Online Appendix of Trading Out of Sight: An Analysis of Cross-Trading in Mutual Fund Families☆

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1. Economic mechanism

In the following, we present a stylized framework from which we derive formally the empirical restrictions discussed in Section 3. The setup of this framework builds on theoretical models of transfer pricing within multi-division organizations and multi-firm groups (e.g., Hirshleifer, 1956; Alles and Datar, 1998). We apply the same economic intuition to exchanges of assets across fund siblings.

Consider a fund family composed of two sibling funds, A and B, that want to exchange a quantity $q > 0$ of asset i among them. We assume that the fund family decides the price, P, of this internal transaction that maximizes its profit as a whole, which is given by the sum of the dollar fees charged by the two funds. Percentage fees, f_A and f_B, are exogenously given.

For simplicity, we assume that the two funds have an abnormal return of 0 on top of what they lose/gain from the cross-trade and that market prices fully reflect the fundamental value of the asset. Hence, any price that differs from the market price reallocates performance between the two funds in a zero-sum game. The reallocated performance is immediately reflected into the value of the funds, as funds mark to market their positions. We denote the effective spread, ES, as the percentage deviation from the fundamental price. Specifically, $ES = |P - M|/M$ where M is the fundamental value of the asset and P is the transfer price chosen by the fund family. An effective spread equal to zero, $ES = 0$, indicates that fund siblings cross-trade at the fundamental value of the asset, i.e., no performance is reallocated across funds as $P = M$. By contrast, a positive effective spread, $ES > 0$, implies that $P \neq M$ and some performance is reallocated across funds. The initial size of the two funds is V_A^0 and V_B^0, respectively. We define as D the *direction* of the performance reallocation, which is also chosen by the fund family. If $ES > 0$ and $D = 1$

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fund A gains and fund B loses from the cross-trade, while if $D = -1$ fund A loses and fund B gains. This implies that the abnormal return of fund A from cross-trading will be $r_A(ES) = D \cdot ES \cdot \frac{q}{V_A^0}$ and the abnormal return of fund B will be $r_B(ES) = -D \cdot ES \cdot \frac{q}{V_B^0}$.

Strategic cross-trade pricing has potential reputational and legal costs. As a consequence, fund families face a trade-off between the benefits of using cross-trades to shift performance and the potential costs arising if the discretion in pricing cross-trades is excessive. We model the cost of transfer pricing as an expected penalty function that depends on both the magnitude of the mispricing, ES, and the probability that the mispricing is spotted and sanctioned. In particular, we assume that the expected penalty is convex in the effective spread: $\mathbb{E}(Penalty) = K \cdot ES^2 \cdot q$, where K is a positive scalar measuring the monitoring intensity ($K > 0$).[1]

We assume that external investors reallocate resources on the basis of fund performance, as they do not (cannot) distinguish between skill and artificially reallocated performance. Investor dollar flows are allocated on the basis of realized performance, which, in our framework, depends entirely on the transfer price of the cross-trade. For simplicity, we do not model the profit maximization problem of the investors, but simply assume that investor flows are linearly increasing in the performance of the fund: $Flow_a = V_A^0 \cdot \beta_A \cdot r_A(ES)$, and $Flow_b = V_B^0 \cdot \beta_B \cdot r_B(ES)$, where $\beta_A (\beta_B)$ is the flow-performance sensitivity—FPS—of fund A (fund B). The assumption of linearity of FPS follows from Spiegel and Zhang (2013) and is analogous to the assumption in Franzoni and Schmalz (2017).[2]

Formally, the fund family maximizes its total profit π by determining ES^* and D^*:

$$\pi = \max_{ES} \underbrace{f_A\Big(\overbrace{V_A^0}^{i} + \overbrace{V_A^0 \cdot r_A(ES)}^{ii} + \overbrace{\beta_A \cdot V_A^0 \cdot r_A(ES)}^{iii}\Big)}_{\text{Dollar fees from fund A}} +$$

$$\underbrace{f_B\Big(\overbrace{V_B^0}^{i} + \overbrace{V_B^0 \cdot r_B(ES)}^{ii} + \overbrace{\beta_B \cdot V_B^0 \cdot r_B(ES)}^{iii}\Big)}_{\text{Dollar fees from fund B}} - \underbrace{\mathbb{E}(Penalty)}_{\text{Expected penalty}} \qquad (1)$$

subject to

$$ES \geq 0. \qquad (2)$$

[1] The expected penalty function can be thought of as consisting of a probability times a penalty, where the probability of facing a penalty is a linear function of the effective spread and the size of the penalty is a linear function of the effective spread and the trade size.

[2] Empirical evidence that investors chase returns even though past returns do not predict future returns can be found in Frazzini and Lamont (2008).

We decompose the dollar profit deriving from each fund in three parts (i, ii, and iii). The different parts are the proceeds from the percentage fee charged respectively on i) the initial assets under management, ii) the value reallocated by the cross-trade, and iii) the assets allocated/withdrawn by investors in response to realized performance. The optimal effective spread from a fund family's perspective is therefore:

$$ES^* = D \cdot \frac{f_A \cdot (\beta_A + 1) - f_B \cdot (\beta_B + 1)}{2K}. \quad (3)$$

The optimal direction of the performance relocation, D^*, follows automatically as Condition (2) needs to be satisfied.

The four testable restrictions described in Section 3 follow:

- *H2-a: The execution price of the cross-traded asset differs from its market price ($ES^* > 0$).*

Proof:

Condition (2) needs to be satisfied, which implies that $ES^* > 0$ if $f_A \cdot (\beta_A + 1) \neq f_B \cdot (\beta_B + 1)$. In words, unless fund siblings are homogeneous in terms of both flow-performance sensitivity and fees, some performance shifting is optimal.[3]

- *H2-b: In the presence of stronger monitoring the cross-traded asset is transferred at a price closer to its market price.*

Proof:

From Equation 3 we have that $\frac{\partial ES^*}{\partial K} = -\frac{ES^*}{K} \leq 0$, as $ES^* \geq 0$ and $K \geq 0$.

We assume that flow-performance sensitivities are higher in bad market conditions. This assumption follows from investors having higher marginal utility of consumption in bad market conditions, which makes funds that outperform in bad market times more valuable *ceteris paribus*. This is in line with theoretical work positing that downturns are more revealing about the skill of asset managers (Kacperczyk et al., 2016 and Schmalz and Zhuk, 2019), which should induce higher flow-performance sensitivity in downturns.[4]

[3] Performance shifting can be optimal even if the funds within the family are similar in terms of fees and flow-performance sensitivity, *if the flow-performance relation is convex*. If that is the case, an increase in performance of one fund generates an increase in dollar flows that is greater than the reduction in dollar flows for a similar decrease in performance experienced by another fund (i.e., the dollar gain of the winning fund more than compensates for the dollar loss of the losing fund), thereby making it optimal to create a wedge in performance between funds (Ippolito, 1992; Chevalier and Ellison, 1997; Sirri and Tufano, 1998).

[4] Two recent papers test empirically the relation between market conditions and FPS. The results depend on the risk adjustment and the proxy of market stress (see Franzoni and Schmalz, 2017 and Starks and Sun, 2016).

Specifically, we assume that $\beta_A = b_a \cdot \xi$ and $\beta_B = b_b \cdot \xi$, where $\xi \geq 1$ is increasing in market stress and $b_a > 0$ and $b_b > 0$ are the baseline flow-performance sensitivities in good market conditions. Under this set of assumptions the next testable restriction follows:

• *H2-c: If strategically priced, the price of a cross-traded asset should deviate more from its market price in downturns.*

Proof:

$$\frac{\partial ES^*}{\partial \xi} = D \cdot \frac{f_A \cdot b_a - f_B \cdot b_b}{2K}, \tag{4}$$

which is positive if $ES^* > 0$.

• *H2-d: High-FPS funds and high-fee funds cross-trade at advantageous prices. Low-FPS funds and low-fee funds cross-trade at disadvantageous prices.*

Proof:

Remember that D is equal to 1 if fund A gains and fund B loses from the cross-trade, and D is equal to -1 if fund A loses and fund B gains. Rewrite (3) as follows:

$$D = \frac{2K \cdot ES^*}{f_A \cdot (\beta_A + 1) - f_B \cdot (\beta_B + 1)}. \tag{5}$$

Condition (2) implies that $D = 1$ if $f_A \cdot (\beta_A + 1) > f_B \cdot (\beta_B + 1)$. Hence, performance is reallocated from fund B to fund A if fund A displays higher flow-performance sensitivity and/or charges higher fees, and from fund A to fund B if fund B has higher flow-performance sensitivity and/or fees.

2. ANcerno data

This section of the appendix provides a detailed description of the ANcerno database and how we link it to other data sources. The sample consists of institutional transaction-level data submitted by ANcerno's clients. The data are provided in batches that include all transactions submitted by a client during the interval of time covered by the batch. The exact length covered by each batch is not predefined and can range from a few trading days to several months.

A variety of clients rely on ANcerno's monitoring services. The data set includes transactions by several of the main mutual fund families domiciled in the United States, a small number of hedge funds, and several pension plan sponsors. For comparability reasons, we limit our analysis to mutual fund families (i.e., institutions that are included in Thomson Financial S12).

A client from ANcerno's perspective is any entity that submits trades, which generally are executed by an individual mutual fund, a group of funds, or a fund manager. ANcerno assigns unique codes to the clients (variable *clientcode*) and the corresponding institution as reported by the client (variable *clientmgrcode*). The exact identity of the client is anonymized.

For a limited period of time, ANcerno provided a file ("MasterManagerXref") including the list of the overarching institutions to which the trading funds are affiliated (i.e., the fund families in the case of mutual funds). This additional file includes the name of the institution (variable *manager*), e.g., PIMCO, and a number identifying the trading entity (variable *managercode*), e.g., 10. We match this file to another file ("ManagerXref") that includes both the numbers identifying the institutions (variable *managercode*) and the client codes (variable *clientcode*). In this way, we are able to match the main institution's name with the original ANcerno trade data via client codes (as the variables *clientcode* and *clientmgrcode* are included both in the "ManagerXref" file and in the main ANcerno file)—see Figure A1. The main variables that we use from the ANcerno database are reported in Table A1. Stock characteristics are obtained from CRSP and are matched to ANcerno via CUSIP. We also match trades from ANcerno to the best bid and ask prices available at the moment of execution from TAQ.

We use the S12type5 table provided by WRDS to map fund families (SEC S12 filings) to mutual funds. See Figure A2 for the detailed mapping scheme. The described procedure ensures that we retain only mutual fund families in our sample.

3. Matching ANcerno clients to fund characteristics in CRSP

We match client codes in ANcerno to funds in Thomson Reuters/CRSP based on the similarity of their trading behavior. To conduct our matching, we proceed in the following way. First, we match fund family names in ANcerno with fund family names in Thomson Financial. Second, we aggregate all trades in ANcerno at a quarter level for each client. Third, we match the net quarterly change in stock holdings of funds in Thomson Reuters (S12) with the net quarterly change in stock holdings by ANcerno clients *affiliated with the same fund family*. If we are able to match at least 80% of all net quarterly trading observations in terms of direction (buy or sell), stock identifier (CUSIP), and exact quantity of the net quarterly change, we link the fund across the two databases. This allows us to identify the trading funds for 18,008 cross-trades. This procedure uses the most restrictive matching algorithm ("MATCH3") proposed by Puckett and Yan (2011).

There are however a number of limitations to this approach. First, clients usually do not submit to ANcerno trades for all days in a quarter. Hence, when we aggregate ANcerno trades at the quarterly level quite often we do not have a complete picture of the total trading activity of the funds, which makes it difficult to exactly match the quarterly change in holdings from Thomson Financial (S12). Second, we can only match an asset manager in ANcerno when the variable *clientmgrcode* uniquely identifies a fund. However, this is not always the case, as the identifier *clientmgrcode* in ANcerno may identify funds, fund managers, or separately managed accounts (see Hu et al., 2018). Third, some of the trades that we observe in ANcerno are unreported in Thomson Financial.[5] Overall, this limits the number of funds that we are able to identify in ANcerno. We prefer to restrict the number of matched funds not to descrease the quality of the matching.

4. Cross-trades and commissions

In the paper, we find that cross-trade prices deviate more from the benchmark than open market trades do (we estimate that cross-trades have a 42 bps larger effective spread on average) and likely reallocate performance among trading counterparties. Yet, we also show that on only 2% of cross-trades commissions are paid (see Figure 1 in the main paper). A potential concern is whether the difference in effective spreads is negligible after taking commissions into account. To answer this question we replicate our analysis adding percentage commissions to the effective spread of cross-trades and open market trades. Importantly though, from a regulatory standpoint the size of the commissions should not matter for determining the fair price of cross-trades. In any case, results reported in Table A3 indicate that cross-trades still exhibit a 32 bps higher effective spread than open market trades $after$ commissions are taken into account.

5. Passive funds

Institutions that offer only or mostly passive funds constitute a natural placebo sample for our analysis. While passive funds commonly use cross-trades to reduce transaction costs, they have a lower incentive to strategically price cross-trades to reallocate performance. This is because passive funds are arguably more homogeneous in terms of fees and sensitivity of flows to returns. If all passive funds have a similar value to the group as whole, there is less of a reason to price cross-trades such that performance is reallocated across funds (this follows from restriction H2-d in Section 3). To run this placebo test, we replicate our analysis on all the trades of the only U.S. institution in our sample selling (almost) exclusively passive investment vehicles.

[5] Thomson Financial (S12) holdings do not necessarily cover the entire equity holdings of a fund. Potential exclusions include: small holdings (typically under 10,000 shares or $200,000), cases with potential confidentiality issues, reported holdings that could not be matched to a master security file, and cases where two or more managers share control (since the SEC requires only one manager in such a case to include the holdings information in their report).

Table A6 reports results for the relation between *CT* and *Effective Spread* in this sample. Different from what we find in the original sample, there is a negative correlation between the two variables. Specifically, cross-trades are on average 12 basis points *cheaper* than open market trades, consistent with cross-trades being mainly used to reduce transaction costs rather than to shift performance. In short, we find no evidence of strategic pricing of cross-trades for an institution in which most fund siblings are passive. This result supports empirical restriction H2-d that the higher effective spreads of cross-trades in our main sample are driven by the incentive to strategically reallocate performance among funds of *different value* from a family's perspective.

6. Further robustness tests

Orders. A potential concern arises because our analysis is conducted at the transaction level. While some orders are executed in a single transaction, many orders are broken down in multiple transactions that are executed at different times throughout the day and, sometimes, even over different days (see Anand et al., 2013 for a discussion of the issue). To consider a trade that is part of a larger order as a standalone execution may underestimate the total transaction costs paid to execute the entire position (as, for instance, the execution of the first portion of the order may bid up the execution cost of the second). Furthermore, the cross-trade and the twin open market trade can affect each other if they are part of the same order. We make certain that this aspect does not bias our results by replicating our analysis only on orders that are executed in a single trade (either internally or on the open market) for which, as a consequence, the effective spread of the order and that of the trade coincide. Results remain similar and are shown in Column 1 of Table A10.

Buy- versus sell (-initiated) trades. We test for the presence of asymmetries in our results. For instance, it is possible that a higher effective spread could arise from comparing *sell*-initiated cross-trades with (twin) *buy*-initiated open market trades. Because cross-trades are more advantageous during market downturns (in which selling is generally more expensive) this could, in principle, affect our findings. To rule out this possibility, we replicate the main analysis including respectively only buy-initiated trades (see Column 2) and only sell-initiated trades (see Column 3). We define trades as buy-initiated if the last sale price is below the execution price of the trade, and as sell-initiated if the last sale price is above the execution price. Furthermore, we separate buys (Column 4) and sells (Column 5). The results are analogous in all sub-samples.

Proxies of Trade Size. In our trade-level analysis, we control for the size of the trade computed as the number of shares in the transaction over the average number of shares traded in the previous five days. However, the relation between effective spread and trade size may be better described by a different specification. To mitigate the concern that our results are driven by heterogeneity in the size of the trades, we also include the number of shares in the transaction over the number of shares traded during the same day, and the number of shares in the transaction over the total number of shares outstanding. Our results are robust to including these additional proxies (see Column 6 of Table A10).

Only S&P 500 Stocks. We replicate our analysis leaving in the sample only S&P 500 stocks. Also in this case the result stays qualitatively similar (see Column 7 of Table A10).

7. The liquidity of cross-traded stocks

Fund families act strategically to maximize total assets under management (see, e.g., Massa, 1998). Several papers posit that cross-trades are one of the tools used by fund families to influence fund performance, with the objective of attracting more assets to manage. Hitherto, it remains an open question *through which channel* cross-trades influence fund performance. For example, Chuprinin et al. (2015) argue that there are at least two possible channels through which cross-trades may affect performance. First, cross transactions may be executed at favorable prices. Second, cross-trading may affect performance if used to absorb fire sales by funds in distress that lack liquidity. In this latter scenario, the impact of cross transactions on performance is not the result of opportunistic pricing practices, but it is rather an effect of a better coordination of individual funds' liquidity needs by the fund family.

In this section, we provide further evidence that the channel through which cross-trades affect performance might have been altered by the regulatory change. To that end, we explore the characteristics of the stocks that are crossed internally. If cross-trading affects performance mostly by reducing fire-sale costs, we should find that the assets that are cross-traded are those that are more vulnerable to fire-sale discounts: i.e., small and illiquid stocks for which the need for optimizing trade execution is the highest. By contrast, if cross-trading affects performance mostly via the strategic pricing of internal transactions, we should find that most cross-traded assets are large and liquid. Even though it may be easier to strategically price them, illiquid assets constitute a relatively small fraction of the portfolio of equity funds. Hence, fund managers would need to cross-trade illiquid stocks in much larger volumes to be able to reallocate performance in any meaningful way. In the following, we explore which type of stocks are more likely to be cross traded before and after the increase in the independence of compliance officers in October 2004.

We find that, before the regulatory change, funds were on average cross-trading large and liquid stocks. However, after the regulatory change, relatively more illiquid stocks are cross-traded (see Table A9). This is consistent with the main channel through which cross-trades affect fund returns being strategic pricing (H_2) before 2004, and fire sale absorption

(H_1) after 2004. Results in this section are mostly suggestive. However, they are in line with other findings in the paper and provide evidence on the prevalent channel through which cross-trades affect fund returns.

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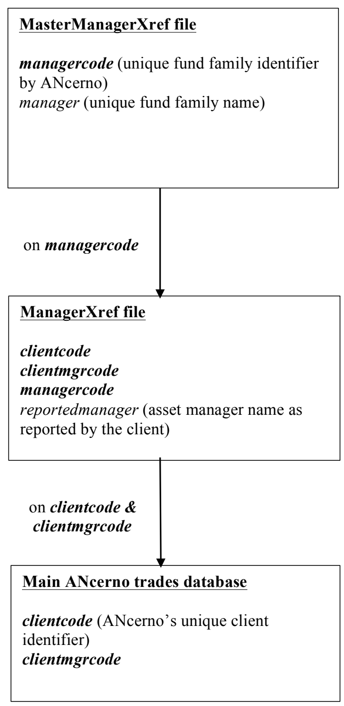

Fig. A1. Procedure to map fund families to ANcerno trades.

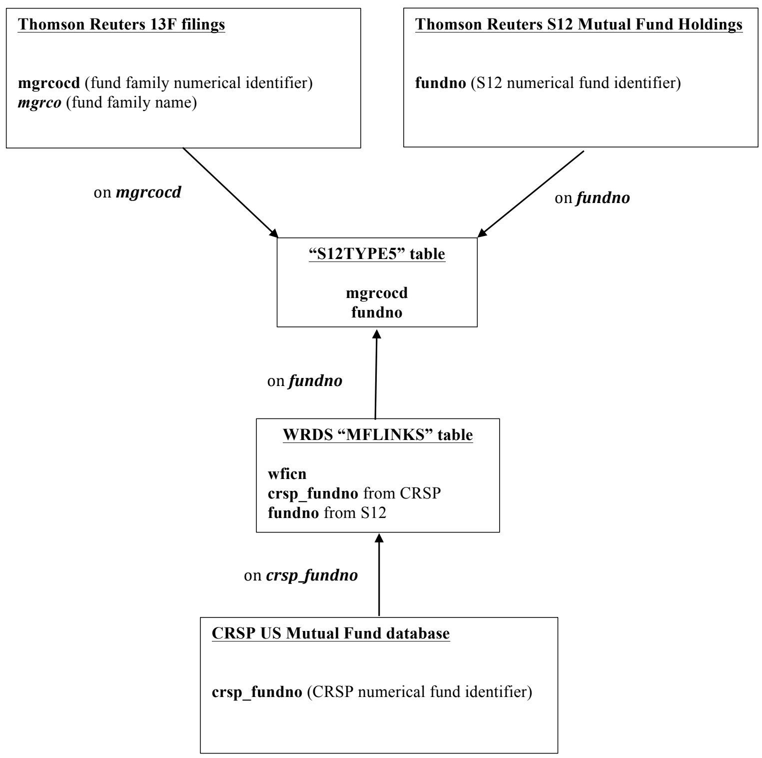

Fig. A2. Procedure to map fund families to individual mutual funds in CRSP.

Table A1
ANcerno variables.
This table describes the ANcerno variables we use in the paper.

Ancerno Variable	Description	Source File
	Fund and fund family identifiers	
clientcode	Ancerno defined Client identifier	Main trades dataset
clientmgrcode	Ancerno defined Client Manager identifier (fund, fund manager, or separate account)	Main trades dataset
managercode	Financial institution (e.g., fund family)	ManagerXref file
manager	Financial institution's name	MasterManagerXref file
	Trade variables	
tradedate	Date of the trade	Main trades dataset
xdtX	Execution time (at minute precision)	Main trades dataset
cusip	Stock cusip	Main trades dataset
Side	Buy or sell (1 = Buy; -1 = Sell)	Main trades dataset
Price	Execution price per share	Main trades dataset
Volume	Number of traded shares	Main trades dataset
CommissionUSD	Per trade commission in USD	Main trades dataset
	Benchmark variables	
xpX	Market price at execution (at minute precision)	Main trades dataset
dpC	Closing price of the day	Main trades dataset
ov	Total shares of the block	Main trades dataset
dpH	High of the day	Main trades dataset
dpL	Low of the day	Main trades dataset
dpOC	VWAP from open to close	Main trades dataset

Table A2
Heterogeneity in the impact of the 2004 reform.

This table reports difference-in-difference estimates for the effective spread of cross-trades and open market trades (control group) by bad- and good-governance fund families. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. We define the effective spread of a trade as $ES = \frac{|P-M|}{M}$, where P is the execution price of the trade as reported by ANcerno, and M is the mid price of the stock at execution time obtained from TAQ. *Bad Governance* is a dummy variable that takes a value of one if a fund family has been investigated by the SEC for illegal trading practices. *Post Regulation* equals one for trades executed from October 1st 2004 onwards and equals zero for trades executed before. *Post Regulation* is absorbed by the fixed effects in Specifications (2)-(5). *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*Effective Spread (ES)*			
	(1)	(2)	(3)	(4)
CT × Post Regulation × Bad Governance	-0.0050***	-0.0028**	-0.0029**	-0.0039***
	(-4.09)	(-2.32)	(-2.50)	(-3.33)
Post Regulation × Bad Governance	-0.0029***	-0.0020***	-0.0012***	-0.0010***
	(-7.93)	(-7.15)	(-5.24)	(-6.12)
CT × Bad Governance	0.0102***	0.0091***	0.0078***	0.0067***
	(13.55)	(27.01)	(20.10)	(12.93)
CT × Post Regulation	-0.0008	-0.0017***	-0.0015***	-0.0012**
	(-1.09)	(-3.31)	(-3.02)	(-2.09)
Post Regulation	0.0001			
	(0.12)			
Bad Governance	0.0016***	0.0003	0.0002	
	(4.53)	(1.29)	(1.28)	
CT	-0.0032***	-0.0032***	-0.0021***	-0.0013**
	(-4.88)	(-12.37)	(-6.19)	(-2.59)
Trade Size	0.0308***	0.0293***	0.0104***	0.0075***
	(15.81)	(13.94)	(10.16)	(8.52)
Stock Fixed Effects	No	No	Yes	Yes
Family Fixed Effects	No	No	No	Yes
Time Fixed Effects	No	Yes	Yes	Yes
Observations	4,020,154	4,020,154	4,020,154	4,020,154
R^2	0.034	0.095	0.160	0.180

Table A3
Including commissions.

This table reports estimates for the effective spread of cross-trades and open market trades (control group) including any commission paid to the broker. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. We define the effective spread of a trade including commissions as $ES_c = \frac{|P-M|}{M} + c$, where P is the execution price of the trade as reported by ANcerno, M is the mid price of the stock at execution, and c is the per dollar commission paid on the trade. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP, *Stock Illiquidity* is the monthly average of the daily absolute stock return scaled by its daily trading volume, *Stock Market Cap.* is the log market capitalization of the stock (in millions), and *Stock Volatility* is the standard deviation of daily stock returns during the month. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*Effective spread (ES) + Commissions*				
	(1)	(2)	(3)	(4)	(5)
CT	0.0064***	0.0033***	0.0033***	0.0032***	0.0032***
	(12.54)	(11.66)	(12.14)	(12.03)	(12.37)
Trade Size			0.0101***	0.0382***	0.0148***
			(12.79)	(15.43)	(20.19)
Stock Illiquidity			0.0867***	0.0488***	
			(19.01)	(4.22)	
Stock Market Cap.			-0.0013***	-0.0051***	
			(-17.40)	(-17.96)	
Stock Volatility			0.0988***	0.1190***	
			(19.32)	(26.90)	
Controls squared	No	No	No	Yes	Subsumed
Stock Fixed Effects	No	Yes	Yes	Yes	Subsumed
Family Fixed Effects	No	Yes	Yes	Yes	Subsumed
Time Fixed Effects	No	Yes	Yes	Yes	Subsumed
Stock × Family × Time Effects	No	No	No	No	Yes
Observations	4,020,154	4,020,154	4,020,154	4,020,154	4,020,154
R^2	0.005	0.210	0.248	0.252	0.448

Table A4
Alternative empirical methodology: nearest-neighbor matching.

This table reports estimates using a Nearest-Neighbor Matching algorithm (NNM). Observations are at the trade level; if an order is executed in multiple trades, we report an observation for each single execution. We define the effective spread of a trade as $ES = \frac{|P-M|}{M}$, where P is the execution price of the trade from ANcerno, and M is the mid price of the stock at execution time obtained from TAQ. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. Column (1) matches each cross-trade to the open market trade in the same stock, family, and day that is the closest in term of trade size. Column (2) matches each cross-trade to the open market trade in the same stock, family, day, and side (buy or sell) that is the closest in term of trade size. Column (3) matches each cross-trade to the open market trade in the same stock, family, day, side (buy or sell), and order execution (the order is filled in one execution vis-à-vis multiple executions) that is the closest in term of trade size. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP. We report the average treatment effect (ATE). Similarity between treatment (cross-trades) and control group (open market trades) is estimated using the Mahalanobis distance. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. *** indicate statistical significance at the 1% level.

Dependent Variable:	*Effective Spread (ES)*		
	Estimation Method: Nearest-neighbor matching		
	(1)	(2)	(3)
	Matched on:	*Matched on:*	*Matched on:*
	Stock Date Family Trade size	Stock Date Family Trade size Side (buy or sell)	Stock Date Family Trade size Side (buy or sell) Order execution
ATE (*CT*)	0.0037***	0.0036***	0.0033***
	(26.03)	(20.47)	(14.79)
Observations	64,764	42,611	33,014

Table A5
Including unreliable time-stamps.

This table reports estimates for the effective spread of cross-trades and open market trades (control group). Also trades that report as execution times 16:00, 16:10, and 16:20 are included. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. We define the effective spread of a trade as $ES = \frac{|P-M|}{M}$, where P is the execution price of the trade from ANcerno, and M is the mid price of the stock at execution time obtained from TAQ. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. Column (1) reports the OLS estimate without including controls or fixed effects; Column (2) includes time, stock, and family fixed effects; Column (3) includes time, stock, and family fixed effects, and time-varying stock-level controls; Column (4) includes time, stock, and family fixed effects, time-varying stock-level controls, and squared time-varying stock-level controls; Column (5) includes stock×family×time fixed effects and *Trade Size*. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP, *Stock Illiquidity* is the monthly average of the daily absolute stock return scaled by its daily trading volume, *Stock Market Cap.* is the log market capitalization of the stock (in millions), and *Stock Volatility* is the standard deviation of daily stock returns during the month. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*Effective Spread (ES)*				
	(1)	(2)	(3)	(4)	(5)
CT	0.0028***	0.0024***	0.0023***	0.0022***	0.0023***
	(5.50)	(7.46)	(7.46)	(7.39)	(7.68)
Trade Size			0.0109***	0.0334***	0.0114***
			(10.97)	(9.51)	(12.19)
Stock Illiquidity			0.0254***	0.0052	
			(6.83)	(0.61)	
Stock Market Cap.			-0.0002***	-0.0022***	
			(-2.81)	(-10.64)	
Stock Volatility			0.1199***	0.1435***	
			(25.38)	(33.44)	
Controls squared	No	No	No	Yes	Subsumed
Stock Fixed Effects	No	Yes	Yes	Yes	Subsumed
Family Fixed Effects	No	Yes	Yes	Yes	Subsumed
Time Fixed Effects	No	Yes	Yes	Yes	Subsumed
Stock × Family × Time Effects	No	No	No	No	Yes
Observations	7,518,456	7,518,456	7,518,456	7,518,456	7,518,456
R^2	0.001	0.202	0.233	0.236	0.442

Table A6
Placebo sample.

This table reports estimates for the effective spread of cross-trades and open market trades (control group) for a sample including only trades from an institution selling mostly passive investment products. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. We define the effective spread of a trade as $ES = \frac{|P-M|}{M}$, where P is the execution price of the trade from ANcerno, and M is the mid price of the stock at execution time obtained from TAQ. *CT* is a dummy variable that equals one if the trade is crossed internally and zero if it is executed on the open market. Column (1) reports the OLS estimate without controls or fixed effects; Column (2) includes time and stock fixed effects; Column (3) includes time, and stock fixed effects, and time-varying stock-level controls; Column (4) includes time and stock fixed effects, time-varying stock-level controls, and squared time-varying stock-level controls; Column (5) includes stock×time fixed effects and *Trade Size*. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP, *Stock Illiquidity* is the monthly average of the daily absolute stock return scaled by its daily trading volume, *Stock Market Cap.* computed as the log market capitalization of the stock (in millions), and *Stock Volatility* computed as the standard deviation of daily stock returns during the month. Errors are clustered at the monthly level. All observations are included and no 10% random sample is drawn. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*Effective Spread (ES)*				
	(1)	(2)	(3)	(4)	(5)
CT	-0.0026***	-0.0013***	-0.0013***	-0.0013***	-0.0012***
	(-12.51)	(-8.80)	(-8.66)	(-8.78)	(-9.04)
Trade Size			0.0000*	0.0002***	0.0000
			(1.96)	(2.94)	(1.64)
Stock Illiquidity			0.0138***	0.0433***	
			(2.87)	(6.50)	
Stock Market Cap.			-0.0001	-0.0010**	
			(-1.11)	(-2.43)	
Stock Volatility			0.0541***	0.0699***	
			(9.63)	(10.69)	
Controls squared	No	No	No	Yes	Subsumed
Stock Fixed Effects	No	Yes	Yes	Yes	Subsumed
Time Fixed Effects	No	Yes	Yes	Yes	Subsumed
Stock × Time Effects	No	No	No	No	Yes
Observations	14,336,460	14,336,460	14,336,460	14,336,460	14,336,460
R^2	0.002	0.173	0.184	0.185	0.316

Table A7

The influence of monitoring on backdating (alternative test of restriction H2-b).

This table reports linear probability estimates obtained by regressing *HighLow* on *CT*. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. *HighLow* is a dummy variable that equals one if a trade is executed either at the highest or the lowest price of the day for the stock. *Post Regulation* equals one for trades executed from October 1st 2004 onward and equals zero for trades executed before. *Post Regulation* is included in all specifications but the coefficient is not reported. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. Column (1) reports the OLS estimate without including controls or fixed effects; Column (2) includes time, stock, and family fixed effects; Column (3) includes time, stock, and family fixed effects, and time-varying stock-level controls; Column (4) includes time, stock, and family fixed effects, time-varying stock-level controls, and squared time-varying stock-level controls; Column (5) includes stock×family×time fixed effects and *Trade Size*. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP, *Stock Illiquidity* is the monthly average of the daily absolute stock return scaled by its daily trading volume, *Stock Market Cap.* is the log market capitalization of the stock (in millions), and *Stock Volatility* is the standard deviation of daily stock returns during the month. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*HighLow*				
	(1)	(2)	(3)	(4)	(5)
CT	0.0070***	0.0065***	0.0070***	0.0071***	0.0074***
	(5.96)	(5.87)	(6.26)	(6.32)	(6.26)
CT × *Post Regulation*	-0.0053***	-0.0036**	-0.0041***	-0.0042***	-0.0048***
	(-3.45)	(-2.51)	(-2.81)	(-2.89)	(-3.10)
Trade Size			-0.0300***	-0.0910***	-0.0567***
			(-6.74)	(-8.28)	(-10.09)
Stock Illiquidity			0.3393***	0.4106***	
			(7.23)	(3.79)	
Stock Market Cap.			-0.0015***	0.0021**	
			(-7.62)	(2.04)	
Stock Volatility			-0.0388***	-0.0462***	
			(-6.46)	(-6.80)	
Controls squared	No	No	No	Yes	Subsumed
Stock Fixed Effects	No	Yes	Yes	Yes	Subsumed
Family Fixed Effects	No	Yes	Yes	Yes	Subsumed
Time Fixed Effects	No	Yes	Yes	Yes	Subsumed
Stock × Family × Time Effects	No	No	No	No	Yes
Observations	4,020,154	4,020,154	4,020,154	4,020,154	4,020,154
R^2	0.001	0.035	0.036	0.036	0.221

Table A8
Robustness backdating.

This table reports linear probability estimates obtained by regressing *HighLow* on *CT*. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. *HighLow* is a dummy variable that equals one if a trade is executed either at the highest or the lowest price of the day for the stock. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Column (1) includes only fund families that have been investigated by the SEC for violations of trading rules; Column (2) includes only fund families that have not been investigated; Column (3) excludes stocks whose price is below $5; Column (4) includes ANcerno client fixed effects; Column (5) adds day×family×stock fixed effects. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*HighLow*				
	(1) Bad Governance	(2) Good Governance	(3) No Penny Stocks	(4) Client FEs	(5) Family×Stock× ×Day FEs
CT	0.0071***	-0.0002*	0.0065***	0.0066***	0.0062***
	(6.54)	(-1.85)	(6.44)	(6.46)	(7.01)
Trade Size	-0.0642***	-0.0427***	-0.0541***	-0.0566***	-0.0137***
	(-8.16)	(-8.04)	(-9.78)	(-10.08)	(-3.92)
Stock × Family × Time Effects	Yes	Yes	Yes	Yes	Subsumed
Client FE	No	No	No	Yes	No
Stock × Family × Day Effects	No	No	No	No	Yes
Observations	2,460,455	1,559,697	3,948,093	4,020,150	3,216,082
R^2	0.192	0.269	0.215	0.221	0.791

Table A9

Which stocks are cross traded?

This table reports estimates obtained by regressing, respectively, *Stock Illiquidity*, *Bid-Ask Spread*, and *Stock Market Cap.* on *CT* and *CT* × *Post Regulation*. *Post Regulation* is included in all specifications but the coefficient is not reported. Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. *Post Regulation* equals one for trades executed from October 1st 2004 onward. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. *Stock Illiquidity* is the monthly average of the daily absolute stock return scaled by its daily trading volume, *Stock Market Cap.* is the log market capitalization of the stock (in millions), and *Bid-Ask Spread* is the bid-ask spread of the stock. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	Stock Illiquidity	Bid-Ask Spread	Stock Market Cap.
	(1)	(2)	(3)
CT	-0.0006***	-0.0005***	0.1002***
	(-11.93)	(-6.21)	(8.12)
CT × *Post Regulation*	0.0004***	0.0004***	-0.0537***
	(5.43)	(4.46)	(-3.85)
Stock Fixed Effects	Yes	Yes	Yes
Family Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Observations	4,020,154	4,020,154	4,020,154
R^2	0.723	0.635	0.960

Table A10

Further robustness tests

This table reports estimates for the effective spread of cross-trades and open market trades (control group). Observations are at the trade level; if an order is executed in multiple trades, we include one observation for each single execution. We define the effective spread of a trade as $ES = \frac{|P-M|}{M}$, where P is the execution price of the trade from ANcerno, and M is the mid price of the stock at execution time obtained from TAQ. *CT* is a dummy variable that equals one if a trade is a cross-trade and zero if a trade is executed on the open market. Cross-trades are defined as transactions occurring i) within the same fund family, ii) in the same stock, iii) in the same quantity, iv) at the same time of the same day, v) at the same price, but vi) traded in opposite directions. Column (1) includes only orders that are executed in a single transaction; Column (2) includes only trades for which the execution price is above the last sale price; Column (3) includes only trades for which the execution price is below the last sale price; Column (4) includes only buys; Column (5) includes only sells; Column (6) includes as additional proxies of trade size the number of traded shares over the shares traded during the day in the same stock (*2nd Proxy of Trade Size*) and the number of traded shares over the number of shares outstanding (*3rd Proxy of Trade Size*); and Column (7) includes only S&P 500 stocks. *Trade Size* is defined as the number of traded shares scaled by the average trading volume for the stock in the previous five days obtained from CRSP. Observations are 10% of trades randomly drawn from ANcerno without replacement, after having identified cross-trades on the whole database. Errors are clustered at the monthly level. The constant is included in all specifications but the coefficient is not reported. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent Variable:	*Effective Spread (ES)*						
	Trade=Order (1)	Buy Initiated (2)	Sell Initiated (3)	Buys (4)	Sells (5)	Trade Size Proxies (6)	S&P 500 Stocks (7)
CT	0.0053***	0.0047***	0.0047***	0.0045***	0.0041***	0.0042***	0.0039***
	(13.45)	(16.71)	(17.10)	(17.63)	(16.35)	(17.15)	(17.12)
Trade Size	0.0298***	0.0092***	0.0111***	0.0110***	0.0090***	0.0559***	0.0177***
	(12.87)	(12.84)	(13.81)	(13.77)	(11.17)	(34.33)	(16.81)
2nd Proxy of Trade Size						-0.0870***	
						(-46.14)	
3rd Proxy of Trade Size						0.0037***	
						(17.25)	
Stock × Family × Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,133,823	1,904,451	1,978,544	1,972,150	1,994,911	4,020,087	2,489,873
R^2	0.414	0.508	0.500	0.431	0.457	0.413	0.380