

Multimarket Contact and the Cost of Trading Corporate Bonds

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Abstract

We show that multimarket contact (MMC)—the extent to which the same dealers trade with each other across many bonds—disciplines pricing. In a dynamic model where dealers alternate between supplying and demanding liquidity, a dealer can profit in the short run by widening her quotes. MMC deters this: because the same dealers meet repeatedly across many bonds, a deviation in one bond triggers retaliation in every other bond the two dealers share. This mechanism sustains tight pricing even where individual bonds trade too infrequently for within-bond retaliation alone to deter deviations. Higher MMC compresses spreads for *all* dealers in a bond, with the largest effects when adverse selection is high and trading is infrequent. Using TRACE data, we find that dealers with higher MMC quote lower interdealer spreads, and these reductions pass through to customers. A shift-share instrument exploiting COVID-era issuance waves confirms that exogenous increases in MMC reduce spreads.

Keywords: Over-the-counter markets; multimarket contact; dealer networks; corporate bonds.

JEL: G12, G14, L13, D85, C73.

1 Introduction

U.S. corporate bonds trade in a highly concentrated dealer-intermediated market: the top 10 dealers account for over 70% of dealer-to-customer trading volume (O’Hara and Zhou, 2021).¹ Such concentration naturally raises classic market-power concerns. When a few intermediaries dominate market-making, standard oligopoly logic predicts supracompetitive prices—namely, wide bid–ask spreads (Green, 2007; Green, Hollifield, and Schürhoff, 2007). And because the set of dealers remains largely stable over time, dynamic incentives should sustain even wider spreads through tacit collusion (Dutta and Madhavan, 1997). Yet both interdealer and dealer–customer spreads are on average quite low (Bessembinder, Maxwell, and Venkataraman, 2006; Bessembinder and Maxwell, 2008) and largely explained by competitive frictions rather than dealer market power (Feldhütter and Poulsen, 2018; Bessembinder, Spatt, and Venkataraman, 2020). So, if intermediation is so concentrated and stable, why aren’t bid–ask spreads much wider?

We show that dealer *multimarket contact* (MMC)—the extent to which the same dealers trade with each other across many bonds—disciplines pricing and helps explain low spreads. Because the corporate bond market is fragmented across thousands of CUSIPs, dealers often trade with each other in the interdealer market to offset their positions and manage inventory risk. MMC links their pricing incentives across bonds: a dealer who widens her quote in one bond faces retaliation in every other bond she shares with the same counterparties. Importantly, holding the total volume of bilateral trade fixed, we show incentives differ sharply depending on whether trading activity is concentrated in a single bond or spread across many heterogeneous bonds.

We formalize the mechanism in a dynamic model with adverse selection in which dealers alternate between supplying and demanding liquidity. As in Glosten and Milgrom (1985), trade is either information- or liquidity-driven, but only the latter generates gains from trade. While a dealer is tempted to widen quotes for a short-run gain, she is deterred from doing

¹As trading migrated from voice to electronic platforms, essentially the same institutions remained central to intermediation: nine of the ten largest voice-trading dealers still rank among the top fifteen in electronic trading (O’Hara and Zhou, 2025). Electronification changed the venue but not the underlying dealer structure.

so by role reversals as then she would pay wider spreads when demanding liquidity herself.² MMC pools interaction across bonds, so that a deviation in one bond triggers retaliation in all other bonds where the same dealers are active. Bond heterogeneity is central: in frequently traded, low-adverse-selection bonds, dealers trade with each other often enough that the within-bond threat of retaliation alone keeps spreads tight; MMC extends this discipline to illiquid or information-sensitive bonds, where dealers trade too rarely for that threat to work. Moreover, because equilibrium spreads reflect the pricing of all active dealers, tighter quotes by high-MMC dealers also strengthen the incentive to cooperate for *all* intermediaries in that bond—compressing spreads market-wide, not only for her direct counterparties.

The model predicts that transaction costs fall with MMC. We test this using regulatory TRACE data, which identifies dealers in each corporate bond trade. Guided by the model, we measure MMC at the dealer–bond–month level, capturing dealer i ’s overlap with other dealers active in bond b across their other bonds. We construct our baseline MMC measure from *trailing* 12-month trading networks (months $t-12$ through $t-1$), so the overlap measure is predetermined relative to spreads in month t and not mechanically driven by contemporaneous trading in bond b . We then estimate dealer–bond–month regressions of transaction costs on MMC and show robustness to alternative network windows of 6 and 1 month.

Interpreting this relationship requires separating MMC from other determinants of transaction costs that move with participation. Dealers with broad franchises may both overlap more and quote more tightly; liquid bonds may attract more dealers, mechanically increasing overlap while lowering spreads. We address these possibilities by including bond–month fixed effects, absorbing all time-varying bond-level determinants of transaction costs, and dealer–month fixed effects, absorbing time-varying dealer-level determinants such as balance-sheet capacity, funding advantages, and technology. Identification comes from two within-month comparisons: across dealers trading the same bond in the same month and across bonds traded by the same dealer in the same month.

The data strongly support the theory. Within a given bond and month, dealers with higher MMC charge lower transaction costs. A one-standard-deviation increase in MMC is

²In over-the-counter (OTC) corporate bond markets, liquidity demand flows through bilateral negotiations with a limited dealer set, so quote-widening is not instantly undercut by a public limit-order book (O’Hara and Zhou, 2025).

associated with a 4–6 basis point decline in spreads relative to an average of about 27 basis points—a 15–22% reduction (roughly \$4,000–\$6,000 per \$10 million trade). The relationship is stable when we add predetermined controls for dealer–bond activity and trading conditions, and it is robust across credit quality, maturity, and issuer industries, as well as alternative constructions of MMC and transaction-cost measures.

The empirical results also align with comparative statics of the repeated-game mechanism. Using Kyle (1985)’s λ as a proxy for adverse selection, we find that MMC has a larger effect in high- λ bonds, where the temptation to widen spreads is strongest. Consistent with the threat of retaliation being weaker when dealers trade less often, MMC also has a stronger effect in infrequently traded bonds. We further show that interdealer spread reductions pass through to customers: tighter interdealer pricing associated with MMC translates into lower dealer–customer transaction costs as well.

Finally, we complement the fixed-effects design with an instrumental-variables strategy exploiting issuance waves during COVID-19. We define segments as rating-group $\times$ issuer-industry category and instrument MMC with a shift–share exposure that interacts segment-level abnormal issuance with dealers’ pre-period segment specialization (Bartik, 1991; Blanchard and Katz, 1992). A key feature of the COVID-19 episode is that issuance surges were concentrated in the investment-grade segment, while high-yield issuance did not rise in tandem (Becker and Benmelech, 2025). Issuance waves expand the set of traded securities in a segment and, given dealers’ specialization, mechanically increase the number of bonds in which the same dealers trade with each other, raising MMC. In 2SLS, abnormal issuance exposure predicts higher MMC in the first stage, and instrumented increases in MMC reduce transaction costs in the second stage. The IV specification includes the same bond–month and dealer–month fixed effects, so identification comes from differential exposure across dealers to the same segment–month issuance shock.

Taken together, our results point to a novel view of pricing in OTC markets. Our framework yields the opposite comparative static from standard mutual-forbearance arguments and helps reconcile concentrated intermediation with low observed spreads—with cost reductions passing through to customers. Our analysis builds on and contributes to three strands of prior work.

First, we contribute to work on OTC markets and corporate bonds. A large literature emphasizes search frictions, limited transparency, and balance-sheet constraints as central determinants of trading costs (Duffie, Gârleanu, and Pedersen, 2005, 2007), and documents substantial dispersion in corporate-bond transaction costs (Bessembinder et al., 2006; Edwards, Harris, and Piwowar, 2007; Goldstein, Hotchkiss, and Sirri, 2006; Bao, Pan, and Wang, 2011; Friewald, Jankowitsch, and Subrahmanyam, 2012; Friewald and Nagler, 2019). More recent work highlights economies of scale in intermediation (Goldberg and Nozawa, 2021), the role of dealer–dealer relationships (e.g., Di Maggio, Kermani, and Song, 2017; Hendershott, Li, Livdan, and Schürhoff, 2020), or dealer–customer relationships (O’Hara, Wang, and Zhou, 2018; Hendershott, Li, Livdan, and Schürhoff, 2020; Choi, Huh, and Seunghun Shin, 2024; O’Hara, Rapp, and Zhou, 2025, among others). Our channel is complementary. We propose a new measure of bilateral dealer relationships based on the *breadth* of shared bonds—the number of distinct securities two dealers trade in common, rather than the volume they exchange. MMC matters because bonds are heterogeneous: liquid and illiquid bonds contribute differently to dealers’ incentives to cooperate. We characterize theoretically the conditions under which the cross-bond overlap disciplines pricing—high adverse selection and low trading frequency—and confirm these predictions empirically.

Second, we contribute to the broader literature on multimarket contact. The canonical IO view is that MMC facilitates tacit coordination by linking punishments across markets (Bernheim and Whinston, 1990), and empirical work typically finds that greater overlap raises prices (Evans and Kessides, 1994; Parker and Röller, 1997; Ciliberto and Williams, 2014; Schmitt, 2018; Hatfield and Wallen, 2022). Different from the canonical setting with exogenous production costs, our setting features endogenous costs of intermediation and delivers the opposite comparative static: a profit-maximizing deviation is to *widen* spreads rather than undercut rivals, so multimarket overlap tightens rather than relaxes the relevant incentive constraints. MMC in dealer markets thus reduces intermediation costs, which in turn improves outcomes for end investors, contrasting with standard mutual-forbearance interpretations.

Finally, we relate to work on financial and dealer networks (Allen and Gale, 2000; Jackson, 2008; Elliott, Golub, and Jackson, 2014; Acemoglu, Ozdaglar, and Tahbaz-Salehi, 2015) and

to evidence on trading networks in corporate-bond intermediation (Di Maggio et al., 2017; Li and Schürhoff, 2019; Colliard, Foucault, and Hoffman, 2021). This literature shows that a dealer’s network position—in particular, centrality—predicts spreads and liquidity. We depart from this work in two ways. Conceptually, most existing network channels operate through static mechanisms such as search, bargaining, or congestion; our mechanism operates through repeated-game incentives that are shaped by *which* bonds dealers share, not just how central they are overall. Empirically, our MMC measure varies *within* a dealer–month across bonds, so dealer–month fixed effects absorb a dealer’s overall network position and time-varying characteristics, and identification comes from cross-bond variation within a dealer–month and cross-dealer variation within a bond–month. The spread compression associated with MMC is robust to this stringent fixed-effects design and to the shift–share IV, confirming that MMC captures something distinct from standard centrality measures.

2 Theoretical Framework

We develop a repeated-game model of dealer cooperation under multimarket contact. We begin with the simplest environment— $N = 2$ dealers trading in $K = 1$ market—and show how repeated interaction leads to cooperation. We then extend the framework to multiple dealers and multiple markets, introducing MMC. We show that MMC makes cooperation incentive-compatible in markets where repeated interaction alone is insufficient and strengthens cooperation for all dealers, beyond bilateral counterparties. Finally, we add customer trades and show that the benefits of dealer cooperation pass through to customers. All proofs are in Online Appendix A.

2.1 One Market and Two Dealers

Stage Game. The stage game follows Glosten and Milgrom (1985). One of the two dealers seeks liquidity either because she is liquidity-motivated (L) or information-motivated (I) and the other dealer acts as a market-maker (M) who provides liquidity. We assume all dealers are risk-neutral, which allows us to abstract from inventory considerations.

The dealers trade a risky asset: its common-value component v is equally likely to be

positive or negative, and its magnitude is independently distributed according to a distribution $F_I(v)$ with support on $[0, 1]$. With probability $\alpha \in [0, 1]$, the liquidity-seeking dealer is information-motivated, in which case she privately knows the common-value component. With complementary probability $1 - \alpha$, she is liquidity-motivated, in which case she has a private-value component b for trading the asset (and knows nothing about the common-value component). The private-value component is equally likely to be positive or negative, and its magnitude is also independently distributed according to a distribution $F_L(b)$ with support on $[0, 1]$. For simplicity, we assume both $F_I(v)$ and $F_L(b)$ are uniform.

The market-making dealer provides quotes symmetric around zero, which is the expected common value of the asset, i.e., the ask (bid) will be s ($-s$). The information-motivated (liquidity-motivated) dealer chooses to trade if the magnitude of the common-value component (private-value component) exceeds s . Thus, in a stage game, the profit of the market-making dealer is

$$\pi_M(s) = (1 - \alpha) \int_s^1 s dF_L(b) - \alpha \int_s^1 (v - s) dF_I(v) = (1 - \alpha)(1 - s)s - \alpha \frac{(1 - s)^2}{2}, \quad (1)$$

which is the sum of gains when trading with a liquidity-motivated dealer and losses when trading with an information-motivated dealer. The profit of the information-motivated dealer is

$$\pi_I(s) = \int_s^1 (v - s) dF_I(v) = \frac{(1 - s)^2}{2}, \quad (2)$$

which is entirely made at the expense of the market-making dealer. In contrast, the profit of the liquidity-motivated dealer is

$$\pi_L(s) = \int_s^1 (b - s) dF_L(b) = \frac{1 - s^2}{2} - (1 - s)s = \frac{(1 - s)^2}{2}, \quad (3)$$

which is the realized private-value component net of the payments made to the market-making dealer.

Lemma 1 (Static monopoly and break-even spreads). *Let s^* maximize $\pi_M(s)$ and let s^B satisfy $\pi_M(s^B) = 0$. Then $s^* = \frac{1}{2-\alpha}$ and $s^B = \frac{\alpha}{2-\alpha}$.*

If there is only one round of trade, the market-making dealer maximizes her current

profits $\pi_M(s)$ and quotes $s^* > 0$. There are two reasons for the dealer to quote a strictly positive spread. First, the dealer raises the quote to protect herself from adverse selection by the information-motivated dealer. Second, the dealer has market power, which allows her to extract rents by raising the quote above the level at which she breaks even, $s^* > s^B$.

Dealer Cooperation in Repeated Game. In the repeated game, the dealers play the stage game ad infinitum and have a common discount factor $\delta \in (0, 1)$. The value of the common component is redrawn from the same distribution each period. The dealer roles alternate between periods. For simplicity, we assume that a given dealer seeks liquidity in stage t with probability $\frac{1}{N}$.

To illustrate the mechanism, we first focus on symmetric equilibria in which both dealers make the same cooperative quote s whenever they act as market-makers. Deviations from this quote are punished by grim-trigger strategies: if a dealer ever deviates in period t , both dealers quote s^* whenever they make the market in all subsequent periods.³

When both dealers expect to make and receive quote s , a dealer's expected per-period profit is

$$\Pi(s) = \frac{1}{2}\pi_M(s) + \frac{1}{2}(\alpha\pi_I(s) + (1-\alpha)\pi_L(s)) = (1-\alpha)\frac{1-s^2}{2}. \quad (4)$$

This profit increases when s falls. Indeed, $\Pi(s)$ equals half of the expected per-period welfare, which itself equals the realized private-value component of the liquidity-motivated dealer, and thus increases for lower s . Although the long-run profits increase with lower s , a market-making dealer could increase her current-period profit by quoting above s . In fact, the most profitable deviation would be to quote the static monopoly spread s^* .

Therefore, a quote $s < s^*$ is sustainable in equilibrium if and only if the continuation value from cooperation outweighs the one-shot gain from the deviation. Formally,

$$\pi_M(s) + \frac{\delta}{1-\delta}\Pi(s) \geq \pi_M(s^*) + \frac{\delta}{1-\delta}\Pi(s^*). \quad (5)$$

That is, the expected payoff from quoting s must exceed the payoff from deviating to the

³This punishment is less severe than a complete termination of future business as in [Hendershott et al. \(2020\)](#) who assume that a dealer loses all business with a client in future if their current negotiations fail.

static monopoly spread s^* . Rearranging yields the incentive-compatibility condition

$$C(s) \equiv \frac{\delta}{1-\delta} (\Pi(s) - \Pi(s^*)) - (\pi_M(s^*) - \pi_M(s)) \geq 0, \quad (6)$$

where we define $C(s)$ as the *cooperation capacity* of the market at quote s . Intuitively, $C(s)$ measures the expected gain from cooperation in future periods net of the opportunity cost of not deviating in the current period.

The cooperation capacity provides a natural way to characterize the set of sustainable cooperative quotes. A quote s is sustainable if $C(s) \geq 0$, that is, if the continuation value of cooperation is large enough to offset the temptation to deviate. The upper boundary of the set is given by s^* . To characterize the lower boundary, we define the *welfare-maximizing cooperative quote* s^W as the lowest sustainable quote:

$$s^W = \min\{s \in [0, 1] \text{ s.t. } C(s) \geq 0\}. \quad (7)$$

Cooperating on s^W is natural because lower spreads increase total welfare: since total surplus is strictly decreasing in s , the planner (or equivalently, the Pareto-efficient equilibrium) selects the lowest spread that is still incentive-compatible. In this sense, s^W corresponds to the efficient subgame-perfect equilibrium sustained by the grim-trigger strategies (see [Abreu, 1988](#); [Fudenberg and Maskin, 1986](#)).

Proposition 1 (Cooperation capacity). *The cooperation capacity $C(s) \geq 0$ for any $s \in [s^W, s^*]$, where s^W is weakly decreasing in δ and weakly increasing in α .*

Figure 1 illustrates the monopolistic spread s^* , the welfare-maximizing cooperative quote s^W , and the break-even spread s^B across different values of δ and α . The shaded area between s^W and s^* represents the set of quotes for which cooperation capacity is positive, $C(s) \geq 0$.

Corollary 1 (Cooperation and frequency of trade). *Cooperation capacity $C(s)$ strictly increases in δ for any $s \in [0, s^*)$. Thus, it is easier to sustain cooperation for assets that trade more frequently.*

To capture differences in trading frequency in our model, we vary the length of the trading period relative to a fixed reference period. This implies that for more (less) frequently traded

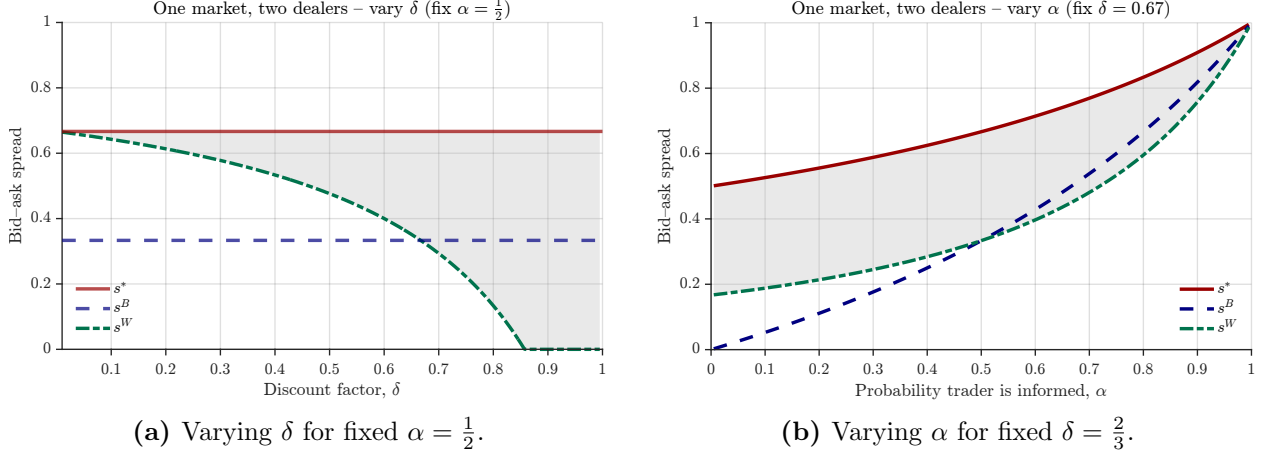


Figure 1. The panels plot the static monopoly spread $s^*(\cdot)$, the competitive break-even spread $s^B(\cdot)$, and the welfare-maximizing cooperative spread $s^W(\cdot)$ that satisfies the incentive constraint. The shaded band shows the IC-feasible region $[s^W, s^*]$ where cooperative quotes are sustainable. Welfare maximization is subject to the constraint $s \geq 0$. Left: comparative statics in δ holding $\alpha = \frac{1}{2}$ fixed. Right: comparative statics in α holding $\delta = \frac{2}{3}$ fixed.

assets, the effective discount factor is higher (lower) than the discount factor δ associated with the reference period. For example, consider an asset that trades twice within the reference period in a high-frequency market h . For such a market, all future payoffs arrive twice as fast, implying an effective discount factor of $\delta^h = \sqrt{\delta} > \delta$ per h -period. Since $C(s)$ increases with the effective discount factor, more frequent trading raises the continuation value of cooperation and expands the set of sustainable spreads. When dealers trade more frequently, the value of future cooperation grows, making it easier to sustain cooperative pricing today.

2.2 Two Markets and Two Dealers

We now add a second asset, with a corresponding market, and consider $N = 2$ dealers that operate in both markets, $K = 2$. Each period t , the stage game is played *simultaneously* in the both markets. In each market k , exactly one dealer is the market-maker and the other is the liquidity taker, and the role assignments are independent across markets. Hence, in a given period a dealer may be the market-maker in neither market, in exactly one market, or in both markets.

For an illustration, we focus on symmetric trigger strategies across markets. Fix cooperative quotes (s^{k_1}, s^{k_2}) . On the cooperative path, whenever a dealer is the market-maker in market k , she quotes s^k . A deviation in *any* market in any period triggers reversion to the static equilibrium in *both* markets from period $t + 1$ onward, i.e., market-makers quote $s^{*,k}$ forever in each market k . Because within-period payoffs are additively separable across markets, the best one-shot deviation is to quote the static monopoly spread $s^{*,k}$ in all markets where the dealer is currently a market-maker. It is sufficient to focus on the *tightest* incentive-compatibility constraint for cooperation in market k , which arises when the deviating dealer is a market-maker in *both* markets in the deviation period: if this constraint holds, cooperation is also sustainable under alternative role assignments across markets.

Consider a history on the cooperative path and a period in which a given dealer is the market-maker in market k . If she deviates in market k (quoting $s^{*,k}$), she obtains the one-shot deviation payoff in market k today, and from $t + 1$ onward receives the punishment continuation values in *both* markets. If she does not deviate, she retains cooperative continuation values in both markets. Using the fact that $\Pi^k(\cdot)$ is defined as the dealer's expected per-period payoff in market k , the tightest incentive-compatibility constraint for not deviating can be written as

$$\pi_M^k(s^k) + \frac{\delta^k}{1 - \delta^k} \Pi^k(s^k) + C^\ell(s^\ell) \geq \pi_M^k(s^{*,k}) + \frac{\delta^k}{1 - \delta^k} \Pi^k(s^{*,k}), \quad (8)$$

where $C^\ell(s^\ell)$ is cooperation capacity of the other market ℓ , defined as in (6). Defining $MMC^k \equiv C^\ell(s^\ell)$, the two-market incentive constraint becomes

$$C^k(s^k) + MMC^k \geq 0. \quad (9)$$

Proposition 2 (Cooperation under multimarket contact). *If MMC^k is strictly positive, the set of sustainable quotes s^k in market k weakly expands.*

Intuitively, cooperation between dealers could improve when they operate in more than one market. In particular, if there is extra cooperation capacity in one market, measured by MMC , it can be transferred to extend cooperation in another market, i.e., if $MMC^k > 0$ the

constraint (9) is more slack compared to the one-market case. The extra capacity however arises only if the two markets differ as highlighted by the following.

Corollary 2 (No improvement in cooperation in symmetric markets). *When identical dealers trade with each other in identical markets, multimarket contact does not aid in sustaining cooperation outcomes.*

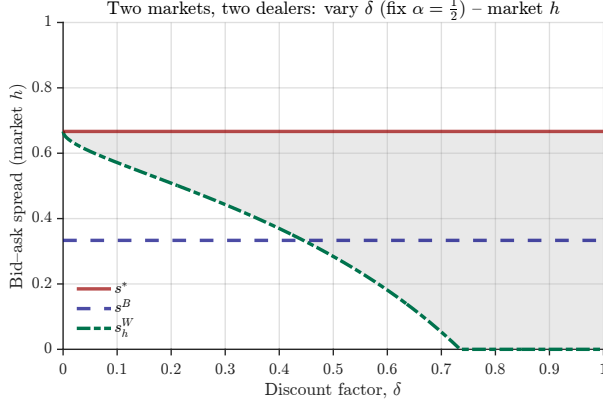
To see why, note that the incentive constraint (9) is effectively $C^k(s^k) + C^\ell(s^\ell) \geq 0$. Thus, if the two markets are identical, the constraint becomes $2C^k(s^k) \geq 0$, which is exactly the same constraint as when dealers operate only in one market, without multimarket contact. Thus, if the dealers cooperate on the welfare-maximizing spreads, the constraints in the two cases, with only one market and with two markets, are both either simultaneously slack or binding. As a result, MMC adds nothing when markets are identical. Asymmetry across markets—in trading frequency, adverse selection, or both—is what allows cooperation capacity from one market to extend cooperation in another.

We illustrate Proposition 2 in the following two examples with heterogeneous markets.

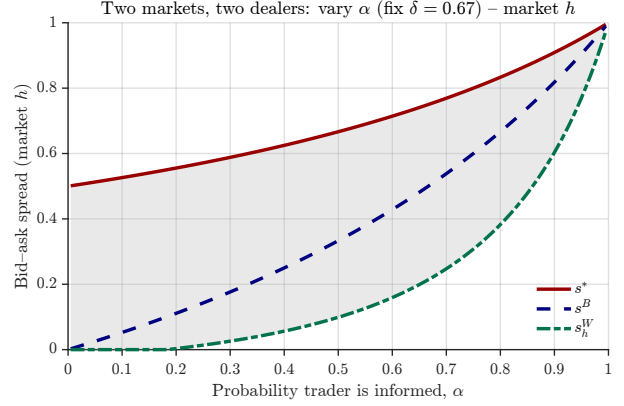
Example 1 (Cooperation under multimarket contact). Suppose that the two markets differ only in the frequency of trade. The first asset is traded every (reference) period, with the effective discount factor $\delta^\ell = \delta$, while the second asset is traded twice as often, with the effective discount factor $\delta^h = \sqrt{\delta}$.

By Corollary 1, the cooperation capacity in market h is higher than in market l . This extra capacity can be used to extend cooperation in market l : by Proposition 2, if the cooperation capacity is positive at quote s^h , it expands the set of sustainable quotes s^l in market l . Figure 2 shows the quotes sustainable in both markets. Comparing the quotes in market l with those in Figure 1, cooperation in market l expands when dealers operate in both markets. The orange hatched regions of the bottom panel show this expansion.

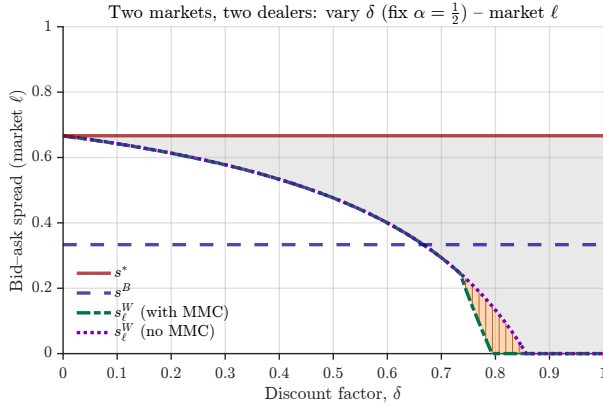
Example 2 (Cooperation under multimarket contact). Consider the same two-market setting as above, but now suppose dealers coordinate on sustaining spreads subject to the constraint $s \geq s^B$, where s^B is the competitive spread. In the high-frequency market h , the implemented quote is the competitive spread s^B whenever it satisfies the incentive constraint; otherwise, dealers revert to the lowest sustainable spread $s_h^{\min}$. The same rule governs market



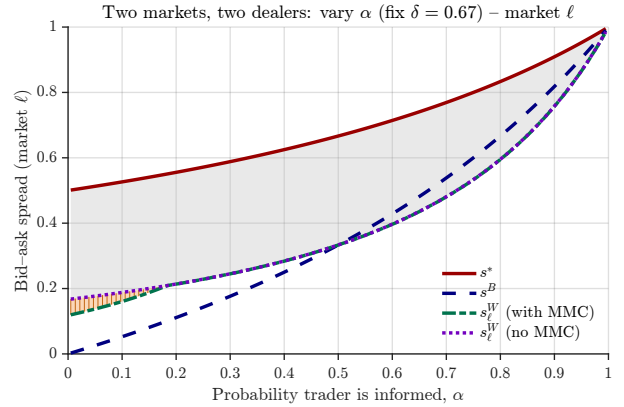
(a) Market h : varying δ for fixed $\alpha = \frac{1}{2}$.



(b) Market h : varying α for fixed $\delta = \frac{2}{3}$.



(c) Market ℓ : varying δ for fixed $\alpha = \frac{1}{2}$.



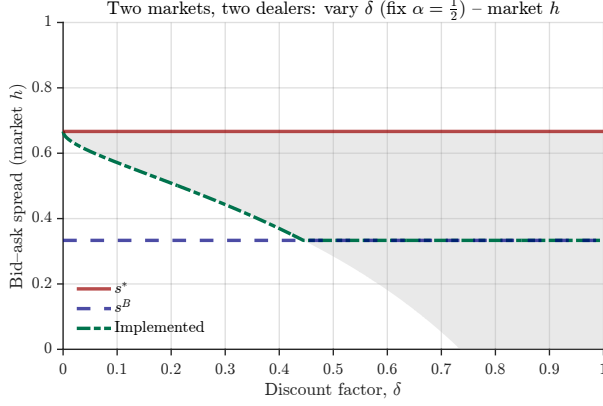
(d) Market ℓ : varying α for fixed $\delta = \frac{2}{3}$.

Figure 2. Sustainable spreads in two markets (h and ℓ) under welfare-maximizing cooperation with multimarket contact. Top row: high-frequency market h ; bottom row: low-frequency market ℓ with slack imported from h . Grey bands indicate the IC-feasible region in each market, while orange areas mark the additional feasible region in ℓ created by multimarket contact. Red solid lines plot the static monopoly spread s^* , blue dashed lines the competitive spread s^B , and green dash-dotted lines the welfare-maximizing cooperative spread s^W . Left column: comparative statics in δ holding $\alpha = \frac{1}{2}$ fixed. Right column: comparative statics in α holding $\delta = \frac{2}{3}$ fixed.

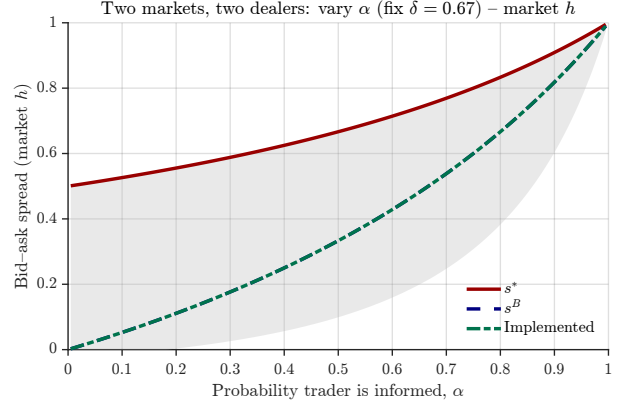
ℓ , but here the set of feasible quotes expands whenever cooperation capacity is imported from market h . Figure 3 illustrates the sustainable quotes in both markets, with the additional feasibility in ℓ highlighted by the orange hatched regions in the bottom panels.

We conclude this section by characterizing how the marginal effect of multimarket contact in a given market varies with that market's characteristics.

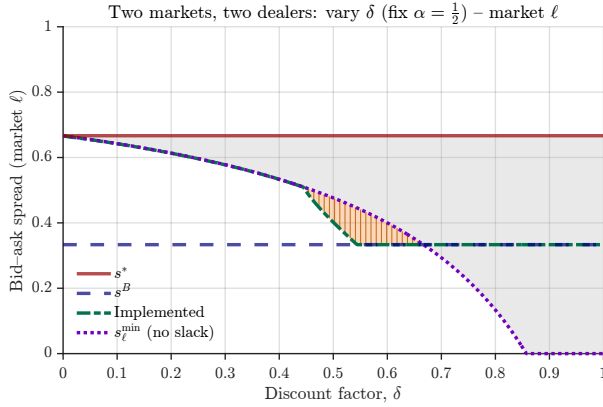
Proposition 3 (The marginal effect of MMC). *The marginal increase in the set of sustain-*



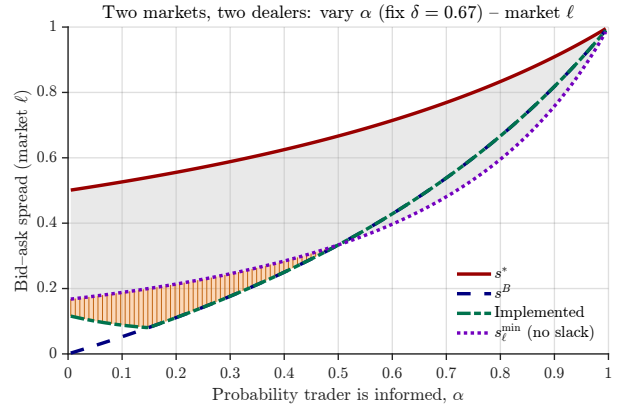
(a) Market h : varying δ for fixed $\alpha = \frac{1}{2}$.



(b) Market h : varying α for fixed $\delta = \frac{2}{3}$.



(c) Market ℓ : varying δ for fixed $\alpha = \frac{1}{2}$.



(d) Market ℓ : varying α for fixed $\delta = \frac{2}{3}$.

Figure 3. Competitive-or-minimum rule with multimarket contact. Dealers quote the competitive spread s^B whenever it is incentive-compatible; otherwise they select the lowest sustainable spread (market h : $s_h^{\min}$; market ℓ : $s_\ell^{\min}$). Shaded grey regions indicate incentive-compatible spreads absent imported cooperation capacity. Orange hatched regions in the low-frequency market ℓ show the additional set of sustainable quotes created by slack imported from the high-frequency market h . Red solid lines denote the static monopoly spread s^* ; blue dashed lines s^B ; green dash-dot lines the implemented spread; and purple dotted lines (bottom panels) $s_\ell^{\min}$ without imported slack. The left column varies δ holding $\alpha = \frac{1}{2}$ fixed; the right column varies α holding $\delta = \frac{2}{3}$ fixed.

able quotes s^k in market k due to the marginal increase in MMC^k weakly decreases with δ and weakly increases with α .

MMC has the greatest effect when cooperative pricing is most difficult to sustain—either because the temptation to deviate is strong or because the value of future interaction is small. When α is high, adverse selection is severe, so the incentive constraint is tight and

MMC matters more. When δ is low, the effective discount factor is low, so the continuation value of cooperation is smaller and MMC again matters more.

2.3 Many Markets and Many Dealers

We now consider the general case with $N > 2$ dealers that could operate in $K > 2$ markets. In the general case, a dealer could operate only in a subset of all markets, a dealer could quote different spreads to different dealers, and a dealer's probability of trade with other dealers could differ across dealers. Thus, unlike in the previous sections, dealers are generically asymmetric.

Formally, let s_{ij}^k denote a spread that dealer i quotes to dealer j in market k and let p_{ij}^k denote the probability of this trade in market k in period t . For market k , denote the matrix of spreads as $S^k = (s_{ij}^k)$ and the matrix of trading probabilities as $P^k = (p_{ij}^k)$ with $p_{ii}^k \equiv 0$ and $s_{ii}^k \equiv 0$. Then, the expected per-period profit of dealer i in market k is

$$\Pi_i^k(S^k, P^k) \equiv \sum_{j \neq i} p_{ij}^k \pi_M^k(s_{ij}^k) + \sum_{j \neq i} p_{ji}^k (\alpha^k \pi_I(s_{ji}^k) + (1 - \alpha^k) \pi_L(s_{ji}^k)). \quad (10)$$

The dealer i 's cooperation capacity in market k , which is the surplus that dealer i loses if other dealers $j \neq i$ cease to cooperate with i in market k net of the maximum one-period gain from deviating, is given by

$$C_i^k(S^k, P^k) \equiv \frac{\delta^k}{1 - \delta^k} \left(\Pi_i^k(S^k, P^k) - \Pi_i^k(S^{*,k}, P^k) \right) - \max_{j \neq i} \left(\pi_M^k(s_{ij}^{*,k}) - \pi_M^k(s_{ij}^k) \right), \quad (11)$$

where $S^{*,k}$ denotes the matrix of monopolistic spreads, i.e., $s_{ij}^{*,k} = s^{*,k}$ for any $i \neq j$. Finally, for dealer i in market k , define $MMC_i^k = \sum_{l \neq k} C_i^l(S^l, P^l)$ as the sum of cooperation capacity in all other markets where i is present. The tightest incentive-compatibility constraint for dealer i in market k is

$$C_i^k(S^k, P^k) + MMC_i^k \geq 0. \quad (12)$$

As in the two-dealer case (Proposition 2), if MMC_i^k is strictly positive, it is easier to sustain lower quotes for dealer i in market k .

2.4 The Effect of MMC beyond Bilateral Cooperation

The multimarket contact between two dealers can lead to tighter spreads for *all* dealers intermediating the same bond.

Intuitively, while cooperation on tighter spreads results in more surplus, the incentives to support the tighter spreads might be lacking. We have already shown how pricing incentives of the two dealers in a given market can be improved by importing some of their joint surplus from other markets via MMC. Similarly, some of the additional surplus created due to cooperation between more than two dealers in a given market can be redistributed among the dealers in this market to improve their pricing incentives. In particular, the pricing incentives of dealers with lower MMC, who cannot import surplus from other markets, could be improved by giving them a higher fraction of the surplus from a given market. Crucially, this can be done without sacrificing the pricing incentives of other dealers in this market only if these other dealers have a higher surplus in other markets, i.e., only if these dealers have higher MMC.

There are two ways dealers with a high MMC can share more surplus with dealers who have a low MMC in a mutually beneficial way in a given market. First, high-MMC dealers can provide liquidity more often to low-MMC dealers than taking liquidity from them. Second, high-MMC dealers can provide a relatively more attractive quotes to low-MMC dealers compared to the quotes they receive from them. We illustrate this idea in the following example.

Example 3 (Effect of MMC beyond bilateral cooperation). We consider a market k with three dealers $\{A, B, C\}$. Each period only one dealer i is liquidity-seeking, with a uniform probability across dealers. Conditional on this, the other two may serve as market-makers: we assume that with probability $\frac{1}{3}$ both dealers $j_1 \neq i$ and $j_2 \neq i$ can serve as market-making dealers, with probability $\frac{1}{3}$ only one dealer $j_1 \neq i$ is a market-maker, and with probability $\frac{1}{3}$ only one another dealer $j_2 \neq i$ is a market-maker. If two dealers are available to quote, the liquidity taker chooses between them with equal probability. Figure 4 plots the lowest sustainable spreads as we vary dealer A 's multimarket contact (MMC_A). Two patterns emerge. First, higher MMC_A relaxes A 's incentive constraint, allowing A to sustain lower

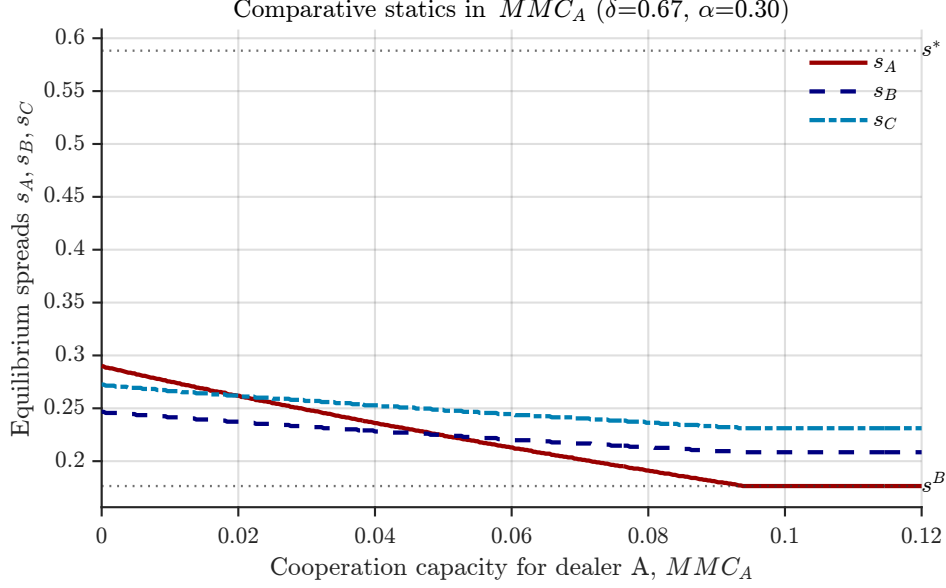


Figure 4. Comparative statics in cooperation capacity MMC_A . The figure plots the equilibrium spreads s_A , s_B , and s_C as functions of MMC_A , holding MMC_B and MMC_C fixed (with $\delta = 2/3$ and $\alpha = 0.3$). The dashed horizontal lines indicate the static monopoly spread s^* and the competitive break-even spread s^B .

spreads. Second, because A 's tighter quotes increase the cooperation benefits for B and C , the spreads quoted by B and C also fall. As a result, all dealers in the market quote lower spreads in equilibrium.

2.5 Pass-Through to Customers

We now add customer trades to the model and show that lower interdealer quotes resulting from higher MMC also benefit ultimate investors.

To incorporate customers, we assume for simplicity that each customer is connected to a single dealer. Whenever a customer needs to trade, she trades with her dealer at an endogenous price s_c quoted by the dealer. As with liquidity-seeking dealers, customer trades are either liquidity-motivated or information-motivated. With probability $\alpha_c \in [0, 1]$, the customer is information-motivated, in which case she privately knows the common-value component. With complementary probability $1 - \alpha_c$, the customer is liquidity-motivated, in which case she has a private-value component b_c for trading the asset (and knows nothing about the common-value component). The private-value component is equally likely

to be positive or negative, and its magnitude is independently distributed according to a distribution $F_{LC}(b_c)$ with support on $[0, 1]$. For simplicity, we assume $F_{LC}(b_c)$ is uniform.

We assume that all customer trades are immediately offset in the interdealer market. Thus, the liquidity-seeking dealer now trades in the interdealer market either because her trade is customer-driven (CD) or because she trades on her own account, in which case she is either (L) or (I) as in our baseline model. We assume that the liquidity-seeking dealer's trade is customer-driven with probability β and driven by her own interests with probability $1 - \beta$. Finally, since the interdealer quote s is effectively a take-it-or-leave-it offer from the market-making dealer, the dealer providing liquidity to her customers takes s as given.

Customer Quote. Given the above assumptions, the profit of the customer's dealer, when offering quote s_c to the customer, is $\pi_{CD}(s_c) = (1 - s_c)(s_c - s)$ and thus the dealer's optimal quote is

$$s_c(s) = \frac{1 + s}{2}. \quad (13)$$

The dealer's quote s_c passes through the interdealer quote s to the customer with a markup.

Interdealer Quote. The characterization of the interdealer quote and how MMC affects it is similar to our baseline model. In the case of one market and two dealers, the profit of the market-making dealer is now the sum of profits from trade with a customer-driven liquidity seeker (CD) and from trade with a dealer acting on her own interests, either (L) or (I):

$$\pi_M(s) = \beta \left((1 - \alpha_c)(1 - s_c(s))s - \alpha_c \int_{s_c}^1 (v - s)dv \right) + (1 - \beta) \left((1 - \alpha)(1 - s)s - \alpha \int_s^1 (v - s)dv \right), \quad (14)$$

where the market-making dealer internalizes the impact of her quote on the customer's quote because the customer's dealer takes the interdealer quote s as given. The dealer's expected per-period profit when both quote s in the interdealer market is

$$\Pi(s) = \frac{1}{2}\pi_M(s) + \frac{1}{2}(\beta\pi_{CD}(s) + (1 - \beta)[\alpha\pi_I(s) + (1 - \alpha)\pi_L(s)]). \quad (15)$$

The incentive-compatibility constraint remains the same—a market-making dealer prefers

to quote s rather than the static monopoly spread s^* , which maximizes (14), whenever

$$\pi_M(s) + \frac{\delta}{1-\delta}\Pi(s) \geq \pi_M(s^*) + \frac{\delta}{1-\delta}\Pi(s^*). \quad (16)$$

Similarly, if there are N dealers who cooperate on interdealer quotes $S^k = (s_1^k, \dots, s_N^k)$ in markets $k \in \{1, \dots, K\}$, the incentive-compatibility constraint for dealer i in market k becomes

$$C_i^k(S^k) + MMC_i^k \geq 0. \quad (17)$$

As before, if MMC_i^k is strictly positive, it is easier to sustain a lower interdealer quote s_i^k for dealer i in market k . The customer's quote therefore also decreases with MMC, since it passes through the interdealer quote with a markup.

Example 4 (Pass-through of dealer cooperation to customers). To illustrate, we consider the case of one market and two dealers in Figure 5. When dealers cooperate, the interdealer quote s^W that maximizes the dealers' joint profit is smaller than the monopolistic interdealer quote s^* . The benefit of dealer cooperation then passes through to customers, as the customer quote also falls: $s_c(s^W) < s_c(s^*)$.

3 Data

We use transaction-level data from the regulatory version of TRACE maintained by FINRA. The dataset covers all U.S. corporate bond trades from 2003 through 2023 and reports detailed information on each transaction, including the date and time, terms, price, trade direction, and dealer identity (but not individual customers). Dealer identifiers allow us to differentiate whether a trade occurs between two dealers or between a dealer and a customer, to construct our measures of MMC, and to analyze how dealers' cross-bond overlap shapes spreads in both interdealer and dealer-customer trading. We follow standard practice in the literature to clean the data (for example, [Dick-Nielsen and Rossi, 2018](#)), removing trade duplicates, cancellations, reversals, and erroneous entries.

We complement the transaction data with bond characteristics from the Mergent Fixed Income Securities Database (FISD). FISD provides detailed issue- and issuer-level attributes,

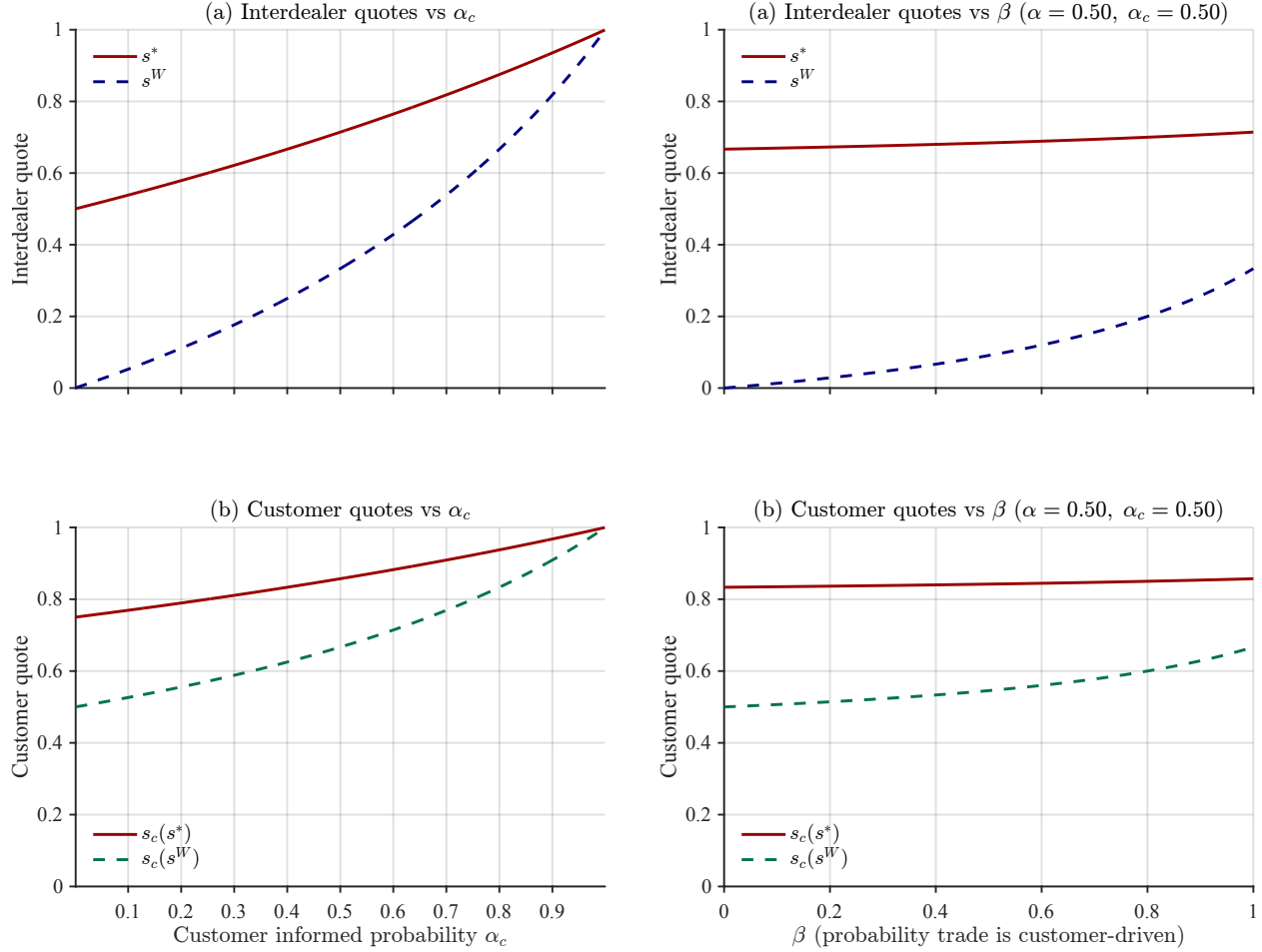


Figure 5. Pass-Through to Customers in a Dealer Market. This figure displays how interdealer and customer quotes respond to changes in (i) the probability that customers are informed, α_c (left panel), and (ii) the probability that trades in the interdealer market are customer-driven, β (right panel). In each case, the top subplot reports the interdealer quotes: the monopoly spread s^* chosen by the market-making dealer and the joint-profit-maximizing spread s^W . The bottom subplot displays the associated customer quotes, given by $s_c(s) = (1 + s)/2$, evaluated at $s = s^*$ and $s = s^W$. The results illustrate how customer-driven activity tightens dealer markups and increases pass-through from interdealer pricing to the ultimate customer price.

including coupon rates, maturity dates, credit ratings from major agencies, call and put provisions, and issuance amounts. We limit our sample to U.S. dollar-denominated, fixed-coupon or zero-coupon corporate debentures and medium-term notes issued by firms domiciled in the United States.⁴ The FISD data enable us to control for key dimensions of bond hetero-

⁴These bonds are identified by the FISD bond type fields CDEB, CMTN, CMTZ, CZ, and USBN. We further require bonds to be nonputtable, not privately placed, not issued under Rule 144A, not convertible or preferred, and senior unsecured.

geneity that affect liquidity and transaction costs, such as credit quality and remaining time to maturity.⁵

Construction of MMC Measures: Our MMC measure captures the extent to which a dealer intermediating bond b overlaps, in *other* bonds, with the dealers that also intermediate b . The construction is closely related to [Evans and Kessides \(1994\)](#), who measure overlap across airline routes (markets). The key distinction is that the relevant competitive environment in corporate bonds is inherently *security-dealer specific*. In OTC bond markets, prices reflect not only bond-level conditions but also dealer-level frictions that vary across securities—balance-sheet constraints, inventory imbalances, client flow, and internal risk limits are all bond-specific and can change quickly. The same dealer can face very different effective costs and competitive pressure across bonds within the same month. A coarser bond-year analogue would average away precisely the heterogeneity that matters for pricing.

Accordingly, we measure MMC at the *dealer-bond-month* level. This granularity is useful for identification because it lets us absorb time-varying bond conditions with bond-month fixed effects and time-varying dealer conditions with dealer-month fixed effects. The remaining variation compares dealers trading the same bond in the same month—holding fixed the bond’s state and the dealer’s month-specific fundamentals—who differ in how much they overlap with these same competitors across other bonds.

Formally, let there be K bonds and N dealers at time t . For each bond k and time t , define an $N \times N$ matrix $A_t = (a_{ij,t})$ with each element being

$$a_{ij,t}^{(-k)} = \sum_{m \neq k} D_{i,m,t-12:t-1} D_{j,m,t-12:t-1} \quad (18)$$

where $D_{i,m,t}$ is an indicator equal to one if dealer i traded bond m in the 12 months before time t and zero otherwise. Thus, $a_{ij,t}$ measures the number of bonds that dealers i and j trade in common outside bond k .

⁵To capture credit quality, we map rating notches to numeric values throughout a bond’s life. When multiple rating agencies rate a bond, we assign the lower of two ratings or the median of three ratings. Bonds not rated by any agency are assigned to an unrated category.

Using this array, we define the baseline MMC measure for dealer i in bond k at time t as

$$AvgDealerOverlap_{i,k,t} = \frac{1}{NumDeal_{k,t} - 1} \sum_{j \neq i} a_{ij,t}^{(-k)} D_{i,k,t} D_{j,k,t}, \quad (19)$$

where $NumDeal_{k,t}$ is the number of dealers with positive volume in bond k at time t and $D_{j,k,t}$ takes value 1 if dealer j trades bond k at time t . This measure reflects dealer i 's *average pairwise overlap* with the other dealers trading the same bond k . Higher values indicate that, when trading bond k , dealer i tends to encounter dealers with whom she shares activity across a broader set of bonds.

To incorporate the intensity of dealer participation, we also construct a revenue-weighted measure. Let $R_{i,k,t}$ denote the share of bond k 's trading revenue captured by dealer i .⁶ Define the analogous $N \times N$ matrix $R_t = (r_{ij,t})$ by

$$r_{ij,t}^{(-k)} = \sum_{m \neq k} R_{i,m,t-12:t-1} R_{j,m,t-12:t-1}. \quad (20)$$

which reflects the degree to which dealers i and j jointly hold large revenue shares across bonds. The corresponding MMC measure is

$$WeightDealerOverlap_{i,k,t} = \frac{1}{NumDeal_{k,t} - 1} \sum_{j \neq i} r_{ij,t}^{(-k)} D_{i,k,t} D_{j,k,t} \quad (21)$$

This measure captures both the breadth of overlap and the relative importance of each dealer pair within the cross-section of bonds.

To implement these measures in a tractable manner we make a few design choices. First, we focus on the cross-section of bonds that is most informative for capturing economically meaningful MMC. In each month we consider the top 2,000 traded bonds, which consistently account for more than 75 percent of market-wide trading volume. Focusing on these actively traded securities ensures that our MMC measures reflect interactions in segments of the

⁶Revenue is computed as trading volume multiplied by a transaction-cost measure; if this product is negative, we set the revenue to zero. This treatment avoids negative "revenue" generated by trades that mechanically imply losses under our transaction-cost proxy.

Table 1. Summary Statistics

	Count	Average	Std	Min	25pct	50pct	75pct	Max
MMC								
Avg. Dealer Overlap	5,185,150.00	484.56	276.81	0.00	250.78	487.65	687.23	1,723.50
Weighted Dealer Overlap	5,185,150.00	2.02	1.90	0.00	0.36	1.48	3.27	18.15
Spreads (bps.)								
Any-Any Cost (bps.)	1,756,920.00	26.74	61.01	-192.80	0.89	10.20	35.22	413.33
Any-ID Cost (bps.)	1,216,291.00	23.24	59.89	-215.54	0.11	8.50	32.50	365.30
CD-ID Cost (bps.)	832,389.00	33.65	65.95	-141.01	1.20	15.18	47.57	377.40
ID-CD Cost (bps.)	718,375.00	25.68	67.91	-178.89	-2.33	9.81	40.05	368.51

Notes: This table reports summary statistics for the MMC and transaction cost measures used in the analysis. *Avg. Dealer Overlap* and *Weighted Dealer Overlap* correspond to the baseline and revenue-weighted MMC measures constructed at the dealer-bond-month level. Transaction costs are measured in basis points using the spread definition in Equation (22). The *Any-Any* and *Any-ID* measures compare trade prices, respectively, to benchmarks constructed from all counterparties or only interdealer trades. The *CD-ID* and *ID-CD* measures compare customer-dealer (interdealer) trades to interdealer (customer-dealer) benchmarks and are used in robustness analyses. All statistics are computed across the full sample period.

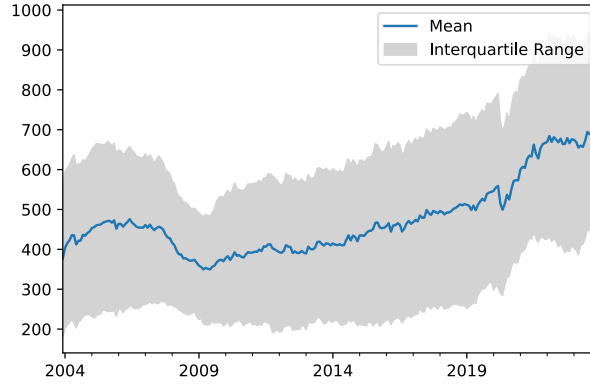
market where dealers have persistent and economically relevant presence. Limiting the bond universe also reduces computational complexity, which is important given that MMC requires evaluating all dealer pairs across all bonds.

Within this set of bonds, for each bond we identify the volume associated with the top five dealers each month based on trading activity, and aggregate across bond-dealers over a trailing 12-month window to compute our MMC measures.⁷ A 12-month look-back window smooths short-term noise in dealers’ trading activity and more reliably identifies the dealers that consistently intermediate a given bond. Limiting attention to the most active dealers ensures that the MMC measure reflects interactions among dealers for whom competition and repeated market presence are most economically meaningful. As we show in our robustness analysis, our findings are not sensitive to shortening the look-back window, suggesting that these choices primarily improve computation speed without driving the results.

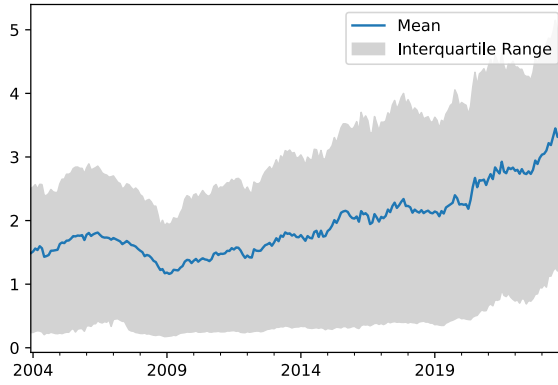
Figure 6 displays the monthly distribution of our MMC measures over time. The top panel shows the baseline measure, *AvgDealerOverlap*, which exhibits a slight upward trend in the average number of bonds that two dealers trade in common. The figure also reveals

⁷In most cases, the trailing-window criterion implies that more than five distinct dealers are observed for a given bond.

Figure 6. MMC Measures Over Time



(a) Average Pairwise Dealer Bond Overlap



(b) Average Overlap, Revenue-Weighted

Notes: This figure shows the average and interquartile range for the MMC over time. Panel A plots the monthly distribution of the baseline MMC measure, *AvgDealerOverlap*, which captures the average number of bonds that a dealer trades in common with other dealers active in a given bond-month. Panel B reports the revenue-weighted version of the measure, *WeightDealerOverlap*, which places greater weight on pairs of dealers that jointly intermediate a larger share of trading revenues. The measures display a modest upward trend over the sample period, along with substantial cross-sectional dispersion. Summary statistics in Table 1 show that the average number of bonds simultaneously traded by a dealer pair is 485.

substantial cross-sectional heterogeneity, which our empirical strategy exploits. The bottom panel displays *WeightDealerOverlap*, which exhibits a similar trend. The average number of bonds simultaneously traded by a dealer pair is 485, as shown in Table 1.

Construction of Transaction Cost Measures: We measure transaction costs using a realized markup relative to a dealer-specific inventory-sourcing benchmark. The measure is defined at the dealer–bond–trade level. Building on [Hendershott and Madhavan \(2015\)](#), for transaction r in bond k executed by dealer i at time t , we construct our transaction cost measure as follows:

$$Spread_{i,k,r,t}^{s_b,s_t} = 10,000 \times Q \times \ln \left(\frac{TradePrice_{i,k,r,t}^{s_t}}{BenchmarkPrice_{i,k,t-\tau}^{s_b}} \right) \quad (22)$$

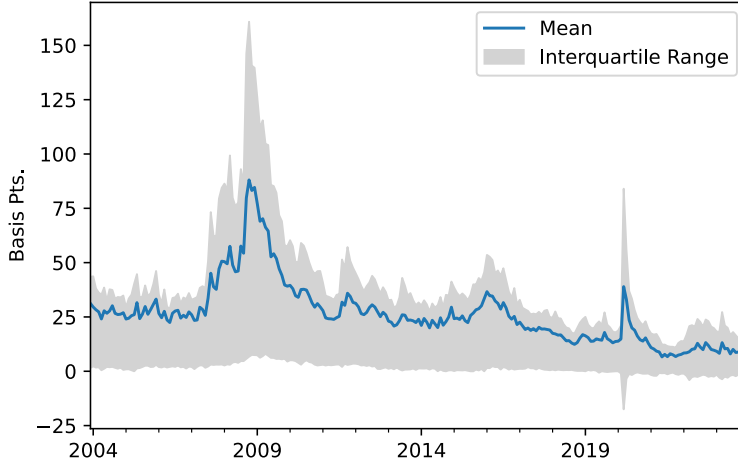
where $s_b, s_t \in \{\text{customer-dealer, interdealer, any}\}$.

We define $Q = 1$ when the *TradePrice* reflects a dealer sale and $Q = -1$ for a dealer purchase. This normalization makes spreads directly interpretable as dealer i ’s effective markup or trading cost, regardless of whether the counterparty is a customer or another dealer.

For each transaction, the benchmark price is constructed using dealer i ’s own past transactions in the same bond on the opposite side of the market within a 24-hour look-back window (i.e., benchmark trades must occur before the relevant transaction and no more than 24 hours earlier). When multiple benchmark trades are available, we use a volume-weighted average within the window. This construction delivers a dealer-specific proxy for the dealer’s contemporaneous marginal valuation (or effective cost of sourcing inventory), smooths idiosyncratic noise in any single trade, and—because it relies only on past transactions—avoids look-ahead bias. A potential concern is that a 24-hour window is more likely to yield a benchmark for relatively liquid bonds, so our baseline sample may tilt toward more liquid securities. In robustness tests, we extend the benchmark window to five business days and show that results are robust to the choice of look-back window.

Beyond the choice of look-back window, a key measurement decision is which trades enter the benchmark price. The transaction-cost measure that maps most directly to the model is what we label the *Any-to-ID* (*any-to-interdealer*) spread. The *Any-to-ID* measure compares any transaction price—whether the counterparty is another dealer or a non-dealer customer—to dealer i ’s recent *interdealer* benchmark price in the same bond. This mapping

Figure 7. Transaction Costs Over Time



Notes: This figure plots the monthly distribution of our baseline transaction-cost measure: the *any-to-interdealer* spread measure compares each trade price to the dealer’s recent interdealer benchmark. The series exhibits strong countercyclicality, with pronounced increases during the Global Financial Crisis and the COVID-19 crisis. Summary statistics appear in Table 1.

is natural given that the model centers on interdealer trading relationships and predicts that MMC compresses interdealer spreads and, through pass-through, customer spreads as well.

In Appendix robustness exercises, we consider three alternative spread measures: (i) an *Any-to-Any* spread that benchmarks each transaction against recent prices from *all* counterparties (dealers and customers), providing a broader measure of execution costs; (ii) a *customer-dealer-to-interdealer* spread that benchmarks customer–dealer transaction prices only against dealers’ recent interdealer benchmark prices; and (iii) an *interdealer-to-customer-dealer* spread, which reverses the direction of the trade–benchmark pairing to verify that our results do not hinge on a particular benchmark construction.

We construct transaction-cost measures at the trade (date–timestamp) level. To match the monthly frequency of our MMC variables, we aggregate these high-frequency measures to the bond–dealer–month level, computing both volume-weighted and equal-weighted monthly averages. Figure 7 shows the resulting monthly distributions of the volume-weighted *any-to-interdealer* measure. The series is strongly countercyclical, with pronounced spikes during

the Global Financial Crisis and the COVID-19 episode. Across bonds, dealers, and time, the mean *any-to-interdealer* spread is 23 basis points. For the three directional variants used in robustness, average *any-to-any*, *customer-dealer-to-interdealer*, and *interdealer-to-customer-dealer* spreads are 27, 34, and 26 basis points. Summary statistics for all four measures appear in Table 1.

4 Empirical Results

To relate our MMC measure to transaction costs, we employ a fixed-effects design that exploits cross-sectional variation within months. At a given point in time, dealers differ in the extent to which they overlap with competitors across other bonds. These differences generate two useful forms of variation. First, among dealers trading the *same bond in the same month*, some dealers face higher MMC than others. Second, for the *same dealer in the same month*, different bonds expose that dealer to different sets of overlapping competitors. Both sources of variation operate within a month, allowing us to hold marketwide conditions fixed and focus on the economic margin highlighted by the theory: how a dealer’s cross-bond overlap affects her pricing behavior in a particular bond.

Let i denote a dealer, k a bond, and t a month. For each dealer–bond–month triple (i, k, t) , we observe a transaction-cost measure constructed from the underlying trade-level data and a measure of multimarket contact, $MMC_{i,k,t}$, which captures how much dealer i overlaps, across other bonds, with the dealers that are active in bond k in month t . We estimate

$$Spread_{i,k,t} = \mu_{k,t} + \mu_{i,t} + \beta_0 MMC_{i,k,t} + \gamma X_{i,k,t} + \varepsilon_{i,k,t}, \quad (23)$$

where $MMC_{i,k,t}$ is either *AvgDealerOverlap* or *WeightDealerOverlap*, standardized to have mean zero and unit standard deviation within each month, and $X_{i,k,t}$ is a vector of additional controls. The bond–month fixed effects $\mu_{k,t}$ absorb all time-varying bond conditions (credit fundamentals, interest-rate exposure, and shifts in demand) common to all dealers quoting that bond in month t . The dealer–month fixed effects $\mu_{i,t}$ absorb time-varying dealer conditions (balance-sheet capacity, risk appetite, and overall market activity) common to all bonds handled by dealer i in month t . With these fixed effects, β_0 is estimated from within-

month variation: comparisons across dealers within a bond-month, and comparisons across bonds within a dealer-month. This design isolates the pricing differences associated with cross-market overlap, holding fixed bond-level and dealer-level conditions at the monthly frequency.

Following Di Maggio et al. (2017), our controls include the log of lagged dealer-bond trading volume, $LogVolume_{i,k,t-1}$, as a proxy for liquidity conditions. Trading activity is strongly negatively related to transaction costs: more active dealer-bond pairs tend to exhibit tighter spreads as search frictions are lower and inventory risks are more easily offset (Bessembinder et al., 2006; Edwards et al., 2007). Lagging volume restricts the control to information available prior to the pricing decision in month t , providing a cleaner comparison across dealers and bonds within a month. Including this measure also allows us to interpret the coefficient on MMC as the effect of multimarket contact above and beyond trading volume, which is useful as the two may be positively correlated.

We also include the number of comparable bonds, $NumCompBonds_{i,k,t}$, as a control for a dealer’s opportunity to exert market power across similar bonds within the same month. The variable is defined as the number of bonds that dealer i trades in month t that fall into the same rating-maturity-industry group as bond k .⁸ A dealer trading many comparable bonds has greater flexibility to adapt pricing across alternative securities within the same category, potentially weakening the disciplining effect of MMC in any single bond. Controlling for $NumCompBonds_{i,k,t}$ therefore allows us to separate the direct disciplining pressure of MMC from the dealer’s potential market power across comparable bonds.

Table 2 reports the baseline estimates. Across all specifications, we find a negative and statistically significant relationship between MMC and transaction costs. The result holds across both MMC constructs, *AvgDealerOverlap* and *WeightDealerOverlap*. The estimates are stable as we move from specifications with bond, time, and dealer fixed effects to those fully saturated with bond-month and dealer-month fixed effects, and remain so when we add controls for lagged dealer-bond trading volume and the number of comparable bonds.

⁸We form nine rating buckets (AAA through C and a group for unrated bonds), four maturity buckets (1–3 years, 4–7 years, 8–15 years, and above 15 years remaining time to maturity), and three industry groups (industrial, financial, and utility).

Table 2. Bond–Dealer Transaction Costs and Multimarket Contact

	(1)	(2)	(3)	(4)	(5)	(6)
Avg. Dealer Overlap	-1.39 (1.58)	-5.90*** (2.05)	-5.31*** (1.95)			
Avg. Dealer Overlap, Weighted				-0.02 (1.36)	-4.54*** (1.51)	-3.94*** (1.45)
Bond FE	✓			✓		
Time FE	✓			✓		
Dealer FE	✓			✓		
Bond-Time FE		✓	✓		✓	✓
Dealer-Time FE		✓	✓		✓	✓
Additional Controls			✓			✓
Obs	1,212,534	1,121,663	1,120,822	1,212,534	1,121,663	1,120,822
<i>Adj.R</i> ²	0.215	0.284	0.285	0.215	0.284	0.285

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table reports baseline estimates of the relationship between MMC and bond–dealer transaction costs. The dependent variable is the *Any-ID* spread, which compares each trade price to the dealer’s recent interdealer benchmark. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. Specifications progressively include bond, dealer, and time fixed effects, as well as bond–month and dealer–month fixed effects. Additional controls include lagged dealer–bond trading volume and standard trade-level covariates. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The magnitudes are economically large. A one-standard-deviation increase in MMC is associated with a reduction in transaction costs of roughly 4 to 6 basis points, depending on the benchmark and the MMC measure. Relative to an average spread of about 27 basis points, these estimates imply a decline of roughly 15 to 22 percent. Dealers with greater cross-bond overlap charge systematically tighter spreads, consistent with the theoretical prediction that MMC constrains dealers’ ability to extract markups.

We next verify that the baseline MMC–spread relationship is robust across subsamples. Online Appendix Table B.1 reports estimates separately for investment-grade and high-yield bonds. In both segments, MMC enters with a negative and statistically significant coefficient. The effect is larger for high-yield bonds—roughly 5 basis points per standard deviation of MMC, compared with 3 basis points for investment-grade bonds. This pattern is consistent with the model: high-yield bonds on average exhibit greater information asymmetry and trade less frequently, precisely the conditions under which Proposition 3 predicts that MMC has the largest marginal effect.

Online Appendix Table B.1 also splits the sample into bonds with below-five-year and

above-five-year remaining maturities. The MMC coefficient is negative and economically significant in both groups. A one-standard-deviation increase in MMC reduces transaction costs by roughly 6–7 basis points for longer-maturity bonds and by 3–4 basis points for shorter-maturity bonds. The MMC–spread relationship is consistently negative across bond maturity.

Online Appendix Table B.2 extends these results across issuer industries and shows similarly stable estimates. Taken together, these subsample analyses show that the MMC effect is present across diverse segments of the corporate bond market and displays a stable economic magnitude across investment-grade versus high-yield bonds, short- versus long-maturity bonds, and different industries.

Furthermore, in the Online Appendix, we implement a series of robustness exercises that examine how alternative constructions of the MMC and transaction cost measures affect our findings. Online Appendix Table B.3 shows that the estimates remain stable when the MMC look-back window is reduced from twelve months to six or even one month, allowing MMC to vary over shorter horizons and capturing more transient patterns in dealer participation. We also construct an alternative MMC measure that scales dealer overlap by the number of bonds a dealer trades rather than by the number of dealers active in each bond, thereby incorporating heterogeneity in dealer scope. This normalization leaves the estimates essentially unchanged.

Online Appendix Table B.3 further shows that our results are robust to alternative constructions of the benchmark price and the monthly aggregation of transaction costs. Our baseline benchmark uses dealer i ’s own opposite-side trades within the prior 24 hours. Because bonds that trade frequently are more likely to generate such benchmarks, the baseline sample may tilt toward more liquid securities. To assess sensitivity, we relax the timing restriction and construct an alternative benchmark based on the dealer’s average purchase price over the prior seven days. The resulting estimates are nearly identical to the baseline. The results are also insensitive to how spreads are aggregated within a month: recomputing dealer–bond–month spreads using equal-weighted averages (rather than volume-weighted averages) yields MMC coefficients that are essentially unchanged.

Table C.1 shows that the MMC–spread relationship is not driven by which trades enter

the spread construction. We begin with an *Any–Any* spread that benchmarks each trade to recent prices from *all* counterparties (dealers and customers). We then turn to two benchmark-swapping measures: *CD–ID*, which benchmarks customer–dealer trades to recent interdealer prices, and *ID–CD*, which benchmarks interdealer trades to recent customer–dealer prices. Across all three constructions, the MMC coefficient is negative, similar in magnitude, and statistically significant, indicating that higher MMC is associated with lower spreads regardless of whether benchmarks are drawn from dealer trades, customer trades, or the pooled trading environment.

Finally, we extend all the robustness and subsample exercises mentioned above to these three spread constructions. Online Appendix Tables C.2–C.6 show that the magnitude, sign, and significance of the MMC coefficients remain stable across alternative benchmark definitions. These results indicate that the relationship between MMC and transaction costs is not sensitive to the construction of either the MMC measure or the transaction-cost measure and emerges consistently across a wide range of specifications.

Table 3 splits the sample by Kyle’s λ , our proxy for the information content of order flow. A large λ means that trades move prices more, indicating that order flow is more likely to reflect information rather than liquidity.⁹ In the model, λ maps directly to a higher probability of informed trading. When informed trading is more likely, the market-making dealer faces a steeper adverse-selection problem and a stronger temptation to charge the static monopoly spread. Proposition 1 shows why this matters: a higher informed-trading probability tightens the incentive constraint by reducing the cooperation capacity $C(s)$. The continuation value of future cooperation does less to offset the one-shot gain from deviating today. In this environment, any additional slack from MMC becomes more valuable because it enlarges the set of spreads that can be supported in equilibrium. Put differently, MMC disciplines dealers’ behavior exactly where the incentives to deviate are strongest.

Point estimates line up with this hypothesis, although the values are close in magnitude. In the above-median λ subsample, a one-standard-deviation increase in MMC lowers transaction costs by 5 to 6 basis points, compared with 3 to 5 basis points in the below-median

⁹We compute λ in the spirit of Collin-Dufresne and Fos (2015), estimating the coefficient from a regression of price change on signed order flow. We then classify bonds based on whether their estimate in a given month is above or below the median value of λ in that month.

Table 3. Bond–Dealer Transaction Costs and Multimarket Contact: Heterogeneity by Adverse Selection and Trading Frequency

This table reports subsample estimates of the MMC–transaction-cost relationship. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. Columns (1)–(4) split bonds by below- versus above-median Kyle’s λ , a proxy for the information content of order flow and the severity of adverse selection. Columns (5)–(8) split bonds by below- versus above-median monthly trading frequency. All specifications include bond–time and dealer–time fixed effects and the baseline controls. Standard errors are two-way clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Below-med. λ	Above-med. λ	Below-med. λ	Above-med. λ	Below-med. freq.	Above-med. freq.	Below-med. freq.	Above-med. freq.
Avg. Dealer Overlap	-4.64*** (1.79)	-5.60** (2.30)			-7.46*** (1.79)	-4.99** (2.06)		
Avg. Dealer Overlap, Weighted			-2.82** (1.32)	-4.56*** (1.55)			-5.02*** (1.30)	-3.73** (1.53)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓
Obs	699,506	404,187	699,506	404,187	217,921	896,698	217,921	896,698
<i>Adj. R</i> ²	0.271	0.287	0.271	0.287	0.241	0.291	0.241	0.291

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

λ subsample. When information frictions make cooperative pricing fragile, MMC continues to deliver significant and typically larger marginal effects.

Table 3 also reports results when splitting by trading frequency. In our framework, higher trading frequency does not change the economic environment of the stage game. It simply means that dealers trade with each other more often in a given asset. This mechanical increase in the arrival rate of future interactions raises the effective discount factor and, with it, the value of future cooperation relative to the one-shot gain from charging a higher spread. Proposition 3 formalizes this logic, proving that the effect of MMC on spreads weakly decreases with trading frequency.

The empirical patterns line up with this prediction. We split the sample by trading intensity at the median, defining bonds with above-median trading frequency per month as frequently traded. For these bonds, a one-standard-deviation increase in MMC reduces transaction costs by 4 to 5 basis points. For less active bonds, the corresponding effect is 5 to 7 basis points. The interpretation is straightforward: when dealers expect to trade with each other frequently in the same asset, the continuation value of cooperation is larger, and the incremental discipline provided by MMC is weaker. In thin markets, where interactions are sporadic, the incentive constraint is tighter and the marginal value of MMC is correspondingly higher.

5 Shift–Share Instrument

We complement our fixed-effects design with a shift–share instrument based on abnormal issuance waves during COVID-19. The key idea is that issuance expands the set of active securities within a segment. When more bonds are issued, dealers active in the segment trade with each other across a larger menu of bonds, mechanically increasing their overlap and, hence, MMC. Because dealer specialization and market segmentation are persistent (Cohen, 2024; Baumann, Kakhbod, Livdan, Nazemi, and Schürhoff, 2025), dealers with larger pre-period footprints in the affected segments are more exposed to these issuance-driven increases in MMC. This generates differential changes in MMC across dealers within the same bond–month that are driven by segment-level issuance shocks rather than by dealers’

contemporaneous trading decisions.

Let g index bond-market segments defined by *rating* (IG versus HY) $\times$ *industry*. Let $Iss_{g,t}$ denote the number of bonds issued in segment g in month t . We construct the segment-month shock as the *abnormal number of bonds issued*, relative to the same calendar month over the prior five years:

$$AbIss_{g,t} = Iss_{g,t} - \frac{1}{5} \sum_{\ell=1}^5 Iss_{g,t-12\ell}. \quad (24)$$

We use issuance *counts* (rather than issuance volume) because the mechanism in the model operates through the number of distinct securities in which dealers can interact and discipline one another. Consistent with this mapping, the MMC measure that aligns most directly with the instrument is $AvgDealerOverlap_{i,k,t}$, which is based on overlap in interaction across bonds rather than revenue weights.

We interact these segment-month shocks with predetermined dealer exposure shares. Our baseline share is dealer i 's pre-period activity share in segment g over 2015–2019:

$$Share_{i,g}^{(1)} = \frac{\sum_{\tau \in \mathcal{T}^{pre}} Vol_{i,g,\tau}}{\sum_{g'} \sum_{\tau \in \mathcal{T}^{pre}} Vol_{i,g',\tau}}, \quad \mathcal{T}^{pre} = \{2015, \dots, 2019\}, \quad (25)$$

where $Vol_{i,g,\tau}$ measures dealer activity in TRACE (e.g., trading volume or number of trades) in segment g in month τ . As a robustness check, we also construct a month-of-year variant that purges seasonality in dealer activity:

$$Share_{i,g,m(t)}^{(2)} = \frac{\sum_{\tau \in \mathcal{T}^{pre}: m(\tau)=m(t)} Vol_{i,g,\tau}}{\sum_{g'} \sum_{\tau \in \mathcal{T}^{pre}: m(\tau)=m(t)} Vol_{i,g',\tau}}, \quad (26)$$

where $m(t) \in \{1, \dots, 12\}$ indexes the calendar month.

For a dealer–bond–month observation (i, k, t) , let $g(k)$ denote the segment of bond k . We define two instruments:

$$Z_{i,k,t}^{(1)} = Share_{i,g(k)}^{(1)} \times AbIss_{g(k),t}, \quad Z_{i,k,t}^{(2)} = Share_{i,g(k),m(t)}^{(2)} \times AbIss_{g(k),t}. \quad (27)$$

$Z_{i,k,t}^{(s)}$ is large when (i) segment $g(k)$ experiences an issuance wave in month t , and (ii) dealer

Table 4. Bond–Dealer Transaction Costs and Multimarket Contact — IV Regressions

This table reports 2SLS estimates that instrument dealer–bond–month multimarket contact with a shift–share exposure to abnormal COVID-era issuance waves. The shift is segment-month abnormal issuance, $AbIss_{g,t}$, defined as the number of bonds issued in segment g (rating $\times$ industry) at time t minus the average issuance in the same calendar month over the prior five years. The shares are dealers’ pre-period (2015–2019) activity weights in each segment: $Share_{i,g}^{(1)}$ uses overall pre-period activity, while $Share_{i,g,m(t)}^{(2)}$ conditions on calendar month to purge seasonality. The instrument for observation (i, k, t) is $Z_{i,k,t}^{(s)} = Share^{(s)} \times AbIss_{g(k),t}$. Panel A reports second-stage estimates for $Spread_{i,k,t}^{Any-ID}$ using the fitted $AvgDealerOverlap$; Panel B reports first-stage estimates for $AvgDealerOverlap$, standardized each month to have mean zero and variance one. All specifications include bond–month and dealer–month fixed effects and the baseline controls. Standard errors are two-way clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

I. 2SLS second stage estimates		
Any-ID Cost		
	(1)	(2)
Instrumented Avg. Dealer Overlap	-168.87* (87.58)	-174.30* (91.14)
Bond-Time FE	✓	✓
Dealer-Time FE	✓	✓
Additional Controls	✓	✓
II. 2SLS first stage estimates		
MMC Basic Score		
	(1)	(2)
$Share_{i,g(k),m(t)}^{(1)} \times AbIss_{g(k),t}$	0.02*** (0.01)	
$Share_{i,g(k),m(t)}^{(2)} \times AbIss_{g(k),t}$		0.02*** (0.01)
Bond-Time FE	✓	✓
Dealer-Time FE	✓	✓
Additional Controls	✓	✓
Obs	38,180	38,180
Adj. R^2	0.983	0.983

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

i had a larger pre-period footprint in that segment. Since the shares are fixed prior to COVID-19, all time variation comes from segment-level issuance shocks.

We estimate 2SLS versions of the baseline fixed-effects design:

$$AvgDealerOverlap_{i,k,t} = \mu_{k,t} + \mu_{i,t} + \pi Z_{i,k,t} + \Gamma' X_{i,k,t} + u_{i,k,t}, \quad (28)$$

$$Spread_{i,k,t}^{Any-ID} = \mu_{k,t} + \mu_{i,t} + \beta \widehat{AvgDealerOverlap}_{i,k,t} + \Gamma' X_{i,k,t} + \varepsilon_{i,k,t}, \quad (29)$$

where $AvgDealerOverlap_{i,k,t}$ is standardized within each month to have mean zero and unit variance, and $X_{i,k,t}$ is the baseline set of controls. Bond-month fixed effects $\mu_{k,t}$ absorb all time-varying bond conditions—including any direct effects of issuance on liquidity, demand, and fundamentals at the bond level—while dealer-month fixed effects $\mu_{i,t}$ absorb time-varying dealer conditions (balance-sheet capacity, funding, risk appetite, and overall activity). Identification comes from differential exposure to the same segment-month issuance shocks across dealers trading the same bond in the same month.

Table 4 reports the IV estimates. The first stage is strong: issuance exposure increases $AvgDealerOverlap$ with a coefficient of approximately 0.02 under either share definition, confirming that issuance waves raise MMC for dealers with larger pre-period footprints in the affected segments. The 2SLS second-stage coefficients on instrumented $AvgDealerOverlap$ are -169 and -174 . The sign confirms the central prediction: exogenous increases in MMC reduce transaction costs. The IV point estimates are an order of magnitude larger than the OLS estimates in Table 2. Two features of the design help explain this gap. First, the instrument isolates variation in MMC driven by the extensive margin—new bonds entering a segment—which may have a larger marginal effect on dealer incentives than the intensive-margin variation that also enters the OLS. Second, the 2SLS estimates identify a local average treatment effect for dealer-bond pairs whose MMC shifted because of COVID-era issuance in their segment. These compliers are concentrated in investment-grade segments that experienced the largest issuance surges, where the scope for MMC to tighten pricing may be particularly large.

6 Conclusions

Concentrated intermediation in corporate bond markets need not imply high transaction costs. We show that multimarket contact among dealers—the overlap in their activity across many bonds—constrains pricing by linking the consequences of a deviation in any one bond to retaliation across all shared bonds. This discipline matters most in illiquid or information-sensitive bonds, where dealers trade with each other too infrequently for within-bond retaliation alone to deter deviations. Because tighter quotes by high-MMC dealers raise the value of cooperation for all intermediaries in that bond, the effect operates market-wide and passes through to customers.

The empirical evidence confirms these predictions. Dealers with greater cross-bond overlap charge lower interdealer spreads, with a one-standard-deviation increase in MMC associated with a 4–6 basis point decline relative to a mean of 27 basis points. The effect is present across investment-grade and high-yield bonds, short and long maturities, and different issuer industries, and is robust to alternative constructions of both the MMC measure and the transaction-cost benchmark. A shift-share instrument exploiting COVID-era issuance waves and pre-period dealer specialization confirms that the relationship is causal.

These findings suggest that market structure and market conduct can diverge sharply in OTC markets. A market that looks concentrated by standard measures—few dealers, high volume shares—can nonetheless deliver competitive pricing when those dealers repeatedly trade with each other across a broad set of securities. Traditional concentration indices may therefore be poor guides to pricing power; what matters is the breadth of cross-bond interaction that makes rent extraction costly to sustain. This view carries practical implications: policies that fragment dealer participation across securities—whether by restricting proprietary trading, segmenting markets by platform, or raising the cost of maintaining broad dealer networks—risk weakening the very linkages that discipline pricing. More broadly, market-design reforms should be evaluated not only for their static effects on transparency and competition, but also for whether they preserve or erode the repeated-interaction structure that keeps transaction costs low.

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Online Appendix

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A Proofs

This appendix presents the proofs of the results presented in the main text.

Proof of Lemma 1. The profit of the market-making dealer $\pi_M(s)$ is given by (1). The direct computation confirms that $s^* = \arg \max_{s \geq 0} \pi_M(s)$ and $\pi_M(s^B) = 0$. $\square$

Proof of Proposition 1. The cooperation capacity is given by (6). Substituting, $\pi_M(s)$ and $\Pi(s)$ from (1) and (4), respectively, obtain

$$C(s) = -\frac{1}{2} \left((2 - \alpha) + (1 - \alpha) \frac{\delta}{1 - \delta} \right) s^2 + s + \left(-\frac{\alpha}{2} + \frac{\delta(1 - \alpha)}{2(1 - \delta)(2 - \alpha)^2} - \frac{(1 - \alpha)^2}{2(2 - \alpha)} \right), \quad (\text{A.1})$$

which is a quadratic function in s . Thus, the equation $C(s) = 0$ has at most two roots, s^* and s^W , with $C(s) > 0$ for all $s \in (s^W, s^*)$.

By the implicit function theorem,

$$\frac{ds^W}{d\delta} = -\frac{\frac{\partial C}{\partial \delta}}{\frac{\partial C}{\partial s^W}} < 0 \quad (\text{A.2})$$

because $\frac{\partial C}{\partial \delta} = \frac{1}{(1 - \delta)^2} (\Pi(s) - \Pi(s^*)) > 0$ and $\frac{\partial C}{\partial s^W} > 0$ at $s = s^W$. Similarly,

$$\frac{ds^W}{d\alpha} = -\frac{\frac{\partial C}{\partial \alpha}}{\frac{\partial C}{\partial s^W}} > 0 \quad (\text{A.3})$$

because $\frac{\partial C}{\partial \alpha} = -\frac{2-\alpha-2\delta(1-\alpha)-(2-\alpha)^3(s^W)^2}{2(2-\alpha)^3(1-\delta)} < 0$ and $\frac{\partial C}{\partial s^W} > 0$ at $s = s^W$. $\square$

Proof of Corollary 1. The cooperation capacity $C(s)$ is given by (6). Because $\Pi(s) - \Pi(s^*) > 0$ for any $s \in [0, s^*)$, it follows that $C(s)$ strictly increases with δ for such s . $\square$

Proof of Proposition 2. By the proof of Proposition 1, $C^k(s^k)$ in (9) is a quadratic function. Thus, the smallest s^k solving $F(s^k, MMC^k) \equiv C^k(s^k) + MMC^k = 0$, decreases with MMC^k . $\square$

Proof of Corollary 2. Taken separately, the incentive constraint in each of the two markets is given by (8). If the two markets are identical, these two incentive constraints are identical. Thus, when dealers cooperate on the same spreads in both markets, $s^{k1} = s^{k2}$, either the two constraints are simultaneously slack, in which case the cooperation capacity in both markets is positive but the welfare can be improved by lowering both spreads, possibly up to $s^{k1} = s^{k2} = 0$, or the two constraints are simultaneously binding, in which case the cooperation capacity in both markets is zero. $\square$

Proof of Proposition 3. Consider $F(s^k, MMC^k)$ defined in the proof of Proposition 2. By the implicit function theorem,

$$\frac{ds^k}{dMMC^k} = -\frac{\frac{\partial F}{\partial MMC^k}}{\frac{\partial F}{\partial s^k}} = \frac{1}{\left((2-\alpha) + (1-\alpha)\frac{\delta}{1-\delta}\right)s^k - 1} < 0 \quad (\text{A.4})$$

because $\frac{\partial F}{\partial s^k} = 1 - \left((2-\alpha) + (1-\alpha)\frac{\delta}{1-\delta}\right)s^k > 0$ for the smallest s^k solving $F(s^k, MMC^k) = 0$. Define $D \equiv \left(\left((2-\alpha) + (1-\alpha)\frac{\delta}{1-\delta}\right)s^k\right)^2$. Now compute

$$\frac{dD}{d\delta} = \frac{2(1-\alpha)}{(1-\delta)^2} \left(MMC^k + \frac{\delta(1-\alpha)}{(1-\delta)(2-\alpha)^2} \right) > 0, \quad (\text{A.5})$$

which means that $\left| \frac{ds^k}{dMMC^k} \right|$ decreases with δ . Similarly,

$$\frac{dD}{d\alpha} = -2 \left(\frac{MMC^k}{(1-\delta)} + \frac{\delta^2(1-\alpha)}{(1-\delta)^2(2-\alpha)^3} \right) < 0, \quad (\text{A.6})$$

which means that $\left| \frac{ds^k}{dMMC^k} \right|$ increases with α . $\square$

Appendix B. Robustness Checks

Table B.1. MMC and Transaction Costs — By Rating and maturity

This table reports subsample estimates of the MMC–spread relationship for investment-grade and high-yield bonds as well as splitting bonds with below-five-year and above-five-year remaining maturities. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Coefficients represent the change in transaction costs associated with a one-standard-deviation increase in MMC within each rating group. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Investment-Grade vs. High-Yield				Maturity: $\leq 5Y$ vs. $> 5Y$			
	IG (1)	HY (2)	IG (3)	HY (4)	$\leq 5Y$ (5)	$> 5Y$ (6)	$\leq 5Y$ (7)	$> 5Y$ (8)
Avg. Dealer Overlap	-3.71** (1.63)	-5.12* (3.02)			-3.88* (2.16)	-7.04*** (2.06)		
Avg. Dealer Overlap, Weighted			-2.26** (0.97)	-5.10** (2.25)			-3.07 (1.87)	-5.78*** (1.26)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓
Obs	862,224	254,157	862,224	254,157	586,700	528,724	586,700	528,724
Adj. R^2	0.305	0.250	0.305	0.250	0.332	0.259	0.332	0.259

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.2. MMC and Transaction Costs — By Industry

This table presents subsample estimates of the MMC–spread relationship across issuer industries. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. MMC coefficients represent the within-industry relationship between multimarket contact and transaction costs. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any-ID Cost					
	(1) Industrials	(2) Finance	(3) Utility	(4) Industrials	(5) Finance	(6) Utility
Avg. Dealer Overlap	-4.68*** (1.80)	-6.64** (2.67)	-3.50 (3.40)			
Avg. Dealer Overlap, Weighted				-3.64*** (1.22)	-4.38** (2.01)	-2.09 (2.49)
Bond-Time FE	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓
Obs	689,805	364,411	37,270	689,805	364,411	37,270
Adj.R ²	0.275	0.327	0.317	0.275	0.327	0.317

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.3. Robustness to Alternative MMC and Transaction-Cost Constructions

This table reports robustness tests using (i) alternative definitions of multimarket contact (MMC), including shorter lookback windows and a normalization based on the number of bonds traded by each dealer, and (ii) alternative constructions of transaction costs, including a shorter benchmark window (up to one week) and equal-weighted monthly spreads. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Coefficients measure the association between MMC and the *Any-to-ID* transaction-cost measure under each construction. Standard errors are clustered at the dealer and bond-year-month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Alternative MMC constructions			Alternative cost constructions			
	(1) 6M lookback	(2) 1M lookback	(3) over # bonds	(4) Up to 1 Week	(5) Up to 1 Week	(6) Equal-Weighted	(7) Equal-Weighted
Avg. Dealer Overlap	-3.68*** (1.38)	-1.38*** (0.49)	-2.63 (2.23)	-5.43*** (2.04)		-5.01** (2.14)	
Avg. Dealer Overlap, Weighted					-4.00** (1.56)		-4.40*** (1.54)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓
Obs	907,788	311,340	1,120,822	1,253,658	1,253,658	1,120,822	1,120,822
Adj.R ²	0.287	0.278	0.285	0.201	0.201	0.307	0.307

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C CD–ID and ID–CD: Baseline Results, Subsample Analysis and Robustness

This appendix presents subsample and robustness results for the CD–ID and ID–CD transaction-cost specifications. These specifications evaluate the MMC–spread relationship using alternative benchmark constructions—customer–dealer prices when the dealer purchases (CD–ID) and interdealer prices when the dealer sells (ID–CD). All regressions follow the baseline empirical design from the main text and include the full set of bond, dealer, and time fixed effects as appropriate.

Table C.1. Baseline MMC–Spread Estimates: Alternative Spread Constructions

This table reports estimates of the MMC–spread relationship using alternative benchmark constructions that swap the market used to form the reference price. *CD–ID* benchmarks customer–dealer transaction prices to recent interdealer prices, while *ID–CD* benchmarks interdealer transaction prices to recent customer–dealer prices. The *Any–Any* measure benchmarks each transaction to recent prices from all counterparties. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any–Any Cost						CD–ID Cost						ID–CD Cost					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Avg. Dealer Overlap	-1.72 (1.37)	-7.65*** (2.61)	-6.91*** (2.47)				-3.34* (1.96)	-12.01*** (2.60)	-11.04*** (2.43)				-3.41** (1.57)	-10.76*** (3.35)	-10.58*** (3.30)			
Avg. Dealer Overlap, Weighted				-1.36 (1.39)	-5.46*** (1.88)	-4.83*** (1.83)				-1.76 (1.83)	-8.42*** (1.97)	-7.48*** (1.86)				-4.05** (1.97)	-8.55*** (2.30)	-8.47*** (2.28)
Bond FE	✓			✓			✓			✓			✓			✓		
Time FE	✓			✓			✓			✓			✓			✓		
Dealer FE	✓			✓			✓			✓			✓			✓		
Bond–Time FE		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓
Dealer–Time FE		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓
Additional Controls			✓			✓			✓			✓			✓			✓
Obs	1,751,888	1,671,779	1,670,403	1,751,888	1,671,779	1,670,403	829,586	730,646	730,164	829,586	730,646	730,164	715,316	613,787	613,340	715,316	613,787	613,340
Adj. R ²	0.256	0.336	0.337	0.256	0.336	0.337	0.275	0.354	0.355	0.275	0.354	0.355	0.222	0.297	0.297	0.223	0.297	0.298

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.2. MMC and Spreads by Rating Tier: Alternative Spread Constructions

This table reports estimates of the MMC–spread relationship separately for investment-grade and high-yield bonds using alternative benchmark constructions: *Any–Any*, *CD–ID*, and *ID–CD*. Splitting by rating tier allows us to assess whether multimarket contact matters differently in segments with systematically different trading frictions, including baseline spreads, adverse selection, and dealer interaction frequency. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any–Any Cost				CD–ID Cost				ID–CD Cost			
	(1) IG	(2) HY	(3) IG	(4) HY	(5) IG	(6) HY	(7) IG	(8) HY	(9) IG	(10) HY	(11) IG	(12) HY
Avg. Dealer Overlap	-6.45*** (1.96)	-2.68 (2.51)			-9.44*** (2.20)	-8.86*** (2.69)			-10.37*** (2.62)	-1.33 (3.39)		
Avg. Dealer Overlap, Weighted			-3.72*** (1.30)	-2.38 (1.85)			-6.20*** (1.51)	-6.37*** (1.71)			-7.34*** (1.78)	-1.56 (2.40)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	1,252,918	412,942	1,252,918	412,942	573,157	153,091	573,157	153,091	486,390	123,862	486,390	123,862
<i>Adj. R</i> ²	0.352	0.327	0.352	0.327	0.380	0.301	0.380	0.301	0.325	0.245	0.325	0.245

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.3. MMC and Spread by Remaining Maturity: Alternative Spread Constructions

This table reports MMC–spread estimates separately for bonds with at most five years remaining maturity and for bonds with more than five years remaining maturity, using the *Any–Any*, *CD–ID*, and *ID–CD* spread constructions. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any–Any Cost				CD–ID Cost				ID–CD Cost			
	(1) Avg. Overlap ≤5Y	(2) Avg. Overlap >5Y	(3) Weighted Overlap ≤5Y	(4) Weighted Overlap >5Y	(5) Avg. Overlap ≤5Y	(6) Avg. Overlap >5Y	(7) Weighted Overlap ≤5Y	(8) Weighted Overlap >5Y	(9) Avg. Overlap ≤5Y	(10) Avg. Overlap >5Y	(11) Weighted Overlap ≤5Y	(12) Weighted Overlap >5Y
Avg. Dealer Overlap	-5.88** (2.60)	-6.18*** (2.04)			-8.72*** (2.30)	-10.11*** (2.50)			-8.85*** (2.84)	-4.15 (3.17)		
Avg. Dealer Overlap, Weighted			-4.81** (2.16)	-4.46*** (1.46)			-5.66*** (2.05)	-6.99*** (1.42)			-7.39*** (2.21)	-3.41** (1.69)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	831,745	833,406	831,745	833,406	415,039	310,427	415,039	310,427	348,786	260,969	348,786	260,969
Adj. R ²	0.376	0.324	0.377	0.324	0.369	0.334	0.368	0.334	0.275	0.304	0.275	0.304

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.4. MMC–Spread Estimates by Issuer Industry and Spread Construction

This table reports MMC estimates separately for industrial, financial, and utility sectors under three spread constructions: *Any–Any*, which benchmarks each trade to recent prices from all counterparties; *CD–ID*, which benchmarks customer–dealer trades to recent interdealer prices; and *ID–CD*, which benchmarks interdealer trades to recent customer–dealer prices. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any–Any Cost						CD–ID Cost						ID–CD Cost					
	(1) Ind.	(2) Fin.	(3) Util.	(4) Ind.	(5) Fin.	(6) Util.	(7) Ind.	(8) Fin.	(9) Util.	(10) Ind.	(11) Fin.	(12) Util.	(13) Ind.	(14) Fin.	(15) Util.	(16) Ind.	(17) Fin.	(18) Util.
Avg. Dealer Overlap	-5.62** (2.28)	-9.58*** (3.39)	-8.80*** (3.03)				-9.65*** (2.45)	-13.09*** (3.29)	-12.64*** (4.49)				-8.16** (3.46)	-15.35*** (3.98)	0.15 (5.61)			
Avg. Dealer Overlap, Weighted				-4.01** (1.63)	-6.25** (2.45)	-4.00* (2.18)				-6.10*** (1.68)	-9.23*** (2.50)	-8.40** (3.55)				-6.11*** (2.11)	-12.32*** (2.89)	-2.33 (5.05)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	1,041,522	524,745	64,124	1,041,522	524,745	64,124	435,613	252,687	21,883	435,613	252,687	21,883	362,634	217,878	16,365	362,634	217,878	16,365
Adj. R ²	0.328	0.380	0.332	0.328	0.380	0.332	0.346	0.390	0.398	0.345	0.390	0.398	0.295	0.319	0.309	0.295	0.319	0.309

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.5. Alternative MMC Measures under alternative spread constructions

This table reports robustness tests using alternative constructions of the multimarket-contact (MMC) measure, including shorter lookback windows (6 months and 1 month) and an alternative normalization based on the number of bonds traded by the dealer. Estimates are shown for the *Any-Any*, *CD-ID*, and *ID-CD* spread measures. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond-year-month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any-Any Cost			CD-ID Cost			ID-CD Cost		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Avg. Dealer Overlap (6M lookback)	-4.82** (1.95)			-7.81*** (1.87)			-8.67*** (2.68)		
Avg. Dealer Overlap (1M lookback)		-1.35** (0.67)			-2.13*** (0.70)			-1.90* (1.01)	
Avg. Dealer Overlap (over # bonds)			-7.79** (3.22)			-9.69*** (2.48)			-14.81*** (3.51)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	1,390,193	546,631	1,670,403	583,938	189,296	730,164	495,739	169,134	613,340
Adj.R ²	0.335	0.318	0.337	0.356	0.347	0.355	0.291	0.250	0.298

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.6. Transaction-Cost Robustness Under alternative spread measures

This table reports robustness to alternative constructions of transaction costs under alternative spread definitions. We vary (i) the benchmark window used to construct the reference price (extending the lookback to up to one week) and (ii) the monthly aggregation scheme (equal-weighted rather than volume-weighted averages). MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond-year-month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any-Any Cost				CD-ID Cost				ID-CD Cost			
	(1) 1-week window	(2)	(3) Equal-weighted	(4)	(5) 1-week window	(6)	(7) Equal-weighted	(8)	(9) 1-week window	(10)	(11) Equal-weighted	(12)
Avg. Dealer Overlap	-7.34*** (2.49)		-6.72** (2.66)		-10.97*** (2.51)		-10.24*** (2.29)		-10.94*** (3.23)		-9.69*** (3.21)	
Avg. Dealer Overlap, Weighted		-5.08*** (1.82)		-5.18*** (1.90)		-6.89*** (1.84)		-7.63*** (1.81)		-8.23*** (2.16)		-7.54*** (2.18)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	1,705,497	1,705,497	1,670,403	1,670,403	885,675	885,675	730,164	730,164	791,961	791,961	613,340	613,340
<i>Adj.R</i> ²	0.300	0.300	0.355	0.355	0.278	0.278	0.396	0.396	0.225	0.225	0.317	0.317

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.7. MMC–Spread Estimates by Kyle’s λ : alternative spread measures

This table reports MMC estimates for CD–ID and ID–CD models split by the magnitude of Kyle’s λ , which proxies for the price impact of order flow. Higher- λ bonds may exhibit stronger information effects, while lower- λ bonds reflect more mechanical liquidity provision. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any–Any Cost				CD–ID Cost				ID–CD Cost			
	(1) Below-med. λ	(2) Above-med. λ	(3) Below-med. λ	(4) Above-med. λ	(5) Below-med. λ	(6) Above-med. λ	(7) Below-med. λ	(8) Above-med. λ	(9) Below-med. λ	(10) Above-med. λ	(11) Below-med. λ	(12) Above-med. λ
Avg. Dealer Overlap	-7.20*** (2.52)	-5.85** (2.60)		-10.03***	-12.02*** (2.22)	(3.05)		-11.58***	-8.36** (3.06)	(4.14)		
Avg. Dealer Overlap, Weighted			-4.36** (1.71)	-4.77** (2.00)			-6.53*** (1.77)	-8.83*** (2.05)			-8.53*** (2.05)	-8.16*** (2.92)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	699,506	404,187	699,506	404,187	461,927	260,195	461,927	260,195	400,303	208,192	400,303	208,192
Adj. R^2	0.271	0.287	0.271	0.287	0.331	0.349	0.331	0.349	0.252	0.315	0.252	0.315

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.8. MMC–Spread Estimates by Trading Frequency: alternative spread measures

This table splits the sample based on monthly trading frequency for each bond. In the table, *infrequent* refers to monthly below-median frequency, whereas *frequent* refers to monthly above-median frequency. MMC is measured using either the unweighted average dealer overlap (*Avg. Dealer Overlap*) or the revenue-weighted measure (*Avg. Dealer Overlap, Weighted*), standardized each month to have mean zero and variance one. All specifications include the full set of fixed effects and controls used in Table 2. Standard errors are clustered at the dealer and bond–year–month levels. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Any–Any Cost				CD–ID Cost				ID–CD Cost			
	(1) Infrequent	(2) Frequent	(3) Infrequent	(4) Frequent	(5) Infrequent	(6) Frequent	(7) Infrequent	(8) Frequent	(9) Infrequent	(10) Frequent	(11) Infrequent	(12) Frequent
Avg. Dealer Overlap	-7.16*** (2.13)	-7.00*** (2.63)			-7.83*** (2.45)	-11.28*** (2.60)			-7.78** (3.22)	-10.92*** (3.45)		
Avg. Dealer Overlap, Weighted			-4.25*** (1.54)	-5.08*** (1.93)			-5.90*** (1.97)	-7.67*** (1.98)			-4.11* (2.09)	-9.20*** (2.36)
Bond-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dealer-Time FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	217,921	896,698	217,921	896,698	130,052	594,453	130,052	594,453	93,238	515,730	93,238	515,730
<i>Adj.R</i> ²	0.241	0.291	0.241	0.291	0.243	0.374	0.243	0.374	0.165	0.313	0.165	0.313

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

