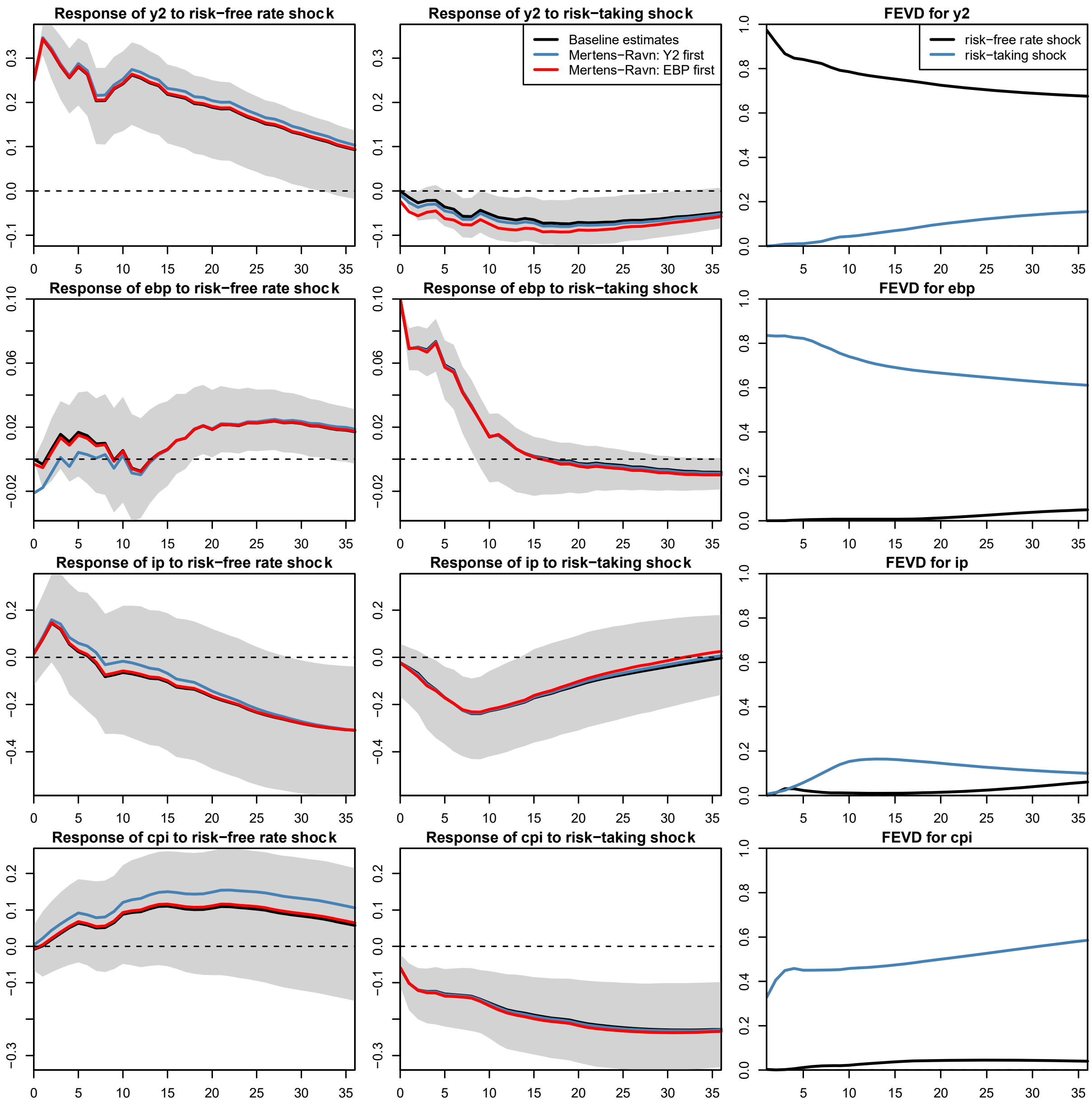
Since MPS and RISK are themselves mutually correlated, it is not possible to cleanly separate the two monetary shocks simply by identifying the former with MPS and the latter with RISK. Instead, we make two additional identifying assumptions: first, that the risk-free rate shock has no contemporaneous effect on EBP; and second, that the risk-taking shock has no contemporaneous effect on the two-year Treasury yield. These restrictions follow quite naturally from our definitions of the two structural shocks. Finally, we scale the impact effects of the shocks to a 25-basis point effect on the two-year yield and a 10-basis point effect on EBP, respectively.[28] Thus, we consider contractionary monetary policy shocks, and our risk-taking shock corresponds to a "risk-off" shock.[29]

In an SVAR with two structural shocks and two external instruments, three further restrictions are required for exact identification: two scaling assumptions or normalizations, and one additional restriction (Mertens and Ravn, 2013; Montiel-Olea et al, 2021). Our two zero-impact restrictions and two scaling assumptions therefore imply one overidentifying restriction. We found that dropping either of the zero-impact restrictions did not materially change our estimates but slightly reduced precision. As an alternative to our baseline identification, we have also considered the approach of Mertens and Ravn (2013), who use different exclusion restrictions in order to achieve exact identification in a VAR with two different structural shocks. We report estimates for each of the two specifications below.

[28] The assumption of a 10-basis point impact effect of the risk-taking shock on EBP serves the purpose of making the impulse responses to the two shocks roughly comparable in magnitude. The scaling affects only the estimated impulse responses but not their statistical significance nor the forecast error variance decompositions.

[29] The online appendix provides results on instrument relevance and details about our identification assumptions.

Figure 3: SVAR impulse responses and variance decompositions



Notes: Impulse response functions (IRFs) in the first two columns are shown for the baseline identification strategy (restricting to zero the impact response of EBP to the risk-free rate shock, and the impact response of the two-year yield to the risk-taking shock) together with 90% confidence bands based on a wild bootstrap with 5000 draws, and for the identification of Mertens and Ravn (2013) ordering either the two-year yield or EBP first. Horizons are from 0 (impact response) to 36 months. The right column shows forecast error variance decompositions (FEVDs) for each of the two structural shocks. The sample period for the VAR variables is from Jan. 1973 to Feb. 2020, and for the high-frequency external instruments from Feb. 1988 to Dec. 2019.

Figure 3 summarizes our results. The first two columns show the impulse response functions (IRFs) of the endogenous variables to each of the two identified monetary policy shocks, for horizons up to 36 months, along with 90 percent confidence bands from a wild bootstrap (following Mertens-Ravn and Gertler-Karadi). We also show IRFs for the Mertens-Ravn identification scheme, ordering either the two-year yield or the excess bond premium first in the VAR. These are generally similar to the IRFs for our baseline identification method, suggesting that the results are not too sensitive to the exact choice of additional identifying restrictions.

As is evident from Figure 3, the two shocks have vastly different effects on the four variables in the SVAR. The risk-free rate shock by construction does not affect EBP on impact, and thereafter leads to a small, mostly insignificant increase in that variable, whereas it has lasting effects on the two-year yield. The response of industrial production shows a brief movement in the "wrong" direction and then a moderate decline that only becomes statistically significant after about two years. The response of CPI shows a price puzzle, although the response is not statistically significant.

By contrast, the risk-taking shock has large macroeconomic effects that are in line with standard New Keynesian intuition. After a risk-taking shock, real activity drops significantly over about the next year before recovering. The price level falls on impact and declines further over subsequent years. The two-year yield falls slightly over the two to three years following the shock, which could be interpreted as a response of monetary policy to weaker economic conditions in the future. The positive effect of the risk-taking shock on EBP is quite persistent, lasting about one year, consistent with the idea that the risk-taking shock works substantially through risk appetite and risk premia.

The third column of Figure 3 plots forecast error variance decompositions for our baseline identification, that is, the share of the variance of each variable explained by each of the two structural shocks at various horizons. As expected, the risk-free rate shock dominates the error variance for the two-year yield, while the risk-taking shock explains the bulk of the variance of EBP. For real activity, the risk-taking shock is more important than the risk-free-rate shock, with the former explaining close to 20 percent of the variance of IP at the one-year horizon, compared to less than three percent by the latter. The biggest difference is found in the variance decomposition for the CPI, where the risk-taking shock explains between 30 and 60 percent of the variance across horizons, while the contribution of the risk-free rate shock remains below two percent.

Overall, these estimates suggest that a decomposition of conventional monetary policy shocks can yield new insights into the different channels of monetary transmission. In particular, the risk-taking channel appears to play a quantitatively important role for the effects of monetary policy shocks on macroeconomic variables documented by Gertler and Karadi (2015), Bauer and Swanson (2022a), and others. The large macro effects we have estimated for the risk-taking shock are consistent with the view that changes in risk appetite play a central role in the monetary transmission via changes in asset prices, household wealth, collateral values, and intermediary balance sheets.

We view this VAR analysis as a helpful step in the analysis of the macroeconomic effects of monetary policy via the risk-taking channel, but there are certainly caveats and we don't want to oversell these results. Neither the instruments nor the identification in our SVAR are perfect. In particular, there is much room for future research to derive even better instruments for risk-taking shocks from financial market data. We are encouraged by the fact that our main result – the strong quantitative importance of the risk-taking shock – was robust in a number of alternative VAR specifications which included other variables (such as uncertainty measures, stock prices, and the unemployment rate), replaced EBP with other measures of risk or risk premia (including our level index and other series shown in Figure 2), or used modified identification schemes. Overall, our SVAR evidence strongly suggests that the risk-taking channel is an empirically important part of monetary transmission.

6 Conclusion

The risk-taking channel of monetary policy has received increasing attention. This article has reviewed some of the evidence on this channel and provided new results on how the risk-taking channel affects both risk appetite in financial markets and the transmission of monetary policy to the macroeconomy. To measure risk appetite, we developed a new daily index, beginning in 1988, that equals the common component of changes in fourteen risk-sensitive financial indicators. We found that the response of the risk appetite index to monetary policy surprises is strong. Somewhat surprisingly, the response of the risk index and some key individual risk indicators—especially credit spreads—further builds up over the days and weeks following the FOMC announcements. That is, there appears to be a predictable post-FOMC announcement drift in risk appetite.

To evaluate the macroeconomic impact of the risk-taking channel, we used a structural VAR with external instruments and separately identified the risk-taking channel from the other effects of a monetary shock working through risk-free interest rates alone. For a variety of specifications, looking at both impulse response functions and variance decompositions, the macroeconomic effects due to changes in risk appetite appear stronger than the monetary transmission effects resulting from changes in risk-free interest rates alone.

There remain important questions that our analysis does not answer. First, our estimates do not shed much light on the mechanisms through which changes in the stance of monetary policy affect risk appetite. Our SVAR findings suggest that part of the risk-taking channel reflects direct effects of monetary changes on the risk appetites of households, firms, and market participants, consistent with a reach for yield or other behavioral or regulatory effects. But our results do not rule out the possibility that some of the effect of monetary policy on risk appetite is an indirect result of induced changes in the economic outlook, which in turn influence risk attitudes. Understanding these linkages should be a priority.[30]

Second, our results help predict the effects of monetary policy actions on the economy and markets, but they do not have much to say about the optimal conduct of monetary policy, discussed in the introduction. We do find that monetary policy has a notable effect on risk appetite, consistent with the worry of some observers that easy policies contribute to financial vulnerabilities. On the other hand, our results also show that monetary policy has stronger effects on output and inflation than can be accounted for by neoclassical policy channels alone, implying that the cost of attenuating the policy response to recessions, due to concerns about financial stability, could be high. Moreover, our results are agnostic about both the relationship between risk appetite and financial vulnerability, and about the factors that determine the likelihood and costs of financial instability. Our inclination is to believe that the probability and cost of a financial crisis—both important unknowns in the analysis of optimal monetary policy—depend heavily on the institutional and regulatory arrangements at a particular time and place.

Acknowledgements

We thank Aeimit Lakdawala, Maik Schmeling, Eric Swanson and Pascal Paul for helpful comments.

[30] Relatedly, analysis of the link between policy communication and risk appetite using machine learning and text analysis is a promising direction for future research.

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