



Trade Process Analysis: Advanced Methods for Analyzing Trading Performance

Trade cost analysis (TCA) has long held out the promise of quantitative, objective evaluation of firms' trading performance and, by extension, of improving that performance. It has largely failed on both counts. Reports tend to be opaque and ambiguous, leaving traders and investment officers to speculate about why some performance metric is better or worse than a peer group and whether the differences are meaningful.

Part of the reason for this failure is that trading takes place in a complex, noisy market environment. Myriad factors affect trading costs, including liquidity, volatility, market trends, regulatory constraints, risk preferences, and perhaps most vexing, the fluctuating performance of the portfolio manager whose trades are being executed. This inherent complexity confounds the simple analyses offered by TCA vendors, which are rarely more sophisticated than a collection of averages. Making sense of trade data is a statistical and analytical challenge.

However, clever and careful analysis of trade data can often cut through the complexity, help a firm understand its trading performance, and generate actionable insights to improve that performance. We call this emerging best practice **Trade Process Analysis (TPA)**, in recognition of the fact that trading performance can only be understood holistically in the context of the entire trading process. TPA involves a systematic examination of this process starting with the PM's trading decisions, continuing through the communication between PMs and the trading desk, the way brokers are used by the trading desk, through the behavior and performance of

those brokers. Each step in the trading process offers opportunities for firms to make mistakes and, on the flip side, improve. In this note we provide a brief overview of the TPA process and the potential benefits it offers.

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TPA can be divided into four stages: data cleaning, broker analysis, trader analysis, and portfolio manager analysis.

The first stage consists of filtering and consolidating the trade data to be analyzed. This data, typically extracted from EMS and/or OMS databases, theoretically provides a full audit trail from the portfolio manager decision all the way through the fills returned from the various brokers. The reality is often less neat due to the limitations of the OMS and EMS systems and data collection processes. A variety of tools must typically be used to validate and clean the data, including correlating it with high-frequency open market data. Even a small amount of bad data can seriously undermine the process and lead to spurious conclusions. The goal of this stage is to arrive at a clean data set consisting of portfolio manager trading decisions, how those trading decisions were communicated to and executed by the trading desk, and finally the fills obtained by the various brokers or algorithms used to execute the trade.

The second part of TPA is concerned with broker analysis. Evaluating broker performance is one of the more appealing and apparently straightforward promises of TCA. But in fact it's as fraught with complexity as any other phase in the trading process.

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One typically sees substantial variation in the shortfalls among different brokers. In many cases, these gross differences don't reflect huge differences in the skill of the brokers, but rather are the result of other less straightforward causes. For example, order difficulty often varies systematically between brokers. A broker specializing in small-cap programs may get much harder orders than a DMA provider. Less obviously, one broker may be used more heavily during a more volatile period than another. Sophisticated statistical methods are necessary to control for these differences. However, even after controlling for a variety of such exogenous variables, performance among brokers still varies significantly.

Much of this remaining variation is due to broker behavior. One important dimension of this behavior, and a key explanatory variable in performance, is the risk a broker tolerates when trading. While a trader might instruct two brokers to execute an order passively, one broker might interpret this as trading over the whole day, while another interprets it as trading over half a day. The result of these different interpretations might cause the first broker to have lower average shortfall than the second at the expense of higher execution risk.

Figure 1 depicts a hypothetical (but realistic) example of the performance of several brokers after adjusting for exogenous variables like order difficulty. In the graph, we plot each broker as a point, with position on the Y axis showing his average implementation shortfall and his position on the X axis showing the standard deviation of the shortfall. The lines through each point are error bars indicating the uncertainty of the average based on the variability of the broker's performance and the amount of data available.

This analysis explains much of the remaining difference among the brokers' average

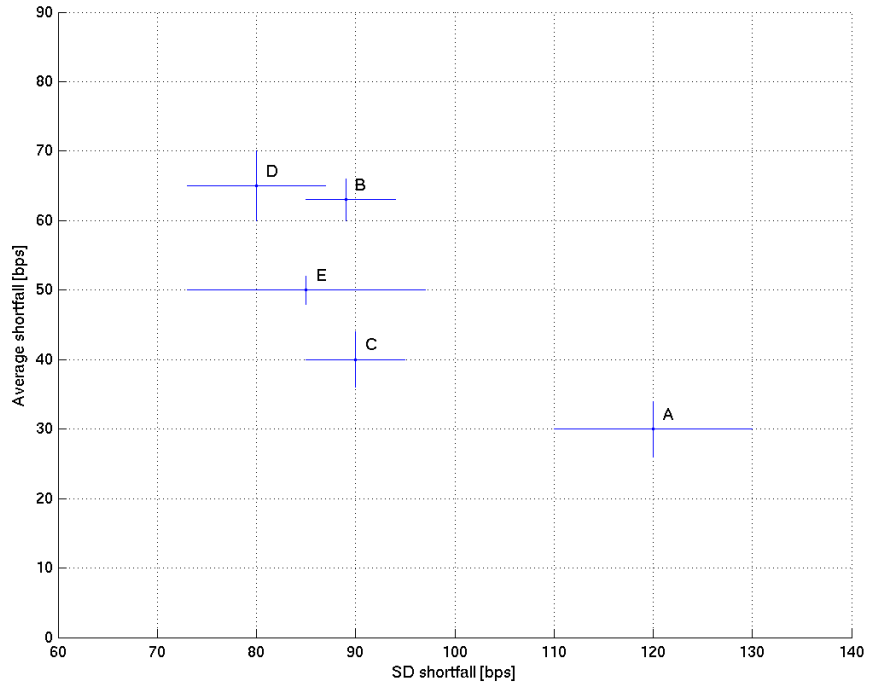


Figure 1: Implementation shortfall versus execution risk for various brokers.

shortfall: some brokers (for example D) trade faster, pay more on average, but take on less execution risk. Others, (for example A) trade slower and have lower average shortfall but higher execution risk. The brokers in the diagram make different tradeoffs between shortfall and execution risk, so while D's shortfall is twice A's, one cannot necessarily conclude that Broker A is better than Broker D.

This tradeoff analysis also offers the possibility of identifying under- or out-performing brokers: those who incur significantly more or less shortfall for the same level of risk than the rest of the brokers. In the figure, broker B takes as much risk as Brokers C and E but has significantly worse average shortfall. Based on this analysis, Broker B may be doing a poor job.

However, this is just the first step in properly understanding and evaluating broker performance. Further analysis of broker behavior should consider time of day of orders, any differences in the volatility or spreads in the periods they traded, and any systematic difference in PM or strategy or other conditions when the broker tended to be used.

In addition to gross patterns of broker behavior, many fine-grained aspects of a broker's trading style can be read from the tick-level trading record, including scheduling choices, trading burstiness, quality of the "price points" brokers choose, limit strategies, microtrading strategies, shortfall-skewing price adaptivity, and so forth. Generally, only by examining the detailed behavior of the broker at the tick level can a firm gain a confident understanding of whether and why a broker is better or worse than its peers.

Beyond the question of performance, the broker style analysis raises the question of whether the tradeoffs evident in brokers' disparate approaches to risk properly reflect and serve the objectives of the trading desk and the firm. In addition, it can help the trading desk identify brokers that do not follow the trader's instructions, e.g., by trading too fast or too slow.

The third part of TPA concerns the trading desk. Depending on the type of instructions the trading desk gives its brokers, the same types of analyses used for brokers can be used to provide insight into the effectiveness of the trading desk. One interesting example at the juncture between trader and broker behavior concerns how a trading desk splits baskets up among brokers. Trading desks will, for example, sometimes split a market-neutral basket up into pieces that have much more market exposure than the original basket as a whole. Brokers commonly trade faster to eliminate risk they perceive. If the risk is phantom (as occurs when the exposure of

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the leg given to a broker is offset by another leg that was given to another broker) then the broker's fast trading provides the client firm little benefit in terms of risk. In some cases uncoordinated broker activity can actually increase the true execution risk. But while the risk benefits of such trading by brokers can be illusory, the market impact of faster trading is very real.

The fourth element of TPA involves analyzing each PM and the trading done on their behalf. In order to execute a trade appropriately, the trading desk needs a reasonable assessment of the expected returns around the trading period. A value trade may have a very different sense of urgency than a momentum or event-driven trade. A trade exit or a cash-flow trade may have a different level of urgency again. TPA analysis includes an estimate of each PM's short-term alpha through strategy-specific event studies. Figure 2 shows the result of such an analysis – the alpha profile around a trade relative to the price at the time the trading desk receives the order.

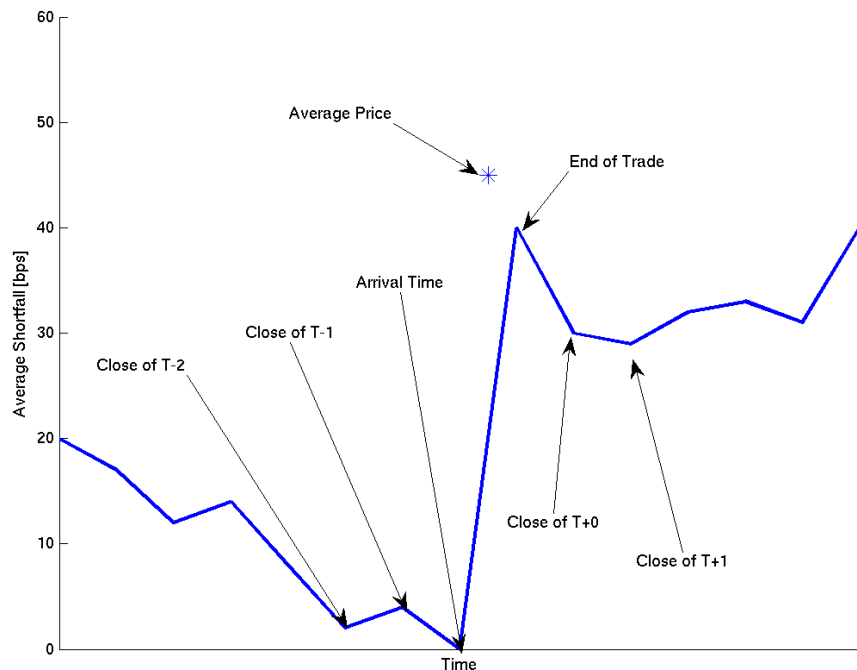


Figure 2: Alpha profile around a portfolio manager trades. Returns relative to arrival price.

This type of analysis can sometimes provide valuable information about what the price action around a trade is likely to be on average. Moreover, it can provide powerful hints as to whether trading may be too aggressive (indicated by significant price reversion after trades complete) or too passive (indicated by significant momentum before and after the trade period.) In the figure above, it appears that value is a component of the stock selection process (because of the negative returns prior to trade initiation), and that trade initiation is reasonably well timed, but that the trading itself may be too aggressive (because there is significant price reversion between the average price of the trade and the close price for the day).

Another PM-specific analysis tries to get at the optimal trading speed for a strategy by taking advantage of the natural variation in the speed with which different traders and brokers trade. From first principles, other things being equal, if aggressive trading is necessary to capture significant alpha, the higher speed trades should have less shortfall on average than slower trades (at least up to some limit). If there is little alpha, then the faster trading should just incur market impact and result in worse shortfalls. The following graph shows how the results of this analysis might look. We depict the average shortfall as a function of trading speed. The data is grouped into three sets based on order difficulty and each group is analyzed separately.

Figure 3 illustrates that, regardless of the difficulty of the trade, higher rates of trading are associated on average with higher shortfall. This suggests that there is little short-term alpha, and that passive trading would yield better results.

The TPA process often provides specific insights and hints for changes to the trade

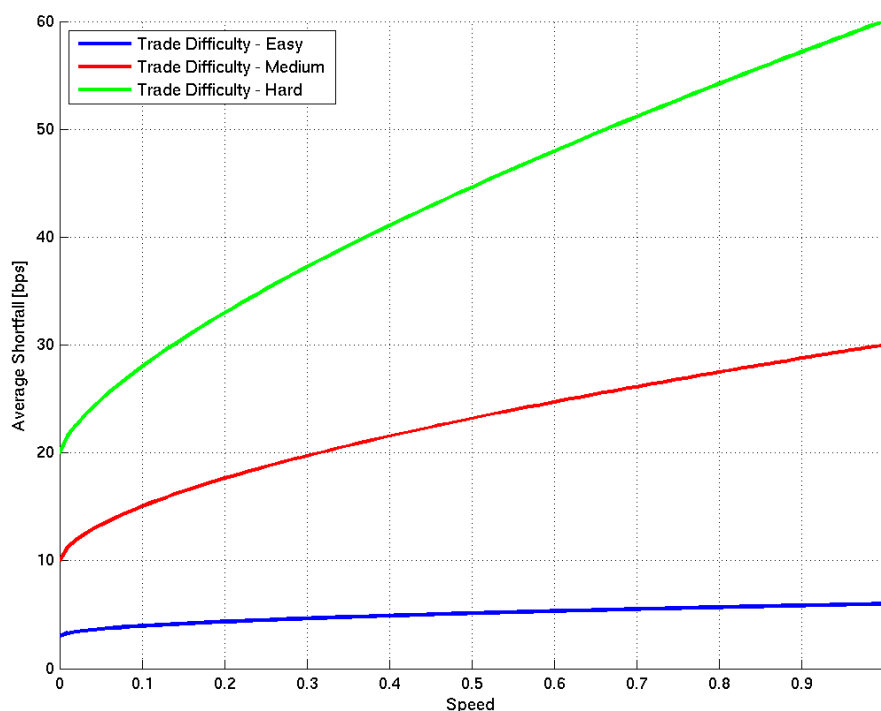


Figure 3: Shortfall as a function of trading speed for orders with similar difficulty.

process that might improve performance. But as importantly, it encourages institutions to think holistically and confront embedded assumptions and misalignments that can undermine performance. Are PMs giving the traders the information they need to trade intelligently? Are traders being evaluated in a way that aligns their trading results with the investment performance of the firm? Are the right benchmarks being used for each portfolio manager? Answering these questions properly is a complex project for a firm to take on, but it offers a true opportunity. Institutional inertia is huge, and firms willing to invest the time and energy can gain a meaningful and lasting advantage over their peers.

For questions or comments on TPA, please email Eran Fishler, Director of Research (efishler@pragmatrading.com), call 866.502.2546, or email algosupport@pragmatrading.com. Pragma provides a comprehensive TPA service.

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