Investor Fragility, Bargaining Power, and Pricing Implications for Short-Term Funding Markets *

Yi Li, Sean Tibay and Ashley Wang

First Draft: June 2024

This Version: June 2025

Abstract

This paper investigates how funding fragility posed by investors affects pricing dynamics in short-term funding markets. Utilizing the 2016 Money Market Fund (MMF) Reform as an exogenous funding shock to the primary commercial paper (CP) markets, we find that CP issuers with high pre-reform reliance on MMFs incur an additional 4-basis-point increase in borrowing costs during sector-wide MMF withdrawals, yet experience no additional stress in funding volume or maturity structure. Analyzing decade-long data, we construct issuer-level funding fragility measures based on MMF flows and document a price impact consistent with the event study. Guided by a stylized Nash bargaining model, our mechanism analyses reveal that issuers with weaker bargaining power face greater pricing penalties during MMF redemptions.

Keywords: Investor redemption, funding fragility, bargaining power, money market mutual fund, primary market

JEL classification: G11, G12, G14, G23

*The views expressed herein are those of the authors and do not necessarily reflect those of the Federal Reserve Board or its staff. All errors are our own. Yi Li is at Board of Governors of the Federal Reserve System, 20th & Constitution Ave NW, Washington, DC 20551. email: yi.li@frb.gov. Sean Tibay is at Board of Governors of the Federal Reserve System, email: sean.r.tibay@frb.gov. Ashley Wang is at Board of Governors of the Federal Reserve System, email: ashley.wang@frb.gov. This article includes data licensed from DTCC Solutions LLC, an affiliate of The Depository Trust & Clearing Corporation. For their helpful comments, we thank Jonathan Wallen (discussant), Ming Yang, seminar participants at the Federal Reserve Board, Federal Reserve Bank of Chicago, Georgetown University, and Carnegie Mellon University Tepper Business School, as well as conference participants at the 2025 Financial Intermediation Research Society (FIRS).

1 Introduction

Funding shocks originating from investors can significantly impact pricing and credit supply, especially in frictional markets dominated by flighty investors. Short-term funding markets, which hold over $10 trillion in assets, are critical to the financial system, providing essential liquidity to banks, corporations, and governments.[1] However, these markets are also highly vulnerable to funding shocks. During periods of stress, sudden investor withdrawals can disrupt funding markets, leading to surging financing costs, breakdowns in liquidity chains, and even systemic runs—as seen during both the global financial crisis and the COVID-19 pandemic.

Two structural features make these funding markets especially vulnerable to sudden shifts in investor behavior. First, unlike equity markets, where transactions occur on transparent and efficient exchanges, short-term funding securities are traded over-the-counter (OTC), introducing frictions such as high search costs and imbalanced bargaining power. These frictions can heighten the markets' susceptibility to investor funding shocks. Second, in contrast to other OTC markets like corporate bonds or municipal bonds, most short-term funding markets have minimal secondary market trading, making the primary market the key trading venue. The absence of effective secondary markets to absorb shocks from investor buy-sell pressures amplifies the impact of investor behaviors on price discovery and funding in primary markets.

To explore the market impact of funding fragility from investors, we focus on the primary market for commercial paper (CP)—a crucial element of short-term funding—and analyze how the funding fragility posed by its most prominent institutional investors, money market funds (MMFs), influence market dynamics. With a market size of approximately $1 trillion, CP is a vital source of liquidity and funding for the economy but is particularly vulnerable to rollover risks.[2] Disruptions in CP markets have previously triggered multiple funding

[1] Well-known examples of short-term funding markets include commercial paper (CP) and repurchase agreements (repos).

[2] For studies on firms' use of CP for funding, see Calomiris, Himmelberg, and Wachtel (1995), Kahl,

freezes and widespread crises.[3] Meanwhile, prime MMFs, which supply about a quarter of the funding in the CP markets, are prone to severe withdrawals during periods of stress, as they invest in risk-bearing illiquid markets while offering daily redemptions to highly risk-averse, liquidity-conscious end investors. Combined, these characteristics of CP and prime MMFs provide a compelling setting to study the intricate dynamics in these markets.

By leveraging confidential transaction-level data on CP and merging it with security-level MMF holdings data, we are the first to examine and provide micro-level evidence for the impact of investor funding fragility on pricing and credit provision in short-term funding markets—an important yet underexplored area of research.

We start by utilizing the 2016 SEC reforms, which significantly reduced MMFs' investments in the CP markets, as an exogenous shock to conduct an event study on the impact of sector-wide MMF withdrawals on CP pricing and issuance. We hypothesize that CP issuers with stronger reliance on MMF funding prior to the reforms experience greater stress during the withdrawal phase. Employing a difference-in-differences approach, we find a substantial price impact due to these MMF withdrawals. Specifically, issuers with high pre-reform dependence on MMFs experience an additional 4-basis-point increase in borrowing costs during the withdrawal period relative to those with low dependence, even after controlling for a slew of CP characteristics and multiple fixed effects. For context, the average cross-sectional standard deviation of CP yields—across size, rating, maturity, type, and issuer—is under 20 basis points, making the 4-basis-point estimated effect, net of these factors, economically meaningful. While MMF withdrawals exert significant price pressures, we do not detect additional strains on issuance volume or maturity structures for CP issuers highly reliant on MMFs. Importantly, we obtain these results within a prolonged phase of extensive yet non-disruptive MMF withdrawals, which we refer to as a "silent run." This phase is distinct

Shivdasani, and Wang (2015), and Hempel, Li, and Tibay (2024).

[3]For instance, turmoil in the asset-backed CP market in 2007 was pivotal in escalating mortgage-related concerns into a global financial crisis. Similarly, after Lehman Brothers' bankruptcy in 2008, a prime MMF "broke the buck" due to its holdings of Lehman's CP, sparkling industry-wide runs on MMFs. For studies on these events, see Kacperczyk and Schnabl (2010), Covitz, Liang, and Suarez (2013), and Duygan-Bump et al. (2013).

from abrupt stress events like the 2008 financial crisis or the 2020 COVID-19 crisis. Our event study reveals that such a "silent run" by MMFs can lead to considerable price impact in the CP markets.

Next, we expand our analysis to a 10-year sample from December 2014 to March 2024.[4] To evaluate funding fragility stemming from MMFs, we focus on the dynamics of MMFs' investor flows, which directly influence funds' portfolio holdings including their investments in CP. It's worth noting that during non-stress period, investor flows to MMFs are primarily driven by changes in regulatory and monetary policy stances, as well as variations in end investors' cash management needs. Thus, MMF flows are generally independent of fundamentals of a specific CP issuer and can be largely viewed as exogenous shocks to that issuer. Specifically, we construct a monthly funding fragility measure for each issuer by aggregating flows from its MMF counterparties, weighted by the proportion of the outstanding CP amount held by each MMF. This composite flow-based fragility measure combines information on the intensity of flows experienced by MMFs and each MMF's relative importance to the specific CP issuer, allowing us to dynamically quantify the extent of MMF flow-induced funding stress on a specific issuer.

Using this funding fragility measure as our key independent variable, we analyze the impact of MMF funding fragility on CP pricing and issuance activities while controlling for CP characteristics and multiple fixed effects. Our findings align with those from the event study: a one-percentage-point increase in the lagged fragility measure results in a 0.3-basis-point increase in CP yields yet has no bearing on funding volume or maturity structure. These results corroborate anecdotal evidence about CP primary market operations. Specifically, while CP issuers often demonstrate a willingness to adjust pricing, the quantity and maturity structure of CP issuance are mainly determined by firms' projected funding needs and timing, leaving little room for negotiation. This explains the documented insensitivity of firms' CP issuance activities to non-fundamental factors, such as MMF flow-induced funding

[4] We exclude from our sample the extreme stress period of March to April 2020 during the COVID-19 pandemic.

pressure. Since pricing is the main lever for negotiation between CP issuers and MMFs, our analyses will henceforth focus on the price impact of MMF flow-induced fragility.

We proceed to investigate whether there is asymmetry in the price impact induced by MMF redemptions versus capital inflows. Understanding this distinction is crucial for grasping the market dynamics between CP issuers and MMFs, as well as its implications for financial stability. If the pricing impact primarily stems from MMFs imposing higher borrowing costs on CP issuers amid redemption pressure, rather than from passing savings to issuers during periods of capital inflows, it indicates that MMFs possess dominant market power in pricing negotiations against CP issuers. This would raise concerns that adverse funding shocks from MMFs may impair corporations' ability to meet their short-term funding needs. Our regression analysis reveals that MMFs charge higher rates on CP issuers under redemption pressures while also lowering funding cost amid capital inflows. This indicates that neither MMFs nor CP issuers are entirely price takers or setters. Instead, pricing in short-term funding markets like CP, which are characterized as relationship-based OTC markets with substantial frictions, can be remarkably influenced by the relative bargaining power between funding providers and asset issuers. Such power dynamic may shift over time and vary among market participants, potentially playing a crucial role in shaping pricing within these markets.

Motivated by these observations, we examine how bargaining power between MMFs and CP issuers shapes the pricing effects of investor flow shocks. We begin by introducing a stylized Nash bargaining model that formalizes how CP funding rates are determined through bilateral negotiation. In the model, the negotiated rate is a weighted average of the issuer's fallback borrowing rate and the MMF's effective opportunity cost, which includes a liquidity cost component driven by investor flow shocks. The model yields two key implications. First, the negotiated rate increases with redemption pressure and decreases with inflows—a prediction consistent with our core empirical findings. Second, during redemptions, the price impact of flow shocks is amplified when MMFs hold greater bargaining power, enabling them to pass more funding stress onto borrowers. In contrast, during inflow episodes, the price impact of flow shocks is not influenced by bargaining power, highlighting an asymmetry in how liquidity shocks are transmitted into pricing. We test this second prediction using both aggregate and issuer-level measures of bargaining power and find consistent empirical support for the mechanism.

At the aggregate level, we evaluate relative bargaining power using two market-wide proxies: the overall importance and concentration of MMFs in the CP market, and prevailing credit risk concerns facing CP issuers. Both measures yield consistent results. When MMFs hold stronger bargaining power—reflected by higher and more concentrated ownership in the CP market—a one-percentage-point increase in lagged MMF redemptions results in an additional 0.4-basis-point rise in CP yields, relative to periods with lower and more diffuse MMF ownership. Similarly, during periods of heightened credit risk concerns, the same redemption pressure leads to an additional 0.3-basis-point increase in yields.

Next, we calibrate bargaining power between MMFs and CP issuers at the individual issuer level, based on characteristics such as market presence, distribution channels, and domicile of the parent company. We argue that CP issuers with less market presence likely possess weaker bargaining power because the CP market is a relationship-based market, in which issuers invest considerable effort in maintaining stable relationships. Thus, issuers that participate less frequently are likely to hold a weaker bargaining position against MMFs compared to those with a more frequent and consistent presence in the market. Moreover, issuers more reliant on dealer intermediation tend to have weaker bargaining power as they lack direct access to investors, limiting the flexibility of their distribution channels in the CP markets. Lastly, foreign issuers generally exhibit weaker bargaining power due to their restricted access to alternative sources of U.S. dollar funding.[5] While U.S. financial firms can attract retail deposits through their extensive branch networks, foreign financial firms

[5] Dollar funding is essential for international trade settlements and as a reserve currency for foreign firms. CP market provides a vital avenue for these firms to secure short-term dollar funding. As of May 2024, about one third of outstanding CP is issued by foreign firms.

have minimal access to dollar depositors. Similarly, U.S.-based non-financial firms can easily establish credit facilities with domestic banks, a resource often unavailable to foreign entities. Our analyses show that for a given level of MMF redemption pressure, CP issuers with less market presence, greater reliance on dealer intermediation, and foreign domicile consistently experience a higher increase in funding costs.

Our paper contributes notably to several strands of literature. First, our analyses provide novel insights into the price impact of investor fragility in short-term funding markets, which are predominantly primary markets.[6] Most existing literature on the price impact of funding fragility arising from mutual fund flows has focused on secondary markets for equity and bonds.[7] Notable exceptions include Zhu (2021) and Adelino et al. (2023), which examine primary markets and analyze how fluctuations in mutual funds' capital supply affect issuance volume and pricing in corporate and municipal bonds, respectively. Our paper is the first to explore the price impact of mutual fund flow-induced fragility within the context of markets with little secondary market trading. Given CP's pronounced susceptibility to rollover risks and its significant role in transmitting systemic risks, combined with MMFs' inherent vulnerability to investor redemptions, this setting offers a unique environment to study the impact of investor funding fragility on the underlying markets, accentuating the distinctive contributions of our paper.

Second, our study provides valuable empirical evidence on how market frictions, such as imbalanced bargaining power, can affect asset prices in OTC markets. A large body of literature has developed theoretical framework to analyze the asset price implications

[6] In contrast, secondary market trading dominates in equities and corporate bonds. Even in the municipal bond market—traditionally seen as rather illiquid—over two-thirds of trading occurs in the secondary market(Green, Hollifield, and Schürhoff, 2007).

[7] For the impact of open-end fund fragility on secondary markets for equity and corporate bonds, see, for examples, Coval and Stafford (2007), Edmans, Goldstein, and Jiang (2012), Lou (2012), Wardlaw (2020), Choi et al. (2020), Jiang, Li, and Wang (2021), and Jiang et al. (2022). For the impact on municipal bond markets, see Li, O'Hara, and Zhou (2024). While Baghai, Giannetti, and Jäger (2022) analyze how MMF funding to the corporate sector changes following the 2016 SEC reforms, they do not study the impact on pricing. Funding fragility faced by entities other than corporations or local governments, such as banks and hedge funds, has been studied as well. For examples, see Jiang et al. (2023), Liu and Mello (2011), and Kruttli et al. (2021).

of search-and-bargaining power in OTC markets (Duffie, Gârleanu, and Pedersen (2005), Duffie, Gârleanu, and Pedersen (2007); Weill (2008); among others).[8] Our CP-MMF framework offers two key advantages in identifying empirical evidence for a bargaining power effect. First, MMF flow-induced adjustments in CP investments during non-crisis times are generally independent of fundamentals of a specific CP issuer. This relative exogeneity of MMF flows enables us to better identify the bargaining power effect on CP pricing. Second, funding volume and maturity structure of CP are typically predetermined by firms' liquidity needs, leaving CP pricing as the primary negotiable term between MMFs and CP issuers. This minimizes potential confounding effects that might arise when market participants negotiate across multiple dimensions. Indeed, employing multiple proxies for the relative bargaining power between MMFs and CP issuers, our paper provides direct empirical evidence on how bargaining power affects pricing amid investors' redemption shocks. In addition, our core empirical findings—on both the price impact of flow shocks and the role of bargaining power—are rationalized within the theoretical framework of a stylized Nash bargaining model.

Finally, our study broadens the implications of MMFs' fragility risk beyond crisis periods. Prior research on MMF fragility primarily examines investor runs during crises, such as the global financial crisis, the Eurozone sovereign debt crisis, and the COVID-19 crisis.[9] Studies addressing the broader implications of MMF fragility on the underlying markets remain limited. This paper is the first to explore the influence of MMF fragility on CP pricing and issuance activities over an extended period when markets are functioning smoothly without acute stress. By combining confidential transaction-level CP data with security-level MMF holdings data, our work significantly expands the understanding of redemption-related

[8]For a comprehensive literature review on search theory and its empirical application in OTC markets, see Weill (2020).

[9]For studies on MMF runs during the global financial crisis, see McCabe (2010), McCabe et al. (2013), Kacperczyk and Schnabl (2013), Strahan and Tanyeri (2015), and Schmidt, Timmermann, and Wermers (2016). For papers on MMF runs during the 2011 Eurozone sovereign debt crisis, see Chernenko and Sunderam (2014), Ivashina, Scharfstein, and Stein (2015), and Gallagher et al. (2020). For MMF runs during the COVID-19 crisis in 2020, see Li et al. (2021) and Cipriani and La Spada (2020).

fragility in MMFs, challenging the traditional view that such fragility is relevant only as a tail risk during extreme crises.

The remainder of the paper is organized as follows: Section 2 summarizes our data sources. Section 3 employs an event study to illustrate the impact of reform-triggered MMF withdrawals on the CP markets. Section 4 analyzes the effects of MMF flow-induced fragility on CP pricing and funding activities over a 10-year sample. Section 5 explores how relative bargaining power between CP issuers and MMFs influences CP pricing amid MMF flows. Section 6 concludes.

2 Data

Our dataset spans from December 2014 to March 2024 and is constructed by combining security-level CP data from two primary sources. Firstly, we use confidential CP data from The Depository Trust & Clearing Corporation (DTCC), which provides transaction-level information in the primary CP market, including CUSIP, transaction date, issuance and maturity dates, face value, issuance yield, and placement channel.[10] We merge this dataset with firm-level short-term ratings from Moody's and S&P. We focus on CP issuers who have received short-term ratings of A3/P3 or higher, which account for about 95% of the primary CP markets over our sample period.[11]

To provide additional context on CP issuers, we divide the top 500 publicly listed U.S. companies in Compustat into two groups—CP issuers (about 180 per quarter, on average) and non-CP issuers—and compare their financial characteristics. As shown in Appendix Table A1, CP issuers are larger (by total assets), more profitable (by earnings per share),

[10] Neither DTCC Solutions LLC nor any of its affiliates shall be responsible for any errors or omissions in any DTCC data included in this publication, regardless of the cause and, in no event, shall DTCC or any of its affiliates be liable for any direct, indirect, special or consequential damages, costs, expenses, legal fees, or losses (including lost income or lost profit, trading loses and opportunity costs) in connection with this publication.

[11] To qualify for inclusion in our sample, CP issuers must have short-term ratings that fall within the following ranges: P-1, P-2, or P-3 for Moody's, and A-1+, A-1, A-2, or A-3 for S&P. If an issuer is rated by both agencies and the ratings differ, the lower of the two ratings is applied. If only one rating is available, that rating is used. Issuers that are not rated by either agency are excluded from our sample.

and slightly more leveraged (by debt-to-asset ratio) than non-CP issuers. Importantly, they also hold a higher ratio of short- to long-term debt and maintain notably lower cash or cash equivalents. These differences in debt structure and liquidity holdings are consistent with CP issuers' better access to short-term funding and liquidity management tools.

Next, we obtain monthly data for MMFs through their mandatory N-MFP filings with the SEC. These filings provide comprehensive holdings information, detailing each MMF's portfolio composition as of calendar month-end. From these filings, we extract security-level holdings data for each MMF, including the issuer name, CUSIP, face value, and asset type, as well as fund-level information such as fund identifiers, net assets, and liquidity metrics. Our analysis focuses specifically on prime MMFs, which are permitted to hold CP.[12]

We merge these two primary datasets using the common identifiers, CP CUSIPs. From December 2014 to March 2024, excluding the peak of COVID-19 crisis (March-April 2020), an average of about 400 CP issuers (including both financial and non-financial firms) and 90 MMFs participated in the CP market each month in our merged sample.

In our analysis, we assess the impact of MMF flow-induced fragility on the primary CP market across three dimensions: pricing, funding quantity, and maturity structure. To evaluate pricing impacts, we aggregate CP yields at the issuer-day level, weighted by issuance face value, to account for CP dealers potentially dividing a bulk order from an issuer into multiple transactions on a given day. This aggregation aims to reconstruct the original terms of the CP order. For funding quantity, we calculate maturity-weighted gross issuance volume and net change in outstanding levels. For maturity structure, we compute the issuance volume-weighted average maturity and the proportion of overnight CP issuance.[13] As CP issuers may not raise funding from the CP markets daily, we aggregate quantity and maturity measures at the issuer-month level to reduce noise in the sporadic daily measures.

[12] As regulatory requirements prohibit government MMFs from holding CP, only prime MMFs are included in our analysis. In addition, we exclude feeder funds in our study, as such funds conduct majority of their investments through a master fund.

[13] Overnight CP issuance is defined as securities with a maturity of four calendar days or less.

3 Event study: Impact of reform-driven MMF withdrawals on CP markets

In this section, we conduct an event study utilizing the 2016 SEC reforms on MMFs—which significantly reduced MMFs' investments in the CP markets—as an exogenous fragility shock to assess the impact of sector-wide MMF withdrawals on CP pricing and issuance.

In October 2016, the SEC implemented reforms on MMFs, aiming to mitigate run risks and enhance financial stability.[14] These reforms mandated institutional prime funds to transition from a fixed \$1 share price to a floating net asset value. Additionally, they permitted all prime funds to impose liquidity fees and suspension gates on investors if their liquidity levels fell below a specified threshold. These reforms had a profound impact on prime funds. Thus, in the year leading up to the reform implementation, total assets in prime MMFs decreased by around \$1.2 trillion to \$0.6 trillion, and their total investments in CP shrank by \$270 billion. Despite the substantial outflows and significant decline in MMFs' CP investments, Figure 1 shows that the overall CP markets appeared to have functioned orderly, without a notable reduction in total market size. Nevertheless, did CP issuers with a stronger reliance on MMF funding prior to the reforms experience greater stress over the extensive withdrawal phase of prime MMFs? In this section, we adopt a difference-in-differences approach to investigate this issue.

3.1 Impact on pricing

We start by examining how CP issuers' pre-reform reliance upon MMF funding affects the pricing of CP in primary markets. Specifically, we conduct the following panel regression at the issuer-day level using a sample spanning from December 2014 to November 2016:

$$Yield_{i,t} = \alpha + \beta High\ Dependence_i + \gamma High\ Dependence_i \times Withdrawal_t + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \quad (1)$$

[14] Investors typically seek MMFs for their safe and liquid investments, with little tolerance for asset value loss. A slight drop below the \$1 net asset value, known as "breaking the buck", can prompt widespread investor runs, a scenario evident in the 2008 financial crisis with the Reserve Prime Fund.

where $Yield_{i,t}$ is the average issuance yield for issuer i on day t, in percent and weighted by issuance face value. $High\ Dependence_i$ is an indicator variable that takes the value of 1 if the average MMF ownership of issuer i from June to November 2014 (i.e., six months before the event study regression sample starts) is above the cross-sectional median, and 0 otherwise. $Withdrawal_t$ is an indicator variable that takes a value of 1 for the period from December 2015 to November 2016, during which the prime fund sector experienced massive withdrawals, and 0 otherwise. We control for daily issuer characteristics ($X_{i,t}$) that may affect CP yields, including issuance amount-weighted average maturity, the logarithm of daily issuance amount, fraction of CP issuance placed directly to the investors instead of through dealers, as well as credit rating- and CP type-fixed effects. In addition, to control for the influence from fluctuations in economic, regulatory, and monetary policy conditions, we include a day-fixed effect (θ_t).[15] Standard errors are clustered at the issuer and day levels.

Table 1 summarizes regression results. Column (1) shows a negative coefficient for $High\ Dependence_i$, statistically significant at the 1% level, indicating that prior to the massive outflow event in the prime MMF sector, the borrowing costs for CP issuers heavily relying on MMF funding are about 10 basis points lower than those with less MMF reliance but otherwise comparable characteristics. Coefficient of the interaction term between $High\ Dependence_i$ and $Withdrawal_t$, our key variable of interest, is estimated to be positive and statistically significant at the 1% level. Specifically, compared to CP issuers with low pre-reform dependence on MMFs, CP issuers with high pre-reform reliance on MMF funding experienced an additional 4-basis-point increase in borrowing costs during the MMF withdrawal period, effectively halving their pre-reform pricing advantage. Additionally, Column (1) also exhibits intuitive results for coefficients on other CP characteristics: CP issuers with shorter maturities tend to incur lower borrowing costs.

In Column (2), we further control for issuer-fixed effect to partial out the influence of unobserved issuer-specific factors on CP pricing, which renders the $High\ Dependence_i$ vari-

[15]Note that the inclusion of day fixed effect absorbs the $Withdrawal_t$ dummy from a standard difference-in-differences setting.

able redundant. The coefficient on the interaction term between $High\ Dependence_i$ and $Withdrawal_t$ remains positive and statistically significant at the 1 percent level, maintaining a similar magnitude to that observed in Column (1).[16] To address the potential concern that CP issuers' high dependence on MMFs may be correlated with other issuer characteristics that could possibly drive differential pricing effects during the MMF withdrawal period, we further include interactions between the $Withdrawal_t$ dummy and all CP characteristics. The results remain robust.[17]

3.2 Impact on funding volume and maturity structure

We proceed to investigate whether CP issuers with a strong pre-reform reliance on MMF funding experience more strains in terms of funding volume and maturity structures during the withdrawal period. To facilitate this investigation, we construct two measures each for funding volume and maturity structure, calculated on a monthly basis for each issuer to reduce noise in the sporadic daily issuance activity data.

For funding volume, we calculate gross issuance by taking maturity-weighted average of dollar issuance amount, as well as net changes in outstanding levels over the month. We include all issuers with non-zero outstanding CP over the event study sample period (i.e., December 2014 to November 2016). If an issuer does not issue any CP in a given month, its gross issuance volume is recorded as zero. For issuers with positive gross issuance volume, we measure their issuance maturity structure by calculating volume-weighted average maturity (in days) and the fraction of overnight CP issuance (in a decimal) at issuer-month level.

Utilizing the measures defined above, we conduct the following panel regressions at the issuer-month level using the sample spanning from December 2014 to November 2016 to

[16] Column (2) in Table 1 shows positive and significant coefficients for both log ($FaceValue$) and $DirectIssuanceShare$. With issuer fixed effect controlled for in this regression, these positive coefficients indicate that for a given CP issuer, borrowing costs tend to increase when the issuer expands the issuance size beyond its typical level, and when a larger fraction of the issuance is arranged through the direct placement. This finding aligns with anecdotal evidence from the CP markets, where issuers often incur additional costs when their daily funding needs surpass usual levels and when they rely unusually more heavily on relationship lending with direct lenders.

[17] These results are omitted for brevity but are available upon request.

estimate the differential impact of MMF withdrawals on CP funding volume and maturity structure due to issuers' pre-reform reliance on MMF funding:

$$Funding\ Volume_{i,t}(Maturity\ Structure_{i,t}) = \alpha + \beta High\ Dependence_i + \gamma High\ Dependence_i \times Withdrawal_t + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \quad (2)$$

We control for monthly CP characteristics, credit rating- and CP type-fixed effects, as well as a month-fixed effect. Standard errors are clustered at the issuer and month levels.

Panel A of Table 2 presents the regression results for funding volume, while Panel B displays the results for maturity structure. In all specifications, the coefficients on the interaction term are not statistically significant. This indicates that during the MMF withdrawal period, high pre-reform reliance on MMF funding does not seem to exert additional strains on CP issuers' funding volume or maturity structure, regardless of whether we control for issuer fixed effects (even-numbered specifications) or not (odd-numbered specifications). This finding contrasts with our earlier results on pricing, suggesting that the systemic MMF withdrawals predominantly affect pricing rather than quantity or maturity structure in the primary CP markets.

Additionally, coefficients on $High\ Dependence_i$ offer insights into the effects of MMF reliance on funding volume and maturity structure prior to the withdrawal period. Specifically, during the calm months (December 2014 to November 2015), CP issuers with high MMF dependence tend to have higher gross issuance volumes (Panel A), longer maturity, and a smaller fraction of overnight issuance (Panel B).

In summary, the event study presented above provides compelling evidence that funding fragility induced by sector-wide MMF outflows significantly impacts CP markets through the pricing channel. Notably, this price impact occurs during a prolonged period characterized by extensive yet non-disruptive MMF withdrawals—a phase we term a "silent run"—rather than during typical abrupt stress episodes like the 2008 financial crisis or the 2020 COVID-19 crisis. Our event study reveals that such a silent run by MMFs still has led to substantial price impacts in the CP markets. In the following section, we expand our analysis beyond the 2016 reform event window. Utilizing a decade long sample with mostly stable funding market conditions, we aim to uncover whether the investor flows in MMFs—which likely prompt fund managers to adjust portfolio strategies including their CP investments—can lead to repercussions in the primary markets of CP.

4 Full sample: Impact of MMF flow-induced funding fragility on CP markets

MMF managers strategically adjust their portfolio strategies in response to investor flows, which directly influences funds' holdings including their investments in CP.[18] In this section, we conduct an extensive set of tests to assess the impact of funding fragility induced by MMF flows on the underlying CP markets, focusing on equilibrium pricing, funding amounts, and maturity structures.

4.1 Construction of the funding fragility measure and summary statistics

We take a bottom-up approach in constructing a monthly funding fragility variable for each CP issuer based on a composite flow measure of the issuer's MMF counterparties. Utilizing the merged dataset of transaction-level CP data and MMFs' security-level holdings, we identify all MMF counterparties of a given CP issuer at month-end. We then calculate a redemption measure based on the monthly flows for each counterparty fund, in decimal, taking into account cases of fund closures and conversions from prime to government funds

[18] According to Im, Li, and Wang (2025), increased flows into MMFs lead to a subsequent increase in credit risk exposures, extension of portfolio durations, and reduction in liquidity reserves.

and treating such cases as a 100% outflow for that closed or converted fund.[19]

$$Redemption_{j,t} = -\left(\frac{Fund\ AUM_{j,t} - Fund\ AUM_{j,t-1}}{Fund\ AUM_{j,t-1}}\right). \tag{3}$$

The higher the net outflows, the greater redemption pressure MMFs face; conversely, for funds experiencing net inflows, this measure is negative.

Next, we construct the fragility measure for a given issuer i in month t, $Funding\ Fragility_{i,t}$, in decimal, by aggregating the redemption measures across all its investing funds, weighted by the proportion of the outstanding CP amount held by each fund at the start of month t.

$$Funding\ Fragility_{i,t} = \sum_{j=1}^{J} Redemption_{j,t} \times \frac{CP\ Holdings_{i,j,t-1}}{CP\ Outstanding_{i,t-1}}. \tag{4}$$

Intuitively, this composite flow-based fragility measure integrates two pieces of information: the intensity of redemption pressure experienced by MMFs and the relative importance of each MMF to the specific CP issuer. For CP issuers without any outstanding MMF counterparties, the composite flow-based measure is, by definition, assigned a value of zero. Moreover, the weights used within this measure generally do not sum to 1 since there are investors other than MMFs in the primary CP markets. This measure effectively captures investor shocks—whether redemption pressure or capital inflows—exerted by the MMF sector on a specific CP issuer.

The full sample period for our study spans from December 2014 to March 2024, excluding the extreme stress period of March to April 2020 during the COVID-19 pandemic. Panel A of Table 3 presents summary statistics for CP characteristics and the funding fragility measure. We begin by calculating these statistics across all issuers within a given month or day, depending on the frequency of the variables. We then take time series averages of these statistics over the sample period. Panel A indicates that, on an average day, issuers raise near $400 million of CP funding, with an average maturity of 30 days. About 6% of these

[19]Note that the majority of fund closures and conversions are concentrated around the MMF reforms in 2016. Furthermore, we winsorize fund-level flows at the top 0.5% level to normalize extreme outliers in the positive direction, which are likely due to data errors.

issuances are placed directly to investors without the facilitation of a dealer. The average funding rates in the primary CP markets over the sample period is 1.7 percentage points. The monthly funding fragility measure, in decimal, averages near zero, with a standard deviation of 0.011. In addition, across CP issuers, MMFs on average provide them with a little over 10% of funding.[20]

Panel B of Table 3 provides pairwise correlations of daily CP characteristics with the lagged fragility measure. The correlations are generally low, indicating that MMF flows are largely exogenous to the fundamentals of CP issuers and that this flow-based measure contains unique insights on CP trades that is not captured by other CP characteristics.

4.2 Baseline results

In this subsection, we investigate whether MMF flow-induced fragility exerts any impact on funding condition in the primary CP markets. Using a decade long sample, we analyze the effects along three dimensions: pricing, funding amount, and maturity structure.

Impacts on CP pricing. We conduct the following panel regression using an issuer-day sample to assess the impact of MMF flow-induced funding fragility on pricing in the CP primary markets:

$$Yield_{i,t} = \alpha + \beta Funding\ Fragility_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \tag{5}$$

where $Yield_{i,t}$ is issuance amount-weighted yield at the issuer-day level. $Funding\ Fragility_{i,t-1}$ is defined in Section 4.1 and represents the holding share-weighted average redemption pressure over the previous month across all MMF counterparties of a given CP issuer. We control for CP characteristics ($X_{i,t}$), including issuance amount-weighted average maturity, logarithm of daily issuance amount, fraction of CP issuance placed directly with investors, lagged MMF ownership as of the most recent month end, as well as credit rating- and CP

[20]The simple average value for MMF Ownership is not weighted by the outstanding amount of CP of each issuer, hence is skewed downward by smaller issuers who receive less MMF funding. Based on dollar amount, MMFs provide approximately 25% of funding for outstanding CP across all issuers.

type-fixed effects. In addition, we include day-fixed effects to control for the influences of economic condition, monetary policy and regulatory environments. Standard errors are clustered at the issuer and day levels. Notably, the key difference between this full sample test and the event study—beyond the much longer sample period—is that we establish a direct link between CP issuers and their MMF counterparties using the dynamic flow-based funding fragility measure, rather than relying on a static pre-reform dependence level to gauge the potential impact of MMF shocks.

Results in Table 4 show that a CP issuer tends to incur higher borrowing costs when funding fragility posed by its MMF counterparties increased over the previous month, with this effect being statistically significant at the 1% level. As shown by in Column (1), a one-percentage-point increase in lagged funding fragility is associated with a 0.3-basis-point rise in CP yields, about 2 percent of the cross-sectional dispersion in yields. It's important to note that during non-stress period, investor flows to MMFs are primarily driven by changes in regulatory and monetary policy stances, as well as variations in end investors' cash management needs. As a result, for a specific CP issuer, the fragility measure based on its MMF counterparties' flows is largely independent of fundamentals of that CP issuer and can be viewed as exogenous shocks to that issuer. Our finding of a significant price impact with nontrivial economic magnitude by nonfundamental factors like MMF flows is particularly noteworthy, as our model controls for an array of issuer characteristics and fixed effects. The coefficients on other CP characteristics are also intuitive: issuances with higher MMF ownership, shorter maturity, larger size, and more direct placement tend to incur lower costs. Column (2) shows that our finding regarding the price impact of lagged funding fragility remains strong with the inclusion of an issuer-fixed effect.

To further demonstrate the robustness of our findings, we employ CP spreads—defined as the rate difference between CP and an overnight index swap (OIS) contract with comparable maturities—as an alternative measure of pricing.[21] We then substitute CP yields with

[21] OIS contracts are liquid floating-fixed interest swaps with the floating leg tied to federal funds rates. The OIS rates are obtained from the Bloomberg Per Security Data License.

spreads and repeat the panel regression as in Model (5). The results, presented in Appendix Table A2, exhibit similar patterns as those in Table 4. Specifically, a one-percentage-point increase in lagged fragility measure results in a 0.3-basis-point rise in CP spreads.

Effect on funding volume and maturity structure. We proceed to investigate whether MMF flow-induced fragility influences funding volume and maturity structure of CP. As in the event study, we utilize both maturity-weighted gross issuance volumes and net changes in outstanding levels to capture funding volume, and compute volume-weighted average maturity and fraction of overnight issuance to gauge maturity structure, all at a monthly frequency. We then estimate the following model using an issuer-month sample from December 2014 to March 2024 while excluding the COVID-19 crisis period:

$$Funding\ Volume_{i,t}(Maturity\ Structure_{i,t}) = \alpha + \beta Funding\ Fragility_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \quad (6)$$

In addition to CP issuance characteristics, we also control for month-fixed effects. Standard errors are clustered at the issuer and month levels.

Panels A and B in Table 5 summarize the results for funding volume and maturity structure, respectively. Panel A shows insignificant coefficients on lagged fragility measures, suggesting that MMF flow-induced fragility does not appear to significantly affect CP funding volumes. In Panel B, while Columns (5) and (7) indicate that CP issuers tend to shorten their issuance maturity by half a day and increase the fraction of overnight issuance by 0.5 percentage point in response to a one-percentage-point increase in lagged fragility measures, such impacts dissipate once we control for issuer-fixed effects as shown in Columns (6) and (8).

Overall, our analyses over a decade-long period with generally calm funding markets reveal a pattern consistent to those observed in the event study: redemption pressure faced by MMFs may prompt adjustments in funds' investment strategies, introducing fragility and affecting funding costs, but not the quantity or maturity structure of CP issuance these MMFs invest in. These findings corroborate anecdotal evidence about CP primary market operations. Specifically, while CP issuers often demonstrate a willingness to adjust pricing, the quantity and maturity structure of CP issuance are mainly determined by firms' projected funding needs and timing—such as scheduled payments, payrolls, taxes, inventory, or other day-to-day operation expenses—leaving little room for negotiation. This explains the documented insensitivity of firms' CP issuance activities to non-fundamental factors like MMF flow shocks. Since pricing is the main lever for negotiation between CP issuers and MMFs, the impact of MMF flow-induced fragility on pricing is clear of confounding effects related to funding amount and maturity structure. As such, our analyses will henceforth focus on the price impact of MMF flow-induced fragility.

4.3 Distinguishing the impact of MMF redemption pressure vs. capital inflows

Next, we assess whether the price impact of MMF flow-induced funding fragility is mainly driven by MMF redemption pressures or by capital inflows. Understanding this distinction helps grasp market dynamics between CP issuers and their MMF counterparties, as well as financial stability implications. If the price impact arises from MMFs imposing higher borrowing costs on CP issuers amid redemptions, rather than from passing on savings to CP issuers during inflows, it indicates that MMFs possess dominant market power in price negotiations against CP issuers. This would raise concerns about stress propagating from the MMF sector that limits financial and nonfinancial corporations' ability to meet their short-term funding needs, amplifying financial stability risks.

To investigate these dynamics, we construct two variables for each issuer: *Redemption* $Pressure_{i,t}$ and $Capital\ Inflows_{i,t}$. *Redemption* $Pressure_{i,t}$ equals $Funding\ Fragility_{i,t}$ for fund i at time t if $Funding\ Fragility_{i,t}$ is above zero, and is set to zero otherwise. $Capital\ Inflows_{i,t}$ equals the negative of $Funding\ Fragility_{i,t}$ if it is below zero, and is set to zero otherwise. We then perform the following panel regression using the issuer-day sample from December 2014 to March 2024 while excluding the COVID crisis period:

$$Yield_{i,t} = \alpha + \beta_1 Redemption\ Pressure_{i,t-1} + \beta_2 Capital\ Inflows_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \quad (7)$$

Control variables and fixed effects are as defined in Model (5). Standard errors are clustered at the issuer and day levels.

We report regression results in Table 6. As shown, the coefficient on lagged redemption pressure is positive and the coefficient on capital inflows is negative, both statistically significant. Column (1) shows that a one-percentage-point increase in MMF redemption pressure over the previous month is associated with a 0.3-basis-point rise in CP yields, while the same increase in MMF capital inflows leads to a 0.34-basis-point reduction in CP yields. Our findings remain robust to the inclusion of an issuer-fixed effect to the regression, as shown in Column (2).[22]

Our analysis reveals that MMFs charge higher rates on CP issuers under redemption pressures while lowering funding cost amid capital inflows. These findings suggest that neither MMFs nor CP issuers are entirely price takers or setters in the primary markets of CP. Rather, in short-term funding markets like CP—characterized as relationship-based OTC markets with substantial search frictions—the relative bargaining power between funding providers and asset issuers may shift over time and vary among market participants.[23] The dynamics of bargaining power may play a crucial role in shaping pricing within these markets, which we will explore in the next section.

5 Mechanism analysis: bargaining power

We've demonstrated that, on average, MMFs tend to lower borrowing costs for their CP issuers upon receiving inflows and increase costs when facing redemptions. This raises im-

[22]As an additional robustness check, we replace CP yield with CP spread as the dependent variable and re-estimate Model (7). Results, not reported here, present a similar influence of both MMF redemption pressure and capital inflows on CP borrowing costs, and are available upon request.

[23]Li (2021) shows that MMFs and their asset issuers engage in sophisticated reciprocal relationship management.

portant questions: why do funds offer pricing benefits to CP issuers during inflows, and why do CP issuers accept higher borrowing costs when their MMF counterparties are under redemption pressure? We hypothesize that these dynamics are driven by the relative bargaining power between MMFs and CP issuers.

In this section, we analyze how the bargaining power between CP issuers and MMF counterparties influences the impact of investor funding fragility on CP pricing. We begin by developing a stylized Nash bargaining model that formalizes how funding rates are determined through bilateral negotiations between MMFs and CP issuers. We then test model predictions using both aggregate and issuer-level variation in bargaining power and find consistent evidence supporting the theoretical mechanism.

5.1 A stylized Nash bargaining model with lenders' flow shocks

Our model abstracts the CP market as a bilateral negotiation between an MMF, acting as the lender, and a CP issuer, acting as the borrower. In this stylized setting, the borrowing rate is determined directly through bargaining between the two parties.[24] We frame this interaction as a Nash bargaining problem (Nash, 1950) to capture how the negotiated rate reflects the relative bargaining powers of the two parties, particularly in the presence of investor flow shocks affecting the MMF.

Consider a bilateral negotiation in which an MMF (lender) provides a fixed amount Q of funding to a CP issuer (borrower).[25] Let $\beta \in (0, 1)$ denote the bargaining power of the MMF, and $1-\beta$ denote the bargaining power of the CP issuer. We assume that the borrower has a fallback borrowing option at an interest rate r_B (e.g., from another lender or an alternative financing source), while the MMF faces a base opportunity cost of funds r_0 (e.g., the return

[24] Although some transactions in the CP market are intermediated by dealers, MMFs and CP issuers typically maintain relationships and communicate either directly or via dealers. Unlike dealers in other OTC markets, CP dealers do not take inventory positions or provide market-making liquidity. Rather, their role is primarily limited to facilitating transactions between counterparties that generally have pre-established bilateral relationships.

[25] Both anecdotal evidence and our empirical analysis suggest that CP issuers' funding quantities are relatively inflexible in negotiations, as they are largely determined by firms' financing needs and cycles.

from investing in Treasury bills or repos) and is subject to investor flow shocks. As in all Nash bargaining models, we assume $r_0 < r_B$ to ensure a positive surplus from agreement.

The borrower's surplus reflects the interest savings for the CP issuer from borrowing at rate r instead of the fallback rate r_B:

$$U_B(r) = Q \cdot (r_B - r).$$

The lender's surplus is more nuanced. It reflects not only the spread the MMF earns over its base opportunity cost r_0, but also incorporates a reduction due to liquidity costs arising from investor redemptions. Intuitively, redemptions impose adverse liquidity shocks by increasing the MMF's immediate need for cash to meet withdrawals. This pressure raises the marginal opportunity cost of lending, as lending competes with the need to maintain adequate liquidity buffers. Conversely, inflows ease liquidity constraints by increasing available funds, thereby lowering the implicit shadow cost of allocating resources to new lending.

Accordingly, the lender's surplus can be expressed as:

$$U_L(r) = Q \cdot (r - r_0 - C(f, \beta)),$$

where $C(f, \beta)$ represents the additional opportunity cost generated by investor redemption shock f and depends on the MMF's bargaining power β.

We naturally assume:

$$\frac{\partial C(f, \beta)}{\partial f} > 0,$$

implying that an increase in redemptions (a larger positive f) raises the lender's effective opportunity cost, while an increase in inflows (a more negative f) lowers it.

The Nash bargaining solution determines the negotiated interest rate r^* by maximizing the weighted product of the borrowers and lenders surpluses. A deal is feasible if $r_0 + C(f, \beta) \leq r \leq r_B$, where r denotes the negotiated interest rate.

Formally, the solution is given by:

$$r^* = \arg \max_{r \in [r_0 + C(f,\beta),\, r_B]} [U_B(r)]^{1-\beta} [U_L(r)]^{\beta}.$$

Substituting the expressions for the borrower's and lender's surplus into the objective function, we have:

$$r^* = \arg \max_{r \in [r_0 + C(f,\beta),\, r_B]} [Q \cdot (r_B - r)]^{1-\beta} [Q \cdot (r - r_0 - C(f,\beta))]^{\beta}.$$

Solving the bargaining problem yields the closed-form solution for the negotiated interest rate:[26]

$$r^* = \beta r_B + (1-\beta) r_0 + (1-\beta) C(f,\beta).$$

This expression shows that the negotiated rate is a weighted average of the borrower's fallback rate r_B and the lender's effective opportunity cost $r_0 + C(f,\beta)$. The term $(1-\beta)C(f,\beta)$ captures the degree to which investor flow shocks are passed through to the borrowing rate, depending on both the direction and magnitude of the shock f and the bargaining power β.

Taking the partial derivative of $r^*(f,\beta)$ with respect to f, we obtain the following proposition:

Proposition 1. *For a given level of relative bargaining power β, the negotiated interest rate between the MMF and CP issuer increases with redemption pressure f. That is:*

$$\frac{\partial r^*(f,\beta)}{\partial f} > 0.$$

Proposition 1 captures the core empirical finding from Section 4: CP rates rise with MMF redemption pressures and fall with inflows. The theoretical framework helps explain this pattern.

Next, to gain further insights into how bargaining power affects the negotiated interest rate, we impose additional structure on $C(f,\beta)$ to capture the asymmetric effects of redemptions and inflows. This reflects the fact that MMFs are particularly sensitive to redemption

[26]Solution details and proofs are provided in Appendix B.

risk and liquidity pressures. Specifically, under redemption episodes, the associated cost rises more sharply—especially when the MMF holds greater bargaining power. In contrast, during inflows, the liquidity relief from incoming cash generates a more muted effect. Accordingly, we define $C(f, \beta)$ as a piecewise function depending on the sign of f:

$$C(f,\beta) = \begin{cases} \frac{\phi f}{(1-\beta)^2} & \text{if } f > 0 \quad \text{(redemption shock)} \\ \frac{\phi f}{1-\beta} & \text{if } f < 0 \quad \text{(inflow shock)}, \end{cases}$$

where $\phi > 0$ is a sensitivity parameter governing how flow shocks translate into the lender's additional opportunity cost.[27]

This leads to the following proposition, describing the role of bargaining power in shaping the sensitivity of the negotiated rate to redemption pressure:

Proposition 2. *When the MMF experiences redemption pressure ($f > 0$), the sensitivity of the negotiated interest rate to redemption increases with the MMF's bargaining power. In contrast, when the MMF experiences inflows ($f < 0$), bargaining power does not affect the negotiated interest rate. That is:*

$$\frac{\partial^2 r^*(f,\beta)}{\partial f \partial \beta} > 0 \quad \text{if } f > 0 \quad \text{(redemption shock)},$$

$$\frac{\partial^2 r^*(f,\beta)}{\partial f \partial \beta} = 0 \quad \text{if } f < 0 \quad \text{(inflow shock)}.$$

Proposition 2 suggests that the effect of redemption pressure on rates intensifies when MMFs hold greater relative bargaining power, allowing them to shift more funding stress onto CP issuers. In contrast, bargaining power does not amplify rate sensitivity during inflow episodes. This asymmetry reflects MMFs' heightened sensitivity to liquidity needs during redemptions compared to periods of abundant cash.

We test the implications of Proposition 2 in the next two subsections, using both aggregate and issuer-level measures of bargaining power. Empirically, it is not possible to evaluate

[27]Under this specification of $C(f, \beta)$, the negotiated interest rate $r^*(f, \beta)$ is strictly increasing in β, the lender's bargaining power, regardless of the value of f, the flow shock.

the absolute bargaining power of MMFs or CP issuers; instead, the aggregate measures reflect time-series variation in relative bargaining power between the two sides, while the issuer-level measures capture cross-sectional differences in issuer-specific bargaining power—recognizing that some CP issuers hold weaker bargaining positions than others.

5.2 Bargaining power at the aggregate level

We begin the analysis with two aggregate measures of relative bargaining power between MMFs and CP issuers. The first reflects the MMF ownership perspective, incorporating both market share and concentration in CP markets. The second captures the overall level of credit risk concerns across the CP market.

5.2.1 Aggregate structure of MMF ownership

As depicted in Figure 2, MMFs are important investors in the primary CP markets, holding over 40% of the total outstanding CP prior to the 2016 reforms and about a quarter by the end of 2024:Q1.[28] MMFs likely wield stronger market power in the CP markets when they collectively hold a larger market share, especially if that ownership is highly concentrated. Under such conditions, it is easier for funds to coordinate—either explicitly through collusion or implicitly through tacit understanding—thereby boosting their bargaining power in price negotiations against CP issuers as competition among funds diminishes (Tirole (1988); Lerner (1995)).

In light of this, we assess MMFs' bargaining power by considering their market share in the CP markets, as well as their ownership concentration measured using the Herfindahl-Hirschman Index (HHI). The HHI is defined as the sum of the squares of individual MMF's CP holdings, divided by the square of the total CP held by all MMFs. Figure 2 demonstrates notable time variations in both the market share and concentration level of MMF CP holdings. We then construct a monthly indicator variable, $High\ MMF\ Power$, which takes the

[28] https://www.federalreserve.gov/releases/z1/

value of one if both the share of CP owned by MMFs and the HHI are above their respective time-series medians, and zero otherwise.[29] We conjecture that during periods when MMFs possess stronger bargaining power, indicated by a *High MMF Power* of one, they are more likely to charge higher CP yields when facing redemptions.

To test this hypothesis, we conduct the following panel regressions at the issuer-day level using the sample from December 2014 to March 2024, excluding the COVID crisis period:

$$\begin{aligned} Yield_{i,t} = \alpha + \beta Funding\ Fragility_{i,t-1} + \\ \gamma Funding\ Fragility_{i,t-1} \times High\ MMF\ Power_{t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \end{aligned} \tag{8a}$$

$$\begin{aligned} Yield_{i,t} = \alpha + \beta_1 Redemption\ Pressure_{i,t-1} + \beta_2 Capital\ Inflows_{i,t-1} + \\ \gamma_1 Redemption\ Pressure_{i,t-1} \times High\ MMF\ Power_{t-1} + \\ \gamma_2 Capital\ Inflows_{i,t-1} \times High\ MMF\ Power_{t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \end{aligned} \tag{8b}$$

We control for CP characteristics included in Model (5) as well as their interactions with the high MMF power dummy. We also include two-way fixed effects for credit rating and CP type. Standard errors are clustered at the issuer and day levels.

Table 7 presents regression results. Column (1) details the estimation results of Model (8a), showing a positive and significant impact of lagged funding fragility on CP yields. The coefficient on the interaction term between lagged fragility measure and the high MMF power dummy is also positive and significant, indicating that the impact of MMF flow-induced shocks on CP pricing is amplified when the MMF sector holds stronger bargaining power against CP issuers. A similar pattern is observed in Column (2), where issuer-fixed effects are included. However, without distinguishing whether this amplification effect results from inflow-triggered price benefits or redemption-induced price penalties, the dynamics of bargaining power remain ambiguous.

Therefore, in Model (8b), we differentiate the impact of MMF capital inflows from that

[29]The *High MMF Power* variable takes the value of one for about 20% of our sample period.

of redemption pressure and report the results in Column (3). The coefficients on the two interaction terms demonstrate that the amplified pricing effects due to high MMF bargaining power are primarily due to higher price penalties amid MMF redemption pressure, consistent with Proposition 2. Specifically, when MMFs have strong bargaining power relative to CP issuers, a one-percentage-point increase in MMF redemption pressure is associated with an additional raise in funding cost of 0.4 basis points to CP issuers compared to periods of weaker MMF bargaining power. These patterns remain robust in Column (4), where we further control for issuer-fixed effects. Our findings show that stronger bargaining power enables the MMF sector to increase CP yields more aggressively when facing redemption pressure.

5.2.2 Credit risk concerns in CP markets

Next, we shift to a different perspective on relative bargaining power, focusing on credit risk concerns. Short-term funding markets like the CP market are characterized by inherent credit risks and extremely limited market liquidity. Thus, MMFs are vulnerable to valuation risks and susceptible to investor runs when credit risks escalate, as end investors of MMFs have little tolerance for asset value loss. Figure 2 reveals substantial variations in CP spreads, even outside the COVID-19 crisis period, during which the spreads surged. Consequently, MMF managers are highly tuned to the overall credit quality in the CP markets and are likely to withdraw their investments or demand higher compensation amid heightened credit concerns. Therefore, we hypothesize that increased concerns about CP credit risks may weaken the bargaining power of CP issuers relative to MMFs, making issuers more susceptible to pricing disadvantages.

To test this hypothesis, we conduct the following panel regressions at the issuer-day level using a sample from December 2014 to March 2024, excluding the COVID-19 crisis period:

$$Yield_{i,t} = \alpha + \beta Funding\ Fragility_{i,t-1} +$$

$$\gamma Funding\ Fragility_{i,t-1} \times High\ CP\ Risk_{t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \quad (9a)$$

$$Yield_{i,t} = \alpha + \beta_1 Redemption\ Pressure_{i,t-1} + \beta_2 Capital\ Inflows_{i,t-1} + \gamma_1 Redemption\ Pressure_{i,t-1} \times High\ CP\ Risk_{t-1} + \gamma_2 Capital\ Inflows_{i,t-1} \times High\ CP\ Risk_{t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \quad (9b)$$

$High\ CP\ Risk_t$ is a daily indicator variable that takes value of 1 if the rate difference between lower-rated CP and maturity-matched OIS is above its time-series median over the sample period, and zero otherwise.[30] We control for CP characteristics included in Model (5) as well as their interactions with the high CP risk dummy. We also include two-way fixed effects for credit rating and CP type. Standard errors are clustered at the issuer and day levels.

Table 8 presents regression results, with Column (1) and (2) detailing the estimation outcome of Model (9a). The positive and significant coefficients on lagged fragility measures indicate that MMF flow-induced shocks significantly impact CP issuers' borrowing costs, even when the credit risk concerns in the CP markets are relatively low. The coefficients on the interaction term between lagged fragility levels and the high-risk dummy are significantly positive, suggesting that the impact of MMF flows on CP pricing is significantly amplified when credit risk concerns are relatively elevated in the CP markets.

To analyze the dynamics of bargaining power, we distinguish between the impact of MMF capital inflows and redemption pressure. Consistent with Proposition 2, Column (3) shows that the amplified price impact during periods of high credit risk is entirely due to larger yield increases amid MMF redemption pressure. This is evidenced by the strongly positive coefficient on the interaction between the high risk dummy and MMF redemption pressure measure, along with the insignificant coefficient on the interaction between the high

[30] We calculate the yield spread for the CP segment with maturity exceeding one month and rated as A2P2, which is considered to have relatively high credit risk exposures in the CP markets. These spreads are computed over OIS rates with comparable maturities. We also consider alternative measures to assess credit riskiness in the CP markets, based on the rate difference between A2P2 CP with maturities exceeding one quarter and their corresponding maturity-matched OIS. Results using the alternative measures remain similar and are available upon request.

risk dummy and MMF inflow variable. This supports the notion that heightened concerns over CP credit risks diminish bargaining power for CP issuers in price negotiations, with a one-percentage-point increase in MMF redemption pressure resulting in a 0.2-basis-points additional rise in CP yields compared to periods of low credit risk concerns. These patterns remain robust in Column (4) when we further control for issuer-fixed effects. Our findings suggest that that heightened concerns about CP credit risk weaken CP issuers' bargaining power and exacerbate the impact of MMF redemptions on issuers' borrowing costs.

5.3 Bargaining power at individual CP issuer level

Thus far, we have demonstrated that when the broad market conditions are conducive to stronger MMF bargaining power, funds can impose additional rate increases on CP issuers when facing redemptions. We proceed to calibrate the relative bargaining power between MMFs and CP issuers at the individual issuer level and test whether this bargaining power continues to influence the impact of MMF flow-induced funding fragility on CP yields. In this subsection, we focus on CP characteristics that may signal an issuer's relative bargaining power, including its market presence, distribution channels, and domicile of the parent company.

5.3.1 Individual bargaining power: By market presence

The CP market is a relationship-based OTC market, in which issuers invest considerable effort in maintaining stable and close relationships with CP dealers and investors. Anecdotal evidence suggests that it can take months for a CP issuer to establish a new relationship with a potential MMF investor. Moreover, if an issuer is absent from the market for an extended period, reestablishing lending relationships can be costly. As a result, issuers that participate infrequently or on an ad hoc basis in the CP market are likely to hold a weaker bargaining position with MMFs compared to those that participate frequently and consistently.

To test our hypothesis that issuers with lower market presence exhibit weaker bargaining power when interacting with their MMF counterparties, especially amid fluctuations in fund flows, we conduct the following panel regressions at the issuer-day level using a sample from December 2014 to March 2024, excluding the period of COVID-19 crisis:

$$\begin{aligned} Yield_{i,t} = \alpha + \beta Funding\ Fragility_{i,t-1} + \\ \gamma Funding\ Fragility_{i,t-1} \times Low\ Presence_{i,t} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \end{aligned} \tag{10a}$$

$$\begin{aligned} Yield_{i,t} = \alpha + \beta_1 Redemption\ Pressure_{i,t-1} + \beta_2 Capital\ Inflows_{i,t-1} + \\ \gamma_1 Redemption\ Pressure_{i,t-1} \times Low\ Presence_{i,t} + \\ \gamma_2 Capital\ Inflows_{i,t-1} \times Low\ Presence_{i,t} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \end{aligned} \tag{10b}$$

CP yield and various flow-based measures are as previously defined. $Low\ Presence_{i,t}$ is an indicator variable that takes the value of 1 if the total number of active issuance days for issuer i over the past quarter is at or below the cross-sectional median, and zero otherwise.[31] We control for CP characteristics included in Model (5) as well as their interactions with the low-presence dummy. We also include two-way fixed effects for credit rating and CP type, as well as day fixed effects. Standard errors are clustered at the issuer and day levels.

Table 9 presents the regression results, with Columns (1) and (2) reporting the estimation results from Model (10a). The strongly positive coefficients on the interaction terms between lagged fragility measure and the low-presence dummy indicate that the impact of MMF flows on pricing is more pronounced for CP issuers with lower market presence.

To analyze dynamics of bargaining power, we differentiate the impact of MMF inflows from that of redemption pressure in Model (10b). Shown in Column (3), the coefficients on the two interaction terms demonstrate that the amplified pricing effects for low-presence CP issuers are solely due to additional price penalties amid MMF redemption pressure. Specifically, as MMF counterparties experience a one-percentage-point increase in redemption

[31] For robustness, we also employ an alternative approach to define $Low\ Presence_{i,t}$ based on issuance activities over the past six months. Regression results with this alternative measure, shown in Appendix Table A3, are even stronger.

pressure, CP issuers with lower market presence—likely having weaker bargaining power—face an additional raise in funding cost of 0.4 basis points compared to issuers with higher presence. Column (4) shows similar patterns, after we further control for issuer-fixed effects.

5.3.2 Individual bargaining power: By distribution channel

In the primary market, CP is distributed through two channels: dealer intermediation and direct placement, with the former accounting for the majority of the issuance. CP transaction data reveal great variations in the extent of reliance on dealer intermediation across issuers.[32]

CP issuers less reliant on dealer intermediation—those with more direct access to investors—likely have greater flexibility in raising funds from the CP markets. We hypothesize that such issuers hold stronger bargaining power, making them less susceptible to pricing pressure when their MMF counterparties experience redemption pressure. To test this hypothesis, we conduct the following panel regressions at the issuer-day level using a sample from December 2014 to March 2024, excluding the COVID-19 crisis period:

$$\begin{aligned} Yield_{i,t} &= \alpha + \beta Funding\ Fragility_{i,t-1} + \\ &\quad \gamma Funding\ Fragility_{i,t-1} \times Dealer\ Dependent_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \end{aligned} \tag{11a}$$

$$\begin{aligned} Yield_{i,t} &= \alpha + \beta_1 Redemption\ Pressure_{i,t-1} + \beta_2 Capital\ Inflows_{i,t-1} + \\ &\quad \gamma_1 Redemption\ Pressure_{i,t-1} \times Dealer\ Dependent_{i,t-1} + \\ &\quad \gamma_2 Capital\ Inflows_{i,t-1} \times Dealer\ Dependent_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \end{aligned} \tag{11b}$$

$Dealer\ Dependent_{i,t-1}$ is an indicator variable that takes the value of one if the fraction of CP issued through dealer intermediation over the previous month by issuer i is at or above the cross-sectional median, and zero otherwise.[33] Other model features are as described in

[32] For instance, Gross, Li, and Wang (2022) show that among the top 50 financial CP issuers over the period from 2013 to 2022, 13 place over 60% of their issuance directly, while nine place less than 10% of their issuance directly.

[33] We follow an alternative approach to gauging the level of dealer dependence, where the $DealerDependent$ variable takes the value of one if a given CP issuer has placed all its issuance through dealers over the previous

Section 5.3.1.

Columns (1) and (2) of Table 10 indicate amplified price impact from MMF flow-induced shocks for CP issuers with a stronger reliance on dealer intermediation. Analyses in Column (3) distinguish the impact driven by inflows from that by redemption pressure. The coefficients on the two interaction terms reveal that the amplification in pricing effects for dealer-dependent CP issuers is significant only when MMF counterparties experience redemption pressure. Specifically, as MMF counterparties experience a one-percentage-point increase in redemption pressure, CP issuers more reliant on dealers incur an additional rise in funding cost of 0.3 basis points compared to issuers with lower dealer dependence. Furthermore, the coefficient on lagged redemption pressure is not significantly different from zero, suggesting that when facing redemptions, MMF counterparties cannot transfer pricing pressure to CP issuers that are less reliant on dealers. These patterns remain consistent in Column (4), which includes issuer-fixed effects.

5.3.3 Individual bargaining power: By issuer domicile

Foreign companies need U.S. dollars for international trade settlements and as a reserve currency, making the CP markets a vital avenue for them to secure short-term dollar funding.[34] As of May 2024, about one third of outstanding CP is issued by foreign firms. Importantly, these foreign issuers face greater constraints in accessing alternative dollar funding sources compared to their domestic counterparts. For instance, domestic financial firms can attract retail deposits through their extensive branch networks, whereas foreign financial firms have minimal access to dollar depositors. Similarly, U.S.-based non-financial firms can easily establish credit lines and other credit facilities with domestic banks, an option often unavailable to foreign entities. Consequently, this restricted access to dollar funding can put foreign CP issuers at a disadvantage in terms of bargaining power relative to U.S. issuers. In light

month, and zero otherwise. Results, unreported and available upon request, show similar patterns.

[34] Other short-term dollar funding markets accessible for foreign firms include the Eurodollar market, repo market, and negotiable certificate of deposit market, all of which are typically available only to financial firms.

of this, we hypothesize that foreign CP issuers are subject to higher pricing pressure when their MMF counterparties experience redemptions. To test this hypothesis, we conduct the following panel regressions at the issuer-day level using a sample from December 2014 to March 2024, excluding the COVID-19 crisis period:

$$\begin{aligned} Yield_{i,t} = \alpha + \beta Funding\ Fragility_{i,t-1} + \\ \gamma Funding\ Fragility_{i,t-1} \times Foreign_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}, \end{aligned} \tag{12a}$$

$$\begin{aligned} Yield_{i,t} = \alpha + \beta_1 Redemption\ Pressure_{i,t-1} + \beta_2 Capital\ Inflows_{i,t-1} + \\ \gamma_1 Redemption\ Pressure_{i,t-1} \times Foreign_{i,t-1} + \\ \gamma_2 Capital\ Inflows_{i,t-1} \times Foreign_{i,t-1} + \mu X_{i,t} + \theta_t + \epsilon_{i,t}. \end{aligned} \tag{12b}$$

$Foreign_{i,t-1}$ is an indicator variable that takes the value of one if the CP issuer's parent company is located outside of the U.S. as of the previous month, and zero otherwise. Other model features are as described in Section 5.3.1.

In Table 11, Columns (1) and (2) indicate that while the price impact of MMF flow-induced shocks is significant for domestic CP issuers, such impact is substantially amplified for foreign issuers. To test the mechanism for bargaining power, Column (3) differentiates the impact due to inflows from that by redemptions. The coefficients on the two interaction terms indicate that the intensification in pricing effects for foreign issuers is only observed when MMF counterparties experience redemption pressure: one-percentage-point increase in lagged redemptions leads to an additional rise in funding cost by 0.5 basis points for foreign issuers compared to domestic issuers. Column (4) shows similar patterns when issuer-fixed effects are included.

Overall, the findings from Section 5.3 consistently support Proposition 2, indicating that CP issuers with weaker bargaining power—characterized by lower market presence, stronger reliance on dealer intermediation, or with a foreign domicile—incur higher rise in funding costs when their MMF counterparties undergo redemption pressure.

6 Conclusion

Funding fragility posed by investors can significantly affect the pricing of the underlying assets. In particular, such fragility arising from liquidity mismatches in open-end mutual funds has drawn great academic and regulatory attention, with extensive research focusing on its impact on secondary markets for equities and bonds. This paper presents a novel exploration of short-term funding markets, which are dominantly primary markets with minimal secondary market trading. These markets are dominated by institutional investors prone to run behavior, making them critical channels for the transmission of systemic risk. Additionally, market frictions—such as imbalanced bargaining power—can amplify the impact of liquidity shocks. By focusing on a $1 trillion short-term funding market of CP and its MMF investors, we investigate the impact of investor fragility on the underlying markets in this distinctive context.

Using the 2016 SEC reforms as an exogenous fragility shock, we conduct an event study examining the impact of sector-wide MMF withdrawals on CP pricing and issuance. We find that CP issuers with high pre-reform dependence on MMFs incur an additional 4-basis-point rise in borrowing costs during the withdrawal period yet display no significant difference in issuance volume or maturity structures, compared to issuers less reliant on MMFs. Expanding our analyses to a period from December 2014 to March 2024 and utilizing a monthly MMF flow-based fragility measure for each CP issuer, we document consistent patterns seen in the event study regarding the impact of MMF funding fragility on CP primary markets. These findings align with the anecdotal understanding of the operations in CP primary markets. Specifically, the quantity and maturity structure of CP issuance are mainly dictated by firms' anticipated funding needs with little room for negotiation. Yet issuers are often ready to adjust pricing to accommodate market conditions.

We further distinguish between the price impact of MMF redemption pressure and capital inflows, finding that CP issuers face higher yields when their MMF counterparties are under redemption pressure and lower yields when their MMF counterparties experience capital inflows. This indicates that neither MMFs nor CP issuers act entirely as price takers or setters. Instead, pricing in CP markets—which are relationship-based and operate OTC with significant frictions—appears influenced by the relative bargaining power between MMFs and asset issuers. Indeed, based on various proxies for bargaining power, we find that for a given amount of MMF redemptions, there is a greater increase in borrowing costs among CP issuers with weaker bargaining power. These empirical findings are rationalized using a stylized Nash bargaining model that incorporates flow shocks on the lender side.

Our study detects a significant price impact of investor funding fragility on the primary CP markets and shows how market frictions, such as imbalanced bargaining power, manifest through this impact and lead to pricing inefficiencies. These findings underscore the structural vulnerabilities of short-term funding markets and their susceptibility to investor funding shocks, even during non-stress periods. Importantly, our results carry critical policy implications, particularly amid ongoing reforms and discussions aimed at enhancing MMF resilience to redemption risks and promoting trading efficiency in short-term funding markets.[35] These improvements, if implemented effectively, could help mitigate the vulnerabilities and bolster financial stability.

[35] See Securities and Exchange Commission (2023) and Financial Stability Board (2024).

References

Adelino, M., S. C. Cheong, J. Choi, and J. Y. J. Oh. 2023. Mutual fund flows and the supply of capital in municipal financing. National Bureau of Economic Research Working Paper.

Baghai, R. P., M. Giannetti, and I. Jäger. 2022. Liability structure and risk taking: Evidence from the money market fund industry. *Journal of Financial and Quantitative Analysis* 57:1771–1804.

Calomiris, C. W., C. P. Himmelberg, and P. Wachtel. 1995. Commercial paper, corporate finance, and the business cycle: a microeconomic perspective. In *Carnegie-Rochester Conference Series on Public Policy*, vol. 42, pp. 203–250. Elsevier.

Chernenko, S., and A. Sunderam. 2014. Frictions in shadow banking: Evidence from the lending behavior of money market mutual funds. *The Review of Financial Studies* 27:1717–1750.

Choi, J., S. Hoseinzade, S. S. Shin, and H. Tehranian. 2020. Corporate bond mutual funds and asset fire sales. *Journal of Financial Economics* 138:432–457.

Cipriani, M., and G. La Spada. 2020. Sophisticated and unsophisticated runs. FRB of New York Staff Report.

Coval, J., and E. Stafford. 2007. Asset fire sales (and purchases) in equity markets. *Journal of Financial Economics* 86:479–512.

Covitz, D., N. Liang, and G. A. Suarez. 2013. The evolution of a financial crisis: Collapse of the asset-backed commercial paper market. *The Journal of Finance* 68:815–848.

Duffie, D., N. Gârleanu, and L. H. Pedersen. 2005. Over-the-counter markets. *Econometrica* 73:1815–1847.

Duffie, D., N. Gârleanu, and L. H. Pedersen. 2007. Valuation in over-the-counter markets. *The Review of Financial Studies* 20:1865–1900.

Duygan-Bump, B., P. Parkinson, E. Rosengren, G. A. Suarez, and P. Willen. 2013. How effective were the Federal Reserve emergency liquidity facilities? Evidence from the asset-backed commercial paper money market mutual fund liquidity facility. *The Journal of Finance* 68:715–737.

Edmans, A., I. Goldstein, and W. Jiang. 2012. The real effects of financial markets: The impact of prices on takeovers. *The Journal of Finance* 67:933–971.

Financial Stability Board. 2024. Enhancing the Functioning and Resilience of Commercial Paper and Negotiable Certificates of Deposit Markets. https://www.fsb.org/uploads/P220524.pdf.

Gallagher, E. A., L. D. Schmidt, A. Timmermann, and R. Wermers. 2020. Investor information acquisition and money market fund risk rebalancing during the 2011–2012 eurozone crisis. *The Review of Financial Studies* 33:1445–1483.

Green, R. C., B. Hollifield, and N. Schürhoff. 2007. Financial intermediation and the costs of trading in an opaque market. *The Review of Financial Studies* 20:275–314.

Gross, M., Y. Li, and A. Wang. 2022. Dealer Intermediation in the Primary Market of Commercial Paper. FEDS Notes.

Hempel, S., Y. Li, and S. Tibay. 2024. Firms' financing choice between short-term and long-term debts: Are they substitutes? FEDS Notes.

Im, J., Y. Li, and A. Wang. 2025. Investor Flows, Monetary Policy, and Portfolio Management of Money Market Funds. Working Paper.

Ivashina, V., D. S. Scharfstein, and J. C. Stein. 2015. Dollar funding and the lending behavior of global banks. *The Quarterly Journal of Economics* 130:1241–1281.

Jiang, E. X., G. Matvos, T. Piskorski, and A. Seru. 2023. Limited Hedging and Gambling for Resurrection by US Banks During the 2022 Monetary Tightening? Working Paper.

Jiang, H., D. Li, and A. Wang. 2021. Dynamic liquidity management by corporate bond mutual funds. *Journal of Financial and Quantitative Analysis* 56:1622–1652.

Jiang, H., Y. Li, Z. Sun, and A. Wang. 2022. Does mutual fund illiquidity introduce fragility into asset prices? Evidence from the corporate bond market. *Journal of Financial Economics* 143:277–302.

Kacperczyk, M., and P. Schnabl. 2010. When safe proved risky: commercial paper during the financial crisis of 2007–2009. *Journal of Economic Perspectives* 24:29–50.

Kacperczyk, M., and P. Schnabl. 2013. How safe are money market funds? *The Quarterly Journal of Economics* 128:1073–1122.

Kahl, M., A. Shivdasani, and Y. Wang. 2015. Short-term debt as bridge financing: Evidence from the commercial paper market. *The Journal of Finance* 70:211–255.

Kruttli, M. S., P. Monin, L. Petrasek, and S. W. Watugala. 2021. Hedge fund treasury trading and funding fragility: Evidence from the covid-19 crisis. FEDS Working Paper.

Lerner, A. 1995. *The concept of monopoly and the measurement of monopoly power*. Springer.

Li, L., Y. Li, M. Macchiavelli, and X. Zhou. 2021. Liquidity restrictions, runs, and central bank interventions: Evidence from money market funds. *The Review of Financial Studies* 34:5402–5437.

Li, Y. 2021. Reciprocal lending relationships in shadow banking. *Journal of Financial Economics* 141:600–619.

Li, Y., M. O'Hara, and X. Zhou. 2024. Mutual fund fragility, dealer liquidity provision, and the pricing of municipal bonds. *Management Science* 70:4802–4823.

Liu, X., and A. S. Mello. 2011. The fragile capital structure of hedge funds and the limits to arbitrage. *Journal of Financial Economics* 102:491–506.

Lou, D. 2012. A flow-based explanation for return predictability. *The Review of Financial Studies* 25:3457–3489.

McCabe, P. E. 2010. *Cross Section of Money Market Fund Risks and Financial Crises*. DIANE Publishing.

McCabe, P. E., M. Cipriani, M. Holscher, and A. Martin. 2013. The minimum balance at risk: A proposal to mitigate the systemic risks posed by money market funds. *Brookings Papers on Economic Activity* 2013:211–278.

Nash, J. F. 1950. The bargaining problem. *Econometrica* 18:155–162.

Schmidt, L., A. Timmermann, and R. Wermers. 2016. Runs on money market mutual funds. *American Economic Review* 106:2625–2657.

Securities and Exchange Commission. 2023. Final Rule for Money Market Fund Reforms. https://www.sec.gov/rules/final/2023/33-11211.pdf.

Strahan, P. E., and B. Tanyeri. 2015. Once burned, twice shy: Money market fund responses to a systemic liquidity shock. *Journal of Financial and Quantitative Analysis* 50:119–144.

Tirole, J. 1988. *The theory of industrial organization*. MIT press.

Wardlaw, M. 2020. Measuring mutual fund flow pressure as shock to stock returns. *The Journal of Finance* 75:3221–3243.

Weill, P.-O. 2008. Liquidity premia in dynamic bargaining markets. *Journal of Economic Theory* 140:66–96.

Weill, P.-O. 2020. The search theory of over-the-counter markets. *Annual Review of Economics* 12:747–773.

Zhu, Q. 2021. Capital supply and corporate bond issuances: Evidence from mutual fund flows. *Journal of Financial Economics* 141:551–572.

Appendix A Variable definition

Variable Name	Definition
Yield (%)	CP Issuance yield aggregated at the day-issuer level, weighted by issuance face value.
Maturity-weighted Gross Volume ($ billions)	Amount of CP issued within a month by a given issuer, weighted by maturity.
ΔOutstanding Amount ($ billions)	Change in month-end outstanding levels of CP for a given issuer.
Issuance Maturity (days)	Average maturity of CP issued within a month for a given issuer, weighted by issuance face value.
Overnight Fraction (decimal)	CP issued in the overnight bucket (1-4 days), as a share of total CP issued within a month by a given issuer.
Funding Fragility (decimal)	Aggregate redemptions for a CP issuer across its MMF counterparties, weighted by the proportion of outstanding CP amount held by each MMF: $Funding\ Fragility_{i,t} = \sum_{j=1}^{J} -(\frac{Fund\ AUM_{j,t} - Fund\ AUM_{j,t-1}}{Fund\ AUM_{j,t-1}}) \times \frac{CP\ Holdings_{i,j,t-1}}{CP\ Outstanding_{i,t-1}}$, where $Fund\ AUM_{j,t}$ is the month-end assets under management for an investing fund of issuer i, $CP\ Holdings_{i,j,t-1}$ is the amount of CP issued by firm i that is held by fund j in the previous month, and $CP\ Outstanding_{i,t-1}$ is the total amount of CP oustanding for issuer i in the previous month.
Redemption Pressure (decimal)	$Redemption\ Pressure = Funding\ Fragility$ when $Funding\ Fragility > 0$, and is zero otherwise.
Capital Inflows (decimal)	$Capital\ Inflows = -Funding\ Fragility$ when $Funding\ Fragility < 0$, and is zero otherwise.
MMF Ownership (decimal)	Fraction of an issuer's total CP oustanding held by MMFs at month-end.
Maturity (days)	Average maturity of CP issuances within a day for a given issuer, weighted by issuance face value.
log(Amount Issued)	Logarithm of CP issuance amount within a day for a given issuer.
Direct Issuance Share (decimal)	Amount of CP issued directly to investors as a share of total CP issuance within a day by a given issuer.
High Dependence	Indicator variable assigned a value of 1 if the average MMF Ownership of an issuer from June to November 2014 (six months before the event study sample starts) exceeds the cross-sectional median, and 0 otherwise.
Withdrawal	Indicator variable that takes a value of 1 for the period from December 2015 to November 2016, during which the prime fund sector experienced massive withdrawals, and 0 otherwise.

High MMF Power	Indicator variable that takes a value of 1 if both the share of CP owned by MMFs and the HHI as of the previous month are above their respective time series medians over the sample period, and zero otherwise. $$HHI_t = \frac{\sum_{j=1}^{J}(CP\ Holdings_{j,t})^2}{(\sum_{j=1}^{J} CP\ Holdings_{j,t})^2}$$ where $CP\ Holdings_{j,t}$ is the CP holdings by fund j at the end of month t.
High CP Risk	Indicator variable that takes a value of 1 if the rate difference between lower-rated CP and maturity-matched OIS on a given day is above its time-series median over the sample period, and zero otherwise.
Low Presence	Indicator variable that takes the value of 1 if the total number of active issuance days for a given issuer over the past quarter is at or below the cross-sectional median, and zero otherwise.
Dealer Dependent	Indicator variable that takes a value of 1 if the fraction of CP issued through dealer intermediation over the previous month by an issuer is at or above the cross-sectional median, and zero otherwise.
Foreign	Indicator variable that takes a value of 1 if the CP issuer's parent company is located outside of the U.S. as of the previous month, and zero otherwise.

Appendix B Proofs and model solution

In this appendix, we present the technical derivations and proofs for the Nash bargaining model discussed in Section 5.1.

B.1 Solution to the Nash bargaining problem

We solve the following Nash bargaining problem, where the negotiated rate r^* maximizes the Nash product of borrower and lender surpluses:

$$r^* = \arg \max_{r \in [r_0 + C(f,\beta),\, r_B]} \left[Q \cdot (r_B - r)\right]^{1-\beta} \left[Q \cdot (r - r_0 - C(f,\beta))\right]^{\beta},$$

where r_B is the borrower's fallback rate, r_0 the lender's base opportunity cost, $C(f, \beta)$ a flow-dependent liquidity cost, and β the lender's bargaining power.

Since $Q > 0$ does not affect the maximizer, we simplify:

$$r^* = \arg\max_{r} (r_B - r)^{1-\beta}(r - r_0 - C)^{\beta}.$$

We define the Nash product objective function as:

$$F(r) = (r_B - r)^{1-\beta}(r - r_0 - C)^{\beta},$$

where $C \equiv C(f, \beta)$ is shorthand for the flow-dependent liquidity cost.

To solve the maximization problem, we take the natural logarithm of $F(r)$ to simplify the expression:

$$\log F(r) = (1-\beta)\log(r_B - r) + \beta \log(r - r_0 - C).$$

We then differentiate with respect to r and set the first-order condition equal to zero:

$$\frac{d}{dr}\log F(r) = -\frac{1-\beta}{r_B - r} + \frac{\beta}{r - r_0 - C} = 0.$$

Solving the first-order condition yields the closed-form solution:

$$r^* = \beta r_B + (1-\beta)r_0 + (1-\beta)C(f, \beta).$$

This shows that r^* is a weighted average of the borrower's fallback rate and the lender's effective opportunity cost.

B.2 Proof of Proposition 1

Differentiating $r^*(f, \beta)$ with respect to f yields:

$$\frac{\partial r^*(f, \beta)}{\partial f} = (1-\beta)\frac{\partial C(f, \beta)}{\partial f}.$$

By assumption, the liquidity cost $C(f, \beta)$ increases with redemption pressure:

$$\frac{\partial C(f, \beta)}{\partial f} > 0.$$

It follows that:

$$\frac{\partial r^*(f, \beta)}{\partial f} > 0.$$

Therefore, the negotiated interest rate increases with redemption pressure f, holding bargaining power β constant. This proves Proposition 1.

B.3 Proof: $r^*(f, \beta)$ is increasing in β

Recall that the negotiated interest rate is given by:

$$r^*(f, \beta) = \beta r_B + (1-\beta)r_0 + (1-\beta)C(f, \beta),$$

where the flow-adjusted cost term $C(f, \beta)$ is defined as:

$$C(f, \beta) = \begin{cases} \frac{\phi f}{(1-\beta)^2} & \text{if } f > 0 \quad \text{(redemption shock)} \\ \frac{\phi f}{1-\beta} & \text{if } f < 0 \quad \text{(inflow shock)}, \end{cases}$$

with $\phi > 0$. We examine both cases separately.

Case 1: Redemption shock ($f > 0$).

Substitute $C(f, \beta) = \frac{\phi f}{(1-\beta)^2}$ into $r^*(f, \beta)$:

$$r^*(f, \beta) = \beta r_B + (1-\beta) r_0 + (1-\beta) \cdot \frac{\phi f}{(1-\beta)^2} = \beta r_B + (1-\beta) r_0 + \frac{\phi f}{1-\beta}.$$

Differentiate with respect to β:

$$\frac{\partial r^*}{\partial \beta} = r_B - r_0 + \phi f \cdot \frac{1}{(1-\beta)^2}.$$

Since $r_B > r_0$, $\phi > 0$, and $f > 0$, all terms are positive:

$$\frac{\partial r^*}{\partial \beta} > 0.$$

Case 2: Inflow shock ($f < 0$).

Substitute $C(f, \beta) = \frac{\phi f}{1-\beta}$ into $r^*(f, \beta)$:

$$r^*(f, \beta) = \beta r_B + (1-\beta) r_0 + (1-\beta) \cdot \frac{\phi f}{1-\beta} = \beta r_B + (1-\beta) r_0 + \phi f.$$

Now differentiate with respect to β:

$$\frac{\partial r^*}{\partial \beta} = r_B - r_0.$$

Again, since $r_B > r_0$, we have:

$$\frac{\partial r^*}{\partial \beta} > 0.$$

In both cases—whether $f > 0$ or $f < 0$—the derivative $\frac{\partial r^*}{\partial \beta}$ is strictly positive. Thus, under the given specification of $C(f, \beta)$, the negotiated interest rate $r^*(f, \beta)$ increases strictly with the lender's bargaining power β.

B.4 Proof of Proposition 2

Case 1: Redemption shock ($f > 0$).

Substitute $C(f,\beta) = \frac{\phi f}{(1-\beta)^2}$ into $r^*(f,\beta)$:

$$r^*(f,\beta) = \beta r_B + (1-\beta)r_0 + (1-\beta)\cdot\frac{\phi f}{(1-\beta)^2} = \beta r_B + (1-\beta)r_0 + \frac{\phi f}{1-\beta}.$$

Now compute the cross-partial derivative:

$$\frac{\partial r^*}{\partial f} = \frac{\phi}{1-\beta}, \quad \frac{\partial^2 r^*}{\partial f \partial \beta} = \frac{d}{d\beta}\left(\frac{\phi}{1-\beta}\right) = \frac{\phi}{(1-\beta)^2}.$$

Since $\phi > 0$, we have:

$$\frac{\partial^2 r^*(f,\beta)}{\partial f \partial \beta} > 0.$$

Case 2: Inflow shock ($f < 0$).

Substitute $C(f,\beta) = \frac{\phi f}{1-\beta}$ into $r^*(f,\beta)$:

$$r^*(f,\beta) = \beta r_B + (1-\beta)r_0 + (1-\beta)\cdot\frac{\phi f}{1-\beta} = \beta r_B + (1-\beta)r_0 + \phi f.$$

In this case, the flow term ϕf is constant with respect to β, so:

$$\frac{\partial r^*}{\partial f} = \phi, \quad \frac{\partial^2 r^*}{\partial f \partial \beta} = 0.$$

Therefore, the cross-partial derivative $\frac{\partial^2 r^*}{\partial f \partial \beta}$ is strictly positive when $f > 0$ and zero when $f < 0$, establishing the asymmetry described in Proposition 2.

Figure 1: **MMF AUMs and CP outstanding levels around the withdrawal period**

This figure displays month-end prime MMF assets under management ($ billions) alongside daily total CP outstanding ($ billions) from June 2014 to December 2016. The shaded area indicates the MMF withdrawal period (December 2015 to November 2016) triggered by the 2016 SEC reforms on MMFs.

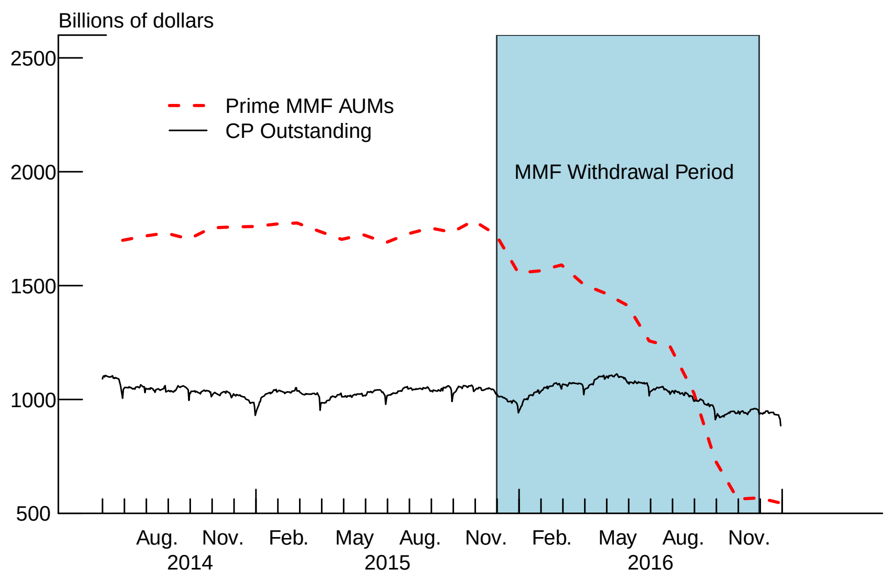

Figure 2: **Aggregate bargaining power measures**

This figure displays prime MMFs' holdings of CP as a percentage of the total outstanding CP, prime MMFs' CP holding concentration (HHI), and the credit risk measure in the CP market (represented by A2/P2 term CP spreads in basis points) from December 2014 to March 2024. The shaded area represents the COVID-19 crisis period from March to April 2020, which is excluded from our analyses.

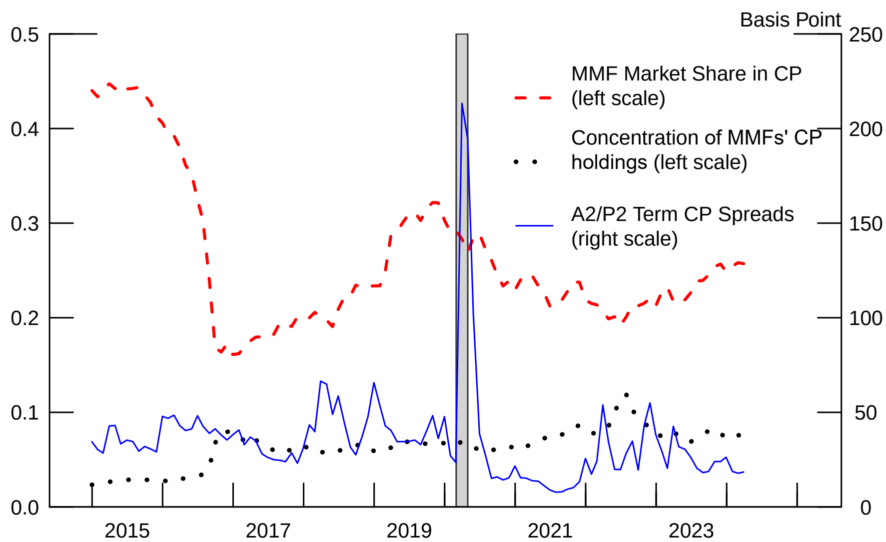

Table 1: **Event study: Impact of sector-wide MMF withdrawals on CP pricing**

The sample period spans from December 2014 to November 2016, with the MMF withdrawal period defined as December 2015 to November 2016. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level and weighted by the issuance face value. *High Dependence* is an indicator variable assigned a value of 1 if the average MMF ownership of the issuer from June to November 2014 (six months before the regression sample starts) exceeds the cross-sectional median, and 0 otherwise. Control variables include the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield		
	(1)	**(2)**
MMF Withdrawal × High Dependence	0.0439***	0.0348***
	(4.39)	(3.63)
High Dependence	-0.1027***	
	(-6.54)	
Maturity	0.0022***	0.0023***
	(24.49)	(33.49)
log(Amount Issued)	-0.0037	0.0024**
	(-1.61)	(2.36)
Direct Issuance Share	-0.0253	0.0258***
	(-1.52)	(4.55)
Rating FE	Yes	Yes
Type FE	Yes	Yes
Day FE	Yes	Yes
Issuer FE	No	Yes
Adjusted R^2	0.779	0.914
N. of Obs	118441	118438

Table 2: **Event Study: Impact of sector-wide MMF withdrawals on CP funding**

The sample period spans from December 2014 to November 2016, with the MMF withdrawal period defined as December 2015 to November 2016. The dependent variables for Panel A are monthly gross issuance volume (weighted by issuance maturity) and monthly change in outstanding amount. The dependent variables for Panel B are average issuance maturity (weighted by issuance face value) and the fraction of overnight issuance, both calculated at the issuer-month level. *High Dependence* is an indicator variable assigned a value of 1 if the average MMF ownership of the issuer from June to November 2014 exceeds the cross-sectional median, and 0 otherwise. Control variables are computed at issuer-month level. Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and month levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Funding Volume				
	Maturity-weighted Gross Volume		**Δ Outstanding Amount**	
	(1)	**(2)**	**(3)**	**(4)**
MMF Withdrawal × High Dependence	0.0147	-0.1001	0.0132	0.0174
	(0.10)	(-0.63)	(0.28)	(0.36)
High Dependence	1.5631***		-0.0429	
	(6.89)		(-1.12)	
Direct Issuance Share	4.5090***	0.7955***	-0.0895	0.0362
	(4.01)	(3.00)	(-0.77)	(0.79)
Rating FE	Yes	Yes	Yes	Yes
Type FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.263	0.734	0.008	-0.002
N. of Obs	11856	11856	11856	11856

Panel B: Maturity Structure				
	Issuance Maturity		**Overnight Fraction**	
	(5)	**(6)**	**(7)**	**(8)**
MMF Withdrawal × High Dependence	0.9166	2.0123	0.0025	-0.0119
	(0.51)	(1.08)	(0.18)	(-0.78)
High Dependence	14.3869***		-0.1754***	
	(4.44)		(-5.67)	
log(Amount Issued)	-6.2830***	-3.8599***	0.0802***	0.0079
	(-8.78)	(-5.43)	(12.46)	(1.11)
Direct Issuance Share	-4.3350	-0.6289	0.0506	0.0267
	(-0.69)	(-0.22)	(0.95)	(1.18)
Rating FE	Yes	Yes	Yes	Yes
Type FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.331	0.762	0.234	0.759
N. of Obs	9472	9465	9472	9465

Table 3: **Summary statistics for full sample**

The full sample period is from December 2014 to March 2024, excluding the extreme stress period of March to April 2020 during the COVID-19 pandemic. Panel A presents summary statistics for CP characteristics and the composite flow measure. We begin by calculating these summary statistics across all issuers within a given month or day, depending on data frequency. We then calculate time-series averages of these statistics over the sample period. Taking $Issuance\ Yield$ as an example, for each day, we first calculate the mean, minimum, median, maximum, standard deviation (S.D.), and interquartile range (IQR) across all CP issuers' yields. We then average these daily statistics over the entire sample period and present them in Panel A. Panel B provides pairwise correlations of CP characteristics and the lagged funding fragility measure.

Panel A: Full Sample Summary Statistics

	Mean	Min	Median	Max	S.D.	IQR	N
Daily Measures:							
Amount Issued ($billions)	0.367	0.002	0.106	8.073	0.936	0.238	490777
Maturity (days)	29.970	1.468	10.318	298.083	47.776	32.091	490777
Direct Issuance Share (decimal)	0.061	0.004	0.004	0.998	0.195	0.017	490777
Issuance Yield (%)	1.691	1.287	1.666	2.474	0.186	0.229	490777
Monthly Measures:							
Funding Fragility (decimal)	0.000	-0.058	0.000	0.085	0.011	0.003	38653
MMF Ownership (decimal)	0.112	0.000	0.018	0.883	0.162	0.189	38653

Panel B: Pair-wise Correlation

	Lagged Funding Fragility	Lagged MMF Ownership	Maturity	Amount Issued
Lagged MMF Ownership	0.087			
Maturity	0.001	0.199		
Amount Issued	0.005	0.203	-0.110	
Direct Issuance Share	0.008	0.104	0.053	0.302

Table 4: **Impact of MMF flow-induced shocks on CP pricing**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level and weighted by the issuance face value. $Funding\ Fragility$ represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield		
	(1)	**(2)**
Funding Fragility	0.3113***	0.2827***
	(3.12)	(4.52)
MMF Ownership	-0.1120***	-0.0875***
	(-5.72)	(-5.92)
Maturity	0.0021***	0.0020***
	(27.23)	(29.61)
log(Amount Issued)	-0.0046*	0.0015
	(-1.92)	(1.44)
Direct Issuance Share	-0.0421*	0.0179**
	(-1.73)	(2.43)
Rating FE	Yes	Yes
Type FE	Yes	Yes
Day FE	Yes	Yes
Issuer FE	No	Yes
Adjusted R^2	0.991	0.994
N. of Obs	490776	490771

Table 5: **Impact of MMF flow-induced shocks on CP funding**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variables for Panel A are maturity-weighted total issuance volume and monthly change in outstanding amount. The dependent variables for Panel B are value-weighted average issuance maturity and the fraction of overnight issuance, both calculated at the issuer-month level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). Control variables are computed at issuer-month level. Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and month levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Funding Volume

	Maturity-weighted Gross Volume		**Outstanding Amount**	
	(1)	**(2)**	**(3)**	**(4)**
Funding Fragility	-2.5595	0.0404	0.2654	0.3610
	(-1.38)	(0.04)	(0.82)	(1.04)
MMF Ownership	4.0056***	1.6555***	-0.2170***	-0.2613***
	(6.26)	(4.82)	(-3.92)	(-4.51)
Direct Issuance Share	4.8447***	0.6386*	-0.1394	0.1383
	(3.79)	(1.79)	(-1.45)	(1.53)
Rating FE	Yes	Yes	Yes	Yes
Type FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.265	0.620	0.010	0.006
N. of Obs	42799	42790	42799	42790

Panel B: Maturity Structure

	Issuance Maturity		**Overnight Fraction**	
	(5)	**(6)**	**(7)**	**(8)**
Funding Fragility	-49.8701*	-3.3342	0.4877**	-0.0318
	(-1.98)	(-0.31)	(2.11)	(-0.33)
MMF Ownership	27.5603***	-3.1748	-0.2530***	0.0055
	(3.70)	(-0.71)	(-5.06)	(0.26)
log(Amount Issued)	-9.8467***	-7.6645***	0.0934***	0.0303***
	(-12.01)	(-9.81)	(16.43)	(6.07)
Direct Issuance Share	6.3153	0.9303	0.0697	0.0302
	(0.66)	(0.21)	(1.08)	(1.04)
Rating FE	Yes	Yes	Yes	Yes
Type FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.319	0.667	0.266	0.720
N. of Obs	38653	38631	38653	38631

Table 6: **Differentiating the impact of redemptions and inflows on CP pricing**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level and weighted by the issuance face value. $Redemption\ Pressure = Funding\ Fragility$ when $Funding\ Fragility > 0$, and is zero otherwise. $Capital\ Inflows = -Funding\ Fragility$ when $Funding\ Fragility < 0$, and is zero otherwise. Both measures are calculated over the previous month and in decimal. Control variables include lagged MMF ownership, the issuance amountweighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield		
	(1)	**(2)**
Redemption Pressure	0.3009**	0.2417***
	(2.45)	(3.33)
Capital Inflows	-0.3445**	-0.4116***
	(-2.14)	(-3.14)
MMF Ownership	-0.1112***	-0.0841***
	(-5.60)	(-5.36)
Maturity	0.0021***	0.0020***
	(27.22)	(29.61)
log(Amount Issued)	-0.0046*	0.0015
	(-1.92)	(1.44)
Direct Issuance Share	-0.0422*	0.0179**
	(-1.73)	(2.42)
Rating FE	Yes	Yes
Type FE	Yes	Yes
Day FE	Yes	Yes
Issuer FE	No	Yes
Adjusted R^2	0.991	0.994
N. of Obs	490776	490771

Table 7: **Price impact and bargaining power: by MMF market power**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). $Redemption\ Pressure = Funding\ Fragility$ when $Funding\ Fragility > 0$, and is set to zero otherwise. $Capital\ Inflows = Funding\ Fragility$ when $Funding\ Fragility < 0$, and is set to zero otherwise. $High\ MMF\ Power$ is a monthly indicator variable, taking the value of one if both the share of CP owned by MMFs and the concentration level are above their respective time-series medians, and zero otherwise. Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (expressed as a decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield				
	(1)	**(2)**	**(3)**	**(4)**
High MMF Power × Funding Fragility	0.3234**	0.2999**		
	(2.05)	(2.19)		
High MMF Power × Redemption Pressure			0.4052*	0.3881**
			(1.82)	(2.12)
High MMF Power × Capital Inflows			-0.0268	0.0082
			(-0.07)	(0.03)
Funding Fragility	0.2785***	0.2400***		
	(3.11)	(4.44)		
Redemption Pressure			0.2850***	0.2133***
			(2.62)	(3.59)
Capital Inflows			-0.2577	-0.3234**
			(-1.64)	(-2.44)
Controls	Yes	Yes	Yes	Yes
Controls × High MMF Power	Yes	Yes	Yes	Yes
Rating × High MMF Power FE	Yes	Yes	Yes	Yes
Type × High MMF Power FE	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.992	0.994	0.992	0.994
N. of Obs	490776	490771	490776	490771

Table 8: **Price impact and bargaining power: by CP credit risk**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). *Redemption Pressure* = *Funding Fragility* when *Funding Fragility* > 0, and is zero otherwise. *Capital Inflows* = $-$*Funding Fragility* when *Funding Fragility* < 0, and is zero otherwise. *High CP Risk* is a daily indicator variable that takes value of 1 if the rate difference between lower-rated CP and maturity-matched OIS is above its time-series median over the sample period, and zero otherwise. Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield				
	(1)	**(2)**	**(3)**	**(4)**
High CP Risk × Funding Fragility	0.1727**	0.1169**		
	(2.24)	(2.04)		
High CP Risk × Redemption Pressure			0.2488***	0.1919***
			(3.26)	(3.48)
High CP Risk × Capital Inflows			0.0346	0.0344
			(0.18)	(0.20)
Funding Fragility	0.2134**	0.2149***		
	(2.48)	(3.53)		
Redemption Pressure			0.1625	0.1355**
			(1.63)	(2.04)
Capital Inflows			-0.3198*	-0.3814***
			(-1.90)	(-2.94)
Controls	Yes	Yes	Yes	Yes
Controls × High CP Risk	Yes	Yes	Yes	Yes
Rating × High CP Risk FE	Yes	Yes	Yes	Yes
Type × High CP Risk FE	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.992	0.994	0.992	0.994
N. of Obs	486724	486719	486724	486719

Table 9: **Price impact and bargaining power: by market presence**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). *Redemption Pressure* = *Funding Fragility* when *Funding Fragility* $>$ 0, and is zero otherwise. *Capital Inflows* = $-$*Funding Fragility* when *Funding Fragility* $<$ 0, and is zero otherwise. *Low Presence* is an indicator variable at the issuer-day level that takes the value of 1 if the total number of active issuance days for an issuer over the past quarter is at or below the cross-sectional median, and zero otherwise. Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield				
	(1)	**(2)**	**(3)**	**(4)**
Low Presence × Funding Fragility	0.3262**	0.3007***		
	(2.11)	(3.30)		
Low Presence × Redemption Pressure			0.3599*	0.3514***
			(1.89)	(3.11)
Low Presence × Capital Inflows			-0.3251	-0.1362
			(-0.98)	(-0.51)
Funding Fragility	0.1704	0.1547**		
	(1.26)	(2.54)		
Redemption Pressure			0.1898	0.1351**
			(1.25)	(2.25)
Capital Inflows			-0.0654	-0.2573
			(-0.21)	(-1.03)
Controls	Yes	Yes	Yes	Yes
Controls × Low Presence	Yes	Yes	Yes	Yes
Rating × Low Presence FE	Yes	Yes	Yes	Yes
Type × Low Presence FE	Yes	Yes	Yes	Yes
Day × Low Presence FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.992	0.994	0.992	0.994
N. of Obs	490770	490765	490770	490765

Table 10: **Price impact and bargaining power: by dealer dependence**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). *Redemption Pressure* = *Funding Fragility* when *Funding Fragility* > 0, and is zero otherwise. *Capital Inflows* = −*Funding Fragility* when *Funding Fragility* < 0, and is zero otherwise. *Dealer Dependent* is an indicator variable that takes the value of one if the fraction of CP issued through dealer intermediation over the previous month by a given issuer is at or above the cross-sectional median, and zero otherwise. Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield				
	(1)	**(2)**	**(3)**	**(4)**
Dealer Dependent × Funding Fragility	0.3089**	0.3661***		
	(2.46)	(3.68)		
Dealer Dependent × Redemption Pressure			0.3066**	0.2955**
			(2.11)	(2.56)
Dealer Dependent × Capital Inflows			-0.2974	-0.6321**
			(-0.77)	(-2.04)
Funding Fragility	0.0570	-0.0168		
	(0.68)	(-0.30)		
Redemption Pressure			0.0495	0.0034
			(0.50)	(0.05)
Capital Inflows			-0.0981	0.1320
			(-0.27)	(0.44)
Controls	Yes	Yes	Yes	Yes
Controls × Dealer Dependent	Yes	Yes	Yes	Yes
Rating × Dealer Dependent FE	Yes	Yes	Yes	Yes
Type × Dealer Dependent FE	Yes	Yes	Yes	Yes
Day × Dealer Dependent FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.992	0.994	0.992	0.994
N. of Obs	486353	486351	486353	486351

Table 11: **Price impact and bargaining power: by issuer domicile**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). $Redemption\ Pressure = Funding\ Fragility$ when $Funding\ Fragility > 0$, and is zero otherwise. $Capital\ Inflows = -Funding\ Fragility$ when $Funding\ Fragility < 0$, and is zero otherwise. *Foreign* is an indicator variable that takes the value of one if the CP issuer's parent company is located outside of the U.S. as of the previous month, and zero otherwise. Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield				
	(1)	**(2)**	**(3)**	**(4)**
Foreign × Funding Fragility	0.3721**	0.2039**		
	(2.53)	(2.26)		
Foreign × Redemption Pressure			0.4826***	0.2171**
			(2.62)	(2.14)
Foreign × Capital Inflows			-0.0136	-0.1476
			(-0.04)	(-0.65)
Funding Fragility	0.0851**	0.1124***		
	(2.04)	(3.23)		
Redemption Pressure			0.0278	0.0616*
			(0.61)	(1.82)
Capital Inflows			-0.2837*	-0.2816**
			(-1.67)	(-2.07)
Controls	Yes	Yes	Yes	Yes
Controls × Foreign	Yes	Yes	Yes	Yes
Rating × Foreign FE	Yes	Yes	Yes	Yes
Type × Foreign FE	Yes	Yes	Yes	Yes
Day × Foreign FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.992	0.994	0.992	0.994
N. of Obs	490774	490769	490774	490769

Table A1: **Comparison of firm characteristics by CP issuance status**

The sample spans from 2014:Q4 to 2024:Q1, excluding the extreme stress period of 2020:Q1 and 2020:Q2 during the COVID-19 pandemic. Each quarter, it includes the top 500 publicly listed U.S. companies in Compustat by market value, divided into two groups based on whether the companies issue CP. On average, 180 of the top 500 firms are CP issuers. For each group, median firm characteristics are calculated across the panel. *Total Assets* refers to the total value of assets (in billions of dollars) reported on the balance sheet. *Earnings per Share* is defined as earnings per share before extraordinary items and discontinued operations, as reported on the income statement. *Debt-to-Asset Ratio* is the total value of liabilities divided by the total value of assets. *Short-term/Long-term Debt Ratio* is the ratio of short-term notes and the portion of long-term debt due within one year to the total amount of debt obligations due beyond one year. *Cash & Cash Equivalents Ratio* measures the share of total assets held in cash and securities readily convertible to cash.

Comparison of Median Financial Characteristics		
	CP Issuers	Non-CP Issuers
Total Assets ($billions)	33.1	16.9
Earnings per Share ($)	0.98	0.81
Debt-to-Asset Ratio	0.66	0.63
Short-term/Long-term Debt Ratio	0.10	0.07
Cash & Cash Equivalents Ratio	0.05	0.09

Table A2: **Impact of MMF flow-induced shocks on CP pricing: alternative pricing measures**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield spreads (in percent) relative to maturity-matched OIS rates, aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Spreads		
	(1)	**(2)**
Funding Fragility	0.3297***	0.2845***
	(3.14)	(4.27)
MMF Ownership	-0.1015***	-0.0563***
	(-5.37)	(-5.18)
Maturity	0.0015***	0.0016***
	(25.81)	(33.58)
log(Amount Issued)	-0.0026	0.0028***
	(-1.27)	(3.16)
Direct Issuance Share	-0.0302*	0.0226***
	(-1.78)	(3.68)
Rating FE	Yes	Yes
Type FE	Yes	Yes
Day FE	Yes	Yes
Issuer FE	No	Yes
Adjusted R^2	0.584	0.745
N. of Obs	490730	490725

Table A3: **Price impact and bargaining power: alternative market presence measures**

The sample period spans from December 2014 to March 2024, excluding the COVID-19 crisis period from March to April 2020. The dependent variable is CP issuance yield (in percent), aggregated at the issuer-day level. *Funding Fragility* represents the holding share-weighted average redemptions over the previous month across all MMF counterparties of a given CP issuer (in decimal). $Redemption\ Pressure = Funding\ Fragility$ when $Funding\ Fragility > 0$, and is zero otherwise. $Capital\ Inflows = -Funding\ Fragility$ when $Funding\ Fragility < 0$, and is zero otherwise. *Low Presence* is an indicator variable at the issuer-day level that takes the value of 1 if the total number of active issuance days for an issuer over the past 6 months is at or below the cross-sectional median, and zero otherwise. Control variables include lagged MMF ownership, the issuance amount-weighted average maturity (in days), the logarithm of the daily issuance amount ($), and the fraction of CP issuance placed directly to investors (in decimal). Credit ratings considered are A1P2, A2P2, and A3P3. CP types include financial CP, nonfinancial CP, and ABCP. Standard errors are clustered at the issuer and day levels, with corresponding t-values in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable: Issuance Yield				
	(1)	**(2)**	**(3)**	**(4)**
Low Presence × Funding Fragility	0.3845**	0.3395***		
	(2.51)	(3.47)		
Low Presence × Redemption Pressure			0.4143**	0.3666***
			(2.19)	(3.10)
Low Presence × Capital Inflows			-0.3367	-0.2617
			(-1.18)	(-1.12)
Funding Fragility	0.1449	0.1360**		
	(1.19)	(2.52)		
Redemption Pressure			0.1658	0.1281**
			(1.15)	(2.14)
Capital Inflows			-0.0645	-0.1648
			(-0.33)	(-1.06)
Controls	Yes	Yes	Yes	Yes
Controls × Low Presence	Yes	Yes	Yes	Yes
Rating × Low Presence FE	Yes	Yes	Yes	Yes
Type × Low Presence FE	Yes	Yes	Yes	Yes
Day × Low Presence FE	Yes	Yes	Yes	Yes
Issuer FE	No	No	No	No
Adjusted R^2	0.992	0.994	0.992	0.994
N. of Obs	490770	490765	490770	490765