The Adani Controversy: A Price Efficiency Analysis

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After the publication of the Hindenburg report on the Adani Group, one of the biggest Indian industrial conglomerates, there has been considerable debate about whether the Adani group engaged in stock price manipulation. Based on Multifractal Detrended Fluctuation Analysis (MF-DFA) of daily and intraday data for share prices of all listed companies in the Adani group for the period between 2010 and 2022, we find that Adani group companies had lower levels of price efficiency than other large, listed companies in India. Although low price efficiency does not necessarily imply price manipulation, it suggests the existence of considerable information asymmetries.

Keywords: Adani Group, Indian market, price efficiency, information asymmetry

INTRODUCTION

Adani Group is an Indian conglomerate that is a dominant player in several key industries in India, including coal trading, electricity production, logistics, agribusiness, natural gas distribution, and data centers. They are also the country's largest private-sector operator of seaports and airports, highlighting its significant presence in India's infrastructure sector. From relatively modest origins, Gautam Adani, founder of the group, rose to become the world's third-richest person with an estimated net worth of $120 billion according to Forbes, 2022 ranking.

Hindenburg report on Adani Group

Hindenburg Research is a New York-based short-seller that tracks fraudulent activities and other anomalies in the stock market. Hindenburg Research has revealed the questionable practices of approximately 30 firms, including Nikola, Block Inc., and Lordstown Motors. The publication of Hindenburg's report on Adani was a bombshell that led to a more than a $100 billion decrease in the combined market value of their publicly traded companies. According to Hindenburg's findings, Adani Enterprises' shares were traded at a staggering 500 times their earnings, while Adani Green Energy boasted an even higher price-to-earnings ratio of over 800.To put this in perspective, during the height of the technology boom in late 2021, the tech-heavy NASDAQ index in the United States had a ratio of less than

30, making Adani's ratios seem unusually high by comparison. The investigation also uncovered that several major publicly listed Adani companies had amassed significant amounts of debt using their overvalued stock as collateral for loans. Among the 578 subsidiaries associated with the Adani Group, the seven publicly listed Indian companies hold a preeminent position and are involved in over 6,025 related-party transactions.

Furthermore, the group maintains many shell companies in foreign jurisdictions such as Mauritius. These shell companies, it was accused, were engaging in stock price manipulation. The Adani Group denied these allegations and claimed that these were motivated attacks by the West to slow down India's growth. Supporters pointed to the excellent execution of infrastructure projects by the Adani Group and their record of never defaulting on their loans. Critics saw this as a case of a politically connected business group enjoying state patronage engaging in financial shenanigans to expand their business at breakneck speed, violating the principles of fair market competition.

Our goal in this paper is not to prove or disprove whether the Adani Group engaged in stock manipulation or other acts of financial misconduct. Instead, our effort is to examine the price efficiency of the stock of Adani Group companies using a novel methodological approach. A security's price is efficient if all available information is reflected in its price. The functioning of financial markets depends on the availability of high-quality information and the incorporation of such information in the prices. Efficient markets are conducive to the allocative efficiency of capital in an economy.

SAMPLE

Our approach to evaluate the price efficiency of Adani Group companies was to compare them against the biggest 20 companies in India by market capitalization. Such an analysis can shed light on the overall efficiency of the Indian market and the relative efficiency of Adani companies against the largest listed companies in India. If the analysis shows significant differences in the market efficiency of Adani companies versus other large companies, researchers can then explore the causes of such differences.

TABLE 1
LIST OF THE LARGEST COMPANIES BY MARKET CAP AND ADANI GROUP COMPANIES

Largest Market Cap in India (1/1/2023)				
Company Name	*Market Cap (in US $)*	*Total Debt ($)*	*Cash ($)*	*Enterprise Value (in US $)*
Reliance Industries Limited	$195,521	$38,837	$5,930	$228,427
Tata Consultancy Services Limited (NSEI:TCS)	$143,986	$917	$717	$144,186
HDFC Bank Limited (NSEI:HDFCBANK)	$109,711	$31,933	$12,869	$128,775
Infosys Limited (NSEI:INFY)	$75,992	$802	$1,828	$74,966
ICICI Bank Limited (NSEI:ICICIBANK)	$75,098	$22,415	$17,026	$80,487
Hindustan Unilever Limited (BSE:500696)	$72,672	$155	$486	$72,341
State Bank of India (NSEI:SBIN)	$66,179	$63,338	$28,769	$100,848
HFDC Limited (BSE:500010)	$58,198	$47,459	$349	$105,309
Bharti Airtel Limited (BSE:532454)	$56,259	$26,788	$1,461	$81,586
Adani Enterprises Limited (BSE:512599)	$53,161	$5,062	$486	$57,738

Life Insurance Corporation in India (NSEI:LICI)	$52,321	$0	$3,509	$48,812
ITC Limited (NSEI:LICI)	$49,730	$31	$595	549,166
Adani Total Gas Limited (NSEI:ATGL)	$49,074	$148	$49	$49,173
Bajaj Finance Limited (NSEI:BAJFINANCE)	$47,927	$17,708	$231	$65,404
Kotak Mahindra Bank Limited (BSE:500247)	$43,831	$6,395	$5,061	$44,832
Adani Green Energy Limited (NSEI:ADANIGREEN)	$36,974	$6,395	$178	$43,192
Asian Paints Limited (NSEI:ASIANPAINT)	$35,789	$229	$102	$35,916
Larsen & Toubro limited (BSE:532215)	$35,421	$15,861	$2,160	$49,122
Adani Transmission Limited (NSEI:ADANITRANS)	$34,899	$4,129	$244	$38,784
Axis Bank Limited (BSE:S32215)	$94,697	$25,155	$8,964	$50,888
Other Publicly Traded Adani Firms (1/1/2023)				
Adani Ports and Special Economic Zone Limited	$21,353	$5,680	$717	$26,316
Adani Power Limited (NSEI:ADANIPOWER)	$13,960	$5,560	$248	$19,272
Adani Wilmar Limited (NSEI:AWL)	9,70	$383	$503	$9,580
Aggregated Value for all Adani firms (1/1/2023)				
Adani (all publicly traded)	**$219,122**	**$27,356**	**$2,424**	**$244,055**

Source: Aswath Damodaran (linkedin.com/in/aswathdamodaran)

Table I provides a list of the biggest 20 companies in India and the Adani Group companies. We collected daily data for the share prices of these companies for the period from 2010 to 2022. Four Adani Group companies, Adani Total Gas Limited, Adani Green Energy Limited, Adani Transmission Limited and Adani Wilmar Limited, have been listed since November 2018, June 2018, July 2015 and February 2022.The same is the case with Life Insurance Corporation of India, which was listed only in May 2022.Therefore, these companies could not be included in the long-term analysis. We did a separate analysis with high-frequency data for all companies for a shorter time window as explained later.

METHOD

Researchers have increasingly used multifractal analysis to assess price efficiency in recent years. Of the many approaches for conducting multifractal analysis, the MF-DFA approach proposed by Kantelhardt *et al*., (2002), has gained increasing acceptance (Diniz-Maganini, Rasheed, Yaşar & Sheng, 2023). A major advantage of the MF-DFA approach is that it allows us to compare the price efficiency of one price series over another unlike prior approaches. The MF-DFA analysis allows us to estimate the generalized Hurst exponent h(q), an important indicator of the efficiency of a time series. The higher the Δh coefficient, the less efficient a company's share price.

RESULTS

We estimated the parameter Δh using the MFDFA approach using daily data for seven years each rolling windows (2010-2016, 2011-2017, 2012-2018, 2013-2019, 2014-2020 2015-2021 and 2016-2022). We used

seven-year windows because MF-DFA analysis requires a large number of data points over an extended period. The rolling windows also allow us to examine changes in efficiency over time which is particularly important in the context of a market which is undergoing institutional changes.

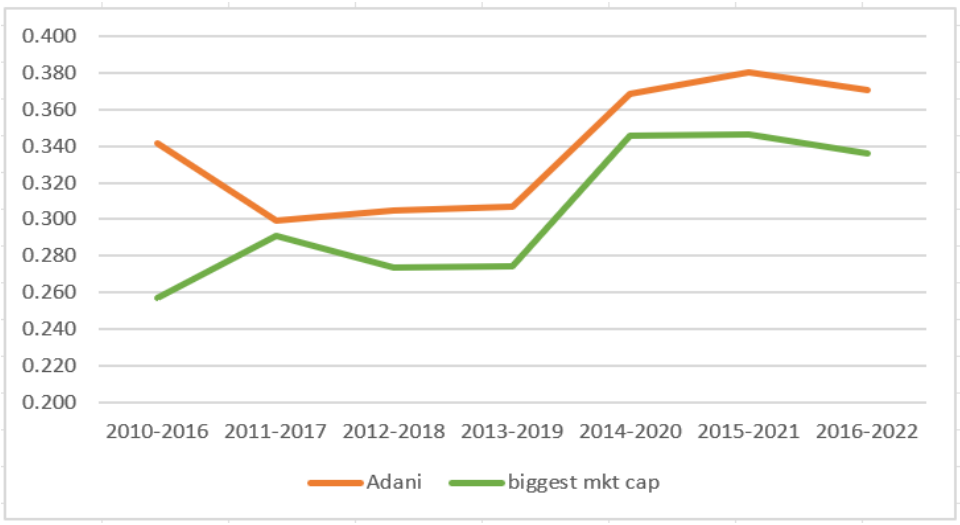
Table II below provides Δh values for the three Adani Group companies and the firms with the highest market cap excluding Adani Group companies. The table shows that in all rolling windows, the average Δh values of the Adani´s Group companies are greater than the averages of the largest Indian companies, indicating lower market efficiency for the companies in the Adani Group for all periods.

TABLE 2
COMPARISON OF EFFICIENCIES OF ADANI GROUP COMPANIES VERSUS BIGGEST MARKET CAP COMPANIES USING ROLLING WINDOWS

Window/ Company	2010-2016	2011-2017	2012-2018	2013-2019	2014-2020	2015-2021	2016-2022
Adani (3 companies)	0.342	0.299	0.305	0.307	0.368	0.380	0.370
Biggest mkt cap	0.257	0.291	0.274	0.275	0.345	0.347	0.336

Additionally, the table suggests the following conclusions. First, the efficiency differences fluctuate over time. The biggest difference is in the 2010- 2016 time window in which Adani Group companies have an efficiency level of 0.342 compared to 0.257 for the average of other companies. This is a 33.04% lower efficiency level. As for the other windows, this difference remains, however, to a lesser extent. For the latest time window, Adani Group companies have an efficiency level of 0.37 versus 0.336 for other big companies, which is a 10.24% gap. Second, the overall efficiency of the market has been declining significantly. Third, the narrowing of the gap in efficiency between Adani companies and other big companies is not due to improvement in Adani companies but due to the efficiency decline of the entire market. The comparison is presented in a graphical format below.

FIGURE 1
COMPARISON OF EFFICIENCIES OF ADANI GROUP COMPANIES VERSUS BIGGEST MARKET CAP COMPANIES USING ROLLING WINDOWS



In the next step in our analysis, instead of comparing the averages, we individually compared the price efficiencies of the top 10 companies. Table III presents the results of this analysis. For each window,

we highlight the two companies with the lowest efficiency. We can see that for five (2010-2016, 2011-2017, 2012-2018, 2014-2020 and, 2016-2022) of the seven rolling windows analyzed, Adani Enterprises Limited, the flagship company within the Adani Group is among the two companies that have the lowest price efficiency. In the 2013-2019 time window, it is the third most inefficient and in the 2015-2021 window, it is the fourth least efficient company. Thus, the general conclusion is that Adani Enterprises have lagged behind other large Indian companies regarding market efficiency.

TABLE 3
COMPARISON OF PRICE EFFICIENCIES OF THE LARGEST INDIAN COMPANIES USING ROLLING WINDOWS

Company Name	2010-2016	2011-2017	2012-2018	2013-2019	2014-2020	2015-2021	2016-2022
Reliance Industries Limited	0.215	0.226	0.222	0.249	0.384	0.369	0.346
Tata Consultancy Services Limited	**0.182**	**0.196**	**0.176**	0.245	0.330	0.280	0.309
HDFC Bank Limited	0.231	0.240	0.254	0.263	0.334	0.330	0.292
Insofys Limited	0.363	0.349	0.325	0.340	0.405	0.371	0.358
ICICI Bank Limited	0.233	0.297	0.268	**0.240**	0.336	0.384	0.314
Hindustan Unilever Limited	0.373	0.375	0.403	0.371	0.343	0.344	0.342
State Bank of India	0.231	0.306	0.259	0.270	0.287	0.291	**0.283**
Bharti Airtel Limited	0.211	0.276	0.264	0.248	**0.249**	**0.264**	0.332
Adani Enterprises Limited	0.468	0.357	0.342	0.301	0.385	0.346	0.379

Figure 2 compares average Δh values of the 9 largest Indian companies in relation to Adani Enterprises. It is clear from the graph that for all time windows the price efficiency for Adani Enterprises is lower than the average of the largest 10 companies.

FIGURE 2
COMPARISON OF EFFICIENCIES OF ADANI ENTERPRISES VERSUS BIGGEST MARKET CAP COMPANIES USING ROLLING WINDOWS

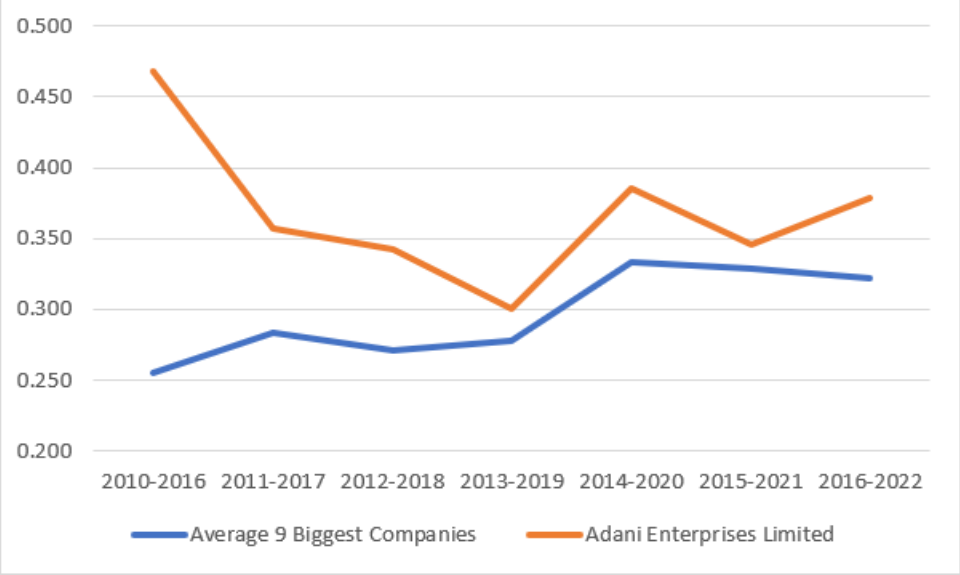


TABLE 4
COMPARISON OF PRICE EFFICIENCIES OF ADANI GROUP COMPANIES VERSUS LARGEST INDIAN COMPANIES FOR THE PERIOD 2022-23 USING HOURLY PRICES

		Largest Market Cap firms in India (1/1/2023)	
Company Name	**Δh**	**Company Name**	**Δh**
Adani Total Gas Limited	0.429	Asian Paints Limited	0.347
Adani Transmission Limited	0.653	Axis Bank Limited	0.322
Adani Power Limited	0.347	Bajaj Finance Limited	0.345
Adani Wilmar Limited	0.447	Bharti Airtel Limited	0.279
Adani Enterprises Limited	0.752	HDFC Bank Limited	0.362
Adani Green Energy Limited	0.461	Hindustan Unilever Limited	0.246
Adani Ports and Special Economic Zone	0.643	ICICI Bank Limited	0.273
	0.533	Insofys Limited	0.343
	0.149	ITC Limited	0.316
		Kotak Mihindra Bank Limited	0.257
		Larsen & Toubro Limited	0.224
		Life Insurance Corporation of India	0.477
		Reliance Industries Limited	0.340
		State Bank of India	0.339
		Tata Consultancy Services Limited	0.374
		Average	**0.323**
		Std.deviation	**0.062**

The differences between Adani group companies and other large companies are much starker during the 2022-2023 period, just before the stock price collapse. While the companies in the Adani group have an average efficiency level of more than 0.53, the other companies have an average of 0.32. That is, the Adani Group companies, on average, have a level of price efficiency 65% lower than the other companies.

DISCUSSION

The results of our analysis indicate that the share price movements of Adani Group companies were lacking in price efficiency. Our analysis suggests that the overall Indian market has a medium level of efficiency, as could be expected from the stock market of an emerging country. The Adani Group companies demonstrate less price efficiency than other large Indian companies. Further, the more recently listed companies show lower price efficiency than the more established group companies.

Why does price efficiency matter? In an efficient market, all available information is reflected in market prices. Markets become inefficient when there is considerable information asymmetry in the market. Worse still, there may be significant information voids due to inadequate or misleading information disclosure. In developed markets, regulatory authorities mandate frequency, quantity and quality of disclosure so that markets are efficient. An efficient market reduces arbitrage opportunities for investors. More importantly, efficient markets deliver better capital allocation within an economy than inefficient markets.

Before we derive policy implications from our analysis of Adani Group companies, it is important to understand the limitations of an efficiency analysis. An efficiency analysis does not tell us if a stock is price reflects its true value or not. Nor does it tell if there was stock price manipulation. It only tells if the prices of a stock reflected all available information at a point in time. However, evidence of price inefficiency in conjunction with other pieces of evidence can provide valuable insights about whether a company's stock price movements indicate attempts at manipulating prices.

Policy Implications

Financial markets worldwide are subject to periodic upheavals, many caused by unethical actions by market participants. The Wirecard scandal in Germany and the Theranos and FTX scandals in the US suggest that even developed markets are not immune to major governance failures. In developed markets, governance failures are promptly followed by quick measures to prevent the repetition of similar failures in the future. The Sarbanes-Oxley Act and the Dodd-Frank Act are examples of such quick measures in the US. What can be done to improve the efficiency of Indian markets?

Strive towards diffuse stock ownership. Indian regulations mandate that publicly listed companies disclose all insider holdings, known as promoter holdings in India, and require that such companies have a minimum of 25% of their float held by non-promoters to prevent market manipulation and insider trading. However, four of Adani's listed companies are perilously close to breaching the threshold owing to excessive promoter ownership. There is evidence to suggest that related parties held a significant part of the remaining shares through offshore companies. Low float, thin trading and trading among related parties can potentially increase the possibility of stock manipulation.

Limit the use of stock as collateral for loans. When a company can use its own stock as collateral for loans, there is naturally an incentive to pump up the stock price. The Adani Group is vastly overleveraged and to a great extent this was made possible by the use of stock as collateral. Placing restrictions on the extent to which stock could be used as collateral for loans can reduce the incentive on the part of promoters to manipulate stock prices.

Improve disclosure of ownership data. Many firms have been able to avoid disclosing stock ownership data by establishing shell companies in tax haven locations to buy significant shares of stock. When the promoters themselves control these shell companies, it leads to excessive control by one group of owners which can lead to principal-principal conflicts with the potential for one group of owners to expropriate benefits from other owners.

Strengthen audit standards. Publicly listed companies must make audited financial statements available to all investors. Independent audits by competent external auditors can greatly enhance faith in the capital markets. Interestingly, Adani Group's auditor is a relatively obscure firm with limited staff. Even more disturbingly, one of the key persons in the group also serves on the board of the auditing firm. It is up to the Securities and Exchange Board of India (SEBI) to develop more stringent requirements to ensure the quality of the auditors.

Although the above measures can strengthen market efficiency in most emerging markets, the problems in the Indian context are exacerbated by the widely held perception that certain business groups enjoy patronage by the state. As Chatterjee (2023) observed "India appears to exhibit a symbiotic relationship between the state leadership and a small coterie of favored businessmen. Instead of the impersonal character of idealized market exchange, a personalized and highly centralized system has arisen to mobilize private resources through elite exchanges of power and wealth." While such patronage through privileged access to resources reduces default risks for creditors in the short run, the absence of efficient markets can inevitably lead to market distortions and inefficient capital allocation.

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