The Dollar Channel of Monetary Policy Transmission*

Ralf R. Meisenzahl
Chicago FED

Friederike Niepmann
Federal Reserve Board

Tim Schmidt-Eisenlohr
Federal Reserve Board

March 21, 2025

Abstract

This paper documents a new dollar channel that transmits monetary policy across borders. Exploiting unique features of the syndicated loan market for identification, we show that changes in the euro-dollar exchange rate around ECB monetary policy announcements that are orthogonal to simultaneous changes in euro-area interest rates and stock prices affect U.S. leveraged loan spreads. Specifically, in response to dollar appreciation, investors require higher compensation for risk, and borrowing costs for U.S. firms increase. These findings imply a causal link between the U.S. dollar and investors' risk appetite.

Keywords: loan pricing, monetary policy spillovers, dollar, institutional investors, risk taking

JEL Classification: F15, G15, G21, G23

*Meisenzahl: Federal Reserve Bank of Chicago. Address: 230 South LaSalle Street, Chicago, IL 60604. Email: ralf.meisenzahl@chi.frb.org. Niepmann: Board of Governors of the Federal Reserve System. Address: 20 and C Streets, Washington, DC 20551. Email: friederike.niepmann@frb.gov. Schmidt-Eisenlohr: Board of Governors of the Federal Reserve System. Address: 20 and C Streets, Washington, DC 20551. Email: tim.schmidt-eisenlohr@frb.gov. We thank Marek Jarocinski and Niklas Kroner, as well as seminar participants at the Bank of Ireland, CEPR "WE ARE" series, Chicago FED, Federal Reserve Board, the New York Fed, the Universidad the Los Andes, the University of Cambridge, the CESIfo Area Conference on Money, Macro, and International Finance, and Whitman SOM, for helpful comments and suggestions. We also thank Wenxin Du and Andreas Schrimpf for making available some data used in this research. Annie McCrone provided outstanding research assistance. The opinions expressed are those of the authors and do not necessarily reflect the view of the Board of Governors, the Federal Reserve Bank of Chicago or the staff of the Federal Reserve System.

1 Introduction

The effects of monetary policy unfold through a number of channels. Central bank actions not only change the monetary policy stance but also reveal information about the economy (Nakamura and Steinsson, 2018; Jarociński and Karadi, 2020). Moreover, recent work (Boehm and Kroner, 2024; Kroencke, Schmeling, and Schrimpf, 2021) argues that monetary policy actions have large effects that are not reflected in the yield curve. While these issues have been studied in the domestic context, little is known about whether channels independent of yield curve changes play a role for the transmission of monetary policy across borders.

In this paper, we document a new dollar channel of cross-border monetary policy transmission by studying how ECB monetary policy spills over to the United States. We show that dollar movements around ECB monetary policy announcements that are orthogonal to changes in the euro-area yield curve and stock market predict U.S. risky asset prices, specifically leveraged loan spreads. In response to dollar appreciation, borrowing costs for U.S. firms increase because investors in leveraged loans require a higher compensation for risk resulting in higher spreads, potentially because of their foreign currency exposures (Bruno and Shin, 2015). Our findings imply a causal interpretation for the previously documented link between the U.S. dollar and investors' risk appetite (Avdjiev et al., 2019).

We study monetary spillovers to the $1.4 trillion U.S. leveraged loan market, which represents the risky segment of the syndicated loan market. Leveraged loans have variable

rates and are syndicated over roughly two-week periods during which the spread the borrower needs to pay is adjusted based on the demand for the loan from investors. We study how these adjustments—the so-called spread flexes—respond to ECB monetary policy announcements. Because we only look at changes in the spread within a loan after initial loan terms have been set, changes in the spread do not reflect selection effects across borrowers but shifting risk preferences of investors.

To disentangle different ways in which monetary policy transmits across borders, we relate spread flexes to high-frequency changes in euro-area interest rates, the euro-area stock price index, and the euro-dollar exchange rate around ECB announcements from Altavilla et al. (2019), so-called ECB surprises. We find that a surprise appreciation of the euro-dollar exchange rate by one percent during the syndication period increases the spread paid on a leveraged loan by up to 22 basis points. This dollar effect is identified with movements in the euro-dollar exchange rate that are orthogonal to simultaneous euro-area interest rate and stock prices changes. To the best of our knowledge, we are the first to show that foreign monetary policy transmits to U.S. borrowing costs through a dollar channel that is independent of changes in interest rates and stock prices.

To provide additional evidence on the effect of dollar movements on leveraged loans spreads via investor risk appetite, we explore heterogeneous effects across loans and borrowers. First, we show that a dollar appreciation in response to ECB monetary policy announcements has a stronger effect on loans with a higher initial interest rate, a proxy for

the ex-ante riskiness of a loan. The results show that the riskier the loan, the higher the increase in the spread from dollar appreciation, consistent with shifting risk preferences of investors.

Next, we address the concern that the dollar may directly affect the profitability of firms that participate in international trade, so that spreads may change not because risk premia go up but because the riskiness of firms increases. To explore this possibility, we split the sample into borrowers from traded and non-traded industries. We find that, even for firms in non-traded industries, for whom the exchange rate should not directly affect income and risk, the dollar channel is active.

Finally, we distinguish between underwritten loans and refinancing. Underwritten loans, which typically finance acquisitions or leveraged buyouts, have a committed, fixed amount that the arranger is obligated to disburse. In contrast, refinancing loans can be withdrawn when financial conditions tighten, introducing a potential downward bias. Indeed, we find that our results are stronger for the underwritten loans subsample.

Results are robust when controlling for changes in U.S. macroeconomic and financial market variables, using different measures of risk and uncertainty, and applying alternative clustering and sample restrictions. Additionally, results do not change when we include responses of U.S. interest rates, the S&P 500 index, and the euro-dollar exchange rate to Federal Reserve monetary policy announcements that occur during the syndication period. Interestingly, an appreciation of the dollar in response to U.S. monetary policy announce-

ments has quantitatively the same effect on U.S. leveraged loans spreads as dollar movements from ECB monetary policy announcements. This suggests that the dollar channel not only transmits monetary policy across borders but also amplifies the effects of U.S. monetary policy on domestic financial conditions.

Altogether, our results show that monetary policy transmits across borders through a dollar channel that is distinct from the classic international trade channels through which exchange rate movements (including those caused by foreign monetary policy) affect an economy. Dollar appreciation lowers investors' risk appetite and tightens U.S. financial conditions.

Literature Our paper adds to the monetary transmission literature that speaks to effects that go beyond the yield curve. An influential literature has shown that Fed policy reveals information about the state of the economy (Romer and Romer (2000), Campbell et al. (2012), Nakamura and Steinsson (2018)). More recent work has shown that monetary policy (interest rate) surprises affect risky assets (see e.g. Bauer, Bernanke, and Milstein (2023)), and that effects of monetary policy can go beyond the yield curve and materialize in risk appetite (Boehm and Kroner (2024), Kroencke, Schmeling, and Schrimpf (2021)).[1] In addition, Gürkaynak et al. (2021) find that monetary policy affects exchange rates even after taking interest rate and information effects into account. We show that there are effects of monetary policy beyond the yield curve that matter for international monetary policy

[1]This has been termed the risk-taking channel of monetary policy (Borio and Zhu (2012)).

spillovers.

We also contribute to the literature on the international spillovers of monetary policy. Seminal work by Rey (2015) and Miranda-Agrippino and Rey (2020) revealed the importance of U.S. monetary policy for the global financial cycle. More recently, Georgiadis and Jarociński (2023) explore the international spillovers of unconventional U.S. monetary policy. Somogyi et al. (2024) document that U.S. monetary policy interest rate surprises transmit to other countries depending on the riskiness of their currency. Jarocinski (2020) studies transatlantic spillovers of ECB monetary policy, focusing on spillovers from interest rate changes conditional on the response of the European stock market (information vs. monetary policy shocks). In contrast, we show that there are ECB monetary policy spillovers to borrowing costs in the United States through a dollar channel separate from interest rate spillovers.

Finally, the paper contributes to the literature on the role of the dollar. Avdjiev et al. (2019) have argued that the dollar is an indicator of risk taking, while Bruno and Shin (2015) suggest that changes in the dollar affect the risk-taking capacity of the financial sector. Jiang, Krishnamurthy, and Lustig (2018) find that the dollar appreciates with the global demand for U.S safe assets. Niepmann and Schmidt-Eisenlohr (2023) show that dollar appreciation reduces the prices of syndicated loans on the secondary market and lowers the credit supply from U.S. banks that follow an originate-to-distribute model. Lilley et al. (2022) find that after the 2007-08 global financial crisis, the dollar co-moves with global risk

measures. Focusing on the global financial crisis, Stavrakeva and Tang (2024) document that U.S. monetary easing led to an appreciation of the dollar, which is consistent with flight-to-safety behavior related to information effects from forward guidance. Obstfeld and Zhou (2023) document that dollar appreciation predicts economic downturns in emerging markets and developing economies. Our paper shows and quantifies how movements in the dollar that are exogenous to the U.S. economy affect U.S. financial conditions.

The remainder of the paper is organized as follows. Section 2 provides an introduction to the syndicated loan market and explains the dollar channel of cross-border monetary policy transmission. Section 3 develops the main hypotheses that we test. Section 4 presents the empirical specifications, and section 5 discusses the data. Section 6 presents our empirical results, and section 7 concludes, summarizing our main takeaways.

2 Background

In this section, we explain the setup and institutional details of the leveraged loan market that we exploit in our analysis and describe our approach to studying the channels through which foreign monetary policy spills over to the price of U.S. risky assets.

2.1 Leveraged term loan market and loan price setting

We study ECB monetary spillovers in the context of the $1.4 trillion U.S. syndicated leveraged term loan market. Leveraged loans are risky variable-rate loans that charge a spread

over an index rate (e.g. Libor or SOFR). Syndication, the process of finding investors for a loan and originating it, typically takes about two weeks, during which the loan spread can be adjusted based on the demand for the loan from investors.

The syndication process, illustrated in Figure 1, starts with borrowers soliciting bids including pricing and risk-sharing provisions from banks. After the borrower chooses a lead arranger bank for the syndication from the solicited bids, initial loan terms are agreed upon by the borrower and the lead arranger. These initial terms include the loan spread, the original issue discount, covenants, and repayment options. Importantly, initial loan terms are set before the lead arranger assembles the syndicate and loan demand realizes and reflect the lead arranger's information about demand from investors at that time.[2]

Once the initial loan terms are agreed upon, the lead arranger places the loan with investors using book building that determines the final loan spread. Book building takes at least one round. In each round, the arranger proposes a facility agreement including all loan terms, such as the pricing to investors. If, given proposed loan terms, there is sufficient demand, the loan is originated at those terms. If the demand for the loan is higher or lower, then there is another round. Based on the demand that realized with the last set of loan terms, the arranger adjusts the pricing terms accordingly. These adjustments are referred to as "flexes." For instance, if demand was low, then the arranger may increase

[2]Competition for the syndication mandate limits banks' incentives to propose inaccurate pricing provisions. Specifically, banks have no incentive to propose a spread that is above the expected final spread. If banks offer a talk spread that is too high, the bank's proposal would likely be rejected by the borrower.

(flex up) the effective spread, the all-in spread accounting for fees and discounts, in the next round.[3] The initial loan arranging agreement is designed such that the fees the bank earns from arranging the loan decrease with the final loan spread the borrower pays. This compensation structure gives the lead arranger strong incentives to obtain the best possible loan terms for the borrower given the realized demand from investors (Bruche, Malherbe, and Meisenzahl, 2020). The book building process continues until the offered loan terms meet the demand from investors and the loan is originated. After the borrower receives the funds, the loan starts trading in the secondary loan market.

To identify monetary policy spillovers, we relate spread flexes to ECB monetary policy announcements that happen during the described book building process. Thereby, we identify the effects of euro-area monetary policy on U.S. loan prices *within* a loan, that is, without confounding effects from borrower selection. Additionally, given that the initial loan terms are preset, and the lead arranger has the incentive to obtain the best loan terms for the borrower, spread flexes should only be driven by changes in the demand from outside investors for a specific loan. Also, because leveraged loans are variable rate loans, such that investors are automatically compensated for interest rate changes without changes to the spread, our exercise reveals how ECB monetary policy transmits to U.S. corporate

[3]We include adjustments to fees, such as discounts, in our calculation of the flex of the spread and hence refer to the total adjustments as flexes in the effective spread. Berg, Saunders, and Steffen (2016) document that discounts play a significant role in loan pricing. While loan amounts can be flexed in some cases, loans taken out for LBO purposes generally do not exhibit amount adjustments. The ability to flex, the range of flexes, and the consequences of flexes for the arranger's fee are part of the risk-sharing in the contract between borrower and arranger (Bruche, Malherbe, and Meisenzahl, 2020).

borrowing costs through changes in the risk appetite of investors.

2.2 Disentangling international monetary policy transmission channels

Traditionally, monetary policy is thought of as operating through changes in interest rates. Changes in policy rates directly move short-term interest rates, while quantitative easing and tightening and forward guidance target the long end of the yield curve. However, recent research suggests that monetary policy affects the economy through factors that are not reflected in the yield curve (Boehm and Kroner, 2024; Bauer, Bernanke, and Milstein, 2023). In particular, these papers argue that there is a lot of movement in risky asset prices around monetary policy announcements that cannot be explained by changes in interest rates.

In our analysis, we assess whether effects beyond the yield curve also play a role in cross-border monetary policy transmission. We focus on movements in the euro-dollar exchange rate around ECB monetary policy announcements and analyze whether they affect U.S. risky asset prices. To identify the transmission of monetary policy across borders through this dollar channel, we exploit movements in the euro-dollar exchange rate that are orthogonal to euro-area interest rate and stock prices changes. To that end, we obtain changes in the yield curve, the stock market, and the euro-dollar exchange rate around ECB monetary policy announcements that happen during the book building process. In line with Altavilla et al. (2019), we call these high-frequency movements around announcements "surprises".

Controlling for interest rate and stock market surprises is key. First, interest rate changes directly affect the euro-dollar exchange rate. When the ECB raises interest rates, the dollar depreciates as investors arbitrage interest rate differentials between Europe and the United States. Through the dollar channel, dollar depreciation eases U.S. financial conditions. At the same time, however, higher interest rates in the euro area raise U.S. loan spreads as investors demand a greater compensation for holding U.S. assets (interest rate channel). In other words, an ECB interest rate hike lowers loan spreads through the dollar channel but raises them through the interest rate channel. As a result, we can only identify the effects of changes in the dollar on loan spreads when controlling for changes in interest rates.

Second, we need to control for changes in stock prices to account for information effects. Changes in stock prices around monetary policy announcements, in addition to capturing the effects of interest rates on firm profitability, reflect information about the state of the economy revealed by the central bank. Information effects can be so strong that they overturn the interest rate effect, so that higher interest rates can be accompanied by increasing stock prices (Jarociński and Karadi, 2020). Controlling for euro-area stock prices ensures that the dollar movements we use to identify the effects on leveraged loan spreads do not simply capture new information about the euro-area economy as reflected in euro-area stock prices.

2.3 Distinguishing the dollar channel from traditional exchange rate channels

It is well known that monetary policy affects the exchange rate and thereby generates spillover effects to other countries through the traditional expenditure-switching channel (Mundell, 1968). The expenditure-switching channel implies that an ECB rate hike that depreciates the dollar makes U.S. goods relatively cheaper and thereby increases U.S. exports and decreases U.S. imports. More recent work has documented that basically all U.S. exports and imports are denominated in U.S. dollars (Gopinath et al., 2020), which contrasts with the assumption in Mundell (1968) of producer-currency pricing.[4] When all trade is invoiced in U.S. dollars, a dollar depreciation should increase export quantities but should leave import quantities unaffected. All else equal, one would expect the positive exports effects of a dollar depreciation to improve the financial position of U.S. exporters, potentially reducing their loan spreads.

Our dollar channel differs from this classic channel because, as we will show, it operates for both firms in traded and non-traded sectors, which is inconsistent with the view that the exchange rate only affects the economy through international trade. Additionally, to the extent that standard international macro models directly link the dollar to interest rates, there should not be an effect of these classic trade channels once interest rates are controlled for.

[4] On the related earlier literature on the dollar as a vehicle currency, see among others Corsetti et al. (2007), Cook and Devereux (2006), Goldberg and Tille (2008) and Goldberg and Tille (2009).

The dollar channel we uncover is more closely related to recent work on the balance-sheet channel that has argued that devaluations can be contractionary in the context of emerging economies that have dollar liabilities (see, e.g., Aguiar (2005)). This literature has shown that, to the extent that a country is indebted in dollars, dollar appreciation can weigh on its economy because it increases the burden from dollar debt. This effect can be strong enough to overturn the expansionary effects of a devaluation arising from the classic expenditure-switching channel. Of course, this foreign-currency debt channel cannot work for the United States in exactly the same way because both firms and banks in the United States operate and are funded in dollars. Instead, our dollar channel reflects global forces that create a link between dollar appreciation and the price of risk demanded by investors. One paper that models such a relationship between dollar appreciation and risk-taking is Bruno and Shin (2015).

3 Testable Predictions

An ECB announcement that leads to an appreciation of the dollar against the euro should decrease risk-taking by investors and thereby tighten U.S. credit conditions. For example, dollar appreciation could increase the risk in investors' portfolios because of investors' currency exposures (Bruno and Shin, 2015). When the dollar appreciates, exposures in foreign currency become riskier, making investors with FX exposure less willing to take on additional risk.

Prediction 1. *Dollar appreciation in response to an ECB monetary policy announcement causes loan spreads for risky U.S. borrowers to increase.*

As discussed, ECB monetary policy announcements can also affect U.S. corporate borrowing spreads through changes in interest rates. Higher interest rates in the euro area relative to the United States should, all else equal, raise U.S. spreads because investor will require higher compensation for holding U.S. assets.

Moreover, as explained in section 2, there is a key interaction between the dollar channel and the interest rate channel because changes to ECB interest rates directly affect the euro-dollar exchange rate. Specifically, an ECB rate hike depreciates the dollar against the euro via the interest rate parity condition. While an increase in euro-area interest rates raises U.S. borrowing costs, the accompanying dollar depreciation reduces them. Therefore, to estimate the dollar channel, one needs to directly control for the interest rate channel. Not doing so generates a downward bias in the dollar surprise coefficient estimate.

Prediction 2. *(i) An increase in euro-area interest rates in response to an ECB monetary policy announcement increases loan spreads for risky U.S. borrowers.*

(ii) When regressing spread flexes on surprises in the euro-dollar exchange rate, the coefficient estimate on the euro-dollar exchange rate increases when the regression also controls for surprises in interest rates.

While leveraged loans are generally risky, their ratings range from BBB to CCC+ and

below as Figure 7 illustrates. Because the dollar affects investors' risk appetite, the effect of the dollar on leveraged loan spreads should be larger for riskier loans.

Prediction 3. *The effect of dollar appreciation in response to an ECB monetary policy announcement on loan spreads is larger for riskier U.S. borrowers.*

In our empirical section, we test Predictions 1 through 3.

4 Specifications

This section presents the main specifications of our empirical analysis.

Baseline Specification The baseline specification relates the effective spread flex of a leveraged loan to the movement in the euro-dollar exchange rate around ECB monetary policy announcements during the loan's syndication period:

$$\Delta \textit{Effective Spread}_{i,\Delta t} = \beta_1 Dollar_{\Delta t}^{ECB} + \gamma X_i + \varphi \Delta Z_{\Delta t} + \delta_{ind} + \delta_p + \delta_l + \epsilon_{i,\Delta t}, \qquad (1)$$

where $\Delta \textit{Effective Spread}_{i,\Delta t}$ is the change in the effective spread of the loan due to a flex or zero if there is no flex. The independent variable of interest, $Dollar_{\Delta t}^{ECB}$, is the change in the euro-dollar exchange rate around the ECB announcement window that falls into the syndication period. The baseline specification includes loan controls X_i, as well as industry (δ_{ind}), product (δ_p), and lead arranger (δ_l) fixed effects. Loan controls are talk (initial)

spread, maturity, and dummy variables for whether or not the loan is sponsored, rated, a cov-lite loan, or a middle market loan. Δt is the time from the launch date of loan i to the flex date of loan i. We also include macro and financial control variables $\Delta Z_{\Delta t}$, computing their differences from the start to the flex date.[5] The predicted sign for the baseline regression is $\beta_1 > 0$, as we expect an appreciation of the dollar to increase the effective spread (Prediction 1).

Interest rate surprises

$$\begin{aligned} \Delta \textit{Effective Spread}_{i,\Delta t} &= \beta_1 Dollar_{\Delta t}^{ECB} + \sum_{i=1}^{4} \beta_{2,i} PCR_{\Delta t}^{ECB,i} \\ &\quad + \varphi \Delta Z_{\Delta t} + \gamma X_i + \delta_{ind} + \delta_p + \delta_l + \epsilon_{i,\Delta t}, \end{aligned} \tag{2}$$

where $PCR_{\Delta t}^{ECB,i}$ is the i^{th} principal component of euro-area yield curve changes around ECB announcements. When estimating the equation, we first run a version that only includes the 2-year OIS rate surprise. Then, in a next step, we control for the four principle components of the yield curve surprises as indicated.[6] We expect a positive effect of interest rate changes on U.S. borrowing costs, i.e. β_2 associated with the 2-year OIS rate should be positive.

[5] We include the VIX as a measure of uncertainty in the economy, the 3-month U.S. Libor and the 2-year Treasury yield as measures of short-term and medium-term interest rates, and the U.S. term spread as a measure of future economic conditions. The Aruoba-Diebold-Scotti Business Conditions Index is also included to capture U.S. business conditions at a high frequency.

[6] Using the 2-year OIS rate suprise allows us to test for the predicted positive sign of the interest rate on U.S. loan spreads. In a next step, the principle components allow us to control for changes across the whole yield curve in a parsimonious way. In section 5, we explain in more detail how the principal components are estimated.

Euro-area stock returns Next, we control for changes in the euro-area stock market index around ECB monetary policy announcements, estimating the following equation:

$$\begin{aligned} \Delta \textit{Effective Spread}_{i,\Delta t} &= \beta_1 Dollar_{\Delta t}^{ECB} + \sum_{i=1}^{4} \beta_{2,i} PCR_{\Delta t}^{ECB,i} + \beta_3 EA\text{ Stocks}_{\Delta t}^{ECB} \\ &\quad + \varphi \Delta Z_{\Delta t} + \gamma X_i + \delta_{ind} + \delta_p + \delta_l + \epsilon_{i,\Delta t}, \end{aligned} \tag{3}$$

where $EA\text{ Stocks}_{\Delta t}^{ECB}$ is the change in the euro-area stock market index (Euro Stoxx 50) around ECB announcements.

Federal Reserve Surprises In a next step, we use high-frequency surprises around Federal Reserve monetary policy announcements as additional controls, estimating:

$$\begin{aligned} \Delta \textit{Eff. Spread}_{i,\Delta t} &= \beta_1 Dollar_{\Delta t}^{ECB} + \sum_{i=1}^{4} \beta_{2,i} PCR_{\Delta t}^{ECB,i} + \beta_3 EU\text{ Stocks}_{\Delta t}^{ECB} \\ &\quad + \beta_4 Dollar_{\Delta t}^{FED} + \sum_{j \in J} \beta_{5,j} R_{\Delta t}^{FED,j} \\ &\quad + \varphi \Delta Z_{\Delta t} + \gamma X_i + \delta_{ind} + \delta_p + \delta_l + \epsilon_{i,\Delta t}, \end{aligned} \tag{4}$$

where $Dollar_{\Delta t}^{FED}$ is the euro-dollar exchange rate change around FED announcements and $R_{\Delta t}^{FED,j}$ is the change in U.S. yields of 3-month, 2-year, and 10-year tenors around FED announcements, i.e. $j \in \{3M, 2Y, 10Y\}$.

Talk Yield Interactions To test Prediction 3, we finally include an interaction term between the log of a loan's initial talk spread and the dollar surprise in the baseline regression:

$$\begin{aligned} \Delta \textit{Effective Spread}_{i,\Delta t} &= \beta_1 Dollar_{\Delta t}^{ECB} + \beta_2 Dollar_{\Delta t}^{ECB} \times Log\ (Talk\ Spread_i) \\ &+ \varphi \Delta Z_{\Delta t} + \gamma X_i + \delta_{ind} + \delta_p + \delta_l + \epsilon_{i,\Delta t}, \end{aligned} \tag{5}$$

We expect a positive coefficient on the interaction term β_2, implying that the increase in the spread is larger for riskier loans, i.e. those with a higher initial talk spread.

5 Data

5.1 Syndicated Loan Data

We obtain information on syndicated loans from Pitchbook's Leveraged Commentary and Data (LCD). LCD contains detailed data on leveraged loans, their characteristics, and their syndication process. The data set includes syndicated loans with either a non-investment-grade rating or with a first or second lien and a spread of at least 125 basis points over Libor.[7]

In our analysis, we focus on loans originated between August 2011 and December 2023 because information on surprises for the longer end of the euro-area yield curve is only available from August 2011 onward. Furthermore, by excluding earlier years, we ensure that our results are not driven by the 2007-08 financial crisis. In addition, we only keep

[7] Figure 7 shows the distribution of loan ratings for the sample.

U.S. borrowers to limit the concern that borrowers' credit risk is directly affected by dollar movements. Table 1 shows summary statistics for our baseline sample of 6,430 loans.

Figure 2 shows the quarterly number of loans and quarterly total loan amounts in the institutional leveraged term loan market during the sample period. We observe on average 129 loans per quarter, totaling $4.3 trillion over the sample period.

Our main variable of interest is the adjustment (flexes) in the loan spread. The data contain information on when a loan was launched (launch date) and when the flex was agreed upon (flex date). Figure 3 shows the incidences of positive and negative flexes to the effective spread. The figure shows that adjustments of the spread are common. Moreover, positive and negative flex incidences exhibit a clear, negative correlation.

5.2 Data on Policy Surprises

We obtain data on euro-dollar exchange rate surprises, euro-area interest rate surprises, and euro-area stock market surprises from Altavilla et al. (2019), who collect responses of these variables around monetary announcements by the ECB. Additionally, we use data from Bauer and Swanson (2023) for information on responses of U.S. interest rates and the S&P 500 to Federal Reserve monetary policy announcements. Finally, we obtain responses of the euro-dollar exchange rate to FED announcements from Ferrari, Kearns, and Schrimpf (2021), as these are not collected in Altavilla et al. (2019).

For the ECB monetary policy surprises from Altavilla et al. (2019), we employ changes

over the monetary policy event window. Specifically, a surprise is then defined as the "change in the median quote from the window 13:25-13:35 before the press release to the median quote in the window 15:40-15:50 after the press conference." Bauer and Swanson (2023) measure "intradaily interest rate changes over a 30-minute window starting 10 minutes before each FOMC announcement and ending 20 minutes afterward, using intradaily data from Tick Data."

To capture the euro-area yield curve response to ECB monetary policy announcements, we run a principal component analysis on all Overnight Index Swap (OIS) rates collected in Altavilla et al. (2019) since August 2011.[8] That is, we include OIS rates of the following maturities in the principal component analysis: 1 week; 1 and 3 months; and 1, 2, 3, 4, 5 ,6, 7, 8, 9, and 10 years. The first four principal components explain 98.8% of the variation across these 13 different maturities. We use the predicted values for the first four principal components as control variables.

As discussed, our analysis exploits movements in the euro-dollar exchange rate in response to ECB monetary policy announcements that are orthogonal to simultaneous interest rate and stock market changes. This is important because euro-dollar exchange rate surprises are correlated with euro-area interest rate surprises and euro-area stock market surprises, as illustrated in Figure 4. The top panel plots the surprises in the euro-dollar exchange rate against the surprises in the 2-year OIS rate, showing a negative correlation: when there is

[8]OIS rates for 15- and 20-year maturities are only available since 2013. Including these additional maturities shortens the sample but does not affect any of our results.

a positive ECB interest rate surprise, the dollar tends to depreciate against the euro, as interest rate parity demands. The bottom panel has the euro-area stock market surprise on the x-axis and the euro-dollar exchange rate surprise on the y-axis, depicting a positive correlation: When there is a positive euro-area stock market surprise, the dollar tends to appreciate against the euro.

Figure 5 plots the orthogonalized euro-dollar exchange rate surprises over time along with the plain euro-dollar exchange rate surprises. Even though interest rate and stock market surprises predict euro-dollar exchange rate movements, there is a lot of variation in the euro-dollar exchange rate around ECB monetary policy announcements that is unrelated to interest rate and stock market changes. The correlation coefficient between the plain euro-dollar exchange rate surprises and the equivalent orthogonalized surprises is high at 77.5 percent.

5.3 Data Set Construction

Using the launch date and the flex date, we first construct the syndication period for each loan. If a loan does not have a flex date, we use the first 12 days after launch as the syndication period. For each loan, we check if any monetary policy announcement takes place during the syndication period. If there is a monetary policy announcement within that time window, we set the ECB and FED surprises to the observed exchange rate, interest rate, and stock market changes around that event. Otherwise, we set each surprise to zero.

We drop 14 loans for which the syndication window overlaps with more than one ECB announcement.

Of the final sample of 6430 loans, 1278 loans (20%) have a positive ECB dollar surprise, 995 loans (15%) have a negative ECB dollar surprise and 4157 loans (65%) do not overlap with an ECB announcement.

5.4 Additional Data

Table A.1 provides information on the data sources of various other variables used in this paper. Key U.S. macro and financial variable are from Federal Reserve Economic Data (FRED). We also employ several measure of risk and uncertainty provided by Bekaert, Engstrom, and Xu (2019) and the Treasury Basis from Jiang, Krishnamurthy, and Lustig (2018). To identify the trade intensity of industries of the borrowers, we draw on information from the Bureau of Economic Analysis (BEA) for data on industrial production and on data from the U.S. Census Bureau to obtain imports and exports by industry. Specifically, we get data for the year 2010 at the NAICS 3-digit level and use them to calculate export and import intensities as exports and imports over domestic absorption, respectively.[9] To match with the loan data that has SIC 4-digit industry codes, we use a NAICS-SITC crosswalk table.

[9]That is, import intensity in industry i is given by: $import\ intens_i = imports_i/(output_i + imports_i - exports_i)$. Export intensity is constructed analogously.

6 Results

This section presents the empirical tests of the predictions laid out in section 3. We first show the baseline result on the dollar channel of cross-border monetary policy transmission. We then provide complementary evidence, studying heterogeneity in the riskiness of loans, borrowers' international trade exposure, and loan purposes. We next show robustness to controlling for additional risk and uncertainty measures and the effect of FED announcements on the dollar. Finally, our results remain highly significant even with more conservative clustering.

6.1 Confirming Prediction 1 Visually

Before delving into regression analysis, we present visual evidence for Prediction 1. Figure 6 shows a scatter plot of the spread flex of leveraged loans against the change in the euro-dollar exchange rate around the ECB monetary policy announcement that falls into the syndication period of the loan. The surprises correspond to those shown in the red line in Figure 5, which have been orthogonalized with respect to simultaneous euro-area interest rate and stock prices changes. The binscatter plot shows a clear positive relationship: when the dollar appreciates in response to an ECB monetary policy announcement, the spread flex is larger, implying higher borrowing costs for U.S. firms.

6.2 Baseline Regression Results

Table 2 presents our baseline regression results, estimating specifications 1 through 4 described in section 4. Columns (1) and (2) report the results from estimating specification 1. This specification tests for a positive relationship between the dollar and U.S. loan spreads illustrated in Figure 6 (Prediction 1). Column (1) shows the effect when controlling only for loan characteristics, as well as industry, purpose, and lead agent fixed effects. The loan controls are the talk (initial) spread, maturity, and dummy variables for whether or not the loan is sponsored, rated, a cov-lite loan, or a middle market loan. The estimated dollar coefficient is highly statistically significant and suggests that a one percent appreciation of the dollar against the euro is associated with an increase in the effective loan spread by 6.2 basis points, which is in line with Prediction 1.

To ensure that our results are not driven by U.S. macroeconomic variables, starting in column (2), we include changes over the syndication period in the VIX, the 2-year Treasury yield, the U.S. term spread, the 3-month U.S. Libor, and the Aruoba-Diebold-Scotti Business Conditions Index. The coefficient size and statistical significance in column (2) are basically the same as in column (1).

To test whether loan spreads increase with euro-area interest rates (Prediction 2, part (i)), the next two columns show results from estimating Equation 2 with two different sets of interest rate surprises. Column (3) adds the 2-year ECB OIS rate surprise. Consistent with our prediction, the 2-year OIS rate surprise is highly significant and has the expected positive

sign. Moreover, once we control for the interest rates, the dollar effect becomes stronger, consistent with Prediction 2, part (ii). Thus, accounting for the interest-rate channel is crucial to fully uncover the dollar effect as discussed in section 3. Column (4) expands the interest rate controls to the first four principal components estimated from the full set of ECB OIS yield curve surprises. Expanding the range of interest controls to the full yield curve further increases the size of the dollar coefficient. In this specification, a one percent appreciation of the dollar against the euro is associated with an increase in the effective loan spread by 13.8 basis points.

In column (5) we check how loan spreads behave when the euro-area stock market increases due to an ECB monetary policy announcement, estimating specification (3). We find that an increase in the euro-area stock market index around an ECB announcement is associated with a decline in the interest rate spread charged to U.S. borrowers. However, the coefficient estimate is not statistically significant. Importantly, controlling for this channel does not weaken the dollar channel. If anything, the estimated coefficient on the dollar surprise becomes even larger.

Finally, to rule out that our results are driven by contemporaneous events in the United States, we control for changes to U.S. interest rates and the S&P 500 around FED policy announcements that overlap with the syndication window, following Equation (4). Column 6 shows the results of including these additional controls. The inclusion of U.S. monetary policy announcement effects does not materially affect the estimated dollar coefficient, showing that

our results are not driven by contemporaneous U.S. monetary policy decisions.

To summarize, we find a strong effect of exogenous dollar appreciation on U.S. borrowing costs that is independent of the interest rate channel, captured by euro-area interest rates, and the information channel, captured by the European stock market index.

6.3 The Role of Borrower Risk

To further tighten the link between the U.S. dollar and investors' risk appetite, we now examine whether exogenous dollar movements affect loans based on their riskiness in line with Prediction 3. If the dollar channel works through investors' risk appetite, then we would expect that ex-ante riskier loans exhibit larger effects of dollar movements on spread flexes. To test this, we include interaction terms between the dollar surprise and the log of a loan's initial talk spread—the spread proposed by the lead arranger at the beginning of the syndication process—as a measure of loan riskiness, estimating Equation 5.

Table 3 shows the results. The interaction effect of dollar surprises with the initial talk spread is positive and statistically significant (column 1). We next add interactions of the talk spread and other surprise variables in columns (2) and (3) which increases the estimated interaction effect. The risk interaction terms is quantitatively relevant. Based on the coefficient estimates from column (3), moving from the 25th to the 75th percentile in log talk spread (i.e. from 325 basis points to 475 basis points), raises the effect of a 1 percent dollar appreciation on the loan spread from 7.1 basis points to 18.8 basis points.

In this setup, we can further tighten identification by controlling for the monetary policy event—that is, we now assess whether spreads of loans with different risk that are exposed to the same monetary policy event respond differently to exogenous moves in the dollar. Column (4) shows the results when including monetary-policy event fixed effects that absorb the baseline monetary policy surprise terms. The positive and significant interaction terms across columns indicate that riskier loans see higher spread flexes relative to safer loans when the dollar appreciates. This finding is consistent with the dollar affecting investors' risk appetite, leading to stronger spread adjustments for riskier loans.

6.4 Firms' International Exposure

Next, we show that changes in the riskiness of borrowers in response to dollar movements do not explain our findings. Dollar movements can directly affect a borrower's revenues and costs if the borrower imports or exports. Changes in income may in turn affect the ability of a borrower to repay a loan and hence the credit spread charged by banks. We address this concern by matching loans to industry-level information on international trade activities. Specifically, we split the sample into U.S. borrowers that operate in non-traded industries and traded industries, respectively. A non-traded industry is an industry that has no direct imports or exports, like, e.g., utilities. Table 4 shows the results of estimating Equation 3 for each subsample. For ease of comparison, column (1) replicates the result from Table 2, column (6) with the sample of loans for which industries could be matched to trade data.

Columns (2) and (3) show results for borrowers in non-traded and traded industries, respectively. Results are highly significant for both groups of borrowers. While not significantly different from the coefficient in column (2), we find a somewhat larger point estimate for borrowers in traded industries. This could reflect additional effects through which dollar appreciation adversely affects firms' riskiness in the traded sector. Importantly, the baseline effect is present independent of borrowers' international trade status in support of the dollar channel, which works through investor risk appetite.

6.5 Loan Purposes

Finally, we study the cross-sectional heterogeneity of spread flexes to dollar movements by loan purpose. For this, we split the sample into loans that are underwritten (loan purpose is acquisitions or LBO) and not underwritten (loan purpose is refinancing). The key difference between the two types of loans is that underwritten loans are *new* loans for which lead arrangers commit to a set of terms. These new loans finance LBOs and M&A activity and are originated even when investor demand is low. If there is insufficient demand for an underwritten loan from investors, the lead arranger can increase the spread but forgoes part of the underwriting fees, but eventually has to provide the remaining funds if investor demand remains low (Bruche, Malherbe, and Meisenzahl, 2020). In contrast, when a firm refinances, the old loan is paid off and the proceeds are distributed to the loan holders, making the holders of the old loan who just received funds likely investors (see, e.g. Beyhaghi, Nguyen,

and Wald (2019)).

Note that our high-frequency within-loan identification is key to fully capture the heterogeneity in spread flex responses between underwritten and refinancing loans. While initial terms for both types of loans might respond to average conditions at the start of the syndication process, flexing during the syndication period should be more tightly linked to the demand for underwritten loans, where the lead arranger looks for new syndicate members.

Table 5 shows the estimated effect for the sample split. For ease of comparison, column (1) replicates the baseline in column (6) of Table 2. Column (2) shows the results of the subsample of underwritten loans. Compared to column 1, the coefficient is more than 40 percent larger, suggesting that a one-percent appreciation of the dollar increases the spreads of underwritten loans by 22 basis points. The coefficient remains statistically significant at the 1 percent level. However, for refinancing loans the estimated effect is economically much smaller (column (3)).

To summarize, the cross-sectional analysis reveals that underwritten and refinancing loans differ notably in their responsiveness to the dollar, corroborating the view that the dollar change represents an exogenous shock to investors' loan demand.

6.6 Robustness

This section presents robustness analysis, showing that results continue to hold when we include additional measures of risk and uncertainty in the regressions, restrict the sample to

loans with ECB announcements, apply different clustering, and control for changes in the euro-dollar exchange rate in response to Federal Reserve monetary policy announcements.

Controlling for Measures of Risk and Uncertainty While our baseline regressions already include a set of macro and financial variables, it could be that our controls do not fully capture changes to risk sentiment of investors and uncertainty uncertainty outside of the dollar channel. Therefore, we include additional measures for robustness. Table 6 presents the results. Columns (1) through (5) replicate the specifications in Table 2, adding four additional variables; first, the change in the yen-euro exchange rate; second and third, the risk aversion and uncertainty indices from Bekaert, Engstrom, and Xu (2019), respectively. Fourth, column (4) shows results when controlling for the Treasury Basis following Jiang, Krishnamurthy, and Lustig (2018) in a shorter sample. Finally, column (5) includes the four variables in a single regression. Across all specifications, the ECB dollar surprise is highly significant and of similar magnitude as in the baseline.

Additional Robustness Checks We present three additional sets of robustness checks. First, Table 7 restricts the sample to loans whose syndication period overlaps with at least one ECB event. That is, we are dropping the zeros in the ECB surprise variables. Results are very similar to the baseline findings.

Second, Table 8 clusters standard errors by ECB event window.[10] In total, there are 223

[10]For this, we set all loans whose syndication window overlaps with the first ECB announcement in our sample as cluster 1. Cluster 2 encompasses all loans that are syndicated between the first and the second

event clusters around the 111 ECB announcements in the sample. With this more conservative clustering, significance levels drop a bit, but coefficients remain highly significant.

Third, we include changes in the euro-dollar exchange rate around FED announcements from Ferrari, Kearns, and Schrimpf (2021) in the specification. The results are shown in Table 9. Including this additional variable decreases the point coefficients on the ECB dollar surprise a bit. More interestingly, changes in the dollar around FED announcements affect U.S. syndicated loan spreads exactly the same way as dollar changes caused by ECB surprises, with coefficient estimates on the dollar surprises not being significantly different from each other.

7 Conclusion

This paper documents a new dollar channel that transmits monetary policy across borders. Changes in the euro-dollar exchange rate around ECB monetary policy announcements that are orthogonal to simultaneous changes in euro-area interest rates and stock prices affect U.S. leveraged loan spreads. In response to dollar appreciation, investors require higher compensation for risk, and borrowing costs for U.S. firms increase. These findings show that monetary policy effects beyond the yield curve (Boehm and Kroner, 2024; Bauer, Bernanke, and Milstein, 2023) also matter for cross-border transmission.

While this paper focuses on exchange rate changes caused by ECB monetary policy

announcements. All loans that overlap with the second ECB announcement are in cluster 3, and so on.

announcements and the leveraged loan market, our findings also speak to a broader literature on the dollar and risk (see Avdjiev et al., 2019; Obstfeld and Zhou, 2023). Earlier papers have documented a strong correlation between the dollar and risk appetite in financial markets. Because we use quasi-exogenous exchange rate changes that are driven by developments outside the United States, which are not confounded by simultaneous interest rate or stock market changes, this paper delivers estimates of the effect of a stronger dollar on overall U.S. financial conditions through the risk-taking channel. They suggest that dollar movements that are unrelated to the U.S. economy can cause sizable changes in U.S. financial conditions.

References

Aguiar, Mark. 2005. "Investment, devaluation, and foreign currency exposure: The case of Mexico." *Journal of Development Economics* 78 (1):95–113.

Altavilla, Carlo, Luca Brugnolini, Refet S Gürkaynak, Roberto Motto, and Giuseppe Ragusa. 2019. "Measuring euro area monetary policy." *Journal of Monetary Economics* 108:162–179.

Aruoba, S Borağan, Francis X Diebold, and Chiara Scotti. 2009. "Real-time measurement of business conditions." *Journal of Business & Economic Statistics* 27 (4):417–427.

Avdjiev, Stefan, Wenxin Du, Cathérine Koch, and Hyun Song Shin. 2019. "The Dollar, Bank Leverage, and Deviations from Covered Interest Parity." *American Economic Review: Insights* 1 (2):193–208.

Bauer, Michael D, Ben S Bernanke, and Eric Milstein. 2023. "Risk appetite and the risk-taking channel of monetary policy." *Journal of Economic Perspectives* 37 (1):77–100.

Bauer, Michael D. and Eric T. Swanson. 2023. "A Reassessment of Monetary Policy Surprises and High-Frequency Identification." *NBER Macroeconomics Annual* 37 (1):87–155.

Bekaert, Geert, Eric C. Engstrom, and Nancy R. Xu. 2019. "The Time Variation in Risk Appetite and Uncertainty." Working Paper 25673, National Bureau of Economic Research.

Berg, Tobias, Anthony Saunders, and Sascha Steffen. 2016. "The Total Cost of Corporate Borrowing in the Loan Market: Don't Ignore the Fees." *Journal of Finance* 71 (3):1357–1392.

Beyhaghi, Mehdi, Ca Nguyen, and John K. Wald. 2019. "Institutional investors and loan dynamics: Evidence from loan renegotiations." *Journal of Corporate Finance* 56:482–505.

Boehm, Christoph and T Niklas Kroner. 2024. "Monetary policy without moving interest rates: The fed non-yield shock." Working Paper 32636, National Bureau of Economic Research.

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):236–251.

Bruche, Max, Frederic Malherbe, and Ralf R. Meisenzahl. 2020. "Pipeline Risk in Leveraged Loan Syndication." *Review of Financial Studies* 33 (12):5660–5705.

Bruno, Valentina and Hyun Song Shin. 2015. "Cross-border banking and global liquidity." *Review of Economic Studies* 82 (2):535–564.

Campbell, Jeffrey R, Charles L Evans, Jonas DM Fisher, Alejandro Justiniano, Charles W Calomiris, and Michael Woodford. 2012. "Macroeconomic effects of federal reserve forward guidance." *Brookings Papers on Economic Activity* :1–80.

Cook, David and Michael B Devereux. 2006. "External currency pricing and the East Asian crisis." *Journal of International Economics* 69 (1):37–63.

Corsetti, Giancarlo, Paolo Pesenti, Richard Clarida, and Jeffrey Frankel. 2007. "The simple geometry of transmission and stabilization in closed and open economies." In *NBER International Seminar on Macroeconomics*, 1. The University of Chicago Press Chicago, IL, 65–129.

Du, Wenxin, Joanne Im, and Jesse Schreger. 2018. "The US Treasury Premium." *Journal of International Economics* 112:167–181.

Ferrari, Massimo, Jonathan Kearns, and Andreas Schrimpf. 2021. "Monetary policy's rising FX impact in the era of ultra-low rates." *Journal of Banking & Finance* 129:106–142.

Georgiadis, Georgios and Marek Jarociński. 2023. "Global spillovers from multi-dimensional US monetary policy." Working Paper 2881, European Central Bank.

Goldberg, Linda and Cedric Tille. 2009. "Macroeconomic interdependence and the international role of the dollar." *Journal of Monetary Economics* 56 (7):990–1003.

Goldberg, Linda S and Cédric Tille. 2008. "Vehicle currency use in international trade." *Journal of international Economics* 76 (2):177–192.

Gopinath, Gita, Emine Boz, Camila Casas, Federico J Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller. 2020. "Dominant Currency Paradigm." *American Economic Review* .

Gürkaynak, Refet S, A Hakan Kara, Burçin Kısacıkoğlu, and Sang Seok Lee. 2021. "Monetary policy surprises and exchange rate behavior." *Journal of International Economics* 130:103443.

Jarocinski, Marek. 2020. "Central Bank Information Effects and Transatlantic Spillovers." ECB Working Paper No. 20202482.

Jarociński, Marek and Peter Karadi. 2020. "Deconstructing monetary policy surprises—the role of information shocks." *American Economic Journal: Macroeconomics* 12 (2):1–43.

Jiang, Zhengyang, Arvind Krishnamurthy, and Hanno Lustig. 2018. "Foreign Safe Asset Demand for US Treasurys and the Dollar." *AEA Papers and Proceedings* 108:537–41.

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

Lilley, Andrew, Matteo Maggiori, Brent Neiman, and Jesse Schreger. 2022. "Exchange rate reconnect." *Review of Economics and Statistics* 104 (4):845–855.

Miranda-Agrippino, Silvia and Hélene Rey. 2020. "US monetary policy and the global financial cycle." *The Review of Economic Studies* 87 (6):2754–2776.

Mundell, Robert A. 1968. *International Economics*. Macmillan.

Nakamura, Emi and Jón Steinsson. 2018. "High-frequency identification of monetary non-neutrality: the information effect." *The Quarterly Journal of Economics* 133 (3):1283–1330.

Niepmann, Friederike and Tim Schmidt-Eisenlohr. 2023. "Institutional investors, the dollar, and U.S. credit conditions." *Journal of Financial Economics* 147 (1):198–220.

Obstfeld, Maurice and Haonan Zhou. 2023. "The global dollar cycle." Working Paper 31004, National Bureau of Economic Research.

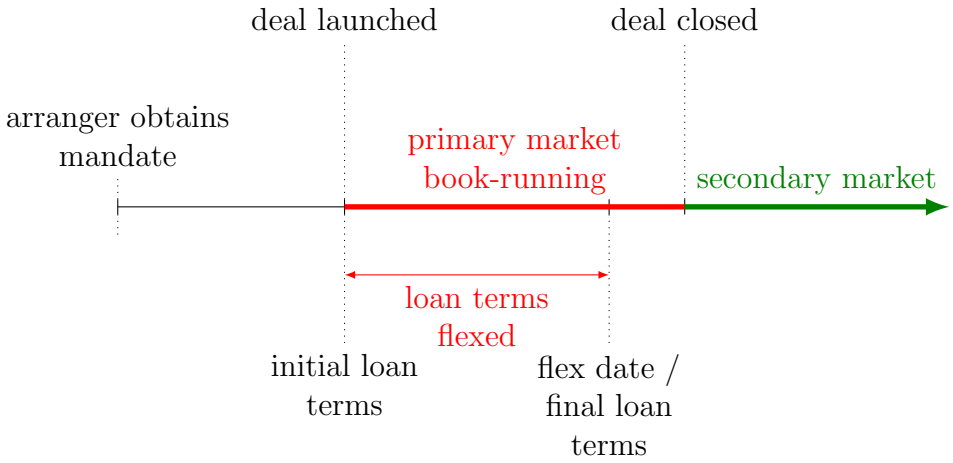
Rey, Hélène. 2015. "Dilemma not trilemma: the global financial cycle and monetary policy independence." Working Paper 21162, National Bureau of Economic Research.

Romer, Christina D and David H Romer. 2000. "Federal Reserve information and the behavior of interest rates." *American Economic Review* 90 (3):429–457.

Somogyi, Fabricius, Erik Loualiche, Colin Ward, and Alexandre Reggi Pecora. 2024. "Monetary Policy Transmission through the Exchange Rate Factor Structure." Ssrn.

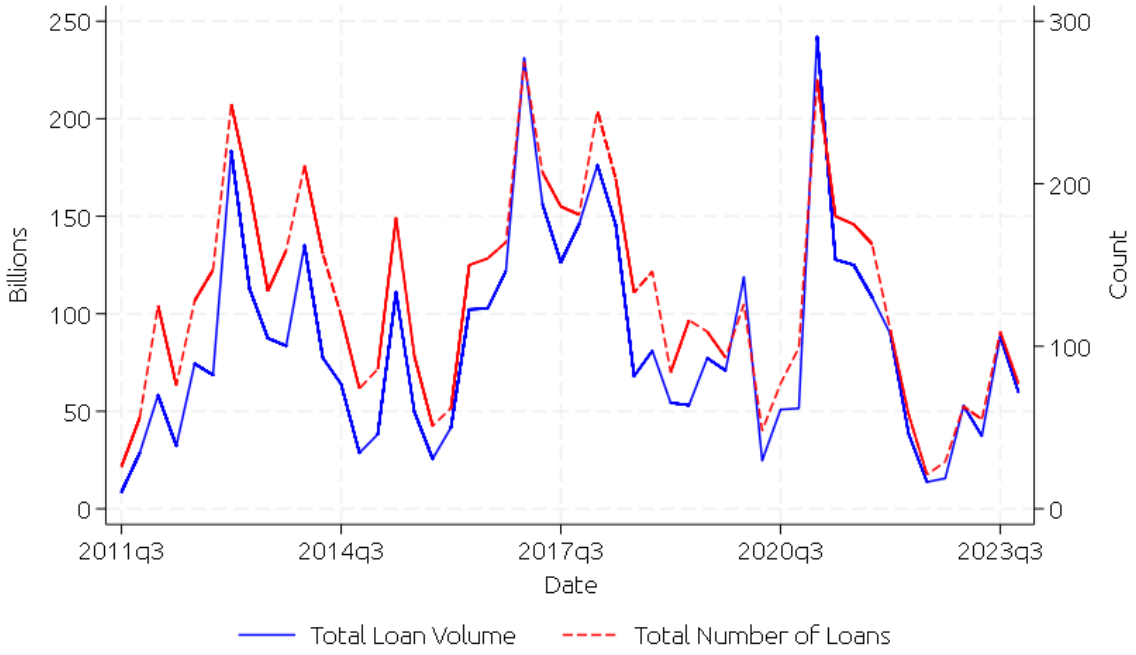
Stavrakeva, Vania and Jenny Tang. 2024. "The Dollar During the Great Recession: The Information Channel of US Monetary Policy and the." *Journal of Finance, forthcoming* .

Figure 1: Syndication Timeline



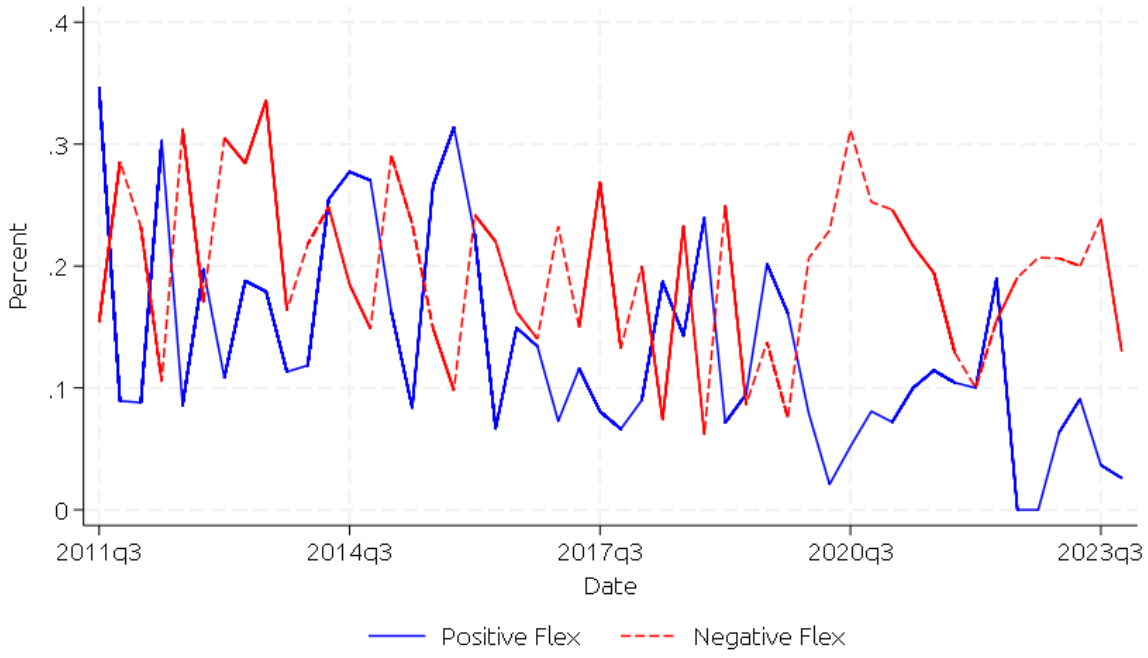
Note: Timeline for the leveraged term loan syndication process based on Bruche, Malherbe, and Meisenzahl (2020).

Figure 2: Total Number of Loans and Loan Amounts



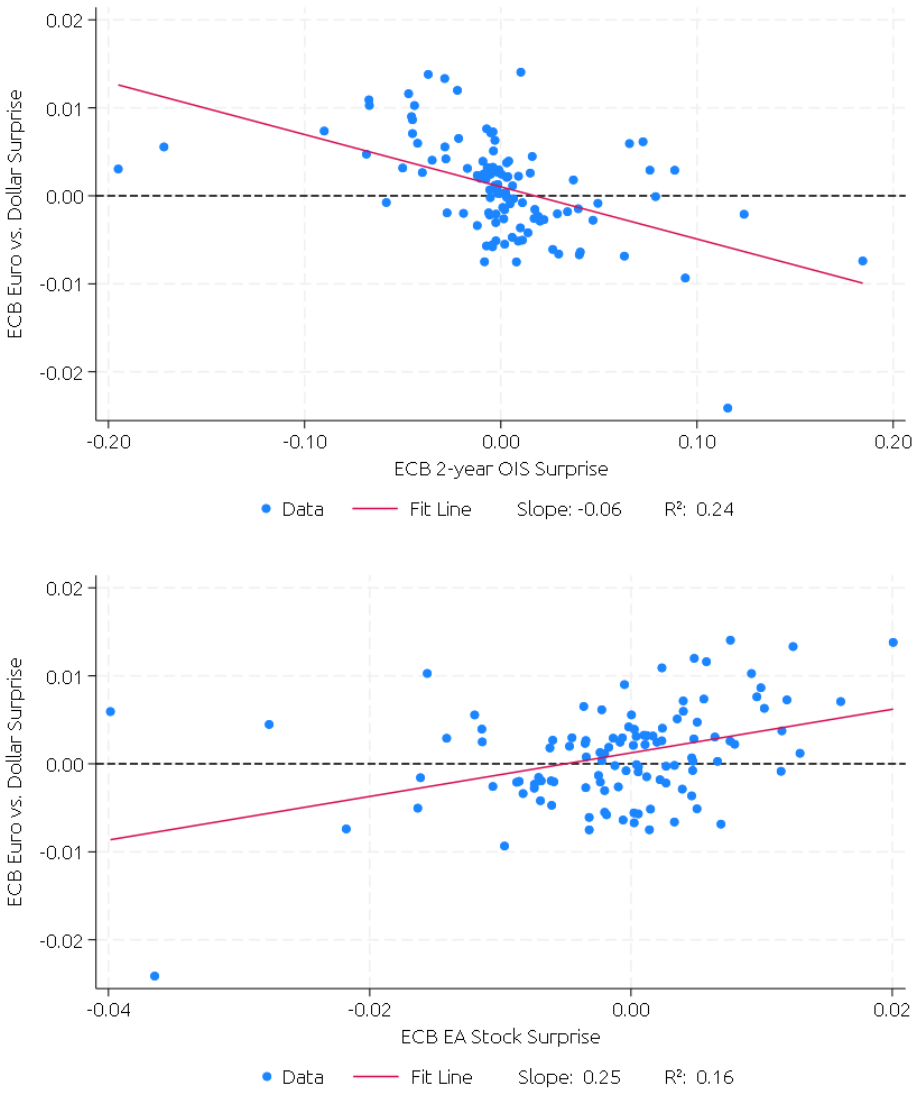
Note: The figure shows the total loan volume and the total number of loans on a quarterly basis, from mid-2011 to 2023. The total loan volume is represented in USD billions, and the total number of loans is a simple frequency count. The figure is based on U.S. borrowers only. Sources: Pitchbook Leveraged Loan Commentary Data (LCD) and Dealscan.

Figure 3: Share of Loans with Interest Rate Spread Flexes



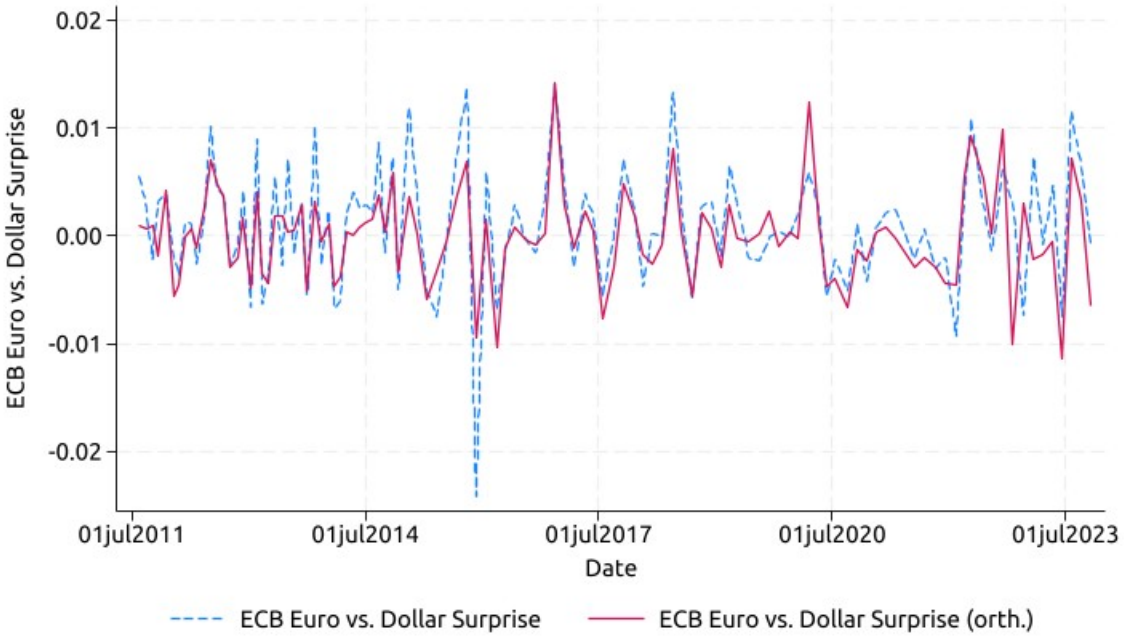
Note: This figure shows the share of total loans that have a positive or negative effective spread flex, on a quarterly basis from mid-2011 to 2023. The figure uses US-borrowers only. Sources: LCD and Dealscan.

Figure 4: ECB Surprises: the Dollar vs. Interest Rates and Stocks



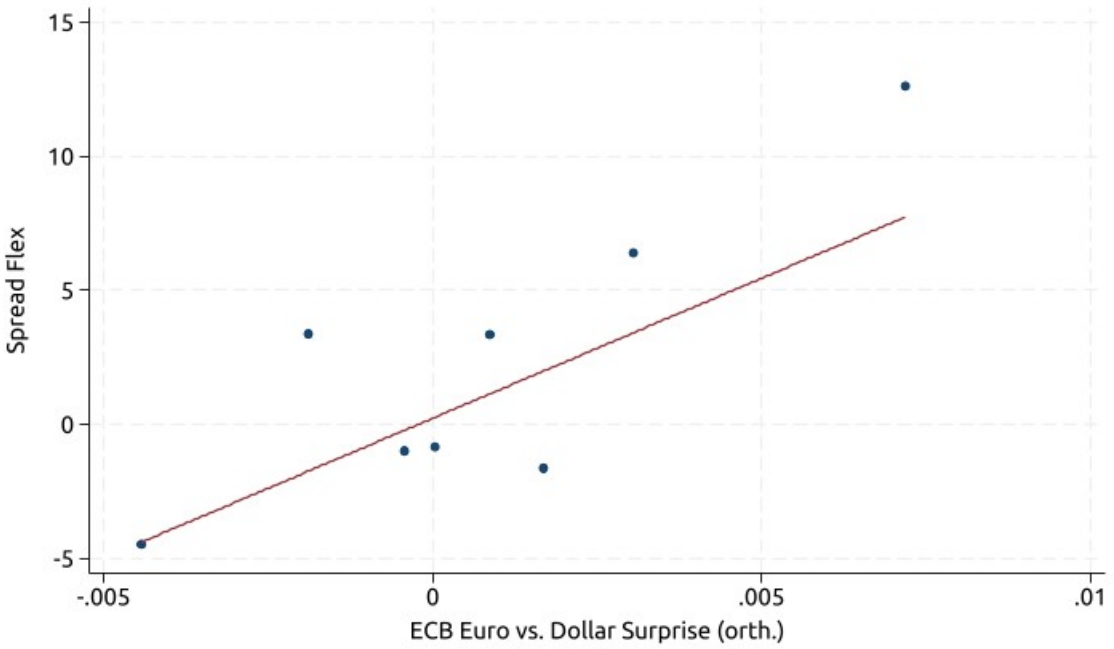
Note: This figure shows how different ECB surprises co-move. The top panel plots the euro-dollar exchange rate surprise against the surprise in the 2-year euro OIS rate. The bottom panel has the euro-dollar exchange rate surprise on the y-axis but the surprise in the euro-area stock market index on the x-axis. The sample include ECB monetary policy announcements from mid-2011 to end-2023.

Figure 5: Orthogonalized Euro-Dollar Exchange Rate Surprises



Note: This figure shows the ECB dollar surprise series. The series in Altavilla et al. (2019) is inverted, so that an increase reflects an appreciation of the dollar. The blue dashed line shows the original inverted series. The red solid line shows the series after orthogonalizing to ECB stock market surprises and the first four principal components of ECB interest rate surprises. A large part of the suprise variation in the euro-dollar exchange cannot be explained by suprises in these other variables.

Figure 6: Spread Flexes and Orthogonalized Dollar Surprises



Note: This figure shows a binscatter plot of the spread flex against the orthogonalized ECB euro-dollar exchange rate surprise. The figure shows that spread flexes increase when the dollar experiences a surprise appreciation against the euro as a result of an ECB monetary policy announcement. The orthogonalized euro-dollar exchange rate surprise is the residual from a regression of the euro-dollar exchange rate surprise on the euro-area ECB stock market surprise and the first four principal components of ECB euro-area interest rate surprises at different maturities. The underlying sample has 6430 loans originated between August 2011 and December 2023.

Table 1: Summary Statistics

	Mean	S.D.	Min.	25th	Median	75th	Max.
Effective Spread Flex (bsp)	0.543	38.258	-250.000	-12.500	0.000	0.000	362.500
ECB Euro (vs. Dollar)	0.033	0.329	-2.413	0.000	0.000	0.000	1.405
Deal Size ($ bn)	0.664	0.744	0.010	0.226	0.425	0.814	12.350
Maturity (log)	1.763	0.241	-0.693	1.658	1.806	1.946	2.126
Δ VIX (log)	0.084	3.499	-18.710	-1.470	-0.125	1.350	27.130
Δ US Term Spread	-0.477	8.891	-49.000	-6.000	-1.000	4.000	65.000
Δ 2-Year Treasury	0.893	9.317	-124.000	-3.000	1.000	5.000	116.000
Δ US Libor	0.912	5.128	-78.675	-0.460	0.125	1.625	79.986
Δ Economic Conditions Index	0.009	0.553	-4.763	-0.114	-0.016	0.114	15.822
Observations	6430						

Note: This table shows the summary statistic for the baseline regression sample that runs from August 2011 to December 2023 and only includes U.S. borrowers.

Table 2: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
ECB Euro (vs. Dollar)	6.215***	6.357***	12.41***	13.75***	15.01***	14.55***
	(1.913)	(1.885)	(2.421)	(2.693)	(2.653)	(2.595)
ECB 2Y OIS			1.832***			
			(0.438)			
ECB Rates PC1				2.708***	2.623***	2.593***
				(0.648)	(0.652)	(0.651)
ECB Rates PC2				1.239	1.284	1.158
				(0.804)	(0.797)	(0.799)
ECB Rates PC3				-0.162	0.171	0.308
				(1.902)	(1.905)	(1.907)
ECB Rates PC4				-1.727	-1.114	-1.197
				(4.163)	(4.174)	(4.159)
ECB EU Stocks					-2.232	-2.126
					(1.614)	(1.628)
FED R2Y						-0.124
						(0.600)
FED R5Y						-0.477
						(1.459)
FED R10Y						1.314
						(1.729)
FED SP500						-0.0137
						(0.0334)
Δ VIX		0.0728	0.104	0.0807	0.0618	0.0382
		(0.137)	(0.137)	(0.138)	(0.138)	(0.138)
Δ US Term Spread		-0.0560	-0.0981	-0.113	-0.107	-0.118*
		(0.0679)	(0.0690)	(0.0700)	(0.0702)	(0.0695)
Δ 2-Year Treasury		-0.176**	-0.181***	-0.170**	-0.169**	-0.245***
		(0.0700)	(0.0697)	(0.0716)	(0.0713)	(0.0713)
Δ US Libor		0.605***	0.519***	0.513***	0.511***	0.565***
		(0.161)	(0.157)	(0.161)	(0.160)	(0.156)
Δ Economic Conditions Index		-1.866**	-2.021**	-2.034**	-2.155**	-1.966**
		(0.943)	(0.934)	(0.936)	(0.930)	(0.924)
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6430	6430	6430	6430	6430	6420
R^2	0.053	0.060	0.065	0.065	0.066	0.066

Note: This table shows the effect of the change in the euro-dollar exchange rate around ECB announcements that fall into the syndication period of a loan on the effective spread flex of the loan for a sample of U.S. borrowers in the leveraged loan market. Loan controls are included but not shown to conserve space. The sample period is from August 2011 to December 2023. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 3: The Role of Borrower Risk

	(1)	(2)	(3)	(4)
ECB Euro (vs. Dollar)	-89.29*	-191.0***	-170.5***	
	(54.16)	(63.99)	(58.15)	
ECB Euro (vs. Dollar) X Log Talk Spread	17.40*	34.22***	30.71***	31.04***
	(9.237)	(10.92)	(9.949)	(11.67)
ECB Rates PC1	2.712***	-37.58**	-33.19**	
	(0.659)	(14.96)	(14.43)	
ECB Rates PC2	1.356*	29.25*	26.66	
	(0.809)	(16.64)	(16.30)	
ECB EU Stocks	-2.114	3.532	-3.775	
	(1.630)	(41.81)	(41.35)	
ECB Rate PC1 X Log Talk Spread		6.663***	5.919**	8.407***
		(2.506)	(2.421)	(2.764)
ECB Rate PC2 X Log Talk Spread		-4.618*	-4.195	-4.175
		(2.756)	(2.696)	(3.308)
ECB EU Stocks X Log Talk Spread		-0.877	0.377	4.957
		(7.060)	(6.984)	(7.426)
ECB PC3 & PC4 X Log Talk Spread	No	Yes	Yes	Yes
FED Surprises X Log Talk Spread	No	No	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
ECB PC3 & PC4	Yes	Yes	Yes	Yes
ECB Stock Surprise	Yes	Yes	Yes	Yes
FED Surprise Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes
MP Event FE	No	No	No	Yes
Observations	6420	6420	6420	6419
R^2	0.068	0.070	0.073	0.185

Note: This table shows heterogeneous effects of ECB euro-dollar exchange rate surprises on leveraged loan spreads by riskiness of the borrower. Borrower riskiness is proxied by the log of the initial talk spread. The sample period is from August 2011 to June 2019. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 4: Borrowers' International Trade Exposures

	(1) All	(2) No Trade	(3) Posit. Trade
ECB Euro (vs. Dollar)	14.71***	11.83**	16.78***
	(2.677)	(6.015)	(2.962)
ECB Rates PC1	2.788***	3.326***	2.381***
	(0.676)	(1.174)	(0.849)
ECB Rates PC2	1.035	1.911	0.387
	(0.828)	(1.485)	(1.050)
Loan Controls	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
ECB PC3 & PC4	Yes	Yes	Yes
ECB Stock Surprise	Yes	Yes	Yes
FED Surprise Controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes
Observations	6172	2002	4163
R^2	0.067	0.097	0.077

Note: This table shows that the effect of the change in the euro-dollar exchange rate around ECB announcements on the effective spread flex of loans is similar for borrowers with and without international trade exposure. To look at firms' international trade exposure, the leverage loan data is merged to industry-level information on international trade at the SITC 4-digit level. Column (1) replicates the baseline results for all merged loans. Column (2) shows results for borrowers in industries that do not import or export. Column (3) shows results for borrowers in industries that import or export. The sample period is from August 2011 to December 2023. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 5: Underwritten vs. Refinancing Loans

	(1) All	(2) Underwritten	(3) Not Underwritten
ECB Euro (vs. Dollar)	14.55***	21.51***	8.776***
	(2.595)	(4.681)	(3.151)
ECB Rates PC1	2.593***	2.604***	2.104***
	(0.651)	(0.965)	(0.802)
ECB Rates PC2	1.158	2.458**	0.547
	(0.799)	(1.198)	(1.192)
Loan Controls	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
ECB PC3 & PC4	Yes	Yes	Yes
ECB Stock Surprise	Yes	Yes	Yes
FED Surprise Controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes
Observations	6420	2430	2738
R^2	0.066	0.110	0.075

Note: This table shows results on the effect of the change in the euro-dollar exchange rate around ECB announcements on the effective spread flex of leveraged loans for underwritten versus refinancing loans. Column (1) replicates the baseline results from Column (5) of Table 2. Column (2) shows results for underwritten loans only. Column (3) shows results for loans that were not underwritten. The sample period is from August 2011 to December 2023. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 6: Robustness: Additional Risk and Uncertainty Controls

	(1)	(2)	(3)	(4)	(5)
ECB Euro (vs. Dollar)	14.48***	14.55***	14.19***	14.29***	13.74***
	(2.650)	(2.595)	(2.600)	(2.947)	(3.026)
ECB Rates PC1	2.582***	2.593***	2.639***	2.370***	2.477***
	(0.656)	(0.654)	(0.646)	(0.832)	(0.841)
ECB Rates PC2	1.158	1.157	1.431*	2.761***	2.906***
	(0.799)	(0.801)	(0.801)	(1.071)	(1.080)
ECB EU Stocks	-2.136	-2.123	-1.901	-1.369	-0.578
	(1.629)	(1.634)	(1.619)	(1.836)	(1.830)
Δ Log Yen-Euro Exchange Rate	8.190				-10.96
	(40.89)				(46.37)
Δ Risk Aversion Index		-0.0212			-2.096
		(1.215)			(1.952)
Δ Uncertainty Index			3.156***		7.410***
			(0.992)		(1.979)
Δ 1Y Treasury Basis				-0.162	-0.135
				(0.142)	(0.142)
Loan Controls	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes
ECB PC3 & PC4	Yes	Yes	Yes	Yes	Yes
ECB Stock Surprise	Yes	Yes	Yes	Yes	Yes
FED Surprise Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes	Yes
Observations	6420	6420	6420	4766	4766
R^2	0.066	0.066	0.069	0.077	0.083

Note: This table shows that the results on the effect of the change in the euro-dollar exchange rate around ECB announcements on the effective spread flex of leveraged loans to U.S. borrowers is robust to including additional risk and uncertainty measures in the regressions. Additional controls include changes in the Treasury Basis following Jiang, Krishnamurthy, and Lustig (2018), the yen-euro exchange rate, and Risk Aversion and Uncertainty indices from Bekaert, Engstrom, and Xu (2019). Loan and macro controls are included but not shown to conserve space. The sample period is from August 2011 to December 2023, except column (5) where the sample ends in 2019. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 7: Robustness: Only ECB Events

	(1)	(2)	(3)	(4)
	All	all	all	all
ECB Euro (vs. Dollar)	5.611***	12.28***	12.32***	10.74***
	(1.869)	(2.725)	(2.687)	(2.639)
ECB Rates PC1		2.431***	2.428***	2.154***
		(0.674)	(0.684)	(0.725)
ECB Rates PC2		1.649*	1.651*	0.965
		(0.849)	(0.846)	(0.848)
Loan Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
ECB PC3 & PC4	Yes	Yes	Yes	Yes
ECB Stock Surprise	No	No	Yes	Yes
FED Surprise Controls	No	No	No	Yes
Industry FE	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes
Observations	2263	2263	2263	2255
R^2	0.138	0.147	0.147	0.154

Note: This table restricts the sample to loans whose syndication window overlaps with at least one ECB meeting. The sample period is from August 2011 to December 2023. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 8: Robustness: Event Clustering

	(1) Baseline	(2) Risk + Uncert.	(3) All Trade	(4) No Trade	(5) Posit. Trade	(6) Underwritten	(7) Not Underwritten	(8) ECB Events
ECB Euro (vs. Dollar)	14.55***	13.74***	14.55***	11.83***	16.78***	21.51***	8.776***	10.74**
	(4.403)	(4.802)	(4.403)	(4.391)	(5.117)	(5.721)	(3.265)	(4.759)
ECB Rates PC1	2.593***	2.477***	2.593***	3.326***	2.381**	2.604**	2.104**	2.154**
	(0.902)	(0.940)	(0.902)	(0.983)	(1.118)	(1.137)	(0.825)	(0.999)
ECB Rates PC2	1.158	2.906**	1.158	1.911	0.387	2.458**	0.547	0.965
	(0.892)	(1.171)	(0.892)	(1.366)	(1.054)	(1.244)	(1.130)	(1.141)
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECB PC3 & PC4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECB Stock Surprise	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FED Surprise Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6420	4766	6420	2002	4163	2430	2738	2255
R^2	0.066	0.083	0.066	0.097	0.077	0.110	0.075	0.154

Note: In this table, standard errors are clustered by event window. All loans whose syndication window overlaps with the first ECB announcement in our sample are cluster 1. Cluster 2 encompasses all loans that are syndicated between the first and the second ECB announcement. All loans that overlap with the second ECB announcement are in cluster 3, and so on. The sample period is from August 2011 to December 2023. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Table 9: Robustness: Controlling for FED Dollar Surprises

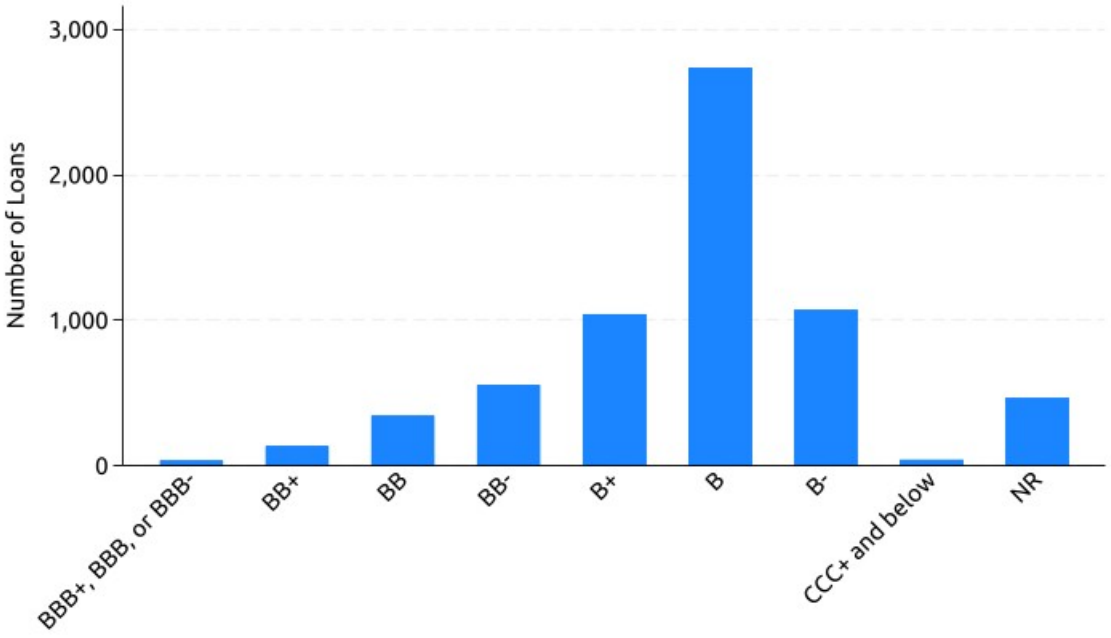
	(1)	(2)	(3)	(4)	(5)	(6)
ECB Euro (vs. Dollar)	5.408***	5.434***	11.09***	12.92***	13.56***	14.32***
	(2.035)	(2.010)	(2.652)	(2.996)	(2.955)	(2.932)
FED Dollar	8.573***	11.43***	10.76***	10.34***	10.19***	12.67***
	(2.714)	(2.744)	(2.751)	(2.724)	(2.789)	(3.991)
ECB 2Y OIS			1.848***			
			(0.583)			
ECB Rates PC1				2.316***	2.304***	2.529***
				(0.849)	(0.848)	(0.832)
ECB Rates PC2				2.895***	2.843***	3.087***
				(1.057)	(1.062)	(1.067)
ECB Rates PC3				4.280	4.284	3.947
				(2.716)	(2.710)	(2.672)
ECB Rates PC4				-0.434	0.119	2.050
				(7.001)	(7.229)	(7.217)
ECB EU Stocks					-0.986	-0.960
					(1.830)	(1.830)
FED R2Y						-1.116
						(1.007)
FED R5Y						-0.544
						(1.901)
FED R10Y						1.089
						(2.071)
FED SP500						-0.0308
						(0.0412)
Δ VIX		-0.0840	-0.0375	-0.0883	-0.0993	-0.106
		(0.192)	(0.193)	(0.194)	(0.194)	(0.195)
Δ US Term Spread		-0.130	-0.173*	-0.175*	-0.174*	-0.183*
		(0.0933)	(0.0948)	(0.0951)	(0.0954)	(0.0937)
Δ 2-Year Treasury		-0.334***	-0.340***	-0.342***	-0.339***	-0.336***
		(0.120)	(0.120)	(0.121)	(0.120)	(0.119)
Δ US Libor		0.905***	0.864***	0.864***	0.861***	0.830***
		(0.236)	(0.236)	(0.237)	(0.236)	(0.242)
Δ Economic Conditions Index		-8.809*	-9.586**	-11.08**	-11.25**	-11.54**
		(4.847)	(4.819)	(4.890)	(4.851)	(4.942)
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes
Lead Agent FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4770	4770	4770	4770	4770	4764
R^2	0.066	0.075	0.079	0.081	0.081	0.080

Note: In this table, the response of the euro-dollar exchange rate to Federal Reserve monetary policy announcements is added as an additional control. The sample period is from August 2011 to June 2019. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level.

Appendix

The appendix provides additional results as well as definitions of all variables used in the empirical analysis. Figure 7 shows the ratings distribution of the loans in our sample. Table A1 gives detailed variable definitions and sources for each variable used in our analysis.

Figure A1: Loan Rating Distribution



Note: This figure shows the total number of loans for each ratings bucket in the sample from 2009 to 2019. Sources: S&P Capital IQ Leveraged Loan Commentary Data (LCD) and Dealscan.

Table A1: Variable Description

Variable Name	**Description**	**Source**
Effective Spread Flex	Equal to Spread Flex plus OID Flex divided by four	S&P LCD
Flex Date	Date flex occurred	
Industry	A categorical variable indicating the industry of the borrower	
Issuer Name	Name of borrower	
Launch Date	Date the deal came to market	
Lead Agent	The administrative agent on the deal	
Maturity	Length of loan in years	
Middle Market	A binary variable indicating whether the issuer is a middle market borrower	
OID Flex	The amount in basis points that the OID has changed since talk	
Purpose	A categorical variable indicating the purpose of the loan	
Rating	Company rating determined by Standard and Poor	
Sponsored	A binary variable indicating whether the deal is sponsored	
Spread Flex	The amount in basis points that the spread has changed since talk	
Talk Spread	Initial spread discussed	
US Term Spread	10-Year Treasury Yield minus 2-Year Treasury Yield	FRED St. Louis FED
US 2-Year Treasury Yield	Yield on US Treasury 2-Year Bonds	
VIX	Volatility Index	
U.S. Libor	3-month U.S. Libor	
Euro-Yen Exchange Rate		
Treasury Basis	1-Year Treasury Basis	Du, Im, and Schreger (2018)
Risk Aversion Index	Baekert-Engstrom-Xu U.S. Risk Aversion Index	Bekaert, Engstrom, and Xu (2019)
Uncertainty Index	Baekert-Engstrom-Xu Uncertainty Index	
Economic Conditions Index	Aruoba-Diebold-Scotti Business Conditions Index	Aruoba, Diebold, and Scotti (2009)
Import Intensity	Constructed as imports/(production+imports- exports)	BEA, U.S. Census Bureau
Export Intensity	Constructed as exports/(production+imports- exports)	
ECB surprises	Changes in euro-dollar exchange rate and other variables around EBC monetary policy announcements	Altavilla et al. (2019); Bauer and Swanson (2023); Ferrari, Kearns, and Schrimpf (2021)
Fed surprises	Changes in euro-dollar exchange rate and other variables around Federal Reserve monetary policy announcements	