

# Global Equity Trading Costs

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Understanding of the magnitude and determinants of *global* execution costs is important to practitioners for several reasons. These include the prediction of trading costs, determining the effect of execution costs on “live” portfolio performance, inter-market cost comparisons, and quantifying international diversification benefits. This article examines the magnitude and determinants of trading costs across 42 countries. We document wide variation in costs across and within regions. While costs have declined, they remain economically significant. We develop the central concept that costs cannot be measured in isolation from the factors that also affect the underlying investment strategy. In particular, realized equity returns depend on turnover as well as costs, and portfolio turnover is likely to be systematically related to the same factors that affect costs. Accordingly, we analyze the inter-relationships between liquidity, equity trading costs, and volatility, and investigate the impact of these variables on equity returns. The estimated models show strong relationships between the variables of interest and shed light on the degree to which liquidity and costs are predictable in practice. Our results suggest that the composition of global efficient portfolios can change dramatically when cost and turnover are taken into account.

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## 1. Introduction

Actual investment performance reflects the underlying strategy of the portfolio manager and the execution costs incurred in realizing those objectives. Recent evidence shows that execution costs can be large, often enough to substantially reduce or even eliminate the notional or “paper” return to an investment strategy. This is especially true in an international context, where execution costs are generally greater than in the United States. So, there is considerable interest in measuring global equity trading costs and understanding their determinants.

A formal analysis of global execution costs is valuable to investment managers for other reasons. Most importantly, global investment strategies are likely to vary systematically with market liquidity and return volatility, the same factors that determine execution costs. A change in, say, volatility may affect realized returns not only through its impact on costs but also indirectly through its effects on a portfolio manager’s overall trading activity. Further, global mean-variance efficient portfolios (and the perceived gain from international diversification) are affected by the inclusion of execution costs into return computations.

Execution costs also matter in a “macro” sense. Differences in trading costs and liquidity across markets are important factors in the international competition for order flow, and reflect the relative merits of different market designs. In illiquid emerging markets where price impact is a major cost, there are repeated concerns that foreign capital inflows and outflows (hot money) could destabilize domestic markets. Large costs in emerging markets may also induce corporations to cross-list their stock in more liquid, developed markets slowing domestic market development. Finally, innovations in technology often are driven by cost considerations.

Yet, except for a handful of studies, there have been no attempts to analyze differences in trading costs and their determinants on a *global* basis.<sup>1</sup> This reflects difficulties in obtaining a common metric for trading costs across markets and over time, and matching this metric with relevant auxiliary data. This paper examines magnitude and determinants of execution costs and analyzes the interactions between cost, liquidity, and volatility using data for a broad sample of 42 countries over time.

Our analysis provides several new and interesting results

- ◆ We develop the concept that costs cannot be measured in isolation from the factors that also affect the underlying investment strategy. In particular, realized equity returns depend on turnover as well as costs, and portfolio turnover is systematically related to the same factors (volatility, etc.) that affect costs. We analyze the determinants of execution costs, and the interaction of costs, liquidity, and return volatility, both across countries and over time using a triangular panel-data model. We find strong relationships between the variables of interest and shed light on the degree to which liquidity and costs are predictable in practice.
- ◆ We document wide variation in one-way equity trading costs across and within regions. Transaction costs have generally declined since 1995, but are nonetheless economically significant when juxtaposed against realized returns. Both implicit and explicit costs are important, but there is systematic variation in the composition of costs across countries.
- ◆ Interestingly, transaction costs in emerging markets are significantly higher than in developed markets, even after correcting for factors affecting costs such as market capitalization and volatility. Reducing the cost of capital may be an important motivation for firms in emerging markets to cross-list their shares or issue American Depository Receipts (ADRs) in US markets.
- ◆ Taken together, the results suggest that the composition of global efficient portfolios can change dramatically when costs are taken into account.

The paper proceeds as follows: Section 2 discusses the data, Section 3 provides data on the magnitude and determinants of costs, Section 4 demonstrates the important linkages among costs, turnover, and volatility, and Section 5 concludes.

## 2. Data Sources and Procedures

The primary source of data for this study is Elkins/McSherry Co., Inc. The firm receives trade data on all global trades by institutional traders and computes trading costs for its institutional clients. The data consist of average trading costs as a percentage of trade value for *active* investment managers in a universe of 42 countries. These costs are not necessarily representative of those faced by retail traders in these markets. The primary sample data are quarterly, from the last quarter of 1995 through the third quarter of 1998, supplemented by data from McSherry (2001). In our primary sample, the institutional traders in the data represented 135 firms, of whom 105 are pension funds, 27 are investment

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<sup>1</sup> Global cost studies include Perold and Sirri (1993), Willoughby (1998), and McSherry (2001). Keim and Madhavan (1998) survey the literature on equity trading costs in US markets.

managers, and 4 are brokers. These institutions accounted for 28 billion shares using 700 global managers and over 1,000 brokers.

The data distinguish between the major components of transaction costs, i.e., commissions, fees, and price impact costs, including the bid-ask spread. Given that there may be tradeoffs between the various cost components (i.e., using full commission brokers to minimize price impact but incurring higher fees as a result) it is important to have this breakdown. In our analyses we aggregate commission and fee cost into a single category, *explicit costs*.

Implicit costs represent indirect trading costs, the major one being the price impact of the trade. Unlike explicit costs where there are typically visible accounting charges, there is no such reporting of implicit costs. Elkins/McSherry computes a benchmark price for every stock in the 42-country universe using a common standard. Specifically, the benchmark is the mean of the day's open, close, high and low prices. The price impact for a buy order is measured by the percentage difference between the execution price and this benchmark, and the reverse is true for a sell order. Willoughby (1998) reports that the price impacts computed using the Elkins/McSherry methodology are very close to those computed using the Value-Weighted Average Price (VWAP) approach.

Auxiliary data are compiled from a variety of sources. Data on turnover (defined as total trading volume divided by average market capitalization) and market capitalization (in millions of U.S. dollars) for emerging markets are obtained from the International Finance Corporation (IFC). For non-emerging markets, data are gathered from Bloomberg Financial Services.

### **3. Magnitude and Determinants of Global Equity Trading Costs**

We begin by analyzing the magnitude and determinants of equity costs and then move to a discussion of the implications for investment managers. Equity trading costs are economically significant and vary widely across countries. In Q3 2000, (McSherry, 2001) costs range from 22 basis points (Netherlands) to 184 basis points (Venezuela), with a mean of approximately 60 basis points. There is considerable consistency in cost rankings from year-to-year (Willoughby, 1998). France is consistently one of the lowest cost countries while emerging markets like Korea are consistently among the highest (Domowitz, Glen, and Madhavan, 2002).

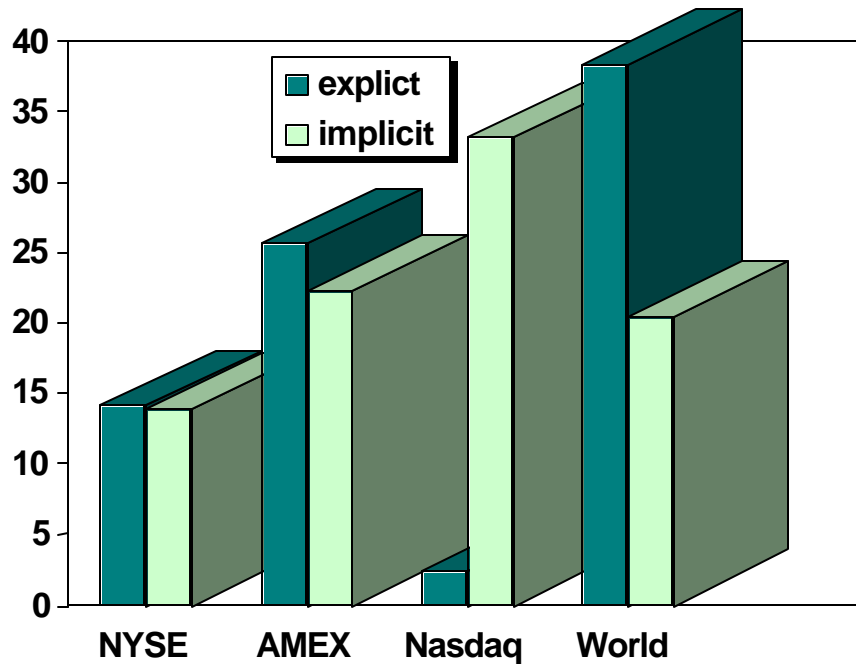
There also is variation in the *composition* of cost across countries, but both implicit and explicit costs are economically substantial in all cases. Overall, explicit costs are roughly two-thirds of total cost. This result is remarkably robust across regions, except in the U.S. where implicit costs account for over 60 percent of the total. In the U.S., explicit costs are 0.2 percent of *value* and have been declining. This decline may reflect increased institutional presence in the market, resulting in a more competitive environment for trading services (institutions commonly negotiate lower commission rates), technological innovations in trading such as the increased use of low-cost Electronic Crossing Networks (ECNs) by institutional traders, and soft dollar payments, by which brokers return a portion of the stated commission to institutional investors.

The correlation in explicit and implicit costs reinforces the importance of considering both costs together in investment analysis and trading decisions. The sample correlation between explicit costs and implicit costs is positive, ranging from 0.09-0.31 by year across the sample period, with no discernible trend. The two execution costs are not substitutes for each other; markets with high market impact costs generally are also expensive in terms of commissions.

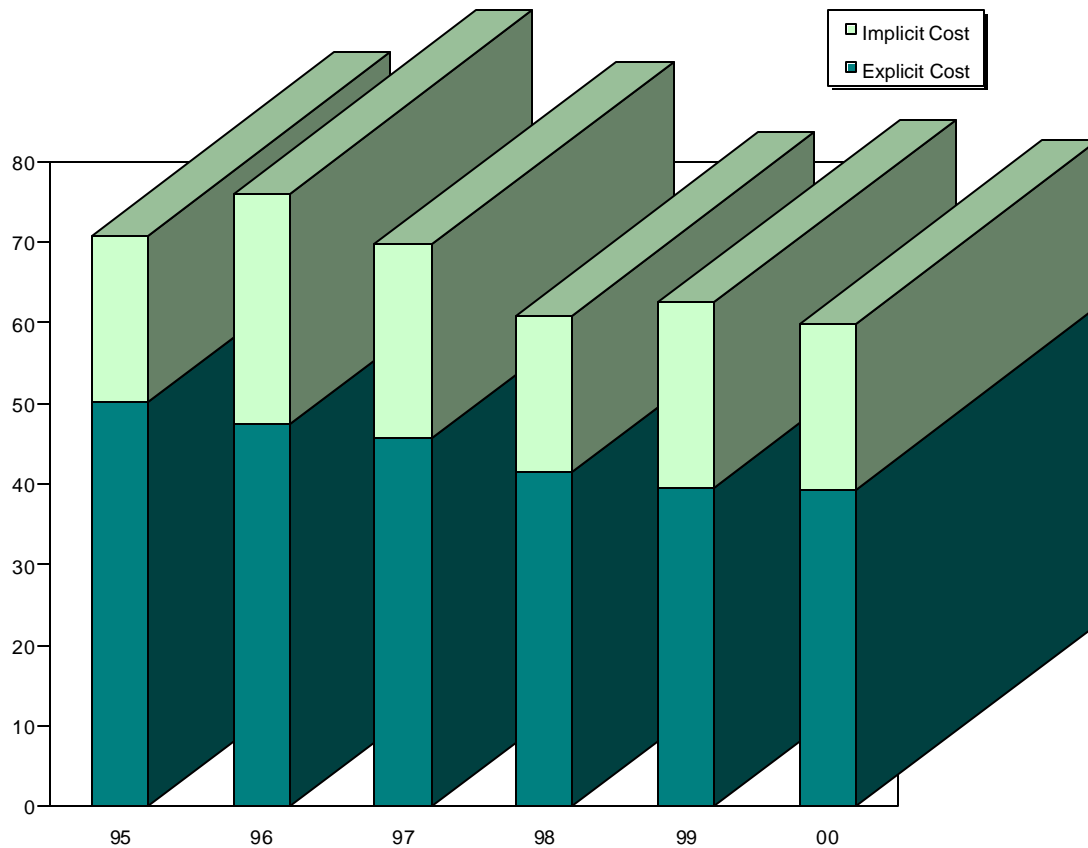
Finally, transaction costs in emerging markets are significantly higher than in more developed markets; more than double those observed in the U.S. Much of this difference lies in implicit trading costs, but explicit costs also are a factor. The large trading cost differential between developed and emerging markets limits the gains from international diversification in these areas as we discuss below.

The NYSE and Nasdaq also vary widely in cost (figure 1) although cost differentials have narrowed over time. McSherry (2001) reports that in the third quarter of 2000, total costs for the NYSE was 28.1 basis points against 35.5 for Nasdaq.

**Figure 1: Equity Trading Costs in US Markets**  
**(One-way, in basis points, for Q3 2000)**



The NYSE operates as a specialist-auction market, where immediacy is provided by public limit orders and an exchange-designated specialist. Nasdaq is a dealer market, where multiple market makers post quotes prior to trading. The extent to which these differences in market structure affect execution costs is an important question, as discussed in Keim and Madhavan (1998) and Madhavan (2000). We find that Nasdaq is consistently more expensive than the NYSE, consistent with earlier studies. Over the entire period, the New York Stock Exchange offered among the lowest execution costs among all countries. Transaction costs decline over the period, as shown in figure 2.

**Figure 2: Mean Global Equity Trading Costs (One-way, in basis points)**

Several factors influencing the time series variation in cost are being captured, of which the following are illustrative. Competition between markets for international order flow is increasing which can reduce domestic market spreads. The widespread adoption of automated limit order book systems is a factor in reducing costs. Domowitz and Steil (1999), for example, document a decrease in explicit costs for listed stocks, and in total costs for OTC shares, of 60 percent and 30 percent, respectively, from trading on automated systems in the U.S. relative to traditional trading systems. Finally, there is increased competitive pressure from new trading systems and regulatory authorities to reduce costs. Overall, implicit costs fall much faster than explicit costs. In the US, the NYSE and Nasdaq both exhibit declining trading costs.

The wide range in costs naturally leads us to an investigation of the *determinants* of execution costs. Table 1 shows correlation coefficients for total (one-way) trading costs, turnover, (log) market

capitalization, return volatility, a dummy variable for emerging markets, and a dummy variable for markets using automated limit order book trading systems. An asterisk (\*) indicates significance at the 5 percent level in a two-tailed test under the null hypothesis that the correlation coefficient is equal to zero.

**Table 1**  
**Correlation Matrix Among Variables of Interest**

	Total Cost	Turnover	Mkt. Cap.	Volatility	Emg. Mkt	Automated
Total Cost	1	-0.110	-0.543*	0.347*	0.642*	0.018
Turnover		1	-0.054	0.026	-0.123	-0.044
Mkt. Cap.			1	-0.342*	-0.466*	-0.315*
Volatility				1	0.507*	0.010
Emg. Mkt					1	0.642*
Automated						1

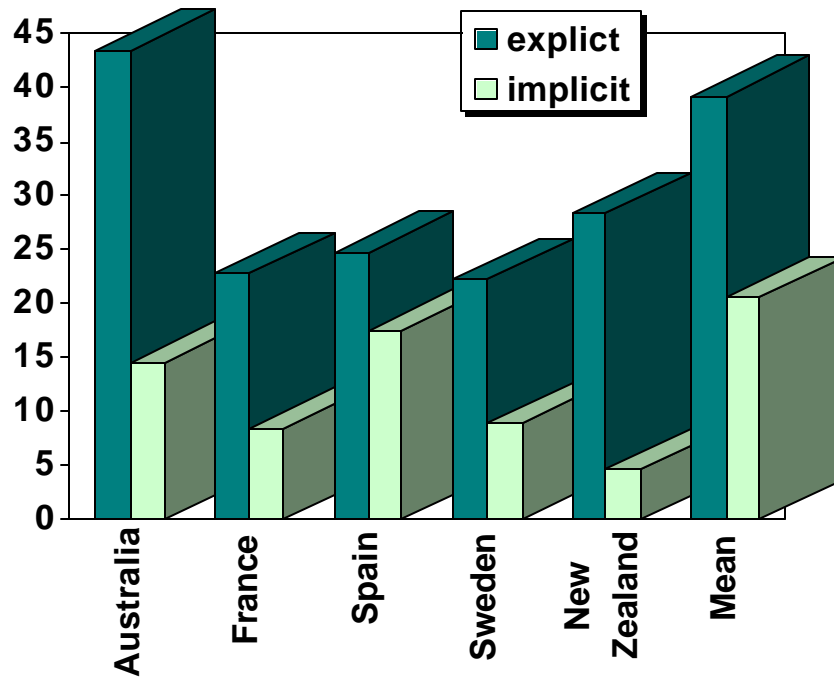
Costs are inversely related to market capitalization and positively related to volatility; they are also higher in emerging markets. Volatility is negatively related to market capitalization and is higher in emerging markets. Turnover is not significantly related to the other variables in this simple two-way analysis, a point we return to later on.

It is natural to use the estimates of trading costs to make inferences about the relative efficiency of alternative trading systems. The countries represented in our sample offer a considerable range of different systems including pure dealer markets (London, Nasdaq), hybrid specialist-auction models (NYSE, Frankfurt, Amsterdam), matching systems (Japan), and automated limit order books (Paris, Toronto), the latter being the most common. Automated systems are cheaper to build and operate than the dealer and floor based systems prevalent on more established markets, and a large percentage of such systems operating today are in emerging markets as a consequence. Automated markets also are prevalent in much of Europe. Automated systems, by virtue of reduced operating costs, and the possibility of eliminating the need for dealer or specialist intervention, might reduce trading costs. The corre-



lations with cost in table 1 are positive, but not statistically significantly different from zero. Again, this appears to be a phenomenon related to the concentration of systems in emerging markets, which exhibit higher costs on average. Examination reveals that automated systems in developed venues tend to reduce implicit costs, as in figure 3 below.

**Figure 3: One-way trading costs (basis points) in select automated markets**



#### 4. Practical Applications

The analysis above highlights the importance of measuring, analyzing, and controlling transaction costs. In the context of global asset management, the control of trading costs presents the greatest practical challenge. Two important – and related – considerations require consideration when implementing a transaction cost management program. First, while expected alpha (or excess return) is proportional to trade size, trading costs are typically increasing as a function of size. Intuitively, as size increases beyond available depth (or liquidity), costs begin to rise at an accelerating rate. As average order size is related to fund size, rising costs imply the existence of an optimal fund size. The optimal level may be quite small, especially in small or emerging markets where liquidity is unavailable at any cost. Second, a portfolio manager needs to consider the interaction of turnover and costs. The common ap-

proach to estimating returns net of costs is simply to subtract annualized costs from expected gross (“paper”) returns. This approach implicitly assumes that the portfolio’s turnover is a constant, an assumption that is questionable in a global context. Specifically, portfolio turnover might be systematically related overall turnover in the constituent countries. So, an active global fund may be more likely to turnover its portfolio in regions or time periods with above average turnover. The same factors affecting turnover might also affect cost, and this interaction needs to be taken into account.

An example may help illustrate this point. Consider a global manager whose expected gross alpha (relative to some benchmark) equals 150 basis points. The manager’s annual fees are 40 basis points. Suppose the average (one-way) transaction costs in the manager’s universe of stocks are 100 basis points, and that annual turnover (defined as the total value of buys and sells divided by portfolio value) is 80%. Then, the portfolio’s expected alpha net costs is 70 basis points ( $=150-100 \times 80\%$ ), and net of fees is 30 basis points. But the manager may be more inclined to turnover portfolio in a highly volatile market, and the same factors that increase volatility may increase cost. In particular, suppose in a volatile period, suppose that costs rise to 130 basis points and turnover also rises to 100%, so that net alpha in a high volatility period is 20 basis points, and overall expected alpha, net of all costs and management fees, is now below zero.

We can represent these ideas mathematically. Let  $S$  be the total fund size, and let  $x$  be a vector of variables such as market capitalization, average trade size, and volatility. The portfolio’s alpha, net of implementation costs, is:

$$\mathbf{a}_N(x) = \sum \omega_i (r_i(x) - r_b - c_i(x)T_i(x)) \quad (1)$$

where, for country  $i$ ,  $\omega_i$  is the portfolio weight,  $r_i(x)$  is the expected gross (“paper”) return,  $r_b$  is the benchmark return,  $c_i(x)$  is the (round-trip) total transactions cost, and  $T_i(x)$  represents turnover.

Overall fund returns,  $r_p$ , are given by

$$r_p = r_b + \mathbf{a}_N(x) - (F / S) \quad (2)$$

where  $F$  represents management fees. Note from equation (2) that size affects fund performance in two ways: First, larger size implies higher average trade size (given turnover) which increases costs, reducing net alpha. Second, larger size allows for economies of scale, reducing costs on a percentage ba-

sis. Equation (2) implies the existence of an optimal fund size when costs are increasing in average trade size, and in turn trade size is positively related to fund size.

### **Modeling Costs**

Equation (1) shows that to understand how net returns are affected by costs, we need to jointly model the drivers behind turnover and costs. To get at this issue, we estimate a recursive panel-data model that is based on simple intuition. Volatility is an exogenous driver, a function of market, regional, and country-specific factors. In turn, volatility affects execution costs. Turnover is related to the cost of trading, and may be affected by volatility as well. While economic theory suggests higher costs will reduce turnover, the effect of volatility is ambiguous. Higher volatility may induce more trading because it is associated with a greater dispersion in beliefs. Alternatively, risk averse traders may reduce their trading in volatile markets. Returns, the ultimate object of interest, are modeled through equation (1) above. The exact details of the estimation are in Domowitz, Glen, and Madhavan (2002).

The three-equation model fits well, with an overall R-square of 0.59 on the cost regression.

The results from the model can be summarized as follows:

- ◆ Lower costs of trading, usually associated with better liquidity, substantially increase activity. Should costs fall in other developed markets to the extent that they decline in North America over the sample period, turnover is predicted to increase by about 33 percent.
- ◆ Turnover is less sensitive to cost in emerging markets than in more developed economies. This is economically intuitive, because volumes in emerging markets might be driven more by politically exogenous factors such as privatizations, and are less sensitive to costs.
- ◆ Although higher volatility appears to stimulate trading with shorter holding periods, the effect is small, suggesting that market development rather than geographic region is the primary factor affecting activity.

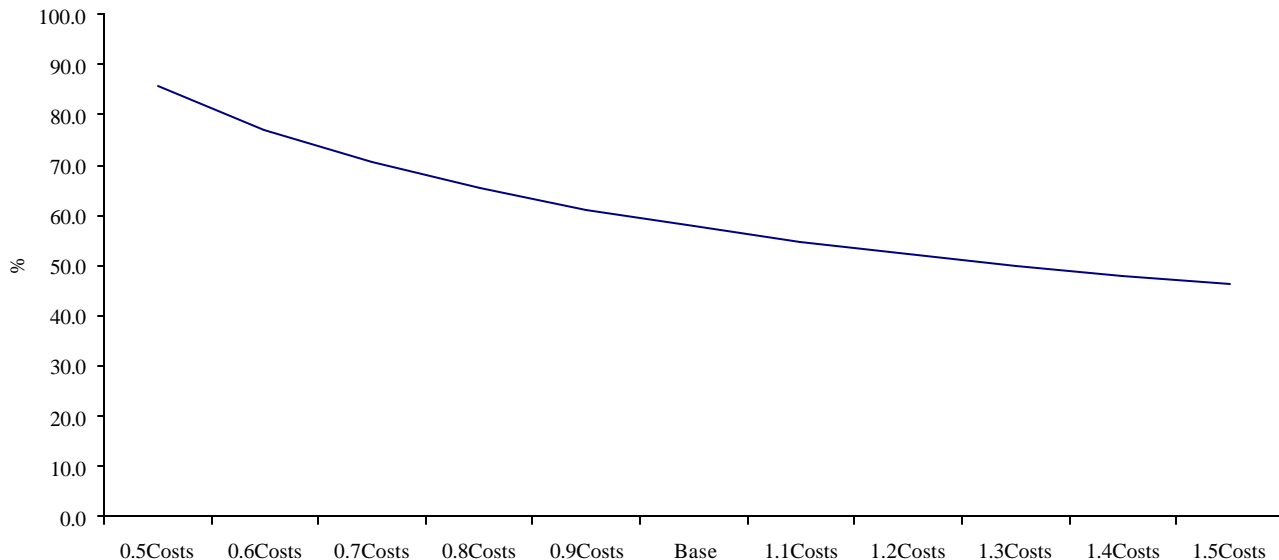
We turn now to an investigation of how changes in volatility, market development and costs affect liquidity and expected returns. The triangular panel-data model suggests that these relations can be complex. For example, an exogenous increase in volatility affects liquidity through its direct effect on turnover but also indirectly through its impact on transactions costs. Higher volatility increases costs, which reduces turnover, but also leads to more trading, so that the overall impact on liquidity of a shift on volatility is unclear.

We use the panel-data estimates to construct response functions for the variables of interest. The response functions first translate hypothetical changes in market capitalization, volatility, and market

development into changes in transactions costs and turnover. For each “experiment,” defined as a percentage change in, for example, volatility, quarterly returns net of costs then are produced, and used to construct the value-weighted portfolio returns assuming a given turnover. The case of interest is where the portfolio’s rebalancing is related to turnover in the constituent countries, as might be the case with an active global fund.

Turnover is decreasing in cost, as shown in Figure 4, consistent with the idea that investors’ desires to trade are price sensitive.

**Figure 4: Annualized Value-Weighted World Turnover as a Function of Cost**



The direct effect of an increase in volatility on cost is positive, resulting in a decline in net returns. Specifically, an increase of 50 percent in volatility occasions roughly a 5 percent drop in returns for the value-weighted portfolio. If turnover also changes in the fashion predicted by the model using equation (1), volatility has *no substantive effect* on portfolio returns net of trading costs. As cost increases together with volatility, turnover declines, canceling out the cost effect.

### **Cost Prediction**

Our results also suggest how cost prediction can be improved. To improve our ability to predict execution costs we need to understand why the previous estimates (Keim and Madhavan, 1998) are so noisy.

There are two factors that complicate the task of estimating and predicting trading costs. First, while some elements of trading costs (e.g., commissions and taxes) are highly predictable, others (such as opportunity and timing costs) are highly variable and depend heavily on prevailing market conditions. Opportunity costs are also a function of the trader's investment style. For example, an index trader, whose objective is to mimic a benchmark portfolio with minimum tracking error, may incur very low opportunity costs but high price impact and commission costs. By contrast, a value trader, who seeks to identify stocks whose fundamental value exceeds the current stock price, may face large opportunity costs but small commission and price impact costs. Second, there are many unobservable factors that may explain the large variation in execution costs. A partial list of such variables includes trader reputation, skill, investment objectives, and subtleties of the trading process (e.g., upstairs intermediation) that are not easily measured. Institutional traders and portfolio managers are especially concerned with being able to predict costs in real time. In this respect, the unpredictability of costs is an important factor. If traders are averse to the high variance in costs, they may alter their trading strategies towards strategies that let them better predict and control costs. Examples include crossing systems (where the crossing price is pre-determined), automated limit order book systems, or guaranteed principal bids, where the trading costs are known prior to trading. The extent to which the unpredictability in execution costs has led to innovations in trading technology is still an open question.

### **Global Efficient Portfolios**

Our analysis suggests that execution costs vary systematically with factors that are relevant for investment strategy. The estimated mean-variance efficient frontier – and hence the perceived gain from international diversification – also will change if execution costs are factored into return computations. This change derives in part from reduced returns, but may also be due to changes in the correlation structure of returns, as costs shift non-uniformly across countries. The effect is compounded because turnover is higher in some markets.

Consider a portfolio focused on large capitalization issues in developed markets with annual (two-way) turnover represented by purchases and sales of 100 percent, management fee of 0.25 percent, and trading costs of 0.4 percent of value. The total costs are  $0.4 \text{ percent} \times 100 \text{ percent} + 0.25 \text{ percent} = 0.65 \text{ percent}$  of portfolio value. By contrast, consider an emerging market portfolio with an-

nual (two-way) turnover of 160 percent, costs of 1.25 percent of value, and management fee of 1 percent. This portfolio has total costs of  $1.25 \text{ percent} \times 160 \text{ percent} + 1 \text{ percent} = 3 \text{ percent}$  of portfolio value. Thus, ignoring risk, the emerging market portfolio would have to provide additional return of 2.35 percent per year to compensate for additional costs.

We construct portfolios differentiated by costs and time periods for a set of markets representative of international investors' concerns. Transactions costs have a substantial impact on returns, and a relatively small effect on the variance-covariance matrix of the portfolio. But, as shown by equation (1), although the risk characteristics of the portfolio may be unaffected by costs, the alphas are affected by both costs and turnover. To gauge the impact of transaction costs, we asked how the composition of a global efficient portfolio would change as a result of including costs. For simplicity, we focus on the tangency portfolio, adopting the viewpoint of a US investor who views the riskless asset as a US treasury bond. The results are dramatic, with large shifts in the tangency portfolio toward lower cost regions. For example, in a global portfolio that includes North America, West Europe, and Latin America, the weight placed for the low cost European countries increases by 15 percent under semi-annual rebalancing. The implication is that considerable care is needed in constructing global efficient frontiers, both respect to costs and turnover.

## 5. Conclusions

Execution costs can substantially reduce or even eliminate the notional or "paper" return to an investment strategy. Yet, despite their importance, we know very little about *global* equity trading costs. This paper examines the magnitude and determinants of equity trading costs across a sample of 42 countries. We document wide variation in costs across and within regions. While costs have declined, they remain economically significant, especially in emerging markets. We develop the central concept that costs cannot be measured in isolation from the factors that also affect the underlying investment strategy. In particular, realized equity returns depend on turnover as well as costs, and portfolio turnover is likely to be systematically related to the same factors that affect costs. Accordingly, we analyze the inter-relationships between liquidity, equity trading costs, and volatility, and investigate the impact of these variables on equity returns. The estimated models show strong relationships between the variables of interest and shed light on the degree to which liquidity and costs are predictable in prac-

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