Which Intermediary Costs Matter for Asset Prices?

Bridging Theory and Empirical Research in Finance FTG Conference

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Introduction

Intermediary balance sheet capacity is limited by different types of costs:

- Risk-based costs: penalize portfolio risk *(e.g., Fed's CCAR, VaR limits)*
- Gross position costs: penalize position size *(e.g., SLR, margin requirements)*

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Arbitrage spreads widely used to measure intermediary capacity

e.g. Treasury-OIS, cash-future basis, CIP deviations etc...

Wider spread $\longrightarrow$ Arbitrage "breaks" $\longrightarrow$ Limited intermediary sector capacity

- Policymakers use spreads as barometers of market dysfunction (and need to intervene)

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2. Empirically, risk-based costs are the main friction affecting price levels

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1. Spreads largely miss risk-based cost, and mainly reflect gross position cost
2. Empirically, risk-based costs are the main friction affecting price levels

⇒ Spreads may miss the dominant source of price-level distortions

This Paper

1. A joint model of price levels and spreads with two intermediation costs

Risk costs penalize portfolio risk
⇒ disproportionately affect levels

Gross position costs penalize position size
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Gross position costs penalize position size
$\Rightarrow$ mostly affect spreads

2. A sufficient statistic approach quantifies relative importance of costs

- Demand shock $\longrightarrow$ price impact $\longrightarrow$ price impact decays to offer excess returns
- Initial decay rates = compensation for liquidity provision = intermediation costs
- different decay rates between levels and spreads $\implies$ different strength of two costs

This Paper (cont'd)

3. Apply the sufficient statistic to identify costs using HF Treasury auction shocks

- Yields move + spreads don't = risk dominates $\approx$ 70%–100% of intermediation cost
- During crises, especially COVID, gross position costs bind, consistent with post-2017 SLR

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- COVID: SLR stress disproportionately widened spreads, but not yields
- Impact of bank deregulation on Treasury market depends on which cost is relaxed

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Spreads may not be informative of the dominant source of price-level distortions

Related Literature

Intermediary asset pricing theory: study levels or spreads, or focus on one type of cost

Gromb and Vayanos (2002); Gârleanu and Pedersen (2011); Adrian and Shin (2014); He and Krishnamurthy (2013); Du, Hébert, and Huber (2023); Du, Hébert, and Li (2023); Hanson, Malkhozov, and Venter (2024),...

...develop a joint model of price levels and spreads with both costs

Intermediary asset pricing evidence: sharpest tests from spreads, but theory is about levels

He, Kelly and Manela (2017); Haddad and Muir (2021); Du, Tepper, and Verdelhan (2018); Boyarchenko et al. (2018); He, Nagel and Song (2022); Duffie et al. (2023); Bräuning and Stein (2024),...

...quantify the link between spreads and price levels

Demand system asset pricing: techniques for estimating reduced-form elasticities

Koijen and Yogo (2019); Gabaix and Koijen (2021), Chaudhary, Fu, and Li (2022)...

...connecting reduced-form statistics to structural parameters

Outline

1. **Model:** Vayanos-Vila framework with slow-moving capital

2. **Identification:** Sufficient statistics and empirical strategy

3. **Results:** Level-spread disconnect and dominance of risk frictions

4. **Calibration:** Assess the impact of different cost changes on spread vs level

Environment

Two securities with identical fundamental value V_t:

- **Cash asset** C: The physical underlying asset (e.g., Treasury bond).
- **Synthetic asset** S: A derivative replicating the asset (e.g., OIS swap).

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Three holders of assets:

1. Noise traders hold $\beta_{C,t}$ and $\beta_{S,t}$ $\rightarrow$ source of demand shocks $d\beta_{i,t}$
2. Intermediaries hold $x_{C,t}$ and $x_{S,t}$ $\rightarrow$ arbitrage & short-term liquidity provision
3. Institutional investors hold $y_{C,t}$ and $y_{S,t}$ $\rightarrow$ slow-moving capital

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Three exogenous shocks: (Follow OU processes)

- One fundamental shock dV_t
- Two noise trader demand shocks $d\beta_{C,t}$ and $d\beta_{S,t}$

Intermediaries face intermediation costs

Intermediary: chooses positions $x_{C,t}, x_{S,t}$ to maximize:

$$\max_{x_{C,t}, x_{S,t}} \mathbb{E}_t(dW_t) - \underbrace{\frac{\gamma}{2} Var_t(dW_t)}_{\text{Risk-based}} - \underbrace{\frac{\psi}{2}(x_{C,t}^2 + x_{S,t}^2)dt}_{\text{Gross position}}$$

$$\text{s.t.} \quad dW_t = \sum_{i \in \{C,S\}} x_{i,t} dP_{i,t} + \left(W_t - \sum_{i \in \{C,S\}} x_{i,t} P_{i,t}\right) r dt$$

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These costs capture a broad family of constraints: Details Hedging demand

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Institutional investors generate intermediary inventory dynamics

Institutional investors: Slow-moving long-term investors that desire to hold $Z_{i,t}$,

$$\begin{pmatrix} Z_{C,t} \\ Z_{S,t} \end{pmatrix} = -\zeta \begin{pmatrix} P_{C,t} - V_t \\ P_{S,t} - V_t \end{pmatrix} + \theta \quad \Longrightarrow \quad d \begin{pmatrix} y_{C,t} \\ y_{S,t} \end{pmatrix} = k \begin{pmatrix} Z_{C,t} - y_{C,t} \\ Z_{S,t} - y_{S,t} \end{pmatrix} dt$$

- Desired demand $Z_{i,t}$ depends on price deviations from fundamentals V_t;
- Two assets are imperfectly substitutable: (ζ is invertible)
- But only fraction $k\,dt$ can adjust each instant;

$\Longrightarrow$ **Sectoral holdings y_t adjust slowly to the desired target.**

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Slow moving institutions generate intermediary inventory dynamics

- Intermediaries absorb shocks, then slowly offload to institutional investors

Equilibrium prices

Equilibrium prices: Prices are affine in five state variables,

$$\begin{pmatrix} P_{C,t} \\ P_{S,t} \end{pmatrix} = \underbrace{\bar{\mathbf{P}}}_{\text{steady-state}} + \mathbf{1} \underbrace{V_t}_{\text{fundamental}} + \zeta^{-1} \cdot \underbrace{\begin{pmatrix} \beta_{C,t} \\ \beta_{S,t} \end{pmatrix}}_{\text{noise demand}} + \boldsymbol{\lambda}_x \cdot \underbrace{\begin{pmatrix} x_{C,t} \\ x_{S,t} \end{pmatrix}}_{\text{intermediary holding}}$$

where λ_x capture the transitory price impact due to intermediary liquidity provision

Details on price loadings

Frictions penalize different trades differently

Level arbitrage requires market positions

- Same direction: $x_{C,t} + x_{S,t}$
- Cost = $\psi + (1+\rho)\gamma\sigma_p^2 \approx \psi + 2\gamma\sigma_p^2$

$\implies$ γ and ψ both matters

Spread arbitrage requires hedged positions

- Opposite direction: $x_{C,t} - x_{S,t}$
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Proposition 1:

When $\psi = 0$, there exists an equilibrium where $P_{C,t} = P_{S,t}$, for all t, even when two assets are imperfectly substitutable according to institutional investors' demand ζ

- To arbitrage the spread, intermediaries take hedged positions that net out risk
- with $\psi = 0$, intermediaries costlessly engineer spread positions to satiate investors' demand

$\implies$ $\psi > 0$ **rules out zero-spread equilibrium**

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Proposition 2: the two costs affect level vs. spread differentially Details

γ disproportionately raises level var V_{level}; ψ disproportionately raises spread var V_{spread}:

$$\frac{\partial(V_{spread}/V_{level})}{\partial\gamma} < 0, \qquad \frac{\partial(V_{spread}/V_{level})}{\partial\psi} > 0.$$

- $\uparrow \gamma \implies$ encourages hedged positions and discourages market position
  Increase level volatility more than spread volatility

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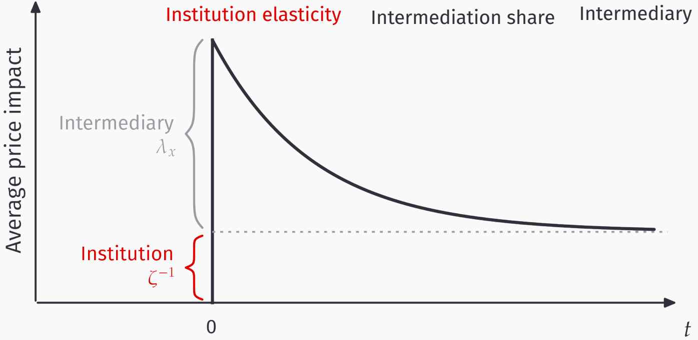
- **Return correlation** is $\downarrow$ in ψ and $\uparrow$ in γ
  $\implies$ ψ **segments markets;** γ **integrates markets**

Identifying intermediary costs using Price Impact Decay

$$\text{Price impact} = \mathbb{E}\left[\frac{\partial P_t}{\partial \beta_0'}\right] = \underbrace{\overbrace{\zeta^{-1}}^{\text{Long-run impact}}}_{\text{Institution elasticity}} + \overbrace{\underbrace{\partial x_t / \partial \beta_0'}_{\text{Intermediation share}} \times \underbrace{\lambda_x}_{\text{Intermediary required comp.}}}^{\text{Transitory impact driven inventory dynamics}}$$



Price impact depends on intermediaries and institutions $\Longrightarrow$ can't identify intermediation costs

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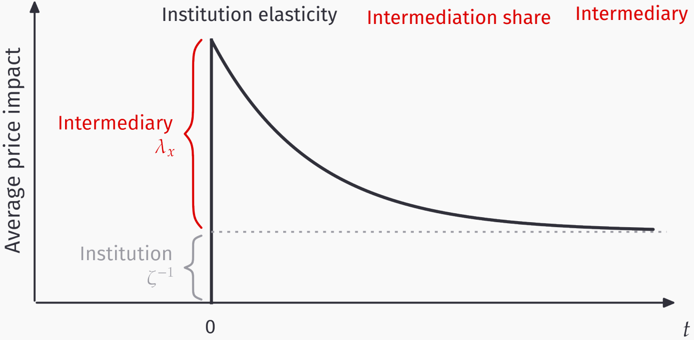

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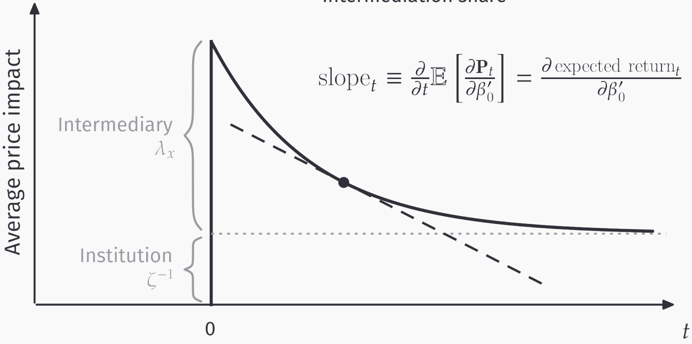

Price impact decay = intermediary compensation for holding inventory

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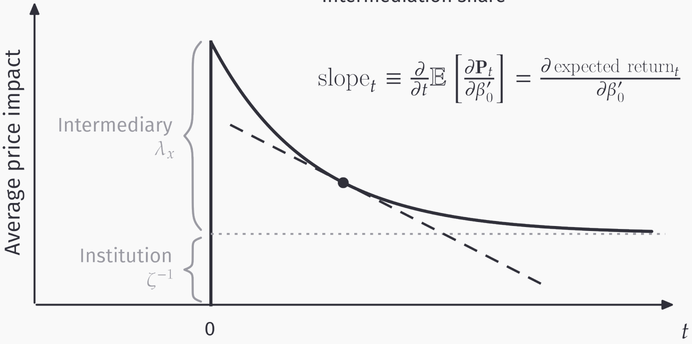
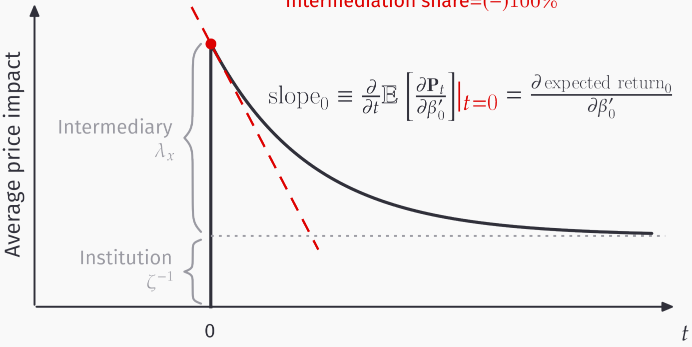


...but we don't observe intermediaries' inventory, so can't identify costs from slope at any t

Identifying intermediary costs using Price Impact Decay

$$\partial \text{Expected return}_0 / \partial \beta'_0 = \underbrace{\left(\partial x_t / \partial \beta'_0\right)\Big|_{t=0}}_{\text{Intermediation share}=(-)100\%} \times \underbrace{\mathbf{C}}_{\text{marginal cost}}$$



Initially shock fully absorbed by intermediary $\Longrightarrow$ initial decay rate reveals costs

Assumptions For Identifying Intermediation Costs

The decay identity isolates the marginal cost $\mathbf{C}$:

$$\underbrace{\partial \text{Expected return}_0 / \partial \beta_0'}_{\text{observed decay on impact}} = \underbrace{\left(\partial x_t / \partial \beta_0'\right)\Big|_{t=0}}_{=(-)100\%} \times \mathbf{C}$$

Identifying the reduced-form C relies on weak structural assumptions:

- Intermediation cost equal to compensation
- Intermediaries absorb 100% of the shock on impact (this defines "intermediaries" in our paper)
- Expected returns = average realized returns ex-post

the full demand shock, inventory, and price dynamics do not enter here

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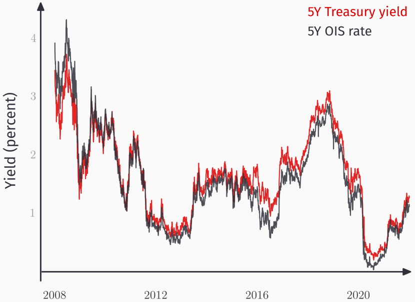
Mapping C to deep parameters requires more structure: $\mathrm{C} = \gamma \boldsymbol{\Sigma}_p + \boldsymbol{\Psi}$

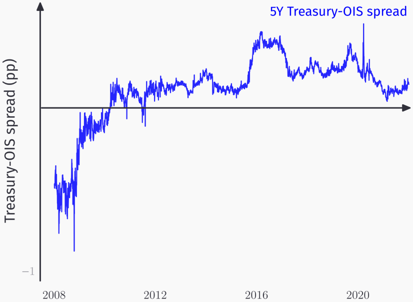
Extends to more general specifications: Hedging demand | Alternative costs & constraints

Estimating the marginal costs of intermediation

Laboratory: Use Treasury and OIS market,

- Treasury 5yr yield: $y_{\text{treasury},t}$ (from Fed H15)
- Treasury-OIS 5yr spread: $y_{\text{spread},t} := y_{\text{treasury},t} - y_{OIS,t}$ (from Bloomberg)
- Treasury and OIS rates highly correlated: $corr(\Delta y_{treasury,t}, \Delta y_{OIS,t}) = 0.92$





High-frequency demand shocks Around Auctions

HF Treasury auction result announcements (Droste, Gorodnichenko, and Ray, 2025):

- Supply is known, demand is not $\implies$ **post-auction Δyield due to demand shocks**
- Auctions are important source of inventory changes (Fleming, Nguyen and Rosenberg, 2024)

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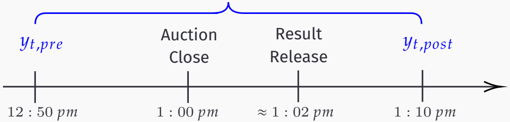
Shock Construction: intraday 5yr Notes and When-Issued forwards from GovPX,

$$u_{Treasury,t} = y_{t,post} - y_{t,pre} \propto \beta_{treasury,t}$$



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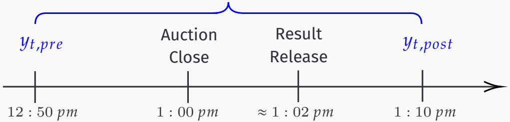
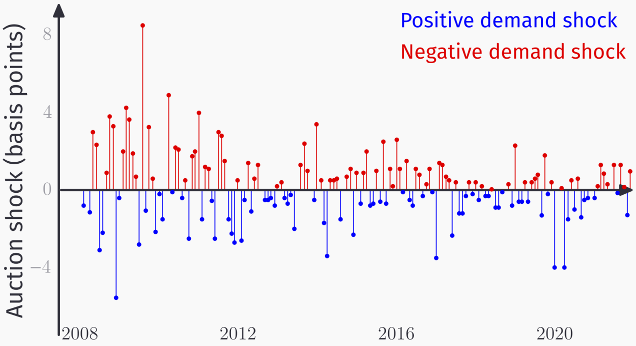


Comments on shocks and identification:

- Price impact observed, not shock's quantity surprise...identify up to scale

Auction shocks: Sample 2008–2022



Estimating relative balance sheet costs

Estimate impulse response via local projections for each horizon h

$$\Delta_h y_{i,t} = a_{i,h} + \hat{M}_i(h) \cdot u_{\text{Treasury},t} + c_{i,h} \Delta_h y_{i,t-h-1} + \varepsilon_{i,t+h} \quad \text{for } i \in \{\text{yield}, \text{spread}\}$$

- $\hat{M}_i(h) \propto \mathbb{E}\left[\partial y_{i,h} / \partial \beta_{\text{Treasury},0}\right]$ is the average impact up to scale

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Estimate the marginal intermediation costs

- From the slope of the price impact in a short window around $h = 0$ $\hat{M}_i(h) = \hat{M}_{i,0} + \hat{c}_i h$

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Map to importance of risk costs for leaning against yield dislocations

$$\left.\frac{\partial \hat{M}_i(h)}{\partial h}\right|_{h=0} = \hat{c}_i \propto \begin{cases} \psi + \gamma \sigma^2_{\text{treasury}} & \text{for } i = \text{treasury} \\ \psi + \gamma \underbrace{\sigma_{\text{treasury,spread}}}_{\approx 0} & \text{for } i = \text{spread} \end{cases}$$

Estimating relative balance sheet costs

Estimate impulse response via local projections for each horizon h

$$\Delta_h y_{i,t} = a_{i,h} + \hat{M}_i(h) \cdot u_{\text{Treasury},t} + c_{i,h}\, \Delta_h y_{i,t-h-1} + \varepsilon_{i,t+h} \quad \text{for } i \in \{\text{yield}, \text{spread}\}$$

- $\hat{M}_i(h) \propto \mathbb{E}\left[\partial y_{i,h} / \partial \beta_{\text{Treasury},0}\right]$ is the average impact up to scale

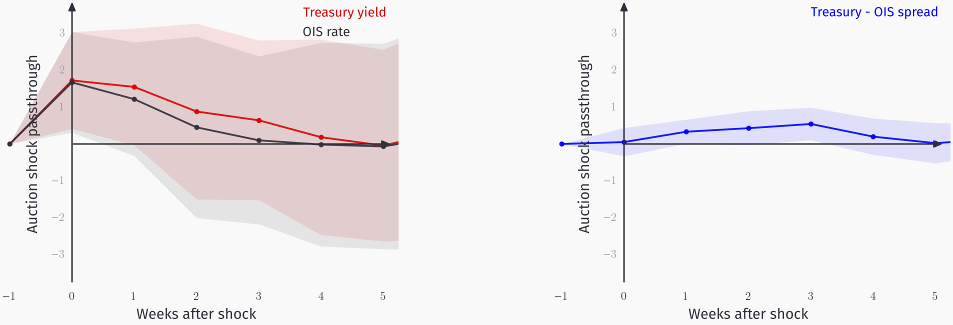
Estimate the marginal intermediation costs

- From the slope of the price impact in a short window around $h = 0$ $\hat{M}_i(h) = \hat{M}_{i,0} + \hat{c}_i h$

Map to importance of risk costs for leaning against yield dislocations

$$\left.\frac{\partial \hat{M}_i(h)}{\partial h}\right|_{h=0} = \hat{c}_i \propto \begin{cases} \psi + \gamma \sigma^2_{\text{treasury}} & \text{for } i = \text{treasury} \\ \psi + \gamma \underbrace{\sigma_{\text{treasury,spread}}}_{\approx 0} & \text{for } i = \text{spread} \end{cases} \implies \text{Risk's yield contribution} = \frac{\gamma \sigma^2_{\text{treasury}}}{\psi + \gamma \sigma^2_{\text{treasury}}}$$

Yields and OIS comove, spread unchanged



1. IRF in line with predictions: jump on impact→revert
2. Yield and OIS move in lockstep; spread unchanged: $\implies$ **risk costs (γ) dominate**

Estimation results: Full sample (2008–2022)

γ is the dominating cost limiting intermediary capacity to trade against yield dislocations.

	Risk Contribution	Window
Baseline	100.0%*** [67,100]	3 weeks
2-week window	100.0%*** [43,100]	2 weeks
1-week window	100.0%** [23,100]	1 week
Drop 10 largest	100.0%*** [52,100]	3 weeks
Excl. GFC & COVID	100.0%*** [64,100]	3 weeks
Multiple tenor auctions	100.0%*** [74,100]	3 weeks

Daily frequency estimates Daily frequency IRFs

Crisis episodes: Gross position cost plays a more important role

	Baseline	GFC	Covid SLR	Covid post-SLR
Risk contribution	100.0%	83.6%	0.0%	100.0%
	[67, 100]	[0, 100]	[0, 100]	[0, 100]
Spread impact (pp)	0.05	-0.56	2.46***	-0.75
Variance Ratio (V_l/V_s)	22.9	16.5	13.8	17.8

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1. Risk contribution smaller during crises $\Rightarrow$ gross position costs matter more
2. Gross position costs play more important role in COVID than GFC, consistent with post-2017 SLR regime

Calibration and counterfactuals

How do changes in intermediary costs affect price levels and spreads?

1. COVID crisis: SLR more binding—how much did it contribute to dislocations?
2. Current policy discussions on loosening banking regulations

Calibrate model to match empirical unconditional moments (full sample)

- Externally calibrated: $M_{l,\infty}$ *(Chaudhary, Fu, and Zhou, 2025)*
- Internally estimated using GMM: $(\gamma, \psi, k, \sigma_\beta, \sigma_V, M_{s,\infty})$

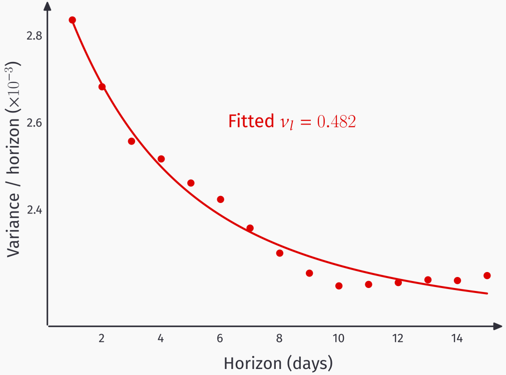
Targeted moments: unconditional variance of spreads and yields across horizons

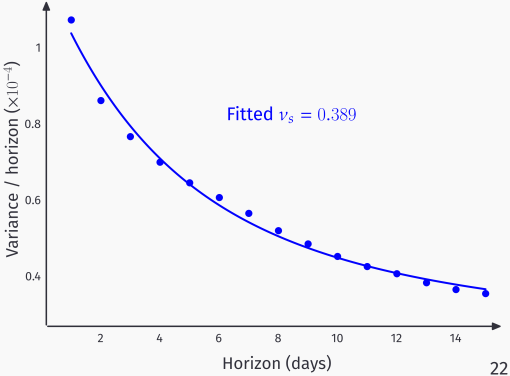
- The variance decay rates reveal the amplification of price impact due to intermediary costs

Structural parameters identified from variance moments

Estimate three variance process parameters $(V_{i,\infty}, V_{i,0}, \nu_i)$ for level and spread,

$$Var_i(H) = V_{i,\infty} + \left(V_{i,0} - V_{i,\infty}\right) \frac{1 - e^{-\nu_i H}}{\nu_i H}, \quad i \in \{level, spread\}$$





Map estimated variance parameters to structural parameters

Structural Parameters

Parameter	Description	Value
γ	Risk cost	0.87
ψ	Gross position cost	0.03
k	Slow-moving capital speed	0.16
σ_β	Demand shock volatility	0.47
σ_V	Fundamental shock volatility	0.21
$M_{s,\infty}$	Spread demand multiplier	0.06
$M_{l,\infty}$	Level demand multiplier (external)	0.15

$\Rightarrow$ Risk contribution $\approx$ 80%, consistent with the sufficient statistic estimates

COVID-19 Crisis Counterfactuals

SLR binded during COVID...how much did this contribute to price and spread dislocations?

Counterfactual: increase ψ to match the price impact slope ratio during COVID crisis

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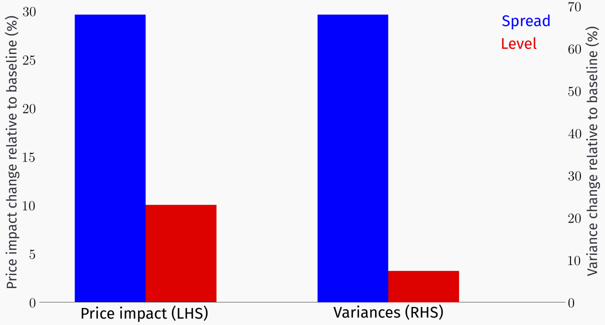
SLR binded during COVID...how much did this contribute to price and spread dislocations?

Counterfactual: increase ψ to match the price impact slope ratio during COVID crisis

SLR had much larger impact on the spread than on the yield dislocations:



Banking deregulation counterfactuals

Discussions of relaxing banking regulations...how will this impact the Treasury market?

Counterfactual: if ψ and γ are reduced by 50%?

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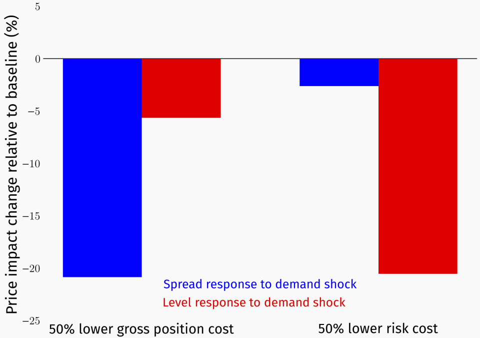
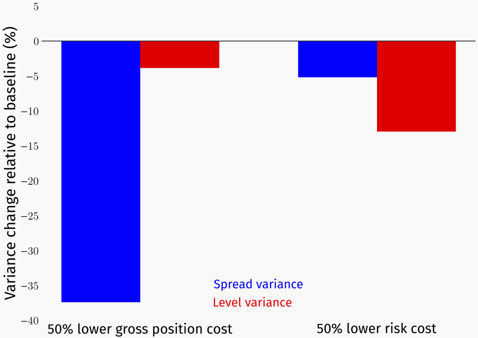
The impact on spreads and yields depends on if ψ or γ is reduced





Conclusion

A joint model of price levels and spreads with two intermediation costs

- Risk costs (γ) and gross position costs (ψ) penalize different trades differently
- Risk costs integrate markets and disproportionately affect levels; gross position costs segment markets and disproportionately affect spreads

Sufficient statistic identifies costs; risk-based costs dominate

- Initial decay rates of yields and spreads pin down γ and ψ
- Gross position costs more important during crises

Policy implications depend on which cost changes

- COVID: SLR stress disproportionately widened spreads
- Banking deregulation: impact on yields vs. spreads depends on whether γ or ψ is relaxed

Spreads alone are a limited diagnostic for price-level distortions

Alternative Costs and Constraints

Generic frictions yield the same FOC (first order, around long-short $x_C > 0 > x_S$):

$$\mathbb{E}_t\left[\frac{d\mathbf{P}_t}{dt}\right] = \bar{\boldsymbol{\Psi}} + \left(\gamma\boldsymbol{\Sigma}_P + \boldsymbol{\Psi}\right)\mathbf{x}_t$$

- Linear gross cost $\kappa(\tilde{\psi}_C|x_C| + \tilde{\psi}_S|x_S|)$ (SLR, RBC): wedge $\bar{\boldsymbol{\Psi}}$ only, $\boldsymbol{\Psi} = \mathbf{0}$
- Convex gross cost $\frac{\kappa}{2}(\tilde{\psi}_C|x_C| + \tilde{\psi}_S|x_S|)^2$: $\Psi_{SC} = -\kappa\tilde{\psi}_C\tilde{\psi}_S < 0$
- Hard constraint on gross dollar exposure (margin, leverage): $\tilde{\psi}_C|P_C x_C| + \tilde{\psi}_S|P_S x_S| \leq \bar{K}$

Off-diagonal Ψ_{SC} = cross-position cost; we assume $\boldsymbol{\Psi} = \psi\mathbf{I}$ (diagonal)

- Long leg uses up capacity $\Longrightarrow$ short leg costlier: complements ($\Psi_{SC} < 0$) — opposite of risk costs $\gamma\boldsymbol{\Sigma}_P$, which favor long-short positions (substitutes)
- Estimator attributes the cross entry of $\mathbf{C}$ to risk: $\widehat{\gamma} = \gamma + \Psi_{SC}/\Sigma_{P,SC} < \gamma$

$\Longrightarrow$ **Estimated risk contribution is a lower bound on the true one**

Back

Hedging demand

Forward-looking intermediaries: exit at Poisson rate δ with terminal utility $-\exp(-\gamma W_t)$

Around the the myopic benchmark (large δ)

- Value function $J(W, \mathbf{s}) = -\exp(-\gamma W - g(\mathbf{s}))$, where $g(\mathbf{s}) = \frac{\gamma}{2\delta}\mathbf{x}^\top \mathbf{C}\mathbf{x} + O(\delta^{-2})$
- FOC gains a hedging demand;

$$\mathbb{E}_t\left[\frac{d\mathbf{P}_t}{dt}\right] = \left(\mathbf{I} + \frac{\gamma}{\delta}\boldsymbol{\Sigma}_{Px}\right)\mathbf{C}\mathbf{x}_t + O(\delta^{-2}), \quad \boldsymbol{\Sigma}_{Px} \equiv \mathrm{Cov}_t(d\mathbf{P}_t, d\mathbf{x}_t)/dt < 0$$

  - Prices fall exactly when inventories build up $\implies$ holding inventory hedges future opportunities $\implies$ lower required $\mathbb{E}_t[d\mathbf{P}_t]$: decay rates dampened
- Level dampened more than spread iff $(1+\rho_\beta)M_{level,0} > (1-\rho_\beta)M_{spread,0}$ — holds in the data: spread impact $M_{s,0} \approx 0 \implies$ lower observed $m_{level}/m_{spreads}$
- Estimator infers risk contribution from $m_{level}/m_{spreads} \implies$ understates it

$\implies$ **Estimated risk contribution is a lower bound on the true one**

Back

Equilibrium Prices

Constant term reflects institutional investors' demand relative to supply:

$$\bar{\boldsymbol{P}} = \boldsymbol{\zeta}^{-1}(\boldsymbol{\theta} - \bar{\boldsymbol{S}})$$

Loading on noise trader demand is determined by institutional investors' elasticity:

$$\boldsymbol{\lambda}_\beta = \boldsymbol{\zeta}^{-1}$$

Intuition: in the long run, institutions absorb noise trader positions

Loading on intermediary holdings λ_x solves a matrix quadratic equation:

$$-\boldsymbol{\lambda}_x \boldsymbol{\Lambda} = \mathbf{C}, \qquad \boldsymbol{\Lambda} \equiv k(\mathbf{I} - \zeta \boldsymbol{\lambda}_x)$$

where the marginal cost matrix is

$$\mathbf{C} = \begin{pmatrix} \psi_C & 0 \\ 0 & \psi_S \end{pmatrix} + \gamma\, \mathbf{p} \boldsymbol{\Sigma} \mathbf{p}^\top$$

The two costs affect prices and spreads differently

Define

$$V_{l,0} \equiv Var(dP_{l,t}) = Var\left(\frac{dP_{C,t} + dP_{S,t}}{2}\right) \qquad V_{s,0} \equiv Var(dP_{s,t}) = Var\left(\frac{dP_{C,t} - dP_{S,t}}{2}\right)$$

Risk-based costs disproportionately affect level volatility; gross position costs disproportionately affect spread volatility

The instantaneous variance ratio $V_{s,0}/V_{l,0}$ is increasing in the position cost ψ and decreasing in the risk cost γ:

$$\frac{\partial(V_{s,0}/V_{l,0})}{\partial\gamma} < 0, \qquad \frac{\partial(V_{s,0}/V_{l,0})}{\partial\psi} > 0$$

Back

Quantity Dynamics: Analytical Characterization

Following a demand shock, intermediary positions evolve as:

$$\frac{\partial \mathbb{E}_t[\mathbf{x}_{t+\tau}]}{\partial \boldsymbol{\beta}_t^\top} = -e^{-\boldsymbol{\Lambda}\tau}$$

- **On impact** ($\tau = 0$): intermediaries absorb the entire shock,

$$\left.\frac{\partial \mathbb{E}_t[\mathbf{x}_{t+\tau}]}{\partial \boldsymbol{\beta}_t^\top}\right|_{\tau=0} = -\mathbf{I}$$

- **Long run** ($\tau \to \infty$): intermediaries fully offload to institutions,

$$\lim_{\tau\to\infty} \frac{\partial \mathbb{E}_t[\mathbf{x}_{t+\tau}]}{\partial \boldsymbol{\beta}_t^\top} = \mathbf{0}$$

Price Dynamics: Analytical Characterization

The price impact at horizon τ following a demand shock is:

$$\mathbf{M}_\tau \equiv \frac{\partial \mathbb{E}_t[\mathbf{P}_{t+\tau}]}{\partial \boldsymbol{\beta}_t^\top} = -\boldsymbol{\lambda}_x e^{-\boldsymbol{\Lambda}\tau} + \boldsymbol{\zeta}^{-1}$$

- **On impact** ($\tau = 0$): price jump amplified by intermediary compensation,

$$\mathbf{M}_0 = -\boldsymbol{\lambda}_x + \boldsymbol{\zeta}^{-1}$$

- **Long run** ($\tau \to \infty$): determined solely by institutional demand elasticity,

$$\mathbf{M}_\infty = \boldsymbol{\zeta}^{-1}$$

Robustness: Daily Frequency Estimation

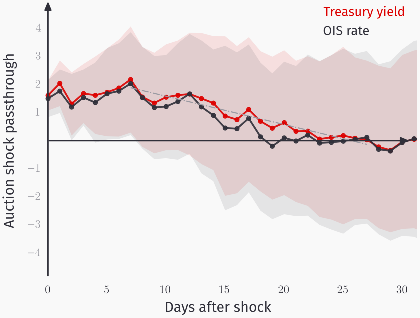
Re-estimating at daily frequency confirms the baseline: risk costs dominate.

	Risk Contribution	Window
Daily, h=0 to 25	100.0%*** [77,100]	25 days
Daily, h=0 to 20	100.0%*** [56,100]	20 days
Daily, h=0 to 15	100.0%** [27,100]	15 days

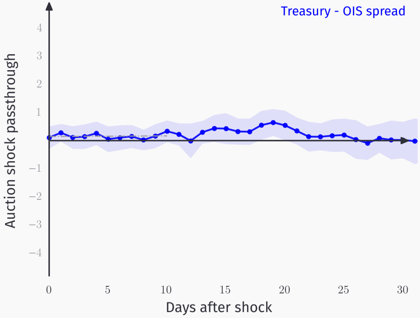
90% confidence intervals from date-cluster bootstrap (1,000 replications). Sample: January 2008–January 2022, 165 auction dates. Back

Daily Frequency IRFs

Level:



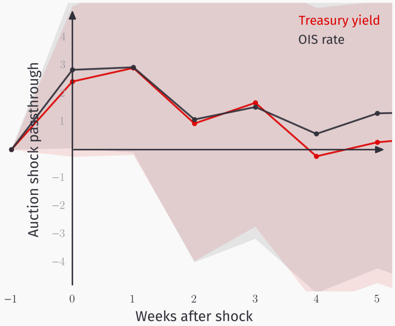
Spread:



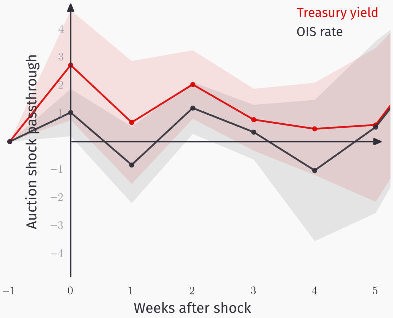
Back

Crisis Episodes: Treasury Yield and OIS IRFs

GFC (Jan 2008 to Jan 2010):



COVID (Feb 2020 to Feb 2021):



In both crisis episodes, Treasury yields and OIS rates co-move closely $\Longrightarrow$ spread misses the level dislocation. Back