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# Pairs-Trading in the Asian ADR Market: Returns and Convergence

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**Abstract**

In this paper, we study pairs-trading strategies for 169 Asian shares listed in their local markets and listed in the U.S from January 2000 to December 2011. Given that all pairs are cointegrated, they are a logical choice for pairs-trading. Pairs-trading delivers positive profits. The results are robust to different holding periods, and estimation periods of the parameters of the pairs-trading strategy. For our base case, with a 90-day holding and a 60 day estimation period and for the average firm, the median return is 2.91% and the median duration of the open positions is 3 days, with a 2-4 days interquartile range. The median firm trades 11.6 per year as an ADR-local pair (average is 11.7). The distribution of the profits is not symmetric, with a bigger average than the median. The main contribution to the profitability of pairs-trading comes from the ADR market. The pairs-trading profits are similar when we group the firms by year, country, and liquidity measures. Pairs-trading profits are negatively correlated to different liquidity measures.
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Abstract

In this paper, we study pairs-trading strategies for 169 Asian shares listed in their local markets and listed in the U.S from January 2000 to December 2011. Given that all pairs are cointegrated, they are a logical choice for pairs-trading. Pairs-trading delivers positive profits. The results are robust to different holding periods, and estimation periods of the parameters of the pairs-trading strategy. For our base case, with a 90-day holding and a 60 day estimation period and for the average firm, the median return is 2.91% and the median duration of the open positions is 3 days, with a 2-4 days interquartile range. The median firm trades 11.6 per year as an ADR-local pair (average is 11.7). The distribution of the profits is not symmetric, with a bigger average than the median. The main contribution to the profitability of pairs-trading comes from the ADR (U.S.) market. The pairs-trading profits are similar when we group the firms by year, country, and liquidity measures.

I. Introduction

Many papers document departures from the law of one price for cross-listed stocks. Rosenthal and Young (1990) show that significant deviations from no-arbitrage parity prices exist for some well-known dual-listed companies (DLCs). de Jong et al. (2009) also find parity deviations for 12 DLCs can get to levels of up to 50%. More recently, Gagnon and Karolyi (2010a) study the deviations for a sample of 506 U.S. cross-listed stocks from 35 different countries. They find that deviations from price parity are on average small, averaging around .049 percent, but the deviations from price parity can be big. For example, U.S. share prices relative to home prices range from - 40.4% to 127.4%, while daily changes in the price deviations can decline as much as -95.6% and increase to as high as 168.5%. Given these deviations, at least on paper, there are potential arbitrage opportunities. The existence of these deviations is usually attributed to several factors, like regulatory and short-selling constraints, taxes, direct transaction costs, holding costs and execution risk.

In this paper, we are interested in the behavior of the potential arbitrage opportunities from cross-listed stocks. We focus on two aspects of these potential arbitrage opportunities: the profits and the duration. To measure profits, we use a simple trading strategy, pairs-trading, also known as "statistical arbitrage." First, a trader needs to find two stocks whose prices have moved together historically. Second, when the spread between them widens, the trader shorts the winner and buys the loser. If the joint distribution of the two stocks is stationary, prices will converge and the trader will profit. To measure the duration of the potential arbitrage opportunity, we measure the time the pairs-trading strategy is open. If the arbitrage opportunities are real, then, the deviations from the law of one price should be short-lived and the positions should be closed quickly. On the other hand, if the arbitrage opportunities are only opportunities on paper, there should be no convergence and the positions should remain open for a long time.

As pointed out by Gatev, Goetzmann and Rouwenhorst (2006) and Zebedee (2001) finding pairs that are highly correlated over time is the key to the success of the pairs-trading strategy. A good pair candidate is a DLC structure. A DLC refers to two companies that agree to operate their business as one single business, while agreeing to distribute cash flows to their shareholders in a given proportional way and retaining their separate legal identity and existing stock exchange listings. A good example of a DLC is Royal Dutch/Shell. Rosenthal and Young (1990) show that significant deviations from no-arbitrage parity prices exist for some well-known DLCs. Another natural and more common pair to study is the American Depository Receipts (ADRs) trading in the U.S. and their underlying foreign assets. Since ADRs represent warehouse receipts for foreign underlying shares that have been deposited in a custodian bank on behalf of U.S. investors, ADRs and their underlying shares should have a high correlation. The law of one price in the case of ADRs and their underlying shares has a very strong intuitive appeal.

Kato, Linn and Schallheim (1991) and Wahab, Lashgari, and Cohn (1992) studied arbitrage opportunities in the ADR market, and found very little evidence for profitable opportunities in the ADR market. In particular, Wahab et al. (1992) follow an implicit pairs trading strategy with two portfolios: an ADR portfolio and an underlying shares portfolio. They sell the "winner" (portfolio with the highest returns over a period of two weeks) and buy the "loser" (the portfolio with lowest returns over the same two-week period). They found limited profits for their pairs trading strategy, and they attributed their small profits (around 4%) to transaction costs and data limitations. That is, pairs trading using ADRs do not seem to be profitable. These studies use a small sample of countries and weekly prices, which might not be the appropriate prices to study arbitrage strategies. However, more recent work using a larger sample of countries and daily prices by Chan et al. (2008) and Gagnon and Karolyi (2010a) show that ADRs and their underlying shares can have significant departures from the theoretical no-arbitrage price parity.

Our paper is also related to the substantial body of literature documenting mean reversion in stock returns in the short-run. DeBondt and Thaler (1985, 1987) and Jegadeesh and Titman (1993) document that long-term past losers outperform long-term past winners over the subsequent three to five years. Jegadeesh (1990) and Lehman (1990) document short-term stock return reversals. In the case of the difference in prices between ADRs and their underlying securities, Rabinovitch et al. (2003) and Chen et al. (2008) show evidence of non-linear mean reversion.

We find, for different settings for the pairs-trading strategy, positive average and median profits. The distribution of the profits is not symmetric, with a bigger average than the median. The main contribution to the profitability of pairs-trading comes from the ADR market. The positions are held for a short time, with a median holding period of 3 days. The pairs-trading profits and durations are similar when we group the companies by year, country, and volume.

The paper is organized as follows: Section I is the introduction. In Section II we discuss the formation of pairs and some methodological issues. In Section III, we describe the data and provide univariate statistics for each pair considered. Section IV contains the results. Finally, section V presents the conclusions.

II. Pairs-trading in the ADR market: Strategy and Profits

We are interested in a very simple arbitrage strategy for the pair ADR-underlying share. As mentioned above, the pair ADR-underlying share has a great appeal for a pairs-trading strategy. Both assets represent the same good and, thus, the law of one price has a strong appeal. There are institutions in place -the depositary banks- that ensure "fungibility" by facilitating the convertibility of ADRS into home-market shares and back again.[1] Since some Asian markets have short-selling restrictions, the

[1] For a good description of the mechanics of traditional arbitrage with ADRs see Gagnon and Karolyi (2010a).

"pairs trading" strategy is restricted to start by buying the underlying shares and selling the ADRs.[2] That is, the strategy we analyze takes the ADR as the "winner" and the underlying as the "loser."

The pairs-trading strategy needs the a priori determination of three different parameters. First, an investor needs to specify an entry point, given by the moment the price discrepancy (measured by deviations from price parity) crosses a predetermined "buy threshold." Second, the investor needs to determine an exit point, given by the moment the price discrepancy crosses a predetermined "sell threshold" . Finally, the investors can choose a maximum holding period, after which any open positions are closed.

That is, the entry point occurs when the price difference (expressed in U.S. dollars) between an ADR and its underlying share is bigger than the predetermined buy threshold κ_o (κ_o>0), then we short the ADR shares and go long an equal number of the underlying shares. There are two possible scenarios to start the pairs-trading. First, we established the short position in the U.S. the ADR shares and, then, the next day we go long the underlying shares. Or, second, we first established the long position in the underlying market and, then, the same day, we go short the ADR shares in the U.S. market. Let P_{ADR} represent the price of the ADR and P_L represent the price, expressed in USD, of the underlying local (foreign to U.S. residents) share. Then, we open an ADR position and its corresponding local share position when:

$$P_{ADR,t+j} - P_{L,t} > \kappa_o,$$

where j=-1 if the long position in Asian market is established first, and j=0 if the short position in the U.S. market is established first. Note that we have a choice to open the short ADR position immediately at the open or wait to check if the price differential still persists at the close. In the case, that we first establish the short position in the U.S., it is probably a more conservative strategy to wait to the U.S.

[2] See Bris, Goetzmann and Zhu (2007). Indonesia, Taiwan, China, India and Korea all had short selling restrictions during the period under study.

close to establish a short ADR position. Once we establish a position in one market, we immediately (at the open) establish the other to form the pair.

Then, we unwind our positions the first time that the spread between the given ADR and its underlying shares is smaller than the predetermined sell threshold κ_c ($\kappa_0 > \kappa_c$). Again, we have two possibilities to close the pairs-trading position. First, we start by going long in the ADR market and the next day we sell the underlying shares in the local market. Or, second, we start by selling the underlying shares in the local market and the same day we also buy the ADR shares. That is, we reverse the ADR position and its corresponding local share position when:

$$P_{ADR,t+j} - P_{L,t+k} < \kappa_c,$$

where j=k if the long position in Asian market is closed first, and j=k-1 if the short position in the U.S. market is closed first. Thus, we bet on the convergence of the ADR price and the underlying local share price. Note that when a trader sets k_C =0, the traders expects convergence to the law of one price. Again, given the lack of overlap between the two markets, we have a choice: close the position immediately, when the market opens, or at the market close.

Note that since Asian markets are not open when the U.S. market is open, the pair, sometimes, cannot be formed. Overnight, the spread may reverse (say, $\kappa_c \leq 0$) and then, the long position is not established. In this case, our short ADR position will be closed the next trading day. In Exhibit 1 we show a diagram with the time line and one algorithm for the pairs trading strategy.

The pairs-trading strategy is related to the error correction model, where the ADR price and the underlying share price are cointegrated. In this context, the pairs-trading strategy implies a long-run relation between the ADR price and the underlying share price. Moreover, if the cointegrating vector is one, which implies we short one share, and go long one share, the long-run spread should be zero.

The determination of the buy threshold, κ_o, and the sell threshold, κ_c, is ad-hoc. Gatev et al. (2006) use two historical standard deviations to determine κ_o. Then, they select κ_c to be non-positive –

i.e., κ_c is implicitly set non-negative, because the positions are closed when the spread reverses for the first time. That is, the trader closes the position when the law of one price holds again. de Jong et al. (2004) set κ_o and κ_c equal to 10% and 5%, respectively. Wahab et. al. (1992) automatically close their positions after two weeks, without setting a-priori values for κ_o and κ_c. Note that the selection of κ_o and κ_c can be different for different agents. Individuals with higher risk-aversion may select a higher κ_o, a lower κ_c, or both a higher κ_o and a lower κ_c.

We played with different values for κ_o and κ_c. We make both values a function of the volatility of the ADR-local spread, $\sigma_t(P_{ADR,t} - P_{F,t})$. We use

$$\kappa_o = \mu_t + k_0 \text{ x } \sigma_t(P_{ADR,t} - P_{L,t}).$$

and

$$\kappa_c = \mu_t + k_C \text{ x } \sigma_t(P_{ADR,t} - P_{L,t}),$$

where k_0 and k_C are ad-hoc constants (set at, say, 2 and .5, respectively); μ_t and $\sigma_t(P_{ADR,t} - P_{F,t})$ are the mean and standard deviation of the ADR-Local spread, $P_{ADR,t} - P_{F,t}$. Given the usual time-varying volatility in stock returns, before the start of the pairs-trading strategy, we estimate the mean and variance of the ADR-local spread using the previous *T* days (*T* is fixed at 30, 60, 90 and 120 days). In Exhibit 2, we show the time line of the estimation of the parameters μ_t and $\sigma_t(P_{ADR,t} - P_{L,t})$,for pairs-trading, for the case of an estimation period of 60 days and holding period of 90 days.

Note that our strategy involves two open positions: a short position of α ADR shares in the U.S. market and a long position of α underlying shares in the Asian market. We are not matching dollar amounts, but quantities of shares. Thus, our net investment is usually never zero. In the terminology of hedge funds, our strategy is beta-neutral, not dollar-neutral, since we are not matching dollar amounts in our long and short positions.

Pairs-trading in our context has some risks, and, therefore, it is not an arbitrage strategy in the strict sense of the definition of arbitrage. First, Asian markets and the U.S. market have no overlap in

trading hours. Thus, it takes several hours to establish the long position, at which time the spread between the ADR price and the underlying share price might have already been reduced to zero. Second, exchange rates can fluctuate widely and, thus, exchange rate risk can affect the convergence of the spread. That is, execution risk is bigger than in markets with overlapping trading hours. Third, some underlying shares might not be very liquid, and, therefore, establishing the long position in the Asian markets might not be possible. Four, even though ADRs and their underlying share are cointegrated, there is no certainty about a convergence date.[3]

Pairs-trading involves different cash flows. As mentioned above, sometimes we open a short position in the U.S., but the spread completely reverses overnight and no long position is established in Asian markets. In this case, only one cash flow will be taken into account. When pairs are formed, we hold the position until there is price convergence or until the pre-established maximum holding period (90 days, 120 days) is reached.

As discussed in Mitchell et al. (2002), measuring returns for portfolios, with long and short positions, is not obvious. From a frictionless arbitrage point of view, the net investment should be negative, since we usually sell the ADR (the "winner") and buy the underlying (the "loser"). However, pairs-trading is not frictionless. To establish a short position in the U.S., investors need to open a margin account, which usually requires a 50% collateral deposit for a given short position.[4] In general, investors do not have available the proceeds of the short sale. Therefore, transferring the short sale proceeds to

[3] In their study, de Jong et al. (2004) find that it can take more than 8 year until convergence takes place for some DLCs.

[4] Regulation T's initial margin requirement on a shot sale calls for "150% of the short sale proceeds." That is, the entire amount received from the proceeds of the sale plus an additional 50% of the proceeds from the short position are kept as collateral.

Asian markets is not possible. Thus, investors need capital to establish the long position in the underlying local shares.[5]

Taking the above considerations into account, we use two measures. For both measures, given that many Asian countries in our sample do not allow margin trading, we use a as the denominator of the long position the whole initial value of the long position. The first measure is a conservative one, which we called *return on overall capital exposed (ROCE).* We conservatively assume that an investor uses as collateral the whole amount to establish a short position. We can think of this investor as a conservative investor that deposits enough collateral to cover potential margin calls. Then, we define ROCE as the sum of the returns in each market, . That is:

$$ROCE_i = \frac{FS_{i,t+j} - FB_{i,t+1}}{FB_{i,t+1}} + \frac{US_{i,t} - UB_{i,t+k}}{US_{i,t}},$$

where $FB_{i,t+1}$ and $FS_{i,t+j}$ are the value of the of the underlying shares when we buy the position *i* at time *t*+1 and sell the position *i* at time *t+j*, respectively; and $UB_{i,t+k}$ and $US_{i,t}$ are the value of the of the ADR shares when we buy the position *i* at time *t+k* and sell the position *i* at time *t*, respectively.

A more realistic measure is what we called *return on usual capital exposed* (RUCE). This measure takes into account that only 50% of the short position should be deposited in the margin account. That is,

$$RUCE_i = \frac{FS_{i,t+j} - FB_{i,t+1}}{FB_{i,t+1}} + \frac{US_{i,t} - UB_{i,t+k}}{.5 \times US_{i,t}}.$$

III. Data

Our database consists of daily closing and opening prices for pairs of ADRs and their underlying shares for the period starting in the first quarter of 2000 and ending in the last quarter of 2011. The data

[5] Mitchell et al. (2002), use a measure where an investor can use a margin account, with 50% collateral, to finance the long position. In our case, this would double the returns from the Asian long position. As

source is Datastream. We use 169 ADRs trading in the U.S. from eleven Asian markets. Although there are thousands of ADR, to be included in the sample we required both the underlying and ADR share should be in Datastram, should have some liquidity (at least 50% of non-zero return days in both markets) and have at least two years of continuous trading. The underlying shares come from Australia (27), India (6), Indonesia (1), Hong Kong/China (36), Japon (58), Korea (5), Malaysia (1), Phillipines (1), Singapore (5), Thailand (1), and Taiwan(5).

As we discuss below, stale prices and missing quotes are common in the data. Even for liquid stocks we have big, extreme spreads. For example, we look at the spread, as a percentage, for a liquid stock, the Korean Electric Power (KEP). Before the year 2000, KEP shows several price differentials (spreads) bigger than 300%. This situation is not unusual for many stocks. There are many possible causes for these unusual spreads. There may be stale prices, holiday effects, ADR ratio changes that are not incorporated or explicitly reported, lack of adjustments for cash or stock dividends, preferential rights to buy more shares given only in the local market, etc. For this reason, throughout the paper, we present the distribution of the results, emphasizing robust measures like the median and the interquantile range.

Table 1 presents some descriptive statistics for a representative sub-sample of the 169 ompanies in our sample. Table 1 reports the total number of trading days, market capitalization (Market Cap), float, number of zero returns day, both in the domestic market and in the U.S. market, the U.S. short ratio, and the U.S. average daily volume. Not all the ADRs trade from the start of the sample. For example, Brambles's ADRs (BMBLY) start trading on March 31, 2009, giving us 720 trading days. Following Bekaert, Harvey and Lundblad (2007), we use the zero-return day metric as a liquidity indicator. An advantage of using the zero return measure in an international setting is that stock prices are widely available and measured consistently across markets relative to other measures such as volume or bid-ask spreads. Note that Datastream reports closing prices –the previous day's closing price- during

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discussed later, given margin restrictions in some Asian markets, we do not use this alternative measure.

holidays. In the U.S., we should expect a minimum of 9 –or 3.6% (9/250)- zero return days. The U.S. short ratio can be used together with daily U.S. volume as an indicator of the easyness of establishing a short position in the ADR market. At the bottom of Table 1, we report the average and the standard deviation for the whole sample –i.e., for the 169 firms. We also describe the whole distribution using the usual percentiles (90%, 75%, median, etc.).

Based on market capitalization, the companies in our sample sample range from large-caps to small-caps. Over 80% of the sample are medium to large cap firms –i.e., market capitalization bigger than USD 2 billion. Some ADRs are very liquid, with a high trading volume, like Indonesia's TLK or Taiwan's TSM, but some ADRs have very thin trading. For example, Silex Systems's ADRs (SILXY) have an average 30-day daily volume of 390 shares. This thin trading can be confirmed by the liquidity indicator, number of zero day returns. Moreover, when we combine the short ratio with the daily U.S. volume, it is seen that for some ADRs establishing a short position should be difficult. For example, the ADRs of China Shenhua Energy Co. (CSUAY) have an average daily volume of 4,240 shares. Bloomberg reports that only 265 shares are shorted. As pointed out by the zero-retun metric, the shares tend to be more liquid at home than in the U.S. Although, not reported, all the pairs of ADR and their underlying shares are cointegrated using the ADF and Perron-Phillips tests.

Table 2 reports the Local-ADR price spread (in USD), measured as a percentage over the ADR price for the same sub-sample used in Table 1. We report the average, standard deviation, maximum, 90% percentile, median, 10% percentile, and the minimun. In the last column, we also report the liquidity indicator, proportion of zero return days in the U.S. As discussed abour, we see some big, unusual spreads, as shown by the maximun and minimum statistics. The average spread tends to be higher than the median, which points out the existence of more big positive outliers than negative ones. These are outliers, likely due to stale prices, the product of thin trading. The 90-10 percentile range tends to include 0, that is, empirical confidence intervals will not reject the null hypothesis of zero price spreads. The overall average is 1.37%, which is significantly different from zero at the 5%, using a

standard t-test. The overall median is lower that the mean, 0.72%. The overall 90-10 percentile range also includes 0.

IV. Results

In our sample, every day we have a total of 169 potential pairs-trading positions. Opening and closing a position depends on the choice of k_0 and k_C. Of course, the actual choice of these constants depends on the risk tolerance and patience of a trader. As the distance between k_0 and k_C increases, a trader will do less trading, and, therefore, incur in lower transaction costs. Also, a bigger difference between k_0 and k_C increases the likelihood of the spread not converging towards zero. We use several values for both constants. For k_0, we use 2.33, 2, and 1.65; while for k_C, we use 1, .5 and 0.

Besides deciding on k_0 and k_C, a trader has to make a decision on the estimation period –i.e., time needed to estimate μ_t and $\sigma_t(P_{ADR,t} - P_{F,t})$- and the holding period –i.e., how long does the trader wait to close a position. Again, we use different values for the estimation period: 30, 60, 90, and 120 days. For the holding period, we use the usual monthly (30 days), quarterly (90 days), and semi-annual (120 days) periods. Overall, we find that the results are qualitatively similar for different holding and estimation periods. We find positive and significant average returns. Similar to Table 2, we observe outliers, in general, the positive outliers tend to have bigger impact.As a result, the median returns are smaller. The main contribution to total returns comes from the ADR market, where the ADR is relatively overvalued and a reduction in its price occurs during the holding period.We tend to find a small duration for the pairs-trading strategy. The median duration tends to be 3 days or lower. That is, the market tends to quickly correct price disparities between the local and ADR markets.

We start by presenting the results for a trader that sets $k_0 = 1.65$ and uses an estimation period of 60 days to calculate the mean and the variance of the spread. Table 3-A presents the local, ADR and total return distribution and the duration of the pair-trading strategy for a trader who sets $k_C = 0$ –i.e., expects convergence to the Law of one price. We present the returns in terms of both measures, ROCE

and RUCE. During the 2000-2011 there are a lot of pairs formed. For a 90-day holding period, a pairs-trader makes 22,013 trades; for a 120-day holding period there are 19,113 trades; while for a 30-day holding period there are 7,772 trades. Each pairs trade involves four trades, two in the local market and two in the ADR market. As pointed out above, for all holding periods, the main contribution to total returns comes from the ADR market, on average the ADR contribution to returns is around 10 times bigger than the contribution from the local market. That is, the convergence to the law of one price is given by a drop in the ADR price, not by an increase in the local price (translated to USD). For a holding period of 90 days, the ROCE measure, the mean return is 3.47% and the median return is 2.50%. For the RUCE measure, the mean and the median return are 6.65% and 4.73%. The bigger returns comes from the less conservative denominator used to scale the profits from the ADR market. For all pairs, the pair-trading total mean returns for both measures (ROCE and RUCE) are positive and significant. As the holding period increases, we tend to see an increase in returns, though the numbes are not signficantly different at the 5% level. As pointed out above, the pairs trading strategy is not without risk. Note that we have, in our portfolio, extreme negative observations. With regard to the duration of the positions, the duration is small, with a median duration of 3 days. This median duration is significantly smaller than the median durations reported by de Jong et al. (2009). When the holding period increases, the average duration also increases, as expected, since we are giving more time to the position to converge. However, these long duration pairs are rare, which can be seen as the median is not affected.

Table 3-B presents the numbers for different values for k_C: 0.5 and 1. For comparison purposes, we also repeat the results for k_C=0. We present the results only for the ROCE measure, since the RUCE returns are roughly 90% bigger that the ROCE returns (the RUCE measure can be easily calculated from the Local and ADR returns). On Panel A, we repeat Table 3-A, where the trader set k_C =0. Panel B presents the results for k_C =0.5, while Panel C presents the results for k_C =1. Overall, we see the same results as in Table 3-A. As expected, a higher k_C increases trading and lowers durations for all holding

periods. Increasing k_C also decreases both median and average returns for all holding periods, since the profits from convergence are a priori set at a lower level.

In Tables 4 and 5, we increse k_o. Again, we only present the returns as measured by ROCE. Table 4 sets k_o =2.0, while Table 5 sets k_o =2.33. As k_o is increased, the average and median profit increases. Also, the duration increases. The median duration is still low, in all cases the median duration is not bigger than 3 days. For example, the duration is 3 days for k_C =0, and 2 days for k_C =0.5. When k_C =1, when the holding period is 30 days, the median is only 1 day. Again, for a given k_o , the returns and duration decrease with k_C.

Next, we want to study the impact of the estimation period on our results. Given that the qualitative results are similar for different holding periods, we concentrate on the effect of different estimation periods on pairs-trading strategies with a 90 day holding period horizon. Also, in the next tables to reduce the number of them, we set $k_O = 2$, and $k_c = 0$. The results for other values for k_O and k_C are similar to the ones presented in the previous tables 3-6.

Table 6 presents the results for 4 different estimation periods: 30 days, 60 days, 90 days, and 120 days. We present the returns calculated under the ROCE and RUCE measures. Given that a longer estimation period implies a shorter time to trade, we have more trades as the estimation periods gets smaller. Overall, returns tend to increase as the estimation period increases. The average durations are very similar accross estimation periods, close to 6 days. The median duration of the pairs is not longer than 3 days. The interquartile range for durations is 6-1 for the first three estimation periods, and 7-1 for the longer 120-day estimation period. Again, the average is affected by some extreme long durations.

Given that the estimation period and holding period do not affect the qualitative results of the different pairs-trading strategies, for the rest of the paper we set the estimation period equal to 60 and the holding period equal to 90 days. As in Table 6, we only report the results for the constants $k_O = 2$, and $k_C = 0$.

Table 7-A reports the ROCE profits for all the firms in the sample. The distribution of this sample is summarized at the bottom of the table (same numbers as on Panel A, Table 4). Table 7-B presents another summary of the data, presenting the distribution of returns calculated using the ROCE and RUCE measures per firm. We also show the distribution of total trades, proportion of zero return days, annual average trades per firm, and the median raw spread. To have a better idea of the significance of the calculated profits, we also estimate the transactions costs, as measured by the effective spread calculated according to Roll (1984).[6] In rows 6 and 7, we show the distribution of Roll's (1984) effective spread measured in both markets. also present The average firm has a median ADR-Local spread of 0.95% and trades 11.7 per year as an ADR-local pair (median is 11.6). The total transaction costs, as measured by Roll's measure, have a 2.67% median and a 3.37% average.[7] The interquartile range for transaction costs covers from 1.6% to 3.5%. We compare these numbers with the returns from pairs-trading. The net profitability depends on the measure used to compute returns. If the measure is ROCE, for the average firm there is a small median net profit of 0.3% in each pair formed (average net profit is 0.4%); but if the measure is RUCE, the net profits are significant. The median RUCE net profit is close to 2.7% per pair formed (average net profit is 3.4%). The duration of the open positions is 3 days, with a 2-4 days inter-quartile range. As a matter of fact, 90% of the positions have durations no longer than 7 days. Taking the median duration into account, according to the RUCE measure, there is a 0.9% median net profit per day.

[6] Roll (1984) measures the effective spread as two time the square root of the autocovariance of returns, which should be in theory negative. If the autocorrelation is positive, then the expression under the root becomes undefined in real numbers. We follow the usual procedure used in the literature, by considering the absolute value of the autocovariance. See Gehrig and Fohlin (2006) and Roll (1984).

[7] These transaction costs are substantially higher than the ones reported by Gagnon and Karolyi (2010a). They report total transaction costs, including commissions, fees, and market impact costs in each market,compiled by Elkins/McSherry LLC, as well as the applicable excise taxes on equity transactions and taxes imposed on trading commissions. These costs average around 0.58% across markets, with a range from 0.30% (Germany) to 2.45% (Colombia).

Table 8 presents results for different starting points for the pairs-trading stratgeies: January 3, 2001, July 1, 2007 and July 1, 2009. The last two dates are chosen to coincide with the first signs and the end of the financial crisis of 2008. For both measures, the results are qualitatively similar. However, we do observe higher returns, higher variance, and longer durations during the financial crisis years than after the financial crisis. But, relative to the whole sample, the financial crisis years are not unusual. As the sample size becomes smaller, the average and median returns are also smaller. Also the returns variances become smaller. The difference between the financial crisis years and the period after the financial crisis is also apparent in Table 9, where we present the mean and median returns and duration for each year. However, relative to the whole sample, the financial crisis period is not unique. The years 2001 and 2002 have higher mean and median returns relative to the rest. They also have a higher average and median duration than the whole sample.

Table 10 presents the results by country. We only show the total returns as measured by the ROCE measure. Again, there are significant average and median profits for all countries. As in all previous tables, the main contribution to total returns comes from the ADR market. We also see in all markets a lower median than the mean, pointing out to the asymmetric behavior of large observations. Outliers, likely caused by stale prices, may be behind the extremely positive contribution from the ADR market observed for the firms in Malaysia and Singapore. With the excepcion of China, with only one firm, CSUAY, the average durations are all lower than 10 days and a median duration lower than 5 days. As a matter of fact, 8 out of 12 markets have a median duration of 3 days. That is, for 50% of the positions are closed within 3 days. Prices tend to converge quickly, mainly, in the ADR market.

V. The Role of Liquidity

Based on the theoretical work by Merton (1987), it is usually reported that that stocks with low liquidity, measured in different ways, earn higher expected returns.[8] In section IV, we documment pairs-trading profits in the Asian ADR market. The literature on the limits to arbitrage points out that arbitrage is risky and costly, and hence implementable arbitrage opportunities are limited, see Shleifer and Vishny (1997). Lam and Wei (2011) argue that, since the difficulty to arbitrage varies across stocks, information should be more quickly included in the prices of stocks that are easier to arbitrage than in those that are not easy to arbitrage. Thus, errors in stock prices should be corrected more quickly for stocks that are easy to arbitrage than for stocks that are difficult to arbitrage. Although arbitrageurs may trade against a mispricing, the correction of a mispricing will take longer when the limits to arbitrage are more severe. That is, the limits to arbitrage hinder relevant information from being included in stock prices and prevent incorrect. In terms of constraints to arbitrage, none is more important than the lack of liquidity. We use this idea to explore the role of liquidity in the pairs-trading strategy. First, we use two readily available liquidity measures: volume and zero return days. Low liquidity can lead to stale prices, which, in turn, can lead to big paper profits, but not to real profits. To study the impact of liquidity, we divide the firms in four different buckets or portfolios, depending on the liquidity of each firm. We use the quartles of the volume distribution to divide the firms in 4 buckets: High Volume, High to Medium Volume, Medium to Low Volume, and Low Volume. The 75%, 50% (median) and 25% volume percentiles are given by 91,332 shares, 17,222 shares, and 3,531 shares, respectively. In terms of the overall U.S. market, only the first bucket can be considered of good daily volume. We do a similar portfolio construction for the zero return days variable. The 75%, 50% (median) and 25% volume percentiles are given by 6.21%, 14.57%, and 29.75%, respectively.

In order to study the effect of liquidity on returns and duration, we sort the firms by two liquidity indicators: average volume and percentage of zero return days. We form four buckets with all firms,

[8] See Amihud (2002), Easley, Hvidkjaer, and O'Hara (2002), Pastor and Stambaugh (2003), Acharya and Pedersen (2004), Baker and Stein (2004), and Hasbrouck (2005), among many others.

according to the quartiles of each indicator. Table 11 and Table 12 present the average, median and interquartile range (IQ range) for the total (ROCE) retuns and the duration of pairs-trading by volume bucket and zero return days bucket, respectively. Both tables, on the second column, also present the total number of trades per volume bucket. All average returns and durations are significantly different from zero. With the exception of the duration of the high-medium volume bucket and the medium-high volume bucket, all average returns and durations are different from each other at the 5%. Both tables presents similar results: better liquidity has a negative impact on median and average profits. For example, for the most liquid bucket, the median return is close to 2% for both liquidity measures, while for the least liquid bucket the median profit increases to 3.66%. This result can be explained by a liquidity premium. Stale prices should not be a problem for, at least, the most liquid bucket. We still observe average significant returns at the 5% level. The average duration and IQ range also decrease with liquidity. Better liquidity, shorter horizons for pairs-trading positions. However, the median is constant across volume or zero return days buckets.

We also sort by Roll's measure, using the quartiles to create four buckets. The results are qualitatively similar. The median duration for all buckets is 3 days. The median (average) return and IQ range decrease with Roll's transaction costs measure. For the lowest quartile (with transaction cost lower than 2.17%), the median (average) return and IQ range are 2.22% (2.69%) and 5-1 days. On the other end, for the highest quartile (with transaction costs higher than 3.55%), the median (average) return and IQ range are 4.05% (6.54%) and 7-1 days.

Overall, our results are consistent with the limits of arbitrage literature. For different liquidity indicators, we have the same result: better liquidity, lower profits and shorter horizons for pairs-trading positions. But, we still find significant average returns for the most liquid bucket, where low liquidity and stale prices should not be a significant problem. The average duration and IQ range also decreases with liquidity. However, the median is constant across volume or zero return days buckets.

Given the amount of outliers in the data, we have emphasized the median and interquartile range in our analysis. In order to analyze the determinants of the profits, we use quantile regressions, see Koenker (2005). We use as dependent variable three different measures of profits per firm: average profit, median profit and median profit standardized by profit's volatility. As explanatory variables we use market capitalization as a control variable, along with different measures of liquidity: Roll's transaction costs for the domestic and U.S. market, proportion of zero returns, arbitrage transactions per year, short ratio. In Table 13, we present the results for the .50 quantile –i.e., the median. Consistent with the results from Tables 11 and 12, Roll's transaction costs, in both markets, and the proportion of zero returns are the only statistically significant variables at the 5% level for the tree measures of profits. The proportion of zero return days and domestic Roll's transaction costs are the most signficant. Market capitalization (Mkcap), short ratio (SR) and trades per year are not signficant. Figure 1 shows the estimated parameters by quantiles for the average profits. Similar patterns are observed for median returns. Market capitalization and short ratio are not significant for any quantiles of profits. On the other hand, the effect of the proportion of zero return days (propzeret) and Roll's U.S. transactions costs (Rollf) are significant across quantiles. The estimates of propzeret are quite stable across quantiles, while the estimates of Rollf are stable up to .75 quantile, from they are increasing but with a very wide confidence intervals. The effect of domestic transactios (Rolld) costs are increasing over quantiles, Rolld starts to be significant for the .4 quantile and above. The number of trades per year (tradespery) has a negative impact on the quantiles of profits, but they tend to be significant only after the .55 quantile. Overall, we find that liquidity has a significant impact on pairs-trading profits.

VI. Conclusions

In this paper, we study pairs-trading strategies for 169 Asian shares listed in their local markets and listed in the U.S. Given that all pairs are cointegrated, they are a logical choice for pairs-trading. We find that pairs-trading in this market delivers significant profits. The results are robust to different

holding periods, and estimation periods of the parameters of the pairs-trading strategy. For our base case, with a 90-day holding and a 60-day estimation period, the median ROCE profit is 2.8%, while the median pairs-trading position is held for 3 days. The median and average ROCE profit is slightly bigger than the transactions costs, as estimated by Roll's effective spread. The median RUCE net profit is close to 2.7% per pair formed (average net profit is 3.4%). That is, the net profitability depends on how pair-trading profits are measured. The more conservative measure, ROCE, delivers a very small median net profit, of the order of 0.1% per day. But, the more realistic RUCE measure delivers a median profit of 0.9% per day. Over time, the pairs-trading profits seem to be decreasing.

The duration of the open positions is low, the median duration is only 3 days, with a 2-4 days inter-quartile range. As a matter of fact, 90% of the transactions have durations no longer than 7 days. The average profit is always bigger than the median profits, pointing out to a non-normal distribution. Almost 90% of the profits from pairs-trading come from the ADR market. The pairs-trading profits are similar when we group the companies by year, country, and volume. When we look at transactions costs, the profitability depends on how pair-trading profits are measured. The more conservative measure, ROCE, delivers very small median net profit, of the order of 0.1% per day. But, the more realistic RUCE measure delivers a median profit of 0.9% per day. Over time, the pairs-trading profits seem to be decreasing. Finally, we find that volume has an effect on pairs-trading profits. The average and median profits are decreasing as volume increases.

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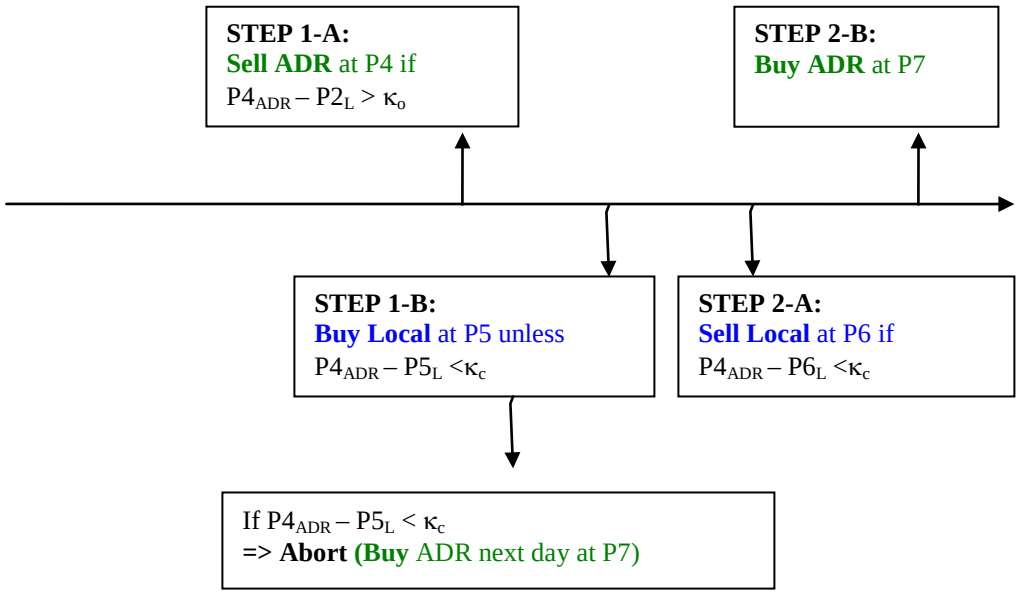
Exhibit 1. Time Line for Pairs-trading

TIME FRAME (FROM PAST TO FUTURE)

Date	01.01	01.01	01.01	01.01	01.02	01.02	01.02	01.02	01.03	01.0
Description	Korea Open 8 PM	Korea Close 2 AM	USA Open 9:30 AM	USA Close 4 PM	Korea Open	Korea Close	USA Open	USA Close	Korea Open	Korea
Code	P1	P2	P3	P4	P5	P6	P7	P8	P9	P1



STEP 1-A can also start with sell ADR at P3 if $P3_{ADR,} - P2_L > \kappa_o$

Exhibit 2
Time line and Estimation of parameters for Pairs-trading
Estimation period: 60 days
Holding period: 90 days

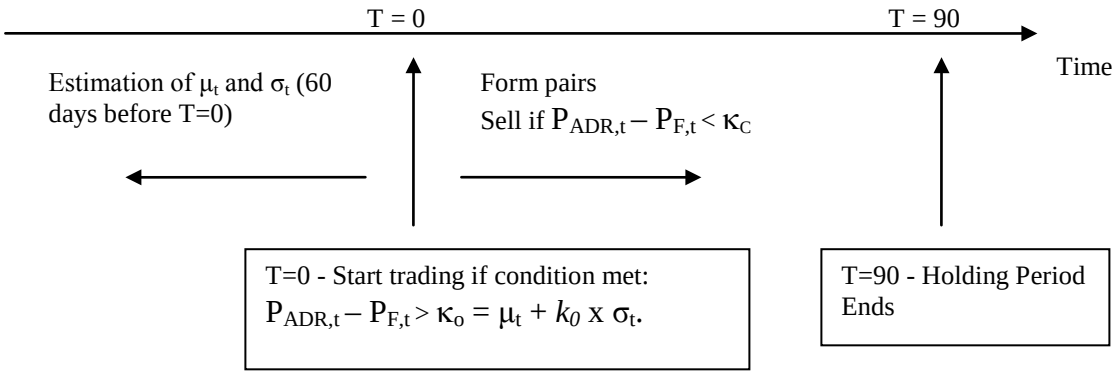


Table 1. Descriptive Statistics – Representative Sample
Sample period: 2000-2011

Firm	Trading Days	Market Cap (in billions)	Float (in millions)	Zero Return Days		Short Ratio	Daily US Volume (in ,000)
				Dom	ADR		
Australia							
U:BMBLY (A:BXBX)	720	9.59	740.18	6	135	0.24	18.84
U:SMS (A:SMS)	991	2.06	205.85	9	36	5.68	68.09
U:SILXY (A:SLXX)	1285	0.56	34.03	12	376	1.44	0.39
U:WBC (A:WBCX)	3130	3.24	64.43	31	158	0.98	660.42
Hong Kong/China							
U:IDCBY (K:ICBC)	729	185.71	17.04	13	39	0.98	81.81
U:JELCY (K:JNEL)	2249	2.12	.359	53	367	0	2.48
U:PNGAY (K:PING)	1536	61.59	3.94	18	637	1.78	35.02
U:CHU (K:UNIC)	3007	33.23	2.36	67	186	5.27	1,156.46
U:YZC (K:YNCL)	3130	7.99	.491	133	313	1.54	222.06
India							
U:HDB (IN:HFC)	2723	24.00	777.34	91	160	3.65	740.51
U:INFY (IN:ITO)	3120	25.14	571.40	77	125	6.97	1,963.22
Japan							
U:ACMUY (J:ACOM)	1642	2.90	626.65	7	175	0	1.33
U:BRDCY (J:BR@N)	3130	16.87	391.33	11	631	0.79	9.65
U:CAJ (J:CN@N)	3130	47.17	1,190.0	13	131	3.09	281.46
U:EJPRY (J:EAJR)	829	22.69	2,370.0	4	52	0.70	171.3
U:HOCPY (J:HQ@N)	1891	8.73	407.93	5	203	2.42	18.12
U:SOMLY (J:KP@N)	3130	9.55	873.08	13	432	0	67.01
Korea							
U:KEP (KO: KAW)	1985	12.80	1,250.0	59	94	1.00	786.44
U:SKM (KO: SKT)	3130	7.49	627.88	71	162	0.60	2,250.63
Taiwan							
U:AUO (TW:ADT)	2503	3.46	882.70	74	130	7.20	1,161.60
U:TSM (TW:TSM)	3130	70.71	5,180.0	91	179	2.10	9,972.98
ALL FIRMS							
Mean	2250.6	15.59	984.76	41.8	406.9	1.84	229.79
Standard Deviation	935.4	22.37	1511.45	65.0	390.7	3.53	957.59
Max	3132	140.00	12010.00	520	1529	35.34	100411.4
90%	3130	32.13	2506.00	91	1032	3.92	410.48
75%	3130	17.41	1000.00	53	631	2.42	91.33
Median	**2531**	**8.65**	**511.05**	**15**	**223**	**0.84**	**17.72**
25%	1285	3.60	204.53	11	125	0.16	3.53
10%	812	0.98	75.59	6	63	0.00	1.04
Min	695	0.01	0.00	2	33	0.00	0.09

Notes:
Trading days: Number of days a quote is provided by Datastream. It includes holidays, but not weekends.
Market Cap: Market capitalization by the end of 2011.
Float: Total number of shares publicly owned and available for trading by end of 2011.
Mean Volume: Mean daily volume (3-mo) by the end of 2011, when available.

Zero Return Days: Number of days that the daily stock price does not change relative to the previous day. Since Datastream reports the same price as the previous day during holidays, in the US, we should expect a minimum of 9 –or 3.6% (9/250)- zero return days.
Short Ratio: Number of shares short divided by Mean volume by the end of 2011, when available.

Table 2. Spread - Descriptive Statistics for Representative Sample
Sample period: 2000-2011

Firm	Spread in USD (as a %)							ADR Prop of Zero Return Days
	Mean	Stand Dev	Max	90%	Median	.10	Min	
Australia								
U:BMBLY	-0.0027	0.0187	0.0872	0.0178	-0.0058	-0.0199	-0.1007	0.1875
U:SMS	-0.0013	0.0252	0.1289	0.0245	-0.0009	-0.0271	-0.1340	0.0363
U:SLXX	-0.0033	0.0304	0.1330	0.0288	-0.0062	-0.0328	-0.2278	0.2926
U:WBC	0.0011	0.0131	0.1085	0.0126	0.0016	-0.0115	-0.1351	0.0505
HK/China								
U:IDCBY	0.0144	0.0173	0.0866	0.0144	0.0173	0.0866	0.0144	0.0535
U:JELCY	-0.0033	0.0189	0.0714	0.0180	-0.0039	-0.0241	-0.2208	0.1632
U:PNGAY	-0.0193	0.0842	0.3297	0.0397	0.0015	-0.1453	-0.4134	0.4147
U:CHU	-0.0001	0.0194	0.1700	0.0200	-0.0006	-0.0202	-0.1157	0.0619
U:YZC	0.0042	0.0248	0.1911	0.0290	0.0030	-0.0214	-0.1199	0.1000
India								
U:HDB	0.0915	0.0761	0.4484	0.1960	0.0824	0.0036	-0.1148	0.0588
U:INFY	0.0581	0.2346	0.6901	0.4483	0.0178	-0.2378	-0.3746	0.0401
Japan								
U:ACMUY	-0.0091	0.0208	0.1729	0.0146	-0.0106	-0.0309	-0.2125	0.1066
U:BRDCY	-0.0007	0.0241	0.2529	0.0141	0.0000	-0.0156	-0.3020	0.2016
U:CAJ	0.0011	0.0146	0.1081	0.0166	0.0014	-0.0148	-0.1083	0.0419
U:EJPRY	-0.0029	0.0138	0.0988	0.0122	-0.0040	-0.0170	-0.0700	0.0627
U:HOCPY	0.0010	0.0156	0.1384	0.0160	0.0016	-0.0145	-0.0827	0.1074
U:SOMLY	-0.0011	0.0210	0.0874	0.0141	0.0003	-0.0151	-0.1995	0.1380
Korea								
U:KEP	0.0138	0.0376	0.1565	0.0553	0.0056	-0.0190	-0.1138	0.0474
U:SKM	0.0317	0.0509	0.2259	0.1134	0.0154	-0.0170	-0.0822	0.0518
Taiwan								
U:TSM	0.1613	0.1922	1.0915	0.4839	0.0777	0.0144	-0.1138	0.0572
U:UMC	0.1182	0.1985	1.1750	0.4472	0.0359	-0.0447	-0.1386	0.0758
ALL								
Mean	**0.0226**	**0.0583**	**0.4930**	**0.0759**	**0.0095**	**-0.0411**	**-0.2191**	**0.1920**
Max	0.4162	0.5824	6.8773	1.1752	0.2625	0.1262	0.0144	0.4983
90%	0.0408	0.1195	0.8643	0.1754	0.0219	-0.0098	-0.0759	0.4344
Median	0.0003	0.0304	0.1842	0.0227	0.0002	-0.0199	-0.1398	0.1457
10%	-0.0086	0.0166	0.0874	0.0132	-0.0057	-0.0661	-0.4883	0.0498
Min	-0.0698	0.0048	-0.7282	-0.7446	-0.0675	-0.7550	-0.9505	0.0363

Notes:
The Spread is measured as:

Spread: $(P_{ADR,t} - P_{F,t+j})/P_{ADR,t}$

where P_{ADR} represents the price of the ADR (in USD) and P_F represents the price (in USD) of the underlying foreign share.

ADR Prop of Zero Return Days = Number of zero return days divided by total trading Days. Number of days that the daily stock price does not change relative to the previous days.

Table 3-A Overall Returns – Returns Distribution (K_O = 1.65)

Overall Profits calculated according to our two measures of principal invested.
Sample period: 2000-2011
Estimation period: 60 days

PANEL A: $K_c = 0$

Holding Period	90 days (Trades: 22,013)				120 days (Trades: 29,113)		30 days (Trades: 7,772)	
	Return				**Total Return**		**Total Return**	
	Local	**ADR**	**ROCE**	**RUCE**	**ROCE**	**RUCE**	**ROCE**	**RUCE**
Mean	0.0038	0.0313	0.0347	0.0665	0.0351	0.0661	0.0370	0.0695
St dev	0.05667	0.0967	0.0940	0.1742	0.0861	0.1918	0.12060	0.2406
Max	**1.33946**	**9.0000**	**9.025**	**18.0250**	**9.0250**	**18.0251**	**9.025**	**18.0250**
95%	0.08249	0.1297	0.1088	0.2217	0.1108	0.2204	0.1138	0.2187
90%	0.05386	0.0898	0.0782	0.1565	0.0792	0.1557	0.0806	0.1552
75%	0.02434	0.0493	0.0466	0.0915	0.0472	0.0908	0.0485	0.0925
Median	0.00204	0.0217	0.0250	0.0473	0.0253	0.0466	0.02598	0.0490
25%	-0.0179	0	0.0088	0.0139	0.0089	0.0136	0.0096	0.0158
10%	-0.0451	-0.0211	-0.0058	-0.0170	-0.0056	-0.0173	-0.0053	-0.0137
5%	-0.0698	-0.0427	-0.0164	-0.0420	-0.0164	-0.0429	-0.0156	-0.0369
Min	**-1.1006**	**-0.7576**	**-0.8665**	**-1.6240**	**-0.8665**	**-1.6240**	**-0.8665**	**-1.6240**

Table 3-B Overall Returns – Returns Distribution (k_O = 1.65)
Overall Profits calculated according to the ROCE measure.
Sample period: 2000-2011
Estimation period: 60 days

PANEL A: k_c = 0								
Holding Period	90 days (Trades: 22,013)				120 days (Trades: 29,113)		30 days (Trades: 7,772)	
	Return			**Duration**	**Total Return**	**Duration**	**Total Return**	**Duration**
	Domestic	**ADR**	**Total**					
Mean	**0.0038**	**0.0313**	**0.0351**	**5.45**	**0.0347**	**5.6596**	**0.0370**	**4.27**
St dev	0.05667	0.09671	0.08613	8.41	0.09401	9.26689	0.12060	4.64
Max	**1.33946**	**9.00001**	**9.025**	**89**	**9.025**	**119**	**9.025**	**29**
95%	0.08249	0.12975	0.11076	19	0.10878	20	0.1138	14
90%	0.05386	0.08981	0.07917	12	0.07820	13	0.0806	10
75%	0.02434	0.04927	0.04720	6	0.04660	6	0.0485	6
Median	**0.00204**	**0.02168**	**0.02529**	**3**	**0.02504**	**3**	**0.02598**	**3**
25%	-0.01787	0	0.00891	1	0.00883	1	0.0096	1
10%	-0.04505	-0.02107	-0.0056	1	-0.00583	1	-0.0053	1
5%	-0.06979	-0.04272	-0.01643	1	-0.01644	1	-0.0156	1
Min	**-1.10062**	**-0.75758**	**-0.86645**	**0**	**-0.86645**	**0**	**-0.8665**	**0**
PANEL B: k_c = 0.5								
	Trades:26,049				Trades: 34,231		Trades: 9,332	
Mean	**0.0031**	**0.0288**	**0.0319**	**4.13**	**0.03129**	**4.25**	**0.0327**	**3.38**
St dev	0.0510	0.1084	0.0998	6.71	0.09383	7.31	0.1119	3.99
Max	**1.3395**	**9.0000**	**9.0250**	**89**	**9.0250**	**119**	**9.0250**	**29**
95%	0.0708	0.1148	0.1005	14	0.0990	14	0.1018	12
90%	0.0474	0.0810	0.0726	8	0.0716	8	0.0735	7
75%	0.0215	0.0438	0.0427	4	0.0424	5	0.0435	4
Median	**0.0016**	**0.0191**	**0.0226**	**2**	**0.0224**	**2**	**0.0229**	**2**
25%	-0.0161	0.0000	0.0072	1	0.0070	1	0.0076	1
10%	-0.0405	-0.0187	-0.0073	1	-0.0076	1	-0.0074	1
5%	-0.0615	-0.0366	-0.0178	1	-0.0181	1	-0.0180	1
Min	**-1.5621**	**-0.7576**	**-0.8665**	**0**	**-0.8665**	**0**	**-0.8665**	**0**
PANEL C: k_c = 1								
	Trades:29,789				Trades: 39,185		Trades: 10,802	
Mean	**0.00255**	**0.02564**	**0.02818**	**3.27**	**0.02774**	**3.36**	**0.02950**	**2.77**
St dev	**0.04525**	**0.09957**	**0.09263**	**5.43**	**0.08721**	**5.93**	**0.10657**	**3.35**
Max	**1.14943**	**9.00001**	**9.02500**	**89**	**9.02500**	**119**	**9.02500**	**29**
95%	0.06251	0.10273	0.09224	11	0.09158	11	0.09460	8
90%	0.04242	0.07234	0.06611	6	0.06545	7	0.06765	6
75%	0.01959	0.03887	0.03876	3	0.03866	3	0.03963	3
Median	**0.00139**	**0.01611**	**0.01970**	**1**	**0.01964**	**1**	**0.02001**	**1**
25%	-0.01464	0.00000	0.00518	1	0.00503	1	0.00546	1
10%	-0.03706	-0.01698	-0.00929	1	-0.00965	1	-0.00910	1
5%	-0.05671	-0.03226	-0.01995	1	-0.02030	1	-0.01985	1
Min	**-0.83378**	**-0.75758**	**-0.86645**	**0**	**-0.86645**	**0**	**-0.86645**	**0**

Table 4 Overall Returns – Return Distribution (k_O = 2)
Overall Profits calculated according to our ROCE measure
Sample period: 2000-2011
Estimation period: 60 days

PANEL A: k_c = 0								
Holding Period	90 days (Trades: 15,585)				120 days (Trades: 20,682)		30 days (Trades: 5,391)	
	Return			**Duration**	**Total Return**	**Duration**	**Total Return**	**Duration**
	Domestic	**ADR**	**Total**					
Mean	**0.00415**	**0.03601**	**0.04016**	**5.91**	**0.03962**	**6.16**	**0.04245**	**4.43**
St dev	0.06119	0.11070	0.10023	9.25	0.10935	10.24	0.14226	4.86
Max	**1.33946**	**9.00001**	**9.02500**	**89**	**9.02500**	**119**	**9.02500**	**29**
95%	0.08882	0.14191	0.12372	21	0.12215	22	0.12388	15
90%	0.05672	0.10050	0.08899	13	0.08767	14	0.08992	11
75%	0.02574	0.05480	0.05269	6	0.05201	6	0.05392	6
Median	**0.00225**	**0.02472**	**0.02843**	**3**	**0.02806**	**3**	**0.02944**	**3**
25%	-0.01878	0.00082	0.01099	1	0.01077	1	0.01197	1
10%	-0.04831	-0.02124	-0.00479	1	-0.00500	1	-0.00427	1
5%	-0.07469	-0.04450	-0.01683	1	-0.01691	1	-0.01536	1
Min	**-1.10062**	**-0.52273**	**-0.38191**	**0**	**-0.38191**	**0**	**-0.38191**	**0**
PANEL B: k_c = 0.5								
	Trades: 18,194				Trades: 24,032		Tades: 6,416	
Mean	**0.003426**	**0.033795**	**0.0372**	**4.54**	**0.03634**	**4.67**	**0.0385**	**3.62**
St dev	**0.055596**	**0.126351**	**0.1175**	**7.52**	0.10995	8.21	0.1325	4.28
Max	**1.339457**	**9.000007**	**9.025**	**89**	**9.025**	**119**	**9.025**	**29**
95%	0.077954	0.129086	0.114617	15	0.1117	16	0.112565	13
90%	0.051146	0.089563	0.08245	10	0.0813	10	0.082931	8
75%	0.022784	0.049094	0.048051	5	0.0477	5	0.048911	4
Median	**0.001738**	**0.022381**	**0.025836**	**2**	**0.02545**	**2**	**0.02651**	**2**
25%	-0.01709	0	0.009255	1	0.0090	1	0.009733	1
10%	-0.04302	-0.0183	-0.00613	1	-0.0064	1	-0.00563	1
5%	-0.06658	-0.03771	-0.01728	1	-0.0175	1	-0.01672	1
Min	**-1.56215**	**-0.55556**	**-0.38191**	**0**	**-0.3819**	**0**	**-0.38191**	**0**
PANEL C: k_c = 1								
	Trades:20,550				Trades: 27,108		Trades: 10,802	
Mean	**0.00284**	**0.03083**	**0.0337**	**3.66**	**0.0330**	**3.78**	**0.0358**	**3.01**
St dev	**0.04897**	**0.11659**	**0.1093**	**6.18**	**0.1025**	**6.79**	**0.1269**	**3.68**
Max	**1.14943**	**9.00001**	**9.02500**	**89**	**9.0250**	**119**	**9.02500**	**29**
95%	0.06739	0.11744	0.10550	12	0.1045	13	0.10860	10
90%	0.04621	0.08246	0.07597	7	0.0752	7	0.07789	7
75%	0.02074	0.04439	0.04405	4	0.0437	4	0.04549	3
Median	**0.00149**	**0.01962**	**0.02315**	**2**	**0.0229**	**2**	**0.02401**	**1**
25%	-0.01567	0.00000	0.00740	1	0.0071	1	0.00799	1
10%	-0.03982	-0.01621	-0.00773	1	-0.0081	1	-0.00686	1
5%	-0.06123	-0.03259	-0.01930	1	-0.019	1	-0.01794	1
Min	**-0.82207**	**-0.45421**	**-0.38191**	**0**	**-0.3819**	**0**	**-0.86645**	**0**

Table 5 Overall Returns – Return Distribution (k_O = 2.33)
Overall Profits calculated according to the ROCE measure.
Sample period: 2000-2011
Estimation period: 60 days

PANEL A: k_c = 0								
Holding Period	90 days (Trades: 11,488)				120 days (Trades: 15,345)		30 days (Trades: 3,844)	
	Return			**Duration**	**Total Return**	**Duration**	**Total Return**	**Duration**
	Domestic	**ADR**	**Total**					
Mean	**0.00411**	**0.04139**	**0.04550**	**6.25**	**0.04495**	**6.55**	**0.04991**	**4.53**
St dev	**0.06489**	**0.15338**	**0.14502**	**9.92**	**0.15264**	**11.02**	**0.22734**	**4.98**
Max	**1.33946**	**9.81301**	**9.75792**	**89**	**9.75792**	**119**	**9.75792**	**29**
95%	0.09282	0.15584	0.13420	24	0.13244	25	0.13216	15
90%	0.06015	0.10742	0.09606	14	0.09511	14	0.09638	11
75%	0.02670	0.05897	0.05775	7	0.05701	7	0.05904	6
Median	**0.00238**	**0.02769**	**0.03176**	**3**	**0.03122**	**3**	**0.03327**	**3**
25%	-0.01977	0.00369	0.01303	1	0.01239	1	0.01446	1
10%	-0.05099	-0.02020	-0.00362	1	-0.00427	1	-0.00186	1
5%	-0.07890	-0.04610	-0.01651	1	-0.01697	1	-0.01421	1
Min	**-1.10062**	**-0.52273**	**-0.38191**	**0**	**-0.38191**	**0**	**-0.38191**	**0**
PANEL B: k_c = 0.5								
	Trades:11,682				Trades: 17,638		Trades: 4,559	
Mean	**0.00353**	**0.03827**	**0.04180**	**5.20**	**0.04149**	**5.06**	**0.04571**	**3.77**
St dev	**0.06044**	**0.20420**	**0.19915**	**8.38**	**0.14256**	**9.04**	**0.20261**	**4.49**
Max	**1.33946**	**10.37405**	**10.26436**	**89**	**9.02500**	**119**	**9.02500**	**29**
95%	0.08527	0.14808	0.12488	19	0.12494	18	0.12649	13
90%	0.05455	0.09767	0.08752	11	0.08942	11	0.09099	9
75%	0.02419	0.05206	0.04997	6	0.05261	5	0.05417	5
Median	**0.00211**	**0.02257**	**0.02690**	**3**	**0.02836**	**2**	**0.03041**	**2**
25%	-0.01866	0.00000	0.00922	1	0.01074	1	0.01230	1
10%	-0.04788	-0.02152	-0.00729	1	-0.00538	1	-0.00329	1
5%	-0.07532	-0.04496	-0.02000	1	-0.01735	1	-0.01509	1
Min	**-0.63167**	**-0.55556**	**-0.38191**	**0**	**-0.38191**	**0**	**-0.38191**	**0**
PANEL C: k_c = 1								
	Trades: 14,850				Trades: 19,722		Trades: 5,208	
Mean	**0.00269**	**0.03654**	**0.03923**	**4.02**	**0.03824**	**4.16**	**0.04307**	**3.21**
St dev	**0.05265**	**0.15251**	**0.14584**	**6.90**	**0.13384**	**7.60**	**0.19291**	**3.95**
Max	**1.14943**	**9.00001**	**9.02500**	**89**	**9.02500**	**119**	**9.02500**	**29**
95%	0.07315	0.13248	0.11975	14	0.11805	14	0.12361	11
90%	0.04889	0.09107	0.08489	8	0.08411	8	0.08694	7
75%	0.02146	0.04963	0.04909	4	0.04880	4	0.05090	4
Median	**0.00126**	**0.02284**	**0.02631**	**2**	**0.02606**	**2**	**0.02741**	**2**
25%	-0.01676	0.00161	0.00949	1	0.00904	1	0.01027	1
10%	-0.04275	-0.01536	-0.00643	1	-0.00700	1	-0.00464	1
5%	-0.06650	-0.03314	-0.01881	1	-0.01932	1	-0.01728	1
Min	**-0.82207**	**-0.45421**	**-0.38191**	**0**	**-0.38191**	**0**	**-0.38191**	**0**

Table 6 Overall Returns – Different Estimation Period
Overall Profits calculated according to ROCE and RUCE measure.
Sample period: 2000-2011
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

	Return				Duration
	Local	**ADR**	**ROCE**	**RUCE**	
PANEL A: Estimation Period: 30 days (Trades: 35,745)					
Mean	0.00364	0.03522	0.03886	0.0741	5.76
St dev	0.06009	0.13758	0.13031	0.2611	8.81
Median	0.00258	0.02364	0.02726	0.0512	3
PANEL B: Estimation Period: 60 days (Trades: 15,585)					
Mean	0.0042	0.0360	0.0402	0.0706	5.91
St dev	0.06119	0.11070	0.10023	0.2021	9.25
Median	0.00174	0.02238	0.02584	0.0534	2
PANEL C: Estimation Period: 90 days (Trades: 9,352)					
Mean	0.00335	0.03544	0.03879	0.0743	5.84
St dev	0.06052	0.08045	0.06262	0.1309	8.97
Median	0.00221	0.02553	0.02846	0.0538	3
PANEL D: Estimation Period: 120 days (Trades: 6,465)					
Mean	0.00296	0.03846	0.04143	0.0799	5.97
St dev	0.06177	0.09133	0.07381	0.1541	9.20
Median	0.00185	0.02703	0.02968	0.0556	3

Table 7-A. Overall Profits – Per Company
Overall Profits calculated according to our ROCE measure.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

	Total Trades	Returns			Duration		
		Mean	Stand deviation	Median	Mean	Stand deviation	Median
U:AMCRY	71	0.0129	0.0178	0.015	5.18	4.95	4
U:AMLTY	23	0.0485	0.0588	0.0333	5.91	6.83	4
U:AWC	116	0.0245	0.0358	0.0183	7.3	10.38	3
U:BMBLY	49	0.0294	0.0235	0.0296	6.22	6.17	4
U:CCLAY	187	0.0353	0.0318	0.0319	4.5	7.43	2
U:CMSQY	41	0.0811	0.0867	0.0639	10.29	11.47	7
U:CMXHY	45	0.0212	0.0196	0.0233	1.91	1.46	1
U:FSUMY	45	0.0091	0.0379	0.0113	3.27	2.66	3
U:GENE	55	0.2608	0.338	0.1612	8.73	14.07	4
U:JHX	149	0.0221	0.0471	0.0193	4.26	4.86	3
U:LVCLY	30	0.1241	0.0819	0.1384	5.67	4.72	5
U:LIHR	163	0.0251	0.0322	0.0224	3.88	3.77	3
U:LNCGY	28	0.0581	0.057	0.0653	3.14	2.40	2
U:MQBKY	65	0.0105	0.0947	0.0145	3.62	2.74	3
U:NABZY	71	0.0026	0.0378	0.01	3.1	3.13	2
U:NCMGY	183	0.04	0.0482	0.0347	4.9	6.63	3
U:NVGN	14	0.0785	0.1075	0.0411	24	23.13	15
U:PRAN	105	0.1197	0.0742	0.1185	5.3	6.25	4
U:SMS	44	0.014	0.0375	0.0065	2.48	1.81	2
U:SILXY	56	0.0711	0.0432	0.0713	6.04	6.22	4
U:SPHRY	72	0.0594	0.069	0.045	4.28	3.46	3
U:SSN	34	0.1347	0.1118	0.1059	5.0	6.41	3
U:TLSYY	73	0.0147	0.0218	0.017	3.75	3.49	3
U:WBK	220	0.0157	0.0282	0.0156	3.01	2.77	2
U:WFGPY	26	0.0772	0.0682	0.0593	8.42	12.45	5
U:CSUAY	7	0.0771	0.0234	0.0728	14	4.97	13
U:TLK	185	0.0364	0.0262	0.0315	4.57	4.21	3
U:PUTKY	30	0.0567	0.031	0.0549	4.03	3.07	3
U:HDB	76	0.0565	0.035	0.049	10.61	14.56	5
U:INFY	48	0.0538	0.0454	0.0466	14.54	15.37	10
U:PTI	40	0.0654	0.0565	0.0468	10.05	12.60	6
U:TCL	116	0.0613	0.0526	0.0514	5.78	6.95	4
U:WIT	48	0.0772	0.0469	0.0698	14.56	18.51	8
U:ATE	126	0.018	0.0346	0.0157	2.56	1.97	2
U:ACMUY	126	0.0459	0.0447	0.0435	9.12	10.78	6
U:ASGLY	169	0.0444	0.039	0.0369	3.99	5.72	3
U:AIFLY	50	0.1202	0.1346	0.0692	7.48	11.05	4
U:BRDCY	172	0.038	0.0496	0.0336	3.34	3.51	2
U:KBSTY	146	0.0638	0.082	0.0458	6.34	11.47	3

U:CAJ	151	0.0062	0.0254	0.0062	2.49	1.70	2
U:WACLY	191	0.0383	0.0314	0.0327	7.97	10.05	5
U:KYO	111	0.0133	0.0264	0.0065	2.41	1.84	2
U:DWAHY	138	0.0399	0.0374	0.0344	5.54	7.73	3
U:DNPLY	46	0.017	0.0205	0.0179	5.76	5.37	3
U:EJPRY	59	0.0167	0.0361	0.0206	7.56	9.39	4
U:ESALY	172	0.0364	0.0368	0.0314	3.04	3.34	2
U:FUJHY	197	0.0283	0.0324	0.0265	3.3	3.34	2
U:HACBY	282	0.0312	0.0318	0.0252	3.63	5.54	1
U:HIT	145	0.0108	0.0287	0.0117	2.39	1.70	2
U:HOCPY	78	0.0239	0.0369	0.018	2.97	3.22	2
U:MNBEY	179	0.0518	0.0877	0.0396	6.23	9.64	2
U:IIJI	130	0.0518	0.0593	0.0454	6.97	10.19	4
U:NISTY	68	0.0356	0.0397	0.0286	5.91	9.01	2
U:CJPRY	105	0.033	0.0222	0.0302	6.39	6.75	5
U:AONNY	191	0.0353	0.0376	0.0277	6.8	8.08	4
U:JUPIY	30	0.0307	0.0257	0.0233	2.53	2.66	1
U:KNBWY	54	0.0167	0.029	0.0153	10.17	10.16	8
U:KNM	131	0.0223	0.0386	0.0208	2.78	2.73	2
U:KUB	145	0.0267	0.0304	0.0247	3.19	3.93	2
U:PC	169	0.014	0.0305	0.014	2.46	2.03	1
U:TKOMY	95	0.0059	0.0333	0.0056	6.14	5.64	4
U:MFG	84	0.0156	0.0381	0.0118	2.31	1.53	2
U:MKTAY	199	0.0349	0.0427	0.0295	4.5	8.14	2
U:MARUY	98	0.0572	0.089	0.0331	7.81	11.58	4
U:NJ	141	0.0216	0.0259	0.0188	3.35	4.53	2
U:NMR	131	0.0117	0.0298	0.0048	3.2	4.00	2
U:NTDOY	157	0.0184	0.0349	0.0181	3.62	4.01	2
U:NSANY	192	0.0187	0.0313	0.0143	3.46	4.08	2
U:NPNYY	68	0.0311	0.0324	0.0252	5.56	8.66	3
U:OCPNY	135	0.0349	0.0499	0.0312	4.1	4.67	3
U:OMRNY	110	0.0391	0.0248	0.0401	6.4	6.10	4
U:IX	156	0.0184	0.0361	0.015	2.66	2.41	2
U:PMSEY	78	0.0395	0.0441	0.0319	16	17.93	11
U:TONPY	219	0.0392	0.0366	0.0313	7.75	11.90	3
U:TMICY	46	0.0108	0.0406	0.0207	3.09	2.14	3
U:FRCOY	39	0.0223	0.0219	0.0231	2.64	2.27	2
U:RICOY	190	0.0340	0.0590	0.0271	3.5211	5.71	2
U:ROHCY	30	0.0204	0.0171	0.0198	2.9	3.12	1
U:SKHSY	138	0.0282	0.0612	0.0169	8.75	14.42	3
U:SEKEY	119	0.027	0.0376	0.024	9.32	11.63	5
U:SGAMY	83	0.0298	0.0309	0.0299	12.02	14.14	7
U:SVNDY	36	0.0132	0.0215	0.0158	3.36	3.34	2
U:SNYFY	5	0.0168	0.0234	0.01	17.4	11.17	13
U:SHCAY	138	0.0978	0.7722	0.0209	5.29	4.94	4
U:SKLKY	63	0.0503	0.0615	0.0484	5.62	6.66	4
U:SSDOY	161	0.0316	0.0383	0.0263	10.261	12.10	6
U:SNE	122	0.0076	0.0308	0.0086	2.8	2.58	2
U:SMMLY	85	0.0524	0.075	0.0266	7.61	10.09	4
U:THKLY	141	0.0397	0.0653	0.0276	7.27	8.98	4

U:TOTDY	183	0.0362	0.0359	0.032	5.89	9.45	3
U:TRYIY	142	0.0345	0.0405	0.0266	4.83	9.41	1
U:DCM	129	0.0278	0.1475	0.0124	2.54	2.61	2
U:TKGSY	25	0.0383	0.0411	0.0321	5.68	5.59	4
U:MAURY	98	0.0524	0.0515	0.0463	7.06	10.76	4
U:SSUMY	97	0.0254	0.0367	0.022	6.48	6.85	5
U:FUAIY	77	0.0702	0.0974	0.0524	13.29	15.10	7
U:ALPMY	33	0.014	0.0178	0.0085	11.73	15.77	6
U:MSBHY	144	0.0224	0.0443	0.0229	4.02	4.37	3
U:OIIM	32	0.1618	0.2003	0.0901	13.19	16.70	7
U:HLPPY	104	0.0456	0.0511	0.0403	8.47	13.16	4
U:BKEAY	120	0.0571	0.0562	0.0409	17.44	19.95	11
U:BHKLY	107	0.0168	0.024	0.0181	8.35	10.97	4
U:DIPGY	62	0.1013	0.1388	0.0743	7.24	7.88	5
U:CPCAY	162	0.0373	0.0247	0.0328	8.19	10.63	4
U:CHEUY	213	0.0238	0.0245	0.022	3.96	5.00	2
U:CTPCY	106	0.0514	0.0796	0.0371	4.68	7.02	2
U:FPAFY	188	0.0672	0.0692	0.0441	4.65	5.93	3
U:GULRY	26	0.0208	0.0141	0.0233	3.85	6.50	2
U:HLDCY	176	0.0538	0.0663	0.0387	7.68	8.75	5
U:HOKCY	131	0.0505	0.0367	0.042	13.88	0.04	7
U:HGKGY	125	0.0533	0.0321	0.0522	14.1	17.69	7
U:HKXCY	51	0.0093	0.0203	0.0064	3.53	3.41	3
U:HNP	89	0.0186	0.0217	0.0153	3.45	3.00	2
U:HSNGY	118	0.0313	0.023	0.0299	7.32	9.59	4
U:JELCY	129	0.0399	0.027	0.0353	9.19	13.81	4
U:NDVLY	50	0.067	0.0915	0.0512	9.08	12.60	4
U:PNGAY	41	0.0717	0.0519	0.0632	4.02	4.38	3
U:CPKPY	56	0.1077	0.1382	0.0666	11.98	22.89	3
U:SUHJY	220	0.0309	0.0314	0.0256	4.99	7.07	3
U:SHI	192	0.03	0.032	0.026	5.13	6.89	3
U:SMI	87	0.0374	0.0519	0.0329	7.8	13.20	3
U:SWRAY	173	0.0263	0.0312	0.023	8.45	14.54	3
U:TCEHY	19	0.0158	0.023	0.0162	2	1.37	1
U:TTNDY	180	0.095	0.1031	0.0744	5.35	9.00	3
U:TSGTY	229	0.0507	0.0521	0.0402	6.87	9.13	4
U:TVBCY	285	0.0459	0.1	0.0276	6.95	10.34	3
U:CHU	163	0.0168	0.027	0.0128	3.27	3.14	2
U:WHLKY	31	0.0376	0.0243	0.0353	5.26	5.30	4
U:YZC	136	0.0213	0.0401	0.0141	2.93	2.86	2
U:YUEIY	30	0.0212	0.0283	0.0127	10	10.71	5
U:KEP	95	0.0307	0.0399	0.0256	5.22	8.37	3
U:WF	123	0.0286	0.0491	0.0309	3.26	3.26	2
U:PKX	161	0.0188	0.0301	0.0175	3.84	4.26	3
U:SHG	117	0.0269	0.0254	0.0246	4.09	4.31	3
U:SKM	71	0.0318	0.0444	0.0267	8.54	14.74	3
U:MLYBY	25	0.6096	0.4183	0.4879	9.44	18.61	3
U:PHI	127	0.0198	0.0235	0.019	4.13	4.17	3
U:AVIFY	177	0.1286	0.1485	0.1142	8.54	14.17	3
U:DBSDY	91	0.0239	0.0409	0.0164	8.77	12.35	4

U:WLMY	24	0.0446	0.0158	0.0391	3.46	2.89	3
U:NPTOY	104	0.0821	0.062	0.0627	9.71	11.88	5
U:UOVEY	45	0.0752	0.0866	0.0544	6.62	13.38	3
U:AUO	101	0.0192	0.0327	0.0166	4.66	5.51	3
U:SPIL	167	0.0469	0.0408	0.0414	5.53	7.20	4
U:TSM	67	0.0435	0.0372	0.0375	12.79	13.62	8
U:UMC	53	0.0614	0.0413	0.0526	13.92	17.73	6
ALL							
Mean	**107.1370**	**0.0461**	**0.0570**	**0.0372**	**6.4498**	**7.8033**	**3.7568**
Max	285.0	0.6096	0.7722	0.4879	24.0000	23.1300	15
90%	187.5	0.0779	0.0916	0.0636	11.8550	14.4800	7
75%	150.50	0.0531	0.0569	0.0419	8.3100	11.0300	4
Median	**105.5**	**0.0349**	**0.0377**	**0.0291**	**5.5500**	**6.7050**	**3**
25%	53.25	0.0212	0.0299	0.0182	3.5525	3.5750	2
10%	30.0	0.0140	0.0232	0.0128	2.8500	2.5950	2
Min	5.0	0.0026	0.0141	0.0048	1.9100	0.0400	1

Table 7-B. Overall Profits – Per Company Summary

Overall Profits calculated according to our two ROCE and RUCE measures.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

	Trading Days	Prop of Zero Ret Days (ADR)	Mean Trades per year per firm	Median Spread	Roll Local	Roll ADR	Median ROCE	Median RUCE	Median Duration
Mean	2236.24	0.1920	11.68	0.0095	0.0151	0.0186	0.0376	0.0701	3.76
St Dev	947.53	0.1427	4.98	0.0997	0.0214	0.0145	0.0449	0.0862	2.34
Max	**3131**	**0.50**	**42.06**	**0.26**	**0.24**	**0.11**	**0.4879**	**0.1516**	**15**
0.90	3130	0.4344	16.47	0.0218	0.0213	0.0337	0.0646	0.1241	7
0.75	3130	0.2975	14.43	0.0026	0.0153	0.0214	0.0419	0.0795	4
Median	2660	0.1457	11.59	0.0002	0.0112	0.0155	0.0291	0.0538	3
0.25	1255	0.0621	8.67	-0.0020	0.0078	0.0100	0.0182	0.0332	2
0.10	808	0.0498	5.77	-0.0057	0.0051	0.0072	0.0128	0.0225	2
Min	**302**	**0.0363**	**0.00**	**-0.0675**	**0.0008**	**0.0006**	**0.0048**	**0.0002**	**1**

Roll: Effective spread, calculated as in Roll (1984).

Table 8 Overall Returns – Subperiods
Overall Profits calculated according to our measures of principal invested.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$

PANEL A: $k_c = 0$					
	Return				**Duration**
	Local	**ADR**	**ROCE**	**RUCE**	
2000+					
Mean	0.0042	0.0360	0.0402	0.0762	5.91
St dev	0.06119	0.11070	0.10023	0.2021	9.25
Median	0.00174	0.02238	0.02584	.0534	2
July 2007+					
Mean	0.0042	0.0309	0.0351	0.0669	5.65
St dev	0.07058	0.08907	0.07446	0.1483	8.51
Median	0.001447	0.02003	0.023881	0.0434	3
July 2009+					
Mean	0.0017	0.0160	0.0177	0.0337	3.76
St dev	0.03955	0.03786	0.02578	0.0513	4.22
Median	0.001008	0.01565	0.01496	0.2774	2
PANEL B: $k_c = 0.5$					
2000+					
Mean	0.003426	0.033795	0.03722	0.0710	4.54
St dev	0.055596	0.126351	0.11750	0.2376	7.52
Median	0.00174	0.02238	0.02590	0.0482	2
July 2007+					
Mean	0.00297	0.02916	0.03213	0.0613	4.20
St dev	0.06236	0.08099	0.07059	0.1388	6.65
Median	0.00095	0.01817	0.02156	0.391	2
July 2009+					
Mean	0.002773	0.021261	0.02403	0.0453	4.00
St dev	0.04655	0.065786	0.05384	0.1108	6.38
Median	0.001678	0.015034	0.01815	0.0327	2

Table 9. Overall Profits – Per Year
Overall Profits calculated according to our ROCE measure.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

Year	Firms Traded	Total Trades	Return (ROCE)				Duration	
			Local	ADR	Total			
			Mean	Mean	Mean (st. dev.)	Median	Mean (st. dev.)	Median
2000	64	1802	0.0013	0.0452	0.0465 (0.0383)	0.0381	2.90 (4.72)	2
2001	71	902	0.0042	0.0719	0.0761 (0.3079)	0.0529	7.86 (11.91)	4
2002	77	566	0.0083	0.0682	0.0764 (0.1307)	0.0509	8.49 (11.61)	4
2003	79	828	0.0025	0.0426	0.0452 (0.0615)	0.0348	7.84 (12.33)	3
2004	88	777	0.0036	0.0361	0.0397 (0.0453)	0.0325	6.02 (8.24)	3
2005	100	1074	0.0035	0.0278	0.0313 (0.0482)	0.0244	5.96 (8.01)	4
2006	105	1199	0.0023	0.0264	0.0287 (0.0372)	0.0230	6.84 (10.50)	4
2007	119	1591	0.0069	0.0237	0.0306 (0.0509)	0.0244	6.05 (9.33)	3
2008	126	1936	0.0076	0.0347	0.0424 (0.0859)	0.0286	5.89 (8.94)	3
2009	143	1287	0.0025	0.0523	0.0547 (0.0979)	0.0342	6.09 (9.47)	3
2010	145	1853	0.0030	0.0268	0.0298 (0.0737)	0.0214	5.75 (8.60)	3
2011	142	1770	0.0045	0.0167	0.0213 (0.0567)	0.0176	5.48 (8.77)	3
ALL	1259	15,585	0.00415	0.0360	0.04016	0.02806	5.91	3

Table 10 Overall Returns – Per Country
Overall Profits calculated according to our ROCE and RUCE measures.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

Country	Total Trades	Return						Duration	
		Local	ADR	ROCE		RUCE			
		Mean	Mean	Mean	Median	Mean	Median	Mean	Med
Australia	1970	0.0034	0.0408	0.0442	0.0275	0.0850	0.0557	4.83	3
Indonesia	215	0.0133	0.0260	0.0392	0.0353	0.0652	0.0555	4.50	3
India	329	0.0234	0.0385	0.0619	0.0513	0.1004	0.0861	9.98	5
Japan	7665	0.0029	0.0296	0.0325	0.0250	0.0620	0.0466	5.28	3
HK/China	3835	0.0035	0.0410	0.0446	0.0325	0.0856	0.0620	7.11	3
Korea	567	0.0060	0.0202	0.0262	0.0240	0.0465	0.0417	4.59	3
Malaysia	25	0.0148	0.5947	0.6096	0.4879	1.2043	0.9694	9.44	3
Philippines	127	0.0083	0.0115	0.0198	0.0190	0.0313	0.0314	4.13	3
Singapore	177	0.0147	0.1139	0.1286	0.1142	0.2424	0.1841	8.54	3
Thailand	287	0.0079	0.0579	0.0658	0.0442	0.1238	0.0906	9.59	4
Taiwan	388	0.0054	0.0356	0.0411	0.0341	0.0767	0.0662	7.71	4
ALL	**15,585**	**0.0041**	**0.0360**	**0.0401**	**0.0280**	**0.0762**	**0.0584**	**5.91**	**3**

Table 11. Overall Profits – Per Liquidity (Volume) Bucket
Overall Profits calculated according to our ROCE measure.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

		Total Return (ROCE)			Duration		
Volume Basket	**Total Trades**	**Mean** (st. dev.)	**Median**	**IQ Range**	**Mean** (st. dev.)	**Median**	**IQ Range**
High	4223	0.0304 (0.0692)	0.0208	0.0431-0.0108	5.21 (8.30)	3	6-1
High-Medium	3561	0.0378 (0.01592)	0.0278	0.0492-0.0108	5.64 (8.31)	3	6-1
Medium-Low	3861	0.0443 (0.0832)	0.0303	0.0509-0.0123	5.81 (9.52)	3	6-1
Low	3917	0.0480 (0.0680)	0.0366	0.0631-0.0181	6.88 (10.40)	3	7-1
ALL	**15,562**	**0.0402**	**0.0284**	**0.0527-0.0110**	**5.91 (9.25)**	**3**	**6-1**

Notes:
The volume buckets are created by Mean volume quartiles. For example, the high volume bucket includes all companies in the top 25% percentile of the volume distribution; the high-medium volume bucket includes all companies in the second quartile; and so on.

Table 12. Overall Profits – Per Liquidity (Zero Return Days) Bucket
Overall Profits calculated according to our measures of principal invested.
Sample period: 2000-2011
Estimation period: 60 days
Holding period: 90 days
$k_O = 2$, : $k_c = 0$

		Total Return (ROCE)			Duration		
Liquidity Basket	**Total Trades**	**Mean** (st. dev.)	**Median**	**IQ Range**	**Mean** (st. dev.)	**Median**	**IQ Range**
High	4121	0.0239 (0.0450)	0.0191	0.0384-0.0035	4.44 (6.79)	3	5-1
High-Medium	3000	0.0306 (0.0508)	0.0253	0.0455-0.0077	5.28 (7.95)	3	6-1
Medium-Low	4732	0.0463 (0.1426)	0.0344	0.0584-0.0157	6.98 (10.58)	3	7-1
Low	3709	0.0573 (0.1051)	0.0366	0.0657-0.0180	6.57 (10.25)	3	7-1
ALL	**15,562**	**0.0402**	**0.0284**	**0.0527-0.0110**	**5.91 (9.25)**	**3**	**6-1**

Notes:
The liquidity buckets are created by proportion of zero return days quartiles. That is, the high liquidity bucket includes all companies in the top 25% percentile of the volume distribution –i.e., companies with a proportion lower than 6.21% of zero return days-; the high-medium liquidity bucket includes all companies in the second quartile –i.e., companies with a proportion between 6.21% and 14.57% of zero return days-; the medium-low liquidity bucket includes all companies in the third quartile –i.e., companies with a proportion between 14.57% and 29.75% of zero return days-; and the medium-low liquidity bucket includes all companies in the third quartile –i.e., companies with a proportion higher than 29.75% of zero return days.

Table 13. Determinants of Profits – Robust Regression

We report a quantile (q=50%) regression of three different measures of profit per firm (ROCE measure, with a holding period of 90 days, estimation period 60 days, $k_O = 2, : k_c = 0$) against liquidity indicators and some control variables. Sample period: 2000-2011

	Average	Median	Median/Volatility
Intercept	0.0024 (0.0105)	0.0088 (0.0097)	0.0064 (0.0097)
Mkcap	-0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001
Short Ratio (SR)	0.0003 (0.0006)	0.0005 (0.0007)	0.0005 (0.0007)
Propzeret	0.0739* (0.0158)	0.0434* (0.0146)	0.0454* (0.015)
Trades per year	-0.0006 (0.0005)	-0.0007 (0.0004)	-0.0006 (0.0004)
Roll Domestic (Rolld)	1.6211* (0.4063)	1.4165* (0.363)	1.4258* (0.4361)
Roll US (Rollf)	0.5262* (0.1771)	0.3296* (0.1465)	0.3252* (0.1522)

Notes:
Mkcap: Market Capitalization in USD millions.
Propzeret: Proportion of zero return days quartiles.
Roll Domestic/US: Transaction costs estimated by Roll's (1984) measure in the domestic and U.S. market.
*: Significant at the 5% level.

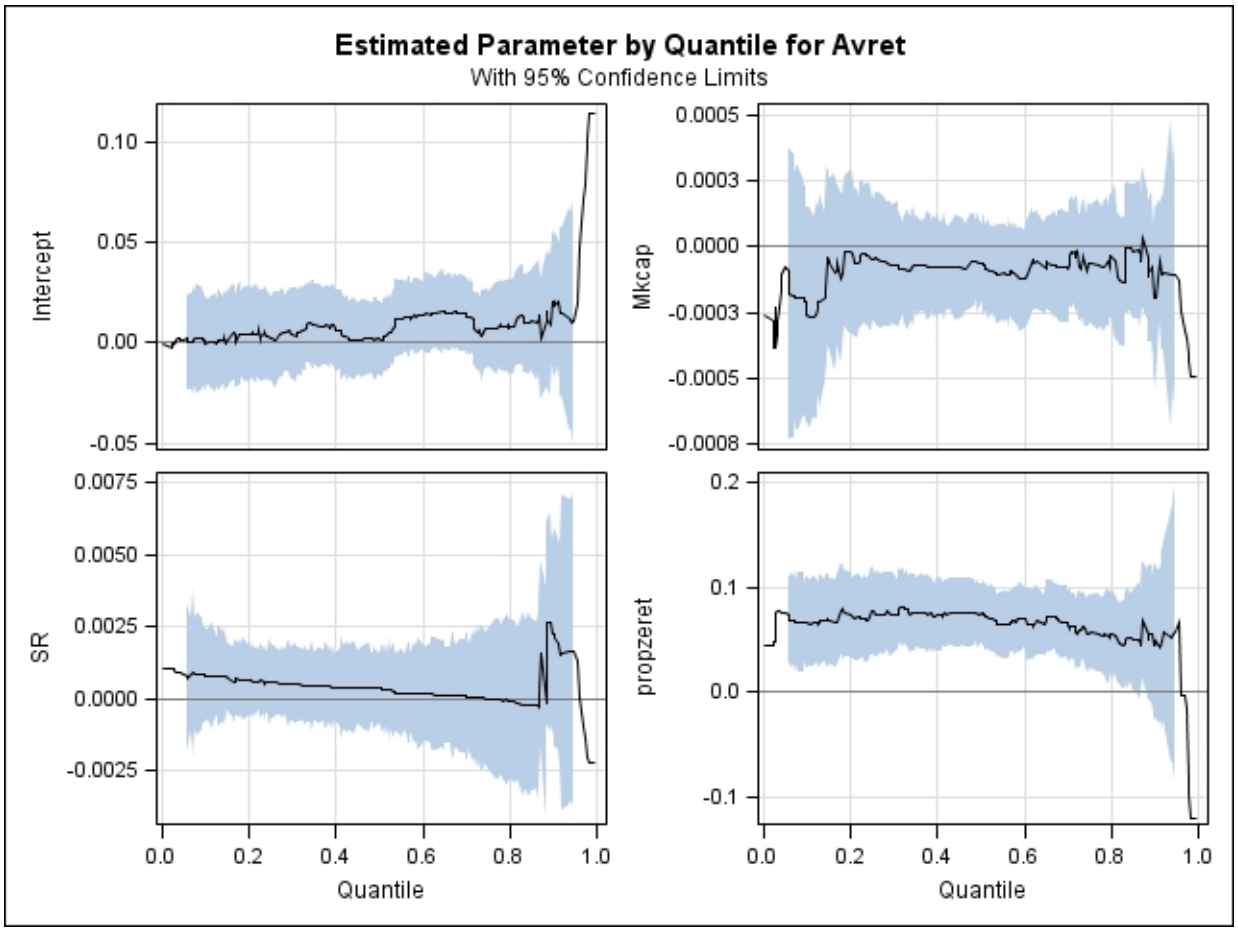
Table 14. Determinants of Duration – Robust Regression

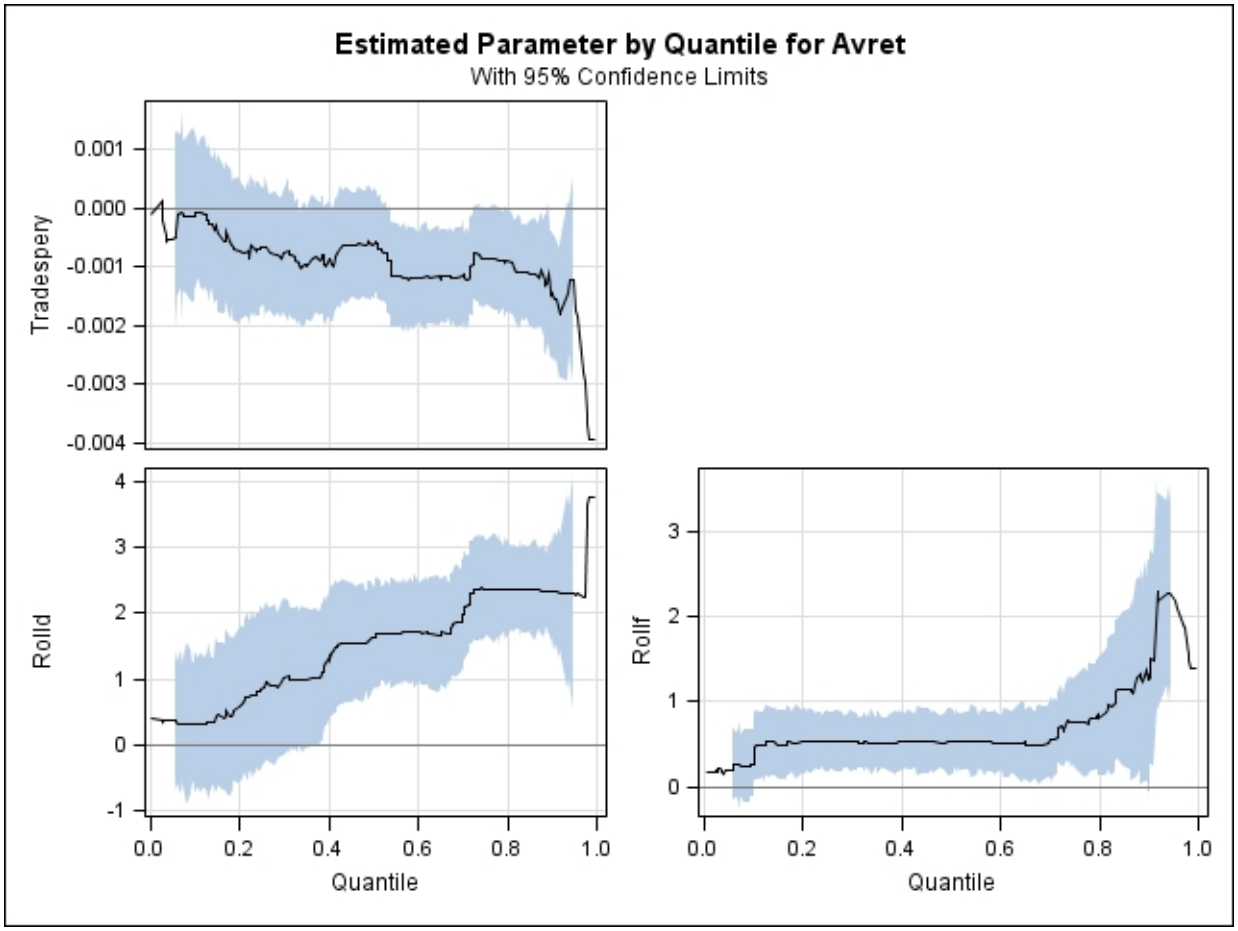
We report a quantile (q=50%) regression of three different measures of duration against liquidity indicators and some control variables. Sample period: 2000-2011

	Average	Median	Average/Volatility
Intercept	6.1736* (1.9103)	3.7458* (0.7717)	5.6421* (1.7759)
Mkcap	-0.0098 (0.0130)	-0.0136 (0.0082)	-0.0116 (0.0143)
Short Ratio (SR)	0.0111 (0.1134)	0.0130 (0.0625)	0.0059 (0.1375)
Propzeret	6.4503* (2.2637)	2.1826* (1.0531)	6.5274* (2.2764)
Trades per year	-0.1754 (0.1022)	-0.0624 (0.0474)	-0.1472 (0.1040)
Roll Domestic (Rolld)	4.6700 (13.7108)	-5.4165 (8.0513)	6.0205 (15.2317)
Roll US (Rollf)	7.9654 (24.3867)	2.9586 (9.4226)	13.0916 (20.9462)

Notes:
Mkcap: Market Capitalization in USD millions.
Propzeret: Proportion of zero return days quartiles.
Roll Domestic/US: Transaction costs estimated by Roll's (1984) measure in the domestic and U.S. market.
*: Significant at the 5% level.

Figure 1
Estimated Parameter by Quantile for Average Profits (Avret)




Estimated Parameter by Quantile for Avret
With 95% Confidence Limits
Tradespery
0.001
0.000
-0.001
-0.002
-0.003
-0.004
RollId
4
3
2
1
0
-1
0.0
0.2
0.4
0.6
0.8
1.0
Quantile
RollF
3
2
1
0
0.0
0.2
0.4
0.6
0.8
1.0
Quantile