Investor Fragility, Bargaining Power, and Pricing Implications for Short-Term Funding Markets[†]

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Abstract

This paper investigates how funding fragility posed by investors affects pricing dynamics in short-term funding markets. Utilizing the 2016 SEC reforms as exogenous funding shocks 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 MMF flow-based measures to gauge funding fragility and document consistent impacts on CP pricing. 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

1. Introduction

With over ten trillion dollars in assets, short-term funding markets play a crucial role in the economy. They provide essential funding for the day-to-day operations of banks, non-financial corporations, and governments, while offering vital cash management and investment options for institutional investors. Disruptions in these markets can lead to reduced credit supply, liquidity shortages, rising funding costs, and heightened systemic risk, as repeatedly observed during periods of market stress.

Two key features of short-term funding markets make them particularly vulnerable to sudden changes in funding conditions driven by investor behaviors. First, unlike equity markets, where transactions occur on exchanges with high transparency and standardized terms, all short-term funding securities—such as commercial paper (CP) and repurchase agreements—are traded over-the-counter (OTC), introducing frictions such as high search costs and imbalanced bargaining power. These frictions heighten the markets' susceptibility to investor funding shocks, amplifying their impact on asset pricing and credit provision. Second, in contrast to other OTC markets like corporate bonds, most short-term funding markets have minimal secondary market trading, making the primary market the key venue for transactions. The absence of a robust secondary market implies that investor behaviors in the primary market can disproportionally influence price discovery and funding structure. Given these unique characteristics of short-term funding markets, it is essential to understand how funding fragility posed by their institutional investors impact these underlying markets, particularly in the presence of market frictions.

To explore these dynamics, 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 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 both financial and non-financial firms but is particularly vulnerable to rollover risks due to its short average maturity of about one month.[1] Disruptions in CP markets have previously triggered multiple funding freezes and widespread crises.[2] Meanwhile, prime MMFs, which supply about a quarter of the funding in

[1] For studies on firms' use of CP for funding, see Calomiris, Himmelberg, and Wachtel (1995), Kahl, Shivdasani, and Wang (2015), and Hempel, Li, and Tibay (2024).

[2] 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

the CP markets, engage in significant liquidity transformation. They invest in illiquid markets with credit risk while offering daily redemptions to highly risk-averse, liquidity-conscious end investors. This structural vulnerability makes prime MMFs prone to severe withdrawals during periods of stress, which can lead to rising funding costs and credit shortages in the CP markets. These characteristics of the CP markets and the prime MMF industry provide a unique setting to study the intricate dynamics and vulnerabilities in short-term funding markets. By leveraging confidential transaction-level data on CP and merging it with security-level MMF holdings data, we examine the impact of investor funding fragility on pricing and credit provision in the 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 observe 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 compared to those with low dependence, even after controlling for a slew of CP characteristics and day fixed effects. Yet, we do not detect additional strains on issuance volume or maturity structures for CP issuers highly reliant on MMFs. Importantly, this significant price impact occurs during a prolonged phase of extensive yet non-disruptive MMF withdrawals, which we refer to as a "silent run." This phase is distinct 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 window from December 2014 to March 2024.[3] 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

and Schnabl (2010), Covitz, Liang, and Suarez (2013), and Duygan-Bump, Parkinson, Rosengren, Suarez, and Willen (2013).

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

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 effectively 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 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 search 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 analyze whether the dynamics of bargaining power between MMFs and CP issuers influence the price impact of MMF funding fragility in the CP markets. We begin by evaluating the relative bargaining power through two aggregate measures: the overall importance and concentration levels of MMFs in the CP markets, and a market-wide measure of CP credit risk concerns. Both measures naturally affect the relative bargaining power between MMFs and CP issuers. We obtain consistent results using the two measures. When MMFs hold strong bargaining power relative to CP issuers—indicated by higher and more concentrated MMF ownership in the CP markets—a one-percentage-point increase in lagged MMF redemptions leads to an additional 0.4-basis-point rise in CP yields compared to periods of lower and less concentrated MMF ownership. Similarly, during periods of elevated concerns over CP credit risk, the same increase in lagged MMF redemptions leads to an additional 0.3-basis-point increase in CP yields.

Next, we calibrate bargaining power between MMFs and CP issuers at the individual issuer level, based on key characteristics such as issuance tenor, distribution channels, and domicile of the parent company. We argue that CP issuers with longer-tenor issuance likely possess weaker bargaining power because long-term CP is less appealing to MMFs, who are hesitant to hold long-term CP due to the lack of an effective secondary CP market and strict liquidity regulations on MMFs. Moreover, issuers more dependent 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.[4] While U.S. financial firms can attract retail deposits through their extensive branch networks, foreign financial 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.

[4] 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.

Our analyses utilizing the three issuer-level bargaining power measures yield consistent results. For a given level of MMF redemption pressure, CP issuers with longer tenors, greater reliance on dealer intermediation, and foreign domicile consistently experience a higher increase in funding costs. Specifically, a one-percentage-point increase in MMF redemptions pressure leads issuers with weaker bargaining power—defined by the three dimensions—to incur an additional 0.3 to 0.5-basis-point rise in funding costs compared to the issuers with stronger bargaining power.

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. Most existing literature on the price impact of funding fragility arising from mutual fund flows has focused on secondary markets for equity and bonds.[5] Notable exceptions include Zhu (2021) and Adelino et al. (2023), who 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 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' heightened 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 of search-and-bargaining power in OTC markets (Duffie, Gârleanu, and Pedersen, 2005, 2007; Weill, 2008; among others).[6] 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

[5] 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), and Wardlaw (2020), Choi et al. (2020), Jiang, Li, and Wang (2021), and Jiang, Li, Sun, and Wang (2022). For the impact on municipal bond markets, see Li, O'Hara, and Zhou (2023). 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, Matvos, Piskorski, and Seru (2023), Liu and Mello (2011), and Kruttli, Monin, Petrasek, and Watugala (2021).

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

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.

Finally, our study broadens the implications of MMFs' fragility risk beyond crisis periods, focusing on its impact on the markets in which MMFs invest. 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.[7] 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 visible stress. By combining confidential transaction-level CP data with security-level MMF holdings data, our analysis significantly expands the understanding of redemption-related 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,

[7] 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 (2023).

issuance yield, and placement channel. 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.[8]

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.[9] We merge these two primary datasets using the common identifiers, CP CUSIPs.

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.[10] 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.

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.

[8] 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.

[9] 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.

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

In October 2016, the SEC implemented reforms on MMFs, aiming to mitigate run risks and enhance financial stability.[11] 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:

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

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

[11] 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.

addition, to control for the influence from fluctuations in economic, regulatory, and monetary policy conditions, we include a day-fixed effect (θ_t).[12] 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*$_i$ variable 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).[13]

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.

[12] Note that the inclusion of day fixed effect absorbs the *Withdrawal*$_t$ dummy from a standard difference-in-differences setting.

[13] Column (2) in Table 1 shows positive and significant coefficients for both log (*Face Value*) and *Direct Issuance Share*. 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.

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

$$\textit{Funding Volume}_{i,t}\ (\textit{Maturity Structure}_{i,t}) =$$
$$\alpha + \beta\ \textit{High Dependence}_i + \gamma\ \textit{High Dependence}_i \times \textit{Withdrawal}_t + \mu\ X_{i,t} + \theta_t + \varepsilon_{i,t} \qquad (2)$$

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 $\textit{High Dependence}_i$ 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.[14] In this section, we conduct thorough 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 and treating such cases as a 100% outflow for that closed or converted fund.[15]

[14] According to Im, Li, and Wang (2024), increased flows into MMFs lead to a subsequent increase in credit risk exposures, extension of portfolio durations, and reduction in liquidity reserves.

[15] 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.

$$Redemption_{j,t} = -\left(\frac{Fund\_AUM_{j,t} - Fund\_AUM_{j,t-1}}{Fund\_AUM_{j,t-1}}\right) \quad (3A)$$

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*.

$$Funding\ Fragility_{i,t} = \sum_{j=1}^{J} Redemption_{j,t} \times \frac{CP\_Holdings_{i,j,t-1}}{CP\_Outstanding_{i,t-1}}. \quad (3B)$$

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 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.[16]

[16] 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.

Panel B of Table 3 provides pairwise correlations of daily CP characteristics with the lagged fragility measure. The correlations are generally low, indicating that this MMF 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:

$$Yield_{i,t} = \alpha + \beta \times Funding\ Fragility_{i,t\text{-}1} + \mu X_{i,t} + \theta_t + \varepsilon_{i,t}, \quad (4)$$

where $Yield_{i,t}$ is issuance amount-weighted yield at the issuer-day level. $Funding\ Fragility_{i,t\text{-}1}$ 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 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.[17] We then substitute CP yields with spreads and repeat the panel regression as in Model (4). The results, presented in Appendix Table 1, 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:

$$Funding\ Volume_{i,t}\ (Maturity\ Structure_{i,t}) = \alpha + \beta \times Funding\ Fragility_{i,t\text{-}1} + \mu\, X_{i,\,t} + \theta_t + \varepsilon_{i,t}\,. \qquad (5)$$

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

[17] 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.

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:

$$Yield_{i,t} = \alpha + \beta_1 \times Redemption\ Pressure_{i,t\text{-}1} + \beta_2 \times Capital\ Inflows_{i,t\text{-}1} + \mu\, X_{i,\,t} + \theta_t + \varepsilon_{i,t}\,. \quad (6)$$

Control variables and fixed effects are as defined in Model (4). 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).[18]

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.[19] 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: relative 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 important 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. Specifically, when CP issuers hold weaker bargaining power relative to MMFs, funds

[18] As an additional robustness check, we replace CP yield with CP spread as the dependent variable and re-estimate Equation (6). 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.
[19] Li (2021) shows that MMFs and their asset issuers engage in sophisticated reciprocal relationship management.

are less inclined to pass on savings in funding costs to their CP issuers amid capital inflows, and are more aggressive in raising costs under redemption pressure.

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 first evaluate the relative bargaining power between MMFs and CP issuers at the aggregate level. Then, we calibrate bargaining power at the individual CP issuer level, considering CP characteristics such as issuance tenor, distribution channels, and domicile of their parent company.

5.1 *Bargaining power at the aggregate level*

We start the analysis with two aggregate measures of bargaining power. From MMFs' perspective, their relative bargaining power depends on the overall importance and concentration levels of the MMF sector when providing CP funding. In addition, we evaluate the relative bargaining power of CP issuers based on the level of credit risk concerns in the broad CP markets.

5.1A 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.[20] 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 evaluate MMFs' bargaining power by considering both their overall importance and concentration levels in the CP markets. Specifically, we quantify the importance of MMFs as the share of MMF funding relative to the total outstanding CP. We calculate their concentration levels using the Herfindahl-Hirschman Index (HHI), defined as the sum of squares of individual MMF 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 value of one if both the share of CP owned by MMFs and the HHI are above their respective time-series

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

medians, and zero otherwise[21]. We conjecture that during periods when MMFs possess stronger bargaining power, indicated by a *High MMF Power* of one, they are less likely to pass on savings to CP issuers during inflows and 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:

$$Yield_{i,t}=\alpha + \beta\, Funding\ Fragility_{i,t\text{-}1} + \gamma\, Funding\ Fragility_{i,t\text{-}1} \times High\ MMF\ Power_{t\text{-}1} + \mu\, X_{i,t} + \theta_t + \varepsilon_{i,t}, \quad (7A)$$

$$Yield_{i,t}=\alpha + \beta_1\, Redemption\ Pressure_{i,t\text{-}1} + \beta_2\, Capital\ Inflows_{i,t\text{-}1} + \gamma_1\, Redemption\ Pressure_{i,t\text{-}1} \times High\ MMF\ Power_{t\text{-}1} + \gamma_2\, Capital\ Inflows_{i,t\text{-}1} \times High\ MMF\ Power_{t\text{-}1} + \mu\, X_{i,t} + \theta_t + \varepsilon_{i,t}. \quad (7B)$$

We control for CP characteristics included in Model (4) 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 (7A), 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 (7B), we differentiate the impact of MMF capital inflows from that 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. 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 consistent

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

in Column (4), where we further control for issuer-fixed effects. Our findings support the hypothesis that stronger bargaining power enables the MMF sector to increase CP yields more aggressively when facing redemption pressure.

5.1B 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:

$$Yield_{i,t}=\alpha + \beta\ Funding\ Fragility_{i,t\text{-}1} + \gamma\ Funding\ Fragility_{i,t\text{-}1} \times High\ CP\ Risk_t + \mu\ X_{i,\,t} + \theta_t + \varepsilon_{i,t}\,, \qquad (8A)$$

$$Yield_{i,t}=\alpha + \beta_1\ Redemption\ Pressure_{i,t\text{-}1} + \beta_2\ Capital\ Inflows_{i,t\text{-}1} + \gamma_1\ Redemption\ Pressure_{i,t\text{-}1} \times High\ CP\ Risk_t + \gamma_2\ Capital\ Inflows_{i,t\text{-}1} \times High\ CP\ Risk_t + \mu\ X_{i,\,t} + \theta_t + \varepsilon_{i,t}\,. \qquad (8B)$$

$High\ CP\ Risk_t$ 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[22]. We control for CP characteristics included in Model (4) as well as their

[22] 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.

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 (8A). 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. 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 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 support the hypothesis that that heightened concerns about CP credit risk weaken CP issuers' bargaining power and exacerbate the impact of MMF redemptions on issuers' borrowing costs.

5.2 *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 issuance tenor, distribution channels, and domicile of their parent company.[23]

5.2A Individual bargaining power: By issuance tenor

CP is issued to meet short-term funding needs such as payroll, accounts payable, tax obligations, and inventories, with an average issuance maturity of about one month. Such short maturity exposes CP issuers to considerable rollover risks, which are more acute during turbulent times. The substantial rollover risks, along with the lack of robust secondary CP markets, make longer-tenor CP relatively unappealing to prime MMFs, as they fear being unable to offload such CP amid redemptions. Moreover, the SEC has progressively implemented stricter liquidity rules on MMFs, further discouraging funds from holding longer-tenor CP.[24] Together, these factors put CP issuers with longer-tenor issuance at a disadvantage in terms of relative bargaining power.

To test our hypothesis that issuers with longer-tenor CP 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 from March to April 2020:

$$Yield_{i,t} = \alpha + \beta\, Funding\ Fragility_{i,t\text{-}1} + \gamma\, Funding\ Fragility_{i,t\text{-}1} \times Long\ Tenor_{i,t} + \mu\, X_{i,t} + \theta_t + \varepsilon_{i,t}, \quad (9A)$$

$$Yield_{i,t} = \alpha + \beta_1\, Redemption\ Pressure_{i,t\text{-}1} + \beta_2\, Capital\ Inflows_{i,t\text{-}1} + \gamma_1\, Redemption\ Pressure_{i,t\text{-}1} \times Long\ Tenor_{i,t} + \gamma_2\, Capital\ Inflows_{i,t\text{-}1} \times Long\ Tenor_{i,t} + \mu\, X_{i,t} + \theta_t + \varepsilon_{i,t}. \quad (9B)$$

CP yield and various flow-based measures are as previously defined. $Long\ Tenor_{i,t}$ is an indicator variable that takes the value of 1 if the average tenor of CP issued on day t by issuer i is at or above the cross-sectional median, and zero otherwise.[25] We control for CP characteristics included in Model (4) as well as their interactions with the long-tenor dummy. We also include two-way fixed

[23] As our regressions are conducted at the CP issuer level, it is more effective to focus directly on issuer characteristics to capture the relative bargaining power, rather than relying on the aggregated characteristics across all MMF counterparties of the issuer, which could introduce greater noise.

[24] As of May 2024, MMFs are required to hold at least 25% of its total assets in daily liquid assets and at least 50% of its total assets in weekly liquid assets. In addition, prime MMFs are required to maintain a weighted average maturity of 60 days or less.

[25] We also employ an alternative approach to define $Long\ Tenor_{i,t}$, where $Long\ Tenor_{i,t}$ is set to 1 if the volume-weighted maturity of issuer i on day t exceeds one month. The results are summarized in Appendix Table 2 and display similar patterns.

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 (9A). The strongly positive coefficients on the interaction terms between lagged fragility measure and the long-tenor dummy indicate that the impact of MMF flows on pricing is more pronounced for CP issuers with longer tenors.

To analyze dynamics of bargaining power, we differentiate the impact of MMF inflows from that of redemption pressure in Model (9B). Shown in Column (3), the coefficients on the two interaction terms demonstrate that the amplified pricing effects for long-tenor CP issuers are solely due to additional price penalties amid MMF redemption pressure, with statistical significance at the 1% level. Specifically, as MMF counterparties experience a one-percentage-point increase in redemption pressure, CP issuers with longer tenors—likely having weaker bargaining power—face an additional raise in funding cost of 0.5 basis points compared to shorter-tenor issuers. Notably, the coefficient on lagged redemption pressure is not significantly different from zero, suggesting that when facing redemptions, MMFs cannot transfer pricing pressure to short-tenor CP issuers. Column (4) show similar patterns, after we further control for issuer-fixed effects.

5.2B 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. As shown in Figure 3, during our sample period, the market share of direct issuance averages about 20 percent, fluctuating between 10 and 40 percent. In addition, CP transaction data reveal great variations in the extent of reliance on dealer intermediation across issuers.[26]

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:

[26] 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.

$$Yield_{i,t} = \alpha + \beta\, Funding\ Fragility_{i,t\text{-}1} + \gamma\, Funding\ Fragility_{i,t\text{-}1} \times Dealer\ Dependent_{i,t\text{-}1} + \mu\, X_{i,t} + \theta_t + \varepsilon_{i,t}, \quad (10A)$$

$$Yield_{i,t} = \alpha + \beta_1\, Redemption\ Pressure_{i,t\text{-}1} + \beta_2\, Capital\ Inflows_{i,t\text{-}1} + \gamma_1\, Redemption\ Pressure_{i,t\text{-}1} \times Dealer\ Dependent_{i,t\text{-}1} + \gamma_2\, Capital\ Inflows_{i,t\text{-}1} \times Dealer\ Dependent_{i,t\text{-}1} + \mu\, X_{i,t} + \theta_t + \varepsilon_{i,t}. \quad (10B)$$

$Dealer\ Dependent_{i,t\text{-}1}$ 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[27]. Other model features are as described in Section 5.2A.

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.

5.2C 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.[28] 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

[27] We follow an alternative approach to gauging the level of dealer dependence, where the *Dealer Dependent* variable takes the value of one if a given CP issuer has placed all its issuance through dealers over the previous month, and zero otherwise. Results, unreported and available upon request, show similar patterns.

[28] 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.

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 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:

$$Yield_{i,t} = \alpha + \beta\, Funding\ Fragility_{i,t\text{-}1} + \gamma\, Funding\ Fragility_{i,t\text{-}1} \times Foreign_{i,t\text{-}1} + \mu\, X_{i,\,t} + \theta_t + \varepsilon_{i,t}, \quad (11A)$$

$$Yield_{i,t} = \alpha + \beta_1\, Redemption\ Pressure_{i,t\text{-}1} + \beta_2\, Capital\ Inflows_{i,t\text{-}1} + \gamma_1\, Redemption\ Pressure_{i,t\text{-}1} \times Foreign_{i,t\text{-}1} + \gamma_2\, Capital\ Inflows_{i,t\text{-}1} \times Foreign_{i,t\text{-}1} + \mu\, X_{i,\,t} + \theta_t + \varepsilon_{i,t}. \quad (11B)$$

$Foreign_{i,t\text{-}1}$ 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 5.2A.

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 5.2 consistently support our hypothesis that CP issuers with weaker bargaining power—characterized by longer tenors, stronger reliance on dealer intermediation, and 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 highly susceptible to rollover risks, play a crucial role in transmitting systemic risks, and feature investors that are vulnerable to runs, particularly MMFs. 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.

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.[29] These improvements, if implemented effectively, could help mitigate the vulnerabilities and bolster financial stability.

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

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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: $$Funding\ Fragility_{i,t} = \sum_{j=1}^{j} -(\frac{Fund\ AUM_{j,t} - Fund\ AUM_{j,t-1}}{Fund\ AUM_{j,t-1}}) \times \frac{CP\ Holdings_{i,j,t-1}}{CP\ Outstanding_{i,t-1}}, \quad \text{(A.1)}$$ 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 set to zero otherwise.
Capital Inflows (decimal)	$Capital\ Inflows = Funding\ Fragility$ when $Funding\ Fragility < 0$, and is set to 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	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. $$HHI_t = \frac{\sum_{j=1}^{j}(CP\ Holdings_{j,t})^2}{(\sum_{j=1}^{j} CP\ Holdings_{j,t})^2} \quad \text{(A.2)}$$ 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.
Long Tenor	Indicator variable that takes a value of 1 if the average maturity of CP issued by an issuer on a given day is at or above 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.

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 blue shaded area indicates the MMF withdrawal period (December 2015 to November 2016) triggered by the 2016 SEC reforms on MMFs.

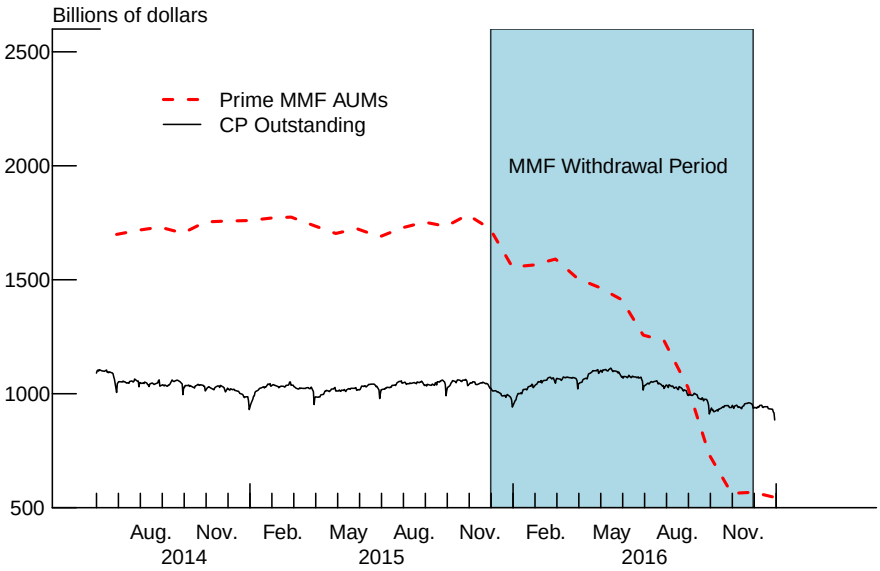

Figure 2: **Aggregate bargaining power measures**

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 gray shaded area represents the COVID-19 crisis period from March to April 2020, which is excluded from our analyses.

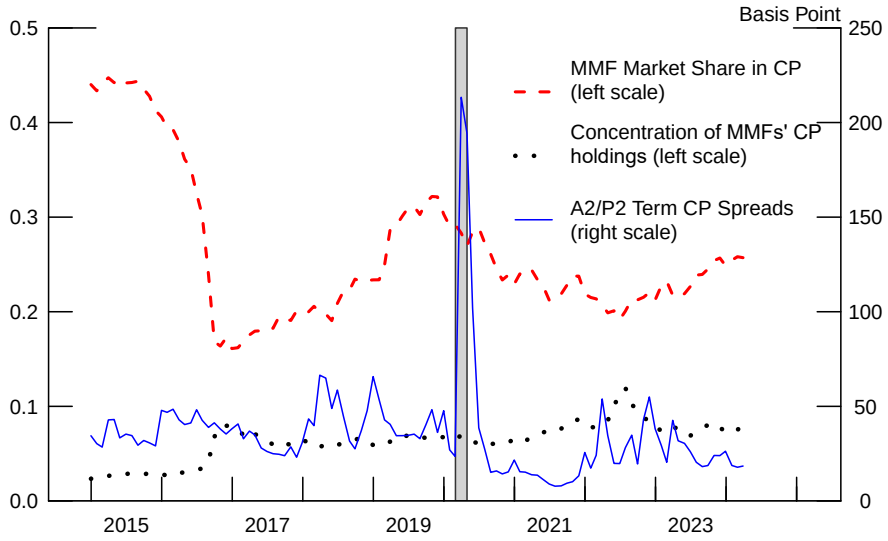

Figure 3: **Share of direct placement in CP issuance**

This figure shows the volume of CP placed directly without dealer intermediation as a percentage of the total CP issuance volume from December 2014 to March 2024. The data series is calculated daily and presented as 5-day moving averages. The gray shaded area represents the COVID-19 crisis period from March to April 2020, which is excluded from our analyses.

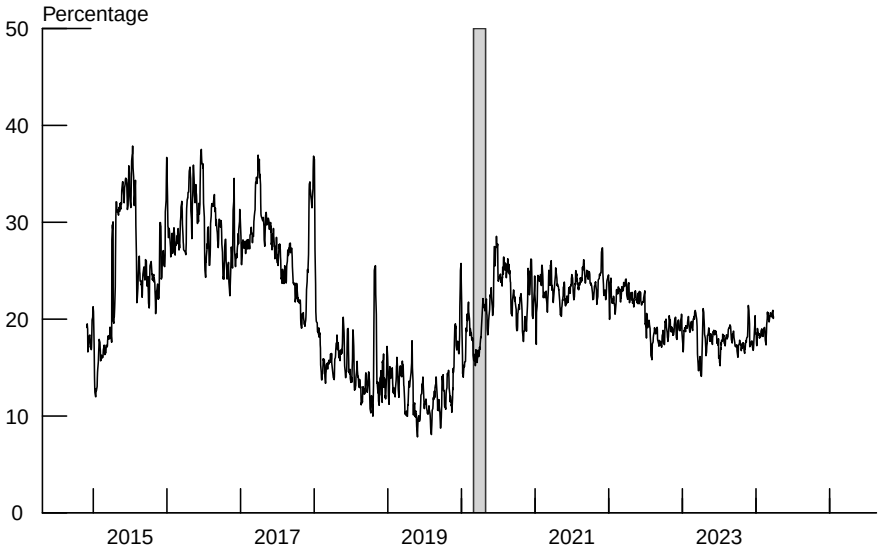

Table 1: **Event study: Impact of sector-wide MMF withdrawals on CP pricing**

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 (six months before the regression sample starts) 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 daily CP characteristics and the lagged composite flow 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 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. *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		**Δ Outstanding Amount**	
	(1)	**(2)**	**(3)**	**(4)**
Funding Fragility	-2.5576	0.0406	0.2668	0.3626
	(-1.37)	(0.04)	(0.82)	(1.04)
MMF Ownership	4.0075***	1.6576***	-0.2163***	-0.2610***
	(6.26)	(4.82)	(-3.91)	(-4.51)
Direct Issuance Share	4.8526***	0.6384*	-0.1385	0.1384
	(3.79)	(1.79)	(-1.44)	(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	0.619	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 set to zero otherwise. *Capital Inflows* = *Funding Fragility* when *Funding Fragility* < 0, and is set to 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 (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)**
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	0.3212**	0.2835**		
	(2.05)	(2.08)		
High MMF Power × Redemption Pressure			0.3905*	0.3586*
			(1.76)	(1.96)
High MMF Power × Capital Inflows			-0.0711	-0.0241
			(-0.18)	(-0.08)
Funding Fragility	0.2802***	0.2414***		
	(3.14)	(4.46)		
Redemption Pressure			0.2884***	0.2159***
			(2.65)	(3.62)
Capital Inflows			-0.2543	-0.3212**
			(-1.63)	(-2.43)
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 set to zero otherwise. $Capital\ Inflows = Funding\ Fragility$ when $Funding\ Fragility < 0$, and is set to zero otherwise. *High CP Risk* is a daily indicator variable that takes value of 1 if the rate difference between lower-rated CP and maturitymatched 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 (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 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 CP tenor**

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. *Long Tenor* is an indicator variable at the issuer-day level that takes the value of 1 if the average tenor of CP issued 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 (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)**
Long Tenor × Funding Fragility	0.3391**	0.3629***		
	(2.57)	(3.97)		
Long Tenor × Redemption Pressure			0.5000***	0.4648***
			(3.38)	(4.27)
Long Tenor × Capital Inflows			0.1665	-0.0118
			(0.58)	(-0.05)
Funding Fragility	0.1889*	0.1472***		
	(1.80)	(3.34)		
Redemption Pressure			0.1129	0.0654*
			(1.00)	(1.65)
Capital Inflows			-0.4782**	-0.4468**
			(-2.23)	(-2.41)
Controls	Yes	Yes	Yes	Yes
Controls × Long Tenor	Yes	Yes	Yes	Yes
Rating × Long Tenor FE	Yes	Yes	Yes	Yes
Type × Long Tenor FE	Yes	Yes	Yes	Yes
Day × Long Tenor FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.993	0.995	0.993	0.995
N. of Obs	490771	490766	490771	490766

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 set to zero otherwise. *Capital Inflows* = *Funding Fragility* when *Funding Fragility* < 0, and is set to 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 (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)**
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 set to zero otherwise. *Capital Inflows* = *Funding Fragility* when *Funding Fragility* < 0, and is set to zero otherwise. *Foreign* is an indicator variable that takes the value of one if the CP issuers 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 (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)**
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

Appendix Table 1: **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 matched-maturity 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 (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 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

Appendix Table 2: **Price impact and bargaining power: alternative CP tenor 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 set to zero otherwise. *Capital Inflows* = *Funding Fragility* when *Funding Fragility* < 0, and is set to zero otherwise. *Long Tenor* is an indicator variable at the issuer-day level that takes the value of 1 if the average tenor of CP issued is greater than one month (40 days), and zero otherwise. 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 (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)**
Long Tenor × Funding Fragility	0.5245***	0.5043***		
	(3.04)	(3.89)		
Long Tenor × Redemption Pressure			0.6019***	0.5900***
			(2.89)	(3.74)
Long Tenor × Capital Inflows			-0.2744	-0.1987
			(-0.82)	(-0.74)
Funding Fragility	0.2101**	0.1641***		
	(2.14)	(3.78)		
Redemption Pressure			0.1511	0.0689*
			(1.37)	(1.72)
Capital Inflows			-0.4190**	-0.4923***
			(-2.36)	(-3.29)
Controls	Yes	Yes	Yes	Yes
Controls × Long Tenor	Yes	Yes	Yes	Yes
Rating × Long Tenor FE	Yes	Yes	Yes	Yes
Type × Long Tenor FE	Yes	Yes	Yes	Yes
Day × Long Tenor FE	Yes	Yes	Yes	Yes
Issuer FE	No	Yes	No	Yes
Adjusted R^2	0.993	0.996	0.993	0.996
N. of Obs	490770	490765	490770	490765