Risk Appetite and the Risk-Taking Channel of Monetary Policy

Michael D. Bauer, Ben S. Bernanke, and
Eric Milstein

How does monetary policy affect the economy? Traditional macroeconomic models posit that monetary policy works primarily through three *neoclassical channels*: cost-of-capital effects, wealth effects, and exchange-rate effects. To illustrate these channels, consider a situation where the central bank raises interest rates in order to prevent the economy from overheating. First, the increase in the cost of capital will dissuade capital investments by firms and purchases of houses and durables by consumers. Second, higher rates will reduce the present value of various assets and the resulting wealth effects will lower aggregate spending. Third, higher rates will strengthen the domestic currency, depressing net exports. In addition, a more modern view recognizes the importance of frictions in financial markets, so that monetary policy may also affect economic activity via so-called *credit channels*. For example, tighter policy reduces both the net worth and the cash flow of firms, and these balance-sheet effects make it more expensive for them to obtain external financing, depressing investment.[1]

These standard channels are important, but they typically place little or no weight on changes in risk perceptions and risk attitudes. This omission is potentially important, because fluctuations in people's willingness to take risks naturally affect their economic decisions. Considerable evidence suggests that the propensities of

■ *Michael Bauer is Professor of Economics, Universität Hamburg, Hamburg, Germany. Ben Bernanke is Distinguished Senior Fellow, Brookings Institution, Washington, DC. Eric Milstein is a PhD student, University of Chicago, Chicago, Illinois. Their email addresses are michael.bauer@uni-hamburg.de, bbernanke@brookings.edu, and emilstein@uchicago.edu.*

[1] For further discussion of the channels of monetary transmission, see Boivin, Kiley, and Mishkin (2010). On credit channels, see Bernanke and Gertler (1995) and Bernanke, Gertler, and Gilchrist (1999).

lenders, borrowers, investors, and other economic actors to take risks do indeed vary over time. Moreover, the willingness to take risks is likely influenced by 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-taking and risk premia has been dubbed the *risk-taking channel* of monetary transmission (Borio and Zhu 2012). Rather than describing a single, specific mechanism, this channel can include a variety of mechanisms operating via financial intermediaries, institutional investors, or the behavior of households.

In this article, we discuss the role of shifts in risk appetite in the transmission of monetary policy to financial markets and the macroeconomy. Our main focus is to review and extend the empirical evidence on the effects of monetary policy on risk appetite in financial markets, the first stage of the risk-taking channel. To identify these effects, we consider high-frequency changes in financial markets, following recent empirical literature in monetary economics (Nakamura and Steinsson 2018a, b). Specifically, we use event studies of the effects of announcements by the Federal Open Market Committee (FOMC) on risky asset prices. We use financial market data around FOMC announcements to measure the unexpected component of monetary policy actions. The event studies generally show that these "monetary policy surprises" have substantial effects on the prices of various risky assets. Consistent with the risk-taking channel, unexpected policy easing leads to "risk on" changes in financial markets, including higher stock returns, lower stock market volatility, tighter credit spreads, and a weaker dollar. Similarly, unexpected tightening leads to "risk off" changes and the opposite movements in risky asset prices.

An important question is whether these estimated effects, many of which have been documented previously, are due to changes in the overall risk appetite of investors or arise from other sources, such as changes in fundamentals or the perceived riskiness of specific assets. To address this question, we develop a new index of risk appetite in financial markets based on the common component of various risk indicators from equity, fixed income, credit, and foreign exchange markets. Our working assumption, motivated by standard asset-pricing theory, is that common movements in risk premia and risky asset prices across all of these markets are due primarily to changes in the overall level of risk appetite. Using our new index, we study changes in risk appetite around FOMC announcements. We find that monetary policy actions appear to have strong and persistent effects on risk appetite, which drive a substantial component of the transmission of monetary policy to financial markets.

Although we do not provide direct evidence of the macroeconomic effects of the risk-taking channel, our results are consistent with a quantitatively important role for this channel in the transmission of monetary policy to the real economy. Changes in risk appetite and risk premia are key determinants of asset prices, wealth, collateral values, and credit costs, which in turn affect financing and spending decisions through a variety of conduits. We would also expect risk appetite in financial

markets to be highly correlated with the willingness of banks, firms, and households to take risks in their lending, investment, and borrowing decisions. However, more empirical research is needed to quantify the macroeconomic importance of the risk-taking channel, as well as to understand its implications for optimal policy and financial stability.

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 discuss why such changes might occur and why monetary policy might be a source of such changes.

The return to any financial asset includes a *risk premium*, that is, the extra compensation that investors receive for bearing the risk of that asset. The risk premium of an asset can usefully be conceptualized as the product of the *price of risk* and the *quantity of risk*—the compensation investors require for each "unit" of risk in their portfolios, times the amount of undiversifiable risk inherent in each specific asset. Indeed, most standard asset pricing models lead to such an intuitive decomposition of risk premia (Cochrane 2005).

Risk appetite, the willingness of investors to bear risk, is typically defined as the inverse of the price of risk (for example, Gai and Vause 2006). The economy-wide level of risk appetite affects risk premia in all financial markets—that is, it is common to all real and financial assets. By contrast, the quantity of risk is asset-specific and depends on the distribution of the particular asset's possible future returns. In general, an asset is riskier if it tends to have high payoffs in states of the world in which investors have high levels of consumption and thus low marginal utility. Because such an asset does not hedge against the risk of bad consumption outcomes, it is less valuable (all else equal) and investors will require greater compensation (in the form of a higher risk premium) to be willing to own it. Because assets differ in their characteristic quantity of risk, risk premia will differ across assets even if the price of risk is the same for all assets.

Why Might Risk Appetite Vary?

Much evidence and casual observation suggest that investors' risk appetite varies over time. What explains that variation? The classic consumption-based asset pricing model provides some intuition: in this model, the price of risk is the product of the representative agent's variance of consumption growth and the agent's degree of risk aversion (as determined by the curvature of the agent's utility function; see Cochrane 2005, p. 17). The classic version of the model is too stylized to be useful in practice; for example, the assumption that consumption growth is the only source of risk is too restrictive. But the model is helpful because it suggests that risk appetite may vary for two broad reasons: shifts in the economic outlook and in investors' risk preferences. We consider each of these in turn.

First, risk appetite changes when the economic or financial outlook changes. For example, risk appetite is likely to improve if the economic outlook becomes more favorable—with the result, say, of raising the mean or reducing the variance of future consumption. This link is at the core of many asset pricing theories that focus on time variation in economic uncertainty and consumption risks to generate changing risk appetite, including long-run risk models (Bansal and Yaron 2004) and models with variable consumption disasters (Wachter 2013). The economic and financial outlook can also affect risk appetite indirectly through its effect on asset values and balance sheets. Because of asymmetric information and other frictions in credit markets, stronger lender and borrower balance sheets are associated with increased credit extension and more-rapid economic growth (Bernanke, Gertler, and Gilchrist 1999), which raises risk appetite. In 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.

Second, risk appetite can change because of shifts in the underlying attitudes of investors towards risk, that is, because of time-varying risk aversion. Both finance practitioners and researchers have commonly observed that investors appear to alternate between bouts of optimism and pessimism, sometimes called "risk on, risk off" behavior. Such changes in sentiment are often cited as explanations of violent swings in financial markets, including the rapid shifts from inflows to outflows of capital from emerging-market economies (Chari, Stedman, and Lundblad 2020; Forbes and Warnock 2021) and the periodic "flights to safety," when many investors seek to increase their holdings of safe assets like US Treasury debt (Baele et al. 2020).

Modeling these swings in investor risk attitudes is challenging, and various approaches have been proposed in the asset pricing literature to generate time-varying risk aversion. One particularly influential strand of this literature has relied on habit formation in consumption, as in the seminal contribution of Campbell and Cochrane (1999). In habit formation models, people are assumed to become accustomed to their recent levels of consumption and thus more risk-averse to gambles that could result in current consumption falling close to or even below habitual levels. By the same token, risk aversion falls as people's expected consumption rises relative to its habitual level. Habit formation models thus imply that risk appetite is procyclical, rising during expansions (when consumption is high) and falling during recessions.

Balance sheet constraints of financial intermediaries can also lead to changes in effective risk aversion. The basic mechanism is that a decline in the aggregate level of capital of intermediaries, by increasing their leverage, brings them closer to regulatory or self-imposed risk limits and therefore reduces their willingness to take on risks. Models of "intermediary asset pricing" give a central role to such constraints in explaining changes in risk appetite and risk premia (for example, Adrian and Shin 2010; He and Krishnamurthy 2013).

Consumption-based and intermediary-based asset pricing models draw a tight connection between normally slow-moving fundamentals and risk aversion, which makes it challenging to generate the relatively frequent changes in investor risk aversion observed in some contexts. Other theories allow more flexibility, for example, by assuming that risk aversion can shift over time for reasons unrelated to fundamentals. A notable example is the "moody investor" framework of Bekaert, Engstrom, and Grenadier (2010), which allows for spontaneous changes in investor sentiment (see also Bekaert, Engstrom, and Xu 2022).

Variation over time in risk appetite has also been explained by "reach for yield"—the idea that investors target a certain return on their assets. When interest rates are low, they accept greater risks—that is, they effectively become less risk-averse—to give themselves a chance to earn their desired return, even though they also increase their risk of loss (for example, Hanson and Stein 2015; Becker and Ivashina 2015). For financial institutions, reach-for-yield behavior might be motivated by distorted regulatory incentives or by contractual obligations. For example, a financial institution that has made prior commitments to provide customers a specified return, as with a defined-benefit pension program or certain insurance contracts, may reach for yield to meet these commitments. For individual investors, the tendency to reach for yield when interest rates are low likely has a significant behavioral component, such as 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). Many open questions remain about reach-for-yield phenomena, including whether 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.[2]

Monetary Policy and Risk Appetite

This discussion suggests that, from an asset-pricing perspective, monetary policy could affect risk appetite through its impacts on both the economic environment and on investors' risk preferences.[3] Easing the stance of monetary policy 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. Both the reduction of economic and financial risks (for example, lower consumption variance) as well as the improved outlook (for example, higher expected consumption relative to habit) would contribute to higher risk appetite. Alternatively, 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

---

[2] Other asset pricing theories focus on the link between investor heterogeneity and changes in aggregate risk aversion, including Chan and Kogan (2002), Gârleanu and Pedersen (2011), and Kekre and Lenel (2022).

[3] The article by Kashyap and Stein in this symposium provides additional discussion of the mechanisms through which monetary policy might affect risk appetite, as well the literature on the effects of monetary policy on risky asset prices and risk premia in various financial markets.

market rates—could make investors effectively less risk-averse, relative to a situation in which policy was tighter and rates were higher.

Much of the literature on the risk-taking channel of monetary policy thus far has focused on risk-taking by financial institutions and the effects of monetary policy on intermediaries' profits, access to funding, leverage, and, ultimately, the volume and riskiness of their lending (Adrian and Shin 2010; Drechsler, Savov, and Schnabl 2018). The available evidence generally supports the existence of a risk-taking channel working through financial institutions, with monetary easing causing them to make more and riskier loans (as in Bruno and Shin 2015; Paligorova and Santos 2017). But while changes in the risk appetite of financial institutions are likely important for monetary transmission, these effects are only a subset of the risk-taking channel, broadly defined (Borio and Zhu 2012). If monetary policy has powerful effects on risk appetite and risky asset prices, then the more-traditional channels of monetary transmission, including wealth effects, changes in the cost of capital, and changes in borrower creditworthiness, are likely to be amplified as well (as in Bernanke 2007; Disyatat 2011). That observation motivates the study of the connection of monetary policy and risk appetite in general, not only in the context of financial institutions.

Monetary Policy Surprises and the Prices of Risky Assets

Previous empirical research on the risk-taking channel has documented substantial effects of monetary policy on risky asset prices and risk premia in various financial markets, including stock, bond, and credit markets. Bernanke and Kuttner (2005) 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 the term premium. Hanson, Lucca, and Wright (2021) similarly argue that this excess sensitivity of long-term rates requires that changes in short-term rates move the term premium in the same direction, at least temporarily. 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 (see also Gilchrist, López-Salido, and Zakrajšek 2015). Bekaert, Hoerova, and Lo Duca (2013) developed proxies for the levels of 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 US monetary policy increases the return to risky assets globally.

Since efficient markets incorporate publicly available information, it is important that estimations of the effects of monetary policy on asset prices incorporate only *unanticipated* policy changes. In an important paper, Kuttner (2001) showed

how to measure unanticipated policy changes by using data from the market for federal funds futures, in which investors make bets on future values of the federal funds interest rate. By comparing the target for the funds rate announced by the FOMC after its policy meeting to the value previously expected by traders in the fed funds futures market, Kuttner estimated the surprise component of the change in the fed funds target rate. Regression of changes in asset prices over a short window around FOMC announcements on this *monetary policy surprise* yields an estimate of the impact of unanticipated policy changes on those asset prices.[4] The underlying idea is that the policy action was determined based on data available before the event window, ruling out reverse causality running from changes in asset prices to the policy action.

Kuttner's (2001) insight has been extended and a number of alternative measures of monetary policy surprises are now available. Gürkaynak, Sack, and Swanson (2005) incorporated information from various futures contracts related to future short-term interest rates, covering market expectations for interest rates beyond the current meeting and collectively spanning the expected path of future short rates out to a horizon of about one year. In addition, they used high-frequency data in order to measure monetary policy surprises over a tight window of 30 minutes around the announcement, which substantially improves the precision of the estimates relative to Kuttner's daily windows. Gürkaynak et al. showed that their monetary surprise can be divided into two parts: a "target factor" that measures news about the current target for the funds rate and is conceptually similar to Kuttner's measure, and a "path factor" that includes news about the funds rate's expected future path and thus captures the Fed's forward guidance about monetary policy. Gürkaynak et al. found that the path factor played an important role in determining long-term bond yields and other asset prices. Nakamura and Steinsson (2018b) used the same futures contracts as Gürkaynak et al., but measured the policy surprise series as the first principal component (that is, the main common factor) of the high-frequency futures rate changes around FOMC announcements; their policy surprise approximately corresponds to the average of the target and path factors. Bauer and Swanson (2022) constructed a similar monetary surprise measure but revised and extended the dates and times of FOMC announcements back to 1988.

Here we revisit and extend the evidence on how monetary policy affects individual risky asset prices. In the next section, we will consider policy effects on a measure that we believe better isolates the risk appetite of investors. The independent variable in our event study regressions is the measure of monetary surprises from Bauer and Swanson (2022). Like the other high-frequency measures

---

[4]The financial market reaction to FOMC announcements may also reflect non-conventional effects, including "information effects," which arise when the central bank's announcements reveal its private information about the state of the economy (Nakamura and Steinsson 2018b; Cieslak and Schrimpf 2019; Jarociśki and Karadi 2020), or misperceptions about the Fed's systematic response to economic conditions (Bauer and Swanson 2022; forthcoming). See Bauer and Swanson (forthcoming) for more discussion.

mentioned above, this measure is based on changes in interest rates over a tight intraday window around the FOMC announcement, from 10 minutes before until 20 minutes after the announcement. The calculation is based on changes in the interest rates on Eurodollar futures, which are derivative contracts with payoffs tied to the three-month London Interbank Offered Rate (LIBOR). This interest rate is an important benchmark for short-term lending in US dollars, and it is directly affected by changes in the Fed's policy rate.[5] The surprise measure is the first principal component of the changes in the first four quarterly Eurodollar futures rates (ED1 to ED4), which capture expectations of the policy rate over the current and subsequent three quarters.

Figure 1 illustrates how monetary policy surprises capture the unanticipated component of FOMC decisions. It plots the evolution of the ED1 and ED4 rates (omitting the other two Eurodollar rates used in our analysis) around four consequential FOMC announcements. Because ED1 is tied to the short rate at the end of the current quarter, it captures the market surprise about the current funds rate target decision, as well as changes in very near-term expectations. By contrast, ED4 reflects expectations for short-term rates at a horizon of about one year and therefore captures changes in more distant rate expectations, arising for example from the Fed's forward guidance and other communications.

The four plotted announcements are interesting in that none involved a change in the Fed's target of the FOMC for the federal funds rate (largely because the funds rate was already near the zero lower bound throughout most of the period), yet all triggered changes in market interest rates and policy expectations. On March 18, 2009, the Fed announced a major expansion of its first asset purchase program, commonly known as quantitative easing. The resulting decline in the market's rate expectations likely reflected the signaling effect of the dramatic new program, which was perceived as underscoring the FOMC commitment to keeping policy easier for longer (Bauer and Rudebusch 2014). On August 9, 2011, the FOMC statement included, for the first time, date-based forward guidance, as the Committee made clear its plans to avoid raising the funds rate "at least through mid-2013." This guidance substantially lowered rate expectations, causing the ED4 rate to fall by close to ten basis points. On June 19, 2013, the statement (and, later, the chair's press conference, which is not captured by the monetary surprise) raised the possibility that the Fed would soon slow ("taper") its asset purchases. Consistent with the increase in ED4 around the announcement, market participants worried that a slowing of asset purchases would be a precursor to faster rate increases than had previously been expected. The resulting volatility in bond markets became known as the "taper tantrum." Finally, on March 16, 2016, the FOMC statement signaled

---

[5] During normal times, three-month LIBOR is only slightly higher than the federal funds rate, but during periods of elevated financial stress, the spread between the two rates can become substantial. For example, around the March 2009 FOMC accouncement discussed below, this spread was around one percentage point. For further discussion, see, for example, Bauer, Lakdawala, and Mueller (2022).

Figure 1
Monetary Policy Surprises
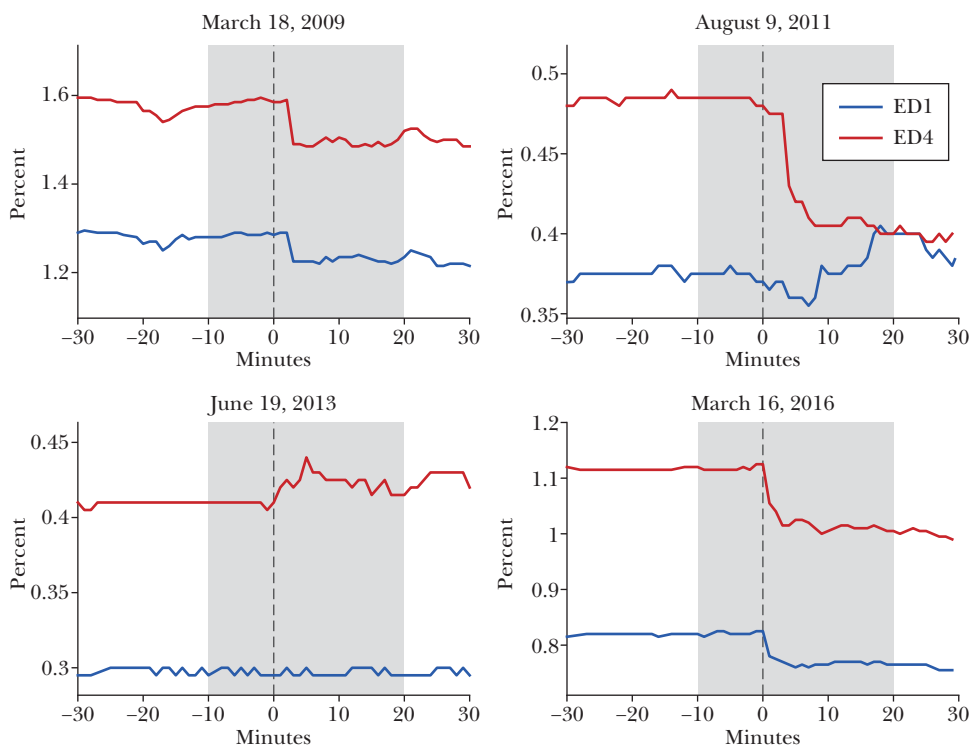
Source: Tick Data.
Notes: Evolution of current-quarter (ED1) and three-quarters-ahead (ED4) Eurodollar futures rates around four important FOMC announcements. Vertical dashed lines indicate the release time of the FOMC statement. Gray-shaded areas indicate the 30-minute window used in the construction of the monetary policy surprise. The Bauer and Swanson (2022) monetary policy surprises surrounding the 2009, 2011, 2013, and 2016 meetings were –6.7, –2.0, 0.2, and –9.1 basis points, respectively.

that a tightening of policy that had been expected by markets would be deferred, resulting in a significant easing surprise.

The monetary policy surprise measure of Bauer and Swanson (2022) captures all these different types of news about monetary policy in a single number, with negative values corresponding to easing/dovish surprises, and positive numbers to tightening/hawkish surprises. It is scaled to have a one-for-one impact on ED4, that is, on one-year-ahead interest rate expectations. For example, the surprise on March 16, 2016, was –9.1 basis points, reflecting the decline in all four eurodollar futures rates in response to the FOMC announcement. For the empirical results of this paper, we rescale the Bauer-Swanson series to gauge the effects of a surprise that

leads to an increase in one-year expectations of ten basis points, a sizeable but not uncommon surprise (the standard deviation of the original policy surprises in our sample is about six basis points).[6]

Using the event-study method, we estimate the effects of monetary policy surprises on six daily variables that reflect, among other things, the risk appetite of investors: (1) the S&P 500 stock market index; (2) the S&P 500 volatility index (VIX), which measures expected stock market volatility using index option prices; (3) the spread of an index of long-term Baa-rated corporate bond yields over ten-year Treasury yields, a measure of the investment-grade credit spread; (4) a high-yield option-adjusted spread (HY OAS), which is a measure of the high-yield credit spread that adjusts for the ability of a debt issuer to call back bonds and then issue new debt if interest rates decline; (5) the spread of the three-month commercial paper rate over the federal funds rate; and (6) the trade-weighted US dollar exchange rate against advanced foreign economies. Our prior is that a surprise tightening of monetary policy, and the resulting reduction in risk appetite, should lower stock prices, increase the volatility of equities, increase the three credit spreads, and strengthen the dollar (a safe-haven currency).

We extend previous event-study analysis of FOMC announcements and allow for both contemporaneous and lagged effects of policy surprises on asset prices. Specifically, we estimate separate regressions using different window lengths for the dependent variable: the contemporaneous asset price response on announcement days, and the cumulative responses over the subsequent 1–20 trading days. The estimated responses of each variable, together with 90-percent confidence intervals using robust standard errors, are shown in Figure 2.

The contemporaneous responses in the stock and foreign exchange markets are consistent with our priors: An unanticipated tightening of monetary policy reduces stock prices, increases stock volatility, and strengthens the dollar. By contrast, none of the three credit spreads increase immediately in response to this surprise, and the Baa and commercial paper spreads in fact significantly decline. This result, which is at odds with the theoretical channels described above, may reflect illiquidity and segmentation in corporate bond markets (Bao, Pan, and Wang 2011). If illiquidity or infrequent trading causes measured corporate yields to respond only after a delay, while Treasury yields rise immediately, we would expect to see the Baa corporate bond spread decline on impact.

Indeed, the dynamic responses in panels C–E of Figure 2 show that bond spreads go in the expected direction over time, 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 several weeks after the announcement. For example, in the case of the Baa spread,

---

[6]In the Online Appendix, we present results for alternative measures of the monetary policy surprise, including the target and path factors of Gürkaynak et al. (2005), which separately capture news about the current target and the expected future path of the funds rate, and the composite surprise measure of Nakamura and Steinsson (2018b). The results are qualitatively similar across all surprise measures.

Figure 2
Effects of a Surprise Monetary Tightening
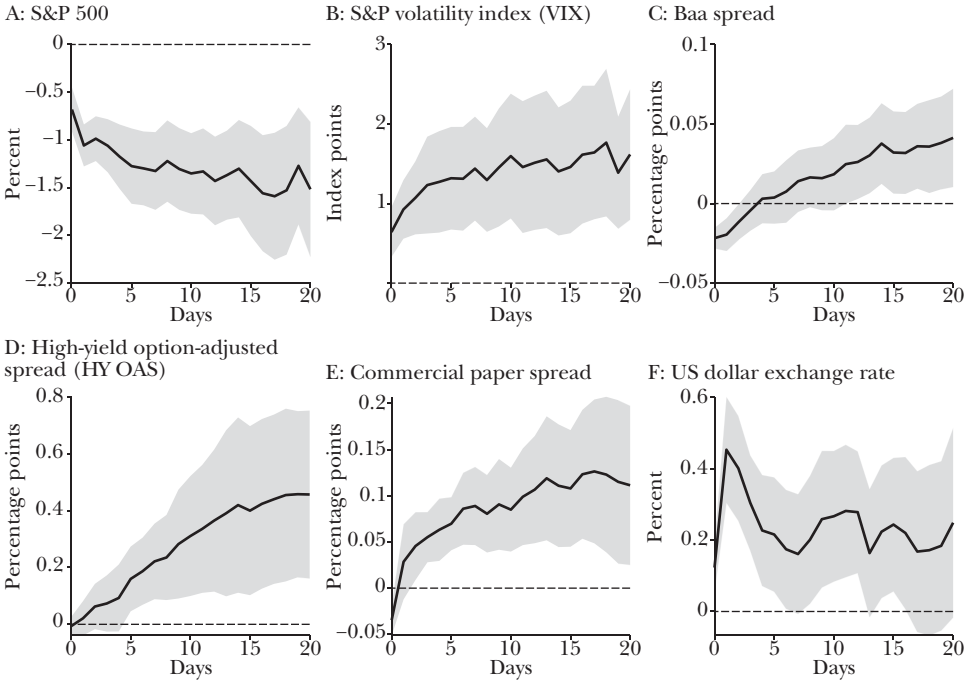
Source: For data sources and details of the calculations, see the Online Appendix.
Notes: Estimated response of asset prices to Bauer and Swanson (2022) monetary policy surprises, scaled to a ten basis point surprise, on the day of the FOMC announcement (day 0) and cumulative responses over the subsequent (1–20) trading days. S&P 500 and the US dollar exchange rate are measured as log changes (that is, returns), VIX as changes in index points, and credit spreads as changes in percentage points. The sample contains all FOMC announcements from January 1988 to December 2019. The sample for the VIX starts in January 1990, the high-yield option-adjusted spread (HY OAS) in January 1997, and the commercial paper (CP) spread in April 1997. Shaded areas correspond to 90 percent confidence intervals based on Huber-White heteroskedasticity-robust standard errors.

the initially negative response turns positive after four days and becomes statistically significant after twelve days. Again, lack of liquidity and transparency in corporate bond markets may help to explain this result, although the duration of the effect remains puzzling. There appears also to be some drift in the responses of S&P 500 and the VIX volatility index, although in those cases the drift is less pronounced.[7]

[7] The drift of the Baa spread, high-yield spread, and commercial paper spread are all statistically significant, in that the t-statistics for the difference between the 20-day responses and the FOMC-announcement-day

The magnitudes of the effects of monetary surprises on our chosen variables seem reasonably large. For example, after ten days, the ten basis point surprise is estimated to lower stock prices by 1.4 percent, raise the VIX volatility by 1.6 index points, increase the Baa, high-yield, and commercial paper spreads by 0.02 percentage points, 0.31 percentage points, and 0.08 percentage points, respectively, and strengthen the dollar by 0.3 percent.

These findings illustrate that, consistent with the economics of the risk-taking channel, a surprise tightening of monetary policy depresses the prices of selected risky assets. The effects appear quantitatively large and persistent. Somewhat surprisingly, credit spreads show considerable drift, rising steadily for several weeks after a hawkish monetary surprise. While these results are suggestive, they are qualified by the fact that these risk indicators will naturally 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 expected future dividends and raising the rate at which these dividends are discounted. Similarly, a surprise monetary tightening presumably causes a deterioration of the economic outlook and thus higher expected rates of corporate default, which would also contribute to higher corporate bond spreads. To get a stronger test of the risk-taking channel, we need a cleaner measure of investors' risk appetite.

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. With this index, we can then use our event study approach to look more directly at how monetary surprises affect risk appetite.

Quite a few indexes of financial risk and financial conditions already exist (for overviews, see Coudert and Gex 2008; Datta et al. 2017). To cite a few prominent examples: the excess bond premium of Gilchrist and Zakrajšek (2012) is an estimate of the overall risk premium in corporate bond spreads; the Federal Reserve Board makes use of a "global risk-on/risk-off index" based on the average of daily returns of 15 risky assets (Datta et al. 2017); the Federal Reserve Bank of Chicago's National Financial Conditions Index (NFCI), based on about 100 financial indicators and described in Brave and Butters (2011), has a so-called risk sub-index 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 of stock and bond returns,

---

responses are 3.6, 2.8, and 3.1 respectively. The analogous t-statistics for the S&P 500, the VIX volatility index, and the US dollar exchange rate are lower, equal to –1.8, 2.1, and 0.7 respectively.

which they combined with data on corporate cash flows and macroeconomic developments to estimate daily measures of risk aversion and uncertainty.[8]

With many empirical measures of risk-taking and risk aversion already available, why construct a new one? We had several motivations. First, our event study of FOMC announcements requires a measure of risk appetite at a daily (or higher) frequency. The need for daily data also dictated our use of financial variables shown in Figure 2 rather than alternative measures of risk such as capital outflows, credit growth, or leverage that are available only at lower frequencies. Second, our emphasis on measuring the short-run effects of monetary policy 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 our monetary policy surprise data begin in 1988, we needed an index of risk appetite that covers a longer period than most. Fourth, recognizing that factors other than risk appetite can 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 risk appetite index is based on 14 risk-sensitive financial indicators, listed in Table 1. All the indicators used are available at a daily frequency, with start dates listed in the table. Our indicators, which span a range of key markets, 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), and two exchange rates (daily log-differences). 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. Exchange rates are included to capture "safe haven effects" of international investors moving to US dollar investments in times of financial stress. Of the 14 variables included in the index, eleven are available daily back to 1997, eight are available from 1990, and six from at least 1988.

All of the variables listed in Table 1 are widely viewed as being sensitive to changes in risk appetite.[9] At the same time, these variables represent different asset classes and are determined by diverse factors, including both fundamentals and risk perceptions. As discussed above, risk appetite is a common driver of all risk premia in the economy. 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—specifically, the first principal component of the 14 series, which is the linear combination of the variables that explains the greatest share of the variance for the data as a whole. The Online

---

[8] 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.

[9] Six of the 14 component variables appeared earlier in Figure 2. Responses of the other eight variables to monetary policy surprises are shown in the Online Appendix.

Table 1

Components of the Daily Risk Appetite Index

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

Source: For more details on sources, see the Online Appendix.
Notes: The loading column shows the weight of each variable in the index (more specifically, 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.

Appendix describes the details of our procedure, which deals with missing observations in order to obtain a complete time series of the index. Our index accounts for about 30 percent of the common variation in the 14 component variables, which suggests a substantial amount of comovement given the variety of different assets and indicators we include.[10] 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.

The rightmost column of Table 1 shows the loading of each variable on the index of risk appetite. Since the components are 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

---

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

Figure 3
Comparison of Selected Risk Indices and Market Events
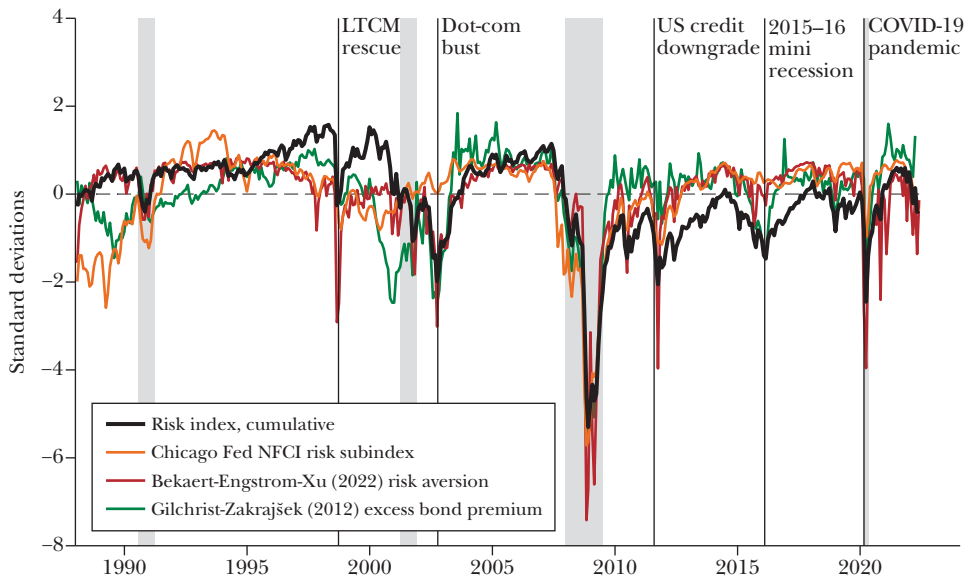
Source: For details on the sources, see the Online Appendix.
Notes: All series are shown at monthly frequency, standardized to have zero mean and unit standard deviation, and signed so that an increase corresponds to an increase in risk appetite. Shading denotes recessions as dated by the National Bureau of Economic Research. Sample period is January 1988 to May 2022.

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 3. Note that because this line is the cumulation of an index with a mean of zero, it has no trend by construction. Expressing the risk appetite index in levels shows how it lines up with key historical events. As Figure 3 illustrates, large "risk-off" days—when investors' risk appetite drops—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 improvements in risk appetite can also 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 US credit downgrade and the COVID shock (with interruptions), and after the March 2020 COVID-induced financial crisis. Overall, there seems to be a pattern

of sharp drops in risk appetite followed by slow recoveries. Indeed, the largest daily changes in risk appetite are typically to the downside: Of the 25 largest changes in our sample (in absolute value), 20 were downward, and the distribution of daily changes is skewed towards large declines.[11] In contrast, on days with monetary policy FOMC announcements, changes in risk appetite were positive on average, with a mean of 0.25, and positive skewness. It appears that risk appetite behaved differently on days with FOMC announcements than on other days, with markets on average mildly reassured by the Fed, perhaps because uncertainties are resolved by the announcement (Bauer, Lakdawala, and Mueller 2022).

For comparison, Figure 3 also shows three other risk indicators from the literature, based on varying approaches, all of which span the period covered by our index: the risk aversion index developed by Bekaert, Engstrom, and Xu (2022); the risk sub-index of the Chicago Fed's NFCI; and the Gilchrist-Zakrajšek excess bond premium. These three alternative indexes give historical descriptions of risk that are qualitatively quite similar to ours. The correlations with our index are 0.60 for the Bekaert et al. index, 0.60 for the Chicago Fed risk sub-index, and 0.64 for the Gilchrist-Zakrajšek excess bond premium.[12]

Using our index, we can now examine how risk appetite is affected by monetary policy. Figure 4 shows the contemporaneous effects of a tightening surprise on the day of the FOMC announcement and the cumulative effects over the 20 trading days following the announcement, with 90-percent confidence intervals. This figure is constructed with regressions similar to those underlying Figure 2 above. On impact, the tightening surprise significantly lowers risk appetite. Over the days and weeks following the announcement, the estimated effects become larger in magnitude and even more highly statistically significant. The drift in the response of the index mirrors that of the components, some of which are also seen earlier in Figure 2. The drift in the response over the entire 20 days, measured as the difference in the 20-day response and impact response, is large and statistically significant. In fact, most of this drift occurs in the first five days after the FOMC announcement. This post-FOMC drift in risk appetite is an intriguing result that is worth further investigation.

The statistical significance of the responses shown in Figure 4 is very high (for example, the t-statistic for the response after five days is 5.8). But how important economically is the response of the risk appetite index shown in Figure 4? On impact, the decline of the index to a ten basis point surprise is a little less than half its standard deviation. After ten trading days, the cumulative decline equals about 1.7 standard deviations.[13] Thus, the effects of monetary policy surprises on

---

[11] Our index has a skewness coefficient of −1.6, indicating the downward skew.

[12] Correlations with alternative indicators of risk, economic and financial conditions, sentiment, and uncertainty are provided in the Online Appendix, and they are also generally high.

[13] The standard deviation of eleven-day changes in the index, is higher than the standard deviation of daily changes by about the square root of eleven, because these changes are almost serially uncorrelated. The estimated decline after ten days is about half as large as this standard deviation.

Dynamic Response of Risk Appetite to a Surprise Monetary Tightening
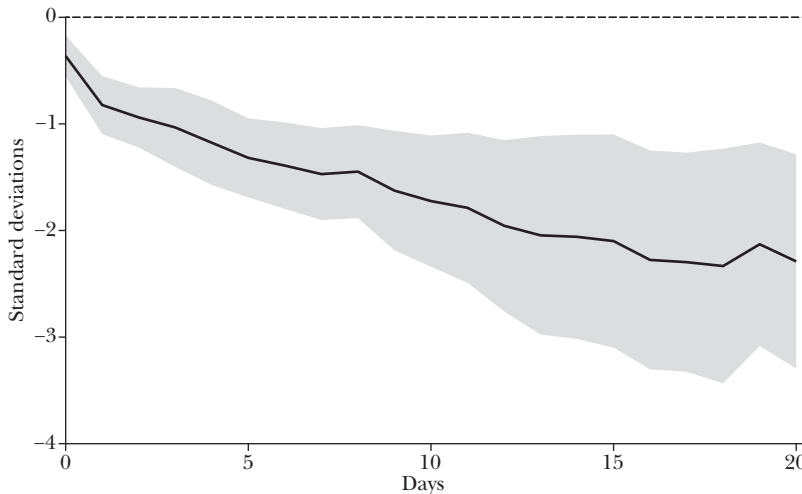
Source: For details of the calculations, see the Online Appendix.
Notes: Estimated response of risk appetite index to Bauer and Swanson (2022) monetary policy surprises, scaled to a ten basis point surprise, on the day of the announcement by the FOMC (day 0) and cumulative responses over the subsequent (1–20) trading days. The risk appetite index has mean zero by construction, and we normalize it to have a standard deviation of one. The sample contains all FOMC announcements from January 1988 to December 2019. Shaded areas correspond to 90 percent confidence intervals based on Huber-White heteroskedasticity-robust standard errors.

risk appetite seem relatively large, compared to historically normal fluctuations in the index.

Figure 4 shows the response of risk appetite to unanticipated movements in current and expected values of the federal funds rate. But monetary policy actions and communication may have effects on risky asset prices and risk appetite that are not captured by event-study regressions using only monetary policy surprises. The FOMC statements and, more recently, the Fed Chair's press conferences following the release of the statement, provide additional information about various aspects of current monetary policy. These include the Fed's economic outlook, the balance of risks around the expected policy path (Bauer and Chernov forthcoming; Bauer, Lakdawala, and Mueller 2022), the policy reaction function (Bauer, Pflueger, and Sunderam 2022), the likelihood of unconventional policies (Kuttner 2018), or the likelihood of backstopping a deterioration in financial conditions (Cieslak and Vissing-Jorgensen 2021). Such information, which is not fully captured by monetary surprises based on risk-free rates with maturities of a year or less, is also likely to affect the risk appetites of investors. In the words of Kroencke, Schmeling, and Schrimpf (2021), "[M]onetary 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."

Our estimates are consistent with the view that monetary policy actions and communication can affect risk appetite in ways not captured by monetary policy surprises: No matter how we measure these surprises or how much delay we allow for the response, we can only explain up to about 10 percent of the daily variation in risk appetite.[14] While some of the variation in risk appetite on days with FOMC announcements is certainly driven by news unrelated to monetary policy, 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, it seems much more plausible that these additional changes in risk appetite are due in part to the news about monetary policy on these days that is not fully reflected in the high-frequency policy surprise. This view is also supported by different types of empirical analysis, including textual analysis linking financial market reactions to the content of FOMC statements (Gardner, Scotti, and Vega 2022), stock market responses in the opposite direction from what one would expect based on monetary policy surprises (Cieslak and Schrimpf 2019; Jarociński and Karadi 2020) and, more generally, evidence on "FOMC risk shifts" (Kroencke, Schmeling, and Schrimpf 2021).

Overall, the evidence strongly suggests that monetary policy actions have pronounced effects on risk appetite in financial markets. Beyond the usual contemporaneous event-study regressions, our estimates showed that these effects build even further over the days following FOMC announcements. In the next section, we discuss our reasons for believing that the effect of the risk-taking channel on macroeconomic dynamics is substantial enough that it deserves more attention from economists and policymakers, together with the more familiar neoclassical channels for the transmission of monetary policy.

The Risk-Taking Channel and Macroeconomic Dynamics

The effects of monetary policy on asset prices and risk appetite are of independent interest, but they are only the first step in the risk-taking channel of monetary policy. The next step in the monetary transmission are the effects of changes in risk appetite and the related changes in risky asset prices on spending, employment, inflation, and other macroeconomic quantities. After all, the ultimate goal of research on the risk-taking channel of monetary policy is to understand the quantitative importance of these effects on the broader economy.

As discussed above, many existing macro-finance theories imply that changes in risk appetite are likely to play an important role in the monetary transmission via changes in asset prices, household wealth, collateral values, and intermediary

---

[14] For some of these alternative measures and calculations, see Table B3 in the Online Appendix.

balance sheets. In addition, empirical work on the macroeconomic effects of monetary policy suggests that changes in risk premia may be important. A prominent example is the work of Gertler and Karadi (2015), who used monetary policy surprises combined with vector autoregressions to understand the role of changes in credit costs and risk premia in monetary transmission. Their estimates show a substantial and persistent impact of monetary policy on risk premia, which is consistent with the view that changes in risk premia are an important component in the monetary transmission. Both the excess bond premium of Gilchrist and Zakrajšek (2012) and the measure of risk perceptions of Pflueger, Siriwardane, and Sunderam (2020) predict future economic activity. Other empirical studies suggest that exogenous changes in the term premium can have significant macroeconomic effects (Rudebusch, Sack, and Swanson 2007; Baumeister and Benati 2013).

Overall, both theory and evidence support the view that the risk-taking channel may be quite important for monetary transmission, and that changes in risk appetite due to monetary policy are likely to have sizeable macroeconomic effects. However, much work remains to convincingly quantify the importance of the risk-taking channel. While there is extensive evidence that monetary policy affects risk premia in financial markets, significantly less is known about how large the consequences of these effects are for economic activity and inflation. The challenge here is considerable. A full analysis would require separating the effects of monetary policy on aggregate outcomes operating through the conventional neoclassical interest rate channels mentioned at the beginning of this paper from the effects working through the risk-taking channel. Moreover, this analysis would need to take into account the arguments noted at the end of the previous section that monetary policy may affect risk appetite via channels other than the policy rate and forward guidance. One potential avenue for empirical work to address these challenges is to combine new econometric tools, including the vector autoregression methods used by Gertler and Karadi (2015) and others, supplemented with high-frequency measures of changes in risk appetite due to monetary policy announcements.[15]

Financial Stability and Optimal 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; Kashyap and Stein in this symposium). We are more agnostic on this point. While this tradeoff may be valid in principle,

---

[15] In preliminary work, using structural vector autoregressions with high-frequency identification, we decompose policy shocks into two components, one due to changes in risk appetite and the other due to changes in other factors. Our estimates suggest that the risk-taking channel explains a significant portion of the effects of monetary policy on output and inflation.

quantitative guidance for policymakers depends on calculation of the costs and benefits of particular strategies. We know too little about critical quantities— including the share of the variation in risk appetite attributable to monetary policy; the precise macroeconomic effects of the risk-taking channel; the relative contributions of monetary, regulatory, institutional, and other factors to bouts of financial instability; the role of initial conditions; and the long-run costs of financial instability—to do reliable cost-benefit analyses. Existing attempts to do such analyses have not provided clear answers.[16] Moreover, 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. That possibility is consistent with our evidence that most large changes in risk appetite involve greater rather than less risk aversion, so that many periods of increasing risk appetite involve a return to a normal level from below. When risk appetite is too low, more aggressive easing of monetary policy than justified by macroeconomic conditions alone could in principle be warranted. Finally, the fact that the risk-taking channel likely induces stronger effects of monetary policy on the economy than can be accounted for by neoclassical policy channels alone implies that the cost of attenuating the policy response to recessions due to financial stability concerns could be high, especially if there are alternative policy tools for dealing with financial risks.

Conclusion

The risk-taking channel of monetary policy has deservedly received increasing attention in academic and policy discussions. This article has discussed how monetary policy, via this risk-taking channel, affects both risk appetite in financial markets and macroeconomic outcomes.

There remain important questions open for future research, including the quantitative importance of the risk-taking channel for the effects of monetary policy on macroeconomic aggregates, as we have emphasized. Relatedly, a better understanding and quantification of the *mechanisms* underlying the risk-taking channel would be useful. In particular, our findings could reflect the effects of monetary surprises on the economic outlook, which in turn influence risk attitudes. Alternatively, the estimated effects could in part be the result of behavioral factors, including the reaching-for-yield phenomenon. Furthermore, our estimates only capture effects on risk appetite from unanticipated changes in the policy action, as measured by monetary policy surprises, omitting additional information provided in the statement or the chair's press conference (as well as the effects of the systematic component of monetary policy). The use of methods such as machine learning

---

[16] See, for example, Svensson (2017) and Guorio, Kashyap, and Sim (2018). 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).

or textual analysis is one promising direction for future research about the link between policy communication and risk appetite.

The implications of the risk-taking channel for the optimal conduct of monetary policy—and in particular, for the interactions between monetary policy and financial instability—are a particularly important topic for further study. At this stage, we know too little about the effects of the risk-taking channel on both financial stability and the real economy to offer useful quantitative advice to policymakers. It is certainly possible that easier monetary policy and the resulting rise in risk appetite affects the probability and cost of a financial crisis—important unknowns in determining optimal monetary policy—but the quantitative linkages must surely depend heavily on the institutional and regulatory arrangements at a particular time and place, as well as the initial economic and financial conditions. Moreover, the behavior of our new index of risk appetite suggests that investor risk appetites are typically below normal during periods of crisis or recession. In such a situation, the tendency of monetary easing to increase risk appetites could be beneficial.

References

Adrian, Tobias, and Fernando M. Duarte. 2016. "Financial Vulnerability and Monetary Policy." Federal Reserve Bank of New York Staff Report 804. https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr804.pdf?la=en.

Adrian, Tobias, and Nellie Liang. 2018. "Monetary Policy, Financial Conditions, and Financial Stability." *International Journal of Central Banking* 14 (1): 73–131.

Adrian, Tobias, and Hyun Song Shin. 2010. "Financial Intermediaries and Monetary Economics." In *Handbook of Monetary Economics*, Vol. 3, edited by Benjamin M. Friedman and Michael Woodford, 601–50. Amsterdam: North-Holland.

Baele, Lieven, Geert Bekaert, Koen Inghelbrecht, and Min Wei. 2020. "Flights to Safety." *Review of Financial Studies* 33 (2): 689–746.

Bansal, Ravi, and Amir Yaron. 2004. "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles." *Journal of Finance* 59 (4): 1481–509.

Bao, Jack, Jun Pan, and Jiang Wang. 2011. "The Illiquidity of Corporate Bonds." *Journal of Finance* 66 (3): 911–46.

Bauer, Michael D., and Mikhail Chernov. Forthcoming. "Interest Rate Skewness and Biased Beliefs." *Journal of Finance.*

Bauer, Michael D., and Glenn D. Rudebusch. 2014. "The Signaling Channel for Federal Reserve Bond Purchases." *International Journal of Central Banking* 10 (3): 233–89.

Bauer, Michael D., and Eric T. Swanson. 2022. "A Reassessment of Monetary Policy Surprises and High-Frequency Identification." In *NBER Macroeconomics Annual 2022*, Vol. 37, edited by Martin Eichenbaum, Erik Hurst, and Valerie A. Ramey. Chicago: University of Chicago Press.

Bauer, Michael D., and Eric T. Swanson. Forthcoming. "An Alternative Explanation for the 'Fed Information Effect.'" *American Economic Review.*

Bauer, Michael D., Ben S. Bernanke, and Eric Milstein. 2023. "Replication data for: Risk Appetite and the Risk-Taking Channel of Monetary Policy." American Economic Association [publisher], Inter-university Consortium for Political and Social Research [distributor]. https://doi.org/10.3886/E183829V1.

Bauer, Michael D., Aeimit Lakdawala, and Philippe Mueller. 2022. "Market-Based Monetary Policy Uncertainty." *Economic Journal* 132 (644): 1290–308.

Bauer, Michael D., Carolin E. Pflueger, and Adi Sunderam. 2022. "Perceptions about Monetary Policy." NBER Working Paper 30480.

Baumeister, Christiane, and Luca Benati. 2013. "Unconventional Monetary Policy and the Great Recession: Estimating the Macroeconomic Effects of a Spread Compression at the Zero Lower Bound." *International Journal of Central Banking* 9 (2): 165–212.

Becker, Bo, and Victoria Ivashina. 2015. "Reaching for Yield in the Bond Market." *Journal of Finance* 70 (5): 1863–902.

Bekaert, Geert, Eric C. Engstrom, and Steven R. Grenadier. 2010. "Stock and Bond Returns with Moody Investors." *Journal of Empirical Finance* 17 (5): 867–94.

Bekaert, Geert, Eric C. Engstrom, and Nancy R. Xu. 2022. "The Time Variation in Risk Appetite and Uncertainty." *Management Science* 68 (6): 3975–4004.

Bekaert, Geert, and Marie Hoerova. 2014. "The VIX, the Variance Premium and Stock Market Volatility." *Journal of Econometrics* 183 (2): 181–92.

Bekaert, Geert, Marie Hoerova, and Marco Lo Duca. 2013. "Risk, Uncertainty and Monetary Policy." *Journal of Monetary Economics* 60 (7): 771–88.

Bernanke, Ben S. 2007. "The Financial Accelerator and the Credit Channel." Speech, Federal Reserve Bank of Atlanta Credit Channel of Monetary Policy in the Twenty-First Century Conference, Atlanta, June 15, 2007. https://www.federalreserve.gov/newsevents/speech/bernanke20070615a.htm.

Bernanke, Ben S. 2022. *21st Century Monetary Policy: The Federal Reserve from the Great Inflation to COVID-19.* New York: W. W. Norton & Company.

Bernanke, Ben S., and Mark Gertler. 1995. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission." *Journal of Economic Perspectives* 9 (4): 27–48.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist. 1999. "The Financial Accelerator in a Quantitative Business Cycle Framework." In *Handbook of Macroeconomics*, Vol. 1C, edited by John B. Taylor and Michael Woodford, 1341–93. Amsterdam: North-Holland.

Bernanke, Ben S., and Kenneth N. Kuttner. 2005. "What Explains the Stock Market's Reaction to Federal Reserve Policy?" *Journal of Finance* 60 (3): 1221–57.

Boivin, Jean, Michael T. Kiley, and Frederic S. Mishkin. 2010. "How Has the Monetary Transmission Mechanism Evolved over Time?" In *Handbook of Monetary Economics*, Vol. 3, edited by Benjamin M. Friedman and Michael Woodford, 369–422. Amsterdam: North-Holland.

Borio, Claudio, and Haibin Zhu. 2012. "Capital Regulation, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism?" *Journal of Financial Stability* 8 (4): 236–51.

Boyarchenko, Nina, Giovanni Favara, and Moritz Schularick. 2022. "Financial Stability Considerations for Monetary Policy: Empirical Evidence and Challenges." Finance and Economics Discussion Series 2022-006, Federal Reserve Board.

Brave, Scott, and R. Andrew Butters. 2011. "Monitoring Financial Stability: A Financial Conditions Index Approach." *Federal Reserve Bank of Chicago Economic Perspectives* 35 (1-2): 22–43.

Bruno, Valentina, and Hyun Song Shin. 2015. "Capital Flows and the Risk-Taking Channel of Monetary Policy." *Journal of Monetary Economics* 71: 119–32.

Campbell, John Y., and Roman Sigalov. 2022. "Portfolio Choice with Sustainable Spending: A Model of Reaching for Yield." *Journal of Financial Economics* 143 (1): 188–206.

Campbell, John Y., and John H. Cochrane. 1999. "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior." *Journal of Political Economy* 107 (2): 205–51.

Chari, Anusha, Karlye Dilts Stedman, and Christian Lundblad. 2020. "Capital Flows in Risky Times: Risk-on/Risk-off and Emerging Market Tail Risk." NBER Working Paper 27927.

Chan, Yeung Lewis, and Leonid Kogan. 2002. "Catching Up with the Joneses: Heterogeneous Preferences and the Dynamics of Asset Prices." *Journal of Political Economy* 110 (6): 1255–85.

Cieslak, Anna, and Andreas Schrimpf. 2019. "Non-monetary News in Central Bank Communication."

Journal of International Economics 118: 293–315.

Cieslak, Anna, and Annette Vissing-Jorgensen. 2021. "The Economics of the Fed Put." *Review of Financial Studies* 34 (9): 4045–89.

Cochrane, John H. 2005. *Asset Pricing*. Revised ed. Princeton, NJ: Princeton University Press.

Coudert, Virginie, and Mathieu Gex. 2008. "Does Risk Aversion Drive Financial Crises? Testing the Predictive Power of Empirical Indicators." *Journal of Empirical Finance* 15 (2): 167–84.

Datta, Deepa, Juan M. Londono, Bo Sun, Daniel O. Beltran, Thiago Ferreira, Matteo Iacoviello, Mohammad R. Jahan-Parvar, Canlin Li, Marius del Giudice Rodriguez, and John Rogers. 2017. "Taxonomy of Global Risk, Uncertainty, and Volatility Measures." International Finance Discussion Paper 1216.

Disyatat, Piti. 2011. "The Bank Lending Channel Revisited." *Journal of Money, Credit and Banking* 43 (4): 711–34.

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl. 2018. "Liquidity, Risk Premia, and the Financial Transmission of Monetary Policy." *Annual Review of Financial Economics* 10: 309–28.

Forbes, Kristin J., and Francis E. Warnock. 2021. "Capital Flow Waves—or Ripples? Extreme Capital Flow Movements since the Crisis." *Journal of International Money and Finance* 116: 102394.

Gai, Prasanna, and Nicholas Vause. 2006. "Measuring Investors' Risk Appetite." *International Journal of Central Banking* 2(1): 167-88.

Gardner, Ben, Chiara Scotti, and Clara Vega. 2022. "Words Speak as Loudly as Actions: Central Bank Communication and the Response of Equity Prices to Macroeconomic Announcements." *Journal of Econometrics* 231 (2): 387–409.

Gârleanu, Nicolae, and Lasse Heje Pedersen. 2011. "Margin-Based Asset Pricing and Deviations from the Law of One Price." *Review of Financial Studies* 24 (6): 1980–2022.

Gertler, Mark, and Peter Karadi. 2015. "Monetary Policy Surprises, Credit Costs, and Economic Activity." *American Economic Journal: Macroeconomics* 7 (1): 44–76.

Gilchrist, Simon, David López-Salido, and Egon Zakrajšek. 2015. "Monetary Policy and Real Borrowing Costs at the Zero Lower Bound." *American Economic Journal: Macroeconomics* 7 (1): 77–109.

Gilchrist, Simon, and Egon Zakrajšek. 2012. "Credit Spreads and Business Cycle Fluctuations." *American Economic Review* 102 (4): 1692–720.

Gourio, François, Anil K. Kashyap, and Jae W. Sim. 2018. "The Trade Offs in Leaning Against the Wind." *IMF Economic Review* 66 (1): 70–115.

Gürkaynak, Refet S., Brian Sack, and Eric T. Swanson. 2005. "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking* 1 (1): 55–93.

Hanson, Samuel G., and Jeremy C. Stein. 2015. "Monetary Policy and Long-Term Real Rates." *Journal of Financial Economics* 115 (3): 429–48.

Hanson, Samuel G., David O. Lucca, and Jonathan H. Wright. 2021. "Rate-Amplifying Demand and the Excess Sensitivity of Long-Term Rates." *Quarterly Journal of Economics* 136 (3): 1719–81.

He, Zhiguo, and Arvind Krishnamurthy. 2013. "Intermediary Asset Pricing." *American Economic Review* 103 (2): 732–70.

Jarocinski, Marek, and Peter Karadi. 2020. "Deconstructing Monetary Policy Surprises—The Role of Information Shocks." *American Economic Journal: Macroeconomics* 12 (2): 1–43.

Kekre, Rohan, and Moritz Lenel. 2022. "Monetary Policy, Redistribution, and Risk Premia." *Econometrica* 90 (5): 2249–82.

Kroencke, Tim A., Maik Schmeling, and Andreas Schrimpf. 2021. "The FOMC Risk Shift." *Journal of Monetary Economics* 120: 21–39.

Kuttner, Kenneth N. 2001. "Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market." *Journal of Monetary Economics* 47 (3): 523–44.

Kuttner, Kenneth N. 2018. "Outside the Box: Unconventional Monetary Policy in the Great Recession and Beyond." *Journal of Economic Perspectives* 32 (4): 121–46.

Lian, Chen, Yueran Ma, and Carmen Wang. 2019. "Low Interest Rates and Risk-Taking: Evidence from Individual Investment Decisions." *Review of Financial Studies* 32 (6): 2107–48.

Miranda-Agrippino, Silvia, and Hélène Rey. 2020. "U.S. Monetary Policy and the Global Financial Cycle." *Review of Economic Studies* 87 (6): 2754–76.

Miranda-Agrippino, Silvia, and Hélène Rey. 2022. "The Global Financial Cycle." In *Handbook of International Economics*, Vol. 6, edited by Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, 1–43. Amsterdam: North-Holland.

Nakamura, Emi, and Jón Steinsson. 2018a. "Identification in Macroeconomics." *Journal of Economic Perspectives* 32 (3): 59–86.

Nakamura, Emi, and Jón Steinsson. 2018b. "High-Frequency Identification of Monetary Non-neutrality: The Information Effect." *Quarterly Journal of Economics* 133 (3): 1283–330.

Paligorova, Teodora, and João A. C. Santos. 2017. "Monetary Policy and Bank Risk-Taking: Evidence from the Corporate Loan Market." *Journal of Financial Intermediation* 30: 35–49.

Pflueger, Carolin, Emil Siriwardane, and Adi Sunderam. 2020. "Financial Market Risk Perceptions and the Macroeconomy." *Quarterly Journal of Economics* 135 (3): 1443–91.

Rudebusch, Glenn D., Brian P. Sack, and Eric T. Swanson. 2007. "Macroeconomic Implications of Changes in the Term Premium." *Federal Reserve Bank of St. Louis Review* 89 (4): 241–69.

Ramey, Valerie A. 2016. "Macroeconomic Shocks and Their Propagation." In *Handbook of Macroeconomics*, Vol. 2, edited by John B. Taylor and Harald Uhlig, 71–162. Amsterdam: North-Holland.

Svensson, Lars E. O. 2017. "Cost-Benefit Analysis of Leaning against the Wind." *Journal of Monetary Economics* 90: 193–213.

Wachter, Jessica A. 2013. "Can Time-Varying Risk of Rare Disasters Explain Aggregate Stock Market Volatility?" *Journal of Finance* 68 (3): 987–1035.