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### **Introduction**

During the past two decades, cross-border listing of equities has grown in popularity. During the 1990s, the number of foreign companies with shares cross-listed and trading on major exchanges outside of their home markets reached 4,700. More recently, however, there has been a slowdown in the pace of cross-border listing and the number of internationally cross-listed stocks had decreased to 2,300 from its 1997 high of 4700. Notwithstanding, the number of non-US companies listed in the US market remains significant.

At the end of 2002, there were 472 non-US companies listed on the New York Stock Exchange, 381 non-US companies listed on Nasdaq and 48 non-US companies listed on AMEX. These cross-border listings represent 19.95, 10.44 and 8.41 percent of total NYSE, Nasdaq and AMEX listings respectively. In particular, the non-US companies listed on the NYSE accounted for 6.94% of total trading volume on the NYSE and those listed on the Nasdaq accounted for 3.47% of total trading volume on Nasdaq. The total number of non-US companies listed in the US goes over 2000 if we include listings not traded on the major stock exchange compared with less than 1000 in 1990.

Given the growing number of non-US companies listed in the US, it is natural to ask if there are any advantages for investors to invest in the US market as opposed to investing in the home market. A common argument is that it is much cheaper to do so. In fact, as consistent with this notion, a survey done in 1995 of over 1200 US institutions that invest in foreign equities showed that 70 percent of the surveyed institutions own ADRs (“American Deposit Receipts”), a common type of non-US stock listed in the US, and 50 percent of the surveyed institutions own only ADRs.

This paper contributes to the existing academic literature by investigating the legitimacy of the above statement. Using information on the equity transactions of US traded cross-

listed stocks from 8 different home markets worldwide, I investigate whether there are any systematic differences in the cost of trading cross-listed shares in the US as opposed to trading these cross-listed shares in the home market. In other words, we take the perspective of a global institutional investor that has access to global markets and ask if it is cheaper to trade in the US market or in the home market.

### **Data Sources and Sample Selection**

The data used in this study were provided by Plexus Group and contain information on the equity transactions of 33 institutions in the US and 36 other equity markets worldwide during two different time periods- April 1996 to March 1997, and the calendar year 2000. For each order, which is composed of typically more than one transaction, the following information is included in the data:

- (i) the identity of the stock to be traded and the date when the trading decision was made;
- (ii) an indication as to whether the trade is a buy or a sell;
- (iii) the closing stock prices (expressed in US dollars) for the fifteen trade days before the decision to trade is made, and for fifteen trade days after the order is completed;
- (iv) the dates and the individual components of the order released to the brokers;
- (v) the volume-weighted average trade price, number of shares traded, and date(s) associated with the trade(s) executed by the broker within a specific order; and
- (vi) commissions, stamp duties, and other explicit trade fees.

The database contains almost 607,000 orders (more than 1.6 million individual trades) across 37 international equity markets with a total trade value of \$1.1 trillion. For the purpose of our research, we are primarily interested with a subset of this sample, namely, the sample of stocks which are cross listed in the US and in the foreign home markets. Of these cross listed stocks, we are interested in the stocks which have transaction data in both the US and in the corresponding home market. We have been able to find matches for 261 shares that are concurrently traded in the foreign home market and in the US market, representing shares from 26 foreign countries. Of these, we have done testing on

data from 8 countries that has the most matches in terms of stocks, representing in total 57907 transactions in the home market and 7635 transactions in the US market. (See Table 1)

### **Types of cross-listed shares**

Within our sample of cross listed stocks, there are two distinct types of cross-listed shares, namely, American Deposit Receipts (ADRs) and Canadian ordinaries.<sup>1</sup> American Deposit Receipts Programs were developed by JP Morgan in the 1920s as a vehicle for investors who didn't have direct access to foreign markets an opportunity to invest in non-US stocks. The mechanism of ADRs is very simple. A US depositary bank purchases home market shares of the cross-listed stock and issues dollar denominated depositary receipts, ADRs, against these immobilized underlying home market shares. Hence, an investor buying ADRs in the US market would in effect be buying claims to the underlying shares in the home market that is held in custody by the US depositary bank. Notice that each ADR does not necessarily represent claims to 1 underlying home market shares- in fact, the ratio of ADR to underlying home market shares differs from issue to issue and is often not one to one. On the other hand, the Canadian ordinaries certificates traded in the US is indistinguishable from the certificates traded in Canada. For our purposes, the difference between ADRs and Canadian ordinaries poses a ramification in how our regression model is defined. In particular, since the outstanding shares of ADRs traded in the US fluctuates depending on the demand for the ADR shares in the US, the same cross-listed company would have different market capitalization across markets in our data. This in turn gives rise to biased and inconsistent estimates of the actual market capitalization of the stock. Therefore, we omit the use of market capitalization as a proxy for liquidity when we specify our trade cost regression model. We will discuss this in more details in the methodology section of this paper.

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<sup>1</sup> There are also other types of cross-listed shares not present in our sample, e.g. New York Registered Shares which are dollar-denominated certificates issued by the company specifically for the U.S. market.

## **Theoretical framework**

To tackle our research question, we turn to the existing theoretical literature on multi-market trading. Specifically, we base our analysis on a theoretical model by Chowhry and Nanja (1991), which builds on the conceptual framework of Kyle (1985) and Admati and Pfleiderer (1988) on multi-market trading. In the paper, Chowdhry and Nanda assume that there are two types of traders: liquidity traders and informational traders. Chowdhry and Nanda further assume that there are two types of liquidity traders: one that has the discretion to move between markets and one that does not. Following these assumptions, the liquidity traders that have the discretion to choose between markets will choose the market which offers the lowest expected trade costs, i.e. the market in which the immobile liquidity traders are concentrated in. Information traders will then trade in this market as well to conceal their trade. As a result, a “winner takes all” situation results with trading aggregated in the market with lowest expected trading cost. As pertaining to our research, the implication of this theoretical framework is that it is cheapest to trade in the market where trading is most concentrated in.

## **Methodology**

In light of the theoretical framework laid out by Chowdhry and Nanda, I make the following hypothesis:

*After controlling for the difficulty of trading, we should find that systematic trade cost differences between countries can be explained by the concentration of volume that exists between countries.*

In particular, this has two testable implications: 1. systematic trade cost differences will exist between markets when the concentration of trading is not balanced; 2. countries with higher volume concentration will have lower trading costs. To test if any systematic trade cost differences exist between markets after controlling for the difficulty of trading, we propose the following regression model estimated separately for buyer initiated order, seller initiated order and also separately for cross-listed stocks that has different home markets. Also, I have used a different model for cross-listed stocks from Canada and for cross listed stocks from other countries. Specifically, to account for trading difficulties when estimating trade cost differences between the home market and the US market, I

estimate a variant of the model used by Keim and Madhavan (1997) in their analysis of total trade costs:

**For cross-listed stocks from Canada:**

**For Buys:**

$$Cost_i = \beta_0 + \beta_1 trsize_i + \beta_2 logsize_i + \beta_3 priorMb + \beta_4 priorXMb + \beta_5 can + \beta_6 trsize * can + \beta_7 logsize * can$$

**For Sells:**

$$Cost_i = \beta_0 + \beta_1 trsize_i + \beta_2 logsize_i + \beta_3 priorMs + \beta_4 priorXMs + \beta_5 can + \beta_6 trsize * can + \beta_7 logsize * can$$

**For cross-listed stocks from other countries:**

**For Buys:**

$$Cost_i = \beta_0 + \beta_1 trsize_i + \beta_3 priorMb + \beta_4 priorXMb + \beta_5 country + \beta_6 trsize * country$$

**For Sells:**

$$Cost_i = \beta_0 + \beta_1 trsize_i + \beta_3 priorMs + \beta_4 priorXMs + \beta_5 country + \beta_6 trsize * country$$

where the dependent variable  $cost_i$  is equal to adjusted opportunity cost for order  $i$ ,  $trsize_i$  is the total quantity of shares traded in order  $i$  as a percent of the total shares outstanding,  $logsize_i$  is the natural logarithm of the market capitalization of the stock traded in order  $i$  in billions of dollars,  $PriorMb=1$  if the 3 week prior return on the local stock market index is negative, zero otherwise,  $PriorMs=1$  if the 3 week prior market return on the local stock market index is positive, zero otherwise,  $PriorXMb=1$  if the 3 week prior excess return of the stock over the return on the local stock market index is negative, zero otherwise,  $PriorXMs=1$  if the 3 week prior excess return of the stock over the return on the local stock market index is positive, zero otherwise,  $country/can=1$  if the transaction took place in the home market, zero if the transaction took place in the US market. Notice that we have also run the above regression using total adjusted opportunity cost as a dependent variable.

Recall that the unit of observation for our analysis is an order, which is an aggregated expression of the trader's desired quantity to be traded. For a buyer initiated order, opportunity cost is defined to be equal to the ratio of the volume weighted average price of the component trades in the order to the decision price less market return, minus 1. The

opportunity cost for a seller initiated order is the negative of this quantity. Intuitively, it gives a measure of both the trade costs that arise from price impact and the trade costs that arise from missed opportunities due to time lag between the decision and the execution of a trade. To control for the variation in opportunity cost that arises due to the different market conditions on the local stock market which is unrelated to the institutional trade behavior specific to the individual stock, the market return is subtracted from the opportunity cost to obtain the adjusted opportunity cost.

The total quantity of shares traded in an order is included in the regression to gauge for the difference in price impact due to different trade size. As price impact and hence trade costs are higher for larger trade sizes,  $\beta_1$  is expected to be positive. The natural logarithm of the market capitalization of the stock being traded is included in the regression as a proxy for liquidity. In particular, the higher the market capitalization of a stock, the higher the liquidity of a stock. Hence,  $\beta_2$  is expected to be negative. The dummy variables  $priorMb$  and  $priorXMb$  are included in the regression for buyer initiated orders to control for the market conditions in which the trade was performed in. In particular, we argue that whether the market has been rising/falling in the 3 weeks prior to our observed transaction and whether the stock has outperformed the market in the 3 weeks prior to our observed transaction is important in determining the trading costs of the transaction. For example, we would expect trading costs for buyer-initiated orders to be higher when the local market index is rising than when the local market index is falling. This follows from the observation that when we buy shares in a rising market, market impact costs are necessarily higher. On the other hand, when we buy shares in a falling market, we are in effect providing liquidity to the market and hence we would expect lower trading costs. A symmetric argument follows when the stock is rising or falling over and beyond the return on the local market index. Following from our definition of the dummy variable  $priorMb$  and  $priorXMb$ , we would expect the coefficient  $\beta_3$  and  $\beta_4$  to be negative. The dummy variables  $priorMs$  and  $priorXMs$  are included in the regression for buyer-initiated orders for the same reasons. In essence, a symmetric result holds for seller-initiated orders. When we sell shares in a falling market, market impact costs are necessarily higher. On the other hand, when we sell shares in a rising market, we are in effect providing liquidity to the market and hence



we would expect lower trading costs. Notice that *priorMs* and *priorXMs* are defined symmetrical to the definitions for *priorMb* and *priorXMb* so that we would expect the coefficients *beta\_3* and *beta\_4* for seller initiated orders to be negative as well. Notice that the coefficients *beta\_5*, *beta\_6* and *beta\_7* (for Canadian cross-listed stocks only) measure the systematic differences in trade costs that arise from trading in the home market as opposed to the US market. For example, a positive *beta\_5* would imply that the trade cost for trading in the home market would be higher than the trade cost for trading in the US market, assuming all other regressors to have a zero value. Alternatively, we can interpret *beta\_1* as the intercept of the prediction function of the regression trade cost with regressors *trsize*, *ln(mcap)*, *priorMb* and *priorXMb*, regressed over the cross-listed stocks that are traded in the US. Then, we can interpret *beta\_1+beta\_5* as the intercept of the prediction function of the same regression regressed over the corresponding trades that are made in the home market. It follows then that the coefficients *beta\_6* and *beta\_7* measures the difference in impact that trade size and market capitalization has on trade costs when trading is done in the home market instead of the US market.

Notice that each regression is done on the aforementioned sub-sample of matched cross listed stocks for which we have transaction data in both the home market and the US market. We have done separate regressions for buy-initiated orders and for sell-initiated orders as we've found structural differences in trading costs between buyer-initiated orders and seller-initiated orders. I have used a different regression for Canadian cross-listed stocks as opposed to cross-listed stocks originating from other countries. In particular, I have dropped the regressor the natural logarithm of market capitalization from the regression for cross-listed stocks originating from countries other than Canada. I have done so for the following reason. For Canada, only one type of shares is traded and the outstanding number of shares in the US market and in the home market for the same company is the same. For other countries, the outstanding shares (ADRs) in the US market fluctuate depending on the demand for the ADR shares in the US. Hence, in our data, the same company would have different market capitalization across markets. As this give rise to biased and inconsistent estimates of the actual market capitalization of

the stock and hence a spurious proxy for liquidity, we omit this variable from the regression.

## **Findings**

To test if systematic trade cost differences exist between markets after controlling for the difficulty of trading, we test the null hypothesis that  $\beta_5 = \beta_6 = \beta_7 = 0$ . Table 2 shows the corresponding F-statistics that results from testing the null hypothesis. Separate tests are performed for buyer-initiated transactions, seller-initiated transactions, and for each home market. Separate tests have also been performed for the regressions for which the dependent variable equals adjusted opportunity cost and total adjusted opportunity cost respectively. From the table, we could see that there is some evidence that points to systematic trade cost differences between markets after controlling for the difficulty of trading. In particular, the trade costs of buyer-initiated transaction of cross listed stocks with home markets in France, Hong Kong and Mexico have statistically significant trade cost differences at the 5% level. In contrast, the trade costs of seller-initiated transaction of cross listed stocks with home markets in Canada, UK, Japan and Mexico have statistically significant trade cost differences at the 5% level as well.

To investigate the direction and magnitude of the systematic trade cost differences that we discovered above, we turn to the coefficient estimates of each regressor individually. We first take a look at the coefficient for the country dummy variable, which measures the “difference in intercept” of the trade cost prediction function with US trades and the corresponding home market trades taken separately. While we could reject the null hypothesis that there are no systematic trade cost differences across markets if we take the country variable and the country\*trsize interaction variable together for the buyer-initiated transaction of cross listed stocks with home markets in France, Hong Kong and Mexico, we could not reject the hypothesis that the “intercepts” are the same for the transactions of cross listed stocks with home markets in France and Hong Kong, i.e. we could not reject the null hypothesis that  $\beta_5 = 0$ .

Hence, we focus our attention on the signs and coefficient of the buyer-initiated transaction of cross listed stocks with home market in Mexico. From table 3, we could see that our estimate of  $\beta_5$  from the regression model is -0.98 with a p-value of less than 0.01 when the dependent variable is adjusted opportunity cost and is -0.88 with a p-value of 0.01 when the dependent variable is total adjusted opportunity cost. In other words, our regression model predicts that it is systematically cheaper to trade in the Mexico home market than it is to trade in the US market<sup>2</sup>. Recall that from our hypothesis, we predicted that countries with higher volume concentration would have lower trading costs. Hence, the negative coefficients estimated from the model would be consistent with our hypothesis if trading is concentrated in the Mexico home market. However, as estimated by Pulatkonak and Sofianos (1997), 68.7% of the transactions of cross-listed stocks with home market in Mexico take place in the US, inconsistent with our prediction. Similarly, for the seller-initiated transaction of cross listed stocks with home markets in Canada, UK, Japan and Mexico, we could only reject the null hypothesis that  $\beta_5=0$  for the transactions of cross listed stocks with home market in Japan. As estimated by Pulatkonak and Sofianos (1997), 88.8% of the transactions of cross-listed stocks with home market in Japan take place in Japan, consistent with our prediction.

Now we turn to the coefficient for the country\*trsize dummy variable, which measures the difference in impact that trade size may have when the transaction is executed in the home market as opposed to the US market. Again, while we could reject the null hypothesis that there are no systematic trade cost differences across markets if we take the country variable and the country\*trsize interaction variable together for the buyer-initiated transaction of cross listed stocks with home markets in France, Hong Kong and Mexico, we could not reject the hypothesis that the impact of trade size on trade cost is the same for the transactions of cross listed stocks with home markets in France and Mexico, i.e. we could not reject the null hypothesis that  $\beta_6=0$ .

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<sup>2</sup> Note that the converse may be true for larger trade size if the coefficient for  $\beta_6$  is negative.

Hence, we focus our attention on the signs and coefficient of the buyer-initiated transaction of cross listed stocks with home market in Hong Kong. Our estimate of  $\beta_6$  from the regression model is -7.96 with a p-value of less than 0.01 when the dependent variable is adjusted opportunity cost and is -8.26 with a p-value of 0.01 when the dependent variable is total adjusted opportunity cost. In other words, our regression model predicts that the impact of trade size on trade cost is systematically smaller when the transaction is executed in the Hong Kong home market as opposed to the US market. Here, the negative coefficients estimated from the model would be consistent with our hypothesis if trading is concentrated in the Hong Kong home market. As estimated by Pulatkonak and Sofianos (1997), 72.2% of the transactions of cross-listed stocks with home market in Hong Kong take place in the US, consistent with our prediction. For the seller-initiated transaction of cross listed stocks with home markets in Canada, UK, Japan and Mexico, however, we could reject the null hypothesis that  $\beta_6=0$  for all of the above cross-listed stocks. Using volume data again from Pulatkonak and Sofianos (1997), we find consistent results for the transaction of cross listed stocks with home market in UK and Japan, and inconsistent results for cross listed stocks with home markets in Canada and Mexico.

As illustrated above, while our regression model has been able to provide some support to the hypothesis that systematic differences in trade costs across markets do exist, we have not been able to use the concentration of volume in each market to explain the structural differences in trade costs that exists.

### **Shortcomings of our regression model**

Given the low predictability of our original regression model in terms of the direction of the structural differences in trade costs that exist between markets, we tried to analyze potential shortcomings with our original regression model. We noticed that there is a high variance in volume concentration across individual stocks in each market. Hence, while it is true that volume may tend to be concentrated in one country on the aggregate; it may not be the case that the volume concentration of all stocks aggregate in that particular market as well. Hence, using “country” and “country\*trsize” as dummy variables to test

our hypothesis may mask important variation in volume concentration that exists across individual stocks within each market, rendering our tests not very accurate. In fact, empirical findings from Smith and Sofianos (1997) support our suspicion. In the paper, Smith and Sofianos (1997) find that volume concentration depends on both country wide factors (time zone, level of country development) and company specific factors (what industry it is in). The implication of this is that we should look at the trading concentration of individual stocks instead of the market as a whole.

### **Proposed New Approach**

To shift our focus from the concentration of trading of the market as a whole to the concentration of trading of individual stocks, I propose the following new regression model:

$$Cost_i = \beta_0 + \beta_1 trsize_i + \beta_2 priorMb + \beta_3 priorX Mb + \beta_4 vv + \beta_5 trsize * vv$$

where  $vv$  is a dummy variable which equals 1 when volume for a individual stock is concentrated in where the transaction took place, 0 otherwise. In this case, if our hypothesis about trading cost is correct, we would expect  $beta\_4$  to have a negative value which is statistically significant. Limitations to the data that we have access to has prevented us from performing new tests using this new approach. Indeed, complete volume data for countries other than US are very difficult to obtain. Of the 8 countries that we are currently investigating in, only 3 of those countries have volume data available on WRDS. However, to look up the volume data in those countries (HK, Japan and Mexico), we need a stock identifier as input which we do not have. The solution to this problem would be to look up the numbers by manually typing in each matched company's name. Consequently, we're still gathering volume data as of now and project to complete this part of the project in summer 2005.

### **Conclusions**

Our regression model gives some evidence that systematic trade cost differences do exist across markets. However, our specification of the model may have shrouded important variation of volume concentration of individual stocks between markets. This may have resulted in our non-conclusive findings as to whether it is systematically cheaper to trade

in the market where volume is concentrated in. Further testing using our proposed new model needs to be performed before we can yield more meaningful results.

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