Trading Series Part 2:

Trading Costs are Very Real — Perspectives for Global Equity Investors

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Key Ideas

As equity markets continue to be volatile and alpha more difficult to generate, active investment managers need to place greater emphasis on constraining those detractors from return that are within their control – the most notable being trading costs. Identifying, measuring and forecasting trading costs remains a challenge for all investment managers given the continued evolution of the markets and unique client constraints. In this paper we will discuss:

- some of the dominant measurement tools and best practices to help mitigate the potential negative effects of high-frequency trading (HFT);
- how investment managers may protect client interests with innovative trading techniques, without revealing too much intellectual property; and
- how Intech® has adapted its implementation process, given the structural changes in the market over the last two decades (see Trading Paper Series Part One: "The Evolution of Trading: From Quarters to Pennies and Beyond").

Intech®

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For all investors, the ability of their investment managers to control trading costs is critical to achieving the highest returns and preserving alpha. Therefore, they should consider establishing a framework within which to successfully implement their investment process while protecting their clients' best interests.

To better understand the impact that trading costs have on safeguarding alpha, it is important to decompose equity transaction costs into explicit and implicit components. At a high level, explicit costs are typically comprised of brokerage commissions, clearing and settlement costs, taxes/stamp duties, and exchange/market fees, and are typically easily determined prior to executing trades. Investment managers have a much more challenging time ascertaining the implicit costs, which include: the bid-ask spread, market impact, and delay and opportunity costs. These costs cannot be known in advance, given that they are dependent upon the execution price, share quantity and market conditions. As a ship's captain navigating through icebergs is not concerned with the piece of the berg exposed above the water, but rather the piece underneath the surface that cannot be seen and may cause severe damage to the ship's hull, investors should be aware of the bigger chunk of the berg, implicit costs, which could potentially lead to lower investment portfolio returns.

Measuring transaction costs

Investment managers should closely monitor, estimate and report trading costs to their clients to ensure transparency, ultimately seeking to deliver best execution. There are various measurements that fundamental, quantitative and mathematical investment managers utilize to assist in best implementing their varying investment methodologies. Two of the most prevalent measurements for institutional trades include:

- implementation shortfall, and
- volume-weighted average price for the day.

A security's volume weighted average price (VWAP) is calculated by dividing the total dollar amount traded of a security on a given day (dollar volume) by the total number of shares traded during the same day (share volume). VWAP is not directly linked to an investment manager's strike price. Implementation shortfall is one of the most widely recognized cost measurements, in which the investment manager has the ability to capture the strike price prior to releasing the order to the marketplace. This strike price then serves as the benchmark for the broker/dealer's ultimate execution of the trade. Intech employs this measurement technique with its select list of broker/dealers, and goes one step further by awarding additional order flow to those brokers who demonstrate more favorable execution. Essentially, the closer to the strike price the broker executes the trade, the more order flow they receive. The result: helping to conserve the returns generated within the client's investment portfolio. This mitigates the delay and opportunity-cost components that may potentially hinder other investment managers' portfolio performance. The low-cost investment process, which focuses on incremental buying and selling of large-cap liquid stocks, in combination with this incentive system, has historically placed Intech in the lowest quartile for trading costs among our peer group of large-cap global investment managers.

Our research has led to a deeper understanding of the effects of two of the most important determinants on our trading costs:

- order size as a percentage of average daily volume (ADV), and
- the level of market volatility.

The dramatic increase in volatility in a short period of time during the Global Financial Crisis should have caused investment managers to re-assess their trading strategies to better adapt to this changing market landscape. Of importance is if those changes have led to improved investment performance. We have learned from past experiences that by improving our ability to identify spikes in volatility, our investment process is better able to adapt and potentially capture the true premium that results from rebalancing portfolios back to optimal target weights. The exhibit below highlights the relationship between our trading costs and order size as a percentage of ADV in 2017.

EXHIBIT 1

THE INTECH 2017 TRADING COSTS BY % OF ADV*

% of ADV	% Traded	Cost
>8%	12%	39 bps
4-8%	16%	23 bps
2-4%	20%	18 bps
1-2%	19%	15 bps
<1%	33%	9 bps
Total	100%	17 bps

*Source: Intech. Represents rebalancing trading costs for Intech strategies. Trading costs measured as the difference between the decision and execution price of the stock, plus commission costs. Data reflects past performance, which is no guarantee of future results.

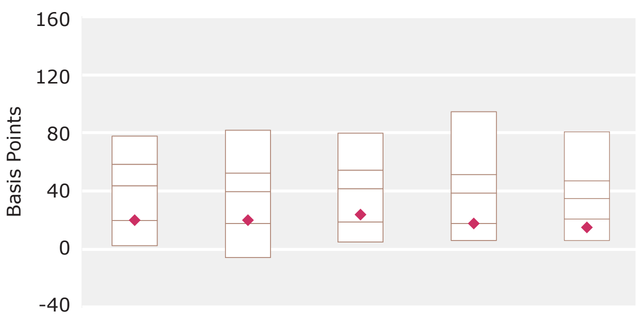
High-frequency trading

Over the last decade, as high-frequency trading has become a prominent share of trading volume, Intech has continued to implement trading mechanisms designed to prevent information leakage to the marketplace. Some of these advancements include:

- randomizing windows of no trading in a way to disguise our hand to sophisticated traders;
- applying intelligent trading techniques that are adaptive to changing market conditions; and
- measuring broker performance beyond implementation shortfall to minimize impact to our strategies.

EXHIBIT 2

TOTAL TRADING COSTS VS. PEER GROUP: GLOBAL DEVELOPED MARKETS*



	2013	2014	2015	2016	2017
5th Percentile	79	83	81	96	80
25th Percentile	59	53	55	52	47
Median	44	40	42	39	35
75th Percentile	20	18	19	18	21
95th Percentile	2	-6	5	6	6
Intech	**20**	**20**	**22**	**18**	**15**
Percent Rank	79%	70%	74%	76%	85%

These advancements have helped to combat the rapid dissemination of information today, as highlighted in Part One of this paper series. To operate against this backdrop, we maintain a concentrated list of institutional program-trading broker/dealers, with the goal of leveraging their critical understanding of the continuous evolution of the markets. Our portfolio rebalancing is performed using a secure proprietary platform that automates the entire investment process, producing a straight-through processing application.

The brokers Intech selects to execute its orders utilize a wide range of complex algorithmic trading tools to help make complicated decisions about how to best access liquidity in the markets. Our brokers are connecting to as many as 40 trading venues and are providing an infrastructure of systems, traders and technology for best execution of large block trades. Investors' Exchange (IEX), as noted in the book, "Flash Boys" by Michael Lewis, is a trading exchange designed to eliminate HFT predatory behavior. Our brokers have used IEX, at times, for best execution for our clients. In the end, we believe, this structure has allowed Intech to stay ahead of the curve, developing trading techniques that help protect our clients' interests.

Other hidden costs

Soft dollars, directed brokerage and commission recapture are other hidden costs that could ultimately negatively impact investment performance. The most common use of soft dollars is the exchange of free research and services from the broker, which are used to help identify securities to be bought and sold for a client's portfolio, for higher brokerage commissions on client trades. Directed brokerage is a client instruction to an investment manager to execute orders with a specific broker. Commission recapture is a provision that may allow a client to regain some of the transaction costs or commissions for various investment activities from individual brokers. Intech does not participate in soft dollars, directed brokerage or commission recapture arrangements. This policy has allowed us to allocate brokerage based on an objective and quantifiable benchmark, focusing solely on seeking best execution. Exhibit 2 shows our total developed-market trading costs are consistently in the lowest quartile among its peers.

*Source: ITG. Results based on trading cost analysis vs. an all developed markets peer group for the periods shown as of the last quarter in each year. For the fourth quarter of 2017, the peer group consisted of 149 managers encompassing a trade value of USD 2,026 billion. Number of managers and trade values for other periods are available upon request. Additional information about ITG can be obtained from its website at www.itg.com. Data reflects past performance, which is no guarantee of future results.

AUM and trading costs – a careful balance

As assets under management (AUM) increase, position sizes also increase and could result in portfolio returns suffering. Unless a manager's investment process is scalable in overcoming the relationship between market impact and order size, their ability to grow could be impeded. Larger orders (>15% of ADV) are typically more challenging to execute than smaller orders. These larger trades tend to increase the levels of market impact (the bottom of the iceberg), which ultimately leads to performance deterioration. Additionally, capacity is not only based on the level of assets, it is based on the timing of inflows as well. For example, a strategy can temporarily reach capacity at lower asset levels – if the timing of inflows occurs over a short period of time. Conversely, a strategy can reach capacity at higher asset levels – if the timing of inflows happens over longer periods of time. As part of portfolio construction, our strategies invest in a broad number of stocks, with the intent of building portfolios that are potentially more efficient than the market, and have moderate portfolio turnover for any given rebalance. We trade incrementally in stocks to capture small but persistent price volatility through regular rebalancing. As a result, our average order size by percentage of ADV in 2017 was roughly 3% for all developed markets, placing Intech in the 1st percentile in its peer group.*

*Source: Intech. Represents rebalancing trading costs for Global/Non-U.S. strategies only. Trading costs measured as the difference between the decision and execution price of the stock, plus commission costs.

Conclusion

Trading costs are very real and may impact an investment manager's ability to generate alpha. This paper has touched upon the explicit and implicit costs, with the understanding that the breakdown of implicit costs for a fundamental or quantitative manager continues to be a gray area depending on the preferred measurement of assessment. Within this context, Intech continues to monitor the trade execution quality for our clients, aligning our unique mathematical investment approach with our proprietary trading methodology. Since the emergence of HFT more than 15 years ago, we have been tracking developments through a combination of discussions with and inspections of our brokers, participation in academic and practitioner conferences, and internal trading research. We estimate the overall impact of the market changes and the emergence of HFT to be a net positive, based on the decline of trading costs for our U.S. equity strategies over the last ten years.**

As markets have evolved, our proprietary trading process has also evolved, helping to mitigate market impact. Our trading methodology:

- provides a transparent and objective way of seeking best execution for our clients by allocating brokerage with the goal of providing transparency and objectivity; as well as
- creates a competitive environment whereby brokers earn their order flow.

Attempting to generate an excess return above the benchmark is critical to our clients being able to meet their funding obligations. Managing trading costs is a vital component of our unique investment process. In light of the significant market structure evolution over the last two decades, Intech has implemented enhancements to its trading methodology with the goal of adapting to and potentially benefitting from these changes in the market. Over the long term, we believe these enhancements strengthen our ability to generate alpha and should be beneficial to our clients.

**Source: Intech. Represents rebalancing trading costs for U.S. strategies only. Trading costs measured as the difference between the decision and execution price of the stock, plus commission costs.

Looking forward

The first two parts of this trading paper series focused on the evolution of trading and best practices in managing trading costs (to provide best execution for clients). As investment managers think about how to provide their clients with best execution, some of the questions they will need to answer to help provide the best outcome for their clients include:

- What are some of the benefits of outsourcing trade execution?
- If a manager elects to outsource trading, does it make sense to then outsource the middle- and back-office operations?

Given the fragmentation of market venues across the world, complex trading infrastructure, ever-changing technology advancements, and heightened awareness of reducing implementation costs, we will explore the concept of outsourcing trade execution in Part Three of our trading paper series.

Intech is a global quantitative asset manager investing on behalf of pension funds, governments, endowments, foundations, and other institutional investors worldwide. Having pioneered the application of Stochastic Portfolio Theory in 1987, Intech continues to seek distinctive alpha sources for clients in five continents. Today, Intech provides investment solutions encompassing ESG, absolute return, defensive equity, and traditional long-only strategies.

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