Analyzing Correlation between Sensex Growth and Earnings growth of Constituents

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Abstract

This research investigates the alignment between the growth of Sensex and the growth of the earnings of its constituents. The study takes into account, four separate time frames. A ten year, five year, three year and the last two quarters periods. By calculating the Compounded Annual Growth Rate (CAGR) of both the Sensex and the earnings of its constituents and the correlation and the regression between these factors, the study aims to uncover the extent to which the Sensex growth is aligned to the growth in the earnings. Through this research, the state of the Sensex can also be observed. Indicating whether it is overvalued or undervalued. This study provides critical insights into whether the growth in the Sensex is supported with fundamentals of its constituents.

Across all periods it is observed that earnings have a strong alignment with that of the growth in Sensex. This suggests that the Sensex growth is largely supported by the earnings growth of its constituents. In the ten year time frame, it is observed that Sensex grew with a CAGR of 11.51%, with PAT growth at 12%. In the five year time frame, it is observed that the Sensex grew with a CAGR of 11.72% with PAT growth ranking higher than Sensex CAGR at 20.30%. In the three year time frame, it is observed that the Sensex grew with a CAGR of 13.72% and the PAT growth again ranking higher at 26.66%. In the last two quarters, the undervaluation of Sensex is sharper, with Sensex at 18% and the PAT growth at 46.48%. This could indicate there are other reasons than PAT, for market movement. Typical fluctuations and economic shocks might be a factor for this observation.

When run through a Pearson correlation model, it is seen that there is strong positive relationship between Sensex growth and PAT growth. The correlation coefficient of 0.54 indicates as such. The correlation was done for the 10 year, 5 year, 3 year and the last 2 quarters time frame. Running through a regression model, gives an output of 0.62. This signifies a positive relationship, meaning as PAT grows, the Sensex will also grow.

This study contributes to the understanding of market efficiency and valuation, providing insights into the degree to which Sensex growth is fundamentally supported by the earnings performance of its constituents companies.

1 Introduction

The Indian stock market, exemplified by benchmark indices like the Sensex, has experienced substantial growth over the past decade. This growth raises an important question: is the increase in market capitalization of the Sensex justified by the earnings growth of its constituent companies? This research aims to delve into this question by examining the relationship between the Sensex's performance and the Profit After Tax (PAT) growth of its listed companies.

The study analyzes historical data from the Sensex over the past ten years, focusing on the Compound Annual Growth Rate (CAGR) of Earnings Per Share (EPS) for individual companies within the index. It further investigates whether the market's overall valuation aligns with the underlying earnings growth

2 Literature Review

Reviewing key studies that have explored similar approaches to understanding the relationship between any indices growth and earnings of its constituents. Several studies have examined the relationship between stock indices and the earnings growth of their constituents. A study published by the National Bureau of Economic Research(NBER), explores the long term relationship between stock prices and earnings and index prices. Additionally, an article from the CFA Institute discusses the impact of earnings on stock returns, arguing that earnings do matter, but other factors also play crucial roles. A study by Lewellen (2004) found the relationship between the stock market index returns and earnings. It highlighted that there is strong relation, albeit having other reasons impacting the index growth. Another study from Klement (2015) found the relationship between the economic growth and stock returns. This study found weak correlations found between economic growth and stock returns.

3 Research Methodology

3.1 Research Design

This study adopts a quantitative approach to analysing the correlation between the growth of the Sensex and the PAT growth of its constituents. The chosen time horizon are ten years, five years, three years, and the latest last two quarters (as at 01-07-2024). The methodology involves calculating the Compounding Annual Growth Rate (CAGR) for both the Sensex and the PAT of the underlying companies. Further a correlation and regression analysis is also carried on to figure the strength of the relation between these variables.

3.2 Data Collection

The data collected for this study was sourced from authentic, proven sources.

- Bloomberg Terminal
- Yahoo Finance
- Screener

This ensures that the data utilised is not faulty and contains authentic data.

3.3 Data Preparation

The data was cleaned and prepared for the analysis. This ensures consistency and completeness. The historical prices of the index was normalised by adjusting prices for stock splits and dividends. The data was kept in accordance with the principle of consistency. Keeping the time frames consistent.

3.4 Software and Tools

Excel was utilized for all computations, including data analysis, statistical calculations, and graphical representations. Excel's built-in functions and features allowed for efficient handling and processing of large datasets, as well as the execution of complex mathematical operations necessary for the study.

3.5 Robustness Checks

Comparison with Benchmarks: The results were compared with relevant market benchmarks and indices to validate the findings and ensure they are in line with broader market trends.

Adjustment for Dividends and Corporate Actions: The Sensex historical prices used were adjusted for dividends and other corporate actions to ensure that the analysis reflects the true growth of the index, accounting for all forms of returns to investors.

Company	
ADANI PORTS and SEZ	Larsen and Tourbo
ASIAN PAINTS	Mahindra and Mahindra
AXIS BANK	MARUTI SUZUKI
BAJAJ FINANCE	NESTLE
BAJAJ FINSERV	NTPC
BHARTI AIRTEL	POWER GRID
HCL TECHNOLOGIES	RELIANCE IND.
HDFC BANK	SBI
HINDUSTAN UNILEVER	SUN PHARMA
ICICI BANK	TATA MOTORS
INDUSIND BANK	TATA STEEL
INFOSYS	TCS
ITC	TECH MAHINDRA
JSW STEEL	TITAN
KOTAK MAHINDRA BANK	ULTRATECH CEMENT
ONGC	WIPRO
Dr. Reddy's Lab	

Table 1: Selected Companies

3.6 Selection of Companies

In this research, a total of 33 companies were selected for analysis. While the Sensex traditionally consists of 30 companies, the additional 3 companies included in this study are those that have been removed and added throughout the years. This comprehensive selection allows for a more accurate representation of the Sensex performance over time and ensures that the analysis captures the impact of changes in the index composition.

Criteria for Selection:

1. **Inclusion of Current Sensex Companies:** All 30 companies currently listed in the Sensex were included in the analysis. These companies represent a broad spectrum of sectors and industries, providing a diversified view of the index.

2. **Historical Sensex Constituents:** Three additional companies that have been part of the Sensex at various points in time but are not currently included were selected. This ensures that the study accounts for the historical evolution of the index and the performance of companies that have influenced the Sensex in the past.

Period	Standard Deviation
10 Years (2015-2024)	0.208
5 Years (2019-2024)	0.287
3 Years (2021-2024)	0.1105

Table 2: Standard Deviation across periods

Time Frame	Sensex	Company-PAT
2015	1.23102062	1.011493418
2016	0.914476882	1.038924278
2017	1.161052614	1.059404915
2018	1.115292236	1.117116016
2019	1.171447546	1.000430516
2020	0.764611886	0.937445297
2021	1.547534398	1.322654685
2022	1.177036518	1.535896116
2023	1.016941678	1.064873984
2024	1.228982695	1.242377813
CAGR - 10 Years	11.51%	12.24%
CAGR - 5 Years	11.72%	20.60%
CAGR - 3 Years	13.73%	27.18%
CAGR - 1 Year	22.90%	25.78%
CAGR - Last 2 Quarters	18.02%	21.88%

Table 3: HPR of Index and PAT across time frames

4 Results and Analysis

4.1 Standard Deviation of Sensex Growth-

The standard deviation aims to understand the volatility of the index over different time periods. This is shown in Table 2

4.2 Calculation of CAGR-

$$\text{CAGR} = \left(\frac{V_f}{V_i}\right)^{\frac{1}{n}} - 1$$

4.3 Calculation of Correlation Analysis-

$$r = \frac{n\sum(X_iY_i) - \sum X_i \sum Y_i}{\sqrt{[n\sum X_i^2 - (\sum X_i)^2][n\sum Y_i^2 - (\sum Y_i)^2]}}$$

$$\begin{aligned} X_i &: \text{The } i\text{-th value of Sensex Growth rates} \\ Y_i &: \text{The } i\text{-th value of Earnings Growth rates} \\ \bar{x} &: \text{The mean value of Sensex Growth rates} \\ \bar{y} &: \text{The mean value of Earnings Growth rates} \end{aligned}$$

4.4 Calculation of Regression Analysis-

$$Y_i = \beta_0 + \beta_1 X_i$$

- Y_i: The i-th value of Sensex Growth rates
- X_i: The i-th value of Earnings Growth rates
- β_0: The intercept of the regression line
- β_1: The slope of the regression line

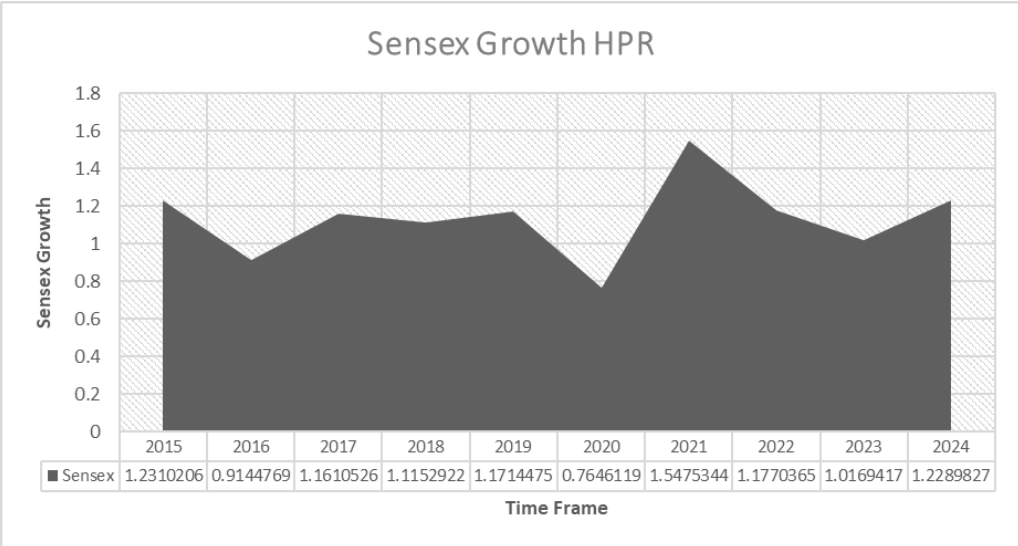

Figure 1: Sensex HPR

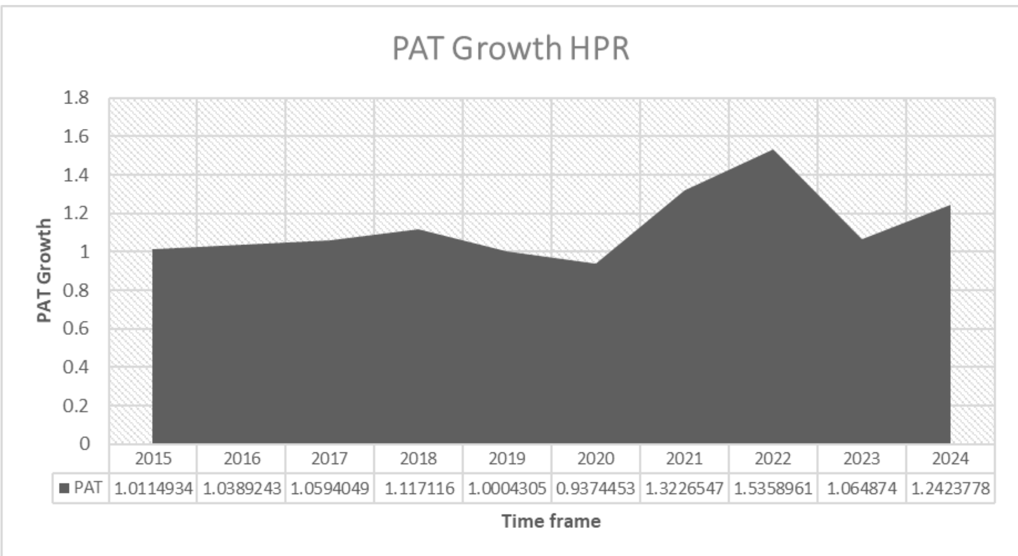

Figure 2: PAT HPR

4.5 Ten-Year Period (2014 -2024)

Refer to Table 3 In the past ten years, basis on the data, it is observed that the Sensex **CAGR** is **11.51%.**

This implies that the growth over ten year time frame in the Sensex is roughly 12%Per Annum. But contrasting this to the PAT growth of the constituents, which is **12.24%.** It is observed that the Sensex did slightly poorer than it could have. But this is well within the margin of error.

> This suggests that the earnings growth of the constituent companies fundamentally support the index's performance.

The close alignment between the Sensex and PAT growth indicates that the market valuations reflect the underlying earnings growth.

This alignment furthers the Efficient Market Hypothesis. In the *Fama-French* hypothesis, this reaction posits a Semi-Strong form of market efficiency. All available information is priced in and is fully reflected in the market.

4.6 Five-Year Period (2019 - 2024)

In the past five years, it is observed that the CAGR of the Sensex is **11.72%.** This implies that the growth is roughly 12% Per Annum. But contrasting this to the PAT growth, which is **20.60%**, it is observed that the Sensex is highly undervalued. The constituents of the Sensex are earning far greater than the Sensex is growing.

This discrepancy between the Sensex and PAT growth may indicate that the market did not fully price in the earnings growth. This strong PAT growth may point towards positive business conditions, efficient operations or any other favourable economic factors affecting the companies in the index.

> The Sensex appears to be significantly undervalued. And has not priced in the Earnings showcase of the company.

This significant difference may also be a cause of economic shocks like Covid, driving the market to be extremely Volatile. Refer to Table 3

4.7 Three-Year Period (2021 - 2024)

Refer to Table 3 The CAGR of the Sensex for a time frame of 3 years is **13.73%.** This implies that the Sensex grew roughly by 14%. Contrasting this with the Earnings growth of the constituent companies of **27.18%.** It is observed that the Sensex is again significantly undervalued. There has been robust earnings growth, but the same is not fully reflected in the Sensex growth.

The divergence between PAT and Sensex growth suggests that the market is underestimating the earnings potential of the constituent companies.

Furthermore, the last three year can be denoted to post pandemic levels. This is substantiated by the fact standard deviation being relatively lower at 0.11 (with 5 years and 10 years being 0.28 and 0.20, respectively). The market was cautious and was significantly less volatile.

4.8 Latest FY Period (2023 - 2024)

Refer to Table 3 The CAGR of the Sensex over the one-year period is **22.90%.** Whereas the CAGR of the PAT over the same period is **25.78%.**

This close alignment between the Sensex growth and PAT growth of constituents, suggests that the market has accurately priced in the earnings growth. The difference may be attributed to other factors, or simply fall within the margin of error.

This alignment indicates that the market is responsive to earnings performance, reflecting a high level of efficiency in incorporating newly available information.

This strong growth rates may reflect a recovery from previous economic downturns or evolving favourable market conditions.

4.9 Latest two Quarters (FY24)

Refer to Table 3 The CAGR for the Sensex is **18.02%**. Whereas the Company-PAT over the same time frame gave a CAGR of **21. 88%.**

It is to be noted that this CAGR of 21.88%, is excluding Tata-Motors. Tata Motors has performed abnormally. Inflating and skewing the results. Tata-Motors is a clear outlier and has been deselected for the purposes of this time frame. Tata-Motors gave an abnormal return of 142% over the Q2 in Q3. Including Tata-Motors in the calculations, gives an abnormal CAGR of 46.48%. Which does not signal a true picture. Hence has been delisted from the calculation.

The discrepancy between the CAGR of 18.02% and 21.88% again highlights the undervaluation of the Sensex in the short term.

4.10 Correlation Analysis

- The Pearson correlation coefficient between Sensex growth and Company-PAT growth over the analyzed periods is 0.55.
- This positive correlation indicates a moderate relationship between the two variables.
- The positive relationship supports the hypothesis that as the earnings (PAT) of the constituent companies grow, the Sensex also tends to grow, reflecting the market's alignment with fundamental performance.

The correlation coefficient indicates that there are other reasons which also significantly affect the growth of the Sensex. Profit after Taxes are an influential factor, but clearly not the only factor that pushes the Sensex.

4.11 Regression Analysis

- The regression model yields a coefficient of 0.62, indicating a positive relationship between Sensex growth and Company-PAT growth.
- This result suggests that an increase in PAT growth is associated with an increase in Sensex growth.
- The regression analysis further supports the idea that the earnings performance of the companies in the Sensex is a significant driver of the index's growth.
- A coefficient of 0.62 means that for each unit increase in PAT growth, the Sensex growth is expected to increase by 0.62 units. This implies a relatively strong relationship, but not a perfect one. There are likely other factors influencing Sensex growth beyond just PAT growth.

When companies in the index report higher PAT growth, it often reflects improved profitability and financial health, which can lead to higher investor confidence and drive up the Sensex.

Measure	Sensex	Company PAT	Divergence from Sensex
CAGR - 10 years	11.51%	12.24%	0.73%
CAGR - 5 Years	11.72%	20.60%	8.87%
CAGR - 3 Years	13.73%	27.18%	13.45%
CAGR - 1 year	22.90%	25.78%	2.88%
CAGR - last two quarters	18.02%	21.88%	3.86%

Table 4: Difference between PAT and Sensex

4.12 Divergence from Sensex

- **10-Year Period:** The difference of 0.73% indicates that over the long term, the Sensex growth closely aligns with PAT growth. This suggests a stable relationship where earnings growth is largely reflected in the index growth.
- **5-Year Period:** The difference of 8.87% shows a significant divergence, with PAT growth outpacing Sensex growth. This might suggest that the market hasn't fully priced in the earnings growth or other factors (like market sentiment or macroeconomic conditions) have impacted the Sensex growth. The moderate to strong positive relationship indicated by the regression coefficient and high correlation suggests that while PAT growth is a key driver of Sensex growth, the market might not immediately price in the earnings growth, leading to short-term discrepancies.
- **3-Year Period:** The difference of 13.45% is even more pronounced, indicating a substantial lag in the Sensex growth relative to the PAT growth. This could imply that despite strong earnings performance, the market has been conservative in its valuation of the index.
- **1-Year Period:** The difference of 2.88% indicates that in the short term, the PAT growth still slightly outpaces the Sensex growth, but the gap is narrower compared to the 3-year and 5-year periods. The Sensex growth begins to catch up with PAT growth, aligning with the positive correlation and regression relationship. The market is starting to recognize and price in the improved earnings performance
- **Last Two Quarters:** The difference of 3.86% shows a moderate discrepancy over the very short term, suggesting that recent PAT growth is still ahead of the Sensex growth, but the market might be starting to catch up. The positive correlation and regression figures indicate that this alignment will likely continue.

Implications:

- **Earnings Reflection:** Over the long term (10 years), the Sensex growth reflects the PAT growth reasonably well. However, in shorter time frames, PAT growth has often been higher than Sensex growth, indicating potential undervaluation or lag in market response.
- **Investment Opportunities:** The significant differences, especially over the 3-year and 5-year periods, may present opportunities for investors who believe that the market will eventually adjust to reflect the higher PAT growth.
- **Market Sentiment:** The discrepancies suggest that market sentiment and other external factors might be affecting the Sensex growth. It's possible that market participants are cautious or there are external economic or political factors at play.

5 Factors Driving Sensex Growth Beyond Net Profit

5.1 Macroeconomic Conditions

Economic Growth

The overall economic health of India significantly impacts the Sensex. Key indicators such as GDP growth rate, inflation, and unemployment rates influence investor confidence and market performance. For instance, robust GDP growth typically signals a strong economy, encouraging investment in equities, thus driving up the Sensex.

5.2 Investor Sentiment

Behavioral Finance

Investor behavior, influenced by psychological factors, plays a crucial role in market dynamics. Herd behavior, where investors follow the actions of others rather than their own analysis, can lead to market rallies or crashes. Overconfidence and loss aversion also affect trading decisions, contributing to market volatility and impacting the Sensex.

5.3 Market Dynamics

Capital Flows

Foreign institutional investments (FIIs) and domestic institutional investments (DIIs) play a crucial role in Sensex movements. High levels of FII inflows often signal strong market confidence, driving up the index, while outflows can lead to declines.

Sectoral Performance

The performance of key sectors such as IT, banking, pharmaceuticals, and manufacturing significantly affects the Sensex. Sectoral booms or busts, driven by factors like demand shifts, regulatory changes, or global trends, can lead to disproportionate impacts on the index.

6 Future Research- Recommendations

6.1 Potential Areas for Further Study:

1. **Comparative Analysis Across Different Markets**: **International Indices**: Conduct a comparative study between the Sensex and other international indices, such as the S&P 500, FTSE 100, and Nikkei 225, to understand if the observed overvaluation is a global phenomenon or specific to the Indian market.

2. **Advanced Analytical Techniques**: **Machine Learning Models**: Utilize advanced machine learning models to predict market movements based on earnings data and other financial indicators.

6.2 Data Improvements

1. **. Enhanced Data Quality:**

- **Longer Time Horizons**: Use data spanning a longer time horizon to capture more market cycles and provide a more comprehensive analysis.

- **Granular Data**: Incorporate more granular data, such as quarterly earnings reports, to provide a more detailed analysis of trends and patterns.

- **Robustness Checks**: Conduct additional robustness checks and sensitivity analyses to ensure the reliability and validity of the findings.

7 Conclusion

This research provides a comprehensive analysis of the alignment between the growth of the Sensex and the earnings growth of its constituent companies over various time frames. The study utilized CAGR, correlation, and regression analyses to determine the extent to which the Sensex growth is fundamentally supported by the PAT growth of its constituents. The key findings are summarized as follows:

1. **Ten-Year Period (2014-2024)**: The Sensex exhibited a CAGR of 11.51%, closely aligned with the PAT growth of 12.24%. This alignment supports the hypothesis that over the long term, the market valuations reflect the underlying earnings growth, consistent with the Efficient Market Hypothesis.

2. **Five-Year Period (2019-2024)**: The Sensex had a CAGR of 11.72%, significantly lower than the PAT growth of 20.60%. This discrepancy suggests that the market may not have fully priced in the robust earnings growth of the constituent companies, potentially indicating undervaluation.

3. **Three-Year Period (2021-2024)**: The Sensex grew at a CAGR of 13.73%, while the PAT growth was 27.18%. This substantial divergence indicates that despite strong earnings performance, the market has been conservative in its valuation of the index.

4. **Latest FY Period (2023-2024)**: The Sensex and PAT growth rates were 22.90% and 25.78%, respectively, showing a close alignment. This suggests that the market has accurately priced in the recent earnings growth, reflecting a high level of market efficiency.

7.1 Implications

Long-Term Alignment: Over the long term, the growth of the Sensex is largely supported by the earnings growth of its constituents, suggesting that the market is efficient in incorporating fundamental performance.

Short-Term Discrepancies: In shorter time frames, significant discrepancies between PAT growth and Sensex growth suggest potential undervaluation or lag in market response. These periods may present investment opportunities for those who believe the market will eventually adjust to reflect the higher earnings growth.

Market Dynamics: Beyond earnings, factors such as macroeconomic conditions, investor sentiment, and sectoral performance also play crucial roles in influencing Sensex growth. Understanding these factors is essential for a comprehensive analysis of market performance.

This study contributes to the understanding of market efficiency and valuation, providing valuable insights into the degree to which the Sensex growth is fundamentally supported by the earnings performance of its constituent companies. The findings underscore the importance of earnings as a key driver of market performance while also highlighting the influence of broader economic and behavioral factors.