ADR Spreads and their Informational Content: the Role of Relative US Investor Sentiment*

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Abstract

ADR spreads being discrepancies between returns on ADRs and returns on underlying shares, they do provide us with an indicator of US investors' relative optimism or pessimism. Panel data of firms with ADR programs from 35 countries during the period 1997-2007, reveal that global and local risk factors, related to market, exchange rate, liquidity and sentiment premiums account for these discrepancies. The investor sentiment hypothesis cannot be rejected and there is evidence that ADR spreads have significant predictive power over next period's ADR returns and over various active trading rules' returns. On a time series level, major events, such as the terrorist attacks of September, 11, are identified as structural breaks in the evolution of US investors' sentiment, as well as on its impact on ADR spreads. On a cross-sectional level, markets are "partially segmented" and the relative importance of spreads' factors varies across different regions of the world, as well as between emerging and developed markets.

KEYWORDS: ADR, spread, investor sentiment, informational content
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1 Introduction

This work examines discrepancies between returns on American Depositary Receipts (ADRs) and returns on their underlying shares (UND). It has been observed that such "ADR spreads" are on a worldwide average higher than 3% on an annual level, with even larger absolute values for emerging market firms and more volatile evolution after major events, such as the terrorist attacks of September 2001. Are these ADR spreads mostly due to segmented markets for market microstructure reasons, as literature has proposed so far for other similar pricing puzzles, i.e. closed-end fund puzzle and country fund puzzle? Is this segmentation rather due to different investors operating in different markets, thus introducing a degree of heterogeneous market perception, or the so-called "sentiment" effect? Can both of these explanations be relevant and if so, can we obtain any useful information from these ADR spreads? Our goal is to seek answers by further examining ADR spreads on a worldwide sample of firms during the period 1997-2007 and analyze their determinants and variation across time and regions. After controlling for market microstructure issues, such as market illiquidity, we claim that a significant part of ADR spreads reflects US investors' sentiment. The impact of ADR spreads' factors varies across regions of the world, or after major events. ADR return spread data provide us with a natural laboratory allowing us to test several additional hypotheses as well, such as the extent of markets' integration, or the predictive power of current ADR spreads in the future return generating process of financial assets.

This paper's focus is not on a firm's decision to cross-list and its valuation premium, but rather on whether returns of established ADR programs are affected by investor sentiment. A potential influence of sentiment would probably be complementary to other reasons related to arbitrage barriers due to market microstructure. The "predecessors" of studies on ADR spreads with a sentiment approach, concern a strand of literature explaining the so called closed-end fund premium (or discount) puzzle[1]. The price discrepancy in that case concerns the difference between the share price of the fund and the Net Asset Value (NAV) of the weighted average of the assets in which it is invested. Traditionally, there have been three major explanations put forward. The first concerns agency costs[2], implying that managerial activity is a "hidden asset or liability" not reflected in underlying asset value, which may undervalue or overvalue NAV. The second explanation refers to tax liabilities that are not captured in reported NAV, hence resulting to a NAV which is overvalued. Thirdly, researchers have proposed the illiquidity of fund assets as an additional reason why NAV may be overvalued.

These three proposed explanations all have to do with a mismeasurement

[1] For an overview, one may see Bodurtha et al. (1996), or Ross (2002).
[2] See Frankel and Schmuckler (2000).

of reported NAV and have their analogies in our framework of ADRs and their underlying shares (UND). More specifically, agency costs may correspond to asymmetric information among different investor groups, which may make UND assets less noisy. Instead of tax liabilities, one may consider market microstructure issues, typically trading costs, including bid-ask spreads and brokerage fees. One may suppose that UND become more expensive due to higher trading costs in emerging markets. Finally, illiquidity of underlying shares and markets versus illiquidity of ADRs may also account for significant pricing differences between the two different markets[3].

An additional explanatory factor for such premiums has been proposed by investor sentiment theory. [Zweig (1973), DeLong et al. (1990), Lee et al. (1991), Chopra et al. (1993)]. Apart from modelling attempts of such a theory [Barberis et al. (1998)], there has been an on-going debate about whether investor sentiment represents an independent and systematic risk. Supporters of this theory claim that premium changes reflect differential sentiment of two distinct investor groups. In the case of closed-end funds, market participants are classified in professionals (institutionals) and non-professionals (small individuals), with the latter dominating positions in closed-end funds. There is a clear analogy in ADR spreads. International capital barriers and higher costs for international transactions may make the distinction between US investors and local investors sound not implausible. Critique on this theory [Chen et al. (1993), Elton et al. (1998), Doukas and Milonas (2004)] is based on limited economic significance of the sentiment index in explaining stock returns, as well as inability to control for market-wide sentiment. Its defenders, thus acknowledge that their sentiment index only reflects the differential sentiment of small US investors.

One solution to confront the market-wide sentiment critique is proposed by country fund premium literature [Bonser-Neal et al. (1990), Bodurtha et al. (1995), Klibanoff et al. (1998)]. NAV are established in local markets outside the US. Therefore, to the extent that foreign investors are unaffected by noise-trading and the so-called "pseudosignals", NAV can be safely used as a benchmark for evaluating US market sentiment. The analogy offering a similar advantage in studying ADR spreads is the following: UNDs are traded in local markets outside the US, therefore to the extent that foreign investors are unaffected by noise-trading, UNDs can be safely used as a benchmark for extracting US market sentiment. Of course, the impact of global common sentiment is still hard to control for. Another advantage of country fund literature is that more than one market factors may be introduced. This allows separate analyses on time-series and cross-sectional levels of fund prices and NAVs in relation to their respective market factors. In a similar manner, while studying ADR spreads,

[3] Acharya and Pedersen (2005) illustrate the mechanism in detail in their liquidity adjusted asset pricing model.

more than one market factors may be introduced, for example US and local market returns.

The persistence of ADR spreads consists a puzzle, since ADRs represent claims on the same expected future cash-flows as their underlying assets. There are, hence, several reasons that make examining such spreads a particularly instructive task. The advantage compared to both closed-end fund and foreign country fund study frameworks is that their firm-specific nature provides us with data on a more micro-level. Before testing any arbitrage opportunities that rise from such discrepancies, one should bear in mind two aspects. On one hand, in an ADR context it is easier to set up a replicating portfolio, as compared to country fund literature. On the other hand, it is more costly to perform transactions on an international level and the importance of market microstructure issues is higher in our framework.

In order to form our testable hypotheses, we use results from existing literature on pricing of ADRs from an investor's perspective[4], as well as on explaining premiums of the type of closed-end funds, or country funds discussed above.[5] Studies on ADR spreads are quite recent, with Kwon et al. (2005) and Bae et al. (2007) focusing on exchange rate premium determinants and Aggarwal et al. (2007) and Chan et al. (2008) focusing on liquidity and other market microstructure factors. A group of papers that are closely related to ours include Suh (2003), Grossmann et al. (2007) and Arquette et al. (2008) that show evidence that arbitrage costs, ownership restrictions and consumer sentiment do explain to some extent the spreads in prices between ADRs and UNDs. We extend their results on explaining ADR price discrepancies, by using direct measures for investor sentiment and by showing that there is a persistent negative relation between US sentiment and ADR spreads.

Our contribution can be summarized in four points. Firstly, we find evidence of a significant investor sentiment component in the changes of ADR spreads. Secondly, we document other factors explaining part of the observed ADR spreads, such as relative market illiquidity, the degree of the home country's market development, the presence of short-selling constraints and investors' expectations about fundamentals. Moreover, we highlight cross-sectional differences of their impact on spreads across different regions of the world. Thirdly, we are able to identify structural breaks in the evolution of US investor sentiment as well as on its relation with ADR spreads. These breaks are observed around major events, such as the terrorist attacks of September 2001. Finally, we document that there is significant informational content in ADR spreads that could be used in order to create profitable active investment strategies.

[4] Related literature includes studies by Kim et al. (2000), Fang and Loo (2002), Boldin et al. (2006), Aggarwal et al. (2007).

[5] Apart from market microstructure and sentiment factors, more recent studies include Chiang et al. (2006) focusing on conditional volatilities and Froot and Ramadorai (2008) depicting the role of institutional portfolio flows.

The information conveyed mostly concerns ADR future returns, rather than UND future returns. A similar argument holds for investor sentiment, since even though spreads reflect relative investor sentiment differential between US and local investors, evidence shows higher correlation with US specific sentiment than local sentiment.

2 Hypotheses to test

2.1 ADR spreads construction and their components

This study is, thus, situated within a theoretical framework, where there is an on-going debate about two main issues. The first issue is how to explain the ADR pricing puzzle. The second issue is how we can extract useful information from such a stylized fact. Why do price discrepancies for securities giving right on the same dividend stream exist in the first place? Are they satisfactorily explained by already proposed factors, such as barriers in arbitrage or sentiment? Is there an informational content hidden in these spreads that investors could potentially exploit? In this section we present those major research questions, as well as some secondary goals, that we subsequently test in the empirical part of section 4. The data we use is presented in detail in section 3.

Previous studies on the ADR pricing puzzle have focused their analysis on defining the so-called ADR premium.[6] They define it as the difference in the price between the ADR and the underlying security in US dollars, divided by the price of the underlying security in US dollars. The price of the underlying security is also adjusted with respect to the ADR factor. We find that such a definition provides us with non-stationary series, as well as series that are not cointegrated. We thus prefer to begin our analysis by defining a proxy for the pricing puzzle, based on the difference of the natural logarithm of the previously defined ADR premium. We obtain a measure that we define as ADR spread that is equal to

$$ADRspread_t = ADR_t - (UND_t - ER_t) \tag{1}$$

where ADR is the US dollar return of the ADR security, UND is the local currency return of the underlying security and ER is the percentage change in the exchange rate, expressed in local currency units per 1 US dollar. In a perfectly integrated market, with no transaction costs and barriers in arbitrage, one would expect the ADR spread to be equal to zero. Pricing through absence of arbitrage would suggest that the dollar return in the ADR security at time t be equal to the dollar return of the underlying security $(UND - ER)$ at the same time period. In reality though, we observe ADR spreads that are

[6] Such studies include Suh (2003), Grossmann et al (2007) and Arquette et al. (2008).

significantly different from zero, with interesting time-series and cross-sectional characteristics.

Our variable is stationary and the cointegrating properties of its components will be useful in extracting the informational content of ADR pricing discrepancies. In addition, examining the factors explaining ADR spreads is the equivalent to examining the factors explaining changes in ADR premiums, whereas studying the factors explaining changes in ADR spreads would be equivalent to studying the factors explaining the rate of increase of ADR premiums. Furthermore, the absolute value of the ADR spread is a proxy for mispricing, whereas the absolute value of the change in the ADR spread proxies the speed of mean reversion to zero.

The fact that we build our proxy on returns observed ex post could suggest an explanation based on differences in expected returns of distinct investor groups, for example between US and local investors. This approach implicitly rejects the perfect market integration hypothesis and introduces additional risk premia for each investor group. The first risk premium that comes into one's mind is the exchange rate risk premium, since US investors bear the translation exposure of converting local currency returns into dollar returns. By incorporating exchange rate changes into our ADR spread variable of equation (1), we need to look for other risk factors that make us observe non-zero ADR spreads. Such risk premia could be related to market risk, liquidity risk and sentiment risk. Other reasons for non-zero ADR spreads could be related to barriers in arbitrage, such as transaction costs, short-selling restrictions and capital controls, especially in emerging markets.

In a first attempt to study and better understand the ADR spread, we propose a factor analysis of its two main components, ADR and UND, following existing literature. Following Kim et al. (2000) and Bae et al. (2007), $ADR_{i,j,t}$ returns of firm i, based in country j, at time t, are affected by underlying returns $UND_{i,j,t}$, US excess market returns $R^{ex}_{US,t}$ and bilateral exchange rate changes $ER_{j,t}$. We add an analysis of how US investor sentiment and changes in US investor sentiment ($SENT_{US,t}$) affect ADR returns and introduce controls for US market wide illiquidity ($ILL_{ADR,t}$):

$$ADR_{i,j,t} = g_1\left[UND_{i,j,t}, R^{ex}_{US,t}, ER_{j,t}, SENT_{US,t}, ILL_{ADR,t}\right] \qquad (2)$$

As far as underlying assets $UND_{i,j,t}$ returns are concerned, we use a specification where they depend on underlying market excess return $R^{ex}_{LOC,t}$, exchange rate changes $ER_{j,t}$ and US market excess return $R^{ex}_{US,t}$. On a limited subsample, on which local sentiment is available, we will test whether changes in local sentiment ($SENT_{LOC,t}$) affect UND returns. Moreover, we introduce controls

for local market wide illiquidity ($(ILL_{UND,t}$):

$$UND_{i,j,t} = g_2\left[R^{ex}_{local,t}, ER_{j,t}, R^{ex}_{US,t}, SENT_{LOC,t}, ILL_{UND,t}\right] \tag{3}$$

Summarizing the goals of our preliminary analysis, a crucial hypothesis to be tested is whether the components of ADR spreads are affected, among others, by proxies for sentiment. There is an on-going debate which examines the impact of Lee et al. (1991) sentiment index on the return generating process of passive portfolios, individual stocks, as well as mutual fund returns. Empirical studies by Elton et al. (1998) and Doukas and Milonas (2004) question its significance by comparing it to other randomly chosen factors, widely considered as non systematic factors, such as industry indices. After applying principal component analysis, they also show that sentiment index correlation with each one of the empirically derived factors is relatively low. The goal of this study is not to evaluate in an exhaustive manner whether market sentiment is a systematic risk factor. Nevertheless, it is useful for our subsequent analysis, to test the impact of investor sentiment on two types of portfolios of particular interest, the ADR and the UND. As a matter of fact, Brown and Cliff (2005) find evidence that sentiment significantly drives stock prices away from fundamentals and Baker and Wurgler (2006) associate firm characteristics that amplify sentiment's impact.

The channels through which investor sentiment affects stock returns are also very important. In order to examine them, we first need to define sentiment. Given a fixed underlying dividend growth rate d_i for an individual firm (or an aggregate dividend growth rate $\overline{d_j}$ for the economy as a whole), distinct investor groups are assigned different subjective beliefs μ_k. The weighted average $\overline{\mu}$ of such subjective beliefs can be seen as the sentiment of our investor group or economy. Literature on asset pricing under heterogeneous beliefs provide us with a solution for the market price of risk, being a decreasing function of $(\overline{\mu} - d_i)$. An increase in sentiment $\overline{\mu}$ leads thus to a decrease of the market price of risk and thus a decrease of excess stock returns. In other words, demand shocks due to an exogenous increase in optimism, without a change in fundamentals, lead to an increase in stock prices and thus a decrease in the expected stock returns. We therefore expect to find a negative relationship between changes in investor sentiment and stock returns. In the empirical part, we also examine how stock returns, are affected by the level of optimism or pessimism as well as by measures of aggregate non-neutrality in expectations.

$$\begin{aligned} \textit{Stock returns} \quad = \quad & g_3[\text{Sentiment}],\ g_4[\text{Changes in Sentiment}], \\ & g_5[\text{non-neutrality in expectations}] \end{aligned} \tag{4}$$

2.2 Spreads due to market microstructure?

Once we have examined the determinants of ADR and UND returns, we focus on the factors explaining ADR spreads. A first possible explanation is related to market microstructure issues that consist barriers to arbitrage. The importance of market microstructure is put forward by many empirical studies[7]. Towards this direction, literature suggests that, for portfolios of securities trading in multiple exchanges, trading tends to concentrate in the exchange with lower transaction costs. From an investor's point of view, industry participants often provide ease of trading argument as a reason for choosing ADR portfolios. Therefore, as Aggarwal et al. (2007) point out, one should control for market microstructure aspects, such as relative market illiquidity or relatively less developed stock market.

According to the partial market segmentation hypothesis, examined among others by Stulz (1981), Adler and Dumas (1983), Bodurtha et al. (1995), ADR spreads are affected by common global factors plus some local factors. In other words, both local and common risk factors affect US and local markets and these factors are reflected in ADR spreads. Possible and intuitive candidates for testing the existence of global factors are US market returns. For local factors one may test local market returns, the degree of local market development and market-wide illiquidity on a country level. Following the traditional one-factor capital asset pricing model, we use the excess market returns factor differential ($R^{ex}_{US} - R^{ex}_{local}$) as a primary explanatory factor for the ADR spread, expecting it to have a positive impact.

Due to the absence of transaction cost data, market wide illiquidity and proxies of market development will be our main indicators for market microstructure issues that may account for non-zero ADR spreads. According to a liquidity-based capital asset pricing model, market wide illiquidity is a systematic pricing factor. Investors are willing to accept a lower expected return on an asset with high returns in times of high illiquidity. Therefore, an increase in market wide illiquidity would negatively affect excess returns, ceteris paribus. This negative effect should prevail on the ADR spread as well. Our hypothesis to test is that the ADR spread decreases when the difference between market wide illiquidity in the US market and market wide illiquidity in the local market ($ILL_{ADR} - ILL_{UND}$) increases From the point of view of a substitution effect, we could explain the impact on the ADR spread as follows: if the relative illiquidity of the ADR portfolio compared to the illiquidity of the underlying UND portfolio is high, investors allocate larger fractions of their investments in the UND portfolio. Aggarwal et al. (2007) and Chan et al. (2008) show the im-

[7] See for instance Huang and Stoll (2001) for its importance around currency crises, or Rabinovitch et al. (2003) for emerging markets. Aggarwal et al. (2007) and Chan et al. (2008) emphasize the role of illiquidity.

portance of relative illiquidity in ADR spreads and we expect to confirm their results. At this point, we implicitly perform a joint test, since in order for investors to be able to choose among international markets, those latter cannot be perfectly segmented.

$$ADRspread_{i,j,t} = g_6\left[R^{ex}_{US} - R^{ex}_{local},\ ILL_{ADR} - ILL_{UND},\ controls\right] \quad (5)$$

Other microstructure issues raising barriers to arbitrage, such as short-selling constraints, institutional capital or ownership restrictions and time-zone effects are emphasized by Bris et al. (2007) and Gagnon and Karolyi (2004). Consequently, in the empirical part, we need to control for such direct market market-based restrictions, but also for indirect market-based barriers, such as different accounting standards, legal framework, investor protection and degree of market development proxies proposed by LaPorta et al. (1998). On a cross-sectional level, our broad sample of 35 countries allows us to test whether the classification of the ADR's home country in emerging or developed, has an impact on ADR spreads. Following Aggarwal et al. (2007) findings, if a portfolio of firms is based in an emerging market, with consequently less developed financial institutions and higher trading costs, investors allocate larger fractions of their investment in the ADR portfolio of these companies relative to the underlying local portfolio. Microstructure factors' importance may thus differ according to the country or region of origin of the firm.

2.3 Spreads due to sentiment?

Apart from market and liquidity factors, we test whether differences in investor sentiment between US investors and investors from different countries/zones of the world ($SENT_{US} - SENT_{LOC}$) has a significant impact on spreads. As explained in the preceding subsections, there is controversy over the role of sentiment in asset valuation. Recent studies shed light on an explanation of ADR premiums through investor sentiment arguments. Suh (2003) first captures the stylized fact using US aggregate market returns as a proxy for market sentiment. Grossmann et al. (2007) use survey based indices as proxies for consumer sentiment and find a negative impact on ADR premiums, which is though not persistent when it comes to the sentiment's impact on ADR or other asset portfolios. Arquette et al. (2008) find a negative impact on a reduced sample of Chinese securities by using P/E ratios as proxies for market wide and firm specific sentiment.

This study's first contribution in that direction is to test equation (4) and show the consistency of the impact's sign. In addition, we shed more light on the debate by testing whether relative investor sentiment changes consistently negatively affect ADR spreads. Based on specification (6), we examine potential

variations of the impact of explanatory factors on ADR spreads on either a time-series or cross-sectional dimension. We are also able to compare the economic significance of sentiment variables in relation to that of market microstructure variables.

$$\begin{aligned} ADRspread_{i,j,t} &= g_7[R^{ex}_{US} - R^{ex}_{local},\ ILL_{ADR} - ILL_{UND}, \\ &\quad SENT_{US} - SENT_{LOC},\ controls] \end{aligned} \tag{6}$$

Another concept which is related to investor sentiment is investors expectations, which leads us examine the following question: Do investors' expectations about the evolution of fundamentals, such as exchange rates and market returns, explain part of ADR spreads evolution? A rigorous answer to this question would involve the development of a model of investors' expectations. For the objectives of this research, we follow the proposition of Chan et al. (2008) who assume the martingale property of asset returns and use current realized asset returns as the best predictors for next period's realization. We thus end up with the following specification:

$$ADRspread_{i,j,t} = g_8[E(ER_{t+1}),\ E(R_{US\,t+1}),\ E(R_{LOC\,t+1}),\ controls] \tag{7}$$

2.4 Informational content of spreads

We focus on two different directions in order to test how we can extract information from ADR spreads. The first is to identify structural breaks in the impact pattern of variables like the relative sentiment change and give a concrete interpretation. The second is to evaluate the predictive power of ADR spreads in relation to future stock returns.

In relation to the first direction and given the 10 years time span of our sample, we choose one major event that is prone to be related to a structural break in US investor sentiment. We believe that the terrorist attacks on US territory on September 11, 2001 may have provoked an exogenous shock on market sentiment or structural parameters, such as risk aversion of US investors. We thus look for an answer to the following research question: Do we observe any structural break around the terrorist attacks of September 11, 2001 in relation to the impact of American investors' relative optimism on ADR spreads? If yes, how can we interpret such a break?

We interpret such potential breaks by well-established results of the impact of investors' optimism changes on asset returns in a framework where there is heterogeneity of information among agents [see Cecchetti et al. (2000), Abel (2002), Berrada (2006)]. In our case, heterogeneity arises in beliefs between two major types of agents, one representative US investor and one representative local investor. If the perfect integration hypothesis is rejected and the two types

of investors mostly proceed to transactions in their respective markets (ADR and underlying market respectively) for the same underlying risky dividend yield, ADR spreads can be perceived as differences in the subjective market price of risk of the two types of agents. As a result, observed structural breaks of the impact of US investors' relative optimism on ADR spreads could largely be due to structural changes in risk aversion coefficients in one of the two types of investors.

Finally, among the most important research questions raised in this study is the extent at which ADR spreads convey information about future asset returns. A possible vehicle of information would be its mean-reverting characteristics. We test the cointegrating properties of its components. Such questions have been examined in the context of the closed-end funds and country funds.[8] The interest for investors is obvious, since it could eventually allow the creation of investment strategies exploiting this information and obtaining abnormal returns.

According to the investor sentiment hypothesis, higher (lower) ADR spreads tend to be associated with lower (higher) future ADR returns. Is it true in our case? Does it also hold for the underlying securities returns, in other words, do future UND returns correlate as well with current ADR spread levels? In his seminal paper about the theory of investor expectations, Zweig (1973) separates market participants into professionals and non-professionals. When non-professional investors' expectations become "sufficiently" one-sided, there exists a high probability that stock prices will reverse towards the unanticipated direction. We could think in our case in an analogous manner since mean reversion in spreads would imply that a given ADR spread at period t may predict a change in the spread at period $t+1$. We create several "buy & hold" investment strategies in order to test the potential information conveyed by ADR spreads. Before we test the above hypotheses and provide some answers in our empirical section, we now need to present in some more detail the data we use.

3 Data and methodology

We focus on non-US firms that have established an American Depository Receipt program earlier than July 1997, which is still running. Therefore, their stock price has been trading on US financial markets[9], as well as on their local stock markets for at least 10 years. The total universe of these firms mounts to 581 from 46 countries. We do not impose any restrictions on the type of ADR

[8] See for instance Thompson (1978), Brauer (1988), Hardouvelis et al. (1994), Bodurtha et al. (1995), Elton et al. (1998), Doukas and Milonas (2004).

[9] Depending on the type of ADR program chosen by the firm, trading on US financial markets may involve an organized stock exchange (for ADRs of levels 2 and 3) or is executed over-the-counter (for ADRs of level 1, unsponsored shares, 144-A and Regulation S).

program; nonetheless in order to avoid very illiquid ADR programs (usually the non-listed ones, or those representing a small percentage of a firm's total market capitalization), we apply a filtering process according to which we eliminate the firms for which there are no transactions for more than 2/3 of our time span. This filter, as well as lack of contemporaneous data for both the ADR and the underlying share in some cases, leads us to a final sample of 315 firms from 35 countries.

For each firm, we collect weekly closing prices and volume data from *Thomson - Datastream* for both share quotes, US and local. Typically, each local quote is valued in local currency and is thus translated into US dollars using the exchange rate in effect on each date. For all 35 countries we also collect from *Thomson - Datastream* total market return data, bilateral US exchange rates defined as the local currency value of 1 US dollar and risk free rates. The choice of risk free rates differs among countries due to unavailability of standardized proxies. We minimize that bias by always choosing the shortest term interest rate available in each country (usually government bond yield with 1 month maturity).

For the purposes of this study, we choose each country as the cross-section identity of our panel. We form equally weighted ADR portfolios at each observation date with the number of firms with available data from each country. In such a way, we enable our empirical analysis identify regional and country effects. Their average annualized returns as well as the average annualized returns of their respective underlying shares portfolios are presented in tables 1a and 2. In order to compute an adjusted ADR spread, local portfolios' returns (UND) are translated in U.S. dollars and the spread is thus computed as the difference of two U.S. dollars returns. Figure 1 and table 1a also present some histograms and descriptive statistics, respectively, of adjusted ADR spreads means for our sample country-based portfolios between July 1997 and August 2007. They illustrate that the adjusted ADR spread is on average negative, around 3.65% on an annual basis for the whole sample, with a higher dispersion and absolute value among emerging market firms than developed market firms.

For the choice of a proxy for market wide investor sentiment, we use survey based indices provided by different sources. Survey based information is in accordance with our definition of investor sentiment, since it captures subjective beliefs about the economic prospects of different regions. The weighted average of the subjective beliefs consists the sentiment index provided by several institutions. Our main source is the German ZEW institute, which on a monthly basis conducts the ZEW Financial Market Survey and publishes the ZEW Indicator of Economic Sentiment on 6 major world economies: U.S., U.K., Japan, France, Germany and Italy. The ZEW indices are constructed as the difference between the percentage share of analysts that are optimistic and the share of analysts

that are pessimistic for the six different economies. They represent the average level of optimism or pessimism about each one of the six countries. These indices are available in *Reuters* and *Thomson - Datastream*. A second source is the European Commission, which publishes monthly sentiment indices representing the percentage change in optimism or pessimism about 13 EU countries of our sample.

We denote with $SENTl_{j,t}$ the average level of sentiment in country j during period t, whereas $SENT_{j,t}$ corresponds to the percentage change in investor sentiment for country j, during period t. For example, if the UK economy at time t has $SENTl_{UK,t} = 10\%$ and $SENT_{UK,t} = -10\%$, this means that at time t, there are 10% more optimistic analysts about the UK economy than pessimistic, but that there is a decrease of 10% in this average optimism with respect to $t-1$. We also define the absolute value of the average level of sentiment $abs(SENTl_{j,t})$ as a measure of non-neutrality in expectations, since the higher it is, the less percentage of analysts have a neutral view.

The choice we make to use weekly frequency is suggested by previous empirical literature for two reasons. It reduces the bias of non-synchronous trading that is present in our sample due to time differences among markets, as to daily frequency, and at the same time does convey richer information than monthly frequency for the relatively restricted time span of 10 years of our study. Investor sentiment indices are the only data series not available on a higher than monthly frequency, we therefore need to interpolate them on a weekly basis. The results remain robust while we use two interpolation methods: one in which we keep the index value constant between two monthly data points and one in which we interpolate linearly and estimate the missing values between two monthly observations. We repeat the estimations with monthly frequency data and the statistical significance of the results is not different.

The need to proxy for market microstructure issues and control our estimations with respect to market wide liquidity leads us create two different illiquidity proxies.[10] In relation to studies by Acharya and Pedersen (2005) and Hasbrouck (2006), who suggest and compare different illiquidity proxies, we choose to use the following two illiquidity measures: the first one ($ILL_{i,j,t}$) is "Amihud's illiquidity measure" defined as the average of the ratio of absolute weekly returns on weekly volume. Once we compute the ratio on a firm level, we compute the country wide average $ILL_{j,t}$ on two portfolio levels, the ADR portfolio ($ILL_{ADR_{j,t}}$) and the UND portfolio ($ILL_{UND_{j,t}}$). The second illiquidity proxy is the "trading infrequency measure" measured as the number of shares traded in a week over the total number of existing shares. The latter is mostly used as a robustness test of the more widely accepted "Amihud's illiquidity measure", in particular to account for cases of stocks with many observations of zero

[10] Aggarwal et al. (2007) and Chan et al. (2008) show the importance of controlling for liquidity when identifying ADR premium explanatory factors.

returns due to zero weekly volume that would be undefined in the first proxy. We do not manage to obtain volume data for the Malaysian and Taiwan ADR portfolios, so whenever we use ADR illiquidity proxies, we limit our data sample to 33 countries. In order to control for other market microstructure issues often proxying market development, we use creditor protection ($RightsCred_j$), low expropriation risk ($RightsExpr_j$) and accounting standards ($Accounting_j$) variables from the LaPorta et al. (1998) database. In addition, we use Bris et al. (2007) data on short-selling restrictions for 34 of our countries, by using time series of dummies for short-selling permission ($DumNSth_{j,t}$), securities lending permission and short-selling practice ($DumNSpr_{j,t}$) in each country j.

In order to test the informational content of ADR spreads, we define several investment strategies. The returns of our equally-weighted portfolios according to these trading rules are computed under the assumption of weekly rebalancing. Previous studies by Hardouvelis et al. (1994) apply similar methodology on country fund premiums and show that their informational content is even less present in short-term rebalancing, therefore our frequency choice may simply reduce the significance of our results. Indeed, we repeat our estimations by using a monthly rebalancing and our conclusions do not change in a substantial manner.

For the first proposed active investment strategy, $ISR_{ADR\ spread}$, the rule at time t consists of taking a long position in the ADR portfolio and a short position in the UND portfolio if $ADRspread_{t-1} < 0$ and vice versa. The second strategy ISR_{ADR}, implies taking a long position in ADR when $ADRspread_{t-1} < 0$ and a short position in ADR otherwise. The third strategy ISR_{UND}, consists of taking a long position in the UND portfolio at time t when $ADRspread_{t-1} > 0$. a short position in UND otherwise. The second and third strategies are feasible even in segmented markets, where the investor can take position either in the US or in the local market, whereas the first strategy is feasible only in integrated markets. Moreover, we define two modified versions ($ISRns_{ADR}$ and $ISRns_{UND}$) of the second and third strategy, where short-selling is not allowed and therefore a neutral position replaces the short position cases. In other words, the $ISRns_{ADR}$ rule suggests that the investor takes a long position in ADR when $ADRspread_{t-1} < 0$ and a neutral position in ADR otherwise. In the case of neutral positions, we replace as actual return the average return of the "buy and hold" strategy over the whole period.

Finally, we define two last active strategies as combinations of some of the above. In particular, in order to account for partial market segmentation the ISR_{seg} strategy consists of using the $ISR_{ADR\ spread}$ for developed markets and the ISR_{ADR} rule for emerging markets. The intuition behind such a strategy is that the investor usually faces ownership restrictions, or high transaction costs in UND portfolios of emerging markets and may thus apply two different rules

according to the home market of the ADR firm. The returns os such a strategy can be noted as

$$ISR_{seg_j} = ISR_{ADR\ spread_j} \uparrow_{j=Developed} + ISR_{ADR} \uparrow_{j=Emerging} \quad (8)$$

In order to account for the presence of short-selling restrictions in several countries, we define the ISR_{ss} strategy. The investor follows the $ISR_{ADR\ spread}$ rule in panel observations where, according to Bris et al. (2007) data short-selling is allowed and practiced, whereas she uses the $ISRns_{ADR}$ rule when and where short-selling is prohibited. The returns of such a strategy can be written as

$$ISR_{ss_{j,t}} = ISR_{ADR\ spread_{j,t}} \uparrow_{DumNSpr_{j,t}=1} + ISRns_{ADR} \uparrow_{DumNSpr_{j,t}=0} \quad (9)$$

Our final sample consists, thus, of 35 countries identified as our cross-sectional identities, with 531 weekly observations for each variable, or otherwise stated, 18'585 pooled panel observations for each variable, including returns, illiquidity measures, bilateral exchange rates, ADR spreads, sentiment proxies. For a complete list of the variables used in the empirical part, one may refer to table 3. After performing stationarity tests and given the first order autocorrelation of our returns and ADR spreads, we decide to use both level and change variables for our estimations. The goal of this study to focus on the impact of aspects such as relative investor sentiment, aligns it with Chan et al. (2008) additional motivation for using change variables. Their motivation concerns the indirect control for other firm and country characteristics that are either relatively stable over time or for which proxies are hard to obtain. Typical examples are restrictions on foreign ownership or short sale constraints, that are hard to quantify in a relatively long and frequent time series span. As far as the methodology is concerned, we mostly use fixed-effect generalized least squares estimations with White heteroskedasticity consistent covariance matrix. We perform evaluation tests of our forecast series and robustness tests of all our estimated equations by using the method of seemingly unrelated regressions, without showing the results since they do not vary substantially.

4 Results

4.1 ADR spreads properties and their components

It is interesting to begin our empirical results by highlighting the main indications from descriptive statistics and univariate analysis. On a cross-sectional level, figure 1 reveals that adjusted ADR spreads exhibit higher dispersion and absolute value among emerging market firms than developed market firms. On a time-series level, the pairwise correlation matrix of ADR spreads shows that

more that 75% of pairwise correlation coefficients is positive, among of which 45% is significant at the 95% confidence level. There is therefore evidence that ADR spreads could be due, at least to some extent to various common factors.

The definition we use for adjusted ADR spreads is based on two portfolios, the ADR and the exchange rate adjusted ($UND - ER$) portfolio, which are conintegrated. This property is very useful in the subsequent part where we extract information incorporated in ADR spreads. In addition, unit root tests on both time series ADR and UND of the spreads components, are rejected. We therefore can safely use levels of tese variables in the multivariate analysis. Both series exhibit significant first and second order autocorrelation, we thus include two lags of each dependent variable in our estimations. ADR spreads exhibit significant first order autocorrelation, we thus include only one lag of the dependent variable in our estimations.

The results on the factors that drive each one of the two components of ADR spreads, help us understand their structure. In such a way, we have a better idea of what to expect from the subsequent factor analysis on spreads themselves. As far as the determinants of ADR returns are concerned, we test equation (2) and the first column of Table 4 confirms most previously established results. In particular, ADR returns are positively affected by the underlying security returns and US excess market returns. They are negatively affected by US dollar appreciations with respect to the local currency, as well as by increasing ADR market illiquidity.

We further examine the channels through which investor sentiment affects stock returns. Table 4 tests equation (4) and confirms most of our hypotheses of section 2. We thus provide answers to the following question: Are US investor sentiment levels, changes in sentiment or non-neutrality in investors' expectations determinants of ADR returns? Even though the impact of sentiment levels is statistically insignificant, the answer to the two latter questions is yes. We note that the relationship is economically more significant for changes in sentiment, but statistically more significant for non-neutrality in expectations. Changes in US sentiment ($SENT_{US}$) negatively affect ADR returns as we expect from theory presented in section 2. On the other hand, an increase in non-neutrality in expectations, as proxied by $abs(SENTl_{US})$ has a positive impact on ADR returns. A possible interpretation could be that periods when analysts express firm non-neutral views are usually associated with increased assets' volatility. Such a volatile environment could increase the risk premium required by investors and thus their expected return on assets, such as the ADR portfolios. We note that the negative impact of sentiment changes contradicts the positive impact of consumer sentiment on ADR returns found by Grossmann et al. (2007).

Robustness tests for our estimations not presented in the tables include re-

placing ADR returns by excess ADR returns as the dependent variable. When we compare the estimations between ADRs based in emerging and ADRs based in developed markets, the statistical significance is non-surprisingly much higher for the latter, whereas the economic significance of US excess returns is surprisingly higher among emerging markets. Finally, dummies for the after-September 11 era have a positively significant impact on ADR returns. Dummies related to countries short-selling restrictions, or the LaPorta (1998) proxies for legal framework are omitted from the tables, since although they exhibit the expected sign, they are not significant.

In the second column of table 4 we show the main determinants of UND portfolio returns testing equation (3). One may notice that the economic importance of US market returns decreases, nevertheless it remains statistically significant. UND portfolios are as expected largely explained by local market returns. They are positively affected by US dollar appreciations; an explanation would be that often such firms active on ADR programs are export oriented and thus have an important exchange rate exposure. The UND portfolio wide illiquidity proxy has also a negative impact. Finally, on the second column, we see that UND returns are significantly positively affected by US sentiment changes, confirming results by Grossmann et al.(2007). The positive effect of non-neutrality in expectations is valid for UND returns as well. When we try proxies for local sentiment though,[11] such as the sentiment indices for the 13 EU countries, there is no significant impact, so we do not present the results. We perform robustness tests by estimating the same specification with seemingly unrelated regressions and all previous conclusions remain unchanged.

Before presenting the results on the multivariate factor analysis of ADR spreads with various control variables, we test on a preliminary level how US investor sentiment may explain ADR mispricing ($abs(ADRspread)$). The third and fourth column of Table 4 gives us a first idea of how ADR spreads account for US investor sentiment. Increasing US optimism is once again associated with decreasing ADR spreads as well as decreasing mispricing in absolute value. In other words, the more US investors become pessimistic about future dividend yields relatively to local investors, the more ADR spreads will increase. This is due to the fact that over-pessimistic US investors under-estimate expected dividend yields and as a consequence their realized ADR returns are higher. On the other hand, when investor sentiment improves, ceteris paribus there is a tendency for overoptimism. Investors are then willing to accept a lower expected return on an asset with high returns in times of overoptimism. Another result is that levels of sentiment and non-neutrality in expectations do not significantly affect spreads, but they both seem to increase mispricing in absolute terms. In

[11] We note that for most emerging markets, we do not have a proxy for local sentiment. We thus are unable to test the impact of local sentiment on UND portfolios on a large cross-section of our sample.

total sentiment related variables seem to account for at least 10% of the total variation of ADR spreads.

4.2 Spreads due to market microstructure

The results of this subsection show the importance of market microstructure variables that explain ADR spreads. Such variables may affect spreads via imposing barriers to arbitrage, as for example short-selling constraints do. They may also affect spreads via the introduction of additional risk premia, or via a combination of the two paths, as for example the relative market wide illiquidity measures do.

In the framework of testing equation (5), we confirm the results by Aggarwal et al. (2007) and Chan et al. (2008) who show the importance of relative illiquidity in explaining ADR spreads. Table 5 shows evidence that relative illiquidity is among the main determinants of ADR spreads, with the expected negative sign. In accordance with liquidity adjusted asset pricing models, investors are willing to accept a lower expected return on an asset with high returns in times of high relative market illiquidity. Even though in our estimations, we present results only with the Amihud illiquidity measure, results do not change much when using the "infrequency" measure. They are slightly more significant for emerging market firms and slightly less for developed markets. All specifications of table 5 that are based on equation (5), show that the impact of relative illiquidity remains important for explaining both ADR spreads and their absolute values, which proxy mispricing in a more general way. Intuitively, the impact of higher illiquidity difference between two markets has a positive impact on the absolute value of "mispricing". One point that does not appear in the tables, but that is worth to comment on, is that illiquidity in the US market appears to have a more important effect on ADR spreads than illiquidity in local markets. This could be due to the claim that ADR spreads are mostly determined by investors in the US market, than investors in the local market. When examining the impact of sentiment proxies on spreads, we find a similar pattern, which also justifies the focus of this study in how ADR spreads reflect mostly US market sentiment than local sentiment.

Our results show that we cannot reject the partial market segmentation hypothesis, since ADR spreads are affected by both common global factors and local factors. In other words, different and common risk factors affect US and local markets and these factors are reflected in ADR spreads. Tests of equation (5) in table 5 show evidence that US excess market returns are among the global factors affecting ADR spreads. In alignment with the country fund premium literature and Bodurtha et al. (1995), we find an analogous result that ADR spread changes correlate positively with contemporaneous excess US market returns. A reason for this is that the magnitude of sensitivity to the US market

factor is higher indeed for ADRs than UNDs as it is shown in table 4. However, contrary to Bodurtha et al. (1995), we find that UNDs remain positively correlated with excess US market returns, even after controlling for local market returns and exchange rate fluctuations. Findings by Lee et al. (1991) on domestic fund premiums differ in that they do not find significant correlation between fund premium changes and US market returns. Our findings support evidence of higher degree of markets' integration as reflected by the globally systematic pricing of US market factor. On the other hand, local factors such as local excess market returns, proxies for local market development, or local illiquidity also significantly affect ADR spreads. These findings support evidence against markets' perfect integration hypothesis and in favor of a so-called "partial market segmentation".

As far as explaining the cross-sectional variation of ADR spreads is concerned, we find that the degree of market development of an ADR's home country, as well as the country's classification as an emerging or developed economy, affect spreads in a significant way. According to Aggarwal et al. (2007), if a portfolio of firms is based in an emerging market, with consequently higher trading costs, investors allocate larger fractions of their investment in the ADR portfolio of these companies relative to the underlying local portfolio. As a result, demand for ADR securities increases and ADR spread increases in absolute value. Evidence from univariate analysis, table 1a and figure 1, all confirm such a prior, since firms from emerging markets exhibit higher absolute ADR spreads. In addition, specification C of table 5, includes a dummy variable for each emerging market UND portfolio and shows that mispricing is consistently higher in those markets.

The impact of several LaPorta et al. (1998) country variables as well as the impact of Bris et al. (2007) proxies for short-selling regulations appear to be significant. In particular, our proxy for "mispricing" ($abs(ADRspread)$) is lower in countries where short-sales are legally permitted ($DumNSth$), as well as in countries where short-sales are a common practice ($DumNSpr$). This is intuitive, since short-sales restrictions create barriers to arbitrage and lead to an increase in mispricing. Furthermore, countries where the risk of expropriation is low and thus investor protection is high, exhibit lower mispricing proxies. Countries where accounting standards are low surprisingly have lower mispricing proxies as well. The negative expected impact of creditors' protection is only verified in our subsample of developed market firms. As stated in the introduction, microstructure related explanations of these cross-sectional variations of spreads are only one part of the picture. The objective of the next subsection is to study whether sentiment related variables is another important part of it.

4.3 Spreads due to sentiment

In order to interpret ADR spreads in terms of aggregate US investor sentiment, one may rely on studies introducing heterogeneity of information among agents[12]. They show that US aggregate pessimism drives US market price of risk at a higher level than what full information asset pricing models would suggest. Higher US market price of risk, ceteris paribus means positive ADR spread. In alignment with theoretical predictions, it is interesting to observe in figure 2, that the three dates on which ADR spread takes the maximum positive value are the observations immediately after the terrorist attacks of September 11[13], the 30th ASEAN Ministerial Meeting announcing serious concerns during the Asian crisis of 1997 and the Russian decision to float the ruble during the crisis of 1998. There is therefore evidence that positive ADR spreads express to some extent US investors' aggregate relative pessimism.

Nevertheless, on average for our 10 year period, we observe negative ADR spreads across the 35 countries. The average negative spreads are interpreted by aggregate US optimism and can be due to three effects. Firstly, because agents with lower beliefs have less wealth (wealth effect). Secondly, agents with lower beliefs have higher risk aversion coefficients (risk aversion effect). Thirdly, agents do not face a symmetric dispersion of beliefs, in our case meaning that optimistic agents are far more optimistic than how pessimistic agents are with respect to the true value.

On a multivariate level, results of tests on the theoretical section's equation (6) are shown in table 6. We find evidence that ADR spreads are significantly negatively affected by relative US sentiment changes. In other words, the more pessimistic are the changes in sentiment for the representative US investor, compared to the changes in sentiment for the foreign investor, the more ADR spreads will increase. As far as the economic significance is concerned, specification A shows that relative investor sentiment is at least as important as relative market wide illiquidity. In terms of R^2, we notice that specification A of table 6 exhibits a higher explanatory power of at least 8% compared to the one of specification A of table 5, where no sentiment proxies are used.

It is interesting to check through specifications B and C, how different US sentiment proxies affect the absolute value of ADR spreads, which represents mispricing in a more general way. We find that all three proxies for US sentiment significantly increase misprcing. In particular, US sentiment changes, US sentiment levels, as well as their absolute value lead to an increase in mispricing. The absolute value of the investor sentiment variable, by construction is a measure of non-neutrality in investors' expectations, since it shows how much

[12] See Berrada (2006).

[13] This still holds when taking into account the fact that the US stock markets remained closed during our first calendar weekly observation after September 11.

analysts' average opinion differs from the neutral opinion. Some intuition, especially for this last result could be that high non-neutrality in expectations increases assets' volatility and therefore the assets' expected returns.

An additional question, which relates to the notion of sentiment through a different perspective and which examines equation (7), is the following: how do investors' expectations about the evolution of fundamentals, such as exchange rates and market returns, explain part of ADR spreads evolution? The answer is significantly and this is shown in specification D of table 6. Compared to Chan et al. (2008) who perform the same test but find contradictory results for US excess market returns, we find a significant impact of expectations with the predicted sign for two out of the three estimated variables. The issue here once again was the choice of proxies for expectations about future exchange rate and stock market changes. Following the martingale property hypothesis, we use the most recent changes as a proxy for such expectations.

Our definition of the exchange rate implies that a positive exchange rate change corresponds to a depreciation of the local currency. An investor in an ADR of a firm from country X is therefore willing to pay a higher premium if she expects the currency of country X to appreciate in the next period (negative exchange rate change). The expected sign on the coefficient of exchange rate changes is negative. The same investor is also willing to pay a higher premium if she expects the stock market of country X to perform relatively better than the US stock market. Expected local stock market returns are supposed to have a positive impact on ADR spread, whereas expected US stock market returns are supposed to affect negatively ADR spreads. Empirical estimations of table 6 cannot reject theoretical predictions with the exception of exchange rate expectations' impact that is insignificant.

4.4 Informational content of spreads

We examine the information that ADR spreads convey by focusing on two directions. The first one concerns the identification of structural breaks in either sentiment or microstructure related variables' impact, in order to draw conclusions about implicit variations in parameters of different investor groups, such as their degree of risk aversion. The second direction is to evaluate the predictive power of spreads on returns of different active investment strategies generating abnormal returns.

As far as structural breaks are concerned, we consider two major events: the introduction of the euro and the terrorist attacks of September 11, 2001. Our main interest is to examine the impact of American investors' relative optimism change on ADR spreads before and after each event. We use a window period of 3 years around the event for our estimations. Interaction effects and potential breaks in the impact of determinants of ADR spreads on these latter are

presented in table 7. For comparison purposes, we use only the ZEW source of sentiment proxies in this estimation. Since ZEW indices of market sentiment are only available for 6 major world economies (U.S., U.K., Japan, France, Germany and Italy), we make the following simplifications while computing local sentiment proxies ($SENT_{LOC}$): For developed markets we use the weighted average of U.K., Japan, France, Germany and Italy. for the EMU region, the weighted average of France, Germany and Italy, whereas for Asia, the Japan index. For emerging markets, we are obliged to consider exclusively the US market sentiment index, since there is no such benchmark index in emerging markets. The coefficient for the emerging markets is no longer significant, showing that absolute US market sentiment does not affect significantly emerging market ADR spread.

Specifications A and B of panel I show that there is a structural break around September 11, 2001, as to the impact of relative U.S. investor sentiment on ADR spreads. A negative shock on US investor sentiment (exogenous increase of pessimism) would lead to a significant increase in ADR spreads before September 11. This in line with traditional theory linking pessimism with higher market price of risk [see Cecchetti et al. (2000), Abel (2002), Berrada (2006)]. However, it is interesting to note that for some period after September 11, an increasing US relative pessimism leads to a decrease in ADR spreads.

As discussed in a preceding section, let's suppose that there exists heterogeneity in beliefs between two major types of agents, one representative US investor and one representative local investor. Given that the perfect integration hypothesis is rejected and that the two types of investors mostly proceed to transactions in their respective markets (ADR or underlying market) for the same underlying stochastic dividend, ADR spreads can be perceived as differences in the subjective market price of risk of the two types of agents. As a result, the observed structural break of the impact of US investors' relative pessimism or optimism on ADR spreads could largely be due to sudden increase in the risk aversion coefficients among the US investors, ceteris paribus[14]. This is an interesting result, since it shows that ADR spreads could be used in order to extract risk aversion coefficients between different groups of investors. Furthermore, structural breaks on the impact of sentiment on ADR spreads allow us to extract shocks in risk aversion differences between groups of investors.

A similar argument can be used in order to interpret the change of sign in panel II for eurozone based firms, around the date of the introduction of the euro currency. Even though the signs are not significant, the change from a negative to a positive sign shows a tendency, ceteris paribus, that investors of the eurozone become less risk averse after the introduction of the common currency.

[14] By ceteris paribus in these models of heterogeneous information, we suppose that the consumption proportions of each type of investor, as well as the volatility of the unique (for each firm) underlying stochastic dividend stream remain constant.

The insignificance of the reported signs could also have to do with the fact that, as shown earlier, ADR spreads rather reflect the US than local investors' sentiments. As far as microstructure proxies are concerned, specifications C and D present a break around September 11, where suddenly relative illiquidity becomes a significant pricing factor for ADR spreads in emerging markets. For robustness purposes, we perform Chow tests for these dates that confirm our structural break hypothesis.

The second direction in which we find that ADR spreads convey useful information for investors is their predictive power on several passive as well as active investment trading strategies. A critical aspect of the spreads that is exploited here is their mean reversion property, as well as the cointegrating properties of spreads' components that we previously discussed. Among our main results, table 8 shows that we cannot reject the investor sentiment hypothesis as presented by Bodurtha et al.(1995). Higher (lower) ADR spreads tend to be associated with lower (higher) future ADR returns. There is a clear negative relationship between ADR spreads at time t and ADR returns at time $t+1$. The relationship is robust among both developed or emerging market groups. Its economic significance is much higher among developed markets though. This reveals that there is a cross-sectional variation in the magnitude of information conveyed by ADR spreads for different countries. The reason could be related to higher asymmetries in information and transaction costs in emerging markets, that undermine the information provided in a given level of spread. Spreads' significant impact persists even after controlling for market returns, market wide illiquidity, US investor sentiment changes, and non-neutrality in expectations explicitly. We claim that in such a case ADR spreads can be viewed as proxies for US *relative* sentiment change. In relation to our control variables, we find that future ADR return is increasing in the lagged change in US investor sentiment. as well as increasing in non-neutrality in expectations.

On the contrary, specification B of table 8 reveals that current ADR spreads do not have any significant impact on future UND returns. We therefore conclude that relative US sentiment change is a component of the return generating process of an ADR, but not of its underlying asset, UND. This result reveals the existence of an asymmetry of the important impact of US relative sentiment on ADRs as compared to the insignificant one on UNDs. We deduce that US investors are prone to trade on sentiment and noisily perceive fundamental values as in Hardouvelis et al. (1994). Only a small component of the ADR spreads capture the sentiment of local investors. This result should however be interpreted with caution: it does not necessarily mean that investor sentiment is a systematic pricing factor for ADRs. Using a single market factor pricing model, we do not find any significant positive alphas that would imply that there are other missing systematic factors.

An additional goal is to test whether the various active investment strategies defined in section 3 generate abnormal returns and to what extent these returns are due to the absolute size of ADR spreads, which proxies for mispricing. The first proposed active investment strategy, $ISR_{ADR\ spread}$, the rule consists of taking a long position in the ADR portfolio and a short position in the UND portfolio if $ADRspread_{t-1} < 0$ and vice versa. Such a strategy exploits the mean reversion observed in spreads and shows that ADR spread at period t does predict to some extent a change in the spread at period $t+1$. It further assumes that investors can take positions in international markets without restrictions and that there are no short-selling constraints. The other four proposed strategies are also considered, so as to account for cases of market segmentation (strategies ISR_{ADR} and ISR_{UND}), as well as for frameworks of both market segmentation and presence of short-selling constraints ($ISRns_{ADR}$ and $ISRns_{UND}$).

The informational content of the size of the ADR spread, as measured by its absolute value, is shown in table 9. With the exception of the two investment strategies based only on UND portfolios, we find that the larger the observed ADR spread in absolute value, the higher the return of each strategy in the subsequent period. Furthermore, the impact of our "mispricing" proxy is highly significant. Once again, we find that the impact of ADR spreads is asymmetric, since they convey far more useful information for future ADR returns than for future UND returns. For illustrative purposes, we choose the $ISR_{ADR\ spread}$ strategy in order to evaluate the forecast of its weekly returns, as shown in figure 3a and 3b. From both the Theil Inequality test[15], as well as the arbitrary zoom of figure 3b, we draw the conclusion that our mean return is correctly forecasted, whereas its volatility is under-estimated. Levels of R^2 for the $ISR_{ADR\ PREM}$ strategy are acceptable for out-of-sample estimations. We do not explicitly control for transaction costs, due to unavailability of data, but we use market wide illiquidity as a control for market microstructure issues. We draw the conclusion that the informational content of ADR spreads is important, even though asymmetric and could be further exploited and analyzed.

Finally, it is interesting to compare our various strategies' performance by using a classical three-factor asset pricing model as a benchmark. Table 10 presents three panels. In panel I, we evaluate the performance of the $ISR_{ADR\ PREM}$ strategy, which assumes integrated markets and no short-selling constraints. Panel II evaluates the ISR_{seg_j} strategy, which is feasible in a framework of partial market segmentation, since it allows the investor to use the ISR_{ADR} rule for emerging market UND portfolios, where there usually exist costly barriers in foreign trading. Panel III evaluates the performance of the $ISR_{ss_{j,t}}$ strategy, which is feasible in a framework of both partial market segmentation

[15] The higher the covariance proportion in comparison to the bias and variance proportion the better the forecast.

and variations in the presence of short-selling constraints. Such a strategy allows the investor to use the $ISRns_{ADR}$ rule for observations when and where short-selling in the country of the UND portfolio is not allowed.

If we do not control for sentiment proxies, table 10 shows that in all three panels we obtain an average weekly abnormal return (alpha) varying from 36 to 32 basis points. The fact that abnormal returns decrease from panel I to panel III is intuitive, because the assumed framework becomes more segmented and short-selling constraints become possible; such barriers restrict our investment strategies exploiting ADR spreads' implicit information on an international level. The magnitude of such abnormal returns is nevertheless attractive when compared to previous literature's estimated transaction costs levels for developed markets. What is even more interesting is that factors related US investor sentiment, such as last period's US investor sentiment and non-neutrality in analysts' expectations, seem to account for more than 5 basis points of the abnormal return. The importance of sentiment related factors is shown in each of the three panels' second column, where the abnormal return is reduced on average by 5 to 6 basis points on a weekly basis. We can therefore draw the conclusion that the informational content of sentiment levels and non-neutrality in expectations proxies could be further exploited in asset pricing models.

5 Conclusions

Building on the strands of literature analyzing price discrepancies, this study tests several existing and new hypotheses on ADR spreads. Among our main findings is that we show that ADR spreads do indeed reflect to some significant extent relative US investor pessimism. These spreads are also affected by market, exchange rate and liquidity factors, proxies more generally related to differences in market microstructure aspects between the US and the ADR's home county. The degree of the home country's market development and its regulatory framework related to barriers in arbitrage, through for instance the presence of short-selling constraints, are also important explanatory factors. Investors' expectations about the evolution of market returns and exchange rates have a significant influence on the sign and size of ADR spreads. In addition, September 11, appears as a structural break, when US investors become relatively more risk averse with respect to the rest of the world.

On a cross-sectional level, the perfect market integration hypothesis is rejected, even though developed markets seem more integrated than emerging markets. An important finding is that current ADR spreads contain valuable informational content with respect to the future evolution of ADR returns. The economic significance of this informational content is higher for developed markets. Their predictive power is asymmetric, since it does not concern future

UND returns. ADR spreads also convey valuable information in relation to the future returns of various active trading rules defined on the basis of past spreads. Finally, US sentiment and non-neutrality in investors's expectations account for a significant part of the abnormal returns generated by these active trading strategies.

There is one aspect of the choice of ADR price discrepancies as our "natural experiment" for the extraction of US investors' sentiment that is not fully exploited in this study. That is the possibility to use additional firm-specific data accounting for capital structure and profitability characteristics. There is plenty of room, hence, for further research towards at least two directions. First, there are interesting perspectives in relation to the inclusion of other firm specific variables, that would probably add explanatory power in the ADR spread factor analysis. Second, one may shed more light on the informational content and predictability power of ADR spreads by evaluating the performance of a large variety of active trading rules and testing their persistence.

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A Figures

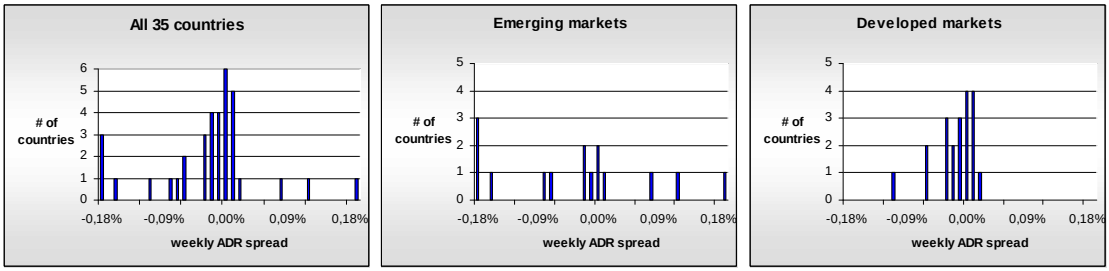

Figure 1. Histograms of ADR spreads means for our sample country-based portfolios between July 1997 and August 2007

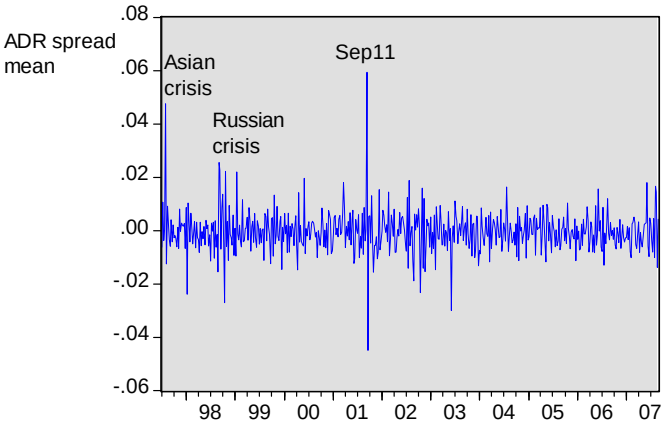

Figure 2. Average weekly ADR spread across 35 countries between July 1997 and August 2007

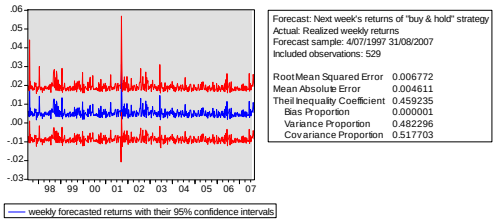

Figure 3a. Forecast evaluation of weekly returns of the *ISRadrspread* strategy exploiting information in past ADR spreads

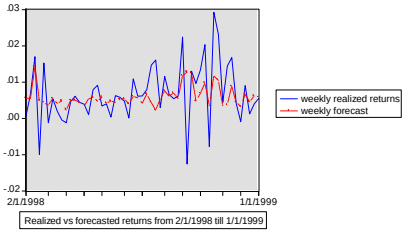

Figure 3b. Forecast evaluation arbitrary zoom in one year of our sample

B Tables

Table 1a. Descriptive statistics of ADR and UND portfolios of the whole sample. Time span: July 1997 to July 2007.

Country of origin	Number of countries	(US dollars) ADR portfolio annual returns	(US dollars) UND-ER portfolio annual returns	Adjusted annualized ADR spread
Developed countries	20	7.51%	9.31%	-1.80%
Emerging markets	15	1.06%	7.75%	-6.69%
Total sample	35	4.74%	8.39%	-3.65%

Table2a. Descriptive statistics of portfolios and market returns by country: July 1997 to July 2007.

Country of origin	Number of firms	(US dollars) ADR portfolio annual returns	(local currency) UND portfolio annual returns	(local currency) Local market annual returns
Argentina	7	-3.14%	6.96%	9.20%
Australia	24	0.97%	1.41%	9.05%
Austria	6	7.15%	7.25%	11.56%
Brazil	15	6.35%	8.47%	17.15%
Chile	11	-0.66%	2.05%	8.72%
China	4	2.73%	10.35%	10.19%
Denmark	1	17.23%	17.86%	11.93%
Finland	3	13.60%	14.00%	13.98%
France	17	6.59%	7.47%	8.44%
Germany	14	7.92%	7.36%	5.54%
Greece	1	10.73%	12.64%	11.01%
Hong Kong	34	1.13%	2.54%	4.53%
Indonesia	2	3.72%	19.87%	8.08%
Ireland	6	16.91%	15.46%	8.97%
Israel	2	13.14%	15.31%	11.54%
Italy	4	2.83%	5.56%	8.54%

Table 2b. Descriptive statistics of portfolios and market returns by country: July 1997 to July 2007.

Country of origin	Number of firms	(US dollars) ADR portfolio annual returns	(local currency) UND portfolio annual returns	(local currency) Local market annual returns
Japan	40	1.90%	2.57%	0.96%
Malaysia	1	-7.13%	10.48%	2.32%
Mexico	7	4.86%	9.54%	17.67%
Netherlands	13	3.72%	2.67%	3.92%
Norway	2	4.28%	8.11%	9.89%
Peru	3	-0.27%	11.55%	8.70%
Philippines	3	-2.13%	6.50%	2.54%
Portugal	2	4.91%	3.99%	6.51%
Russia	4	12.48%	13.73%	18.04%
Singapore	8	7.44%	14.74%	6.81%
South Africa	11	7.83%	13.53%	14.44%
South Korea	3	9.75%	17.23%	13.26%
Spain	5	10.32%	9.14%	8.92%
Sweden	6	10.40%	12.49%	8.52%
Switzerland	4	6.70%	6.44%	5.42%
Taiwan	1	-10.26%	-13.09%	-0.34%
Thailand	4	-3.39%	12.13%	4.59%
United Kingdom	44	2.27%	3.42%	4.18%
Venezuela	3	-4.85%	7.93%	5.52%
TOTAL	315	4.56%	7.95%	8.49%

Table 3. Variable definitions and sources. Variables used hereafter are expressed in weekly frequency. For each variable, we provide a short definition, its type (category), as well as the source from which they were accessible (data source).

Variable	Definition	Category	Data source
$ADR_{,j,t}$	Equally weighted average of weekly return on ADR shares closing price of country j	portfolio	Thomson - Datastream
$UND_{j,t}$	Equally weighted average of weekly return on underlying shares closing price of country j	portfolio	Thomson - Datastream
$ER_{j,t}$	Nominal exchange rate change (GTIS) of country j Value of 1 USD expressed in local currency	country	Thomson - Datastream
$ADRspread_{j,t}$	Adjusted ADR spread $ADR_{j,t} - UND_{j,t} + ER_{j,t}$	portfolio	created
$R^{ex}_{j,t}$	Excess market return (Market index- Risk free rate)	country	Thomson - Datastream
$ILL_{j,t}$	Illiquidity measure (Amihud or Infrequency)	portfolio	created
$SENT_{j,t}$	Investor Sentiment index for country j (ZEW or EU)	country	Thomson - Datastream & Reuters
$ISR_{j,t}$	Weekly return of investment strategy	portfolio	created
$DumSep11$	Dummy for period after the terrorist attacks of September 11, 2001	general	created
$DumNS_{j,t}$	Dummy for absence of short-selling constraints	country	Bris et al. (2007)
$RightsCred_j$	Variable proxying for creditor rights	country	LaPorta et al. (1998)
$RightsExpr_j$	Variable proxying for low risk of expropriation	country	LaPorta et al. (1998)
$Accounting_j$	Variable proxying for accounting standards	country	LaPorta et al. (1998)

Table 4. Estimates from panel regressions on level variables. Specifications A and B use *contemporaneous ADR* and UND portfolio returns as the dependent variable. Specifications C and D use *contemporaneous* ADR spreads and their absolute value (which is used as a proxy for mispricing) as the dependent variable. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are shown in parenthesis.

		A: ADR portfolio		B: UND portfolio		C: ADR spreads		D: abs(ADR spreads)	
Variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
$AR(1)$	1^{st} lag	-0.377***	(0.000)	-0.024**	(0.017)	-0.324***	(0.000)	0.332***	(0.000)
$AR(2)$	2^{nd} lag	-0.134***	(0.000)	-0.003	(0.752)				
UND	Underlying return	0.871***	(0.000)						
R^{ex}_{US}	US excess return	0.103***	(0.000)	0.041***	(0.000)				
R^{ex}_{LOC}	Local excess return			0.973***	(0.000)				
ER	US bilateral ER change	-0.818***	(0.000)	0.054***	(0.000)				
ILL_{ADR}	Amihud illiquidity	-0.001**	(0.050)						
ILL_{UND}	Amihud illiquidity			-0.002**	(0.015)				
$SENTl_{US}$	US sentiment level	1E-05	(0.629)	-0.001	(0.420)	0.001	(0.437)	0.002***	(0.000)
$SENT_{US}$	US sentiment change	-0.005**	(0.037)	0.028***	(0.000)	-0.009***	(0.000)	-0.009***	(0.002)
$abs(SENTl_{US})$	Non-neutrality in expectations	0.001***	(0.000)	0.001***	(0.002)	0.001	(0.331)	0.003***	(0.000)
$DumSep11$		0.001***	(0.000)	-1E-05	(0.655)				
Fixed Effects		YES		YES		YES		YES	
Method		GLS -White correction cross section weights		GLS -White correction cross section weights		GLS -White correction cross section weights		GLS -White correction cross section weights	
Countries		33		35		35		35	
Panel observations		15'621		18'176		18'401		18'401	
R^2 (adjusted R^2)		81.90%	(81.85%)	71.81%	(71.75%)	10.56%	(10.37%)	14.99%	(14.81%)

Table 5. Estimates from regressions explaining ADR spreads via market microstructure variables. Specification A uses *contemporaneous ADR spread* as the dependent variable. Specifications B, C and D use the absolute value of *contemporaneous ADR spread* (proxy for mispricing) as the dependent variable. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively. P-values are shown in parenthesis.

Variable	Proxying	A: ADR spreads Coefficient	(p-value)	B : abs(ADR spread) Coefficient	(p-value)	C : abs(ADR spread) Coefficient	(p-value)	D : abs(ADR spread) Coefficient	(p-value)
$AR(1)$	1^{st} lag	-0.321***	(0.000)	0.349***	(0.000)	0.355***	(0.000)	0.339***	(0.000)
c	constant	-0.001**	(0.028)	0.027***		0.006***	(0.000)	0.042***	
$R^{ex}_{US} - R^{ex}_{local}$	Market factors differential	0.136***	(0.000)						
$abs(R^{ex}_{US} - R^{ex}_{local})$				0.108***	(0.000)	0.118***	(0.000)	0.109***	(0.000)
$ILL_{ADR} - ILL_{UND}$	Relative market illiquidity	-4E-06**	(0.049)						
$abs(ILL_{ADR} - ILL_{UND})$				5E-06**	(0.029)	5E-06***	(0.024)	4E-06**	(0.021)
$DumNSth_{j,t}$	Short selling allowed	0.001**	(0.034)	-0.004***	(0.000)			-0.006**	(0.039)
$DumNSpr_{j,t}$	Short selling practised	-2E-04	(0.450)	-0.002***	(0.001)			-0.003***	(0.000)
$RightsCred_j$	Country creditor rights			5E-05	(0.476)			-2E-04***	(0.009)
$RightsExpr_j$	Country low expropriation risk			-0.002***	(0.000)			-0.003***	(0.000)
$Accounting_j$	Country accounting standards			5E-05***	(0.000)			5E-05***	(0.000)
Dummy Sep11	Post September 11, 2001	2E-04**	(0.038)	4E-04**	(0.034)			3E-05	(0.880)
DumEmerging	Dummy for emerging economy					0.006***	(0.000)		
Method		GLS -White correction		GLS -White correction		GLS -White correction		GLS -White correction	
Countries		32		28		33		19 developed	
Panel observations		15'409		13'847		15'745		9'344	
R^2 (adjusted R^2)		15.64%	(15.61%)	15.90%	(15.85%)	14.01%	(13.99%)	17.38%	(17.30%)

Table 6. Estimates from regressions explaining *contemporaneous ADR spread* via sentiment and market microstructure variables. Specifications A and D explain ADR spread for 5 countries on which $SENT_{LOC}$ is available by ZEW. Specifications B and C explain abs(ADR spread), or "mispricing" by including sentiment variables. Specification D includes investor expectations. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are shown in parenthesis.

		A: ADR spread		B : abs(ADR spread)		C : abs(ADR spread)		D : ADR spread	
Variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
$AR(1)$	1^{st} lag	-0.342***	(0.000)	0.292***	(0.000)	0.335***	(0.000)	-0.351***	(0.000)
c	constant					0.027***	(0.000)		
$R^{ex}_{US}-R^{ex}_{local}$	Market factors differential	0.177***	(0.000)					0.189***	(0.000)
$abs(R^{ex}_{US}-R^{ex}_{local})$				0.114***	(0.000)	0.105***	(0.000)		
$ILL_{ADR}-ILL_{UND}$	Relative market illiquidity	-4E-04**	(0.039)					-4E-04**	(0.045)
$abs(ILL_{ADR}-ILL_{UND})$				5E-06**	(0.029)	5E-06**	(0.031)		
$SENT_{US}-SENT_{LOC}$	Relative US market sentiment	-0.026***	(0.003)					-0.019**	(0.026)
$SENTl_{US}$	US market sentiment level			0.003***	(0.000)	0.003***	(0.000)		
$abs(SENT_{US})$	US market sentiment change			0.053***	(0.000)	0.053***	(0.000)		
$abs(SENTl_{US})$	Non-neutrality in expectations			0.002***	(0.000)	0.003***	(0.000)		
$DumNSpr_{j,t}$	Short selling practised					-0.002***	(0.000)		
$RightsExpr_j$	Country low expropriation risk					-0.002***	(0.000)		
ER_{t-1}	Expected ER change							-0.005	(0.751)
$(R^{ex}_{US})_{t-1}$	Expected US market return							-0.078***	(0.000)
$(R^{ex}_{LOC})_{t-1}$	Expected local market return							0.082***	(0.000)
Fixed Effects		YES		YES		Dummies		YES	
Method		GLS -White correction		GLS -White correction		GLS -White correction		GLS -White correction	
Countries		5 with ZEW data		33		31		5 with ZEW data	
Panel observations		2'630		15'652		14'795		2'630	
R^2 (adjusted R^2)		24.17%	(23.94%)	17.74%	(17.54%)	16.55%	(16.51%)	24.74%	(24.42%)

Table 7. Interaction effects estimates from regressions on change variables using *contemporaneous ADR spread* as the dependent variable. Using the changes of the regression specification A of table 6, we present here the impact of major explanatory variables around two major events. Panels I and II study the impact of the terrorist attacks of September 11 and the introduction of the euro on the influence of different explanatory variables. Coefficients' sign significance at 99%, 95% and 90% confidence level is noted by $---$, $--$, $-$ or $+++$, $++$, $+$ respectively. Not significant signs are presented in parenthesis. Specifications A, B, C and D contain all countries, developed, emerging and eurozone markets respectively.

Variable*		Proxying	A: All countries Coefficient	B: Developed markets Coefficient	C: Emerging markets Coefficient	D: EMU Coefficient
Panel I: September 11, 2001						
$SENT_{US}-SENT_{LOC}$	$Before$	US market sentiment ex ante	$--$	$--$	$(-)$	$(-)$
	$After$	US market sentiment ex post	$++$	$+++$	$(-)$	$+$
$ILL_{ADR}-ILL_{UND}$	$Before$	Relative illiquidity ex ante	$---$	$---$	$(-)$	$(+)$
	$After$	Relative illiquidity ex post	$---$	$--$	$--$	$---$
Panel II: Introduction of the euro, January 1, 1999						
$SENT_{US}-SENT_{LOC}$	$Before$	US market sentiment ex ante				$(-)$
	$After$	US market sentiment ex post				$(+)$
$ILL_{ADR}-ILL_{UND}$	$Before$	Relative illiquidity ex ante				$-$
	$After$	Relative illiquidity ex post				$---$

Note that wherever (for 20 countries) there is no data for $SENT_{LOC}$, we use a proxy for $SENT_{region}$ or $SENT_{US}$ instead of $SENT_{US}-SENT_{LOC}$

Table 8. Estimates from regressions with *future ADR and UND returns* as dependent variables. We use one period lagged variables as explanatory factors. The lagged ADR spread is multiplied with the emerging market dummy. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively. P-values are shown in parenthesis.

		A: ADR		B: UND	
Lagged Variables	Proxying	Coefficient	(p-value)	Coefficient	(p-value)
$(R^{ex}_{US})_{t-1}$	US excess market return	0.011	(0.449)	0.053***	(0.000)
$(R^{ex}_{local})_{t-1}$	Local excess market return	0.0455***	(0.005)	0.027**	(0.036)
$(ILL_{ADR})_{t-1}$	U.S. Amihud illiquidity	1E-06	(0.609)		
$(ILL_{UND})_{t-1}$	Local market illiquidity			7E-06	(0.961)
$(SENT_{US})_{t-1}$	US excess market return	0.094***	(0.000)	0.142***	(0.000)
$abs(SENTl_{US})$	Non-neutrality in expectations	0.003**	(0.016)	-0.001	(0.806)
$DumEmerging * (ADRspread)_{t-1}$	ADR spread for emerging UNDs	-0.162***	(0.001)	0.008	(0.684)
$(1 - DumEmerging) * (ADRspread)_{t-1}$	ADR spread for developed UNDs	-0.295***	(0.000)	-0.005	(0.690)
Fixed Effects		YES		YES	
Method		GLS -White correction		GLS -White correction	
Countries		33		35	
Panel observations		16'119		18'271	
R^2 (adjusted R^2)		3.46%	(3.22%)	1.27%	(1.05%)

Table 9. Estimates from regressions with five investment strategies' future returns as dependent variables (GLS White method with fixed effects). Panel I strategies allows for short-selling positions, whereas Panel II strategies do not. The $ISR_{ADR\ spread}$ strategy. implies a long position in ADR, short in UND if $ADRspread_{t-1} < 0$ and vice versa. Specifications B and C explain strategies implying a long position in ADR (ISR_{ADR}) or a short position in UND (ISR_{UND}) if $ADRspread_{t-1} < 0$ and vice versa. Specifications D, E explain strategies implying a long position in ADR ($ISRns_{ADR}$) or a neutral position in UND ($ISRns_{UND}$) if $ADRspread_{t-1} < 0$ and vice versa. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are in parenthesis.

Panel I : Framework with no short-selling constraints		A: $ISR_{ADR\ spread}$		B: ISR_{ADR}		C: ISR_{UND}	
Lagged Variables	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
$AR(1)$	1^{st} lag	-0.096***	(0.000)	-0.014	(0.333)	0.005	(0.581)
$\left\|ADRspread_{t-1}\right\|$	ADR spread absolute value	33.108***	(0.000)	29.256***	(0.000)	-0.017	(0.289)
$(R^{ex}_{US})_{t-1}$	US excess market return	1.098**	(0.023)	3.220**	(0.029)	-0.017	(0.180)
$(R^{ex}_{local})_{t-1}$	Local excess market return	-2.841***	(0.000)	-2.928*	(0.062)	0.002	(0.886)
$(ILL_{ADR})_{t-1}$	U.S. Amihud illiquidity	1E-04*	(0.099)	2E-05	(0.891)		
$(ILL_{UND})_{t-1}$	Local market illiquidity	0.015	(0.674)			-24-05	(0.792)
Countries		33		33		35	
Panel observations		15'714		16'173		18'298	
R^2 (adjusted R^2)		9.34%	(9.12%)	2.60%	(2.37%)	0.43%	(0.22%)

Panel II : Framework with short-selling constraints		D: $ISRns_{ADR}$		E: $ISRns_{UND}$	
Lagged Variables	Proxying	Coefficient	(p-value)	Coefficient	(p-value)
$AR(1)$	1^{st} lag	-0.071***	(0.000)	-0.019	(0.143)
$\left\|ADRspread_{t-1}\right\|$	ADR spread absolute value	16.371***	(0.000)	-0.005	(0.678)
$(R^{ex}_{US})_{t-1}$	US excess market return	2.033*	(0.064)	0.024***	(0.005)
$(R^{ex}_{local})_{t-1}$	Local excess market return	5.729***	(0.000)	0.028**	(0.012)
$(ILL_{ADR})_{t-1}$	U.S. Amihud illiquidity	6E-05	(0.656)		
$(ILL_{UND})_{t-1}$	Local market illiquidity			-3E-05	(0.704)
Countries		33		35	
Panel observations		15'888		18'298	
R^2 (adjusted R^2)		2.35%	(2.12%)	0.43%	(0.22%)

Table 10. Estimates from regressions with three investment strategies' future returns as dependent variables (GLS White method with constant and AR(1)). Panel I considers a framework with integration and short-selling. The $ISR_{ADR\ spread}$ strategy implies a long position in ADR, short in UND if $ADRspread_{t-1} < 0$ and vice versa. Panel II allows for partial segmentation. The ISR_{seg} strategy mixes $ISR_{ADR\ spread}$ strategy for developed and ISR_{ADR} strategy for emerging markets. Panel III allows for short-selling constraints. The ISR_{ss} strategy mixes $ISR_{ADR\ spread}$ strategy for observations with no short-selling restrictions and $ISRns_{ADR}$ strategy for observations with short-selling restrictions. US Market, SMB and HML refer to the three standard Fama French factors of market, size and book-to-market. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively. P-values are shown in parenthesis.

		Panel I : Integration & short-selling				Panel II : Allow partial segmentation			
Lagged Variables	Proxying	A: $ISR_{ADR\ spread}$		B: $ISR_{ADR\ spread}$		C: ISR_{seg}		D: ISR_{seg}	
alpha	abnormal return	0.360***	(0.000)	0.303***	(0.000)	0.335***	(0.000)	0.285***	(0.000)
$(\text{US Market})_{t-1}$	market	-0.022***	(0.000)	-0.021***	(0.000)	-0.018***	(0.000)	-0.018***	(0.000)
$(SMB)_{t-1}$	size	-0.009*	(0.071)	-0.013**	(0.014)	-0.009**	(0.049)	-0.012***	(0.009)
$(HML)_{t-1}$	book-to-market	-0.023***	(0.000)	-0.027***	(0.000)	-0.024***	(0.000)	-0.028***	(0.000)
$(SENTl)_{t-1}$	US sentiment level			0.042**	(0.027)			0.021	(0.212)
$(SENT)_{t-1}$	US sentiment change			0.041	(0.451)			0.061	(0.185)
$abs\left((SENT)_{t-1}\right)$	market non-neutrality			0.198***	(0.000)			0.172***	(0.000)
Panel observations		18'515 (35 countries)		18'445 (35 countries)		18'515 (35 countries)		18'445 (35 countries)	
R^2 (adjusted R^2)		0.10%	(0.08%)	0.17%	(0.13%)	0.49%	(0.47%)	0.52%	(0.48%)

		Panel III : Allow short-selling constraints			
Lagged Variables	Proxying	E: ISR_{ss}		F: ISR_{ss}	
alpha	abnormal return	0.320***	(0.000)	0.256***	(0.000)
$(\text{US Market})_{t-1}$	market	-0.014***	(0.000)	-0.014***	(0.000)
$(SMB)_{t-1}$	size	-0.006	(0.248)	-0.010*	(0.057)
$(HML)_{t-1}$	book-to-market	-0.022***	(0.000)	-0.027***	(0.000)
$(SENTl)_{t-1}$	US sentiment level			0.025	(0.204)
$(SENT)_{t-1}$	US sentiment change			0.117**	(0.033)
$abs\left((SENT)_{t-1}\right)$	market non-neutrality			0.219***	(0.000)
Panel observations		17'986 (34 countries)		17'918 (34 countries)	
R^2 (adjusted R^2)		0.74%	(0.72%)	0.2%	(0.79%)