Cross-Asset Limit Allocation of Trading Desks

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How do dealer-banks allocate capital?

- The intermediation of financial markets is crucial for efficient market functioning and price discovery
- The same large dealer banks intermediate multiple asset markets (Treasuries, equity, FX, MBS, . . .)
- Depending on how they allocate capital, shocks to one asset class may have **implications for other asset classes**

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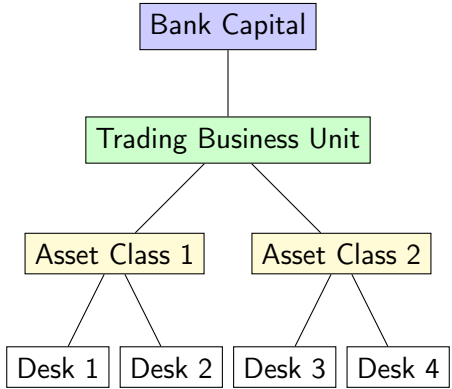
This paper: we provide evidence that

1. Dealers operate **hierarchical** capital markets within their trading division
2. Trading desk limits respond endogenously to intermediation profits
3. $\uparrow$ limits in one asset class $\Rightarrow \downarrow$ limits in other asset classes at the same bank

We do so using granular **supervisory data** on desk-level trading limits and usage

The hierarchical structure of limit allocation: an illustration



Hierarchy:

1. Bank allocates to trading unit
2. Trading unit allocates across asset classes
   - ABS, commodities, corporate bonds, equities, FX, gov bonds, munis
3. Asset classes allocate across individual desks

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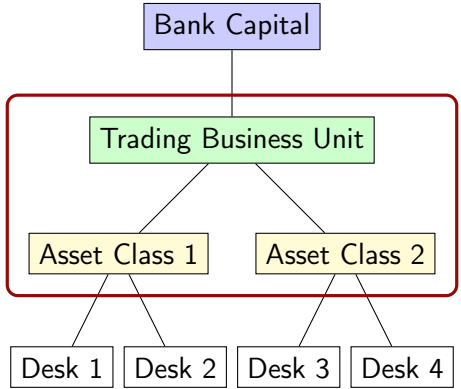

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Literature contribution

1. **The impact of constrained intermediaries on prices and liquidity.** He and Krishnamurthy, 2013; Adrian, Moench and Shin, 2010; Adrian, Etula and Shin, 2015; Gârleanu and Pedersen, 2007; Breckenfelder and Ivashina, 2023; Duffie et al., 2023; Barbiero et al., 2026; Bräuning and Stein, 2026.
   - Natural follow-up question: What in turn determines dealer constraints?
2. **Bank constrains and returns of multiple asset classes.** He, Kelly and Manela, 2017; Du, Hébert and Huber, 2023; Siriwardane, Sunderam and Wallen, 2025.
   - We seek a sharper identification in measuring spillovers and provide direct micro-evidence behind the mechanism.
3. **Internal capital markets in banking organizations.** Stein, 1997; Cetorelli and Goldberg, 2012; Bräuning and Ivashina, 2020.
   - Inter-linkages from resource constraints on banks' trading business are also key for asset market intermediation.
4. **Other papers using VV-1 data.** Anderson, McArthur and Wang, 2023; Li, Petrasek and Tian, 2024; Lu and Wallen, 2024; Barbiero et al., 2026; Bräuning and Stein, 2026.

Roadmap

1. Data
2. Stylized Facts
3. Model
4. Own-Market Dynamic Response
5. Limit Reallocation between Asset Classes
6. Trading Limits and Arbitrage Spreads
7. Conclusion

Roadmap

VV-1 Dataset

- Collected under the Volcker Rule of Dodd-Frank Act
- Covers 90%+ of US-based trading activity
- Sample: 2016 – 2023
- Daily frequency for 1,114 market-making desks across 16 banks
  - We categorize into one of 7 asset classes

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Key variables:

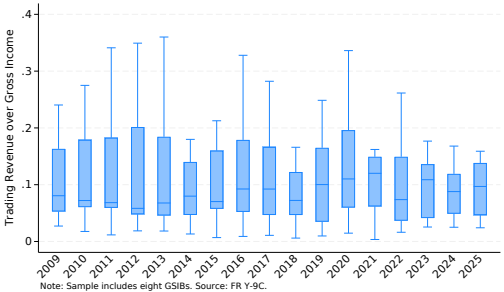
- **Limits:** 99% Value-at-Risk (VaR) limit and usage
- **Profit & Loss:** new positions (intraday) and existing positions
  - Calculate modified Sharpe ratio: income $\div$ 99% VaR
- **Positions:** market value of long/short securities and derivatives
- **Turnover:** gross market value of transactions (30-day rolling sum)

Summary statistics | Pillar 3

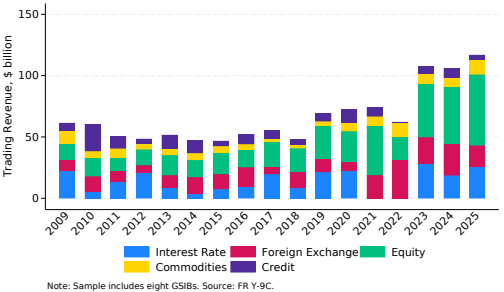
Roadmap

Fact 1: Bank trading revenue is sizable

- Trading revenue represents about 10% of total *gross* income
- All key assets classes are meaningful revenue contributors



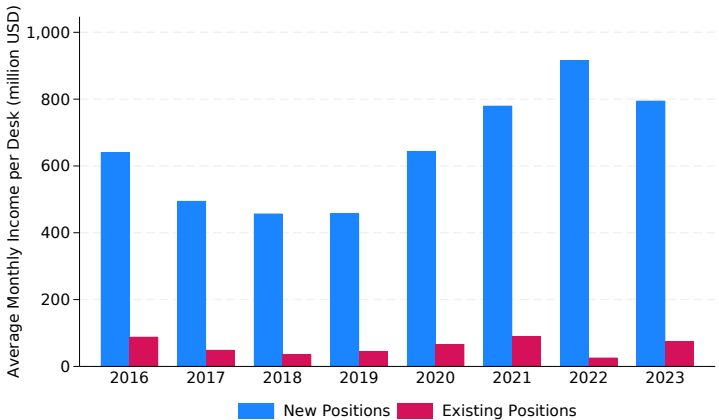
(a) Trading Revenue/Gross Income



(b) Trading Revenue in Dollars

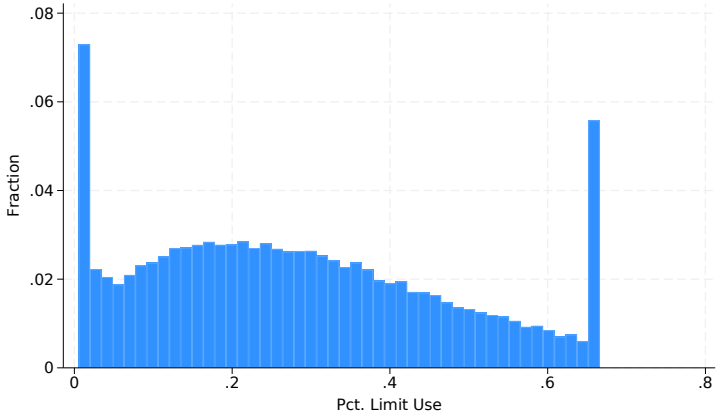
Fact 2: Desks make the majority of their profit from intraday trading

Implies profits primarily come from bid–ask spreads and commission income rather than market gains



▸ Additional evidence

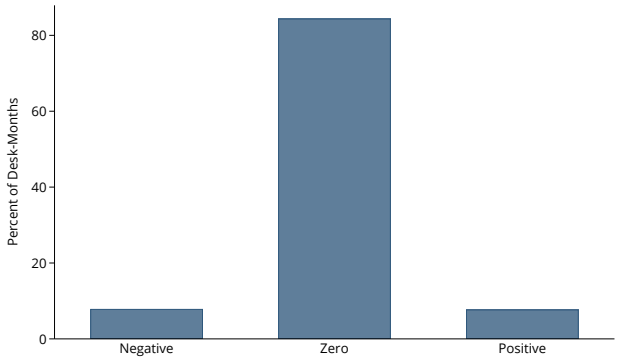
Fact 3: Desks tend to operate with a healthy VaR buffer



- Median desk uses only ∼25% of allocated VaR limit
- But >5% of desk-months use over two-thirds of limits
- Desks can be constrained even when not at limit (Barbiero et al., 2024; Bräuning and Stein, 2024)

Fact 4: Risk limits adjust infrequently

Percent of Monthly Limit Changes that are Positive, Negative, or Zero



- *Not* the case for limit use, percent utilization, and desk profitability, as measured by the modified Sharpe ratio ▸ Table
- Rationalized by adjustment costs and time-to-build considerations
  - Limit changes require managerial approval

Fact 5: The bank-time dimension is a key source of risk limit variation

Variation in Limit Changes

	(1) $\Delta\text{Log(Limit)}_{d,b,m}$	(2) $\Delta\text{Log(Limit)}_{d,b,m}$	(3) $\Delta\text{Log(Limit)}_{d,b,m}$	(4) $\Delta\text{Log(Limit)}_{d,b,m}$	(5) $\Delta\text{Log(Limit)}_{d,b,m}$
Time FE	Yes	-	-	-	-
Bank FE	Yes	-	Yes	-	-
Asset FE	Yes	Yes	-	-	-
Bank*Time FE	-	Yes	-	Yes	-
Asset*Time FE	-	-	Yes	Yes	-
Bank*Asset*Time FE	-	-	-	-	Yes
R^2	0.022	0.348	0.051	0.361	0.453
N	39,657	39,646	39,657	39,646	38,499

Notes: Observations are at the desk-month level.

- Common bank-level factors explain $\sim 1/3$ of desk limit changes
  - Suggests bank-level factors (e.g., equity capital) are key drivers ▸ Tier 1 Capital Ratio
- Bank-asset level factors explain another 10 p.p.
  - Suggests asset-level limit allocation decisions are bank specific, do not depend solely on market conditions

Roadmap

Model environment

- Dealers b, asset markets a, time $t \in [0, 1]$
- Dealers earn revenue by charging a bid-ask spread $s^a_{b,t}$ on turnover $y^a_{b,t}$, while facing VaR limits $\bar{v}^a_{b,t}$ that constrain their VaR usage $v^a_{b,t}$
- Turnover is linked to VaR usage:

$$v^a_{b,t} = \phi^a_t \cdot y^a_{b,t}$$

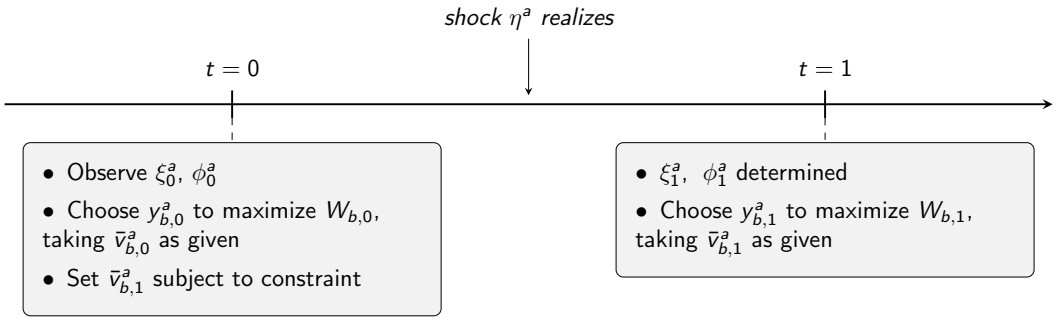
  - Order flow imbalance ratio $\phi^a_t \in (0, 1]$
- Financial market participants have CES preferences across dealers with elasticity $\sigma^a > 1$

$$s^a_{b,t} = \xi^a_t (y^a_{b,t})^{-1/\sigma^a}$$

  - Stochastic demand shifter evolves $\xi^a_1 = \xi^a_0 + \eta^a$, where η^a is a random shock
- ϕ^a_t is linked to ξ^a_t

$$\phi^a_t = \bar{\phi}^a + \rho^a \frac{\xi^a_t - \bar{\xi}^a}{\bar{\xi}^a}$$

Model timing and the dealer's problem



The dealer's problem: two decisions

1. Within-period: choose turnover $y^a_{b,t}$ to maximize within-period profit $W_{b,t}$

$$\max_{\{y^a_{b,t}:\, \phi^a_t y^a_{b,t} < \bar{v}^a_{b,t}\}} W_{b,t} = \sum_a \left[\underbrace{\xi^a_t (y^a_{b,t})^{\alpha^a}}_{s^a_{b,t} \cdot y^a_{b,t}} + \lambda^a \ln(\bar{v}^a_{b,t} - \phi^a_t y^a_{b,t}) \right]$$

2. Across periods: at time 0, the dealer sets limits for period 1 by choosing $\bar{v}^a_{b,1} = \bar{v}^a_{b,0} + \delta^a_b$

$$\max_{\delta^a_b} W_0 - \sum_a \frac{\gamma_b}{2} (\delta^a_b)^2 + \beta\, \mathbb{E}_0[W_1] \quad \text{subject to} \quad \sum_a \delta^a_b = 0$$

- **Key budget constraint:** total VaR is fixed at the bank-level
- FOC: dealers reallocate toward markets with above-average expected VaR shadow value / modified Sharpe ratios

Model predictions

1. **Own-market within-period:** Higher demand in market $a \Rightarrow \uparrow$ turnover, VaR usage, utilization, modified Sharpe ratio
2. **Limit reallocation:** Higher demand in market $a \Rightarrow$
   - Own-market: $\uparrow$ limit in next period
   - Cross-market ($a' \neq a$): $\downarrow$ limit in next period
3. **Cross-market spillover:** Higher demand in market $a \Rightarrow$ in market a' next period:
   - $\downarrow$ turnover, VaR usage, utilization
   - $\uparrow$ modified Sharpe ratio

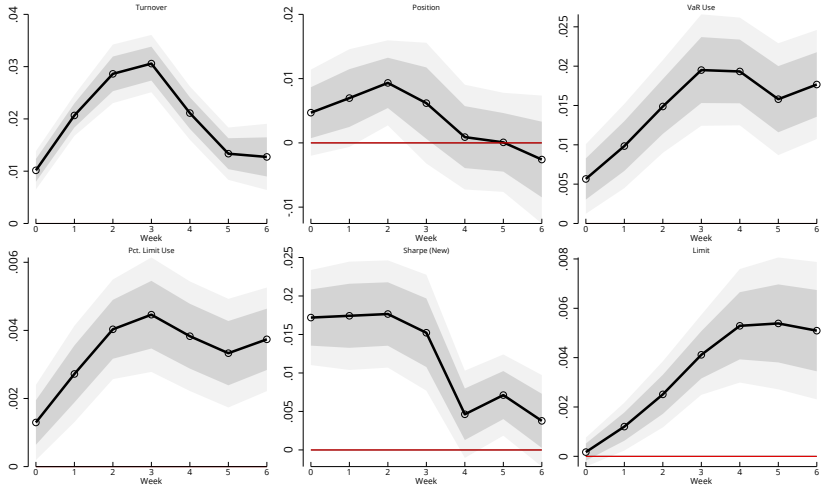
Roadmap

Does desk profitability translate into a higher limit?

- Trading desks make the majority of their income from commissions / bid–ask spreads $\implies$ increase in demand for intermediation / volume should increase marginal revenue
- Proxy the demand shift with VIX
- Local projections for weekly horizons $h \in [0, 6]$ of key variables

$$y_{d,b,m+h} = \alpha_{d,b} + \beta^h \Delta VIX_m + \sum_{j=1}^{12} \mu_j^h \Delta VIX_{m-j} + \sum_{j=1}^{12} \zeta_j^h y_{d,b,m-j} + \varepsilon_{d,b,m}^h$$

Volatility *does* seem to lead to delayed increase in limits



Notes: Turnover and limit are in logs. Net position is absolute value of log. Observations are at the desk-week level. The sample is constant across time. Robust standard errors are clustered at the desk level. The light shaded area shows a 90% confidence band. The dark shaded area shows 1 standard error band.

Roadmap

Causal identification: desk closures

- Exploit exogenous desk closures at *other* banks
- Example:
  - Bank A exits municipal bond business (strategic decision)
  - Bank B's muni desks see higher profitability (less competition)
  - Bank B increases muni desk limits
  - Bank B reduces limits in other asset classes (e.g., corporate bonds)
- Construct a leave-one-out measure for each bank b, asset a, time t:

$$\text{VaR of closed desks}_{b,a,t} = \sum_{\iota != b} \Delta\text{Limit}_{\iota,a,t}$$

  - $\Delta\text{Limit}_{\iota,a,t}$ measures the limit change in bank ι in asset a due to a desk closure
  - Normalize by the total limit available in the asset class across all banks last period, then standardize to have unit variance
- Anecdotally, desk closures are often higher level management decisions that are typically part of a bank-specific strategy overhaul

▸ Variance decomposition

Desk dropouts increase turnover, positions, and modified Sharpe ratios in that asset class at *other* banks

	ΔTurnover$_{b,a,t}$		ΔPosition$_{b,a,t}$		ΔVaR Use$_{b,a,t}$		Pct. Limit Use$_{b,a,t}$		Sharpe (New)$_{b,a,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VaR of Closed Desks$_{b,a,t}$	0.054*	0.055	0.130***	0.150**	0.024	0.024	0.002	0.004	0.008**	0.009*
	(0.032)	(0.042)	(0.044)	(0.063)	(0.022)	(0.030)	(0.004)	(0.004)	(0.003)	(0.005)
Asset*Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank*Asset FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank*Time FE	-	Yes	-	Yes	-	Yes	-	Yes	-	Yes
R^2	0.14	0.30	0.10	0.27	0.14	0.37	0.60	0.70	0.65	0.72
N	7,488	7,439	7,471	7,424	7,471	7,426	7,504	7,456	7,482	7,437

Notes: Turnover and Position are in log differences. Modified Sharpe ratio is computed as income from new positions relative to value at risk. "VaR of Closed Desks" is standardized to have zero mean and unit variance. Standard errors are clustered at bank-asset level. *** p<0.01, ** p<0.05, * p<0.1.

- In response to a one-standard-deviation increase in dropped VaR, turnover at remaining desks increases by 5%.

Desk dropouts increase other banks' risk limits in that asset class at the expense of other asset classes

	Risk Limit$_{b,a,t+1}$		Limit in Other Assets$_{b,a,t+1}$	
	(1)	(2)	(3)	(4)
VaR of Closed Desks$_{b,a,t}$	0.157***	0.153***	-0.081***	-0.138***
	(0.036)	(0.034)	(0.021)	(0.028)
Asset*Time FE	Yes	Yes	Yes	Yes
Bank*Asset FE	Yes	Yes	Yes	Yes
Bank*Time FE		Yes		Yes
R^2	0.13	0.43	0.10	0.28
N	7,338	7,295	7,338	7,295

Notes: All LHS variables are in log differences and refer to the subsequent $(t+1)$ period. "VaR of Closed Desks" is standardized to have zero mean and unit variance. Standard errors are clustered at the bank-asset level. *** p<0.01, ** p<0.05, * p<0.1.

- In response to a one-standard-deviation increase in dropped VaR, risk limits in unaffected banks
  - increase by 15% in the asset class of the dropped desks, and
  - decrease by 14% in other asset classes

Other asset classes see a fall in intermediation ability

	Turnover$_{b,a,t+1}$		Position$_{b,a,t+1}$		Limit Use$_{b,a,t+1}$		Pct. Limit Use$_{b,a,t+1}$		Sharpe (New)$_{b,a,t+1}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VaR of Closed Desks$_{b,a,t}$	-0.096*	-0.133**	-0.097**	-0.100**	-0.062**	-0.126***	0.001	0.000	0.001	0.002*
	(0.052)	(0.057)	(0.047)	(0.049)	(0.031)	(0.040)	(0.004)	(0.003)	(0.003)	(0.001)
Asset*Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank*Asset FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank*Time FE		Yes		Yes		Yes		Yes		Yes
R^2	0.11	0.42	0.10	0.34	0.11	0.26	0.21	0.85	0.26	0.85
N	7,322	7,279	7,309	7,266	7,308	7,267	7,296	7,295	7,296	7,295

Notes: Turnover, position, and VaR use are in log differences. "VaR of Closed Desks" is standardized to have zero mean and unit variance. Standard errors are clustered at bank-asset level. *** p<0.01, ** p<0.05, * p<0.1.

Roadmap

Do the pairwise correlations of asset-level arbitrage spreads relate to the pairwise correlations of limits?

- Intermediaries contain segmented trading desks that specialize in different assets
  - When trading desks of two different asset classes receive the same shock on their limits, their ability to arbitrage also moves in tandem
  - When limits tend to be reallocated between two asset classes, arbitrage spreads in those asset classes should also exhibit negative correlation
- Related to different correlations of arbitrage spreads in Siriwardane, Sunderam and Wallen (2025)

Testing whether pairwise correlations of arbitrage spreads and limits are related

1. Compute pairwise correlations of the absolute value of monthly arbitrage spreads
   - Government bonds: 10-year OIS swap spread
   - Equities: S&P cash-future basis
   - Exchange rates: 3-month USD-EUR covered interest rate parity deviation
   - Corporate bonds: bond-CDS basis for investment grade credit
   - Commodities: the mean of the 3-month silver and gold forward swap spreads

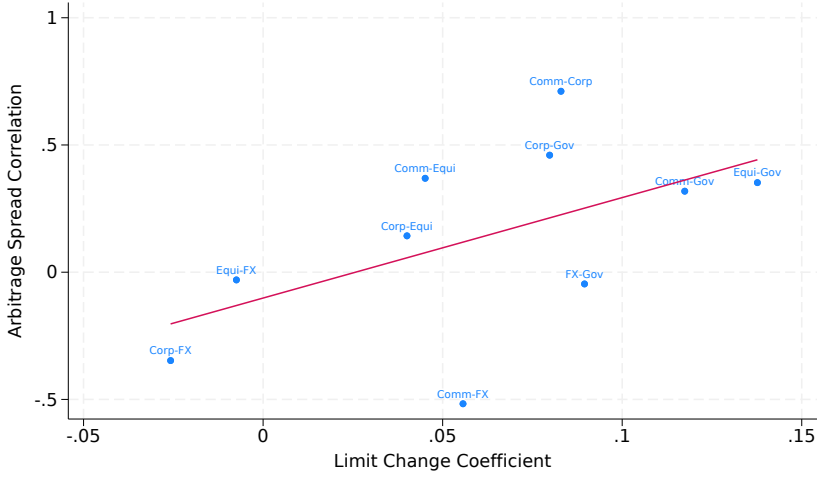
   ▸ Timeseries

2. For limits, run the following set of regressions for each asset pair $\{a, a'\}$:

$$\Delta \log \text{Limit}^{a}_{b,t} = \alpha_b + \beta^{a,a'} \Delta \log \text{Limit}^{a'}_{b,t} + \varepsilon_{b,t} \tag{1}$$

   where α_b refers to bank fixed effects
   - Average $\beta^{a,a'}$ and $\beta^{a',a}$ into one coefficient per asset pair

Asset pairs with higher correlations in their arbitrage spreads tend to be allocated higher or lower limits at the same time



Roadmap

Conclusion

- Limit allocation follows a **hierarchical structure**, where the trading unit allocates to individual asset classes
- Limits respond endogenously to risk-adjusted intermediation income
  - "Winner-picking"
  - Trading desks earn income primarily from bid-ask spreads (market-making)
- Limit increase in one asset $\rightarrow$ decrease in others
  - Causal evidence using exogenous desk closures at other banks
  - **A novel channel** linking asset markets through the internal capital allocation of dealer banks

Policy relevance:

1. Market concentration in dealer intermediation creates linkages
2. Regulatory capital requirements affect multiple markets simultaneously
3. Asset-specific developments may have cross-market effects

APPENDIX

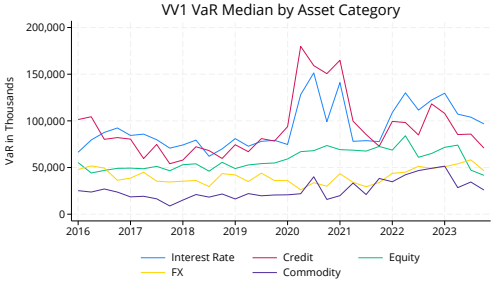
Desk-level summary statistics

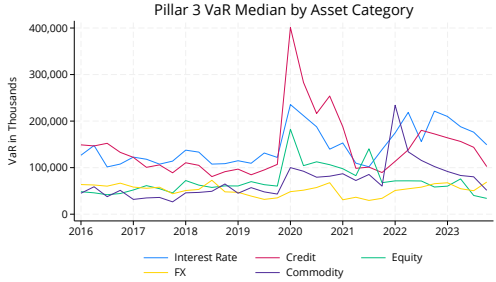
	mean	p10	p25	p50	p75	p90	count
Turnover	476.431	0.043	0.938	9.525	101.227	540.441	1123
Gross Position over Turnover	10.365	0.011	0.238	1.943	9.687	40.887	1098
Net Position over Gross Position	0.149	-0.036	0.000	0.024	0.180	0.627	1112
Sharpe (New)	0.535	0.000	0.021	0.093	0.262	1.267	1104
Sharpe (Existing)	0.024	-0.102	-0.031	0.002	0.046	0.154	1104
Limit Use	32.961	0.009	0.246	1.280	3.686	8.874	1123
VaR over Net Position	0.009	0.000	0.000	0.002	0.007	0.025	1109
Pct. Limit Use	0.252	0.023	0.111	0.245	0.372	0.483	1118
Income New Pos over Turnover	0.376	0.000	0.011	0.080	0.332	1.138	1098
Income Exist Pos over Net Position	0.131	-3.983	-0.428	0.001	0.630	2.966	1109

Notes: The Turnover variable is expressed in USD Billions while Limit is in USD millions. Both Income New Position over Turnover and Income Existing Position over Net Position are displayed in bps. The sample covers 2016 through 2023, and all variables are winsorized at the 5th and 95th percentiles. In order to calculate summary statistics at the desk-level, we first aggregate each variable at the monthly level, and we then take the median by desk across time.

Back

Data Validation: VV-1 vs. Pillar 3





- VV-1 covers market-making desks; Pillar 3 includes all market risk
- Patterns by asset class match well between datasets
- VaR in the Pillar 3 disclosures is larger
  - Market risk can sit in other areas of the bank

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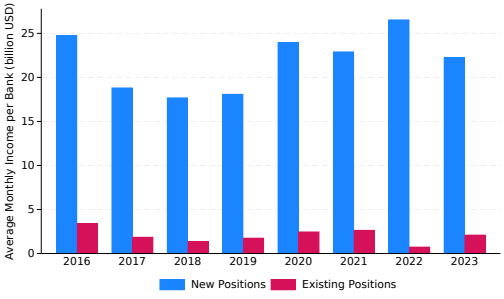
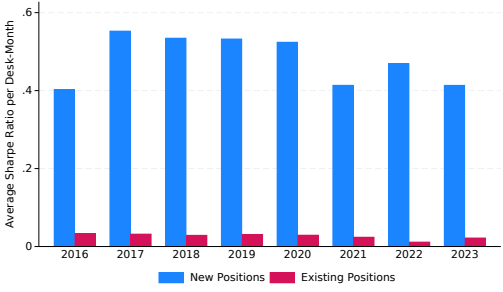
Fact 2: Additional Evidence



(a) Bank-Level Income



(b) Modified Sharpe Ratio

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Fact 4: Additional Evidence

Distribution of Sign of Variable Changes

	Negative (%)	Zero (%)	Positive (%)	N
Δ Limit	8.0	84.1	7.9	38508
Δ Limit Use	50.6	0.0	49.3	38508
Δ Pct. Limit Use	48.2	4.7	47.1	38508
Δ Modified Sharpe (New Positions)	47.0	7.1	46.0	38508

Notes: The sample is restricted to observations where all four variables are non-missing.

Back

Desk limits correlate with bank constraints

	$\text{Log(Limit)}_{b,q}$	
	(1)	(2)
$\text{SLR}_{b,q}$	0.089	
	(0.245)	
Tier 1 Capital $\text{Ratio}_{b,q}$		0.304***
		(0.079)
Time FE	Yes	Yes
Bank FE	Yes	Yes
R^2	0.734	0.734
R^2 within	0.001	0.076
N	204	216

Notes: This table shows how VV-1 (log) limits vary with high-level bank capital ratios: the Supplementary Leverage Ratio and the risk-based Tier 1 capital ratio. Limits are summed across desks within a given bank and quarter, before taking logs. Observations are at the bank-quarter level. The sample covers 2016 to 2023 and is comprised of market-making desks. Robust standard errors are clustered at the desk level. *** p<0.01, ** p<0.05, * p<0.1.

- 1pp higher Tier 1 ratio $\implies$ $\sim$20% higher limits
- Evidence consistent with a hierarchical allocation

Back

Variance decomposition of desk closures

	Desk Dropouts$_{d,b,m}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bank FE	Yes	-	-	-	-	-	Yes
Asset FE	-	Yes	-	-	-	-	Yes
Time FE	-	-	Yes	-	-	-	Yes
Bank x Asset FE	-	-	-	Yes	-	-	Yes
Bank x Time FE	-	-	-	-	Yes	-	Yes
Asset x Time FE	-	-	-	-	-	Yes	Yes
R-squared	0.000	0.000	0.285	0.001	0.584	0.347	0.652
N	9,223	9,223	9,223	9,223	9,166	9,223	9,166

Notes: Observations are at the desk-month level.

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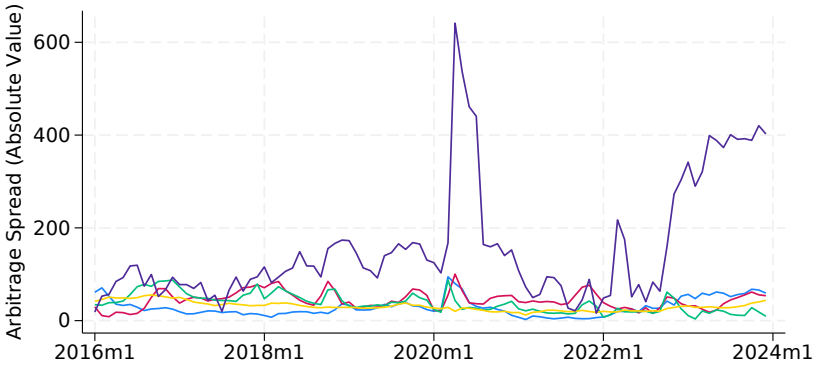
Timeseries of Arbitrage Spreads



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