

Clients' Connections: Measuring the Role of Private Information in Decentralized Markets

JF 2022(02)

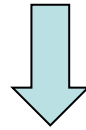
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2023年1月18日



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~~Private Information and Client Connection in Government Bond Markets~~



Clients' Connections: Measuring the Role of
Private Information in Decentralized Markets



文章逻辑

Measurement and Summary Statistics

- Summary Statistics (Client-Day Level)
- Client Connections as Proxy for Private Information

Alternative Explanations

- Connections as a Proxy for Large Demand Shocks
- Informed Dealers and Uninformed Clients

Applications

- Information Leakages
- The Nature of Private Information: Future Fundamentals or Future Orderflow

Robustness

- The baseline is not driven by daily average percentage returns weighted by the size of each transaction, surprise component of macroeconomic news release, and data at the client-day level



Abstract

- We propose a **new measure** of private information in decentralized markets— **connections**—which exploits **the time variation in the number of dealers with whom a client trades in a time period**.
- Using **trade-level data** for the **U.K. government bond market**, we show that clients **perform better** when having more connections as **their trades predict future price movements**.
- Time variation in market-wide connections also helps explain **yield dynamics**.
- Given our novel measure, we present **two applications** suggesting that (i) dealers **pass on information**, acquired from their informed clients, to their affiliates, and (ii) informed clients better **predict the orderflow** intermediated by their dealers.



Background & Motivation

现实背景:

金融市场的一个重要角色就是汇聚由经济代理持有的私有信息，并通过交易活动和随后的资产价格调整向更广泛的公众释放这些信息，从而提高市场效率和增加社会福利。而关于这一机制的研究所面临的主要挑战是，私有信息及其所有者的身份不容易被观察到。

文献背景:

- 已有私有信息的相关研究是对利用私有信息的总知情交易特征进行的分析，但是没有对某一给定交易者的知情交易进行分析。
- 已有知情交易关注的是特定客户群体的活动，如大股东维权人士或公司内部人士，通常在特定时期。这些研究主要关注信息的横截面异质性，建立在预先假设之上，即哪些客户应该更了解信息，哪些时期私有信息应该更集中。但是这些研究不能系统地识别客户的知情交易时期。



Innovation

- 首次提出clients connections作为去中心化市场中私有信息的代理变量。

Contribution

- 本文对金融市场中的私有信息的度量有一定的贡献。
- 本文对知情交易的识别有一定的补充贡献。本文使用时间序列的异质性来识别给定客户的知情交易时期，该测量方法可以系统地识别任何给定客户的知情交易周期，即使这些周期在不同客户之间是不相关的。
- 然最近的一些文章研究了场外交易市场的核心-外围结构（主要关注交易商-客户关系的横截面特征），但本文的研究结果强调了网络的动态和本质。



主要假设

HYPOTHESIS 1: Periods with more connections for a client should be associated with higher trading profit.

HYPOTHESIS 2: More connections for a client who buys (sells) on a given date should be associated with a larger subsequent price increase (decrease).

HYPOTHESIS 3: These effects should be stronger for more sophisticated traders. (more sophisticated traders: hedge funds and asset managers; less sophisticated traders: insurance companies, pension funds, commercial banks, and government organizations)

HYPOTHESIS 4: Periods with more aggregate connections should be associated with larger absolute innovations in yields.

Data

数据来源: ZEN 数据库 (交易日期和时间、执行价格和数量、国际证券识别号、帐号和买卖标志等)

样本区间: 2011年10月至2017年6月

最终样本: 大约20个交易商(dealers), 480个可识别客户(identified clients), 这些客户与他们的交易商进行的120万笔交易。



Summary Statistics



Summary Statistics—Client-Day Level

Panel A. All Clients						
	Mean (1)	Median (2)	p10 (3)	p90 (4)	SD (5)	N (6)
First-Order Connection	3.28	3.00	1.00	6.00	2.33	100,696
Transaction Number	10.14	6.00	3.00	20.00	12.92	100,696
Volume (£millions)	73.31	12.36	0.11	214.66	158.69	100,696
Number of Bonds Traded	6.45	4.00	2.00	13.00	6.27	100,696

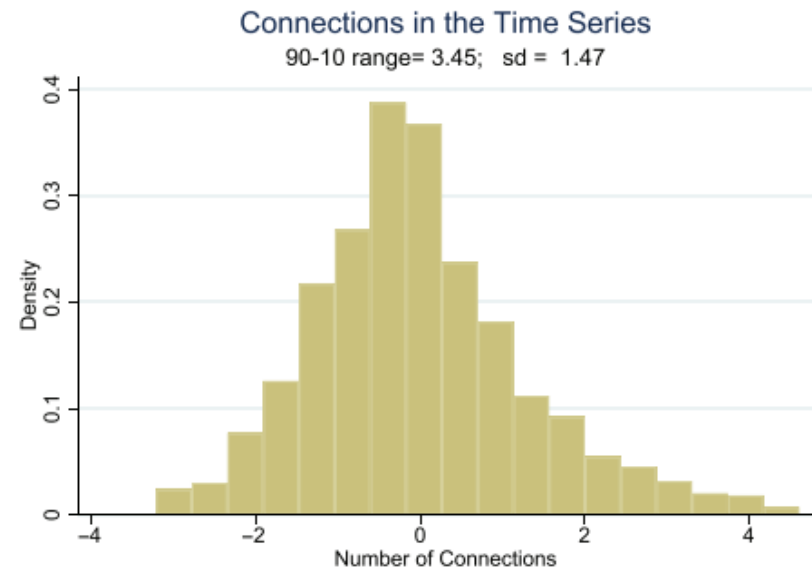
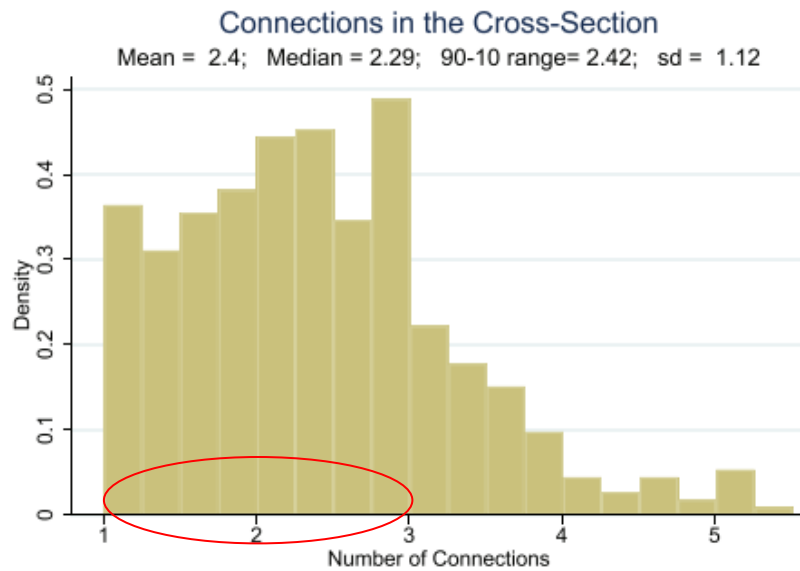
Panel B. High-Connection versus Low-Connection Days				
	High-Connection Days		Low-Connection Days	
	Mean	Median	Mean	Median
Two-day Performance	0.54	0.27	-0.22	0.09
Four-day Performance	0.69	0.31	-0.27	0.18
First-Order Connection	5.04	4.00	2.38	2.00
Transaction Number	14.70	10.00	7.80	5.00
Volume (£millions)	114.29	27.80	52.30	8.04
Number of Bonds Traded	8.55	6.00	5.37	4.00

Panel A: 统计结果显示，某一天的平均客户与三个交易商有连接，并与他们进行了大约10笔交易。然而，由于在第90百分位和第10百分位之间的连接的平均差异是5个，因此存在大量的样本差异。

Panel B: 统计结果显示，平均客户在交易商连接较多的日子绩效更好。注意到，高连接日的交易数和交易量也更高，作者在回归中把这些变量加入控制变量。



Cross-client and within-client variation in connections



连接中的内部变化是数据的一个关键特征，本文的实证分析依赖于该特征。



Trading Performance Measurement



Trading Performance

➤ Baseline Measure

本文采用Maggio et al. (2019)的方法，计算客户*i*在每笔交易的T日期限收益：

$$Performance_j^T = [\ln(P^T) - \ln(P_j^*)] \times \mathbf{1}_{B,S},$$

交易绩效

相应国债
T日后
收盘价

成交
价格

指示函数：
买入交易时=1，
卖出交易时=-1

➤ Decomposing Trading Performance

$$\ln(P^T) - \ln(P_j^*) = \underbrace{[\ln(P^T) - \ln(\bar{P})]}_{\substack{\text{Anticipation} \\ \text{未来价格变化}}} + \underbrace{[\ln(\bar{P}) - \ln(P_j^*)]}_{\substack{\text{Transaction} \\ \text{当前价格影响}}},$$

\bar{P} 为交易*j*的时间点前的平均交易价格



Client Connections as Proxy for Private Information



Client Connections and Trading Performance: Baseline Results

$$Performance_{i,t}^T = \beta \times ClientConnections_{i,t} + X_{i,t} + \alpha_{i,year} + \mu_t + \varepsilon_{i,t},$$

	One-Day (1)	Two-Day (2)	Three-Day (3)	Four-Day (4)	Five-Day (5)
Client Connections	0.190** (2.12)	0.268** (2.46)	0.406*** (2.91)	0.535*** (3.04)	0.569*** (2.94)
Volume	0.206* (1.65)	0.281* (1.93)	0.306* (1.71)	0.269 (1.38)	0.282 (1.28)
Tran.	-0.801*** (-2.95)	-1.222*** (-3.19)	-1.620*** (-3.86)	-1.552*** (-3.36)	-1.965*** (-3.98)
<i>N</i>	100,414	100,414	100,414	100,414	100,414
<i>R</i> ²	0.057	0.056	0.057	0.057	0.058
Day FE	Yes	Yes	Yes	Yes	Yes
Client*Year FE	Yes	Yes	Yes	Yes	Yes

结果显示，客户连接和交易绩效之间存在正相关关系，且其幅度和统计显著性随期限不断增加。

	Baseline (1)	Transaction (2)	Anticipation (3)
Client Connections	0.535*** (3.04)	0.098** (2.43)	0.430** (2.39)
Volume	0.269 (1.38)	-0.075 (-1.21)	0.338* (1.75)
Tran.	-1.552*** (-3.36)	-0.240* (-1.84)	-1.313*** (-2.82)
<i>N</i>	100,414	100,348	100,348
<i>R</i> ²	0.057	0.095	0.055
Day FE	Yes	Yes	Yes
Client*Year FE	Yes	Yes	Yes

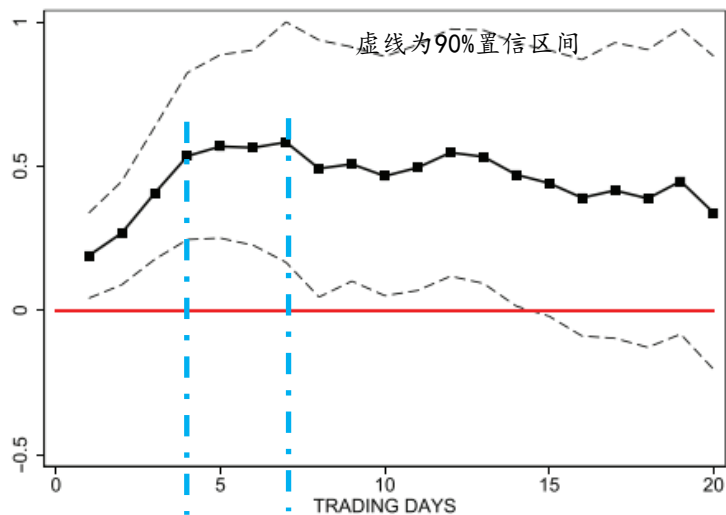
更多连接的客户绩效更好是因为预期部分（也就是说，他们可以更好地预测未来几日的价格变化）而非交易部分。



Connections and performance

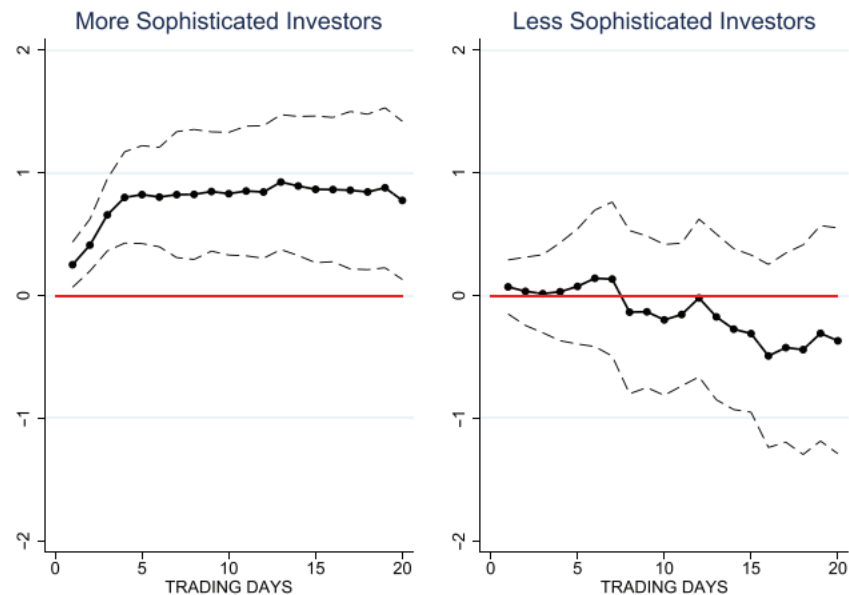
$$Performance_{i,t}^T = \beta \times ClientConnections_{i,t} + X_{i,t} + \alpha_{i,year} + \mu_t + \varepsilon_{i,t},$$

over 1 to 20 day horizons



结果显示，客户连接和绩效的相关性在4天和7天的间的系数达到峰值，在数周内保持正，但是逐渐减小的。

over 1- to 20-day horizons: more versus less sophisticated clients



结果显示，成熟和不成熟客户类型之间存在大量的异质性，大多数基线反应是由更成熟的客户驱动的。



Illustrating the Economic Significance of Connections

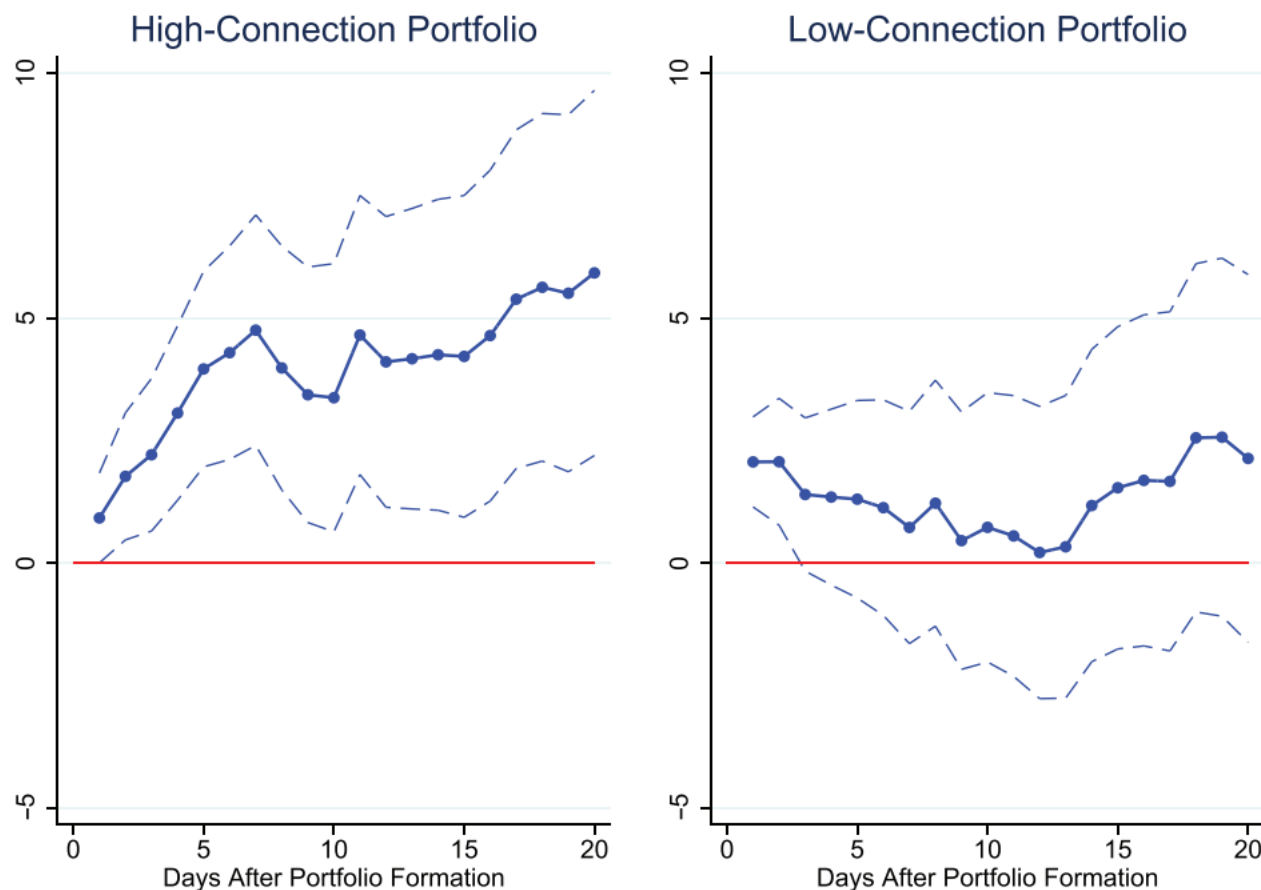
	Average Daily Volume (in £000s)		Average Daily Four-Day Performance		Decomposition of Gross Performance	
	Mean	Median	Mean	Median	Mean	Median
Low Connection Days	50,000	6,900	-0.381	0.136	-33%	9%
High Connection Days	109,000	24,900	0.704	0.393	133%	91%
					100%	100%

对同一客户的高、低连接日，大部分的正交易绩效都集中在高连接日。此外，当客户的连接更多时，他们的交易量就会更多（与基线回归一致）。



Aggregate Connections and Portfolio Returns

Long-short portfolio returns—sorted by daily orderflows of high/low connection clients



结果显示，高连接客户的多空投资组合产生了**正的收益**，20天后达到约5bps。相比之下，低连接客户的多空投资组合收益长期统计上是**不显著**的。因此，在高连接客户的综合投资组合选择中存在很强的信息内容。



Aggregate Connections and the Yield Curve

Explaining Daily Changes in 10-Year Yields with Aggregate Connections

	More Sophisticated Investors			Less Sophisticated Investors		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \log(\text{Connections}_t)$	0.028*** (6.22)	0.034*** (3.57)		0.021*** (5.88)	0.001 (0.07)	
$\Delta \log(\text{NumOfClients}_t)$		-0.016* (-1.70)			0.024*** (2.87)	
$\Delta\left(\frac{\text{Connections}_t}{\text{NumOfClients}_t}\right)$			0.011*** (2.93)			-0.003 (-0.79)
N	1,450	1,450	1,450	1,450	1,450	1,450
R^2	0.032	0.035	0.029	0.027	0.034	0.019

结果显示，两种类型（成熟和不成熟）客户的总连接的每日变化和收益水平的绝对偏差之间存在统计上显著相关性（2.8 bps和2.1 bps）。

对于更成熟的客户，每个客户所连接的交易商总数的变化（而不是客户数量的变化）驱动了逐日收益的变化；而对于不那么成熟的客户，是客户数量的变化影响了收益。



Alternative Explanations



Connections as a Proxy for Large Demand Shocks?

The Role of Trading Volume

Volume	Connections	Average Daily Volume (in £000s)		Average Daily 4-day Performance		Decomposition of Gross Performance	
		Mean	Median	Mean	Median	Mean	Median
Low	Low	17,300	2,400	-0.414	0.113	-28%	7%
Low	High	44,800	9,700	0.733	0.403	128%	93%
High	Low	83,100	20,600	-0.347	0.147	-33%	12%
High	High	173,000	57,400	0.676	0.380	133%	88%

结果显示，无论客户的交易量是高还是低，高连接日和低连接日的绩效差异大致相同，且高连接日的绩效远优于低连接日。因此，大多数积极的交易绩效继续集中在高连接日。

	One-Day	Two-Day	Three-Day	Four-Day	Five-Day
Client Connections * Low Volume Days	0.353*** (3.46)	0.488*** (3.85)	0.668*** (4.05)	0.760*** (3.62)	0.784*** (3.37)
Client Connections * High Volume Days	0.136 (1.53)	0.195* (1.80)	0.319** (2.34)	0.461*** (2.66)	0.498*** (2.64)
Volume	0.361*** (2.64)	0.491*** (3.18)	0.555*** (2.89)	0.482** (2.21)	0.487** (2.01)
Tran.	-0.744*** (-2.74)	-1.144*** (-2.98)	-1.528*** (-3.64)	-1.473*** (-3.18)	-1.889*** (-3.83)
p-value, equality of connection coefficients	0.00004	0.00005	0.00007	0.0109	0.0162
N	100,414	100,414	100,414	100,414	100,414
R ²	0.057	0.056	0.057	0.057	0.058
Day FE	Yes	Yes	Yes	Yes	Yes
Client*Year FE	Yes	Yes	Yes	Yes	Yes

结果表明，在低交易量的情况下，连接效应更强。



Decomposing Four-Day Performance: Controlling for the Average Characteristics of Clients' Dealers

	Transaction Component			Anticipation Component		
	(1)	(2)	(3)	(4)	(5)	(6)
Client Connections	0.098** (2.43)	0.111*** (2.69)	0.082** (2.16) ↓	0.467** (2.34)	0.456** (2.27)	0.468** (2.34)
Mean Connections of Client's Dealers		0.034*** (2.95)	-0.005 (-0.41)		-0.031 (-0.58)	-0.014 (-0.25)
Dealers' Mean Volume			0.384*** (4.43)			-0.162 (-0.49)
N	100,348	100,348	100,348	100,348	100,348	100,348
R ²	0.095	0.095	0.096	0.056	0.056	0.056
Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Client*Year FE	Yes	Yes	Yes	Yes	Yes	Yes

结果显示，对于Transaction Component加入**客户特征**控制变量（客户交易商的平均连接数和交易商平均交易量）后，**客户连接系数减小**。这一结果主要是由其中**内含的交易量所驱动的**，这表明增加连接以获得更小买卖价差的客户倾向于与**提供更优惠价格的大型交易商**进行交易。

对于Anticipation Component，**交易商特征**对基线连接结果没有影响。也就是说，**连接客户的交易方向**预测了随后的价格走势，而这些客户的**交易商的特征**则不能预测未来价格走势。所以，即客户连接可以作为私有信息的代理变量。



Applications



Information Leakages

Dealers' Informed Clientele and the Performance of Dealers' Affiliates

$$InfShare_{i,t} = \frac{Vol_{i,t}^H}{Vol_{i,t}^L + Vol_{i,t}^H}$$

客户知情交易占比
交易商 (dealer) i 与在 t 日的连接分别为高 (H) 和低 (L) 的客户 (clients) 的交易量。

$$AffilPerformance_{i,t}^T = \beta \times InfShare_{i,t} + X_{i,t} + \alpha_{i,year} + \mu_t + \varepsilon_{i,t}$$

交易商附属机构绩效

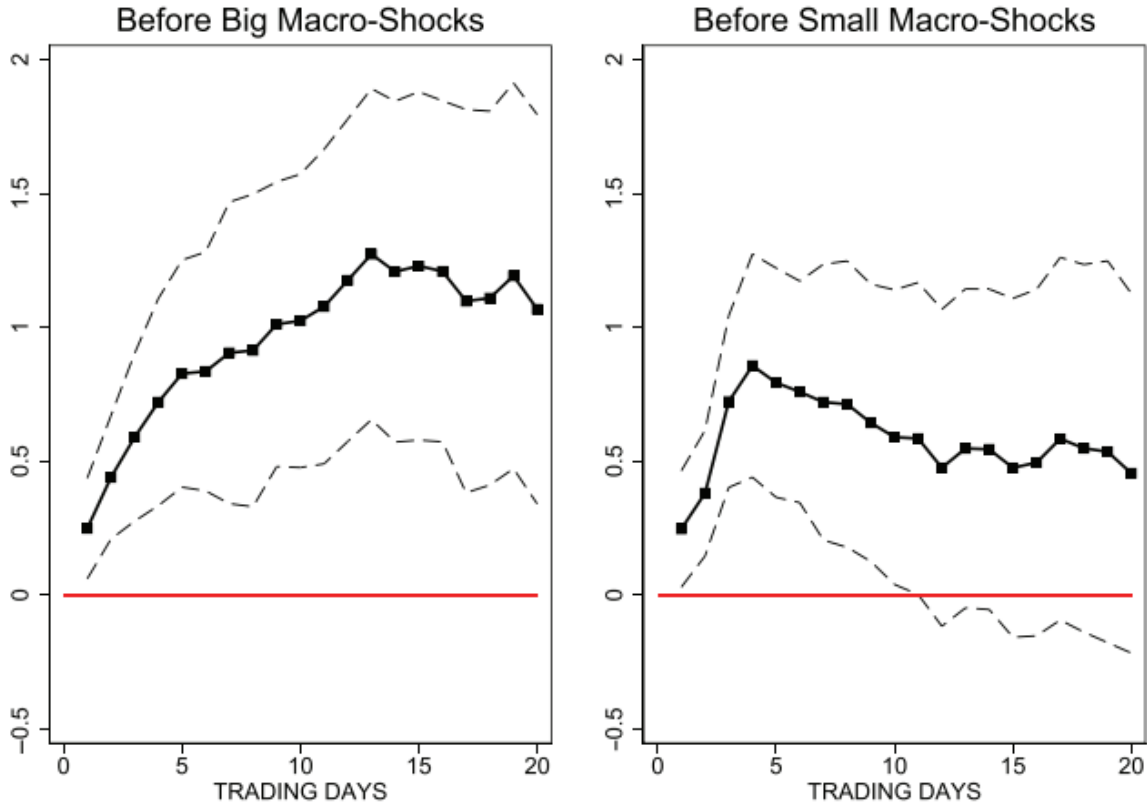
	(1) Zero-Day	(2) One-Day	(3) Two-Day	(4) One-Day	(5) Two-Day
InfShare	0.278 (0.59)	1.690** (2.26)	1.889* (2.03)	1.657** (2.29)	1.812* (1.95)
DealerVolume	-0.005 (-0.04)	-0.377** (-2.10)	-0.328 (-1.19)	-0.384* (-2.08)	-0.338 (-1.23)
DealerConnections	-0.003 (-0.11)	0.016 (0.31)	-0.028 (-0.32)	0.016 (0.31)	-0.027 (-0.31)
AffilConnections				0.024 (0.14)	0.015 (0.07)
InfShare of OtherDealers				-0.548 (-0.44)	-1.567 (-0.73)
N	20,898	20,898	20,898	20,880	20,880
R ²	0.081	0.082	0.079	0.082	0.079
Day FE	Yes	Yes	Yes	Yes	Yes
Affil.#Year FE	Yes	Yes	Yes	Yes	Yes

信息是从经销商流向他们的附属机构，而不是相反的方式。



The Nature of Private Information: Future Fundamentals

Connections and performance over 1- to 20-day horizons:
Before macroeconomic surprises



The Nature of Private Information: Future Fundamentals or Future Orderflow

Trading Performance on Days with High Covariance with Future Orderflow

Panel A. Covariance with the Total Market Orderflow				
	One-Day Covariance		Five-Day Covariance	
	One-Day Perf. (1)	Three-Day Perf. (2)	Five-Day Perf. (3)	Seven-Day Perf. (4)
$Q_{i,t}^{Total} = 1$	2.186*** (5.66)	3.211*** (5.26)	2.439*** (3.07)	2.571*** (2.73)
Volume	0.223* (1.80)	0.346* (1.96)	0.347 (1.57)	0.333 (1.30)
Tran.	-0.526** (-2.09)	-1.033*** (-3.01)	-1.133*** (-3.06)	-1.312*** (-2.69)
N	100,311	100,311	100,040	100,039
R ²	0.058	0.058	0.058	0.056
Day FE	Yes	Yes	Yes	Yes
Client-Day FE	Yes	Yes	Yes	Yes

Panel B. Covariance with the Market Orderflow Intermediated by Own Dealers				
	One-Day Covariance		Five-Day Covariance	
	One-Day Perf. (1)	Three-Day Perf. (2)	Five-Day Perf. (3)	Seven-Day Perf. (4)
$Q_{i,t}^{Own} = 1$	0.607** (2.37)	1.096** (2.58)	1.532*** (2.86)	2.023*** (3.47)
Volume	0.211* (1.70)	0.344* (1.94)	0.349 (1.60)	0.338 (1.34)
Tran.	-0.516** (-2.04)	-1.039*** (-3.03)	-1.155*** (-3.11)	-1.334*** (-2.76)
N	100,407	100,407	100,407	100,406
R ²	0.057	0.057	0.058	0.056
Day FE	Yes	Yes	Yes	Yes
Client*Year FE	Yes	Yes	Yes	Yes

$$\Psi_{i,t}^{T,g} = \frac{1}{K} \sum_{k=1}^K \left(W_{i,t,k} - \frac{1}{K} \sum_{k=1}^K W_{i,t,k} \right) \left(W_{t+T,k}^g - \frac{1}{K} \sum_{k=1}^K W_{t+T,k}^g \right).$$

$$Performance_{i,t}^T = \gamma \times D_{i,t}^{T,g} + \alpha_i + \mu_t + \varepsilon_{i,t},$$

$$D_{i,t}^{T,g} = \phi \times ClientConnections_{i,t} + X_{i,t} + \alpha_i + \mu_t + \varepsilon_{i,t},$$

结果显示，在高协方差日，客户的交易绩效高，即预测市场的订单流是盈利的。



Orderflow Client Connectivity and Covariance with the Orderflow

	Regular Connections		Nonregular Connections	
	One-Day Covariance (1)	Five-Day Covariance (2)	One-Day Covariance (3)	Five-Day Covariance (4)
Client Connections Volume	0.0045** (2.55)	0.0037** (2.57)	-0.0007 (-0.42)	-0.0023 (-1.43)
Tran.	0.0011 (0.60)	0.0027 (1.57)	0.0046** (2.11)	0.0044** (2.19)
<i>N</i>	100,407	100,407	100,407	100,407
<i>R</i> ²	0.051	0.054	0.038	0.040
Day FE	Yes	Yes	Yes	Yes
Client*Year FE	Yes	Yes	Yes	Yes

如果客户在给定的交易日以及前两周与给定的交易商进行交易，我们认为客户-交易商之间的连接是频繁（regular）的。

结果显示，与客户的连接度相关的是与频繁交易商的订单流的协方差。

交易商也有可能给关系比较近的客户传递一些私有信息。



稳健性检验

- 1. 检验测度偏误：**本文基线绩效指标使用由每笔交易规模为权重的每日平均百分比收益。为了表明基线结果不是由这个**加权方案**驱动的，在线附录中用**未加权绩效**重新估计了基线模型。重新估计结果与表II结果一致。
- 2. 检验样本选择偏差：**本文选了**宏观经济新闻**发布作为信息密集时期。作者还根据**已实现价格波动率**(由交易价格的每日离散度衡量)将交易日分为两组。进行这种分组的动机是，高价分散的日子代表了市场摩擦时期，这可能为知情的交易者带来更有利可图的交易机会。因此，我们期望**connections**和**performance**之间的关系在这些时期会更加明显。结果表明，与低价格分散的交易日相比，在价格分散度更高的交易日，**connections**对成熟客户交易绩效的影响更强、更显著、更持久。
- 3. 检验样本选择偏差：**本文所有绩效回归都是基于**客户-日水平的数据**，而不是**客户-月水平数据**。该规范允许准确地测量客户-交易商连接的形成和动态。然而，它也可能导致我们对那些非常频繁交易的客户进行过度取样，例如，每天（都交易的客户）。作者在之前版本的论文Kondor and Pinter（2019）中，在客户-月水平上进行了分析，并得到了类似的结果。



研究结果

1. 一个客户与更多交易商连接的时阶段应该和更多的交易利润相关。
2. 当客户有更多的交易商连接时能更好地预测未来的价格变动。这种效应在宏观经济公告前后更为明显。
3. 通过连接确定的那部分私有信息是客户所有的私有信息而非交易商，且该信息与给定客户的交易商在随后几天收到的订单流的成熟度结构有关。
4. 总连接数更多的时间段应该与更大的收益创新相关。
5. 交易商将从其客户群推导出的信息泄露给他们的附属公司。

研究结论

- ✓ 客户连接中的时间变化可以作为私有信息中时间变化的实证代理变量。
- ✓ 金融网络的形成与政府债券市场的价格发现过程的相关。





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谢谢大家！
欢迎批评指正！

