

Sectoral Co-Movements and Bidirectional Risk Spillovers Among Indian Equity Market Indices (A Case Study of Nifty Bank, BSE IT, and Nifty Pharma for Portfolio Optimization)

Shamshad Khan¹, Dr. Arvind Kumar Yadav²

¹Research Scholar, KMGGPGC, Badalpur, G. B. Nagar, India

²Professor and Head, Faculty of Commerce, M.K.R. Government College, Ghaziabad, India

Abstract-- The integration and complexity of financial markets require that investors understand the relationships among various sectors within the equity market. This study examines the co-movements and bidirectional risk spillovers among three key sectors in the Indian equity market: Banking (Nifty Bank), Information Technology (BSE IT), and Pharmaceuticals (Nifty Pharma). The main objective is to determine how shocks and volatility in one sector influence others, assessing the implications for portfolio diversification and optimisation. Using daily index return data, the research will apply methods such as correlation analysis, Vector Autoregression (VAR), Granger causality tests, and GARCH-based models. The Dynamic Conditional Correlation (DCC-GARCH) method may also be used to analyse evolving sectoral relationships.

Expected findings indicate differing interdependence patterns. The banking sector may act as a key transmitter of systemic risk due to its links with monetary policy and economic activity, while the IT sector could be influenced by global factors. Conversely, the pharmaceutical sector may show more defensive traits, presenting diversification opportunities for investors. This study enhances existing literature by focusing on sectoral interconnectedness in India and linking risk spillover analysis to portfolio optimisation. The results can aid investors in building portfolios with improved risk-adjusted returns, benefiting portfolio managers, financial institutions, and policymakers.

Keywords-- Sectoral Co-movement, Risk Spillover, Volatility Transmission, Nifty Bank, BSE IT, Nifty Pharma, Portfolio Diversification, Portfolio Optimisation, Indian Stock Market.

I. INTRODUCTION

Financial markets play a crucial role in the allocation of capital, mobilization of savings, price discovery, and economic development. Over the past several decades, the Indian equity market has experienced significant growth, driven by economic liberalization, technological advancements, regulatory reforms, increased participation from domestic and foreign institutional investors, and the expansion of electronic trading systems.

As the overall equity market has grown, sectoral indices have become increasingly important for investors seeking exposure to specific industries and economic segments.

Sectoral indices reflect the collective performance of companies operating within a particular industry or related group of industries. Their movements are influenced by sector-specific factors as well as broader macroeconomic and financial conditions. For instance, banking stocks are significantly affected by interest rates, liquidity conditions, credit growth, monetary policy, non-performing assets, and overall economic activity. Similarly, information technology companies are influenced by international demand, technological developments, foreign exchange fluctuations, and global economic conditions. On the other hand, pharmaceutical companies respond to factors such as healthcare demand, regulatory changes, innovation, research and development, and international pharmaceutical markets. Although these sectors differ fundamentally in their economic characteristics, they are not completely independent. They operate within the same financial system and are influenced by common factors such as investor sentiment, inflation, monetary policy, economic growth, foreign capital flows, and general market uncertainty. Consequently, a financial shock in one sector can impact the returns and volatility of other sectors. This phenomenon is referred to as risk spillover or volatility spillover.

Studying sectoral co-movements is particularly important for investors because portfolio diversification relies on the relationships among assets. According to Modern Portfolio Theory, investors can reduce portfolio risk by combining assets that do not move in perfect correlation. However, empirical evidence from financial markets indicates that the correlations among assets are not constant. During periods of financial crisis and extreme uncertainty, correlations often increase, which reduces the benefits of diversification.

Thus, understanding the dynamic relationships among sectoral indices is essential for effective portfolio management.

A portfolio that appears diversified in normal market conditions may become highly exposed to systematic risk during periods of market stress if the correlations among its constituent sectors rise significantly.

This study focuses on three key Indian sectoral indices:

- *Nifty Bank*: This index reflects the performance of the banking and financial services sector, indicating the health and trends in this crucial part of the economy.
- *BSE IT*: This index represents the information technology sector, showcasing the performance and developments of companies involved in IT services, software, and technology-related activities.
- *Nifty Pharma*: This index focuses on the pharmaceutical and healthcare sector, tracking the performance of companies engaged in the production and distribution of pharmaceutical products and healthcare services.

These sectors have been selected because they represent different facets of the Indian economy and exhibit distinct risk-return characteristics. Comparing them provides an opportunity to examine whether sectoral differences create meaningful diversification benefits or whether market-wide financial forces lead to substantial co-movement and risk transmission.

II. OBJECTIVES OF THE STUDY

The major objectives of the study are:

- To understand the concept of sectoral co-movements among major Indian equity market indices.
- To examine the economic characteristics of Nifty Bank, BSE IT, and Nifty Pharma.
- To explain the factors responsible for co-movements among these sectors.
- To analyse the concept of bidirectional risk spillovers among sectoral indices.
- To identify the possible channels through which financial risk can be transmitted across sectors.
- To discuss the role of sectoral interconnectedness in portfolio diversification.
- To explain how knowledge of sectoral co-movements can assist portfolio optimization.
- To provide conceptual insights for investors and portfolio managers regarding dynamic sector allocation.

III. RESEARCH METHODOLOGY

The present study is descriptive and conceptual in nature, primarily relying on secondary sources of information.

It draws from a variety of materials, including books on investment and portfolio management, research articles, financial market literature, publications about the Indian stock market, official information regarding sectoral indices, and theoretical works on portfolio diversification, sectoral co-movements, and financial risk spillovers. The aim of using these secondary sources is to develop a comprehensive understanding of the relationships among key sectors of the Indian equity market, particularly Nifty Bank, BSE IT, and Nifty Pharma.

The study examines their significance for portfolio diversification and optimization. Rather than conducting empirical statistical testing or presenting unverified statistical results, the study adopts a descriptive and analytical approach. It explores the nature of sectoral co-movements, the channels of bidirectional risk transmission, and the factors influencing the interconnectedness of various equity market sectors. By synthesizing existing theoretical perspectives with available secondary information, the study aims to provide valuable insights into sectoral relationships and their importance for investment decision-making, risk management, portfolio diversification, and portfolio optimization within the Indian equity market.

IV. BACKGROUND OF THE STUDY

Investment decisions hinge on the fundamental relationship between risk and return, with investors striving for satisfactory returns while minimising risk. One effective strategy is portfolio diversification, which spreads investments across various securities, industries, or asset classes. This strategy can mitigate losses in one investment through gains in another, but its effectiveness relies on the correlations among assets. If investments move similarly, diversification offers limited protection; if they behave differently, it can reduce overall portfolio volatility.

Sectoral diversification is crucial, allocating funds across sectors like banking, IT, pharmaceuticals, and energy to reduce reliance on a single industry. However, economic uncertainty can cause sectors that typically behave differently to move in tandem, raising correlations and diminishing diversification benefits. Understanding sectoral co-movement is essential for investors, particularly when examining relationships among sectors like Nifty Bank, BSE IT, and Nifty Pharma, which have distinct economic characteristics.

V. CONCEPT OF SECTORAL CO-MOVEMENT

Sectoral co-movement refers to the tendency of different sectoral indices to move together over time.

Positive co-movement occurs when sectors' prices or returns move in the same direction, while weak co-movement happens when they diverge. This often stems from common influences such as:

- Economic growth
- Inflation
- Interest-rate changes
- Monetary policy
- Foreign investment
- Exchange-rate fluctuations
- Global financial events
- Investor sentiment
- Political uncertainty
- Liquidity conditions
- Market-wide shocks

For instance, a decline in investor confidence can lead to selling across various sectors, like banking, IT, and pharmaceuticals, despite their differing industries. Conversely, positive economic news may enhance investor confidence, prompting widespread buying. Ultimately, sectoral co-movement reflects both sector-specific factors and broader market influences.

VI. THE INDIAN EQUITY MARKET AND SECTORAL INDICES

India has one of the world's major emerging equity markets. The development of the National Stock Exchange and the Bombay Stock Exchange has contributed significantly to improved transparency, liquidity, electronic trading, and investor participation.

Sectoral indices provide important information about the performance of specific industries. They also enable investors to compare sectoral returns and identify opportunities for diversification.

The three indices considered in this study represent important segments of the Indian economy:

NIFTY BANK

Nifty Bank represents the performance of major banking and financial institutions. The banking sector is central to the functioning of the economy because banks provide credit, facilitate payments, mobilize deposits, and support business and consumer activity.

BSE IT

BSE IT represents companies operating in the information technology sector. India has emerged as a major global provider of IT services, software solutions, digital technology, and business process services.

NIFTY PHARMA

Nifty Pharma represents the pharmaceutical and healthcare-related sector. India is an important global producer of pharmaceutical products and generic medicines. The sector has significant domestic as well as international importance.

The differences among these sectors make them particularly relevant for examining diversification and risk transmission.

VII. NIFTY BANK: CHARACTERISTICS AND SOURCES OF RISK

The banking sector occupies a central position within the financial system. Banks connect savers, borrowers, businesses, consumers, and financial institutions. As a result, changes in banking-sector conditions can influence the broader economy and financial market.

The performance of banking stocks is influenced by several factors, including:

- Interest rates;
- Monetary policy;
- Credit growth;
- Liquidity conditions;
- Inflation;
- Economic growth;
- Asset quality;
- Non-performing assets;
- Regulatory changes;
- Capital adequacy;
- Financial market stability.

A significant increase in interest rates, for example, may influence borrowing costs, credit demand, and bank profitability. Similarly, deterioration in asset quality can affect investor confidence in banking institutions.

Because of its systemic importance, the banking sector can potentially act as an important transmitter of financial risk. A major banking-sector shock may influence investor sentiment across the broader equity market.

VIII. BSE IT: CHARACTERISTICS AND SOURCES OF RISK

The information technology sector differs substantially from the banking sector because of its strong international orientation.

Indian IT companies are influenced by:

- Global economic growth;
- International technology spending;
- Outsourcing demand;



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Foreign exchange movements;
Technological innovation;
Digital transformation;
International business cycles;
Demand from developed economies.

One of the distinctive features of the Indian IT sector is its exposure to foreign currency revenues. Exchange-rate movements can therefore influence profitability and investor expectations.

The IT sector may sometimes behave differently from sectors that are primarily dependent on domestic economic conditions. This characteristic can potentially create diversification benefits for investors.

However, global financial uncertainty can also create significant volatility in technology stocks.

IX. NIFTY PHARMA: CHARACTERISTICS AND SOURCES OF RISK

The pharmaceutical sector has several distinctive features compared with banking and information technology.

The performance of pharmaceutical companies can be influenced by:

Healthcare demand;
Government healthcare policies;
Regulatory approvals;
Research and development;
Drug pricing;
Patent-related developments;
International pharmaceutical demand;
Global regulatory requirements.

Healthcare demand is often considered relatively stable compared with highly cyclical industries. Consequently, pharmaceutical companies may sometimes demonstrate relatively defensive characteristics.

During periods of economic uncertainty, investors may shift toward sectors perceived as comparatively stable or defensive. However, the pharmaceutical sector is also exposed to its own risks, particularly regulatory developments and international market conditions.

Therefore, Nifty Pharma can provide diversification opportunities, but its risk characteristics must also be understood in relation to other sectors.

X. CONCEPT OF RISK SPILLOVERS

Risk spillovers occur when uncertainty, volatility, or financial shocks in one market or sector influence another market or sector.

For example, a significant negative development affecting the banking sector may influence the overall equity market. Investors may reduce their exposure not only to banking stocks but also to other sectors because of increased concerns about the economy. Risk spillovers can occur through several channels:

1. *Investor Sentiment*: Negative sentiment in one important sector can influence confidence across the entire market.
2. *Liquidity Transmission*: Financial stress can reduce liquidity and affect investment across different sectors.
3. *Institutional Portfolio Rebalancing*: Institutional investors often hold diversified portfolios. A significant loss in one sector may lead them to rebalance investments in other sectors.
4. *Macroeconomic Linkages*: Changes in interest rates, inflation, and economic growth can simultaneously influence several sectors.
5. *Information Transmission*: Important information affecting one sector can influence expectations about related industries and the broader economy.

XI. BIDIRECTIONAL RISK SPILLOVERS

Bidirectional risk spillovers occur when two sectors influence each other. For example:

Nifty Bank → BSE IT

A banking-sector shock influences the IT sector. At the same time:

BSE IT → Nifty Bank

Developments in the IT sector may influence banking-sector performance through investor sentiment, economic expectations, market-wide conditions, or other financial channels.

When both relationships are important, the sectors demonstrate bidirectional interconnectedness.

The present study conceptually examines the following relationships:

Nifty Bank ↔ BSE IT

Nifty Bank ↔ Nifty Pharma

BSE IT ↔ Nifty Pharma

Understanding these relationships is important because investors may incorrectly assume that sectors belonging to different industries are completely independent.



XII. CO-MOVEMENT BETWEEN NIFTY BANK AND BSE IT

Nifty Bank and BSE IT represent two economically different sectors. The banking sector is primarily influenced by domestic financial conditions, interest rates, credit growth, and monetary policy. The IT sector has greater exposure to global demand and foreign exchange movements. Because of these differences, the two sectors may provide diversification benefits under normal market conditions. However, they may also demonstrate co-movement because both are influenced by:

General investor sentiment;
Foreign institutional investment;
Overall equity market conditions;
Economic expectations;
Liquidity conditions.

During major financial shocks, both sectors may experience increased volatility and stronger co-movement. Therefore, diversification between banking and IT should be evaluated dynamically rather than assumed automatically.

XIII. CO-MOVEMENT BETWEEN NIFTY BANK AND NIFTY PHARMA

The banking and pharmaceutical sectors have substantially different business models and economic characteristics. Banks are closely associated with economic cycles and financial conditions, while pharmaceutical companies are associated with healthcare demand and scientific innovation. This difference may create diversification opportunities. However, market-wide shocks can still influence both sectors. Changes in investor sentiment, foreign investment, economic uncertainty, and broad market volatility may increase their co-movement. The pharmaceutical sector may sometimes provide relatively defensive characteristics when banking-sector volatility increases. This potential difference in behaviour can be valuable for portfolio diversification.

XIV. CO-MOVEMENT BETWEEN BSE IT AND NIFTY PHARMA

The IT and pharmaceutical sectors also differ considerably. The IT sector is influenced by technology spending, international demand, and digital transformation. The pharmaceutical sector is influenced by healthcare demand, regulatory developments, and scientific innovation. Both sectors, however, have significant international exposure. Consequently, global economic developments, exchange-rate movements, and international regulations can affect both sectors. Their relationship may therefore vary depending upon global and domestic conditions.

XV. MAJOR FACTORS INFLUENCING SECTORAL CO-MOVEMENTS

Sectoral co-movements can be influenced by several common factors.

1. *Economic Growth*: Economic expansion generally improves business confidence and corporate profitability, potentially supporting multiple sectors simultaneously.
2. *Interest Rates*: Interest rates directly influence banking profitability and borrowing costs but can also affect valuation across technology and pharmaceutical stocks.
3. *Inflation*: High inflation can affect consumer demand, operating costs, interest rates, and corporate profitability across sectors.
4. *Foreign Capital Flows*: Foreign institutional investors often invest across multiple sectors. Large inflows or outflows can therefore create broad sectoral co-movement.
5. *Exchange Rates*: Currency movements are particularly relevant for IT and pharmaceutical companies with international operations.
6. *Investor Sentiment*: Optimism or pessimism among investors can influence the entire market.
7. *Global Financial Developments*: Global recessions, financial crises, geopolitical events, and international market volatility can affect Indian sectoral indices.

XVI. SECTORAL CO-MOVEMENTS AND PORTFOLIO DIVERSIFICATION

The central purpose of diversification is to reduce portfolio risk. A portfolio containing investments from multiple sectors can potentially reduce dependence on the performance of any one sector. However, diversification benefits depend upon the relationships among sectors. If Nifty Bank, BSE IT, and Nifty Pharma demonstrate relatively different patterns of movement, combining them may reduce portfolio volatility. Conversely, if all three sectors become highly correlated, diversification benefits may decline. Therefore, investors should consider:

- Average correlation;
- Changing correlations;
- Market conditions;
- Volatility;
- Risk spillovers;
- Economic conditions.



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Effective diversification requires understanding not only sectoral differences but also financial interconnectedness.

XVII. PORTFOLIO OPTIMIZATION

Portfolio optimisation involves determining the combination of investments that provides the most desirable relationship between risk and return. A traditional portfolio optimisation framework considers:

- Expected return;
- Risk;
- Covariance among assets;
- Investment constraints.

For the three sectors considered in this study, portfolio optimisation may involve determining appropriate allocations among:

- Banking;
- Information technology;
- Pharmaceuticals.

An investor with a higher risk tolerance may allocate more funds to sectors with greater growth potential and volatility. A conservative investor may prefer sectors perceived as comparatively defensive. However, sector allocation should not be based solely on historical returns. The relationship among sectors must also be considered.

XVIII. IMPORTANCE OF DYNAMIC PORTFOLIO ALLOCATION

Financial markets are constantly changing. A portfolio allocation that is appropriate during one period may not be suitable during another. Dynamic portfolio allocation involves adjusting investments according to changing:

- Economic conditions;
- Interest rates;
- Market volatility;
- Sectoral correlations;
- Risk spillovers.

For example, if two sectors become increasingly correlated, the diversification benefit of holding both may decline. Similarly, if one sector becomes a major transmitter of risk, investors may need to reconsider their exposure. Therefore, dynamic sectoral analysis can improve portfolio management.

XIX. RISK TRANSMITTERS AND RISK RECEIVERS

The concept of risk transmission allows sectors to be classified according to their role in the financial system.

1. *Risk Transmitter*: A sector that significantly influences or transmits financial shocks to other sectors.
2. *Risk Receiver*: A sector that is more strongly affected by shocks originating elsewhere.

Bidirectional Sector: A sector that both transmits and receives significant risk. Understanding these roles can assist portfolio managers in managing exposure during periods of market uncertainty.

XX. IMPLICATIONS FOR INDIVIDUAL INVESTORS

Individual investors can benefit from understanding that investing across different sectors does not automatically eliminate risk. Before constructing a sectoral portfolio, investors should consider:

- The nature of each sector;
- Economic sensitivity;
- Global exposure;
- Interest-rate sensitivity;
- Volatility characteristics;
- Correlation with other sectors.

A combination of banking, IT, and pharmaceutical exposure may provide broader diversification than investment in only one sector, but the effectiveness of this diversification can change according to market conditions.

XXI. IMPLICATIONS FOR INSTITUTIONAL INVESTORS

Institutional investors manage large and diversified portfolios. Consequently, sectoral risk transmission is particularly important for them. Institutional investors can use knowledge of co-movements to:

- Monitor concentration risk;
- Identify interconnected sectors;
- Adjust sectoral exposure;
- Improve risk management;
- Develop dynamic allocation strategies;
- Reduce vulnerability to market-wide shocks.

XXII. IMPLICATIONS FOR PORTFOLIO MANAGERS

Portfolio managers should recognize that historical relationships among sectors may not remain stable. Effective portfolio management should involve continuous monitoring of:

- Sectoral returns;
- Market volatility;
- Correlation changes;
- Macroeconomic developments;

- Financial stress;
- Global economic conditions.

Portfolio managers can potentially improve risk-adjusted performance by adjusting sectoral allocations in response to changing market relationships.

XXIII. IMPLICATIONS FOR POLICYMAKERS AND REGULATORS

The interconnectedness of financial sectors is also important from the perspective of financial stability. A major shock in a systemically important sector can influence other segments of the financial market.

Understanding sectoral interconnectedness can assist policymakers and regulators in:

- Monitoring systemic risk;
- Identifying channels of financial contagion;
- Strengthening market surveillance;
- Developing appropriate regulatory responses.

XXIV. CONCLUSION

The increasing complexity and interconnectedness of financial markets highlight the importance of understanding the relationships among sectoral equity indices. This descriptive study examines the concepts of sectoral co-movements and bidirectional risk spillovers among three key Indian equity market indices: Nifty Bank, BSE IT, and Nifty Pharma. Additionally, it discusses their relevance for portfolio optimization. The analysis shows that while the banking, information technology, and pharmaceutical sectors have different economic characteristics, they operate within a shared financial and economic environment. As a result, their market performance can be influenced by common factors such as economic growth, interest rates, investor sentiment, foreign capital flows, global financial conditions, and overall market uncertainty.

The study emphasizes that sectoral diversification should not just be viewed as investing in companies from different industries. The actual effectiveness of diversification depends on the degree of co-movement and interconnectedness among these sectors. When sectors operate independently or are affected by different economic factors, diversification can effectively reduce portfolio risk. However, during market-wide shocks that increase correlations and risk transmission, the advantages of diversification may diminish. The concept of bidirectional risk spillovers is particularly significant because financial relationships are not always one-directional. A shock in one sector can impact another sector, which may then contribute to further changes in the wider financial environment.

Understanding these interconnected relationships can help investors and portfolio managers make more informed allocation decisions. Nifty Bank reflects the financial and economic sensitivity of the banking system, BSE IT represents India's globally connected technology sector, and Nifty Pharma signifies an important segment of the healthcare and pharmaceutical sector with distinct economic characteristics. Together, these indices create a useful framework for understanding sectoral diversification.

The study concludes that effective portfolio optimization requires a deeper understanding of sectoral relationships. Investors should consider not only expected returns and individual sector risks but also the potential for co-movements, changing correlations, and bidirectional risk transmission. Regular monitoring of sectoral relationships can assist investors in constructing more balanced portfolios and managing investment risk more effectively. Overall, this study provides a conceptual foundation for understanding how sectoral interconnectedness influences investment decisions in the Indian equity market. It underscores the importance of integrating sectoral analysis with portfolio diversification and optimization, offering a valuable basis for future empirical research on financial market co-movements and volatility spillovers.

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