

COUNTRY-SPECIFIC INVESTOR ATTENTION AND ADR MISPRICING

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Abstract

This paper examines the effect of country-specific investor attention on ADR mispricing. Investor attention is measured by the amount of traffic a country's Wikipedia profile page receives. A two-stage least squares (2SLS) regression is employed to examine the relationship between investor attention and ADR mispricing, but also to mitigate endogeneity between the two variables of interest. We use the FIFA World Ranking (country soccer ranking) and the number of UNESCO heritage sites as instruments for investor attention, given the unlikelihood that either of those variables can be caused by ADR mispricing. Our results show that lower levels of investor attention lead to higher ADR mispricing, therefore leading to greater divergence of the law of one price for the sample of ADRs. The results are robust across various model specifications and to well-known determinants of mispricing such as turnover, stock prices, exchange rates, and market capitalisation.

JEL: G14, G15, G40

Keywords: American Depositary Receipts, Investor Attention, Wikipedia Page Views

1. Introduction

American Depositary Receipts (ADRs) are financial instruments traded in the U.S. representing ownership in foreign publicly traded firms. ADRs are generally issued by U.S. banks. Many ADRs are publicly traded in American stock markets, such as the New York Stock Exchange and the NASDAQ. They are often seen as a convenient vehicle for U.S. investors who seek to diversify their portfolios internationally. ADRs remove the major inconvenience of having to purchase the shares directly in foreign stock markets (e.g., converting dollars to a foreign currency or establishing a brokerage account offshore). According to the law of one price, ADRs and their underlying stocks should converge to one price after accounting for exchange rates and transaction costs (Kato et al., 1990). This convergence is because the real asset (the firm) is expected to generate the same future stream of cash flows for both financial assets (i.e., the ADR and the foreign-listed stock).

Although ADRs should reflect the underlying security's price behaviour, it is not uncommon to see deviations from the price-parity condition that is expected from the law of one price. These deviations can have a positive or negative value, for which they are commonly referred to as premiums or discounts, respectively. This phenomenon is known in the literature as ADR mispricing. The study of ADR mispricing is particularly relevant for traders who may benefit from these price deviations, as Suarez (2005) shows. There is a debate in the literature on whether ADR mispricing exists. Early findings suggest that there is no mispricing on cross-listed securities, therefore, it is not possible for arbitrageurs to benefit.

For instance, Rosenthal (1983) examined the weak form efficiency of ADRs from 1974–1978. He showed that weak form efficiency is supported by the serial correlation and ran tests for a sample of NASDAQ ADRs. Later, Kato et al. (1990) also found evidence in favour of the law of one price in their study of foreign stocks from Australia, England, and Japan. They observed no significant difference between the ADR and the underlying stock's price; they attributed the small differences in the return correlation to differences in market timing. Also, Lamont & Thaler (2002) argue that limits to arbitrage can prevent the law of one price to hold and, hence, force ADRs to exhibit significant deviations (premiums and discounts) from their underlying securities.

More recent studies have found that ADR mispricing exists, and it is possible for investors to benefit from arbitrage opportunities (Wahab et al., 1993; Suarez, 2005; and Ansotegui et al., 2013). However, the factors that drive the mispricing are still being debated in the literature. For example, Foerster and Karolyi (2000) showed that investment barriers account for the long-run difference in the performance of cross-listed firms. Furthermore, Maldonado and Saunders (1983) argued that such barriers represent an arbitrage opportunity for unrestricted investors, while Kadiyala and Subrahmanyam (2004) determined that ADRs from countries with foreign ownership restrictions are sold at a premium of around 11.33%, with respect to their underlying foreign shares. Similarly, Arquette et al. (2008) found that expected currency appreciation in Chinese cross-listed stocks has a negative effect on the discounts of a sample of both ADRs listed on the NYSE and H-Shares listed in Hong Kong. According to Hsu and Wang (2008), trading volume and macroeconomic events generate heterogeneous expectations between the home and foreign markets, which might explain the premia (or discounts) observed in the data. Chan et al. (2008) showed that higher levels of liquidity in the ADR, with respect to its underlying share, lead to a higher premium.

Another stream of the mispricing literature attributes deviations from the price-parity condition to investor sentiment. Grossmann et al. (2007) looked at a sample of ADRs from nine countries and determined that transaction costs, lower dividend payments, and the difference in consumer sentiment (a proxy for investor sentiment) of the U.S. and the home country influence ADR mispricing. Hwang (2011) studied the effect of country-specific sentiment on ADR mispricing. He found that country popularity among U.S. investors is also responsible for deviations from the price-parity condition for ADRs. More recently, Beckmann et al. (2015) attributed ADR mispricing to information asymmetry with regard to the underlying stock, along with freedom scores of the home country, listing level and idiosyncratic risk. Finally, Wu et al. (2017) examined the effect of local and global investor sentiment on mispricing and found that idiosyncratic risk is an important determinant.

Recently, investor attention in stock markets has played a greater role in the finance literature. For example, Barber and Odean (2008) showed that individual investors are overwhelmed by the amount of investment options. As a result, they make their investment choices based on preference after their limited attention has put together their choice set. Van Nieuwerburgh and Veldkamp (2010), showed that the selection of risky assets depends on the assets the investor possesses information about. Moreover, the use of Wikipedia as a tool to gauge investor attention has also been established in the literature. For example, Kristoufek (2013), studied the effect of Google Trends and Wikipedia searches on Bitcoin prices; this study determined that there is an asymmetric effect with spikes in interest; he also suggests that people might search for countries on Wikipedia to learn more about their economic phenomena, such as the value of digital currencies. Also, Gozzi et al. (2020), utilised COVID-19 Wikipedia pages as a proxy for public attention to model and predict public response to media coverage and epidemic progression. This study indicates that people may search for countries on Wikipedia in response to media coverage of events happening in those countries. Moreover, Corwin and Coughenour (2008) show that limited attention to actively traded stocks results in infrequent price adjustments and increased transaction costs to less noticed stocks.

Eichler (2012) examined the relationship between investor attention and ADR mispricing. He used the number of times internet users visited websites domiciled in a particular country as a proxy for investor attention. His study used a sample of 537 ADRs for a period of three months. Eicher (2012) showed that a higher degree of investor attention leads to lower levels of ADR mispricing for the sample of 537

ADRs. Mondria et al. (2010) showed that when U.S. investors' equity home bias is lower, the more attention they pay to a foreign country's stock. Tang and Zhu (2017) studied how increases in SVIs are related to contemporary abnormal returns for a set of ADRs, implying that higher levels of attention are associated with higher returns. One of the first studies in finance literature to use Wikipedia page views information was Moat et al. (2013). This new dataset showed the predictive power of Wikipedia page views for stock returns during the Great Recession. Da et al. (2011) used the Search Volume Indices (SVI) from Google to show that increases in the searches for companies are related to a subsequent stock price increase after two weeks. Recently, Gutierrez Pineda and Perez (2021), showed that ADR's respond to changes in a high-frequency U.S. investor sentiment, similar to U.S. stocks.

Over the past few years, household internet usage data has become increasingly important and useful for scholarly research. The growth and relevance of the internet in our day-to-day activities represents a unique opportunity to observe trends and learn about the dynamics of investors' attention. Thanks to initiatives such as Google Trends and Wikipedia Trends, it is now possible to collect data from aggregated users' search history and discover its informational content for financial assets and markets, among other things.

More specifically, in this study, we argue that Wikipedia's country page views constitute a better measure of investor attention compared to the ones used in previous studies (Eichler, 2012; Mao & Wei, 2013). While this paper employs a direct measure of country-specific investor attention, past literature either use a search volume index (SVI), as in Mao and Wei (2013), or the number of clicks on search engine results from websites hosted in a particular country (Eichler, 2012; Mao & Wei, 2013). The main problem with Mao and Wei (2013) is that observations are scaled in proportion to a specific country and time span, which does not allow for an unbiased cross-country study. For Eichler (2012), the limitation is that several websites are hosted on foreign servers and the well-known practice of geographically tailored websites, which may lead to misrepresentative results. We obtain the number of times that internet users open a country's profile page on Wikipedia and use it as a proxy for investor attention to a country's ADRs. The choice of this proxy is based on Wikipedia's unquestionable position as the most popular encyclopedia freely available on the internet. The reliability and credibility of Wikipedia as a source of information is not relevant for the purpose of this study, but its popularity among users is.¹

This paper contributes to the literature on investor attention and ADR mispricing in the following distinct ways. First, using a two-stage least squares (2SLS) regression, we test whether investor attention (proxied by Wikipedia country-profile page views) impacts overall ADR mispricing for a large set of ADRs. To the best of our knowledge, this is the first study that examines the influence of Wikipedia country page views (our proxy for investor attention) on ADR mispricing. Furthermore, our dataset of ADRs includes a larger sample size compared to prior studies (Eichler, 2012) and spans from 2008 to 2014. One benefit of this sample period is that it allows us to examine if the Great Recession had an influence on the relationship between investor attention and ADR mispricing. Second, we test whether the influence of investor attention differs for Level I ADRs or Level II and Level III ADRs.² Finally, we briefly examine the role of investor attention across a variety of ADR industries (e.g., telecommunications, technology, industrials, consumer services, basic materials). This allows us to see if the influence of investor attention on mispricing is sector-specific, something prior studies have not accounted for.

¹According to Alexa.com and Similarweb.com, two popular internet traffic measuring companies, Wikipedia stands as the 5th and 12th website with most daily visits on the internet, respectively. More information can be found on <https://www.similarweb.com/website/wikipedia.org> and <https://www.alexa.com/siteinfo/wikipedia.org>.

²American Depositary Receipts (ADR) are classified in Levels I, II, and III. Level I ADR's are typically traded over-the-counter (OTC) and are not required to comply with many of the reporting regulations enforced by the Securities and Exchange Commission (SEC) applicable to U.S. companies. On the other hand, Level II and Level III ADRs need to comply with all these regulations, including SEC Form 20, GAAP reporting, Sarbanes-Oxley Act, etc. The main difference between level II and level III is the ability to raise capital through public offerings.

Overall, the results from the various 2SLS models show that a higher level of investor attention leads to a lower level of ADR mispricing. In other words, many Wikipedia country-profile page views are associated with a lower ADR mispricing for a sample of 1,840 cross-listed securities from 31 countries. Additionally, when we *separate* ADRs by level (i.e., Level I versus Level II and III), the findings indicate that the impact of investor attention on ADR mispricing is determined by the level of ADR. For instance, we show that investor attention has a greater impact on Level I ADRs relative to Level II and III ADRs. Moreover, our results show that the Great Recession has an impact on how investor attention influences ADR mispricing. For instance, the crisis dummy variable is larger for Level I ADRs than for levels II and III. Our study also shows that investor attention influences ADR mispricing across industries. For example, higher levels of investor attention reduced ADR mispricing for the consumer services industry. However, not all industries were influenced by investor attention (e.g., consumer goods, financials, and utilities). Overall, this study sheds new light on how investor attention influences ADR mispricing.

The remainder of the paper is organised as follows. Section 2 discusses the data and methodology. Section 3 presents the empirical findings, and Section 4 concludes.

2. Data and Methodology

This study employs two-stage least squares (2SLS) regressions using monthly data from January 2008 to December 2014. The data on ADRs is obtained from DataStream. The country-specific investor attention measure, Wikipedia country page views, is obtained from the Wikipediatrends.com website. The sample consists of 1,840 unique ADRs, from 31 countries³, for a total of 130,788 firm-month observations. We limit this study to include only countries for which the date range and country profile page views measure was available through Wikipediatrends.com⁴. The remaining countries are China, Switzerland, United Kingdom, Spain, South Africa, Australia, Denmark, Taiwan, Italy, Germany, Philippines, Japan, Belgium, Indonesia, France, Norway, Sweden, Netherlands, Israel, Mexico, Ireland, Finland, Chile, Russia, Brazil, Argentina, Colombia, Peru, India, Greece, South, and Korea. We include all available ADR's that traded over this period of time for which information is available in our source.

We compute ADR mispricing based on Eichler (2012). He estimates an absolute mispricing measure that is calculated as the percentage deviation of the ADR price from the price implied by the home-country's underlying stock:

$$ADR\ mispricing_{it} = \left| \frac{ADR\ price_{it} - Underlying\ stock\ price_{it}}{Underlying\ stock\ price_{it}} \right| \quad (1)$$

where the ADR price (in U.S. dollars) of firm i , in month t is adjusted by the ADR ratio⁵ (number of foreign shares represented by one ADR) and the underlying stock price of firm i in month t is converted from its local currency to U.S. dollars. We winsorize the mispricing data at the 5% level, (2.5% on each tail)

⁴ The country Turkey was purposely omitted due to being a homonym with the animal.

⁵ ADRs are sometimes offered in a ratio different than the underlying security, that is, one ADR may be equivalent to one or multiple shares of the foreign company and vice versa, as listed in their original market. We cross compare the data to adjust for these ratios by looking at different sources besides DataStream.

to remove extreme values, outliers, and ADR's that have missing or mismatching ratio adjustments. ADR's that show stale prices over multiple months are also removed⁶.

Our study lies at the intersection of the work of Hwang (2011), who shows that country-specific popularity is relevant for ADR mispricing, and the work of Eichler (2012), who finds that investor attention is also a determinant of mispricing. Therefore, our main hypothesis is that more investor attention leads to less mispricing of ADRs relative to the price of the underlying shares. As a result, we expect our model to find an inverse relationship between investor attention and ADR mispricing, which is theoretically consistent with the idea that less arbitrage opportunities exist when investors pay more attention (scrutiny) to a security from a more popular country, and vice-versa.

The investor attention measure, Wikipedia country page views, is the number of times that internet users open a country's profile page on Wikipedia. We adopt this measure as a proxy for investor attention for a country's ADRs. We consider this to be a better proxy than the ones from the previous literature because it is not subject to scaling biases (e.g., proxies using search volume indices) or foreign-host website bias (e.g., proxies that ignore that a country's webpage may be hosted by foreign country's servers). Moreover, our study spans seven years of monthly observations and includes 1,840 ADRs, including Level I ADRs, which are known to possess greater information asymmetry and therefore exhibit higher mispricing.

We anticipate that the search for information related to a particular country can be triggered by either positive or negative news. For example, the views of Brazil's page spiked during the 2014 Soccer World Cup, which can be considered a positive event overall, but the same peaks of interest occur when negative events happen (e.g., earthquakes, terrorist attacks, economic collapses). Therefore, the purpose of this study is not to clarify whether interest in each country corresponds to a premium (discount), but to assess the high (low) level of mispricing generated by investors' country-specific attention as a mechanism to obtain and reduce information asymmetry. In that sense, an investor seeking more information about a particular country on the internet will be prone to learn more about the country's ADRs. The natural consequence of doing so is that by learning more about a country, information asymmetry is narrowed and as a result price discrepancy should be smaller. It is also worth noting that Wikipedia country profiles display a section with condensed economic information such as overall economic policy, gross domestic product, unemployment, main industries, and significant mergers. Information that could be used by investors as a *prima facie* step into finding securities from that country or, in this case, ADRs.

Figure 1 displays some of the countries with the highest and lowest levels of ADR mispricing expressed in percentages. The figure shows that the highest levels of ADR mispricing correspond to the countries with the smallest numbers of Wikipedia views such as Greece (above 55% mispricing in 2012 with only 56.4 million Wikipedia views), Russia (above 35% mispricing in 2009 against 100.5 million views), and Argentina (above 32% mispricing in 2013 vs. 52.7 million views). At the same time, we observe that the lowest levels of ADR mispricing are from countries that have the largest numbers of Wikipedia views such as the United Kingdom (less than 8% mispricing in 2010 against 3.6 billion Wikipedia views) and Japan (6% mispricing in 2010 vs. 3.0 billion views) as shown in Figure 2.⁷

As Eichler (2012) points out, there could be a potential endogenous relationship between ADR mispricing and investor attention. In other words, it's plausible that the degree of mispricing in ADR's could trigger a spike in interest on a certain country which could naturally impact the number of Wikipedia country profile page views. Therefore, we control for endogeneity by estimating a two-stage least squares (2SLS) regression model:

⁶ It is important to mention that many Level I ADRs are traded over the counter (OTC) and the data sometimes offers incongruencies and/or misleading values.

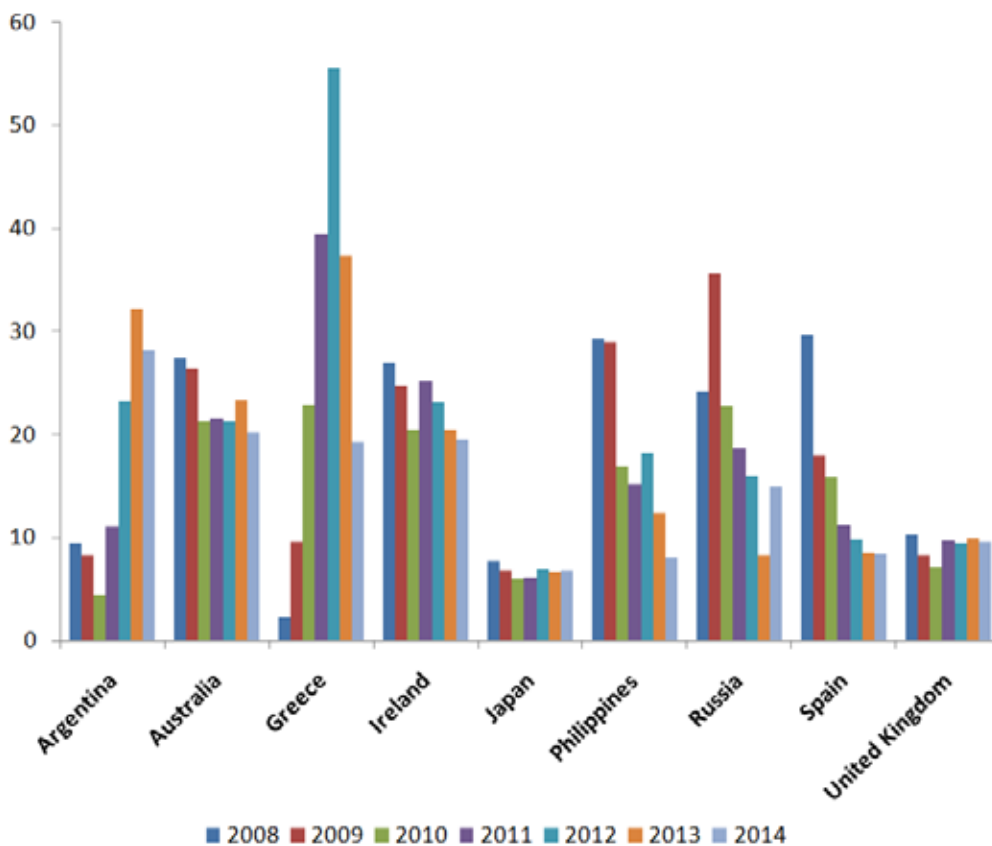
⁷ Figures 1 and 2 report the ADR mispricing levels and Wikipedia views (respectively) of selected countries, which have much greater (lower) levels than average.

$$\ln(\text{investor attention})_i = \pi_0 + \pi_1' Z + \pi_2' X + v_i, \tag{2}$$

$$\text{ADR mispricing}_i = \alpha + \beta_1 \ln(\text{investor attention})_i + \beta_2' X + u, \tag{3}$$

where the dependent variable in the first-stage regression is *investor attention*, π_0 is a constant, v_i is the residual and Z is a vector of instrumental variables (IVs). The 2SLS regression model is a statistical method that addresses endogeneity concerns where the dependent variable might influence the independent variable. This is achieved using instrumental variables that are expected to be correlated with the endogenous variable. The fitted values of this first stage are now regressed on the dependent variable. We expect these instruments and their residuals to influence the dependent variable, but the contrary is unlikely to be true. Similar to Eichler (2012), we use the FIFA World Cup ranking score of a country's national soccer team and the number of United Nations World Heritage sites as instrument variables for investor attention. We assume these instruments to be exogenous since we cannot imagine reverse causation from ADR mispricing to the performance of a national soccer team or the number of heritage sites declared by the United Nations.

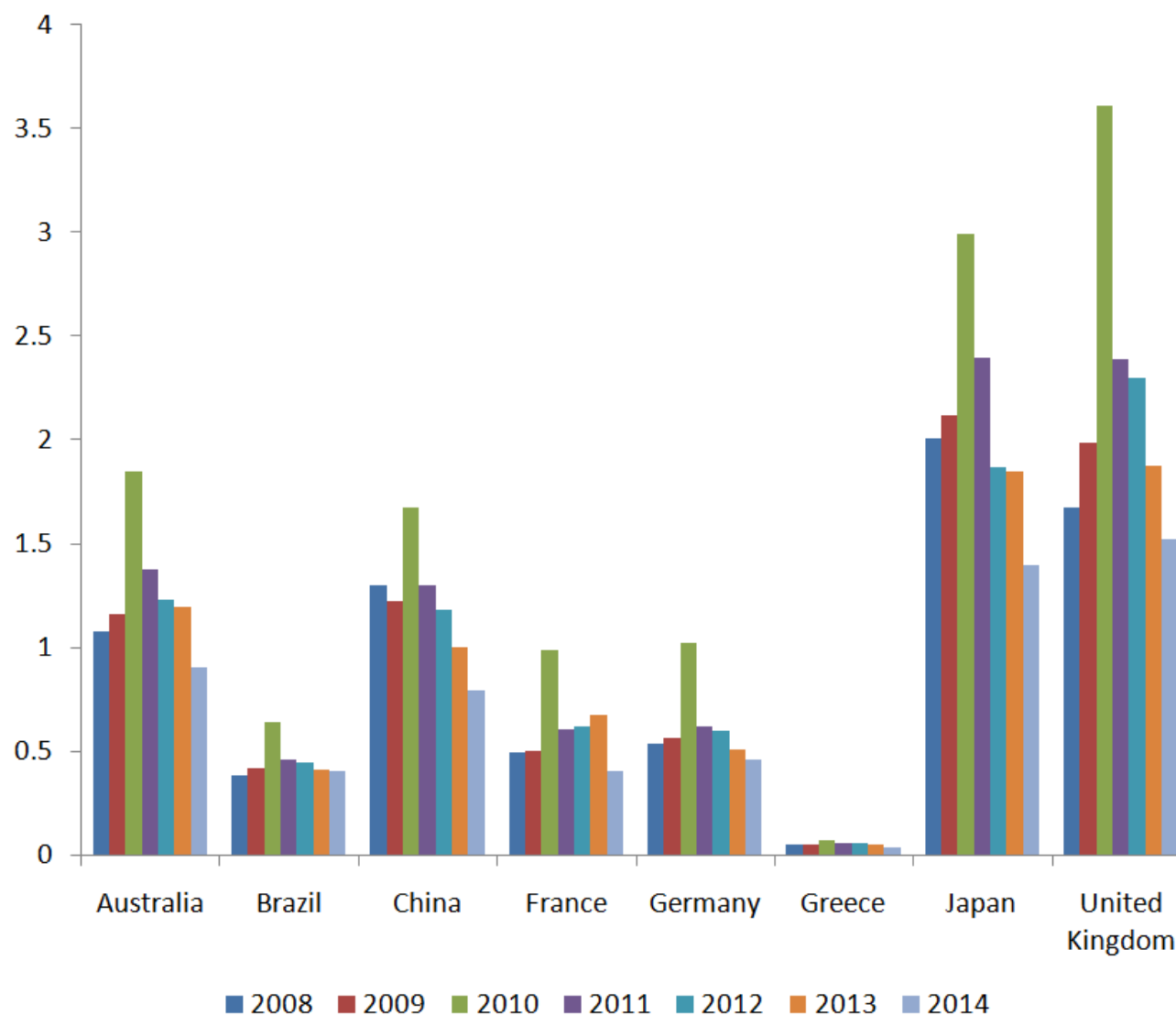
Figure 1: ADR mispricing for a select group of countries



Notes: This figure shows ADR mispricing as a percent, as estimated by the following equation:

$$\text{ADR mispricing}_{it} = \left| \frac{\text{ADR price}_{it} - \text{Underlying stock price}_{it}}{\text{Underlying stock price}_{it}} \right|$$

Figure 2: Wikipedia country profile page views for select countries (in billions)



Notes: The country-specific investor attention measure, Wikipedia country profile page views, is obtained from the *Wikipediatrends.com* website. This chart shows the number of Wikipedia page views for each country by year in billions.

The dependent variable in the second-stage regression is ADR mispricing, investor attention (*Wikipedia country page views*) is the explanatory variable of interest, α is the constant, u is the residual and X is a vector of control variables. The set of control variables includes: $1/P$ is the inverse price of the underlying stock which is often used in the ADR literature as a proxy for transaction costs, dividend yield is the dividend as a percentage of the underlying stock price, and volume is the log of the ADR trading volume. Additionally, following Mollick and Assefa (2013), we include a crisis dummy variable that assumes the value of 1 between January 2008 and June 2009 and zero otherwise.⁸ Market value is the log of the product of the number of outstanding shares times the current price of the underlying

⁸The National Bureau of Economic Research (NBER) dates the crisis from December 2007 to June 2009. Since the data for this study begins on January 2008, we use that as the starting point for the dummy. More information can be found at: <http://www.nber.org/cycles.html>.

stock. Amihud is an “illiquidity” measure that is calculated by dividing the absolute value of an ADR return by its respective trading value: the higher value the lower liquidity, it is retrieved from Amihud (2002). Level I dummy is a binary variable that is equal to 1 for the ADRs of Level I and zero otherwise.

Table 1: Descriptive Statistics

Variables	N	Mean	Median	SD
Mispricing (%)	84,093	10.80	1.91	20.70
Investor Attention	130,788	585,921	534,750	296,012
Returns	83,798	0.08	0.04	0.50
1/P	84,673	0.31	0.07	3.07
Volume	68,753	10,683	187	50,245
Market Value	85,564	12,883	4,656	27,079
Dividend Yield (%)	85,642	3.01	2.03	5.41
Crisis	130,788	0.21	0.00	0.41

Note: This table reports the summary statistics for the variables in this study. All variables are in a monthly frequency. The time span is from January 2008 through December 2014. The variables are as follows: ADR mispricing, investor attention (Wikipedia country page views is the proxy of investor attention), volume, market value, absolute returns ($|Returns|$), inverse price (1/P), dividend yield and the crisis dummy that assumes the value of 1 between January 2008 and June 2009, and zero otherwise. The data on ADRs is obtained from DataStream. The country-specific investor attention measure, Wikipedia page views, is obtained from the Wikipediatrends.com website.

Table 1 reports the descriptive statistics. The table shows the summary statistics of the entire sample for the variables used in this study. The mean and median values of ADR mispricing are 10.80% and 1.91%, respectively. The ADR mispricing is higher in 2008 and 2009, that is, during the Great Recession. The mean and median values of Wikipedia views are 585,921 and 534,750, respectively. The number of views grows from 2008 to 2010 and then the trend reverses until the last year of the sample. The absolute value of returns, a measure used to construct the Amihud’s illiquidity measure, ($Amihud = \frac{1}{D_i} \sum_{d=1}^{D_i} \frac{|ADR\ returns|_{i,d}}{ADR\ trading\ value_{i,d}}$), has a mean of 0.08 and a median of 0.04. The inverse price (1/P) of the underlying stock, a proxy for transaction costs, has a mean of 0.31/\$ and median of 0.07/\$. The mean and median values of ADR trading volumes are 10,683 and 187, respectively. Market value has a mean of \$12,883 and a median of \$4,656. The dividend yield averages 3.01% with a median of 2.03%.

Table 2: Correlation Matrix

	Mispricing (%)	Investor Attention	Returns	1/P	Volume	Market Value	Dividend Yield (%)	Crisis	Level I Dummy
Mispricing	1.000								
Investor Attention	-0.0230	1.000							
Returns	0.0307	-0.0020	1.000						
1/P	0.0926	0.0060	0.0180	1.000					
Volume	-0.0907	-0.0354	-0.0231	-0.0221	1.000				
Market Value	-0.1218	0.0539	-0.0460	-0.0997	0.5298	1.000			
Dividend Yield	0.1075	-0.0611	0.0260	0.0938	0.0339	-0.0802	1.000		
Crisis	0.0696	-0.0444	0.0261	-0.0014	0.1521	-0.0121	0.0396	1.000	
Level I Dummy	0.0351	0.1227	0.0077	0.0191	-0.6226	-0.1709	-0.0325	-0.1106	1.000

Note: This table reports the correlation coefficients for the variables used in this study. The time span is from January 2008 through December 2014. The variables are as follows: ADR mispricing, investor attention (Wikipedia country page views is the proxy of investor attention), volume, market value, absolute returns, inverse price, dividend yield and the crisis dummy that assumes the value of 1 between January 2008 and June 2009, and zero otherwise. The Level I Dummy is a binary variable that is equal to 1 for Level I ADRs and zero otherwise.

Table 2 reports the correlation matrix. As hypothesized, ADR mispricing is inversely related to investor attention (Wikipedia views). This correlation coefficient (-0.023) provides preliminary insight into the relationship between these two variables. ADR mispricing is also inversely related to volume, and market value, and has a positive correlation to absolute returns, inverse price, and dividend yield, all of which is in line with previous literature. Most of the correlations in the correlation matrix are relatively low, except for the correlation (0.53) between volume and market value, which indicates that more valuable firms have higher trading volumes, and the volume and the Level I dummy (-0.62), showing that Level I ADRs' trading volume is smaller than the ones from ADRs of other levels (e.g., Levels II and III).

3. Results

Table 2: 2SLS Estimation Results

Independent variables	Dependent variable: ADR mispricing					
	(1)	(2)	(3)	(4)	(5)	(6)
Investor Attention	-3.295*** (0.242)	-3.231*** (0.242)	-2.892*** (0.242)	-2.815*** (0.234)	-3.270*** (0.250)	-2.989*** (0.247)
1/P	1.078*** (0.141)	1.079*** (0.140)		3.107*** (0.366)		2.973*** (0.351)
Dividend Yield	1.579*** (0.068)	1.547*** (0.067)	1.646*** (0.078)	1.306*** (0.064)	1.488*** (0.066)	1.318*** (0.064)
Volume	-0.387*** (0.016)	-0.425*** (0.016)	-0.247*** (0.018)			
Crisis		2.508*** (0.177)				2.112*** (0.177)
Market Value			-0.668*** (0.054)	-0.740*** (0.044)		-0.669*** (0.044)
Amihud				11.320*** (3.754)	15.290*** (4.077)	11.170*** (3.682)
Level I dummy					1.625*** (0.117)	1.347*** (0.118)
Constant	48.460*** (3.227)	47.490*** (3.219)	48.430*** (3.230)	46.650*** (3.150)	44.880*** (3.264)	47.000*** (3.259)
Observations	52,589	52,589	52,582	51,943	51,953	51,943
Number of ADRs	1,840	1,840	1,840	1,840	1,840	1,840
F-statistic of 2SLS regression	288.88***	261.42***	253.45***	192.93***	186.7***	163.7***
P-value of instrument relevance	0.00	0.00	0.00	0.00	0.00	0.00
Hansen overidentification statistic	141.819***	157.596***	131.539***	59.328***	78.002***	99.205***
RP ²	2.2%	2.8%	2.4%	2.1%	1.0%	2.5%

Note: This table reports estimation results of the various 2SLS instrumental variable regressions; see equations 2 and 3 in the text. The numbers in parentheses are White heteroscedasticity-consistent standard errors. ***, ** and * denote significance at the 1%, 5% and 10% levels. The variables in the study are ADR mispricing, Wikipedia views is the measure of investor attention, volume, market value, absolute returns, inverse price, dividend yield and the crisis dummy that assumes the value of 1 between January 2008 and June 2009, and zero otherwise. The Level I dummy is a binary variable that is equal to 1 for Level 1 ADRs and zero otherwise.

Tables 3 through 5 report 2SLS estimation results for 1,840 ADRs from 31 countries. The dependent variable is ADR mispricing, while Wikipedia views are the proxy for country-specific investor attention.

FIFA World Cup ranking score and UN World Heritage sites are instrumental variables in controlling potential endogeneity bias. The instrument specification tests reject both null hypotheses of weak instrument relevance and overidentification biases for all regressions in Tables 3, 4, and 5.⁹

Table 3 shows 2SLS regression results for the entire sample, with the total number of observations varying between 51,943 and 52,589. The variable, investor attention, displays a negative coefficient that ranges from -3.3 to -2.8; which means that as investor attention increases by 1 percent, we expect ADR mispricing to decrease by around 3 percent.¹⁰ These results are similar to others found in prior literature (e.g., Eichler, 2012). Our results differ in that they include a much larger data set, which includes 1,840 ADRs and a much greater number of observations. Furthermore, our investor attention measure differs from that of Eichler's (2012). The coefficients for investor attention are economically and statistically significant at the 1% level across all six specifications. The control variables display the expected signs: inverse price (1/P), dividend yield, crisis dummy, Amihud and Level I dummy are positive and significant; volume and market value are negative and significant. It is important to mention that both the sign of the coefficient and the statistical significance confirm our hypothesis that higher country-specific attention leads to higher attention to securities from such countries, and therefore, allow less room for deviations from the price parity condition. The idea is that overall, if investors pay more attention to securities from one country, they will identify arbitrage opportunities much faster than from countries that are not on their radar.

Table 3: 2SLS Regressions by ADR Level

Independent variables	Dependent variable: ADR mispricing					
	Level I			Levels II and III		
	(1)	(2)	(3)	(4)	(5)	(6)
Investor Attention	-4.246*** (0.426)	-4.066*** (0.418)	-3.406*** (0.366)	-1.786*** (0.250)	-1.525*** (0.237)	-1.540*** (0.234)
1/P	2.178*** (0.344)		2.559*** (0.480)	3.572*** (0.564)		3.142*** (0.511)
Dividend Yield	3.062*** (0.140)	2.410*** (0.124)	1.368*** (0.090)	1.069*** (0.075)	1.062*** (0.076)	1.067*** (0.075)
Crisis	3.496*** (0.299)		2.717*** (0.246)	1.012*** (0.207)		1.040*** (0.208)
Market Value		-3.743*** (0.073)	-1.002*** (0.065)		-0.368*** (0.044)	-0.280*** (0.045)
Amihud			10.290*** (3.536)			305.900* (178.600)
Constant	60.520*** (5.650)	91.550*** (5.687)	56.720*** (4.986)	25.600*** (3.268)	26.090*** (3.239)	24.950*** (3.239)
Observations	47,841	47,742	38,828	13,228	13,228	13,115
Number of ADRs	1,322	1,322	1,322	235	235	235
F-statistic of 2SLS regression	252.88***	1052.3***	139.34***	73.51***	86.44***	56.17***
P-value of instrument relevance	0.00	0.00	0.00	0.00	0.00	0.00
Hansen validity test statistic	4.939**	124.495***	53.863***	394.323***	443.09***	400.478***
RP ²	5.6%	11.9%	2.3%	3.2%	2.8%	3.6%

⁹The first-stage estimation results, from the 2SLS model presented in Table 3, are available in Table 6 in the appendix. This table also displays the Wu-Hausman endogeneity tests statistic, Sanderson-Windmeijer (SW) first-stage chi-squared test of under-identification statistic and F-statistic test of weak identification of individual endogenous regressors. First-stage estimation results for the other estimations (Tables 4 and 5) are available upon request.

¹⁰The coefficients are interpreted this way because they are estimated using a level-log regression.

Note: This table reports estimation results of 2SLS instrumental variable regressions by ADR level; see equations 2 and 3 in the text. The first three columns display results for Level I, while the last three columns show results for Levels II and III together. The numbers in parentheses are White heteroscedasticity-consistent standard errors. ***, ** and * denote significance at the 1%, 5% and 10% levels. The variables in the study are ADR mispricing, Wikipedia views is the measure of investor attention, volume, market value, absolute returns, inverse price, dividend yield and the crisis dummy that assumes the value of 1 between January 2008 and June 2009, and zero otherwise. The Level I dummy is a binary variable that is equal to 1 for the ADRs of Level I and zero otherwise.

Table 4 shows the 2SLS regressions by ADR levels. The first three columns correspond to Level I ADRs, with the number of observations ranging from 38,828 to 47,841. The last three columns are regressions for Level II and III ADRs, totaling about 13,200 observations. Our results show that investor attention has a stronger negative impact on ADR mispricing for Level I ADRs. The coefficients for investor attention on Level I ADR returns range from -4.246 to -3.406, versus the smaller coefficients for investor attention on Level II and III ADRs, which range from -1.786 to -1.525. Our results expand on the literature since Eichler (2012) does not examine how investor attention influences ADR mispricing by ADR level. With respect to the control variables, the inverse price (1/P) has a stronger positive effect on mispricing for Level II and III ADRs compared to Level I ADRs. The coefficient for the dividend yield is larger for Level I ADRs. The coefficient for the crisis dummy variable indicates that higher mispricing is associated with Level I ADRs. The coefficient on market value indicates a stronger negative effect on mispricing for Level I ADRs. Finally, Amihud’s illiquidity coefficient suggests a higher sensitivity to changes in the degree of liquidity for Level II and III ADRs (305.9), than for Level I (10.29).

Table 5: 2SLS Regressions by Industry

Independent variables	Dependent variable: ADR mispricing									
	Basic Materials	Consumer Goods	Consumer Services	Financials	Health Care	Industrials	Oil & Gas	Tech	Telecoms	Utilities
Investor Attention	-3.235***	0.017	-4.560***	0.412	-1.970***	-6.537***	-2.544***	-9.977***	-11.500***	1.019
	(-0.452)	(-0.518)	(-0.542)	(-0.656)	(-0.276)	(-0.91)	(-0.787)	(-1.423)	(-1.089)	(-1.055)
1/P	1.901***	4.129***	15.900***	-2.530***	14.660***	-0.551	9.990***	5.300***	-7.688	7.164***
	(-0.425)	(-0.703)	(-2.914)	(-0.958)	(-1.6)	(-3.59)	(-1.911)	(-0.966)	(-6.765)	(-2.704)
Dividend Yield	-0.08	2.958***	0.455***	1.978***	0.799***	0.685***	0.242	-1.742***	0.993***	-0.620***
	(-0.193)	(-0.225)	(-0.152)	(-0.184)	(-0.094)	(-0.214)	(-0.249)	(-0.223)	(-0.239)	(-0.141)
Volume	-0.803***	-0.373***	-0.928***	-0.478***	-0.429***	-0.114*	-0.048	-0.621***	0.354***	0.167***
	(-0.065)	(-0.038)	(-0.088)	(-0.056)	(-0.034)	(-0.059)	(-0.084)	(-0.055)	(-0.119)	(-0.063)
Crisis	3.664***	3.152***	1.094***	4.552***	0.529***	1.770***	-0.273	0.888***	1.292*	1.423**
	(-0.516)	(-0.408)	(-0.392)	(-0.54)	(-0.172)	(-0.49)	(-0.467)	(-0.272)	(-0.716)	(-0.557)
Amihud	6.575	12.96	35.470***	11.73	19.410*	16.250**	-2.93	31.920*	263.400**	58.700***
	(-7.128)	(-7.9)	(-13)	(-8.319)	(-10.14)	(-6.697)	(-2.182)	(-18.95)	(-114.7)	(-15.44)
Level I dummy	-1.343***	0.995***	-2.007***	-3.480***	-1.950***	-0.247	3.468***	0.662**	1.379*	2.627***
	(-0.361)	(-0.231)	(-0.293)	(-0.411)	(-0.195)	(-0.675)	(-0.552)	(-0.327)	(-0.726)	(-0.548)
Constant	51.320***	1.265	68.510***	2.559	29.740***	91.070***	36.240***	137.600***	150.400***	-11.02
	(-6.384)	(-6.722)	(-7.577)	(-8.345)	(-3.688)	(-11.82)	(-10.9)	(-18.9)	(-14.01)	(-13.63)
Observations	5,766	8,279	5,019	8,168	2,579	9,313	2,804	2,597	2,704	3,251
Number of ADRs	173	211	161	225	119	303	89	80	51	77
F-statistic of regression	50.44***	64.11***	28.57***	46.78***	44.14***	18.66***	43.35***	38.88***	19.49***	12.40***
IV relevance (p-value)	0	0	0	0	0	0	0	0	0	0
Hansen overid. statistic	7.629***	80.375***	15.235***	18.648***	0.859	97.527***	67.308***	0.876	99.569***	0.508
R ²	3.20%	10.80%	8.60%	4.80%	15.80%	2.50%	9.00%	5.40%	9.70%	0.03%

Notes: This table reports estimation results of 2SLS instrumental variable regressions by industry; see equations 2 and 3 in the text. The numbers in parentheses are White heteroscedasticity-consistent standard errors. ***, ** and * denote significance at the 1%, 5% and 10% levels. The variables in the study are ADR mispricing, Wikipedia views is the measure of investor attention, volume, market value, absolute returns, inverse price, dividend yield and the crisis dummy that assumes the value of 1 between January 2008 and June 2009, and zero otherwise. The Level I dummy is a binary variable that is equal to 1 for the ADRs of Level I and zero otherwise.

Table 5 displays 2SLS regressions by industry. We find that investor attention (Wikipedia page views) has a negative and significant impact on ADR mispricing for most industries. Investor attention has the greatest impact on the following industries: telecommunications (-11.50), technology (-9.98), industrials (-6.54), consumer services (-4.56), basic materials (-3.235), oil and gas (-2.54), and health care (-2.38). Statistical insignificance of investor attention for consumer goods, financials, and utilities may indicate that these industries are less sensitive to the marginal impact of investor attention. In fact, the lack of significance for utilities and financials are consistent with the corporate finance literature, which often excludes those industries due to the former's regulated nature and the latter's spotty historical coverage of firms (e.g., Fama and French 2001). For the control variables, the results are in line with our previous findings in Table 4. This set of results also contributes to the literature, given that Eichler (2012) does not focus on how investor attention influences ADR mispricing by industry.

4. Conclusion

There is a growing body of literature on ADR mispricing, but the focus of more recent studies has been on behavioral finance to try to explain this deviation from the law of one price (Grossmann et al., 2007; Hwang, 2011; Wu et al., 2017). Moreover, recent studies have shown that investor attention plays a role in the portfolio selection process (Barber & Odean, 2008; Van Nieuwerburgh & Veldkamp, 2010). Only one prior study has examined the link between investor attention and ADR mispricing (Eichler, 2012). Our study expands on Eichler (2012).

This paper contributes to the literature on the influence of investor attention on ADR mispricing in the following distinct ways. First, we use a unique measure of investor attention, Wikipedia country-profile page views. To the best of our knowledge, this is the first study that tests the impact of Wikipedia country page views (a proxy for investor's attention) on ADR mispricing. Second, we expand the dataset of ADRs to include a larger sample size that spans from 2008 to 2014, with a larger number of observations. Our sample period allows us to examine if the Great Recession had an influence on the relationship between investor attention and ADR mispricing. Furthermore, we include Level I ADRs, whereas prior studies only included Level II and Level III ADRs (Eicher, 2012). Adding Level I ADRs allows us to examine if investor attention has a larger effect on mispricing compared to Level II and Level III ADRs. Finally, we examine the role of investor attention across ADR industries.

The results from the 2SLS models show that country-specific investor attention has an inverse relationship to ADR mispricing. Overall, high Wikipedia country-profile page views are related to lower ADR mispricing for a sample of 1,840 cross-listed securities from 31 countries. That is, as investors pay more attention to a country, the level of ADR mispricing is reduced significantly. Furthermore, when we *disaggregate* ADRs by level (i.e., I versus Level II and III), our results show that investor attention's influence on ADR mispricing depends on the ADR level. For instance, we show that Wikipedia page views have a greater influence on level I ADRs compared to levels II and III ADRs (the coefficients on Level I are much larger than those of levels II and III). These results confirm the previous findings of Eichler (2012) and are consistent with the previous literature (Beckmann et al., 2015); the ADR level determines the degree of ADR mispricing. Additionally, our results show that the Great Recession also significantly impacts how investor attention influences ADR mispricing. For instance, the crisis dummy variable is larger for level I ADRs than for levels II and III, which means that during times of turmoil, this effect was increased. A possible reason for this increased effect could also be related to the fact that Level I ADRs are less regulated and riskier overall. Therefore, during recessionary periods, investors prefer to invest in bigger companies with longer track records rather than smaller foreign firms, magnifying the effect of the mispricing. Our study also shows that investor attention influences ADR mispricing across industries. For example, higher levels of investor attention reduced ADR mispricing for the consumer services industry. However, not all industries were influenced by investor attention (e.g., consumer goods, financials, and utilities). Perhaps the steady cash flow nature of the utility sector and its relevant public interest, along with the overall increased regulatory oversight in the financial

industry, could have an impact in the price discovery process altogether for these industries, making the investor attention measure less relevant or at least the coefficients insignificant in our study. Lastly, all the tests for correctly specified models, such as overestimation, under-identification, and weak under-identification, provide robustness to the empirical results. Overall, this study sheds new light on how investor attention influences ADR mispricing.

The economic implications of this study are quite important for practitioners. Considering that an investor could develop a plan to observe ADRs from less popular countries to find arbitrage opportunities using long and short positions depending on whether the ADR is sold at a premium or at a discount.

This study is not without its limitations. First, country population, gross domestic product (GDP), and educational level could be used as control variables for country popularity proxied by the Wikipedia profile page views. For instance, a country's population could drive the number of visits a given profile receives on a periodical basis. Second, a more educated country could also draw more attention from its citizens or foreigners, thus driving up the level of attention it receives. Lastly, when data becomes available, the country popularity measure could be retrieved in other languages to contrast the results from the English country profiles since ADRs are not restricted to U.S. investors only. Finally, other variables, such as financial regulation, could pose a limit to arbitrage, as proposed by some literature. However, that is to be explored in a future research project, as well as the proxy for attention and the sign of mispricing (premium or discount).

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Appendix 1: First Stage Estimation Results

Independent variables	Dependent variable: Investor Attention					
	-1	-2	-3	-4	-5	-6
UN World Heritage Sites	0.017*** 0	0.017*** 0	0.016*** 0	0.016*** 0	0.016*** 0	0.016*** 0
FIFA Ranking	-0.001*** 0	-0.001*** 0	-0.001*** 0	-0.001*** 0	-0.001*** 0	-0.001*** 0
1/P	0.003 -0.002	0.003 -0.002		0.045*** -0.011		0.361*** -0.011
Dividend Yield	-0.020*** -0.002	-0.020*** -0.002	-0.017*** -0.002	-0.020*** -0.002	-0.018*** -0.002	-0.016*** -0.002
Volume	-0.002*** -0.001	-0.001** -0.001	-0.006*** -0.001			
Crisis		-0.039*** -0.005				-0.028*** -0.005
Market Value			0.020*** -0.002	0.012*** -0.001		0.018*** -0.001
Amihud				-0.055 -0.036	-0.103*** -0.035	-0.073** -0.036
Level I dummy					-0.104*** -0.004	0.110*** 0.004
Constant	12.830*** -0.005	12.830*** -0.005	12.670*** -0.013	12.700*** -0.013	12.740*** -0.005	12.580*** -0.14
Observations	52,589	52,589	52,582	51,943	51,953	51,943
Wu-Hausman F-test	129.117***	130.28***	104.20***	108.84***	118.35***	110.31***
Sanderson-Windmeijer Under-identification Chi-sq	13,062***	13,043***	12,721***	12,991***	12,453***	12,234***
Sanderson-Windmeijer Weak identification F-test	6,530.63***	6,521.10***	6,360.13***	6,495.07***	6,225.91***	6,115.96***
Number of ADRs	1,840	1,840	1,840	1,840	1,840	1,840
RP ²	20.20%	20.30%	20.50%	20.40%	21.20%	21.50%

Note: This table reports estimation results of the first stage regressions of the instruments on the variable of interest. We assume Wikipedia page views as the endogenous variable, while the number of United Nations World Heritage sites and the FIFA World Cup ranking score are used as instruments. The numbers in parentheses are White heteroscedasticity-consistent standard errors. ***, ** and * denote significance at the 1%, 5% and 10% levels. The Wu Hausman F-test report the test statistics, the H0 is that the regressor is exogenous. The Sanderson-Windmeijer are first stage chi-squared and F statistics tests of under-identification and weak identification of individual endogenous regressors. The variables in the study are ADR mispricing, Wikipedia views is the measure of investor attention, volume, market value, absolute returns, inverse price, dividend yield and the crisis dummy that assumes the value of 1 between January 2008 and June 2009, and zero otherwise. The Level I dummy is a binary variable that is equal to 1 for the ADRs of Level I and zero otherwise.