International Journal of
Finance
(IJF)

Are Indian ADR Premiums Mispriced?

CARI Journals

International Journal of Finance

ISSN 2520-0852 (Online)

Vol. 8, Issue No. 1, pp 1 - 18, 2023

www.carijournals.org

Are Indian ADR Premiums Mispriced?

Umesh Kumar

State University of New York at Canton

Corresponding Author Email: kumaru@canton.edu

Abstract

Purpose: Indian ADRs have been observed to trade at premiums to the price of the underlying shares flouting the law of one price theorem. Therefore, it becomes imperative to investigate whether the observed premiums are mispricing or investor demand. This paper examines the Indian ADRs trading at a significant premium for an extended period.

Methodology: The paper studies all ten Indian ADRs traded from 2001 to 2006. It uses NYSE Trade and Quote Database to compute order imbalance for analysis of the mispricing. It employs multivariate regression models to examine the premiums.

Findings: The results suggest that Indian ADR returns are closely associated with the underlying market returns. Premiums are negatively related to the underlying stock returns. The ADR prices only adjust partially to the prices of the underlying stock. The ADR and underlying stock have a separate process for price formation in their respective markets. Using order imbalance of small and total trades of ADRs, this study shows that Indian ADR premiums are significantly and positively related to the buy demand of investors. Overall, the results support the idea that investor demand drives the Indian ADR premiums and is not mispriced.

Unique Contribution to Theory, Policy, and Practice: The study provides valuable information on the same security traded in different trading locations and market segmentations. It offers insight into an emerging market stock listed in the most developed financial markets. It expands the literature on order imbalanced and dual-listed securities, particularly for ADRs. The order imbalance can be decomposed into short- and long-run components, showing how both parts influence ADR returns and premiums/discounts.

Keywords: *American Depositary Receipts (ADR), Premium, Order imbalance*

JEL Classification Codes: *G14, G15*

1. Introduction

The law of one price dictates that a security having the same underlying cash flows traded on different markets will have an identical price. American Depositary Receipts (ADRs) traded on the U.S. market should not diverge significantly from the underlying shares traded on the home market. Consistent considerable price divergence between the ADRs and underlying shares can suggest mispricing or arbitrage opportunities. Indian ADRs have been observed to trade at premiums to the price of the underlying shares. This paper analyzes the Indian ADRs and whether they are mispriced. If they are mispriced, that could lead to arbitrage opportunities.

Indian government regulations limit arbitrage activity in Indian ADRs. While ADRs can be converted to underlying shares, ADRs can be created from underlying shares only in the primary market after the firm obtains permission from the Indian government. Thus, premiums on Indian ADRs cannot be arbitraged away in secondary markets (Kadapakkam and Misra (2003); Puthenpurackal (2006)). Prior studies note that arbitrage opportunities may only exist if there is a price difference of the same security due to market segmentation and geographic locations (Froot and Dabora (1999); Lamont and Thaler (2003)). Therefore, it becomes crucial to understand the Indian ADRs and whether they are mispriced in the U.S. markets since they trade at a premium. The ADR premiums observed are due to investor interests or a current economic event.

Asset Pricing literature has provided several explanations for the divergence of ADR prices from sentiment to rational explanations, such as investor sentiments, illiquidity, capital gains, institutional investors, etc. However, it is important to note that such divergence should not be consistent and significant. Efficient markets theory contends that the market price of ADRs and the prices of its underlying shares reflect all available information, and this information is uniform. If there is a consistent overvaluation of Indian ADRs, it may suggest irrational or overly speculative behavior. However, such divergence or mispricing will only last for a while.

This paper studies the source of the mispricing if it exists in the Indian ADRs. Hietala (1989) argues that a stock can trade at different prices in two segmented markets if investors in the two markets have different assessments of the security's systematic risk due to the different market portfolios available to investors in each market. Securities are more sensitive to the market index for the countries in which they are traded (Chan, Hameed and Lau (2003)). Literature suggests that for cross or dual-listed securities such as ADRs, the securities traded in developed economies carry higher prices (Jithendranathan, Nirmalanandan, and Tandon (2000); Bae, Kwon and Li (2008); Stigler, Shah, and Patnaik (2010)). Information asymmetry and relative supply of securities traded in different markets can cause security price premiums (Beckmann, Ngo, and Wang

(2015); Wu et al. (2020)). Investors' outlooks on the economy can explain the price divergence (Zhang, Jia, and Lv (2020)).

Therefore, the paper examines the Indian ADR premiums from investors' trade orders, particularly order imbalance. In financial markets, an order imbalance occurs when there is a mismatch between the buyer and seller's number of securities placed for trade. Order imbalance can occur at any time during trading. Buy or sell order imbalances indicate investors' intensity and activity towards a particular security or asset. The examination of order imbalances of Indian ADRs has the potential to explain if the divergence prices of ADRs and underlying shares are investors induced pricing or mispricing.

This paper contributes to the expanding literature on dual / cross-listed securities and asset prices. First, it examines the emerging market country ADRS, i.e., Indian ADRs traded at a premium. It investigates the premium, whether it is a case of mispricing or investor demand. It uses weekly data compared to monthly data in most literature. It extends its study for six years, providing a distinct insight into its findings.

Hughen and McDonald (2005) examine the relationship between order imbalance measures and closed-end fund discounts. They conclude that the closed-end fund discount is unrelated to a small-trade order imbalance. Prior research has identified other factors that may influence ADR premiums. Chan, Hong, and Subrahmanyam (2007) document that liquidity differences between the ADR and its underlying stock affect the ADR premium. Similarly, Atanasova and Li (2018) suggest that ADR prices and underlying stock prices get affected by liquidity factors. Amihud, Hammed, and Zhang (2015) indicate that there is a liquidity premium component in illiquid assets.

The paper uses all ten exchange-traded Indian ADRs from 2001-2006. These ADRs are liquid and generally traded at a premium. The liquidity in the ADR market is healthy compared to the liquidity of the underlying stocks in the Indian market, especially when the relative size of the ADR issue is compared to the float in the home market. To understand the ADR premium analysis, it is pertinent to recognize the trading hours of the U.S. and Indian markets and their differences in real-time at both markets. The Indian time (IST) is 9:30 hours ahead of New York time (NYSE) without the daylight savings adjustment. There is no overlap in trading hours between the two markets. Further, India has a single time zone. The non-synchronous trading limits investors' ability to drive the price to equilibrium.

Consistent with prior literature, Indian ADR returns are significantly and closely related to the underlying market returns. As expected, underlying stock returns are strongly related to home markets compared to ADR returns to its trading markets. These findings are consistent with market segmentation leading to related but separate processes for price formation in the two markets.

The premiums on individual ADRs cannot be explained by the extent of small investor participation or trading as a proportion of total trading. To better understand the ADR premiums and investor demand, the role of order imbalance of small trades and total trades is analyzed. The results reveal that the premiums are significantly and positively related to the buy order imbalance of small and total trades. The results support the idea that though the Indian ADRs trade at a premium, it is not due to mispricing. As scrutinized by the order imbalances, investor demand plays a significant role in determining ADR prices and subsequent premiums. The rest of the paper is organized as follows. Section 2 describes the data sources. Section 3 outlines the methods used in the analysis. Section 4 provides descriptive statistics and empirical results. Finally, the findings and conclusions are summarized in Section 5.

2. Data Sources

The exchange-traded Indian ADRs are obtained from the Center for Research in Securities Prices (CRSP). The sample period varies from January 2001 to December 2006, depending upon the initial listing date of each ADR. Only ADRs are selected whose underlying stocks are traded on Indian exchanges and listed simultaneously for at least a year on both markets. Daily opening and closing ADR prices and the S&P 500 index data are obtained from the CRSP database. The Bloomberg database provides the corresponding data for the underlying stocks along with the Indian market index (BSE 100) returns and foreign exchange rates (U.S. Dollar versus Indian Rupee). Shareholding data is obtained from the Electronic Data Information Filing and Retrieval System of the Securities and Exchange Board of India to create Relative DR size. NYSE Trade and Quote Database provide the trade order data. The order imbalance analysis includes all trades and quotes during trading hours. Quotes are omitted if the bid or the ask price is negative or if the bid price is higher than the ask price.

3. Methods

3.1. Premium Estimation

The ADR premium is a weekly premium using the Friday opening price for the ADR and the Friday closing price in the Indian market for the underlying stock.

$$\text{Prem}_{i,d} = \frac{P_{i,d}^{ADR} op * ER_d}{P_{i,d}^{UM} cl * AD_{i,d}} - 1$$

where $\text{Prem}_{i,d}$ is the premium for ADR i on day d, $P_{i,d}^{ADR} op$ is the opening ADR price on Friday, $P_{i,d}^{UM} cl$ is the closing underlying stock price on Friday, ER_d is the currency exchange rate, and $AD_{i,d}$ is the ADR ratio.

The ADR ratio is crucial in calculating the ADR premium. The ADR ratio is obtained from the Bank of New York website and verified using the Bloomberg database to make any adjustments if the ratio has changed over time during the sample period due to stock splits or stock dividends. The weekly ADR opening price is observed within a few hours after the Indian market closes. Thus, the ADR opening prices have only a slender time advantage over the Indian closing price, given the weekly horizon. Since the U.S. market opens after the closing of the Indian market, it is expected that the Friday opening ADR price would capture all price-sensitive information from the Indian market.

3.2. Order imbalance Measurement

Prior literature suggests that trades with a value of less than $10,000 can be considered small trades (Lee and Radhakrishna (2000)). Institutional trades can be broken into small trades. Further, Barber, Odean, and Zhu (2008) interpret small trades as trades by small investors. This paper considers less than $10,000 trades as small trades for brevity. Since ADR premiums are measured using Friday opening prices, weekly order imbalance is calculated using trades from Friday to Thursday. The Lee and Ready (1991) algorithm are used to classify trades. Based on their algorithm and tick test, each trade is classified as a buyer or seller-initiated trade and calculates weekly order imbalance as follows:

$$\text{OIM}_{i,t} = \frac{BD_{i,t} - SD_{i,t}}{\text{AvgVol}_{-13,-1}}$$

where $BD_{i,t}$ ($SD_{i,t}$) denotes buyer-initiated (seller-initiated) dollar volume for ADR_i for week t, and $\text{AvgVol}_{-13,-1}$ is the average dollar value of trades in the preceding thirteen weeks. Thus, the weekly order imbalance is computed as the difference in dollar value between buyer-initiated and seller-initiated trades for the entire week. Order imbalance of small trades is calculated using only those trades with a value less than $10,000; later, Total order imbalance is measured using all trades regardless of size. Small trade (total) order imbalance measures are standardized by the average trading value of small (total) trades in the preceding thirteen weeks.

4. Empirical Results

Table 1 presents the premium statistics for all ADRs during the sample period. Though Indian ADRs sometimes trade at a discount, they typically trade at premiums. This is consistent with the requirement that ADRs can be created only in the primary market after the Indian government approves; premiums cannot be arbitraged away in the secondary market. Infosys Technologies shows the highest premium on average, 43.26% (median 45.06%), during the sample period, while Silverline Technologies has the lowest average premium -1.78% (median -3.14%). All ADRs present a considerable variable in the average and median premiums, respectively.

Table 1: Descriptive Statistics of ADRs and their Premium

This table provides summary statistics on ADR premiums (%). ADR premium is computed weekly. The weekly ADR premium is the dollar premium using the Friday closing price of the underlying stock and the Friday opening price of the ADR. ADRs opening price is used since the U.S. markets begin after the closing of the Indian markets.

Issuer	N	Mean	Median	Standard deviation	Minimum	Maximum
Dr. Reddy's	296	1.94	0.68	4.89	-7.84	27.58
HDFC Bank	281	11.07	10.09	8.05	-5.99	37.71
ICICI Bank	311	10.80	10.89	8.13	-8.89	38.11
Infosys Technologies	311	43.26	45.06	18.22	7.18	98.60
MTNL	268	7.84	4.08	9.76	-5.07	34.38
Satyam Computers	292	21.49	16.35	15.48	-0.29	88.45
Silverline Technologies	133	-1.78	-3.14	8.31	-23.88	21.08
Tata Motors	118	0.13	0.14	1.13	-2.48	3.43

VSNL	311	-0.06	-0.36	2.98	-10.87	18.99
Wipro	311	16.78	16.36	14.20	-5.67	60.60

Table 2 documents the sensitivity of weekly underlying stock returns to U.S. and Indian market indices. Given the time differences between the two markets, returns in the U.S. market are calculated using Friday opening prices. In contrast, returns in the Indian market are calculated using Friday closing prices. S&P 500 and BSE 100 indices are used as proxies for the U.S. and Indian markets, respectively. The exchange rate change return of the Indian rupee is a control variable. The following equation indicates the relationship of underlying stock return with the U.S. and Indian market indices.

$$ST_{ret\ i,w} = \alpha + \beta_4 * BSE_{ret\ w} + \beta_5 * S\&P_{ret\ w} + \beta_6 * Fx_{ret\ w} + \varepsilon_i$$

The regression coefficients are presented in Table 2. As expected, the estimates of underlying stock returns are significantly positive with the home market index, i.e., BSE return (1.090). However, all stocks except one are positively related to the S&P return in the U.S. market (0.233). The changes in foreign exchange (-0.784) have adverse effect on the stock returns. Overall, the results show that the underlying stock returns are more sensitive and significantly related to the home markets.

Table 2: Relationship of Underlying Stock Return with the U.S. and Indian Markets

This table reports the sensitivity of the returns on the underlying stock-to-market indices in both markets. The Underlying stock returns, market returns, and foreign exchange returns are computed using Friday closing prices. S&P 500 Index return is the weekly return using Friday opening prices. BSE 100 Index Return is the weekly return using Friday closing prices. Fx Return is a control variable for the foreign exchange return of the Indian currency.

Issuer	Underlying Stock Return					
	N	Intercept	BSE Return	S&P Return	Fx Return	Adj. R^2

Dr. Reddy's	294	0.081	**0.642**	0.011	-0.026	0.16
		(0.32)	**(6.80)**	(0.08)	(-0.04)	
HDFC Bank	281	0.303	**0.461**	**0.199**	**1.088**	0.22
		(1.51)	**(6.20)**	**(2.03)**	**(2.38)**	
ICICI Bank	311	0.378	**0.707**	0.143	0.794	0.17
		(1.21)	**(6.62)**	(0.95)	(1.07)	
Infosys Technologies	310	0.250	**1.065**	**0.468**	**-1.837**	0.41
		(1.01)	**(12.45)**	**(3.73)**	**(-3.10)**	
MTNL	268	**-0.579**	**1.194**	**-0.440**	0.237	0.29
		(-1.80)	**(9.95)**	**(-2.58)**	(0.33)	
Satyam Computers	292	0.015	**1.287**	**0.402**	**-2.081**	0.42
		(0.05)	**(12.53)**	**(2.94)**	**(-3.24)**	
Silverline Technologies	118	**-1.618**	**2.807**	0.117	**-10.420**	0.53
		(-1.94)	**(10.54)**	(0.40)	**(-2.59)**	
Tata Motors	118	-0.127	**1.095**	0.103	0.101	0.51
		(-0.45)	**(9.57)**	(0.46)	(0.19)	
VSNL	310	-0.076	**0.843**	**0.529**	0.068	0.25
		(-0.23)	**(7.46)**	**(3.31)**	(0.09)	
Wipro	310	-0.262	**1.584**	**0.360**	**-2.812**	0.49
		(-0.87)	**(15.46)**	**(2.37)**	**(-3.96)**	

All ADRs	2612	-0.124	**1.090**	**0.233**	**-0.784**	0.30
		(-1.18)	**(29.29)**	**(4.51)**	**(-3.18)**	

Similarly, the sensitivity of the ADRs is analyzed to the U.S. market in Table 3. The following equation is as follows:

$$ADR_{ret\ i,w} = \alpha + \beta_1 * BSE_{ret\ w} + \beta_2 * S\&P_{ret\ w} + \beta_3 * Fx_{ret\ w} + \varepsilon_i$$

As expected, the results show a strong positive relationship between the ADR returns and both market indices, i.e., BSE return (0.901) and S&P return (0.557). The exchange rate returns do not affect ADR returns in most cases.

Table 3: Relationship of ADR Return with the U.S. and Indian Markets

This table reports the sensitivity of the returns on the ADRs to market indices in both markets. The ADR returns are computed using Friday opening prices, while market returns and foreign exchange returns are computed using Friday closing prices. S&P 500 Index return is the weekly return using Friday opening prices. BSE 100 Index Return is the weekly return using Friday closing prices.

Issuer	ADR Return					
	N	Intercept	BSE Return	S&P Return	Fx Return	Adj. R^2
Dr. Reddy's	294	0.183	**0.565**	**0.317**	0.006	0.12
		(0.59)	**(4.90)**	**(2.06)**	(0.01)	
HDFC Bank	281	0.340	**0.519**	**0.511**	0.438	0.21
		(1.28)	**(5.29)**	**(3.95)**	(0.73)	

ICICI Bank	311	0.487	**0.727**	**0.498**	-0.374	0.15
		(1.30)	**(5.66)**	**(2.74)**	(-0.42)	
Infosys Technologies	310	0.200	**0.730**	**0.976**	-1.113	0.32
		(0.88)	**(7.39)**	**(6.72)**	(-1.62)	
MTNL	268	-0.393	**0.864**	-0.108	0.011	0.15
		(-1.13)	**(6.64)**	(-0.58)	(0.01)	
Satyam Computers	292	0.098	**1.118**	**0.810**	**-1.677**	0.34
		(0.29)	**(9.04)**	**(4.92)**	**(-2.17)**	
Silverline Technologies	118	-1.605	**1.938**	0.122	-7.392	0.19
		(-1.33)	**(5.02)**	(0.29)	(-1.27)	
Tata Motors	118	-0.138	**1.056**	0.342	-0.114	0.54
		(-0.51)	**(9.73)**	(1.60)	(-0.22)	
VSNL	310	0.012	**0.686**	**0.905**	0.470	0.24
		(0.03)	**(5.59)**	**(5.22)**	(0.55)	
Wipro	310	-0.152	**1.343**	**0.658**	-1.195	0.41
		(-0.46)	**(12.02)**	**(3.95)**	(-1.54)	
All ADRs	2612	-0.013	**0.901**	**0.557**	-0.566	0.23
		(0.08)	**(12.69)**	**(8.13)**	(0.60)	

From Tables 2 and 3, a careful examination of the beta difference between the ADR and its underlying stock to the Indian market index, i.e., the difference in coefficients of BSE

return (0.901 – 1.090) to ADR and its underlying stock is -0.189. When the beta difference between the ADR and its underlying stock to the U.S. market (0.557 – 0.233) is analyzed, it shows a positive difference, i.e., 0.324. The results reveal that, compared to the underlying stock, ADRs are more sensitive to the U.S. market. Similarly, ADRs are less sensitive than the underlying stock to the Indian market, though this tendency is much less pronounced. Thus, securities are more sensitive to the market index for the countries in which they are traded. Overall, these results are consistent with prices for the ADRs and the underlying stocks being determined in segmented markets.

Now, the paper analyzes the relationship of ADR premiums with order imbalance to disentangle whether the premiums observed are due to mispricing or investor demand. The following model is used to analyze the cross-sectional, time-series panel data on weekly ADR premiums:

$$Prem_{i,t} = \sum_i \alpha_i D_i + \sum_i \beta_i Prem_{i,t-1} + \sum \gamma_k Z_{k,t} + \sum_i D_i R_{i,t}^{Stock} + \sum_i \lambda_i D_i R_t^{SP500} + \sum_i \phi_i D_i R_t^{BSE500} + \sum_i \psi_i D_i R_t^{Fx} + \varepsilon_{i,t}$$

where $Prem_{i,t}$ is the premium observed in week t on ADR_i, D_i is dummy variable set equal to 1 for ADR_i and 0 otherwise; $Prem_{i,t-1}$ is the one-week lag premium, and Z_k is a vector of k potential determinants of the ADR premiums. It is a fixed effects model with first-order autoregressive disturbance terms and maximum likelihood to account for autocorrelation in the regression residuals. The α coefficients account for fixed effects in the data.

Table 4 explores the relationship of ADR premiums to one-week lag premium, small investor participation, small (total) order imbalances, and control variables such as returns on the underlying stock, S&P500, BSE100 indices, and foreign exchange. Model 1 of Table 4 scrutinizes the relationship between ADR premiums to one-week lag premiums. As expected, the lag premium is highly and positively related to the premium. ADR premiums have a significant, positive relationship to contemporaneous S&P500 index returns, but they are not related to BSE index returns. Interestingly, ADR premiums are negatively and significantly related to contemporaneous returns on the underlying stocks. The results suggest that ADR prices only adjust partially to the underlying stock prices.

Table 4: The Regression Analysis of ADR Premium with Trade Orders

This table presents the effect of trade orders on ADR premiums after controlling for market factors. It reports the estimates of fixed effects models with first-order autoregressive disturbance terms. Lag Premium is the weekly premium of the previous week. Small Investor Participation measures small trades as a percentage of the total weekly ADR dollar volume. Trades with a value of less than $10,000 are classified as small trades. Small (Total) Order imbalance measures the order imbalance of small (total)

trades from Friday to Thursday. They are standardized by respective average dollar volume in the preceding quarter. Stock Return is the weekly return for underlying stock using Friday's closing price. S&P Return is the weekly Standard and Poor's 500 Index returns using Friday's opening price. BSE Return is the weekly BSE 100 Index returns using Friday's closing price. Fx Return is the foreign exchange rate weekly returns of Indian currency using Friday closing price. ADR premium, the dependent variable, is a percentage premium calculated using Friday opening prices of ADRs and Friday closing prices of underlying stocks. Dummies is an interactive dummy for each ADR with S&P 500 returns, BSE 100 returns, and foreign exchange rate returns. Numbers in parentheses are t-statistics based on White's correction.

Variables	Weekly Premium as Dependent Variable			
	Model 1	Model 2	Model 3	Model 4
Lag Premium	**0.940**	**0.940**	**0.937**	**0.937**
	(145.63)	**(145.38)**	**(146.88)**	**(148.21)**
Small Investor Participation		0.002		
		(0.30)		
Small Order imbalance			**0.023**	**0.014**
			(8.73)	**(4.45)**
Total Order imbalance				**0.017**
				(6.30)
Stock Return	**-0.111**	**-0.111**	**-0.136**	**-0.151**
	(-6.22)	**(-6.18)**	**(-7.58)**	**(-8.40)**
S&P Return	**0.351**	**0.352**	**0.315**	**0.311**
	(2.60)	**(2.60)**	**(2.32)**	**(2.31)**

BSE Return	-0.052	-0.054	-0.052	-0.038
	(-0.52)	(-0.54)	(-0.52)	(-0.40)
Fx Return	0.023	0.033	0.097	0.039
	(0.04)	(0.06)	(0.14)	(0.07)
Dummies	**0.979**	**0.951**	0.635	0.510
	(1.81)	**(1.69)**	(1.16)	(0.93)
Chi-Square	189.01	183.20	169.23	171.31
Number of Observations	2430	2429	2386	2386

Model 2 of Table 4 examines the effect of small investor participation on ADR premiums. Small investor participation is measured as the percentage of total volume that is accounted for by trades with a value less than $10,000. The results do not support the conclusion that small investor participation positively relates to ADR premiums. Therefore, Model 3 of Table uses order imbalance for small trades to examine its impact on ADR premiums. The regression results show that it is positively and significantly related to ADR premiums. However, high ADR premiums may induce this result for small orders. To control for such an effect and to get an overall understanding of investor demand, Model 4 of Table 4 includes total order imbalance, which is based on all trades regardless of size. Thus, investor demand should be related to overall order imbalances rather than imbalances within a segment of trades. The results demonstrate that small or total order imbalance remains positive and highly significant, suggesting no mispricing in ADR prices. If there is mispricing, the premium will not continue for an extended period. The findings suggest that investor demand as proxied order imbalances leads to continuing ADRs premium.

Since the order imbalance data used in the analysis is weekly, it is pertinent to test the autocorrelation. The test indicates that small or total order imbalances are autocorrelated. Next, as a robustness check, Table 5 accounts for this autocorrelation by cumulative change using four lags for both order imbalances and relative depositary receipts size compared to underlying stocks. The four lags change variable allows us to attest to the findings of Table 4 and how unexpected changes in investor sentiment influence ADR premiums.

Table 5: The Regression Analysis of ADR Premium – Robustness Checks

This table presents the effect of small trades on ADR premiums after controlling for market factors. It reports the estimates of fixed effects models with first-order autoregressive disturbance terms. Small (Total) Order imbalance – Change is the cumulative change using four lags of the small (total) order imbalance to measure the overall small (total)-trade order imbalance. Relative DR Size is represented as percentages of total outstanding shares. The remaining variables are explained in Table 4. Numbers in parentheses are t-statistics based on White's correction.

Variables	Weekly Premium as Dependent Variable		
	Model 1	Model 2	Model 3
Lag Premium	**0.942**	**0.941**	**0.925**
	(143.96)	**(144.74)**	**(128.37)**
Small Order imbalance - Change	**0.028**	**0.020**	**0.020**
	(9.21)	**(5.81)**	**(5.64)**
Total Order imbalance - Change		**0.015**	**0.015**
		(5.44)	**(5.58)**
Relative DR Size			**-0.123**
			(-5.32)
Stock Return	**-0.156**	**-0.168**	**-0.163**
	(-8.52)	**(-9.19)**	**(-8.73)**
S&P Return	**0.329**	**0.327**	**0.316**
	(2.38)	**(2.38)**	**(2.32)**
BSE Return	-0.035	-0.024	-0.034

	(-0.37)	(-0.27)	(-0.34)
Fx Return	0.055	0.016	-0.011
	(0.07)	(0.02)	(-0.02)
Dummies	0.813	0.606	**3.149**
	(1.50)	(1.11)	**(3.06)**
Chi-Square	169.07	169.22	143.45
Number of Observations	2298	2298	2186

Model 1 of Table 5 reveals that the coefficient for small order imbalance change is positively and statistically significant. When the total and small order imbalances change, both are accounted for in Model 2 of Table 5, and the results are similar to Table 4. The inclusion of relative depositary receipts size in Model 3 of Table 5 does not alter the coefficients of both change variables. However, as expected, it is observed that the ADR premium is negatively related to the level of relative DR size.

Based on regression analysis, the findings primarily suggest that Indian ADR premiums are induced by investor demand rather than by mispricing. The results are consistent regardless of contemporaneous or four lags of order imbalances.

5. Conclusions

The paper examines the Indian ADR premiums across stocks and over time. Indian government regulations prevent these premiums from being arbitraged away in secondary markets. Consistent with prior literature, the findings indicate that Indian ADR returns are significantly and closely related to the underlying market returns. Premiums are negatively related to the contemporaneous return on the underlying stock. These findings suggest that ADR prices only adjust partially to prices of the underlying stock and are consistent with market segmentation leading to related but separate processes for price formation in the two markets.

Using order imbalance of small and total trades, this study indicates that ADR premiums are positively affected. In other words, Indian ADR premiums are significantly and positively related to the buy demand of investors. Overall, the results support the idea that the Indian ADRs are not mispriced and premiums observed are due to investor demand, as appraised by order imbalances.

This study expands to the literature on order imbalanced and dual-listed securities, particularly for ADRs. The data frequency is a weekly frequency compared to monthly data in most literature. It provides a valuable source of information on the same security traded in different trading locations and market segmentations. Further, it offers insight into an emerging market stock listed in the most developed financial markets. In the future, this study can be extended to cover all ADRs and examine the relationship between their premium or discounts with order imbalance. Further, the order imbalance can be decomposed into short- and long-run components, showing how both parts influence ADR returns and premiums/discounts.

Limitation of the Paper: This paper contains all Indian ADRs traded on the U.S. market during the sample period. However, the sample size is ten ADRs. One needs to be careful to generalize the implication of the research to other countries' ADRs. Though the sample period is six years, it is from 2001 to 2006. The quote data is only limited to ADR quotes and not the underlying stocks.

REFERENCES

Amihud, Y., A. Hameed, W. Kang and H. Zhang, 2015, "The illiquidity premium: International evidence," *Journal of Financial Economics*, Vol. 117, No. 2, pp. 350–68.

Atanasova, C. and M. X. Li, 2018, "Multi-market trading and liquidity: Evidence from cross-listed companies," *Journal of International Financial Markets, Institutions and Money*, Vol. 53, pp. 117–38.

Bae, S. C., Kwon, T. H., and Li, M. (2008) Foreign exchange rate exposure and risk premium in international investments: Evidence from American depositary receipts. *Journal of Multinational Financial Management* 18(2), 165–179.

Barber, B.M. Odean, T. and Zhu, N. (2008), "Do retail trades move markets?" *The Review of Financial Studies*, Vol. 22 No. 1, pp. 1-36.

Beckmann, K. S., Ngo, T., and Wang, D. (2015) The informational content of ADR mispricing. *Journal of Multinational Finance Management* 32–33, 1–14.

Chan, J. S. P. Hong, D. and Subrahmanyam, M. G. (2007), "A tale of two prices: Liquidity and asset prices in multiple markets", *Journal of Banking & Finance*, Vol. 32 No. 6, pp. 947-960.

Chan, K. Hameed, A. and Lau, S. T. (2003), "What if Trading Location is Different from Business Location? Evidence from the Jardine Group", *The Journal of Finance*, Vol. 58 No. 3, pp. 1221–1246.

Froot, Kenneth A., and Emil M. Dabora (1999) 'How are stock prices affected by the location of trade?' *Journal of Financial Economics* 53(2), 189 – 216

Hietala, Pekka T. (1989), "Asset pricing in partially segmented markets: Evidence from the Finnish Market", *The Journal of Finance*, Vol. 44 No. 3, pp. 697-718.

Hughen, J. C. and McDonald C. G. (2005), "Who are the noise traders?" *The Journal of Financial Research*, Vol. 28 No. 2, pp. 281-298.

Jithendranathan, T., Nirmalanandan, T. R., and Tandon, K. (2000). Barriers to international investing and market segmentation: Evidence from Indian GDR market. *Pacific-Basin Finance Journal* 8(3–4), 399–417.

Kadapakkam, P and Misra, L. (2003), "Return Linkages between Dual Listings under Arbitrage Restrictions: A Study of Indian Stocks and their London Global Depositary Receipts", *The Financial Review*, Vol. 38 No. 4, pp. 611-633.

Lamont, Owen A., and Richard H. Thaler (2003) 'Anomalies: The law of one price in financial markets.' *Journal of Economic Perspectives* 17(4), 191–202

Lee, C.M. and Radhakrishna, B. (2000), "Inferring investor behavior: Evidence from TORQ data", *Journal of Financial Markets*, Vol. 3 No. 2, pp. 83-111.

Puthenpurackal, J. (2006), "Explaining premiums in restricted DR markets and their implications: The case of Infosys", *Financial Management*, Vol. 35 No. 2, pp. 93-116.

Stigler, M., Shah, A., and Patnaik, I. (2010) Understanding the ADR premium under market segmentation. National Institute of Public Finance and Policy Working Paper.

Wu, J., Lin, J., Yang, Z., and Dong, L. (2020) Effects of cross-border capital flows on stock returns of dual-listed firms in mainland China and Hong Kong: Evidence from a natural experiment. *Pacific Economic Review* 2020, 1–29.

Zhang, X. C., Jia, Y. D., and Lv, T. T. (2020) The impacts of the US dollar index and the investors' expectations on the AH Premium: A macro perspective. The People's Bank of China Working Paper No.2020/4.