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Informed Trading Vol. 2

Three Pillars of Trading

- *Informed Trading Vol. 2* explores volume, volatility and spread in the global markets, the three most important factors in trading that drive our trading decisions and market impact estimation.
- While the U.S. market is expectedly the most liquid and efficient, many Asian markets appear to have trading costs higher than expected given their trading volumes.
- The first hour of the trading day accompanies high volatility-to-volume ratios in many but not all countries, suggesting the preferred trading schedule, or entry timing, should vary by market.
- Tick size affects volatility and spread profiles significantly. With the U.S. tick size pilot program beginning in October, we expect many changes in how the pilot stocks are traded.
- Instinet's analytics products enable users to examine historical intraday profiles stock-by-stock, run market impact estimations that take into account these profiles, and compare these analyses with real-time market data.

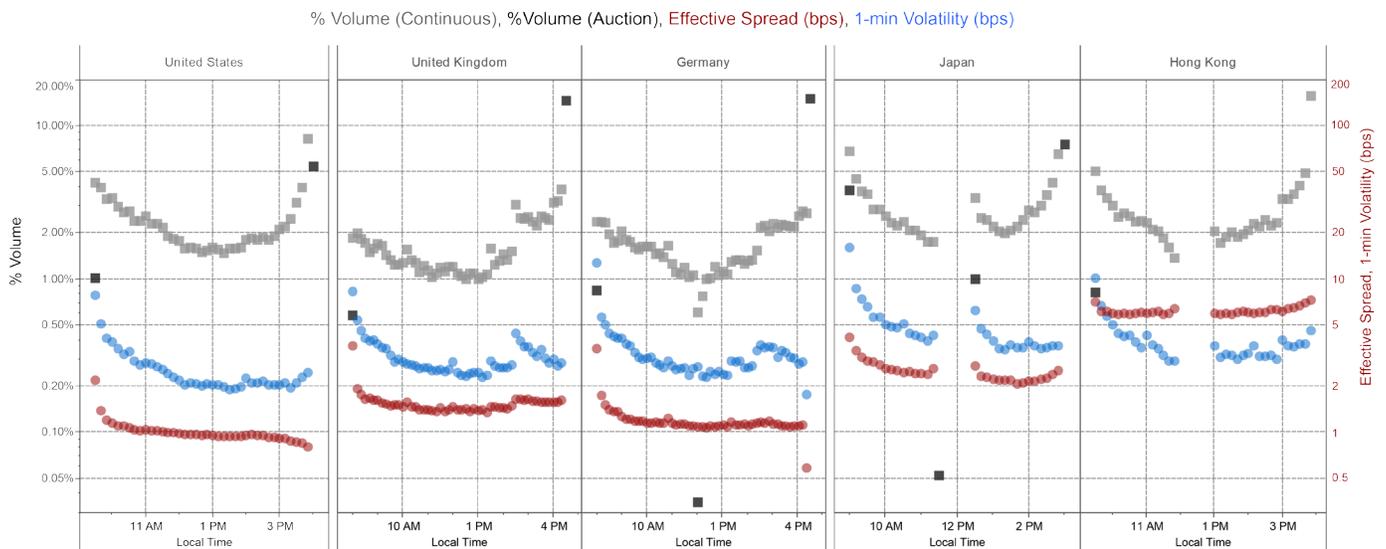
The Three Pillars

We consider volume, volatility and spread to be the three pillars of trading in that they are the primary factors driving both strategic and tactical trading decisions. In this installment of *Informed Trading*, we explore in some detail the intraday patterns of these important factors. We also compare the profiles across global markets and cross-sectional categories.

Exhibit 1 shows intraday volume, volatility, and spread profiles for five major global markets. When we look at the U.S. profiles for example, the three measures move downward in tandem for the first three hours from the market open. They then start to diverge, however, as volume increases exponentially toward market close, volatility remains rather constant and spread actually decreases slightly.

Exhibit 1 Intraday Profiles of Volume, Volatility, and Spread for Major Global Markets

Each profile is an aggregate of that country's most liquid group of stocks that collectively account for 50% of the country's total trading value. Volume profiles are displayed as percentage volume in ten-minute buckets (opening and closing auctions are shown separately in black.) The U.K. mid-day auction volume is included in the continuous trading volume. Volatility is based on one-minute price returns and displayed in basis points. Effective spread is shown as a ratio to the mid-price in basis points.



Source: Instinet

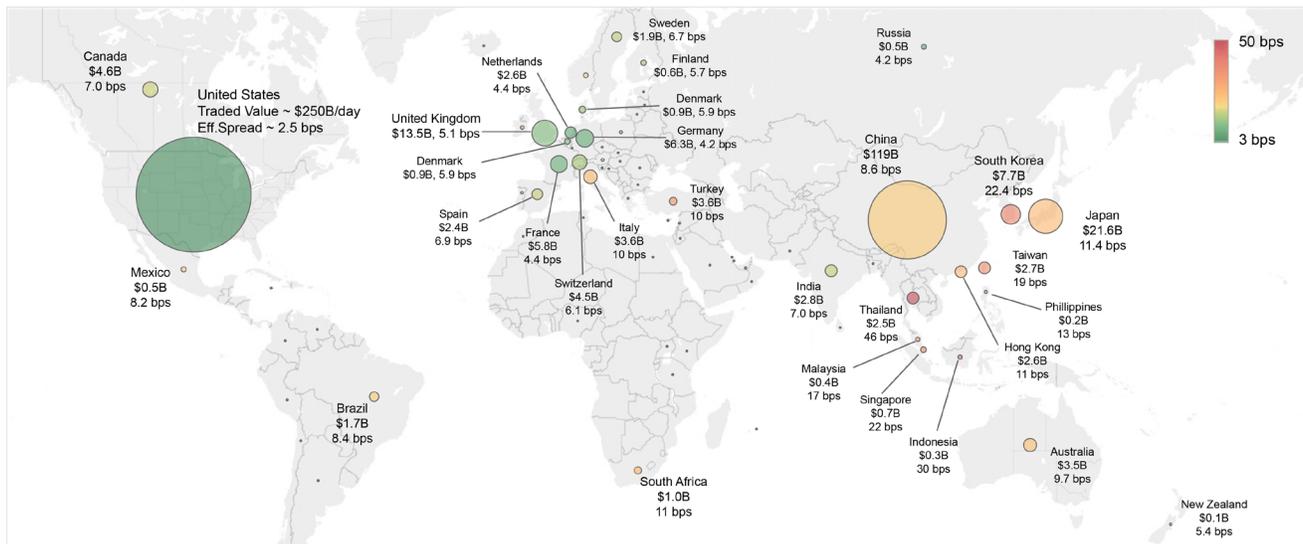
Although this may be a familiar observation, there are two important ideas about this relationship that should help inform our trading decisions:

1. Expected trading cost, *i.e.* market impact plus spread cost, depends on the order start time, even with the same order quantity and execution duration.
2. Preferred trading tactics should change across the time of day to account for these volatility and spread patterns.

Regarding Point 1, market impact is a function of volatility-to-volume ratio, and that the overall trading cost is the market impact plus (half) spread. It is clear from the U.S. profiles that the ratio varies significantly throughout the day, as does the spread. We demonstrate how these variations affect our market impact estimation further below.

Exhibit 2 Average Daily Trading Value and Effective Spread by Country

Spreads are the average of all actively traded stocks in the country weighted by the stock's average trading value (USD). Circle size is proportional to the trading value. Trading values of European markets only include those from order books [1].



Source: Instinet, BATS

With respect to Point 2, when spread and volatility are both elevated, trading tactics need to balance the potential spread savings through liquidity provision with increased adverse and negative selection. One way to achieve this is to provide liquidity more frequently, but in smaller sizes relative to those used in lower volatility periods. Additionally, we may employ active cancellation techniques to reduce adverse selection.

Global Heterogeneity

Exhibit 1 also demonstrates the heterogeneity of these profiles across markets. First and foremost, the U.S. effective spreads are clearly the smallest. In particular, the spreads of Japan and Hong Kong are considerably greater, as is their intraday volatility. Needless to say, these stylistic differences should inform our trading algorithms when trading globally. Also, this observation is surprisingly contrary to the common understanding that these markets are “mature” or “developed” and come with the promise of efficient, low-cost trading.

Exhibit 2 shows the average daily trading value and effective spreads by country. It comes as no surprise that the U.S. market is by far the most liquid and lowest-cost. The Asian markets, however, are more intriguing. China, which supplanted Japan around eight years ago in equity trading value, now completely dominates the region, securing second place behind the U.S. Furthermore, Japan, Hong Kong, South

Korea and Australia, though considerably smaller than China, have large trading value and rival many European counterparts.

Despite their higher trading activity, the effective spreads of these Asian/Pacific markets are consistently wider than those of the other regions. Each country may have specific reasons for this apparent inefficiency, but there are a few common factors associated with these markets.

1. Most of them lack inter-venue competition and stocks are traded on a single exchange. Although Japan and Australia do have alternative venues, their market shares are below ~5% and ~20% respectively, and trading happens predominantly on the largest incumbent exchange [2]–[4].
2. Tick sizes as a fraction of the stock price tend to be larger than those of other regions. Although large relative tick sizes are thought to attract high frequency market makers [5], [6], they also act as floors for bid-ask spreads.

Therefore, we think it becomes apparent that greater trading activity and investment in equity markets do not automatically translate to more efficient equity markets. Rather, efficient trading is a result of flexible regulatory actions encouraging competition and innovation [7].

Exhibit 3 Auction Volumes by Country and Liquidity

Auction volumes are shown as percentage of daily volume averaged by the country and liquidity group. The *Liquid* group consists of the most liquid stocks by trading value (USD) and collectively accounts for 50% of the country’s total trading value; *Medium* and *Illiquid* groups each accounts for 25%. China, Hong Kong, and India do not implement closing auctions.¹ The countries are sorted by the total trading value (USD) within each region.



Source: Instinet

Wide Auction Variety

Regarding **Exhibit 1**, we see that the volume profiles of these countries are more or less similar in shape, but auction volumes, as a percentage of the daily volume, differ markedly. **Exhibit 3** shows the auction contribution to the daily volume by country, further broken down by the trading value. Here we see considerable variation:

1. In the Americas, auction contribution varies by country. For large caps, closing auction volume ranges from ~5% (United States and Canada) to 10-15% (Brazil and Mexico). Opening auctions are significantly smaller, limited to ~1% (United States and Canada).
2. Asian countries also show wide diversity. Among the largest countries, closing auction volume ranges from ~4% (South Korea) to ~13% (Australia). China, Hong Kong and India do not even implement closing auctions.¹ In Japan, Australia, Taiwan, Thailand, and Singapore, opening auction volume is more significant at 1-3% than that of the United States.
3. European countries are comparably uniform; closing auctions tend to account for ~10-15% of daily volume in the large caps throughout the largest markets. Opening auctions are consistently insignificant.
4. Intra-day auctions are employed by the few Asian countries with lunch breaks and account for ~1% of daily volume. United Kingdom and Germany also hold an intra-day auction, but their contribution to the daily volume is negligible.
5. With only a few exceptions, auction volumes are consistently larger in larger caps globally.

The predominance of closing auctions compared to opening and mid-day auctions may be attributed to the fact that closing prices serve as a benchmark for many participants. It is also understandable that liquid stocks exhibit larger closing auction volume as a percentage of daily volume considering the fact that these stocks are more likely members of stock indices.

The factors driving the observed diversity across countries are elusive. We may conjecture that the difficulty of trading in the continuous session due to high volatility and spread, typically observed in emerging markets, is driving the volume further toward closing auctions.

¹ The Hong Kong Stock Exchange introduced Closing Auction Session (CAS) on July 25, 2016 [8]. Our analyses were conducted prior to this and thus do not contain auction data.

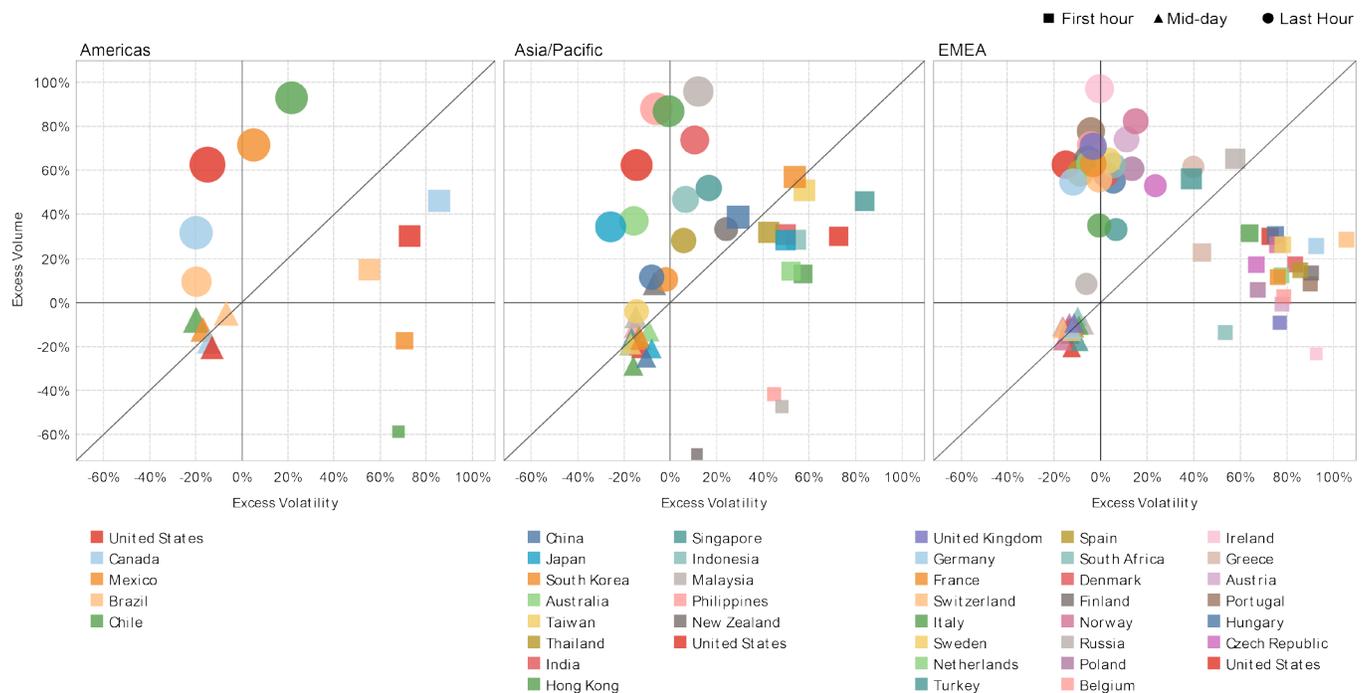
Costly Mornings

As discussed above, morning periods are more volatile and are accompanied by wider effective spreads. Although the volume is also higher, the rule of thumb—especially in the U.S. market—is that the extra liquidity does not make up for the excess volatility and spreads, and thus trading in the morning is difficult and expensive.

Expanding this idea globally, we have compared excess volume and excess volatility in three intraday periods by country. **Exhibit 4** shows the excess volume-to-volatility ratio for each country for *First*, *Middle*, and *Last*.² Upper-right (lower-left) regions of the diagram correspond to positive (negative) excess volume and volatility. The upper-left (lower-right) regions of the diagram indicate easier (harder) to trade.

Exhibit 4 Intraday Excess Volume vs Excess Volatility

Horizontal axis shows *excess volatility*, i.e. one-minute volatility averaged over the period of interest normalized to the average volatility over the entire day. Vertical axis shows *excess volume*, i.e. percentage volume within the period normalized to its duration as a fraction of the trading day. Auctions are not included in the excess volume calculation. Excess volume and volatility are computed for individual stocks and then averaged for each country weighted by the stocks' trading value. Upper-right (lower-left) regions of the diagram correspond to positive (negative) excess volume and volatility. United States (red) is displayed in each panel as a reference. The numbers are based on the volume and volatility profiles that Instinet's *Execution Experts* use, which are calculated every day from trading data during the prior few months.



Source: Instinet

² *First* is the first hour after market open. *Last* is the last hour before market close. *Middle* is the time in between. Auctions are excluded from volume calculation, and the lunch breaks are excluded when computing period duration.

Exhibit 4 shows that the first-hour period of the U.S. market is disproportionately volatile; one-minute volatility is ~75% higher than the day's average, whereas the volume is only ~25% higher. In contrast, the last-hour period is characterized by high excess volume (~55%) and low short-term volatility (approx. -15%). Combined with the fact that spreads consistently decrease throughout the day, this confirms our general understanding that the last hour of the trading session is the least costly in the United States.

On the other hand, these observations do not necessarily hold outside the United States. In the Americas, the first-hour period of Mexico is quite volatile, but the volume is in fact lower than the rest of the day. In Brazil and Canada, the excess volume in the last-hour period is limited to ~10% and ~30% respectively, considerably smaller than that of the United States.

When we look at Asia/Pacific, we also realize that the reduced volatility in the evening is one of those perks only available with trading in the Americas. In roughly half of the countries in Asia/Pacific, volatility is higher than average in the last hour of trading. Japan and Australia follow an intraday transition similar to that of the United States. However, the data points of China, South Korea, and Taiwan are all aligned around the diagonal line, which means the volume-to-volatility ratio remains constant through the day. Considered together with the rather flat spread profiles of these countries, their trading cost does not change much throughout the day.

Most European countries follow intraday paths similar to that of the United States, except their last-hour periods tend to be as volatile as the day's average. The uniformity of European markets, observed in both auction volumes and intraday profiles, may be attributed to their similarity in market design and market hours, as well as the existence of trading venues trading pan-European stocks.

U.S. Uniform Tick Size Creates Diversity

Exhibit 5 shows intraday volatility and spread profiles for the U.S. market broken down by the stocks' trading value and price. It is widely known that the less liquid a stock, the greater the volatility and spread in the U.S. market. **Exhibit 5** verifies this fact, as both spread and volatility of each price group increase from the bottom of each chart (most liquid) to the top (most illiquid). Furthermore, it also demonstrates a stark difference between the two price groups after controlling for the liquidity.

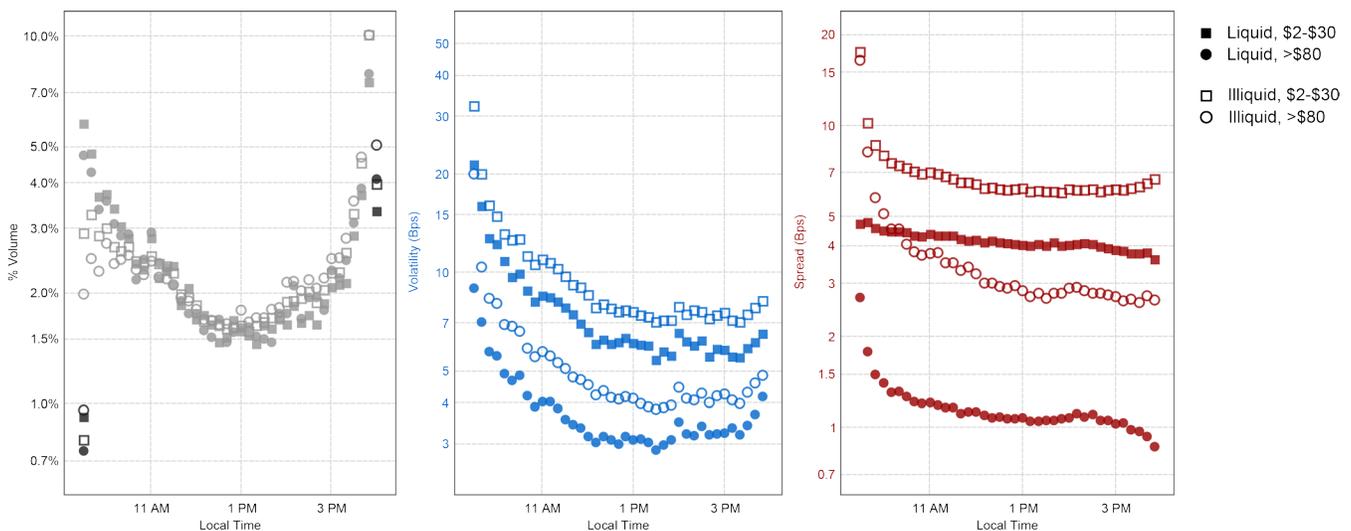
Due to the uniform one-cent tick size of the U.S. market, the relative tick size depends proportionally on the stock price. For instance, the tick size amounts to 10 bps for a \$10-stock and 1 bps for a \$100-stock. This simple and seemingly innocuous rule is manifested in the intraday profiles as a remarkable discrepancy due to stock price. The differences of average effective spreads between the two price groups are over 200% and consistent across the liquidity groups.

Furthermore, the spread profiles of the two price groups look quite different. In the low-price groups, spread profiles remain around their highest immediately after the market open. This is most likely because the

spread is constrained by the tick size; *i.e.* the spread is floored by the regulated minimum price variation despite the downward pressure. The difference in the short-term volatility between the price groups is also unexpectedly noteworthy. Comparing these profiles with their high-price counterparts, it is reasonable to hypothesize that the spreads and volatility of the low-price stocks would be much smaller most of the day, if the tick sizes were smaller.

Exhibit 5 U.S. Intraday Profiles by Price and Liquidity

Intraday profiles of volume, volatility and spread profiles are shown for U.S. stocks grouped by the stock price and average trading value. The *Liquid* group (filled circles/squares) consists of the 151 most liquid stocks by average daily trading value and collectively accounts for 50% of the country’s total trading value. The *Illiquid* group (open circles/squares) consists of the least liquid 5134 stocks, and accounts for 25% the country’s total trading value.



Source: Instinet

Changes Ahead Due to U.S. Tick Pilot Program

These findings have important implications today, as the U.S. market prepares for the tick size pilot program scheduled to begin on Oct. 3, 2016 [9], [10]. Around 1200 pilot stocks will be quoting at a nickel increment, and of those, around 800 stocks will also be required to trade with the wider increment. Besides all the technical issues and confusion that may arise, we expect that this will considerably alter the ways the pilot stocks are traded.

The effective spreads and intraday volatility for the pilot stocks will significantly increase. Their intraday profiles will also change as implied by the above observations; other trading characteristics such as queue length and adverse selection will also likely be affected. Therefore, informed trading algorithms should also be prepared to adapt.

Instinet Analytic Suites for Intraday Profile and Cost Analysis

Exhibit 6 shows Instinet’s Indigo application³ highlighting intraday profiles of IBM overlaid with the real-time volumes (left panel). It also shows market impact and execution risk estimates by our latest METRIC model⁴ (right panel). Cost analyses were run for six different order start times, all assuming 100K shares, VWAP strategy, and a one-hour duration. The lower-right chart visualizes the six pairs of estimated impact and price risk. The points in different colors represent different order start times, collectively forming a cost frontier.

Consistent with our findings based on **Exhibit 4**, these examples demonstrate that trading towards the start of the trading session results in not only a higher impact cost but also incurs a higher price risk. In comparison, trading toward the end of the trading session tends to have much lower impact and incurs less price risk. This leads to a significant difference from a traditional cost frontier curve under a uniform liquidity profile regime.⁵

These tools and models are developed by leveraging in-depth quantitative studies inspired by our perspectives of the three pillars of trading described above. We refer readers to our follow-up note for more details on how Instinet products make effective use of this information.

Exhibit 6 Indigo Intraday Profile Viewer and METRIC Cost Analysis Tool



Source: Instinet

³ Indigo is Instinet’s dynamic decision support tool which allows users to build their own analytics dashboard using real-time and historical data visualization widgets for single stocks and portfolios on a global basis.

⁴ METRIC (Model-Estimated TRade Impact Cost) model is our industry-leading market impact cost model. It is designed to be sensitive to intraday variations in volume, bid/ask spread and volatility.

⁵ Assuming uniform profiles in volatility, volume and bid/ask spread, a cost frontier would typically show a higher estimated market impact and lower execution risk and vice versa.

Summary & What's Next

Our second issue of *Informed Trading* explored the intraday profiles of volume, volatility and spread, the three most important measures in trading. These profiles inform trading schedules, market impact estimation, and tactical trading decisions. We discussed the diversity of trading characteristics across the globe, as well as by market segment. We also highlighted Instinet's analytics products that leverage these perspectives and bring transparency to the market.

As indicated above, tick size considerably affects how stocks are traded. We urge investors to be aware of not only the technical aspects of the tick size program, but also its implications to trading, from expected costs to choice of trading tactics. As the U.S. tick size pilot program approaches, our next issue will focus on the relationships between tick size, liquidity, and trading characteristics. We will discuss the implications of the tick size change to trading, as well as our original methodology to inform our liquidity provision tactics.

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