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# An analysis of the volatility of Indian Defence stocks using Bollinger bands

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**Abstract**:

The existence of a relationship between Stock market fluctuations and the economy of the state, country or region may be interrelated to each other in one way or another. This research paper is an effort to understand the fluctuations or volatility in Indian Defence stocks and how it has propelled the growth of the Indian Defence sector in recent times. Five major companies include includes Hindustan Aeronautics Limited (HAL), BHARAT ELECTRONICS LTD, Mazagon Dock Shipbuilders Limited, Cochin Shipyard Ltd, Bharat Dynamics Ltd for the period of one year approx. i.e., between 30-12-2021 to 30-01-2023 (272 days of stock trading).

*Keywords*: defence, market, movement, stocks, volatility

## INTRODUCTION

A country's growth and development might be related to the volatility of the stocks or group of stocks in its macroeconomy.

First, when a country grows, its production structure shifts from more volatile to less volatile industries. Second, the volatility of country-specific macroeconomic shocks decreases over time. Third, the covariance of sectoral and country-specific shocks does not vary systematically with development level. There is also evidence that the degree of sectoral concentration decreases throughout the early stages of development and rises later on. Many ideas relating to volatility and development, we believe, are inconsistent with these findings, and we propose alternative routes for future theoretical investigation. Another paper (António Afonso, Davide Furceri, 2010) examines the impacts of government revenue and spending on growth in OECD and EU nations in terms of size and volatility. The paper's findings show that both characteristics are harmful to growth. Looking more closely at each component of government revenue and spending, the results show that among indirect taxes (size and volatility) among social contributions (size and volatility);

government consumption (size and volatility); subsidies (size); and government investment (volatility) all have a sizeable, negative, and statistically significant effect on growth.

A new model was developed (Robert F. Engle, Eric Ghysels, Bumjean Sohn, 2019) with a long-term component driven by inflation and industrial output growth that, in terms of pseudo-out-of-sample prediction, are comparable to or exceed more typical time series volatility models over longer time horizons. As a result, including economic fundamentals in volatility models pays dividends in terms of long-term predictions. We also discover that macroeconomic fundamentals have an important effect even over a short period.

When economies are fragile, manufacturers of fighter planes, battleships, and missiles are traditionally one of the finest defensive havens for investors, Geopolitical turmoil and unrest are also crucial components in the attacking arsenal this time around.

When a downturn erodes demand or an external shock rattles the market, the US government budget, particularly military spending, tends to remain constant. When recession worries raise, equities such as Lockheed Martin Corp., Northrop Grumman Corp., and others become more appealing. As the world watches Russia's assault on Ukraine, nations are increasing military spending. Even more concerning is China President Xi Jinping's growing friendship with Russian President Vladimir Putin, which includes Chinese forces participating in joint drills sponsored by Russia. This just adds to concerns over China's recent demonstration of military strength around and above Taiwan during US House Speaker Nancy Pelosi's August visit to the island. That led to an increase in market demand for US war machines which further led to an increase in the market for such defence products.

## INDIAN INDUSTRY EXISTENCE:

The Indian defence ministry's budgetary allotment was increased in Budget 2022–23 by 9.8% to $70.6 billion. There are several factors that led to this surge in defence spending, with geopolitical factors including the standoff with China in Ladakh and the sight of Russian weaponry performing poorly in Ukraine. The latter circumstance taught India three lessons:

1. When it becomes utmost necessary, foreign equipment manufacture and availability may be constrained. Because some of the components for their outdated precision weapons are created in other nations, who are now either unwilling or unable to supply them, the Russians are failing to replace them.

2. The Indian Armed Forces' predominantly Russian-made equipment appears to be ineffective against Western weaponry.

3. Western equipment, while of great quality, is very expensive and difficult to build rapidly in large quantities. As a result, deliveries to Ukraine have been delayed since Western nations are unwilling to provide expensive equipment that is also difficult to replace soon.

It is therefore not surprising that the Indian government has emphasized "Make in India" in the manufacturing of defence. The military ministry just announced the sixth positive indigenization list, which consists of 780 products and would reduce defence imports. To gradually increase their capacity for producing defence goods, Indian businesses (both public and private) are also investing more and more in defence technology (such as drones, armoured vehicles, and rockets).

Top defence stocks that stockholders may be interested in include:

| SI No. | Name of the company | Share price change in last 1 year |
|---|---|---|
| 1 | Hindustan Aeronautics Ltd | 89.57% |
| 2 | Bharat Electronics Ltd | 62.17% |
| 3 | Bharat Dynamics Ltd | 127.92% |
| 4 | Mazagon Dock Shipbuilders | 156.84% |
| 5 | Cochin Shipyard Ltd | 65.15% |

*Table 1. Top Indian defence stocks*
*(Source:* **https://www.angelone.in/blog/best-defence-stocks-in-india***)*

## LITERATURE REVIEW:

The literature review has been divided into two parts to understand some major literature studies for both the stock market Volatility and Defence sector.

### a. Stock Market Volatility:

The concept of stock market volatility aids in determining the characteristics of the financial market in current times. Kim HiangLiow (2005) investigated the dynamics of conditional returns, volatility, and systematic risk in 10 emerging and developed real-estate markets, as well as two global market indexes (i.e., world stock and world real estate). He also mentioned how clustering, predictability, strong persistence, and asymmetry in country-specific and global market conditional volatility are important for developing real estate markets, which have higher conditional volatility and persistence than developed markets, and how time-varying real estate betas relative to a world real-estate index over a world stock index may favour time-varying real estate betas. Bo-Young Choi et al. (2017) investigated how exchange rate volatility affects total factor productivity

(TFP) across multiple dimensions. The findings revealed that the negative impacts of volatility on productivity were distributed unevenly among TFP quantiles and formed an inverted W-shape curve. The negative effects were especially obvious for exporting plants with the lowest or highest TFPs. Gabaix Xavier (2005) Excess stock market volatility is a notion in which market swings are caused by trades by very large institutional investors in very illiquid markets. Derivations from such theory reveal these investors' optimal trading behaviour, which provides a cohesive explanation for seemingly disparate empirical regularities in returns, trading volume, and investor size.

Another study by Hashimijoo (2012), looked at the relationship between dividend policy and share price volatility in consumer goods companies listed on the Malaysian stock exchange. The empirical findings of this study revealed a substantial negative association between share price volatility and the two key dividend policy measurements, dividend yield and dividend payout. Furthermore, a significant inverse link between share price volatility and size is discovered. Among predictor variables, dividend yield and size had the greatest impact on share price volatility, according to the findings of this study.

Some segments of stocks may behave similarly as indicated by research by Perlin, and Marcelo (2007), who proposed a multivariate variant of pairs trading in which an artificial pair for a certain stock is created using information from m assets rather than simply one. The key conclusion of the paper is that for the majority of the parameters, the proposed version outperformed the benchmark returns and random portfolios. Daniel, Kent D. (1997) develop a theory based on investor overconfidence and biased self-attribution to explain many anomalous securities return patterns from the standpoint of efficient markets with rational investors. The first premise says that private information is overreacted to and public information is under-reacted to. This is consistent with (1) stock price 'drift' following business events and earnings announcements, (2) negative long-lag autocorrelations (long-run 'overreaction,' and (3) excess volatility of asset values. When the second assumption is included, there are (4) positive short-lag autocorrelations 'momentum', (5) short-run post-earnings release 'drift,' and a negative correlation between future stock returns and long-term measures of previous accounting performance.

A certain level of difficulties that are raised by high-frequency trading (HFT) was discussed by Charles M Jones (2013), based on an examination of recent theoretical and empirical studies on high-frequency trading (HFT). The researcher also mentioned the regulatory difficulties raised by HFT are the same as those raised by more traditional marketplaces. Now, regulators in the United States are depending on competition to reduce abuses. If there are market failures, additional regulation is required. Consolidated order-level audit trails, for example, are critical to effective enforcement. The need for liberalisation can also be one of the affecting factors that can lead to more investments in the stock market with both pros and cons. Kent Hargis (2000) investigated the effects of various types of foreign investment liberalisation on risk in emerging equities

markets. Some of these liberalisations include the abolition of foreign investment restrictions in the domestic equities market, as well as international cross-listings and closed-end country funds in the United States. Market risk exposure, as assessed by the beta on the global portfolio, rises in Argentina with liberalisation, Chile with an ADR index, and Thailand with increased foreign ownership, diminishing the diversification benefits of these countries.

b. **Defence Sector**:

Nicholas W. Barber (2013) conducted research to demonstrate the concerns raised by the separation of powers when the doctrine is powered by a thin political theory, i.e. concepts that are so uncontroversial that almost all political theorists would support them. He discovered several issues, such as weak force, whose significance can be a continuing factor leading to the thicker normative theory being established. Structural difficulties are at the heart of the notion by using thin normative assumptions, even if they are too shallow to allow us to develop a complete model of the division of powers. Robert J. Alexander (1995) investigated the model for which too much has been claimed in some previous work to understand how growth in real non-Defence output is affected rather than growth in real aggregate output (inclusive of military spending) as the dependent variable for a small group of OECD countries. Using only good quality data and non-Defence output as the dependent variable, no evidence in favour of the under-consumption (as opposed to the Defence as a burden) position was identified. SonmezAtesoglu and Michael J. Mueller (1990) established a link between Defence spending and economic growth using an econometric technique based on a two-sector production function model of the economy. The analysis concluded that, except for very substantial sustained cuts, a major reduction in Defence spending should have little impact on US economic development...Sakura Adebola Solarin and Pritish Kumar Sahu (2015) investigated the impact of military spending on stock market development in 36 nations from 1989 to 2010. Overall, the findings indicate that military spending has a negative and considerable impact on stock market performance in the countries studied.

Michael Beenstock (1998) investigated the literature on economic elements of Defence in Israel, which is critically examined by subject measuring the Defence burden, determinants of defence spending, the consequences of Defence spending on the economy, and the military industrial complex.

As derived from the above literature study, we needed to understand how some similar defence stocks in India have behaved in recent times. Further, certain alternate hypotheses were considered:

a. Stock volatility of major Indian Defence stocks remains less concerning the time factor. ( H1)
b. Stocks in a similar cluster (Indian Defence cluster) maybe have consistently similar concerning time factor (H2).

## Data collection:

The data needed for comparing and understanding volatility in stocks of five major Indian Defence companies were gathered using Excel functions in Microsoft Excel 365 Enterprise Edition (licensed version).

## Data Analysis:

The data analysis has been conducted on the data fetched using the stock history function in Microsoft Excel 365 enterprise version (licensed version). We have collected data for five significant defence stocks that include Hindustan Aeronautics Limited (HAL), BHARAT ELECTRONICS LTD, Mazagon Dock Shipbuilders Limited, Cochin Shipyard Ltd and Bharat Dynamics Ltd, for the period of one year approx. i.e., between 30-12-2021 to 30-01-2023 (272 days of stock trading). Later, we used the Bollinger band for volatility analysis using the R console version 3.4.0 for all 5 stocks namely HAL, BEL, MAZDOCK, COCHINSHIP and BDL respectively.

The coding of the stocks (as per availability in the stock exchange) were:

| COMPANY | STOCK CODE |
|---|---|
|  |  |
| Hindustan Aeronautics Limited | HAL |
| BHARAT ELECTRONICS LTD | BEL |
| Mazagon Dock Shipbuilders Limited | MAZDOCK |
| Cochin Shipyard Ltd | COCHINSHIP |
| Bharat Dynamics Ltd | BDL |

*Table 2. Five Top Indian Defence Stocks*

(Source: Author analysis)

The formula used for 3 bands in Bollinger band: -

Middle Band = 20-day simple moving average (SMA)
Upper Band = 20-day SMA + (20-day standard deviation of price x 2)
Lower Band = 20-day SMA - (20-day standard deviation of price x 2)

*Figure 1.* Bollinger bands descriptions

(Source: Author analysis)

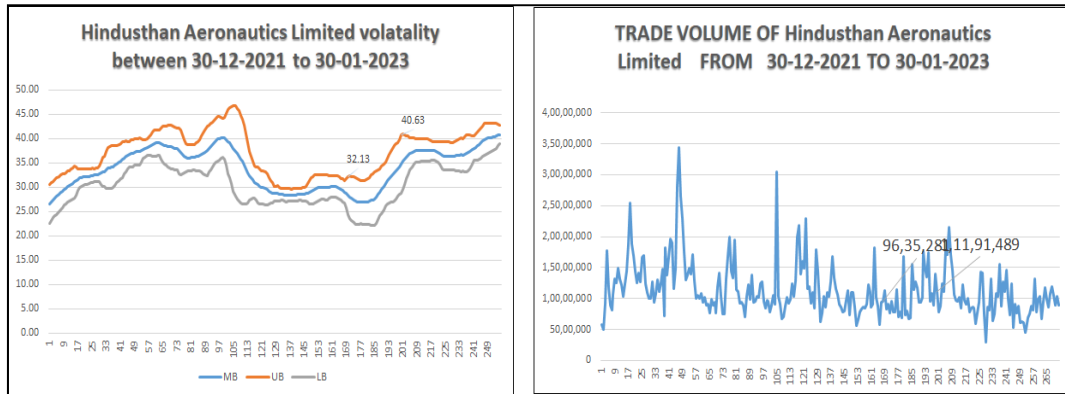1. Stock volatility and Trade Volume formal



*Figure 2. HAL stock volatility using Bollinger Bands and Volume recorded from 30-12-2021 to 30-01-2023*

As seen in above figure 2, fluctuations have been seen from the 168th day to the 200th day during which even the stock trading recorded was also very high that fluctuated between 96,35,281 to 1,11,91,489 units.

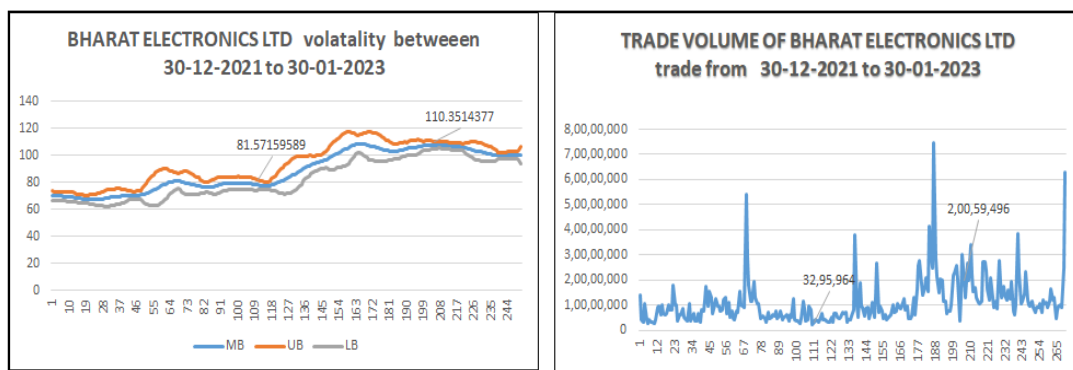2. **Stock Volatility and Trade Volume for BEL**



*Figure 3. BEL stock volatility using Bollinger Bands and Volume recorded from 30-12-2021 to 30-01-2023*

As seen in above figure 3, fluctuations have been seen from the 111th day to the 206th day during which even the stock trading fluctuated between 32,95,964 to 2,00,59,496 units.

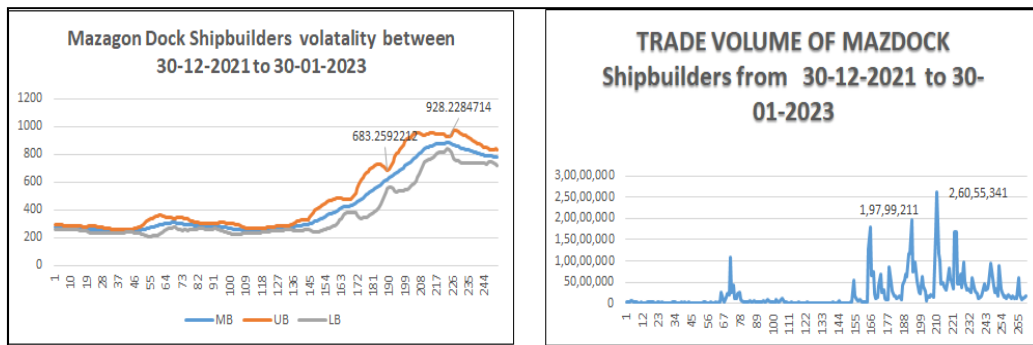### 3. Stock Volatility and Trade Volume for MAZDOCK



*Figure 4. MAZDOCK stock volatility using Bollinger Bands and Volume recorded from 30-12-2021 to 30-01-2023*

As seen in above figure 4, fluctuations have been seen from the 190th day to the 208th day during which even the stock trading recorded was also very high that fluctuated between 1,97,99,211 to 2,60,55,341 units.

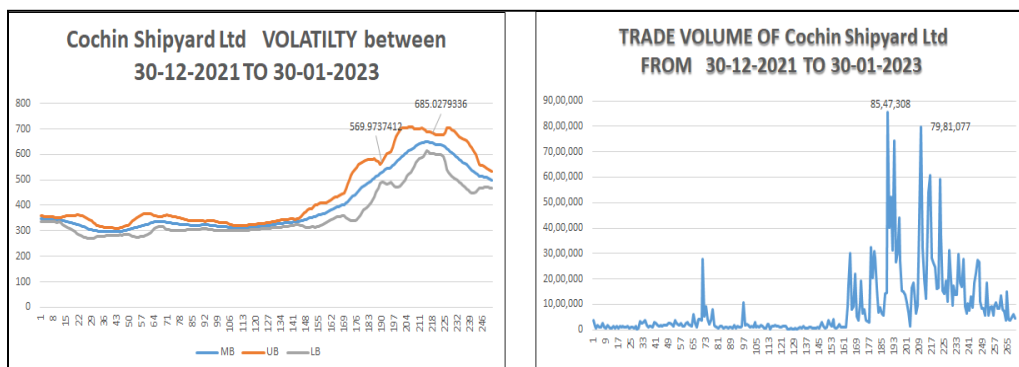### 4. Stock Volatility and Trade Volume for COCHINSHIP



*Figure 5. COCHINSHIP stock volatility using Bollinger Bands and Volume recorded from 30-12-2021 to 30-01-2023*

As seen in above figure 5, fluctuations have been seen from the 190th day to the 208th day during which even the stock trading recorded was also very high fluctuating at 79,81,077 to 85,47,308 units.

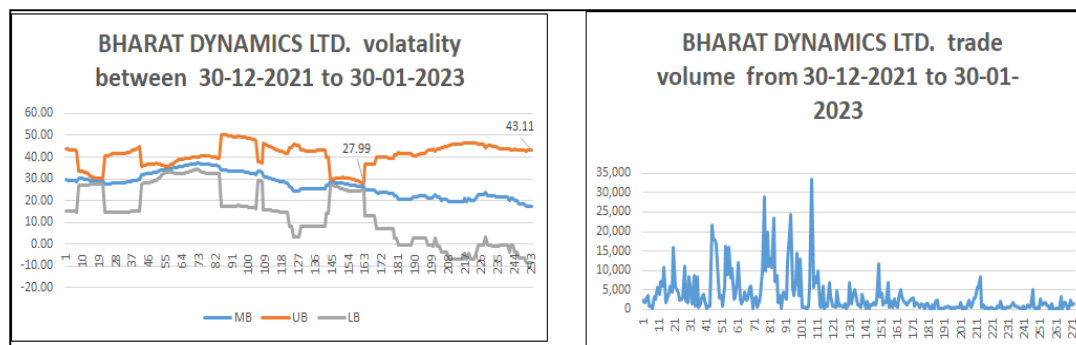5. **Stock Volatility and Trade Volume for BDL**



*Figure 6. BDL stock volatility using Bollinger Bands and Volume recorded from 30-12-2021 to 30-01-2023*

As seen in above figure 6, fluctuations have been seen from the 160th day to the 253th day during which even the stock trading highly fluctuated between 1203 to 568 units.

## MAJOR FINDINGS:

1. HAL stocks seemed moderately volatile during the period of 30-08-2022 to 14-10-2022 but became consistent later.

2. BEL stocks seemed moderately volatile during the period of 10-06-2022 to 28-10-2022 but became consistent later.

3. MAZDOCK stocks seemed moderately volatile during the period of 04-10-2022 to 01-11-2022 but became consistent later.

4. COCHINSHIP stocks seemed moderately volatile during the period of 04-10-2022 to 01-11-2022 but became consistent later.

5. BDL stocks seemed moderately volatile during the period of 18-08-2022 to 19-10-2022 but became consistent later.

Technically, prices are relatively high when above the upper band and relatively low when below the lower band. However, "relatively high" should not be regarded as bearish or as a sell signal. Likewise, "relatively low" should not be considered bullish or as a buy signal. Prices may be high or low for other economic reasons. We can further interpret that the Stock volatility of major Indian defence stocks remains less concerning the time factor. **(H1)**. Also, Stocks in a similar cluster (defence cluster) may behave consistently similarly concerning time factor **(H2)**.

Therefore, both of our hypothesis i.e. **H1, and H2** stands as true and can be considered as a more common phenomenon in the present and future times.

Our research was limited to a given period and based on data collected for 272 days of the above-discussed stock prices. The results might vary if the more or lesser period is considered which another constraint of this research remains. The paper can be used by academicians and policymakers to determine how policies may be restructured or adjusted as per prevailing future expectations of the growth of different economies.

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