

Do ADRs violate the Law of One Price? Deviations from Price Parity in the
Absence of Fundamental Risk

By
Alex Bryan

Abstract

The Law of One Price states that identical goods should carry identical prices. Through this research, I built upon previous studies to assess the validity of the Law of One Price as applied to emerging market American Depository Receipts (ADRs). I found that price parity was enforced for most ADRs most of the time; however, there were many ADRs that deviated from parity significantly for extended periods of time. In order to further investigate these deviations from price parity, I separated my analysis into three components. I first conducted a regression analysis in order to isolate the variables driving deviations from price parity and to uncover their relationships with those price deviations. The results of this analysis reveal the importance of corrective arbitrage in enforcing price parity. In support of previous research, the results of this regression analysis indicate that both U.S. and home market sentiment have a significant impact on the relative prices of the ADRs and their underlying shares. Secondly, controlling for the variables included in my regression analysis, I investigated whether deviations from price parity arise in relation to annual corporate earnings announcements, and found that they do not create significant price divergence. Finally, I analyzed whether deviations from price parity create profitable arbitrage opportunities that investors could capture with a simple arbitrage strategy. The results of this portion of my analysis indicate that investors can profit from large price deviations, because price parity is almost always restored in the long-term. Interestingly, I found that price convergence occurs more quickly and yields larger arbitrage profits when the home market shares are overvalued relative to their ADR counterparts than when the opposite is true. As far as I am aware, this is a novel finding with significant implications.

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Introduction

Can two assets representing the same cash flows and underlying company have different prices? In the absence of fundamental risk, traditional economic theory would indicate that these assets should carry identical prices in an efficient market. This idea is at the core of most financial economics, and is articulated as the Law of One Price. The Law of One Price states that two identical commodities should be priced at parity, because they are perfect substitutes (Lamont 1). Accordingly, buyers and sellers should converge on a single market clearing price for that particular commodity. However, there are several well documented cases in which the Law of One Price does not hold in actual financial markets. In particular, deviations from price parity are often observed between cross-listed stocks, including ADRs, and between the stocks of dual-listed companies.

A dual-listed company is an arrangement similar to a merger, in which two companies agree to share their cash flows between their shareholders, and combine operation activities. Unlike a traditional merger, each company retains its separate identity and stock listing. One company's stock is not convertible into the other's. Because these two stocks represent the same cash flow, there is no difference in fundamental risk between the two stocks. According to the Law of One Price these two stocks should trade at parity, when adjusted for the dividend ratio set between the two companies. Yet, several researchers (Froot 1998, Jong 2005) have discovered that these securities often substantially diverge from parity for extended periods of time. However, when the dual-listed companies announce unification, their stock prices rapidly converge. This pattern represents an interesting phenomenon; although two equities may represent the same stream of cash flows, investors are not necessarily willing to correct relative

mispricings until they can directly convert one security into the other, thereby fully arbitraging away the mispricing. Foreign ownership restrictions, such as the division of A shares and B shares in the Chinese market, also result in a similar violation of the Law of One Price.

In the period from 1993 to 2000, A shares in the Chinese market traded at a 420% premium to their B share counterparts, despite representing identical cash flows and voting rights (Mei 1). This price discrepancy could not be arbitraged away due to legal restrictions. But why did this discrepancy appear in the first place? If the two stocks represent the same fundamental value, there must be a separate component entering into the pricing equation; although the stocks yield the same claim on the underlying company, the stocks may actually represent different fundamental value because of the characteristics of the markets in which they trade. In a study published in 2004 entitled, “Speculative Trading and Stock Prices: An Analysis of Chinese A-B Share Premia,” the authors analyzed the role of liquidity in explaining the A share premium, and found that with a 500% annual turnover rate, the A share market was much more liquid and speculative than the B share market (Mei 1). They attributed a portion of the premium to value of the speculative put option embedded in the A shares. The authors contend that the speculative nature of the A share market is driven by the dominance of individual investors in that market, who were responsible for five times the trading volume of institutional investors in 1999 (Mei 12). Furthermore, the greater liquidity of the A share market increases the value of the shares trading in that market, and accounts for 25% of the premium (Mei 18). Consequently, a portion of the premium is justified by real differences between the two stocks. Similar to the price convergence of the stocks of

dual-listed companies in the wake of a merger announcement, the A share premium was substantially reduced following a regulatory shift, allowing domestic investors to hold B shares (Mei 26).

Similar to these observed mispricings between the stocks of dual-listed companies and A and B shares in China, American Depository Receipts (ADRs) represent a natural experiment to study the Law of One Price. I have chosen to focus my research on ADRs because like other dual-listed securities, they carry the same fundamental risk. However, ADRs provide a larger sample size, thereby allowing for greater flexibility to study a wider range of questions. Through this research, I will analyze the performance of emerging market ADRs relative to their underlying home market shares in order to test the Law of One Price. In addition to testing their long term performance, I will also examine the responsiveness of ADRs relative to their underlying shares during earnings announcement periods.

ADRs are stocks denominated in U.S. Dollars, representing a set ratio of underlying shares trading in the home market. Therefore, the ADR represents the same claim on the underlying company as the shares trading in the home market, adjusted for the depository ratio. A depository institution, such as the Bank of New York, will hold the underlying shares and issue the depository receipts. The depository institution facilitates convertibility of the depository receipts into the underlying shares (Gagnon 2). However, investors incur significant transaction costs when converting their depository receipts, and may be prevented from doing so by foreign ownership restrictions, particularly prevalent in emerging markets (Gagnon 6). In this regard ADRs differ from either dual-listed companies or Chinese A and B shares. Both dual-listed companies and

Chinese foreign and domestic shares are not convertible, making it difficult to effectively arbitrage away potential mispricings between the two asset classes. Despite the transactions cost associated with converting depository receipts, they should trade closer to parity than either of the other two examples of dual listed securities. For instance, most ADRs trade between 20 to 85 basis points from parity, which is within the bounds of transaction costs (Gagnon 1). However, larger deviations from parity are observed in emerging markets, where legal restrictions, greater asymmetry of information and transaction costs hinder corrective arbitrage (Gagnon 10, 16).

Because ADRs and their underlying shares represent the same fundamental value and carry the same fundamental risk, arbitrageurs should be able to exploit potential mispricings in order to return the prices to parity. The less costly it is to conduct this arbitrage, the more quickly prices will converge (Gagnon 22-23). In reality, there may be substantial risks involved in engaging in arbitrage, and barriers to trade arising from market segmentation particularly prevalent in emerging markets. For instance, similar to China's A share market, the ADR market is dominated by individual investors, and is therefore more susceptible to speculative behavior (Suh 13). Consequently, even when ADRs and their underlying shares are not trading at parity, arbitrageurs may be unwilling to correct the mispricing as noise traders may push the prices further away from parity. Additionally, arbitrageurs are constrained by restrictions on short sales, capital repatriation, foreign ownership, and foreign exchange controls (Gagnon 10-14). However, arbitrage may not occur simply because of time differences between the two markets that prevent investors from correcting short term deviations from parity (Gagnon 10). Similarly, information about the fundamental value of the firm may flow from the

home market to the U.S., leaving a time lag during which the U.S. market may not necessarily reflect all available information (Gagnon 12, Podpiera 3). These barriers to trade have the potential to make arbitrage ineffective, and highly risky.

Although ADRs represent the same claim on their underlying companies as their corresponding home shares, there may be real differences in the fundamental value of the shares, due to market fragmentation. For instance, if the interest rate in the home market is higher than in the U.S., ADRs should trade at a premium to their home market counterparts, because investors require a greater discount rate from the home market shares in order to offer returns competitive with the prevailing interest rates in that country. Interest rate fluctuations in either market may prevent price convergence, and thus, introduce an additional risk to arbitrageurs seeking to exploit deviations from parity (Grossmann 5). Additionally, ADRs may not trade at parity due to differences in liquidity with the home market shares. All else equal, investors are willing to pay a premium for greater liquidity (Miller 113-115). Thus, when liquidity is constrained in the home market, particularly by foreign ownership restrictions characteristic of many emerging markets, ADRs should trade at a premium to the home market shares.

I have specifically chosen to study emerging market ADRs because emerging markets are not fully integrated into the global economy; consequently, the barriers to trade interfering with price convergence are likely to be the greatest in these markets. The majority of research conducted in this field has focused on developed markets, and has found that deviations from parity are often small in magnitude and short in duration. In a study examining Canadian stocks cross-listed in the U.S., the authors discovered that most price deviations were corrected within the same trading day, and often in less than

15 minutes¹ (Mehrotra 213). This rapid price convergence is likely observed because low capital barriers between these two developed markets enable arbitrage to effectively correct potential mispricings. In contrast, emerging markets are segmented from global capital markets by lower liquidity, less investor recognition, greater asymmetric information resulting from less stringent disclosure requirements (Miller 118). These market frictions are likely to create deviations from price parity. As a result, arbitrage strategies modeled on these mispricings yield higher excess returns in emerging markets (Miller 116).

In order to provide an appropriate context for my research, it is helpful to refer to the rich literature on this topic. I will then describe how my research differs from previous studies, and offer an overview of my methodology.

Literature Review

One of the most extensive studies conducted analyzing the limits of arbitrage and the potential for price divergence across securities with the same fundamental risk does not cover cross-listed stocks, such as ADRs, but rather, dual-listed companies. In 2005, a study was published examining the relative stock performances of 12 dual listed companies from 1980 until 2002 or otherwise from their inception until share unification (Jong 9). The authors discovered deviations from parity for each pair of dual-listed companies, averaging from 4% to 8% over their sample period (Jong 4). They found that these deviations from parity could be largely attributed to the correlation of each twin stock with its respective domestic market (Jong 12). According to their research, the influence of market indexing is the most plausible explanation for this phenomenon (Jong 13). For instance, when Standard & Poor eliminated non-U.S. companies from the S&P

¹ The Canadian stocks in this study were not listed as ADRs.

500, the share prices of Royal Dutch and Unilever NV fell relative to their British counterparts, although both pairs of companies represented the same stream of cash flows (Jong 13).

In order to investigate whether these mispricings offer profitable arbitrage opportunities, the authors examined eight arbitrage strategies, applying simple buy and sell thresholds, and set time horizons. These conditions were varied slightly across the eight strategies to test their robustness (Jong 15). If the sell threshold was not crossed by the end of the set time horizon, the position would be closed out (Jong 15). Additionally, the researchers applied initial margin restrictions of 50%, commission fee of 25 basis points, and bid-ask spread of 40 basis points, in order to more realistically model the actual returns of these arbitrage strategies (Jong 15, 17). Although five of the eight strategies analyzed yielded significant excess returns, ranging from 4.1% to 9.8%, those with the shortest time horizons produced the least impressive returns (Jong 18, 19). More than half of the arbitrage positions mandated by those strategies with a maximum time horizon of one month yielded negative returns. Additionally, transaction costs had a greater influence on these returns, as investors engaged in more frequent trading (Jong 18). Arbitrage strategies employing longer time horizons tended to yield higher average returns, and expose investors to smaller transaction costs (Jong 18). Despite the apparent profitability of these strategies, price convergence may not occur for extended periods of time, during which time the two stocks may deviate further from parity (Jong 20). In this regard, arbitrage in dual-list companies is more risky than other forms of arbitrage, because as long as it is impossible to convert one company's stock directly into the other's, mispricings may persist (Jong 22).

Although arbitrage in dual-listed companies exposes investors to minimal fundamental and systematic risk, it does present a substantial degree of idiosyncratic risk (Jong 22). For instance, the average idiosyncratic risk of the arbitrage strategies was roughly 50% greater than the corresponding idiosyncratic risk of the S&P 500 (Jong 21). Arbitrageurs tend to concentrate their holdings in a few positions, and lack full diversification. Consequently, idiosyncratic risk affects their investment decisions more directly than would be traditionally expected, and may impair their willingness to execute corrective arbitrage. An additional possible explanation for the prolonged deviations from parity is that there is relatively little money devoted to arbitrage to correct these mispricings, due to the constraints on the specialists best suited to enter these positions (Jong 22). The authors conclude that there are sufficient inefficiencies in international capital markets to frustrate arbitrage in assets with the fundamental risk (Jong 30).

ADRs may deviate from parity for many of the same reasons described for dual-listed companies, as found by Louis Gagnon and G. Andrew Karolyi (2004) in what is one of the most comprehensive studies on cross-listed stocks. They studied 581 pairs of cross-listed stocks, most of which were ADRs, from 39 countries between 1993 and 2002 (Gagnon 1). Of the 39 countries, 19 were classified as emerging markets (Gagnon 15). While most stocks traded close to parity, some deviated substantially (Gagnon 1). Similar to the findings for dual-listed companies, they found that returns on cross-listed stocks are more highly correlated with the markets in which they list than their corresponding home market. They argue that these strong correlations are created by institutional and informational barriers to arbitrage (Gagnon 1). The most common barriers to arbitrage are foreign ownership restrictions. When these limits are reached,

ADRs might trade at a premium to the corresponding home market shares (Gagnon 7). The authors further divide potential barriers to arbitrage into three categories: market-based, information-based, and trading-based. Market-based barriers include investment restrictions on both foreigners and domestic residents, transaction costs, time differences, accounting and legal standards (Gagnon 10). Information-based barriers include noise trading, asymmetric information, and covariance with the local market, which exhibits an inverse relationship with firm specific risk (Gagnon 12, 13). Trading-based barriers include illiquidity, and geographic trading preferences (Gagnon 13). The authors contend that these barriers have the potential to interfere with corrective arbitrage.

In order to test their hypothesis that arbitrage enforces price parity between cross-listed stocks and their home market counterparts, the authors regressed the return differentials between the cross-listed and home market shares on the market index returns of both the U.S. and domestic markets, in addition to the log currency changes of the two markets (Gagnon 7). Asynchronous trading can cause artificial mean-reversion effects that might alter the results of such a regression. The reason for this is that trading based on company specific news is likely to occur during local trading hours with a lagged effect on the cross-listed shares (Gagnon 11). In order to correct for this problem, the authors included a one-day lagged price differential variable (Gagnon 7).

The results of their regressions indicate that the return differentials tend to be the greatest among stocks domiciled in emerging markets, and that these differentials tend to persist across the sample period (Gagnon 15, 16). The average price differential was only 7 basis points; however, there were several large outliers (Gagnon 15). On average, the U.S. market accounts for 30% of the aggregate trading volume in cross-listed securities,

indicating that it is a less liquid market for many of these securities (Gagnon 16). With respect to the independent variables, they found an inverse relationship between the return differentials and net home market exposure, indicating that as the value of the home market rises, the return differential declines. In contrast, they found an insignificant relationship between exposure to the U.S. market and the size of the return differentials. Similarly, the exchange rate variable was insignificant, suggesting that the deviations from parity are independent of exchange rate risks. Furthermore, the mean-reversion coefficient was significant, while the lead and lagged coefficients were not; indicating the dominance of contemporaneous effects (Gagnon 18). The significance of the mean-reversion in these regressions suggests that most price discrepancies are reversed within one trading day. These price discrepancies are corrected more quickly when the home market is developed, accounting standards and investor protections are stronger, transaction costs are smaller, and short sale restrictions are absent (Gagnon 22, 25).

In order to discover the sources of arbitrage risk, the authors conduct additional regression analysis to test the effects of their proposed barriers to trade. They incorporate measures of financial development, legal and accounting standards, and investor protections. Additionally, they include four measures of market barriers to arbitrage, time zone differences, short sales restrictions, capital controls, and transaction costs; three measures of information-based barriers: synchronicity, inside and institutional ownership; and four measures of trading-based barriers: home illiquidity, U.S. illiquidity, stock market capitalization, and location of trading (Gagnon 20, 21). The results of their analysis indicate that the return differentials are inversely related to financial

development, extent of investor protection in the domestic market, and positively associated with short sale restrictions. Additionally, there is a positive relationship between discrepancies with price parity and, market time differences, restrictions on capital controls, transaction costs, and illiquidity in both the U.S. and home markets (Gagnon 22). Also in accordance with expectations, there is an observed inverse relationship between the price differentials and firm size, an additional measure of liquidity. With respect to U.S. trading volume, the authors observe an inverse relationship with synchronicity, domestic country wealth, investor protections, time differences, and firm size. Furthermore, they found a positive relationship between short sales restrictions in the home market and U.S. share of trading volume (Gagnon 23).

The authors conducted an additional analysis of the excess co-movements of the return differentials with both the home and U.S. markets in order to better understand their sources. Surprisingly, they found that the quality of home market legal standards do not significantly alter the positive covariance between the return differentials and the U.S. market. Additionally, their asymmetric information variables do not appear to influence this relationship (Gagnon 26). In accordance with expectations, higher transaction costs in the home market tend to increase the excess covariance of the return differentials with the U.S. market. Similarly, there appears to be a positive relationship between the volume of trading in the U.S., and covariance with the U.S. market, indicative of the influence of the trading venue on stock returns (Gagnon 26). Contrary to expectations, they found a positive relationship between firm size and exposure to U.S. market risk, arguing that the tendency of these firms to trade primarily in the home market hinders arbitrage activity. With respect to the home market, the authors discovered an inverse

relationship between synchronicity and the co-movements of the return differentials with the home market (Gagnon 27). Additionally, the excess co-movements with the home market decreased with increased market development and better accounting standards. Similar to the results for the U.S. market, the authors discovered a direct relationship between the primary location of trading and co-movement with the local market (Gagnon 27). They also studied liquidity effects, and found a direct relationship between excess co-movement with the home market and its liquidity, and an inverse relationship with U.S. liquidity (Gagnon 27).

The authors conclude that most deviations from parity are small, and tend to be corrected quickly. Their principle discovery extends the findings for dual-listed companies to a much broader scope of cross-listed stocks that deviations from parity are correlated with the primary market of trading (Gagnon 29, 30). They do, however, concede that their sample was unbalanced, due to the addition of many of their cross-listings toward the end of the sample period, and that a static analysis may hide other deviations from parity (Gagnon 30).

Darius Miller adopted a more dynamic focus, studying the performance of a firm's stock during the time period surrounding the announcement and introduction of a depository receipt program. Specifically, he studied the impact of cross-listing on firm value, and the effect of liquidity and shareholder recognition on firm value (Miller 104). Miller hypothesized that dual-listing enables firms to bypass market segmentation, thereby lowering their cost of capital and increasing firm value (Miller 104). However, there are several cross-listing options available, all of which require the firm to make a trade-off between greater liquidity and higher disclosure costs. The least expensive

method to cross-list in the U.S. is to launch a Level I depository receipt program. Level I depository receipts are traded in the over-the-counter market, which provide the least liquidity of any of the listing options; however, disclosure requirements for such securities are minimal, as they do not need to adopt GAAP or full SEC requirements (Miller 106). In contrast, Level II depository receipts may trade on the AMEX, NASDAQ, or NYSE. These stocks must meet full GAAP and SEC requirements in addition to the listing requirements on the exchange they are traded. This arrangement allows for superior liquidity, but at greater cost (Miller 106). A Level III listing is similar to the Level II listing; however, it also allows a company to issue new equity in a public offering, although this is the most costly listing option (Miller 108). Alternatively, a firm may opt for a cheaper option, offered by Rule 144A. Rule 144A depository receipts are initially sold in private placement and trade on PORTAL. However, this market is highly illiquid (Miller 108).

In order to test his hypothesis that illiquidity and investor recognition segment capital markets, Miller analyzed the relative performance of each depository receipt class (Miller 114). He found that firms that dual list on the NASDAQ or NYSE, (Level II and Level III depository receipts) where liquidity and investor recognition are the greatest, yield the largest excess returns during the announcement period. In contrast, those stocks that list on PORTAL, (Rule 144A depository receipts) where liquidity and investor recognition are the lowest, yield negative abnormal returns (Miller 115). Level I depository receipts, or those trading in the over-the-counter market, yield higher excess returns than those trading on PORTAL, however, offer smaller excess returns than those trading on the major exchanges. Therefore, as liquidity and investor recognition increase,

so do the share prices of the companies that cross-list in those markets (Miller 115). Miller interprets these results as support for the market segmentation hypothesis, and argues that depository receipts serve to integrate otherwise segmented markets (Miller 115).

Because the degree of market segmentation potentially has important implications for value added by cross-listing, Miller assigned each firm a developed, free emerging, or restricted emerging market classification based on where it was domiciled (Miller 116). This classification scheme captures both direct and indirect barriers to trade. Conducting a similar regression analysis to those previously performed, Miller found that firms located in emerging markets with few legal barriers exhibited higher excess returns upon the announcement of cross-listing than their counterparts domiciled in developed markets. He subsequently hypothesized that firms domiciled in restricted emerging markets should yield even greater excess returns upon their announcement of cross-listing. Yet, the results indicate that the excess returns for these firms were no higher than their counterparts in developed markets (Miller 116). Miller attributes this finding to the prevalence of 144a depository receipts from these markets, which tend to benefit less from the dual-listing, as they do not gain as much liquidity as the Level II and Level III listings. Additionally, firms from these markets appear to offer higher excess returns than either developed or free emerging markets in the period leading up to the announcement, indicative of insider trading or imprecise announcement dates (Miller 116-117). Finally, Miller conducted a multivariate regression analysis to separate the influences of direct and indirect barriers to trade. The results indicate that indirect barriers exert greater influence on emerging than developed markets (Miller 118). More

generally, he concludes that indirect barriers are the most important creating market segmentation, although concedes that the proxies for direct barriers might be incorrectly specified (Miller 120).

In order to better understand the degree of market segmentation in international capital markets, and the strength of informational flows between them, Podpiera investigated dual-listed stocks from three emerging markets in central Europe (Poland, Czech Republic, and Hungary) that launched Global depository receipt listings in London from 1994 to 2000 (Podpiera 1, 5). He hypothesized that information flows could work in both directions: from the local market to the foreign market because the local market has better firm-specific information, and from the larger foreign market because it may react more quickly to developments in global capital markets, and create a spillover effect into the local markets (Podpiera 14). The author discovered that in over half the securities studied, information moved in both directions, from the local market to the London market and vice versa, although in most cases the London market appears to exert a slightly stronger influence on the listing in the local market (Podpiera 19). He also found a significant lagged effect in both directions, implying that these markets are not fully integrated (Podpiera 20). Furthermore, according to this study, deviations from parity are corrected in both the home and London markets by changes in price of similar scale in each market (Podpiera 20). Thus, as the local market acts to correct this mispricing, the mispricing creates a strong influence on the local return variance (Podpiera 31).

Grossmann and his colleagues attempt to explain these mispricings with a different focus than most previous researchers. Rather than exclusively investigating the

effects of arbitrage costs on ADR mispricing, they also analyzed the impact of consumer and market sentiment on deviations from parity (Grossmann 2). The authors hypothesized that both the holding costs and transaction costs influence the ease of arbitrage, and consequently, deviations from price parity. Among the holding costs considered, the authors focused on dividend yield and market interest rates (Grossmann 3). Higher interest rates increase the opportunity costs of arbitrage. Therefore, higher interest rates should be associated with larger mispricings. Conversely, larger dividend yields decrease the opportunity cost of arbitrage, thus moving the dual listings closer to parity (Grossmann 7). The authors additionally hypothesized that consumer and investor sentiment could help explain the deviation of ADR prices from their underlying shares (Grossmann 4). In order to test their hypothesis they studied 76 ADRs from 10 developed markets between 1996 and 2003. As proxies for U.S. and foreign market sentiment, they employed each market's respective index. In order to measure consumer sentiment, they employed a series of standardized consumer sentiment surveys providing uniform measurement across all markets (Grossmann 12). With these proxies, they modeled the return differentials as a function of transaction costs, dividend yield, 3 month T-bill rate, consumer sentiment, exchange rate, U.S. market index, and foreign market index.

The results of the regression analysis indicate that higher transaction costs, lower dividend yields, and higher interest rates are associated with larger deviations from parity (Grossmann 5). In accordance with the market segmentation hypothesis, U.S. sentiment has a direct relationship with the level of ADR prices. Not surprisingly, foreign market sentiment exhibits an inverse relationship with ADR premiums (Grossmann 15, 25).

Additionally, both U.S. and foreign consumer sentiment appear to be positively related to the level of ADR prices. However, it appears that U.S. market sentiment exerts a stronger influence on these prices than the corresponding foreign market sentiment (Grossmann 15, 16). Interestingly, U.S. consumer sentiment also appears to impact the price of the underlying asset in the foreign market. Combining these two effects, an increase in U.S. consumer sentiment tends to reduce the ADR premium over the underlying share price, and causes a reduction in the magnitude of ADR mispricing (Grossmann 15, 16). In order to explain the significance of U.S. consumer sentiment, the authors argue that ADRs tend to be issued by large international companies that derive a large portion of their income from the U.S. market. Consequently, ADR price would be more closely correlated with U.S. rather than domestic consumer sentiment (Grossmann 16). They conclude that these results can be interpreted in support of the product market spillover hypothesis (Grossmann 18).

However, my research is most closely related to a study conducted by Suh that extended this analysis into emerging markets. The author argued that country specific factors, including U.S. market sentiment, would not be priced in fully integrated global capital markets (Suh 1-4). However, in fragmented markets, arbitrage may be unable to enforce price parity due to a lack of common risk factors (Suh 1, 2). Suh further claimed that deviations from parity should only occur in fragmented markets (Suh 4). Accordingly, he chose to focus his study on emerging markets with restrictions on foreign ownership and other explicit barriers to trade (Suh 2). Ownership restrictions can be applied in both directions. Often emerging markets impose a set limit on the fraction of total shares foreigners are allowed to own, in which case, the ADRs trade as

unrestricted shares because both domestic and foreign investors can trade them. As a result, ADRs from countries with foreign ownership restrictions tend to trade at a premium to their underlying shares (Suh 2). Conversely, an emerging market might place restrictions on capital repatriation, which serves to limit domestic investment in foreign assets. As a result, ADRs might trade at a discount to their underlying shares (Suh 2).

In order to test his hypothesis that U.S. market sentiment influences ADR mispricing, Suh analyzed the relative performance of 28 ADRs from eight emerging markets between 1997 and 1999 (Suh 5). Although the majority of the ADRs in the sample deviate from parity, parity was often restored to those markets in which foreign ownership restrictions were lifted, (Suh 9). The author further assumed that ADRs trading close to parity were not subjected to binding foreign ownership restrictions (Suh 9). Therefore, these ADRs were eliminated from the regression sample. Stocks were also removed from this sample if their ownership restrictions were lifted during the sample period (Suh 10). With the ADR sample finalized, the author calculated a weekly ADR premium index, and conducted a regression analysis to model changes in this index as a function of the foreign market index (proxy for foreign market sentiment), changes in the exchange rate, and return on the U.S. market index (proxy for U.S. market sentiment) (Suh 10). Additionally, lead and lagged variables were included for the foreign market index and exchange rate variables to correct for spurious correlation arising from time differences (Suh 11). The results of this regression analysis suggest that the ADR premiums in restricted emerging markets are associated with U.S. market returns, and thus, U.S. market sentiment (Suh 12). The author interprets this finding as

evidence of a U.S. specific pricing factor in emerging market equities, and further concludes that this investor sentiment is indicative of the significance of noise traders in creating these mispricings (Suh 12).

Methodology

Although foreign ownership restrictions are among the most significant capital barriers preventing global capital market integration, indirect barriers to trade prevalent in emerging markets can be just as divisive. Consequently, I have taken a broader view of emerging markets than Suh, and included both those with and without explicit capital restrictions on domestic and foreign investors. Additionally, the sample period Suh analyzes covers is one of the most volatile periods in recent emerging market history, as it overlaps with both the Russian Ruble and Asian financial crisis. Therefore, it might not be representative of long-term ADR pricing patterns. More importantly, most previous studies conclude before 2000. Since then there has been an explosion in the number of ADR listings on the NYSE, NASDAQ, and AMEX, thus providing a fresh and more diverse sample. Furthermore, many emerging markets have since relaxed their capital restrictions, and are now better integrated into the global economy.

I will depart from previous studies in two ways. First, unlike previous studies, I will analyze the reaction of both ADRs and their underlying shares in the wake of earnings announcements, in order to determine whether deviations from parity arise in relation to these events, and whether they persist. Secondly, I will attempt to build a more complete model to determine the variables associated deviations from price parity using a nearly complete sample of Level II and Level III emerging market ADRs.

The remaining structure of my paper begins with an overview of the data used in my analysis, and a description of the calculations employed to transform this raw data into easily interpretable information. I will then provide a brief overview of my initial results before constructing a model to better identify the drivers of deviations from price parity, and their relationship with those deviations. Subsequently, I will then use a modified version of this model to analyze whether deviations from parity arise in relation to earnings announcements, and its implication for market efficiency. Finally, I will build upon previous research to determine whether price deviations present investors with profitable arbitrage opportunities, and how long they persist.

Data

I obtained a complete list of ADRs from the Bank of New York website, from January 1, 2002 to March 30, 2007. In order to determine the countries to include in the sample, I selected countries from the MSCI list of emerging markets, which included 25 countries. However, not all emerging markets have listed Level II or Level III ADRs; consequently, those markets were dropped from the sample. A complete list of emerging markets included in this sample can be found in appendix A². I chose to exclude ADRs listed as Level I (over-the-counter) or PORTAL because these stocks tend to exhibit similar trading patterns and liquidity with their underlying shares, and appear to exhibit smaller price deviations than their Level II and Level III counterparts (Miller 155-116). I further excluded all ADRs for which complete price data were not available for either the ADR or its underlying stock. In the final sample, 101 ADRS from 16 countries were included.

² Hong Kong is not classified as an emerging market by MSCI, however, it was included in this sample because a significant portion of Chinese companies that list as ADRs list primarily on the Hong Kong stock exchange.

In order to calculate the ADR price premiums, I first adjusted the underlying share price to reflect the ADR bundling ratio reported on the Bank of New York website. Often times, the ratio is one-to-one, in which case, no adjustment is necessary. However, ADRs commonly represent a bundle of underlying shares, or occasionally a fraction of a single share, requiring adjustment in order to compare the equivalent share prices. After accounting for these adjustments, I calculated the daily ADR premiums relative to their underlying shares as follows: $(ADR_P - HM_P) / HM_P$, where ADR_P is the price of the ADR, and HM_P is the dollar price of the home market shares. Thus, a positive price deviation value can be interpreted as an ADR premium (home market discount); conversely, negative price deviations are interpreted as an ADR discount (home market premium). Interestingly, the long term average price deviation over the course of this sample period was close to zero for most pairs of ADRs and their corresponding home market shares. In fact, the median daily price deviation was only 0.1015%. The average daily price deviation, at a value of 2.4199%, was significantly larger. Additionally, these average deviations ranged from -45% to 54%, contrary to the predictions of the Law of One Price. Because the transaction costs associated with conducting corrective arbitrage are significant, particularly in emerging markets, we would not expect the ADRs to trade at perfect parity with their underlying shares, however they should trade close to parity, as transaction costs are taken into account. For the purposes of this research, I employed a 1% buffer around price parity as a zone of effective parity; I considered ADRs trading at a deviation from parity of less than 1% to be at price parity.

Despite the long term trend towards parity, many stocks in the sample deviated substantially from parity for extended periods of time. These deviations could possibly

be explained by capital barriers such as foreign ownership restrictions imposed by emerging market governments such as China and India or by investor speculation and noise trading. With an average daily premium of 14.0639%, Indian ADRs traded at the largest premium to their underlying shares of any emerging market. With foreign ownership restrictions limiting the availability of Indian home market shares (Farrell), demand for their ADR equivalents is driven higher, resulting in these relatively large premiums, as investors are unable to buy the underlying shares in order to conduct corrective arbitrage. By contrast, with an average daily premium of -4.04%, Chinese ADRs traded at the greatest discount to their underlying shares of any emerging market. Although China also imposes foreign ownership restrictions similar to India, this average discount is driven by the substantial underperformance of the SHI ADR, which traded at an alarming 45% discount to its corresponding underlying stock. Home market speculation is a possible cause of this substantial discount, as the A share market in China is largely influenced by the activities of noise traders, which may serve to drive the value of the home market shares above their fundamental value more accurately reflected in the ADR price. Later in the analysis section, we will determine whether these deviations offer investors profitable arbitrage opportunities. A complete list of summary statistics for these price deviations by country can be found in Appendix A.

In order to understand how these deviations from parity are created, it is necessary to understand their trading behavior. I downloaded trade volume data for both the ADRs and their corresponding underlying shares from Datastream in order to gain more insight into the trading patterns of these cross listed securities in both the U.S. and their respective home markets. In accordance with the methodology employed by Amihud

(2002) and Gagnon (2003), I calculated a proxy measure for illiquidity. This illiquidity measure is defined as the ratio of absolute return to the dollar value of trading activity, and was calculated as follows: $\text{absolute value}(\% \text{ return}) / ((\# \text{ shares traded})(\text{share price}))$. This ratio captures the percentage return per dollar of trading volume. The intuition behind this measure is that large price changes created by relatively minor dollar trading volume reflect a degree of illiquidity caused when either buyers must pay large premiums, or sellers must offer large discounts in order for trade to occur. Increased trading volume creates higher share turnover, resulting in greater liquidity. Similarly, stocks with greater price stability tend to be more liquid, because smaller price fluctuations are necessary to induce trade. However, this metric can be misleading when used alone; if no trade occurs, the price remains constant although the stock may be highly illiquid. Although, the illiquidity ratio captures the illiquidity associated with low trading volume, it fails to account for the rare instances in which no trade occurs. If a stock was not actively traded on a particular day, or no trade volume data was available on that day, that observation was dropped from the sample. Because this exclusion may materially influence the results of my analysis, I filled these holes with a moving average as a robustness check with which to compare the results of the sample with the excluded data points.

Additionally, from the trade volume data I calculated the percentage of turnover in the U.S. market in order to determine the primary location of trading, and whether it is associated with deviations from price parity. I adjusted the quantity of ADR shares traded for the imbedded bundling ratio, in order to maintain consistency between the U.S. and home markets. I found on average, shares traded on the U.S. market as ADRs comprise 42.2% of the total share turnover. However, the percentage of average U.S.

share turnover ranges from as little as 1.7% to as much as 97.2%. Thus, although the U.S. market remains the secondary market for most cross-listed stocks listed as ADRs, it remains a highly influential market responsible for nearly half of the average share turnover, and in many cases more. In particular, Latin American markets rely more heavily on U.S. exchanges for liquidity, and are therefore even more susceptible to U.S. specific market conditions. Because a significant portion of trade is divided between the two markets and investors are exposed to market-wide factors specific to that market, the primary location of trading should have an effect on ADR mispricing. As a greater portion of trade moves to either of the two markets, we should expect greater deviations from price parity as shares traded on the primary market move more in sync with the market index, reflecting market sentiment (Gagnon 14, 29). Additionally these shares may become divorced from parity because investors in the secondary market lack significant liquidity to correct deviations from parity. Conversely, we would expect the price of ADRs and their underlying shares to converge as trade becomes more evenly spread between the U.S. and home markets.

In order to test this hypothesis, I calculated the correlation between each stock pair's percentage turnover in the U.S. and its corresponding deviation from parity. Interestingly, the average correlation in my sample at .14%, was insignificantly different from zero. This might result if deviations from parity are greater when share turnover is unequally distributed between the two markets in both directions, thus canceling the effect that might be detected in a correlation test. Consequently, this test would be most effective when the deviations move in only one direction with the distribution of share turnover. The latter was observed with some frequency, resulting in correlations ranging

from -0.63 to 0.46. Interestingly, both these extreme cases were observed for stocks domiciled in the Indian market. A negative correlation can be interpreted as an increase in the percentage of turnover in the U.S. market is associated with a decrease in the degree of mispricing between the two markets. Conversely, a positive correlation indicates that as the percentage of total share turnover increases in the U.S., ADR prices diverge further from parity. Although the primary location of trading is indicative of the influence of that market on deviations from price parity, it does not capture the direction of that effect. Rather than directly incorporating the location of trading into a model to study the determinants of price deviations, it is more appropriate to examine the effects of both the U.S. and home market indices³ as they more accurately reflect market-specific investor sentiment (Suh 9, 11).

Regression analysis

The purpose of this section of my analysis is to build upon the model developed by Suh in order to develop a more complete model of ADR price deviations from parity, and to determine whether the effects discovered in previous studies were consistent with my sample. The model developed by Suh can be expressed as follows:

$$P_2 - P_1 = P_1 + RM_{us} + (RM_{us-1} + RM_{us+1}) + RM_h + (RM_{h-1} + RM_{h+1}) + FX + (R_{fx-1} + R_{fx+1})$$

where P_2 is the current percentage price deviation. Rather than explicitly using the price deviations as the dependent variable, I employed the change in the level of price deviations in accordance with Suh's model. This approach allows for a more dynamic model, as it provides an additional dimension with which to predict future deviations from parity. For instance, this setup enabled Suh to incorporate a lagged price deviation

³ I defined the U.S. market index as the S&P 500, and employed the MSCI country index as a measure for the performance of the home markets where available.

variable, which might not otherwise be possible, due to problems with autocorrelation. The lagged price variable is designed to measure the mean reversion created by arbitrage activity. Therefore, we would expect the coefficient of this variable to be negative; the more negative the coefficient, the faster the mean reversion occurs. In addition to this mean reversion variable, Suh included the return on the US market. If the US market is the primary location of trading (ADRs are more actively traded than their underlying shares), we would expect the coefficient of this variable to be positive and highly significant. Similarly, because the price deviations are measured as the ADR price minus the equivalent share home market price, we would expect the coefficient of the home market return variable to be negative, particularly when the home market is the primary location of trading. The location of trading is significant because a stock that is traded primarily on a particular market should move in sync with that market, as market wide sentiment and performance spillover into the stock's price performance. Consequently, deviations from price parity should be strongly correlated with the markets on which the ADR and its underlying shares trade. Additionally, the foreign exchange variable is designed to detect whether exchange rate fluctuations have any significant impact on price parity. In order to address the issue of non-synchronous trading, I included the lead and lagged components along with the contemporaneous component of the two market return variables and foreign exchange variable in accordance with Suh's methodology.

In contrast to Suh, who included the change in the level of the foreign exchange rate, I calculated the foreign exchange return in accordance with Gagnon's (2004) model. This approach allowed me to separate the market return from the currency return, and maintained consistency between the two components. Therefore, I calculated the home

market returns in the local currency, in order to maintain the integrity of these distinct components. Additionally, I employed the return index from Datastream in order to calculate the continuously compounded market return. The return index includes dividend returns in addition to returns from capital gains. Consequently, it provides a more accurate measure of total market returns than a more banal price index. Finally, I added the illiquidity measure, previously described, for both the ADRs and their underlying shares to the original model developed by Suh. The direction of the relationship between the illiquidity measures and ADR premiums is unclear; if price adjustments are sluggish in one market relative to the other, ADR prices could be held either artificially above or below its parity value. I decided to use the illiquidity calculations where observations with missing trade volume data were dropped from the sample, rather than the adjusted measure because after running a few regressions, it appeared that the adjusted measure understated the true relationship between the right and left-hand side variables. Additionally, the resulting equation could not account for as much of the variance, as the regression with the omitted data points. My final model can be expressed as follows:

$$P_2 - P_1 = P_1 + RM_{us} + (RM_{us-1} + RM_{us+1}) + RM_h + (RM_{h-1} + RM_{h+1}) + R_{fx} + (R_{fx-1} + R_{fx+1}) + IL_{us} + IL_h$$

With this model, I ran a separate time series regression for each pair of cross-listed stocks in my sample for which sufficient data was available. Nine ADRs were excluded from this analysis either because they were too thinly traded to allow my liquidity measure to be meaningful, or because there was insufficient trade volume data available from either the home or U.S. market. Due to insufficient data, Russia and

Colombia were excluded from this analysis altogether. The results of the time series regressions for the remaining 92 ADRs are illustrated in Table I. In order to correct for heteroskedasticity, all significance levels are reported with the White-adjusted standard errors.

Table I (Independent Variables)

	Average	Significant ⁴
C	0.000805	N/A
US_M	0.292815	65/92
Home_M	-0.08835	43/92
FX	0.027173	36/92
US_LIQ	0.000315	32/92
H_LIQ	0.001346	33/92
PREM(-1)	-0.50755	90/92
US_M(-1)	-0.05489	27/92
US_M(1)	-0.02613	13/92
Home_M(-1)	-0.00403	13/92
Home_M(1)	0.06828	36/92
FX(-1)	-0.01148	28/92
FX(1)	-0.19767	43/92
Adjusted R-squared	0.363837	N/A

As illustrated, the lagged price deviation variable was significant in nearly every regression, more than any other variable. In accordance with expectations its coefficient is negative, suggesting that arbitrage works to correct the prior trading day's deviation from parity. Interestingly, the lagged premium coefficient is the smallest in India, where the average price deviation from parity is the greatest, indicating that arbitrage exerts the least amount of corrective pressure in that market resulting in unusually slow price convergence. However, the opposite trend does not hold true; although the lagged premium coefficient is the greatest on average for South African ADRs, they exhibit the second largest average price deviation of any market after India. Thus, while corrective arbitrage is clearly an important deterrent of changes in the level of deviations from price parity, it is not sufficient to fully explain the variance of these changes. The U.S.

⁴ This column indicates the number of regressions in which the variable was significant at the 10% level.

market index is perhaps one of the most fundamental drivers of changes in the level of ADR premiums. As illustrated, this variable was a significant determinant of price deviation changes for 65 of the 92 ADRs in the sample. Additionally, the positive average coefficient of this variable conformed to my expectations, and indicates that as returns on the U.S. market index increase, so too do ADR premiums. This result provides further support for the findings of Suh and Grossmann who argue that U.S. market and investor sentiment explains a portion of ADR premiums. The intuition behind this relationship is straightforward. As the value of the U.S. market increases, investors may have greater confidence in the market and are willing to bid up the price of stocks across the board because their required rate of return is likely lower. Because of its sound logical relationship with deviations from parity, it is surprising that this variable was not significant in more regressions. Perhaps it is even more surprising that the home market variable was significant in even fewer regressions. Although the home market index should share the same intuitive relationship, only in the opposite direction, this variable was significant in less than half of the regressions. Additionally, despite having the expected inverse relationship, the average home market effect was smaller than its U.S. counterpart. This phenomenon can most plausibly be attributed to the fact that emerging markets are invariably smaller, and consequently, less influential than the U.S. market in setting international asset prices.

As displayed in Table I, the illiquidity measures are only significant in only slightly more than a third of the regressions. These variables appear to be less influential than their peers; however, in order to understand why, it is first necessary to recall how they were constructed. The illiquidity proxy variables capture the percentage return

generated across each dollar volume of trading scaled up by a factor of 10^3 . Because of the minute influence of each dollar of trading volume on the equity's return even after this adjustment, we would expect this coefficient to be smaller than its peers. However, it is not surprising that these coefficients are close to zero, because depending on the stock, the relationship between illiquidity and ADR premiums could work in either direction. Illiquidity implies price rigidity, which may serve to perpetuate deviations from parity, however, does not dictate the direction those deviations will go. If for instance, an ADR is highly illiquid and undervalued relative to its underlying stock, the ADR will likely continue to trade at a discount to its underlying shares. However, if the ADR was initially overpriced, it will likely continue to trade at a premium. These mixed results were manifested in my regressions. Despite the positive average values of the illiquidity coefficients, there were many stocks in my sample that displayed an inverse relationship between illiquidity and their ADR premiums. Because of these competing effects, the overall relationship between price deviations and illiquidity is weak and close to zero.

The influence of the foreign exchange variable is also complex. Its contemporaneous component suggests a positive relationship between the strength of the dollar and ADR the premium, whereas the lead and lag variables both suggest an inverse relationship. Interestingly, not only is the lead coefficient significant in more regressions than its contemporaneous counterpart, but it also exhibits a stronger relationship with the ADR premium, only in the opposite direction. This trend suggests that investors build in expectations of the future exchange rate into the price of ADRs and their underlying shares. Specifically, if the value of the dollar is expected to increase, price convergence is typically observed. Because the home market share price is largely independent of

changes in the exchange rate, it follows that the appreciation of the dollar is accompanied by a decline in the dollar price of the ADR, which in turn reduces the ADR premium. In order to illustrate this point, consider a Mexican ADR trading at \$10 with an underlying share price of 10 Pesos. The ADR trades at parity, and the initial exchange rate is 1P/1USD. However, if the dollar were to appreciate to 2P/1USD, and the price of the underlying shares remains constant, the resulting ADR price must fall to \$5 in order to maintain price parity. With this intuitive inverse relationship, it is interesting that the coefficient of the contemporaneous variable is positive. It may be the case that investors overreact to the expected future exchange rate, and are thus correcting for this overcompensation. However, this effect is much weaker than that generated by lead coefficient. Although the lagged foreign exchange coefficient illustrates a continuation of the expected inverse relationship, characteristic of the lead variable, it indicates a weaker relationship with the ADR premium than either of its counterparts, and is significant in fewer regressions. Therefore, the influence of the foreign exchange rate on ADR premiums is dominated by the lead variable, indicating the significant role future expectations have in enforcing price parity.

The lead and lagged coefficients of the market index variables also exhibit complex relationships with the size of deviations from parity. In particular, both the lead and lagged U.S. market coefficients, in addition to the lead home market coefficient, exhibited the opposite relationship with price deviations as their contemporaneous counterparts. On the surface, these findings are contrary to my initial predictions, more accurately applied to the contemporaneous effects. However, further analysis reveals a simple explanation for these phenomena. First consider the inverse relationship

between the lagged U.S. market coefficient and deviations from parity. If the U.S. market index yielded positive returns on the previous day, ADR prices would have likely increased on that day, as investors bid up the price of stocks to reflect their stronger confidence in the market and lower required rate of return. As previously explained, this would have the effect of increasing the ADR premium on that given day. However, the negative coefficient on the lagged variable is indicative of mean reversion, as ADR investors may have overreacted to positive market sentiment and are working to correct the consequential mispricing. Unlike their ADR counterparts, the underlying share prices are not significantly influenced by the U.S. market, therefore, ADR prices must fall in order to restore price parity. Interestingly, the lagged home market coefficient is also negatively associated with changes in the ADR premium; however, its effect is much smaller, and only significant in 13 of the 92 regressions. In contrast, the lead home market variable exhibits a direct relationship with the magnitude of deviations from parity ADR premium. A possible explanation for this trend is that if the return on the home market is positive tomorrow, the current underlying share prices, along with the other equities trading in that market, are lower than their fundamental value warrants. Therefore, their ADR counterparts in the U.S. may be more appropriately priced if the current trading day in the home market is followed by a bull market, resulting in the increased price deviation prior to strong home market performance. Although it shares the same association with price deviations as its lead counterpart, the lagged home market coefficient is much smaller and only significant in 13 of the 92 regressions.

The resultant pattern of significance among the four lead and lagged market coefficients provides evidence that price discovery generally occurs in the home market,

and moves to the U.S. with a delayed effect. Because the lead U.S. and lagged home market coefficients were only significant at the 10% level in 13 of the 92 regressions, it may be inferred that these effects are not likely significant. Thus, information that might alter the relative price of ADRs to their underlying shares does not typically flow from the U.S. to the home market. Rather, the relative size and significance of the lead home and lagged U.S. market coefficients, suggests that information flows in the opposite direction, because not all relevant information is immediately incorporated into relative ADR prices. Further, because future performance of the home market has a significant impact on these relative prices, the home market creates price shocks that migrate to the U.S, and may initially upset parity.

Earnings Announcement Analysis

If price parity does not always hold, does new firm-specific information lead to price convergence, or does it serve to increase deviations from parity? Intuitively, the effect could work in either direction; if one market more quickly assimilates this information relative to the other, price discrepancies would initially increase. However, new information may serve to decrease speculation in both markets, and thus, provide a source of homogeneous market expectations and a common foundation for fundamental valuation. Specifically, I choose to study whether annual earnings announcements have any significant impact on deviations from parity separate from the drivers of price deviations described in the previous section. I obtained the earnings announcement dates from Bloomberg, and examined a 21 day window surrounding the actual earnings announcement date, with 10 days prior and 10 days following the announcement. Such a window is standard in event study research, as information may have already leaked into

the market before its actual release, and may not immediately be fully incorporated into asset prices.

In order to control for the separate effects of the variables detailed in the previous section, I estimated the regression equation previously described with the data from the beginning of the sample period until the last trading day prior to the earnings announcement window. For each subsequent period, I used the data from the first trading day following the last earnings announcement window until the beginning of the next window in order to estimate the regression equation. In contrast to the full sample regression model, I dropped the lead U.S. and lagged home market variables because although they may be significant in some instances, they will more likely serve to distort projections, particularly when the sample period is shortened. The advantage of estimating the regression equations separately for each earnings announcement is that it allows the coefficients to vary with time and prevents previous earnings announcements from biasing the regression, resulting in a more accurate model. Because sufficient data prior to the earnings announcement window were required in order to run the regression models, several earnings announcements were dropped from my sample. In the final sample, I examined 484 earnings announcement windows of 92 ADRs from 14 countries, each with its own estimated regression equation. With the estimated regression equations I calculated the predicted changes in the ADR premium, and added these to the actual premium on the prior trading day in order to calculate the expected deviations from parity. I subsequently ran a two-tailed t-test in order to determine whether the difference between the actual and predicted price deviations was statistically significant. Throughout this section and the appendix I measured the discrepancy between the actual

and predicted ADR premiums as the actual minus the predicted premium. Thus, a negative discrepancy indicates that the earnings announcement had a convergence effect; conversely, when the actual exceeds the predicted premium it suggests that the earnings announcement creates further divergence. Although the average discrepancies between actual and predicted ADR premiums for each earnings announcement range from -20.17% to 13.39%, the mean for the total sample is only -.02%. Similarly, the median difference between the actual and predicted price deviations of -.04% also suggests that annual earnings announcements do not significantly influence deviations from price parity. However, the difference between actual and predicted price deviations was statistically significant at the 10% level for 165 of the 484 earnings announcements⁵.

In order to understand why these results may have been statistically significant in so many cases, despite the overall appearance that earnings announcements do not have an influential effect on deviations from parity, I must concede two caveats. First, because many of the regression equations had adjusted R-squared values of less than 50%, there was often a large component of idiosyncratic variance. As a result, even when there is a statistically significant difference between the predicted and actual values, the difference may not be entirely attributable to the earnings announcement, but rather statistical noise. Secondly, the period over which statistical significance was measured only included 21 observations, which may have not been enough to establish whether a true difference existed. Further, there was no clear pattern among the statistically significant observations, as some indicated that earnings announcements were associated with price convergence, whereas other suggested that they were linked to greater divergence from parity. Therefore, even when the results are statistically significant, they are mixed

⁵ Refer to Appendix for a more detailed break-down of the estimation errors and their significance.

making it impossible to discern a general relationship between earnings announcements and the direction of the concurrent price deviations. Additionally, because the average effect of the earnings announcement is virtually the same as predicted by the regression equations, we can conclude that annual earnings announcements do not significantly influence deviations from parity. In further support of this conclusion, it appears that each market's average deviation from parity during earnings announcements is representative of the full sample, as illustrated in the following table.

Mean ADR Premiums (Table II)

	EA Window	Total Sample	Discrepancy
Argentina	0.004297	0.00738	-0.00308
Brazil	0.013415	0.014983	-0.00157
China	-0.04078	-0.0404	-0.00038
India	0.144014	0.140639	0.003375
Mexico	0.012601	0.024313	-0.01171
South Africa	0.082849	0.07821	0.004639
Turkey	0.010427	0.01259	-0.00216
Chile	0.010085	0.008453	0.001632
Hungary	-0.00238	-0.00093	-0.00145
Peru	0.025404	0.014082	0.011322
Indonesia	-0.00433	-0.00157	-0.00275
Israel	0.01182	0.010776	0.001043
Korea	0.00328	0.008708	-0.00543
Taiwan	0.08234	0.063166	0.019174

The more important question is why this type of dynamic corporate event bears little to no relation to the relative pricing of the firm's cross-listed securities. It appears that new information generated by earnings announcements is quickly assimilated into security prices in both markets, and does not appear to be an additional source of deviations from parity. This is a remarkable finding in light of the fact that investors in the home market often have better access to firm-specific information, but is also a testament to market efficiency, suggesting that generally the U.S. and emerging markets are largely integrated. Before this conclusion can be properly reached, it is necessary to

explore a few alternative explanations. Perhaps the largest obstacle preventing us from completely ruling out the possibility earnings announcements have an impact on price deviations is that the event window might be too large. For instance, the announcement may initially create price divergence as information might first leak into one market, or become more quickly assimilated into the security's price in the more efficient market. Typically, as we will find in the arbitrage analysis, information about systematic market mispricings is usually acted upon very quickly, thereby enforcing long-term parity. Thus, it is possible that any true deviation created during the earnings announcement window could be masked by the excess observations in that window. Unfortunately, the solution to this problem, shortening the event window, would have the adverse consequence of reducing the power to detect statistical significance. An alternative explanation for the insignificant influence of annual earnings announcements on price deviations is that quarterly earnings announcements were included in the estimation period of the regression equations and may have biased those equations with the built-in earnings announcement effect. However, the most likely explanation is that the market already anticipated future earnings, and most earnings announcements served to confirm market expectations. In this case, the earnings announcement itself is not considered news, and will not substantially affect relative security prices. Most companies will provide earnings guidance for the next quarter, and unless their actual earnings significantly differ from market expectations, they will not have a large impact on the securities' prices. Consequently, earnings announcements that depart the furthest from market expectations would likely have the greatest impact on relative security prices, as they introduce an information shock to the market that may upset parity.

Arbitrage Analysis

Perhaps the most relevant question to investors is whether deviations from price parity present profitable arbitrage opportunities that can be easily exploited. In order to investigate this possibility, I adopted a simple trading strategy with fixed buy and sell signals, requiring a zero net investment position. The buy signal was triggered when the deviation from parity met or exceeded 10%. Thus, when one of the dual-listed securities was overvalued relative to the other, the zero net position required the investor to short the overvalued stock and use the proceeds to fund the purchase of the undervalued stock. The investor would subsequently hold this position until price convergence was reached when the deviation from parity was less than or equal to 1%, or until the sample period ended. I adopted the 10% buy thresh-mark because it represents a conservative strategy, where one security is clearly overvalued relative to the other, and as a result, convergence should occur more quickly. The greatest danger involved with such a strategy, is that the two securities diverge further from parity while the investor holds the zero net position. If this were to occur, the investor might receive margin calls on the short position, and may be forced to prematurely close the position before profits can be realized. Consequently, ADR arbitrage is far from risk free. However, we would expect the two component positions of a zero net investment strategy to yield identical offsetting returns, thus resulting in a zero percent net return. By definition of a zero net position, any returns other than zero can be interpreted as abnormal returns. This arbitrage strategy becomes more profitable as the deviation from parity becomes greater, and as the speed of convergence increases.

I considered the arbitrage positions where the ADR was overvalued separately from those positions where the underlying shares were overvalued in order to determine whether investors react differently to these conditions. Only considering the case where ADRs are overvalued, 61 out of 101 pairs of ADRs and their underlying shares offered at least one arbitrage strategy over the course of the 63 month sample, as illustrated in Table III. There was an average of about 4.25 arbitrage positions per stock, with an average holding period of roughly 48 days. However, this mean statistic is biased by the relatively few stocks for which convergence never took place. Therefore, the median holding period of 6 days, more accurately illustrates the relatively short time horizon generated by most of these arbitrage positions. More significantly, the average daily return generated by this arbitrage strategy was 3.02%. As impressive as this mean return is, the arbitrage strategy yielded daily returns ranging from close to 0 to 17.58%, although it is important to note that the majority of returns fell between 0 and 3%.

Arbitrage Positions Created by ADR Overvaluation (Table III)

	<i>Quantity of arbitrage positions per ADR</i>	<i>Holding period</i>	<i>Average daily return</i>
Mean	4.251634	47.98843	0.030205
Standard Error	0.719489	7.679316	0.005613
Median	1	6	0.008818
Standard Dev	7.266487	159.6116	0.04384
Sample Var	52.80184	25475.86	0.001922
Kurtosis	6.622859	35.65759	3.597579
Skewness	2.485819	5.683525	2.039272
Range	38	1366	0.176685
Minimum	0	1	-0.00085
Maximum	38	1367	0.175839
Count			61

The arbitrage positions created when the underlying shares were overvalued differ from those created by the overvaluation of ADRs in several respects. Of the 101 pairs of

dual-listed securities, only 46 offered at least one arbitrage position, nearly 25% fewer stocks than those offering positions in the opposite direction, as illustrated in Table IV. With an average of 2.79 arbitrage positions per stock, they are less common than their counterparts in the opposite direction. Additionally, the average holding period for these positions, at 21.88 days, is less than half the average time horizon for those positions created by ADR overvaluation. This substantial mean reduction can be attributed to the absence of extreme outliers observed when convergence fails to occur. Supporting this inference, these positions share the same median holding period of six days as their counterparts in the opposite direction. Yet, the greater symmetry in the distribution of holding days provides compelling evidence to suggest that price convergence occurs more quickly when the home shares are overvalued relative to their ADR counterparts. Due in part to this faster convergence these positions also yield higher expected returns, with a mean daily return of 4.15%. In order to understand why convergence occurs more rapidly and yields more profitable arbitrage opportunities when the home market shares are overvalued, it is first necessary to understand why these mispricings arise.

Arbitrage Positions Created by Home Share Overvaluation (Table IV)

	<i>Quantity of arbitrage positions per ADR</i>	<i>Holding period</i>	<i>Average daily return</i>
Mean	2.792079	21.88298	0.041501
Standard Error	0.548322	5.331611	0.007914
Median	0	6	0.018246
Standard Dev	5.510566	89.53297	0.053678
Sample Var	30.36634	8016.154	0.002881
Kurtosis	12.01016	185.2591	2.496248
Skewness	3.048738	12.76741	1.831485
Range	35	1367	0.195285
Minimum	0	1	0.001032
Maximum	35	1368	0.196318
Count			46

While it is clear deviations from price parity presents investors with a profitable arbitrage strategy built on simple trading rules, it is more difficult to determine why they occur. If rational investors conduct corrective arbitrage, the Law of One Price should be strictly enforced within the bounds of transaction costs, and deviations from parity should be corrected almost immediately. Otherwise, free money would be left on the table, and in an efficient market, risk-free arbitrage opportunities should not persist. This does not mean in an efficient market deviations from parity can never occur, only that they should never persist as they induce corrective arbitrage that prevent systematic deviations from parity. Thus, in an efficient market, investors should not be able to develop a simple trading strategy yielding returns in excess of the required compensation for the given level of risk.

Yet, the success of the arbitrage strategy in this study suggests that the U.S. and emerging markets are not efficiently integrated. There are several possibilities to explain this phenomenon. The market segmentation hypothesis advanced by Miller, argues that there are barriers to trade that prevent full market integration, and may lead to divergence from parity. Perhaps one of the most significant barriers to trade is created by asymmetric information flows from the home market to the U.S. market. For instance, if an earnings announcement is made in the home market during off-trading hours in the U.S. market, the price between the home market shares and ADRs may initially deviate from parity. However, that deviation should be corrected with a lagged effect as soon as the U.S. market opens. Because firm-specific information often flows from one market to the other, there might be a delayed effect preventing convergence from occurring immediately, as investors in the two markets might not share the same information. Yet,

this does not explain why substantial deviations from parity often persist for many days at a time. It is possible that because the market for ADRs is comprised almost entirely of individual investors who might lack access to the complete range of relevant information available to home market investors, dissemination of information and resulting price convergence might take longer than in other areas of finance. However, in the absence of capital controls home market investors should be able to exploit any informational advantages they have over foreigners because ADRs could then be converted into the home market shares without restriction. Because capital controls often impose a legal barrier interfering with the execution of corrective arbitrage, they are often responsible for the persistence of deviations from price parity. Capital barriers, such as limits on foreign ownership and capital repatriation may explain why Indian ADRs exhibited the largest average deviation from parity of any emerging market. In particular, foreign ownership restrictions limit the availability of home market shares, and may cause ADRs to trade at a premium to the home market shares (Gagnon 7).

Even in the absence of explicit capital barriers, emerging equity markets are segmented from the U.S. market by differences in investor sentiment, liquidity, required rate of return, and other market-specific conditions (Gagnon 9-14). For instance, if a company's home market shares are highly illiquid, weeks may pass before a trade is executed. During this period, the home market share price remains constant while its more liquid ADR counterpart is actively traded, allowing its price to potentially deviate significantly from parity. An additional source of price deviation is created by the divergence in market performance between the home and U.S. markets. For example, if the home market is experiencing a period of expansion and in a strong bull market, most

stocks trading on that market will increase in price and often deviate from their fundamental value. In contrast, the U.S. market would not likely have been influenced by this bull market, and thus, ADR prices might not immediately reflect the home market optimism allowing them to more accurately preserve and reflect the fundamental value of the underlying shares. This market sentiment effect is consistent with my regression analysis, and has been well documented by many researchers including Suh. Although differences in market sentiment help to explain why deviations from parity arise, it cannot explain why they persist and allow investors to capture significant profits with a simple arbitrage strategy. Therefore, the best explanation lies within the arbitrage strategy itself.

Although the results of the arbitrage strategy are impressive on paper, they may not be as grandiose in reality. My analysis did not take into account transaction costs associated with executing ADR arbitrage. In order to enter a position in an emerging market, investors would encounter large commission fees, bid-ask spreads, and substantial information costs. Yet, it is even more costly and risky to enter a short position. Short positions almost always require the investor to maintain a set margin for their position. If their capital falls below the margin requirement, investors would receive a potentially costly margin call, forcing them to either close a portion of their position at an unfavorable time, or to commit more capital. Because of the risks involved with short positions, many of the non-institutional investors who dominate the ADR market may be hesitant to execute corrective arbitrage, as they may lack the capital to justify these risks. Further, due to capital restrictions imposed by many emerging markets, a zero net arbitrage strategy may not be feasible. Many emerging markets

including China do not allow short sales, thereby preventing investors from executing this zero net arbitrage position (Bris 13-14). Because this zero net investment position was closed out only upon price convergence, an investor would not be required to convert the ADR into its underlying shares and incur a depository fee; yet, this additional transaction cost may serve to restrict corrective arbitrage. In fact, capital repatriation and foreign ownership restrictions often make it impossible for investors to directly convert their ADRs into its underlying shares, thus allowing deviations from parity to persist. However, capital restrictions vary from market to market, and do not likely prohibit corrective arbitrage activity all together. The fact that price parity was maintained for most ADRs during the vast majority of the sample period indicates that by and large corrective arbitrage enforced the Law of One Price. Additionally, because most arbitrage positions were closed within two weeks, it appears that transaction costs are not sufficiently large enough to prevent profitable arbitrage opportunities from arising. Consequently, in spite of transaction costs and capital barriers, investors can capture substantial returns with this simple zero net arbitrage strategy.

In order to explain why convergence takes place more rapidly and offers higher returns when the home market shares are overvalued relative to their ADR counterparts then when the opposite is true, it is necessary to understand the dynamics of each market. Home market investors typically have better access to firm-specific information and are more familiar with the local market conditions and how they might affect the company's balance sheet. Therefore, this class of investor is in closer-step with the actual current and likely future prospects of the firm in which they have invested. Additionally, they generally receive this information more quickly than ADR investors, with limited access

to firm-specific information originating in an emerging market. This home market advantage is enhanced by the fact that individual investors comprise the vast majority of ADR ownership, and may have extremely limited access to firm-specific information. If home market investors have access to more accurate information, we would expect them to drive corrective arbitrage; however, this would not explain why price convergence does not take the same amount of time in both directions. Although home market investors might have quicker access to accurate information, it may be prohibitively expensive or infeasible for them to correct persistent ADR overvaluation. For instance, the local government may tax repatriated capital at a high enough rate to crowd out any potential arbitrage profits. Additional capital restrictions may also produce similar effects. Alternatively, the ADR overvaluation may persist longer than underlying share overvaluation due to the laws of supply and demand. Typically, the supply of shares in the ADR market is more constrained than the home market, as most firms retain their primary listing in their home market, where investor recognition is likely better⁶. Coupled with this effect, foreign ownership restrictions often limit the availability of home market shares to foreigners, and thus increase the demand for ADRs. Short supply, coupled with excess demand often creates a persistent ADR premium that may be justified by the fundamental market dynamics independent of firm-specific information. Thus, due to these effects it is possible for investors in the two markets to share the same views about the fundamental value of the company in which they have invested, however, they may be willing to pay different prices for this firm value. However, due to greater supply in the home market, it is less common for this effect to work in the opposite direction.

⁶ Refer to share turnover data in the location of trading table in Appendix

Recall that while the average arbitrage holding period is much greater when the ADR is overvalued relative to its underlying shares than when the opposite is true, the median holding period is the same for both. Therefore, the dramatic reduction in the average holding period is attributable to fewer extreme outliers when the home market shares are overvalued. For instance, when arbitrage positions were created by ADR overvaluation, there were 15 positions for which the holding period exceeded 100 days. In contrast, of those positions opened when the home shares were overvalued, only 4 had holding periods exceeding 100 days. This pattern suggests that convergence failed to occur more often when the ADRs were overvalued relative to their underlying shares than vice versa. Thus, although price convergence usually takes the same amount of time in both directions in accordance with expectations, extreme cases of slow convergence are more common when the ADRs are overvalued. These rare observations are most likely created by excess demand relative to the available supply of ADR shares.

Conclusion

In conclusion, the results of this study indicate that the Law of One Price is generally enforced between ADRs and their underlying shares in the long-term. However, there are many circumstances in which these otherwise identical equities will deviate from price parity. Through my regression analysis I have identified several variables that influence these deviations and are largely responsible for maintaining parity. In accordance with previous research, I have found that arbitrage activity provides the strongest corrective force on deviations from parity, as most deviations are corrected within a single trading day. Yet, capital restrictions and information barriers hinder corrective arbitrage and serve to perpetuate price deviations. In contrast to

Podpiera who found that information flows primarily from the developed market to the home market, my results indicate that the flow of information works in the opposite direction, as supported by my regression analysis. Therefore, the information barrier may be exacerbated by the dominance of individual investors in the ADR market with limited access to firm-specific information. Also contrary to previous research, I found that market expectations of future exchange rates are often built into the relative prices of ADRs, resulting in a significant impact on deviations from parity. However, price parity is commonly disturbed by the relative market performance on which the securities are listed. This occurs because as the required rate of return in a particular market changes in response to the level of investor confidence in the market, the overall level of security prices must adjust to accommodate the shift in investor sentiment. Consequently, the relative prices of ADRs and their underlying counterparts may be distorted by this market spillover effect. In this respect, my results provide strong support for the findings of Grossmann and Suh that suggest market sentiment is often responsible for ADR mispricings. Finally, the results of my regression analysis indicate that illiquidity effects are generally weak; however, an alternative measure of liquidity might lead to a different conclusion. This might be an interesting avenue to explore for future research.

Similarly, this regression model accurately predicted deviations from parity during earnings announcement periods, indicating that earnings announcements do not typically exert a separate influence on these deviations. The implication is that global markets are largely integrated, and new information is quickly assimilated into security prices in both markets. However, it is likely that most earnings announcements serve to confirm market expectations and do not constitute new information. In contrast, when

the earnings announcement differs substantially from the market consensus it may create an information shock that could reveal potential market inefficiencies. Consequently, it is imprudent to adopt any broad conclusion of international market efficiency before examining this possibility. If this topic were to be explored again in the future, I would recommend examining the earnings announcement relative to earnings guidance, in order to determine whether announced surprises have any significant affect on price deviations.

Finally, while it is clear that price parity is generally held in the long-term, there are many instances in which substantial deviations from parity persist for extended periods of time. Although these may be attributable to capital market segmentation between the two markets arising from legal and informational barriers to trade, they often represent profitable arbitrage opportunities before accounting for transaction costs. Employing simple buy and sell thresh-marks to construct a net-zero investment position during this period, investors would have captured significant abnormal returns. I have additionally found that price convergence occurs more quickly and yields larger returns when the home market shares are overvalued relative to their ADR counterparts, than when the opposite is true. While actual returns would not be as large after accounting for transaction costs, they would likely still be significant. However, the actual feasibility of such a strategy depends largely on whether an investor is able, both legally and practically, to construct and maintain a short position in light of the possibility that prices may further diverge before parity is restored. Yet, the reoccurrence of these arbitrage opportunities across most emerging markets suggests that their presence is not attributable to any single legal or market barrier, but is rather a puzzling phenomenon that should not persist in efficient capital markets. Therefore, these arbitrage positions

indicate that the U.S. and emerging markets are not fully integrated, and may be segmented by a variety of informational, legal, and market sentiment. The implication for investors is that they should adhere to the principle articulated in the arbitrage strategy and invest in ADRs, or where feasible their underlying shares that are substantially undervalued relative to their counterpart. This strategy would likely yield higher than expected returns, even when constructing the opposite short position is not feasible, because in the long-term, but usually sooner, price convergence will almost always occur. Because of the regularity with which price convergence occurs, it appears that many investors may already be applying a similar arbitrage strategy. Thus, while global capital markets are not yet fully integrated, they eventually respond to fundamental mispricings to enforce the Law of One Price.

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Appendix A Summary Statistics

Summary of All ADR Premiums

Mean	0.024199
Standard Error	0.009213
Median	0.001015
Standard Deviation	0.092587
Sample Variance	0.008572
Kurtosis	17.89623
Skewness	1.310841
Range	0.992624
Minimum	-0.45116
Maximum	0.541461
Quantity of ADRs	101
Confidence Level(95.0%)	0.018278

	Brazil	India	China	Korea	Mexico	Russia	South Africa	Turkey	Chile
Mean ADR prem	0.015	0.1406	-0.04	0.0087	0.0243	0.0715	0.0782	0.0126	0.0085
Standard Error	0.001	0.0027	0.0008	0.0016	0.0022	0.0063	0.0016	0.001	0.0009
Median	0.0159	0.1286	-0.039	0.0013	0.0012	0.032	0.0827	0.0039	0.004
Standard Dev	0.037	0.1007	0.0303	0.0594	0.0796	0.2335	0.058	0.0369	0.0348
Sample Var	0.0037	0.0128	0.0032	0.0051	0.0196	0.0545	0.0068	0.0014	0.0023
Kurtosis	5.8148	11.313	3.6062	3.4513	8.1259	10.114	2.269	3.0102	9.8353
Skewness	0.2763	1.4667	0.0717	0.9544	0.4703	2.8924	-0.043	1.556	0.2788
Range	0.2702	0.6033	0.2302	0.4692	0.6439	1.6442	0.4407	0.2702	0.332
Minimum	-0.102	-0.056	-0.152	-0.153	-0.143	-0.362	-0.132	-0.083	-0.155
Maximum	0.168	0.5476	0.0785	0.3162	0.5005	1.2819	0.3091	0.187	0.1767
Confidence Level(95.0%)	0.002	0.0053	0.0016	0.0031	0.0042	0.0124	0.0031	0.002	0.0018
Quantity of ADRs	19	8	11	5	10	1	7	1	13

	Hungary	Peru	Indonesia	Argentina	Colombia	Israel	Taiwan
Mean ADR prem	-9E-04	0.0141	-0.002	0.0074	-0.014	0.0108	0.0632
Standard Error	0.0004	0.002	0.0005	0.0038	0.0013	0.0009	0.0016
Median	-0.001	0.0024	-0.002	0.0194	-0.004	0.0081	0.0541
Standard Dev	0.0132	0.0725	0.0194	0.1415	0.0479	0.0346	0.0604
Sample Var	0.0002	0.0053	0.0004	0.0474	0.0023	0.0023	0.0045
Kurtosis	1.8909	27.472	1.3053	13.37	6.3595	3.3451	1.6868
Skewness	-0.032	5.1649	-0.007	-1.043	-1.984	-0.173	0.6154
Range	0.1401	0.6359	0.1852	0.9811	0.4392	0.2651	0.4232
Minimum	-0.089	-0.097	-0.098	-0.462	-0.292	-0.132	-0.112
Maximum	0.0515	0.5393	0.0875	0.5196	0.1475	0.1336	0.3116
Confidence Level(95.0%)	0.0007	0.0038	0.001	0.0075	0.0025	0.0018	0.0032
Quantity of ADRs	1	1	2	10	1	6	5

U.S. Trade Volume Correlation
with ADR Premiums

Mean	0.001465
Standard Error	0.013233
Median	0.013013
Standard Deviation	0.12898
Sample Variance	0.016636
Kurtosis	7.04069
Skewness	-0.9546
Range	1.088339
Minimum	-0.63031
Maximum	0.458026
Count	95

Appendix B Regression Analysis

	Taiwan	Brazil	China	India	Mexico	South Africa	Chile
C	0.00456	-9E-05	-6E-05	0.00412	-0.0003	0.00345	0.00098
US_M	1.15963	0.10976	0.46048	0.69392	0.07234	0.19311	0.06009
Home_M	-0.2693	-0.0252	-0.015	-0.0599	-0.027	0.05932	-0.1175
FX	0.54793	0.11263	-0.2944	0.09597	-0.1913	-0.196	0.22484
US_LIQ	-0.0078	0.00151	5.4E-05	0.0004	-0.0025	0.00333	-0.0001
H_LIQ	0.01406	0.00078	0.00153	-0.0031	0.00092	-0.0007	0.00058
ADR_PREM(-1)	-0.2035	-0.6586	-0.6361	-0.1035	-0.6361	-0.7739	-0.4874
US_M(-1)	-0.506	0.02231	-0.0406	-0.2347	0.06362	0.03338	-0.0385
US_M(1)	-0.0354	-0.0548	-0.0086	0.05055	0.00248	-0.2018	-0.0268
Home_M(-1)	0.00376	-0.0044	-0.0376	-0.0308	-0.0041	-0.0525	0.03946
Home_M(1)	0.15199	-0.006	0.16377	0.04415	0.03472	0.3652	0.01843
FX(-1)	-0.3136	0.08985	-0.3047	-0.0217	0.21408	0.13916	0.00467
FX(1)	-0.5595	-0.3233	-0.2171	-0.1302	-0.0745	-0.1567	-0.2456
Adj R^2	0.37361	0.45085	0.47107	0.12957	0.39639	0.47415	0.2967

	Hungary	Peru	Indio	Israel	Korea	Argentina
C	-0.0014	0.00028	-0.0014	-0.0003	-0.0018	0.00095
US_M	0.29118	0.17614	0.50451	0.2092	0.4167	0.23111
Home_M	-0.1066	-0.0522	-0.1904	-0.0351	-0.3747	-0.202
FX	0.0536	-0.1181	0.16514	0.03359	-0.1675	0.02861
US_LIQ	1.9E-05	0.00133	-0.0001	0.00782	-0.0016	-8E-05
H_LIQ	0.00202	4.3E-06	0.00238	0.00044	0.0048	-5E-05
ADR_PREM(-1)	-0.6425	-0.131	-0.6507	-0.6542	-0.2445	-0.2902
US_M(-1)	-0.065	-0.135	0.04303	-0.0367	-0.1967	0.03945
US_M(1)	-0.0172	0.05062	-0.0026	-0.0535	0.05243	0.01196
Home_M(-1)	0.04698	0.00121	-0.0473	0.01622	-0.0096	0.01387
Home_M(1)	0.05616	0.01532	0.17537	-0.0412	0.11376	0.00611
FX(-1)	0.06755	0.10305	-0.0002	-0.0491	-0.3101	0.18248
FX(1)	-0.0315	-0.1243	-0.0472	0.0437	-0.2472	-0.0089
Adj R^2	0.40279	0.11562	0.45436	0.37447	0.30594	0.25341

Taiwan ⁷	ASX	MXIC	SPIL	TSM	UMC
C	0.004578	-0.00495	0.008394	0.00187	0.012923
US_M	0.866304	0.606365	1.112554	1.628435	1.584486
TAIW_M	-0.19539	-0.20081	-0.19504	-0.37919	-0.37591
FX	0.727753	0.46984	0.464498	0.730362	0.347215
US_LIQ	1.46E-05	9.38E-08	2.09E-06	-0.02702	-0.01178
H_LIQ	0.012735	0.002313	0.011357	0.042423	0.001488
ADR_PREM(-1)	-0.24418	-0.44114	-0.22597	-0.0245	-0.08181
US_M(-1)	-0.35676	-0.12327	-0.45104	-0.85405	-0.74475
US_M(1)	-0.10169	-0.05262	-0.01033	0.00067	-0.01297
TAIW_M(-1)	0.008378	0.043533	-0.00627	0.009623	-0.03645
TAIW_M(1)	1.59E-01	0.109199	0.073158	0.210573	0.208421
FX(-1)	-0.77455	-0.36748	-0.03679	-0.22095	-0.16816
FX(1)	-0.58602	-0.15851	-0.68777	-0.71634	-0.64881
Adj R ²	0.343886	0.261672	0.380124	0.453175	0.429192

Brazil	ABVC	ABV	ARA	BBD	BTM	CBD	CIG
C	-0.00266	0.002992	0.00166	0.005529	-0.00035	0.000433	-0.00078
US_M	-0.10475	0.210289	0.170788	0.163004	-0.02898	0.089171	0.14165
BRAZ_M	-0.03467	0.009048	-0.03922	0.022152	-0.05216	0.031356	-0.01198
FX	-0.10983	0.319348	0.073171	0.221544	-0.07445	-0.0836	0.120433
US_LIQ	6.31E-05	0.028575	-0.0018	0.000663	-1.96E-06	-0.00041	-0.00016
HOME_LIQ	-4.13E-05	0.000186	0.000131	0.007531	0.000774	1.60E-05	-0.00158
ADR_PREM(-1)	-0.75252	-0.112	-0.86921	-0.39147	-0.83854	-0.89376	-0.69449
US_M(-1)	0.115775	-0.12491	0.044793	-0.06625	0.055818	-0.02965	0.005262
US_M(1)	-0.09468	0.023664	-0.11411	-0.05163	-0.00078	-0.07294	-0.11082
BRAZ_M(-1)	-0.0808	0.02311	-0.01466	0.017879	-0.02604	-0.01623	0.065354
BRAZ_M(1)	0.122927	-0.06661	0.005291	-0.02483	-0.07572	-0.01103	-0.02437
FX(-1)	0.092853	0.163942	0.143065	0.147104	0.032325	0.169946	0.175467
FX(1)	-0.11744	-0.44085	-0.38046	-0.41023	-0.26507	-0.27544	-0.37746
Adj R ²	0.750228	0.285543	0.587058	0.358903	0.518675	0.539448	0.502486

Brazil	ELP	ERJ	GGB	RIOP	SID	TCN	TMB
C	-4.69E-04	-0.01269	0.001049	0.000695	-0.00055	-0.00309	0.001092
US_M	0.092764	0.180809	0.147763	0.13946	0.206197	0.01246	0.07125
BRAZ_M	0.006584	-0.13119	-0.0211	0.024307	-0.0416	-0.16877	-0.06257
FX	0.014386	0.324282	0.081772	-0.01745	0.04913	0.533856	-0.00879
US_LIQ	4.73E-05	1.74E-05	-7.52E-05	-0.00083	-0.00036	4.81E-06	1.53E-05
HOME_LIQ	0.000105	0.001623	0.000347	-0.00072	0.001328	8.20E-06	0.000477
ADR_PREM(-1)	-0.79422	-0.01479	-0.87277	-0.94046	-0.80018	-0.77362	-0.83678
US_M(-1)	0.040652	-0.031	0.023855	0.006744	-0.02715	0.29014	0.03817
US_M(1)	0.030175	-0.09355	-0.05821	-0.01752	-0.01033	-0.21767	-0.02076
BRAZ_M(-1)	0.01386	0.012892	-0.02081	0.03104	0.010275	-0.10467	-0.01085
BRAZ_M(1)	-0.00583	0.067765	0.004563	-0.02319	-0.0299	-0.00268	-0.03114
FX(-1)	0.099502	0.086814	0.076392	0.132031	0.064977	-0.09521	0.084088
FX(1)	-0.287	-0.25405	-0.30419	-0.39254	-0.3981	-0.2983	-0.36091
Adj R ²	0.475657	0.05119	0.537872	0.645432	0.494356	0.426343	0.483009

⁷ In the remaining regression tables, all cells highlighted in yellow are significant at the 5% level. The cells highlighted in blue indicate significance at the 10% level.

Brazil	TNE	TSP	UGP	VIV
C	0.004073	0.002131	-0.00012	-0.0006
US_M	0.158258	0.141585	-0.0506	0.234576
BRAZ_M	0.023113	0.009284	0.024248	-0.03955
FX	0.003934	0.209101	0.165237	0.205234
US_LIQ	0.001394	-2.30E-05	-8.96E-06	-1.78E-05
HOME_LIQ	0.002997	-0.00035	-3.12E-06	0.001282
ADR_PREM(-1)	-0.83227	-0.51932	-0.72062	-0.19849
US_M(-1)	0.012244	0.010074	0.008042	0.029021
US_M(1)	-0.09745	0.043138	-0.04156	-0.08151
BRAZ_M(-1)	0.026592	0.018938	-0.02482	0.000235
BRAZ_M(1)	-0.02258	-0.04743	0.013519	0.042693
FX(-1)	0.074144	-0.0284	0.089235	0.108958
FX(1)	-0.40456	-0.33278	-0.19885	-0.32058
Adj R^2	0.571517	0.307374	0.400905	0.179315

China	ACH	CBA	CEO	CHL	CHU	GSH	PTR
C	0.00083	-0.00026	0.000273	0.001357	-0.0007	0.000146	4.04E-05
US_M	0.490696	0.382796	0.439914	0.779994	0.799842	0.353964	0.43772
CHINA_M	-0.0565	0.009511	-0.09238	-0.00818	-0.025	-0.06108	-0.01951
FX	-0.37213	-0.34393	-0.19704	-0.46352	-0.35442	-0.62364	0.548493
US_LIQ	-7.24E07	-3.68E05	9.47E-05	-2.22E05	-6.26E05	-4.19E06	0.000616
HOME_LIQ	-0.00026	-0.00032	0.00316	0.000102	0.006667	0.000186	0.009006
ADR_PREM(-1)	-0.75175	-0.62165	-0.75237	-0.89759	-0.80985	-0.45493	-0.77015
US_M(-1)	-0.08595	-0.08333	0.036539	-5.83E05	-0.10721	-0.01243	0.020044
US_M(1)	-0.07801	-0.11139	0.005097	-0.02145	-0.03099	0.006663	0.012113
CHINA_M(-1)	-0.02815	-0.03091	-0.04667	-0.00489	-0.03472	-0.04349	-0.04239
CHINA_M(1)	0.262196	0.143999	0.170485	0.15437	0.146311	0.122257	0.235217
FX(-1)	-0.17804	-0.02489	-0.95581	-0.09379	-0.18682	-0.23885	-0.27936
FX(1)	-0.50678	-0.38472	0.092018	-0.27492	-0.06049	-0.56373	0.162229
Adj R^2	0.516627	0.411291	0.550946	0.757872	0.706013	0.3021	0.548414

China	SHI	SNP	YZC	ZNH
C	-0.00348	-0.00015	0.001275	-2.41E05
US_M	0.211	0.493505	0.26612	0.409783
CHINA_M	0.377524	-0.05224	-0.07569	-0.16187
FX	0.024999	-0.38757	0.13802	-1.2075
US_LIQ	-7.75E06	2.66E-05	-4.47E08	-1.22E05
HOME_LIQ	-0.00023	-0.00317	0.001292	0.000394
ADR_PREM(-1)	-0.00775	-0.77574	-0.5843	-0.57107
US_M(-1)	-0.1399	0.002808	-0.10002	0.02261
US_M(1)	-0.00431	0.045425	0.040997	0.041786
CHINA_M(-1)	-0.10653	-0.06922	-0.02467	0.017913
CHINA_M(1)	0.090342	0.204533	0.182194	0.089545
FX(-1)	0.512696	-0.34553	-0.8706	-0.69045
FX(1)	0.368079	-0.25602	-0.04182	-0.92236
Adj R^2	0.116071	0.526755	0.372818	0.372896

India	HBD	INFY	MTE	RDY	SAY	VSL	WIT
C	0.005551	0.008659	0.00446	0.00279	0.005243	-0.001	0.003104
US_M	0.523716	1.179566	0.560202	0.385011	1.059759	0.411898	0.737257
INDIA_M	0.033061	-0.13575	-0.05683	-0.04964	-0.03419	-0.11146	-0.06442
FX	-0.00302	-0.01096	0.159193	0.183312	0.234992	-0.01336	0.121623
US_LIQ	2.07E-07	0.00355	-6.91E06	-9.56E07	-0.00029	-4.76E05	-0.00037
HOME_LIQ	0.000141	-0.0112	-0.01595	0.000302	-0.00279	0.000294	0.007464
ADR_PREM(-1)	-0.05507	-0.02244	-0.04113	-0.24984	-0.02178	-0.30215	-0.03224
US_M(-1)	-0.06907	-0.60846	-0.1444	-0.1499	-0.43591	0.022228	-0.25721
US_M(1)	0.042314	0.209339	0.018739	-0.11581	0.05847	0.005879	0.134889
INDIA_M(-1)	-0.06511	0.006101	-0.05788	0.067356	-0.09898	-0.11235	0.045363
INDIA_M(1)	0.067729	0.033366	0.002613	0.013869	0.034229	0.072725	0.084551
FX(-1)	-0.06132	0.072321	0.000319	-0.10274	0.141164	0.037345	-0.23925
FX(1)	0.063836	-0.00532	-0.11942	-0.40363	-0.26708	0.043649	-0.22322
Adj R^2	0.072258	0.146726	0.061375	0.188986	0.133674	0.194117	0.109868

Mexico	ASR	CX	GMK	IBA	ICA	KOF	TFONY	TMX
C	-0.00113	0.000195	-1.24E04	0.001279	0.002341	9.80E-05	-0.00319	-0.00165
US_M	0.127307	0.077266	0.044578	0.179033	-0.08322	0.189006	0.019745	0.024987
INDIA_M	-0.05732	-0.03798	-0.05631	0.014235	-0.06284	-0.01534	0.0309	-0.03111
FX	0.180184	-0.34965	-0.08166	-0.06059	-0.29188	-0.23512	-0.33085	-0.36121
US_LIQ	4.08E-07	-0.00728	-4.21E06	1.14E-05	-2.83E06	-0.00158	-5.60E06	-0.01148
HOME_LIQ	-5.26E06	0.00289	-1.73E06	-1.77E06	0.000101	-1.21E06	8.58E-07	0.004409
ADR_PREM(-1)	-0.35128	-0.90271	-0.59285	-0.50422	-0.02206	-0.83075	-0.8913	-0.99338
US_M(-1)	0.12419	-0.00805	0.103025	0.112393	0.2082	0.019334	-0.01855	-0.03163
US_M(1)	0.003244	-0.00867	-0.07275	-0.03487	0.183395	-0.00084	-0.00982	-0.03985
MEXICO_M(-1)	0.005011	0.016158	-0.02225	-0.08521	0.015107	0.003565	0.019703	0.014982
MEXICO_M(1)	0.049672	0.022895	0.067718	0.166083	-0.11559	0.014892	0.067113	0.004956
FX(-1)	0.36623	0.11178	0.315958	0.023061	0.662341	0.093022	0.117576	0.022651
FX(1)	-0.22275	-0.04157	-0.14572	-0.08617	0.075432	-0.09213	0.024602	-0.1073
Adj R^2	0.186274	0.597019	0.402391	0.362259	0.033399	0.498296	0.498137	0.593359

South Africa	AU	DROOY	GFI	HMY	SPP	SSL
C	0.000275	0.01169	0.001732	-0.00037	0.003292	0.004107
US_M	0.145854	-0.05778	-0.06621	-0.03339	0.927534	0.242627
SA_M	-0.07284	0.003649	-0.03375	0.012373	0.588266	-0.14175
FX	-0.19735	-0.11979	-0.19597	-0.25739	-0.41474	0.009012
US_LIQ	0.008255	-0.00322	0.007251	0.007712	-0.00015	0.000108
HOME_LIQ	-0.00043	-2.51E05	0.00103	0.000136	-0.01157	0.006646
ADR_PREM(-1)	-1.01628	-0.81249	-1.03501	-1.02303	-0.00549	-0.75081
US_M(-1)	0.04079	0.016712	0.074377	0.055564	0.022153	-0.00935
US_M(1)	-0.19852	-0.24849	-0.27886	-0.29828	-0.10443	-0.08201
SA_M(-1)	-0.08048	-0.05213	-0.0943	-0.1028	0.066764	-0.05193
SA_M(1)	0.398749	0.409378	0.552905	0.581822	0.046959	0.201363
FX(-1)	0.108293	0.235486	0.118905	0.216896	0.135076	0.020317
FX(1)	-0.13732	-0.2062	-0.22823	-0.20942	-0.06143	-0.09744
Adj R^2	0.567036	0.420753	0.570524	0.566424	0.23791	0.482273

Chile	TKC	AKOA	AKOB	BCH	CTC	CU	DYS
C	0.001459	-0.00234	-0.00072	0.000748	0.007256	-0.00097	0.002984
US_M	0.448261	0.184133	0.079085	-0.00831	0.128099	0.07599	0.112098
TURK_M	-0.31295	-0.20926	-0.19612	-0.0288	-0.16278	-0.11192	-0.07879
FX	3.81E-02	0.191621	0.304547	0.123322	0.387439	0.258154	0.050558
US_LIQ	-9.03E05	-3.62E07	6.98E-07	-2.73E05	-0.00219	4.62E-05	-8.03E07
H_LIQ	0.007496	-1.39E07	-9.10E06	1.41E-06	0.000541	6.53E-07	4.00E-05
ADR_PREM(-1)	-0.18251	-0.56453	-0.58742	-0.19082	-0.17349	-0.56467	-0.80038
US_M(-1)	-0.18915	0.031083	-0.02819	0.235552	-0.05911	-0.00363	0.032162
US_M(1)	0.036812	0.082853	0.003217	0.000127	-0.1041	0.004073	-0.11288
TURK_M(-1)	0.010836	0.015833	0.026216	-0.04858	0.065015	0.001443	0.050214
TURK_M(1)	0.113265	0.099079	0.003893	0.03814	0.188272	0.027195	0.032471
FX(-1)	-0.09044	-0.1257	0.032843	0.119041	-0.08877	-0.03667	0.12478
FX(1)	0.039265	0.016561	-0.07193	-0.22322	-0.37085	-0.25372	-0.31588
Adj R^2	0.279456	0.310558	0.325858	0.113494	0.151154	0.351711	0.421134

Chile	ENI	EOC	MAD	PVD	SQM	SQMA	VCO
C	0.004907	-0.0005	0.006704	-0.00207	-0.00034	-0.0022	-0.00115
US_M	0.024987	0.097264	-0.24988	0.027257	0.034772	-0.14399	0.031422
TURK_M	0.107155	-0.06355	-0.62798	-0.03388	-0.03584	0.142545	-0.03249
FX	0.576728	0.045387	-0.16922	0.387508	0.094884	0.500075	0.358669
US_LIQ	0.00023	3.24E-06	1.95E-06	2.14E-05	-1.51E05	6.66E-06	-1.22E05
H_LIQ	2.35E-05	-3.88E09	-1.32E07	-4.54E06	-3.30E07	-1.64E06	-8.10E07
ADR_PREM(-1)	-0.11172	-0.84061	-0.35608	-0.49112	-0.85796	-0.37747	-0.72501
US_M(-1)	-0.05616	-0.01796	-0.63419	0.001799	0.057568	-0.00944	0.100313
US_M(1)	-0.21028	-0.07421	-0.03757	0.013826	-0.04482	0.106298	-0.03791
TURK_M(-1)	-0.05277	0.02583	0.688339	0.03893	-0.04201	-0.17271	-0.05416
TURK_M(1)	-0.12787	0.017154	-0.04078	-0.04314	-0.01207	-0.08532	0.047739
FX(-1)	0.022991	-0.01671	0.141842	-0.06635	0.023954	0.051963	-0.02741
FX(1)	-0.51953	-0.24857	-0.68422	-0.14642	-0.25535	-0.25843	-0.14654
Adj R^2	0.07099	0.453201	0.178403	0.324089	0.477036	0.278355	0.41841

Hungary	MTA
C	-0.0014
US_M	0.291181
HUNG_M	-0.10661
FX	0.053597
US_LIQ	1.91E-05
H_LIQ	0.00202
ADR_PREM(-1)	-0.64249
US_M(-1)	-0.06497
US_M(1)	-0.01719
HUNG_M(-1)	0.046975
HUNG_M(1)	0.056155
FX(-1)	0.067546
FX(1)	-0.03152
Adj R^2	0.402791

Peru	BVN
C	0.000282
US_M	0.176136
PERU_M	-0.0522
FX	-0.11815
US_LIQ	0.001327
H_LIQ	4.30E-06
ADR_PREM(-1)	-0.13095
US_M(-1)	-0.13502
US_M(1)	0.05062
PERU_M(-1)	0.001214
PERU_M(1)	0.015322
FX(-1)	0.10305
FX(1)	-0.12435
Adj R^2	0.115617

Indio	IIT	TLK
C	-0.00193	-0.00084
US_M	0.386625	0.622403
INDIO_M	-0.14741	-0.23345
FX	0.151814	0.178459
US_LIQ	-4.83E05	-0.00017
H_LIQ	0.001301	0.00346
ADR_PREM(-1)	-0.64153	-0.65984
US_M(-1)	0.041537	0.044526
US_M(1)	0.036898	-0.0421
INDIO_M(-1)	-0.09247	-0.0022
INDIO_M(1)	0.099315	0.25143
FX(-1)	-0.08417	0.083828
FX(1)	-0.08519	-0.00921
Adj R^2	0.404837	0.50389

Israel	BSI	DELT	FORTY	KOR	NICE	TEVA
C	0.001245	0.002593	-0.00366	-0.00101	-0.00017	-0.00103
US_M	0.129618	-0.02809	0.182773	0.220676	0.43169	0.318515
ISRAEL_M	-0.05567	0.041961	-0.02973	-0.0636	-0.0266	-0.07708
FX	0.159395	0.162551	-0.05593	0.03713	-0.06776	-0.03384
US_LIQ	2.96E-06	-1.64E06	3.50E-07	-8.75E07	-3.75E05	0.046978
H_LIQ	1.96E-05	-1.44E05	9.66E-05	1.51E-04	0.000197	0.002205
ADR_PREM(-1)	-0.02178	-0.80194	-0.72938	-0.70157	-0.81289	-0.85774
US_M(-1)	-0.18817	-0.05644	-0.00081	0.037186	-0.01076	-0.00139
US_M(1)	0.006974	-0.03848	-0.03234	-0.00557	-0.0722	-0.17963
ISRAEL_M(-1)	0.111105	-0.03228	-0.01555	-0.05917	0.02185	0.07137
ISRAEL_M(1)	-0.16692	-0.11141	-0.10708	-0.17289	-0.00104	0.312294
FX(-1)	0.063861	-0.13755	-0.10003	0.015705	-0.11564	-0.02123
FX(1)	0.236094	-0.02383	0.047231	0.004368	-0.01301	0.011355
Adj R^2	0.020107	0.447637	0.413725	0.375477	0.468011	0.521848

Korea	KTC	MRAE	PKX	SKM	HANA
C	0.000745	-0.0081	0.000897	0.001986	-0.00477
US_M	0.456281	0.021155	0.723793	0.577725	0.304553
KOR_M	-0.26764	-0.93068	-0.15199	-0.27738	-0.24579
FX	0.243478	-1.68537	0.157707	0.179839	0.266716
US_LIQ	-0.00782	-2.69E07	-0.00037	0.000429	-2.86E06
H_LIQ	0.017534	0.003983	0.000617	-0.0126	0.014474
ADR_PREM(-1)	-0.02815	-0.31883	-0.50061	-0.04715	-0.32781
US_M(-1)	-0.32999	0.004471	-0.19236	-0.34777	-0.11768
US_M(1)	-0.01905	0.337874	0.013635	0.03464	-0.10497
KOR_M(-1)	0.095337	-0.20142	-0.02734	0.06149	0.023832
KOR_M(1)	0.079659	0.087359	0.103837	0.060643	0.237317
FX(-1)	-0.16411	-1.16712	0.06216	0.026472	-0.3079
FX(1)	-0.04521	-0.84365	-0.25149	-0.17029	0.074419
Adj R^2	0.31049	0.187851	0.504017	0.318797	0.208566

Argentina	BFR	CRESY	GGAL	MGS	PZE	TAR	TEO	YPF
C	0.007664	-0.0003	0.004948	-0.00451	-0.00025	0.002597	-0.00253	-3.38E06
US_M	0.278858	0.035621	0.340176	0.10496	0.291335	0.23236	0.328348	0.237211
ARGENT_M	-0.22866	-0.14317	-0.22579	-0.22176	-0.21414	-0.08123	-0.33198	-0.16954
FX	0.120928	0.065897	0.012006	0.075674	0.017442	-0.04792	-0.00807	-0.00704
US_LIQ	-3.75E05	3.17E-05	1.32E-06	1.12E-06	-0.0005	8.85E-06	-5.18E05	-7.75E05
H_LIQ	3.90E-05	-1.16E06	3.11E-05	5.39E-06	-0.00047	1.61E-06	1.84E-05	-1.23E06
ADR_PREM(-1)	-0.18646	0.006566	-0.58581	-0.4617	-0.16435	-0.46002	-0.24453	-0.2251
US_M(-1)	0.000471	0.052248	0.041679	0.124886	-0.03602	-0.06858	0.012572	0.18832
US_M(1)	0.069558	-0.10192	0.128122	0.080603	-0.05582	0.05826	0.133481	-0.21657
ARGENT_M(-1)	0.103306	0.050571	0.030794	-0.02867	0.041157	-0.08107	0.097259	-0.10242
ARGENT_M(1)	0.053284	-0.05454	0.020724	0.057162	0.036949	-0.10618	0.017463	0.024007
FX(-1)	0.235234	0.062331	0.074488	0.72629	0.117038	0.103238	0.110969	0.030271
FX(1)	-0.13826	0.001358	-0.16009	0.329304	-0.09111	0.063291	-0.09172	0.015805
Adj R^2	0.203903	0.260096	0.349185	0.308431	0.16421	0.348366	0.205972	0.187099

Appendix C Earnings Announcement Analysis

	Actual - Predicted Price Deviations	Significant ⁸
Argentina	0.008764	18/43
Brazil	0.000835	35/93
China	-0.00013	20/56
India	0.003188	15/35
Mexico	-0.00202	14/47
South Africa	-0.00315	8/30
Turkey	0.000483	1/6
Chile	-0.00266	17/67
Hungary	-0.00223	1/6
Peru	-0.03392	2/6
Indonesia	0.00054	2/9
Israel	-0.0004	10/30
Korea	-0.00181	11/25
Taiwan	-0.00072	11/27

Brazil	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
ABV.C	0.018006	0.001259	4/5
ABV	0.033156	-0.00126	1/6
ARA	0.001632	-0.00384	2/5
BBD	0.018819	0.007876	5/6
BTM	0.000531	0.000651	1/6
ELP	-0.0002	-0.00103	2/5
CBD	0.000174	0.003356	2/4
CIG	-0.00271	-0.00039	2/6
SID	-0.00069	1.03E-06	0/6
RIO-P	0.000815	-0.00072	3/6
ERJ	0.197155	-0.00024	2/5
GGB	0.001164	0.0008	0/6
TCN	-0.00194	0.004089	1/5
TNE	0.005557	-1.1E-05	5/6
TSP	0.00277	0.001569	0/6
TMB	0.002789	0.000464	0/5
UGP	-0.00106	0.001621	3/6
VIV	0.000812	0.000821	2/6

⁸ This column indicates the fraction of earnings announcements for which there was a significant difference between the predicted and actual price deviations at the 10% level.

India	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
RDY	0.011329	0.002428	1/5
HDB	0.114097	-0.00061	1/5
INFY	0.393922	-0.00048	2/5
MTE	0.074874	0.034014	5/5
SAY	0.216079	-0.00326	2/5
VSL	0.001018	-0.01071	2/5
WIT	0.194293	0.000944	2/5

China	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
ACH	0.000777	0.000997	1/6
CBA	-0.00152	-0.00293	0/6
CHL	0.001753	0.001112	4/5
CEO	0.001112	0.000129	3/5
SNP	-0.00056	-0.00292	2/5
ZNH	-0.0002	0.002299	4/4
CHU	0.000201	-0.00267	2/5
GSH	0.000903	-0.00102	1/5
PTR	0.001025	-0.00036	1/5
SHI	-0.45116	0.002516	1/5
YZC	0.003264	0.001624	1/5

Korea	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
HANA	-0.01149	-0.00372	2/5
KTC	0.036482	0.000669	1/5
MRAE	-0.01092	-0.004	2/5
PKX	0.001936	-0.0011	3/5
SKM	0.027532	-0.00088	3/5

Mexico	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
CX	8.05E-05	-0.00065	0/5
KOF	-0.00127	0.000108	1/6
ICA	0.132243	-0.00334	3/6
GMK	-0.00444	-0.00732	3/6
ASR	-0.00194	-0.0005	1/6
IBA	-0.00453	-0.00593	3/6
TFONY	-0.00439	0.00251	2/6
TMX	-0.00191	-0.00083	1/6

	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
South Africa			
AU	0.001143	-0.00172	3/5
DROOY	0.010825	-0.00967	1/5
GFI	0.002737	-0.00465	1/5
HMY	0.000996	0.000955	0/5
SPP	0.541461	-0.00088	1/5
SSL	0.00656	-0.00296	2/5
Turkey	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
TKC	0.01259	0.000483	1/6
Chile	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
PVD	-0.0048	-0.00108	0/3
BCH	0.006803	-0.01073	2/2
CU	-0.00143	0.000446	0/6
CTC	0.036586	-0.00137	1/6
DYS	0.00361	-0.00013	0/6
AKOA	-0.00526	-0.00133	3/6
AKOB	-0.00139	-0.00071	2/6
EOC	-0.00057	0.00072	1/6
ENI	0.053296	-0.03944	2/6
MAD	0.032608	0.016657	1/5
SQM.A	-0.00697	0.003491	3/5
SQM	-0.0005	-4.3E-05	2/5
VCO	-0.0021	-0.0006	0/5
Hungary	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
MTA	-0.00093	-0.00223	1/6
Peru	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
BVN	0.014082	-0.03392	2/6
Indonesia	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
IIT	-0.00275	0.002749	2/5
TLK	-0.0004	-0.00222	0/4

Argentina	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
BFR	0.037865	0.004284	2/6
CRESY	-0.09421	0.003492	3/4
GGAL	0.008927	0.01433	2/6
MGS	-0.00417	0.011633	2/6
PZE	-0.01352	0.012471	3/6
TEO	-0.01231	0.004413	2/6
TAR	0.001015	0.005646	3/4
YPF	-0.01577	0.011499	1/5

Israel	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
BSI	0.069635	0.003225	1/6
DELT	0.000229	-0.00131	3/5
FORTY	-0.00346	-0.00642	2/3
KOR	-0.00171	-0.00042	2/4
NICE	5.31E-05	0.000927	1/6
TEVA	-9E-05	-0.00155	1/6

Taiwan	Mean ADR Prem	Mean actual - predicted dev. during EA	Significant (mean actual - predicted dev. during EA)
ASX	0.028113	-0.00216	2/5
MXIC	-0.00808	-0.00104	2/5
SPIL	0.048043	0.001011	2/5
TSM	0.10548	-0.00265	1/6
UMC	0.142273	0.001244	4/6

Appendix D Arbitrage Analysis

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
ABV.C	5	17.8	0.00882	6	16.5	0.00747
ABV	1	1	0.08788	0		
ARA	0			0		
BBD	2	16.5	0.00601	0		
BTM	0			0		
ELP	0			0		
CBD	0			0		
CIG	0			1	1	0.17456
SID	1	1	0.16005	0		
RIO-P	1	2	0.05632	0		
ERJ	1	1050	0.0001	0		
GGB	0			0		
PDA	7	77.7143	0.00147	4	87.75	0.00155
TCN	6	4	0.03209	4	3	0.04848
TNE	0			0		
TSP	2	5	0.0204	0		
TMB	0			0		
UGP	0			1	5	0.02193
VIV	0			1	131	0.00103

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
RDY	6	15.1667	0.00776	0		
HDB	6	173	0.00063	0		
IBN	6	190	0.00069	0		
INFY	1	1367	0.00019	0		
MTE	6	105.833	0.0014	0		
SAY	3	427	0.0003	0		
VSL	5	8.4	0.02296	1	1	0.11508
WIT	3	369.333	9.80E-05	0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
ACH	0			1	1	0.12175
CBA	0			2	3	0.03826
CHL	0			0		
CEO	0			0		
SNP	2	1	0.16413	0		
ZNH	0			0		
CHU	0			0		
GSH	1	1	0.12128	1	6	0.02148
PTR	0			0		
SHI	0			1	1368	0.00114
YZC	1	2	0.04876	0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
HANA	9	9.55556	0.0139	11	8.27273	0.01663
KTC	3	175.667	0.00053	0		
MRAE	38	9.02632	0.02246	35	14	0.01323
PKX	0			0		
SKM	1	277	0.00034	0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
CX	0			0		
KOF	0			0		
ICA	2	268.5	0.00074	0		
GMK	1	5	0.0239	3	9.33333	0.0145
ASR	2	3	0.04385	3	4.33333	0.02491
SIM	14	23.8571	0.00652	11	11.0909	0.01636
TMM	19	23.5789	0.00589	17	21.4118	0.00723
IBA	4	2.25	0.04534	4	19.5	0.00576
TFONY	1	1	0.1405	0		
TMX	0			0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
VIP	19	27.0526	0.00553	7	35.4286	0.00484

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
AU	0			0		
DROOY	23	2.65217	0.06032	8	2.75	0.07033
GFI	3	1.66667	0.11398	2	1	0.19224
HMY	3	1	0.17584	1	1	0.17808
HSVLY	22	6.5	0.02869	8	26.875	0.0076
SPP	1	1367	-7.20E-05	0		
SSL	0			0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
TKC	3	61	0.00166	0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
PVD	0			0		
BCH	22	14.5455	0.01558	12	24.0833	0.00968
CU	0			1	2	0.05202
CTC	1	43	0.00867	0		
DYS	0			0		
AKOA	0			1	4	0.02772
AKOB	0			0		
EOC	0			0		
ENI	4	96.25	0.00135	0		
MAD	21	12.5238	0.02309	15	4.4	0.08318
SQM.A	3	5.66667	0.01891	2	21	0.00493
SQM	0			0		
VCO	0			0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
MTA	0			0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
BVN	1	48	0.00707	0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
IIT	0			0		
TLK	0			1	1	0.19632

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
APSA	33	18.1515	0.00783	14	6.14286	0.03095
BFR	10	61	0.00247	1	30	0.00745
CRESY	2	3	0.03968	2	107	0.0058
GGAL	12	6.16667	0.02647	15	4.86667	0.05369
MGS	13	5.23077	0.03714	14	7.92857	0.01986
			-			
NTL	2	376.5	0.00085	2	295	0.00227
PZE	0			4	39.75	0.00456
TEO	1	3	0.03446	12	11.5833	0.01592
TAR	20	5.85	0.03209	20	7.2	0.02663
YPF	2	3	0.05233	7	27.2857	0.00497

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
CIB	1	3	0.05855	7	20.1429	0.0071

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
BSI	10	72	0.00111	5	19.8	0.00703
DELT	0			2	1.5	0.08838
FORTY	0			1	4	0.06079
KOR	0			1	2	0.05824
NICE	0			0		
TEVA	0			0		

	ADRs overvalued			Home Shares overvalued		
	Quantity of Arbitrage Positions	Avg holding period	Avg return	Quantity of Arbitrage Positions	Avg holding period	Avg return
ASX	11	31.8182	0.00339	0		
MXIC	9	4.11111	0.03777	9	13.4444	0.01072
SPIL	10	81.9	0.00145	0		
TSM	8	102.875	0.00138	1	5	0.02638
UMC	2	678.5	0.00025	0		