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A STUDY OF INTERRELATIONSHIPS BETWEEN THE BOND AND STOCK MARKET IN INDIA.

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Abstract

The aim is to study the Interrelationship between financial markets for which the S&P BSE Bond index and the S&P BSE 100 index are used. Using the time series data of these index of the Indian bond and stock market ,the study employs various statistical and econometric tools to analyse the relationship between these two markets and concludes with a regression model explaining the relationship between bonds, stocks and gold to understand the extent to which gold is used as a substitute investment. Finally, the study concludes with bringing out the relationship between gold, stocks and bonds. The reason why gold is used in this analysis is because it is widely viewed as a haven investment when other assets fail.

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Introduction

Financial Markets refers to a commercial centre, where creation and trading of financial assets, such as shares, debentures, bonds, derivatives, currencies, etc. occur. It assumes an essential job in allocating limited resources in the nation's economy. It acts as a mediator between the savers and investors by mobilizing funds between them. Financial markets assume a fundamental job in facilitating the smooth activity of economies by allocating resources and creating liquidity for investors and businesses. The markets facilitate the trading of their financial holdings between buyers and sellers. Financial markets create financial products that provide a return for investors (who have excess funds) and make these funds available to borrowers (who need these funds that are raised by these products).

Financial Markets include Equity markets, Bond markets, Forex market, and Derivatives market, among others. In this research paper, we will be comparing the Equity and Bond markets.

An Equity market (or the stock market) is a type of financial market in which securities are issued and traded. It is one of the most significant medium of an economy as it gives companies a platform to raise funds and investors a way to own a company with the potential to gain profits. On the other hand, the Bond market—also known as the debt market or credit market—is a financial medium where investors can trade debt securities issued by either the government or even corporates. Governments ordinarily issue bonds to raise capital to pay down debts or fund infrastructural developments. Companies that are publicly-traded issue bonds to fund business expansion projects or for management of current operations. The Bond market has two divisions: the primary market and the secondary market.

In the primary market, transactions take place only between the bond issuers and buyers. It is a market for "new issues" of shares. Whereas, the existing securities that have once been sold in the primary market are bought and sold in the secondary market.

Factors influencing financial markets are economic growth, interest rates, stability, confidence and expectations, Bandwagon effect, related markets and Price to Earnings (PE) Ratios.

The S&P BSE Bond index and the S&P BSE 100 index are used as the yardsticks for the two markets. The S&P BSE India Bond Index is designed to track the performance of local-currency denominated government and corporate bonds from India. All information for an index before its Launch Date is back tested, based on the methodologies that were in effect on the Launch Date. BSE100 index is designed to measure the performance of the 100 largest and most liquid Indian companies within the S&P BSE Large Midcap. The index is calculated in Indian Rupees.

Review of Literature

Roopali's and Kapil's (2012) paper inquires about concentration of the association among offers and securities and relative assessment of shares which are listed on financial trade exchange and securities (Government Securities) which are recorded in NSE Government security list. For surveying the association among stock and security market to think about the general examinations of the two markets and besides finds the relationship and mixture between the two markets, whether or not these business divisions help each other or not. The goal of this examination is to explore the association and linkage structure of stock and security return across different time periods among stock and Bond Market Indices over a period from January 2005 to Dec 2010. The disclosures shed some light on the closeness of mean disintegrating game-plan of relationship across changed financial conditions. During the monetary blast, there is a positive and noteworthy connection among bond and stock returns.

Tolikas' (2017) paper looks at the relative enlightening effectiveness of bonds and the underlying stocks through the lead-lag connection between their day to day returns. It locates that stock returns lead the profits of high return securities, yet not those of investment-grade bonds, which indicates that the financial exchange is generally more effective than the security market. The discoveries suggest exchanging open doors for the bonds that are exceptionally sensitive to the arrival of new data. It additionally finds that stocks identify approaching defaults sooner than bonds, which suggests that investors may have enough opportunity to protect their capital.

Christoph Schon's (2019) study deals with income and security yields currently merging and beginning to move a similar way again; numerous speculators are starting to think about what the connection between the two significant resources classes will appear as they go ahead. A delayed inversion of the stock-bond value relationship from negative to positive would have fundamental ramifications for multi-resource class portfolio risk the management. Effective broadening depends on resources moving in independent or in any event, opposing directions as well. Off chance that two of the significant investments in the portfolio were to walk in lockstep, support directors would need to discover elective methods for decreasing their overall risk.

Roberto Dieci, Noemi Schmitt and Frank Westerho (2017) in their paper develop a model in which investors can participate in stock, bond and housing markets. The entry decision of the investors is dependent on the price trends and their mispricing's. A 4-Dimensional nonlinear map governs the model, and it also takes into consideration the relations between dividends, rents and the bond rate. This paper also concludes that endogenous countercyclical stock and housing market dynamics emerge if investors react strongly to the markets price trends.

Arun, Akhila and Dharmalingam (2016) in their investigation, expect to do a near examination of the execution of stocks and securities in India. Besides contrasting the Indian financial exchange and select worldwide financial exchange, it is discovered that Indian financial exchange has a positive relationship with created securities exchanges. Furthermore, it is likewise discovered that security performance is inversely related to the financial exchange. The examination demonstrates the presence of a direct mix between stock returns of India with U.S, U.K, Japan and Government Bond index. To put it plainly, there exists a long-haul relationship, and since quite a while, there runs a balance between these business sectors which might be in disequilibrium. Correlation of India's stock

and security market will profit in making an ideal portfolio having few hazards and greater returns, especially when the Indian stock or security list is confronting a difficulty.

Thomas' and Li's paper (2009) investigates the dynamic relationship of stock–security returns for six propelled markets. Estimations suggest that stock–bond relations are time-fluctuating and show smooth transitional changes. The stock–security connections are conversely related with financial exchange helplessness as evaluated by the prohibitive change and the recommended unpredictability of the S&P 500 rundown. In any case, stock-security relations are emphatically related to securities market vulnerability as assessed by the unforeseen vacillation of security returns. The evidence likewise shows that stock–security connections are influenced significantly by default risk and the London inter-bank offered rate T-bill rate spread in the crisis time period.

Anders C. Johansson (2010) in his paper examines the relationship between stocks and bonds in several Asian countries. It concludes that there is a vast volatility effect between stock and bond markets in many countries using a bivariate model. This paper also mentions the ever-changing relationship between the stock and bond markets over a period of time and how this relationship becomes stronger during periods of turmoil in a country. It also discusses the impact of this relationship on regional policymakers as well as on investment including both domestic and international investors.

In Liliia's paper (2013), stock and security showcased in Russia are inspected by testing the theory of time-fluctuating relationship among stock and bond returns. Information for this examination originates from the Moscow Exchange and covers day by day and every week returns on stocks and government bonds during the time of 2003-2013. Dynamic restrictive connection adaptation of the multivariate GARCH model, considering unbalanced reactions of instability to positive and negative stuns, is applied to measure the contingent stock-bond relationships.

Fang and Chang's paper (2017) looks at the connection between government security and China's financial exchanges. In straightforward experimental settings, we delineate these thoughts, actualizing the structures typically from quantile relapse. Extraordinary quantile investigation shows the relation between government security and financial exchanges as negative as the financial exchange descends. Their commitment gives the opportunity to gage the growing impacts on global speculators credited to the Chines e administration's protection and financial trade. This analysis has major implications during limits for hazarding t he executives and resource assignments. In addition, the result is important for universal resource assessment beca use the introduction to the joint ridiculous threat and should be noted in this manner for estimating worldwide resources.

Goyenko & Ukhov (2009) in their paper established liquidity links between the bond market and the stock market. There exists a lead-lag connection between these markets and bidirectional Granger causality. The effect of stock ill-liquidity on bond ill-liquidity is solid with flight-to-quality or flight-to-liquidity scenes. To start with, stock and Treasury security markets are coordinated by means of illiquidity. An adjustment in the illiquidity of one market

has an effect on the illiquidity conditions in the other. Secondly, while stock and security exhibit ill-liquidity, sharing various comparable qualities, they have diverse monetary natures. Bond illiquidity rushes to catch the impact of financial approach factors, even though this impact takes longer for stock illiquidity. The outcomes are steady with the view that money related approach stuns are shown in bond illiquidity and then directed to the value advertise by means of the impact of bond illiquidity over stock illiquidity. This sets up a connection between fiscal arrangement and financial markets illiquidity. By and large, illiquidity increments because of the contraction of monetary policies. Thirdly, this investigation points out the significance of considering bond illiquidity of different maturities. Specifically, outcomes show that while illiquidity across maturities tends to commove, illiquidity of short-term bonds is more sensitive to money related policy shocks and strongly affects market illiquidity contrasted with medium-and long-term securities. Thus, in an instructive sense, the illiquidity of short-term bonds assumes a significant role in cross-market dynamics.

Mihaela Nicolau's (2010) paper's main objective is to investigate the interactions between various financial sectors. It mainly ensures that the commodities market, the bond market and the stock markets are closely related, hence through an intensive investigation of one ought to joins contemplation of the other two. The purpose of this article is to show that even with a hypothetical perspective, budgetary markets demonstrate solid and strong connections between them, under financial unrest the relationships change their signs. Both basic guidelines of monetary hypothesis and models with ongoing arrangement are used in the display. The consequences of our assessment underline that a fundamental theoretical examination of money related markets' conduct through expansion and financing costs can't characterize the certified communications of the business sectors and progressively solid research approaches are required.

Ritesh Patel (2016) in this examination investigates the co-development among the picked stock trades, that is, 'BSE', 'Hangseng', 'MXX', 'RTS', 'BVSP', 'FTSE-100', 'Nikkei' and 'NASDAQ'. This examination is done using the regular list of every securities exchange from 1 January 1998 to 30 June 2015. This assessment has been finished using various tests like 'The ADF test', 'The PP test', 'The Granger causality test' and 'The Johansen co-joining test'. ADF and PP tests show that the arrangements are non-stationary. The consequences of the Granger causality test exhibits that the BSE is Granger-caused about by BVSP, FTSE 100, MXX, NASDAQ and the RTS advertise. The Mexican (MXX) and Russian (RTS) stock exchanges influence Brazilian (BVSP) stock exchange. The Return of the FTSE 100 is affected by BVSP, MXX and NASDAQ, and Hangseng is impacted by BSE, BVSP, FTSE 100, MXX and NASDAQ. None of the stock exchanges the assessment influence the MXX and Nikkei. NASDAQ is impacted by BVSP, FTSE 100 and Hangseng markets. The stock exchange RTS (Russia) has the dependence on the FTSE-100 (UK) and Hangseng Stock Exchange. RTS depend upon FTSE 100 and Hangseng. The co-coordination test is finished which exhibits the long haul relationship among all the picked markets. Head segment assessment makes the discontinuity of market in the two locale, the South Asian and the Latin American protections trade (BSE, BVSP, NASDAQ, MXX, Hangseng and FTSE 100) and the Northeast Asian money related trade (RTS and Nikkei).

Raj Kumar (2013) mentions two crucial factors for economic growth which are the stock markets and the prevailing interest rates. It analyses the effect of interest rate on the stock market and the implication of this relationship on the monitory policy, risk management practices, financial securities valuation and government policy towards financial markets.

Ramdhany's, Seetanah's, Bhattu-Babajee's and Boodhoo's (2018) investigation observationally examinations the conceivable connection between securities exchange costs and trade rates for five developing markets to be specific Brazil, China, India, Mauritius and Russia from 1995 to 2015, utilizing dynamic board information investigation, specifically a Board Vector Autoregressive model. The board co-mix tests propose that there's a since quite while ago run connection between financial exchange costs and the factors. Moreover, the Vector Mistake Revision Model declares that financial exchange costs are contrarily yet irrelevantly related with trade rates. Stock costs are additionally contrarily related with cash supply and absolute stores; it absolutely was likewise settled that loan fees are adversely connected with trade rates. Bi-directional connection between stock costs and the two factors: cash supply and complete stores were watched. Furthermore, circuitous connections between stock costs and expansion through cash supply and the other between stock costs and trade rates through all out stores were likewise settled.

Fałdziński's, Balcerzak's, Meluzín's, Pietrzak's and Zineker's (2016) study approves confirmation of linkages among capital markets is significant for surrounding plans that consider chance related with all inclusive budgetary markets inter-dependencies. Right now, reason for the article separates inter-dependencies among capital markets of Germany, Poland, Czech Republic and Hungary. The investigation theory was given as follows: there's a similar course and changes inside the between conditions among capital markets of Germany and in this manner the business divisions of the referenced countries of the Visegrad Gathering. In the assessment a DCC-GARCH model was applied. The model is allowed to evaluate unforeseen connections that exhibit nature of the interrelationship among the business segments. The co-integration examination of the unexpected connections was driven. The proposed econometric system checks the assessment hypothesis. It avowed that the capital markets of Germany, Poland, Czech Republic and Hungary are depicted with equivalent long stretch way. Likewise, the investigation showed that modifications toward the way and nature of the interrelationships among the inspected markets are directed by the German capital market eventually, which is a pioneer in the area.

Rashid's (2007) paper analyses the effect of macroeconomic factors on the stock and securities advertise exercises in two Asian nations. We look at the impact of financing cost changes, expected expansion rate, and securities exchange returns on total stock and security issuance in Malaysia and Korea. Utilizing vector autoregressive models (VARs) and fluctuation decay procedures, our outcome show that elements of value and bond issuance in the two nations shift fundamentally. Our discoveries show that there has been a two-path connection between financing cost changes and bond issuance on account of South Korea, though, stock returns have fundamentally impacted the security issuance (rather than value issuance) in Malaysia. The discoveries appear to help developing fame of corporate security in Asian locale.

Sami's, Magnus' and Elizaveta's (2008) paper analyzes the impacts of inflation, saw securities exchange vulnerability just as economic growth desires on the time-fluctuating correlation among stock and bond returns. Understanding the particular elements of the relationship among stock and security markets is significant for a few reasons. One macroeconomic variable that, in principle, may influence the stock-bond return correlation is inflation. The objective of this paper is to decide how inflation and growing economy desires and perceived securities exchange vulnerability influence the relationship among stock and bond returns. The empirical analysis is performed utilizing day by day information on US, UK, and German stock and bond returns. Discoveries show that normal inflation is positively identified with the time-differing relationship among stock and bond returns. Stock and bond costs generally tend to move a similar way when there is an ongoing period of high inflation, while epochs of negative stock-bond return relationship happen when there are least degrees of inflation expectations

Harvey (1989) in his paper states that although both bond and stock market data contain information important for predicting GNP growth, the bond market helps in deriving more accurate predictions. It shows that a firms' returns have positively correlation with economic growth. Variations in stock prices can be a cause of changes in the perceived risk of stock cash flows as well as changes in expected economic growth. Investors have now changed their perceptions of the riskiness of cash flows which can confound the information about expected economic growth.

Mongi Arfaoui and Aymen Bem Rejeb (2017) had the goal behind this paper is to investigate, in an overall perspective, the oil, gold, US dollar and stock costs interdependencies and to perceive promptly immediate and indirect linkages among them. A method subject to synchronising conditions frameworks was used to perceive immediate and indirect linkages for the period 1995-2015. The researchers endeavour from the outset to find hypothetical responses to principle question of the examination by discussing causal respective connections while focusing on multilateral affiliations. The results show basic collaborations between all business sectors. There was seen as a negative connection among oil and stock costs anyway oil cost is fundamentally and decidedly impacted by gold and USD. Oil cost is moreover affected by oil future costs and by Chinese oil net imports. Gold rate is affected by changes in oil, USD and stock trades. The US dollar is adversely impacted by securities exchange and fundamentally by oil and gold cost. Aberrant effects reliably exist which certify the nearness of worldwide interdependencies and incorporate the financialization procedure of commodity markets.

Sumner, Johnson and Soenen in their paper attempted to show the interdependence among stock, bonds and gold. For the full sample of information inspected, return spill over seem muted; be that as it may, some proof exists of volatility spill over for the whole example. A great part of the volatility spill over is owing to an overflow from innovations in stocks to bond bring unpredictability back. By analysing short example windows, it was discovered that overflows are dynamic in nature. Spill overs regarding returns are higher during the mid-1980s, mid-1990s, and the latest financial crisis. Volatility spill overs have been exceptionally raised in the latest financial crisis just

as in the late 1970s and mid-1990s. It seems that there is not a pattern in the spill overs, just periods when the spill overs increment, remain raised for a period, and afterward come back to "typical" levels. Verifiably, gold and commodities as a rule have been a significant resource class for speculation purposes. Gold has frequently been viewed as a place of refuge or counter-patterned speculation vehicle. It is notable that gold returns will in general fall when there is a bull pattern in the equity market, and the other way around. The absence of any considerable connection among gold and stocks and gold and bonds brings up an issue about whether gold price movements can be utilized as a predictor of stock or bond costs. The very low spill over impact from gold to stocks and to bonds, particularly as for returns, profoundly limits the forecasting intensity of gold with respect to both other two classes. Notwithstanding, gold's low and somewhat negative relationship with stocks and bonds stays a major positive from the point of view of portfolio development. Gold stays a significant resource class for the portfolio speculator yet appears to have its very own existence because no huge spill over impacts with either the stock or the bond showcase is evident. Considering the place of safe trait of the US dollar in the midst of monetary or political uncertainty, it might be of interest as a zone for future research to examine to what degree the exchange weighted estimation of the US dollar has any bearing on the spill over impacts of stocks and bonds.

Varsha Ingalhalli, Poornima B.G. and Y.V. Reddy (2016) have attempted to contemplate the Indian economy throughout the years as it has, earlier, experienced an unstable circumstance in its financial markets. Forex markets saw consistent incapacitating of rupee against dollar, trailed by ascend in oil costs, gold costs, expansion rate which made RBI to interfere with its increase in policy rates to control the inflation. Effect of one market on another market is unquestionably not anything new, anyway the differences in the degree of impact and co-developments between the business sectors ought to be investigated. The essential objective of this examination is to look at the effective connection between oil, gold, forex and stock trades, for a period running from January 2005 till July 2015. This examination uses the Granger causality test. The results show the nearness of simply single directional relationship among the components. The Granger causality test reveals that oil costs contribute towards advancement and envisioning of swapping scale and gold costs, while changes in oil costs are granger achieved by Sensex.

The authors S. J. H. Shahzad, N. Raza, M. Shahbaz & A. Ali (2017) of this paper inspects the reliance of gold and benchmark securities with ten financial exchanges including five bigger created markets (for example USA, UK, Japan, Canada and Germany) and five Eurozone fringe GIPSI nations (Greece, Ireland, Portuguese, Spain and Ireland) financial exchanges. We utilize a unique quantile-on-quantile (QQ) thanks to cope with develop the reliance assessments of the quantiles of gold and security with the quantiles of economic exchanges. The QQ approach, as these days created by Sim and Zhou (2015), catches the reliance between the entire circulations of monetary resources and divulges some subtlety highlights of the connection. The observational discoveries fundamentally show that gold is solid support and diversifier for the stock portfolio apart from when both the business sectors are fraught. Further, the trip to wellbeing marvel is brief since national benchmark bonds show a positive reliance with their separate nations stock lists at different quantiles. In contrast to this writing, the QQ

approach propose that bonds approaches places of refuge for the stock portfolio yet gold doesn't. Our discoveries additionally propose that reliance between stock-gold and stock-security sets isn't uniform and this relationship is advertising state (for example bearish, mellow bearish, idealistic or bullish) and nation explicit.

Mervyn King's, Enrique Sentana's & Sushil Wadhwani's (1990) paper's experimental goal is to reflect the time-variety of the covariances between business sectors. Using information on 16 national financial exchanges, we gage a multivariate figure model that instigates benefit volatility by adjusting symmetrical variables ' unpredictability. Returns on abundance are expected to rely both on changes in visible financial factors and on unnoticeable variables. The hazard premium on a gain is a similar combination of the factors-related hazard premia. The fundamental exact finding is that perceptible monetary factors can be expressed by solitary some degree of th e time variety in the covariances between national financial exchanges. Changes in the market for relationships ar e essentially due to unnoticeable factors developments. We also gage each nation's hazard incentives and can identify generous innovations in the requisite value profit. Furthermore, our findings suggest that, even though relationships between the business sectors have risen since the financial exchange crash in 1987, this is not really evidence of a decrease in trends.

Steeley (2006) in his paper used a two-factor no-arbitrage model to provide a theoretical link between stock and bond market volatility. This has important implications in the process of portfolio selection in financial markets. A theoretical model was utilized to give the premise to looking at the connections between the volatility of short-term yield, long term security yields and stock returns. The observational investigation utilized a GARCH system that allowed more extravagant structures than could be broke down utilizing the theoretical model. Specifically, the effect of dynamic overflows and time-shifting relationships among the volatility processes could be analysed. The time-differing relationships utilized a non-parametric smooth change process that permitted the correlation between market stuns to develop over the example time frame. Utilizing information for the UK stock and security markets, it was discovered that the connection between short run yield shocks and long term security yield shock was generally steady during the sample time frame, while the relationship between each of these markets and the equity market reversed sign. This unmistakably has significant ramifications with respect to the expanded supporting capability of the bond advertise showcase lately, as the relationships among advertise stuns are presently unequivocally fundamentally negative. It likewise makes clear the significance of allowing relationship structures to develop inside experimental details. While this paper has thought about just a single nation, it could without much of a stretch be applied to different nations, and across nations, where displaying time changing connection structures is additionally liable to be a key factor. Such applications are left for future research.

M. Raju and TrinleyPaldon (2019) endeavoured to explore the Stock Market slightness of BSE and NSE in Indian economy as shown by the examination of Economic survey for the time of (2015 - 2018). This research paper mentions India's economic movement in recent years and as the essentiality of the Indian stock exchange on the rich expansion pace of the global exchange.

Research Methodology

Objectives

The **primary objective** of this research study is to investigate the interrelationship between financial markets. The study focuses on two markets: the stock and bond markets. The S&P BSE Bond index and the S&P BSE 100 index are used as the yardsticks for the two markets. The study employs various statistical and econometric tools to analyse the relationship between the two markets and concludes with a regression model explaining the relationship between bonds, stocks and gold to understand the extent to which gold is used as a substitute investment.

Hypothesis

Ho: no relationship between the bond, the stock and gold markets.

H1: There is a relationship between the bond, the stock and gold markets.

Methods of data collection

We have chosen secondary data collection method for our paper. We have taken data from BSE website for historical prices the indices and the gold petal futures. .The prices from January 2016 to 2019 are taken for the study. S&P BSE Bond index and the S&P BSE 100 index are used.

Introduction of statistical tools

1. **Moving correlation**

   Correlation quantifies the relationship in the deviation from the trends for two data series of profits. A perfect positive correlation implies that the correlation coefficient is exactly 1. This means that as one security moves, the other security moves in the same direction as the first one, either up or down. Whereas, negative correlation implies that two securities move in opposite directions. When there is no relationship between the series, it has zero correlation.

2. **Cointegration**

   Cointegration tests recognize situations where at least two non-stationary time arrangement are coordinated together such that they can't deviate from equilibrium in the long run. The tests are utilized to recognize the level of impact of two factors to a similar normal cost over a predetermined timeframe

   One of the strategies for testing cointegration is Engle-Granger Two-Step Method:

   The Engle-Granger Two-Step strategy begins by making residuals dependent on the static relapse and then testing to see if the residuals have presence of unit roots. It utilizes the Augmented Dickey-Fuller Test (ADF)

or different tests to test for stationarity of units in time arrangement. In the event that the time arrangement is cointegrated, the Engle-Granger strategy will show the stationarity of the residuals.

The constraint with the Engle-Granger strategy is that if there are multiple factors, the technique may show more than two cointegrating connections. Another confinement is that it is a single equation model.

3. Mann Kendall Trend Analysis

This test is utilized to break down information gathered over time for reliably expanding or diminishing patterns in Y values. It is a non-parametric test which implies it works for all distributions. It examines the distinction in signs among former and latter data points.

4. Exponential Smoothening

Exponential smoothing is a method used to produce a smoothed time series. It assigns exponentially decreasing weights as the observations get older unlike Simple Moving Averages in which the past observations are assigned equal weights. Exponential smoothening helped us to better understand the validity of the data and the model in use.

For any time period t, the smoothed value St is found by computing

Basic equation: $St=\alpha yt-1+(1-\alpha)St-1$ $0<\alpha\leq 1t\geq 3$

Where S is the smoothed observation and y stands for the original observation. The constant α is also called the smoothing constant. As a method of initialization, the first smoothed observation was set as the first original observation. (S2=y1)

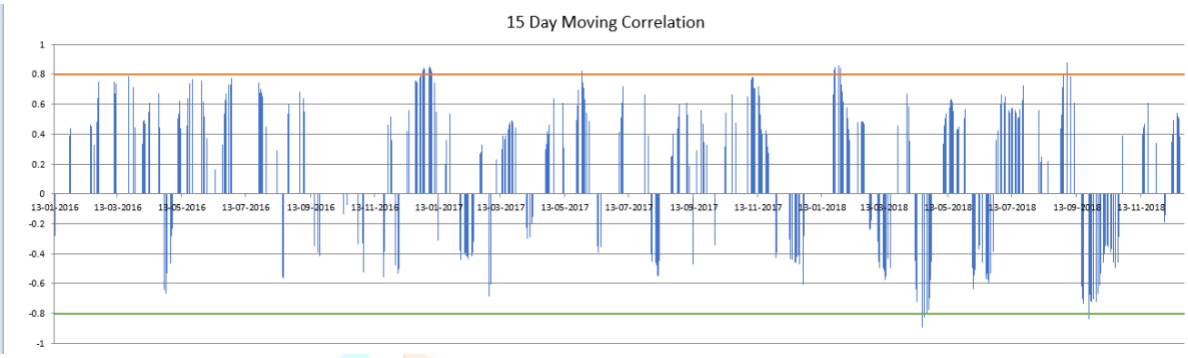
5. Multivariate Regression

It is a statistical technique that analyse a single regression model with one or more outcome variable. This statistical method is used to predict the behaviour of dependent variables associated to changes in independent variables, once a desired degree of relation has been established. Multivariate regression is part of multivariate statistics, concerned with models with more than one outcome variable. So, a multivariate regression model refers to regression models with at least two dependent/outcome variables which can be predicted by one or more independent variables.

Data Analysis

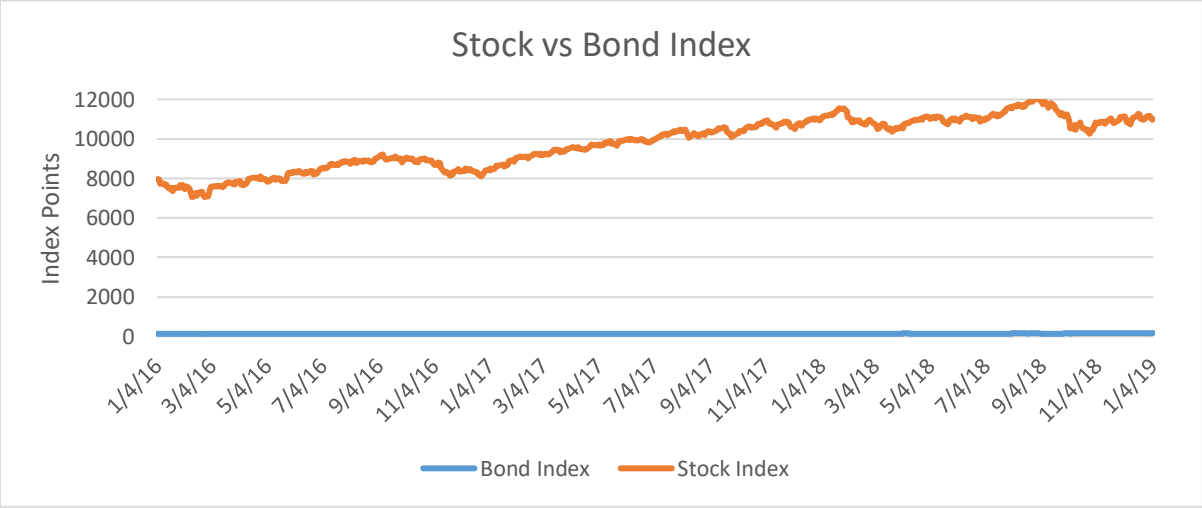
1. Moving Correlation

By applying this method to the data, we saw that the returns gained from both the data series move in the same direction at times and hence have a positive correlation. This is because, at the point when bond costs start to fall, stocks will in the long run stick to this same pattern and head down. As borrowing turns out to be progressively costly and the expense of doing business increases due to inflation, it is sensible to expect that organizations (stocks) will not do as well.



However, this is just substantial during times of high inflation expectations which may have resulted in negative correlations at times in this data. For instance, during the period of September 2018, the returns of these series have shown negative correlation. This may be because the all-India general CPI inflation rose marginally to 3.77% in September 2018. Likewise, times of elevated stock market uncertainty result into a decoupling among stock and bond costs.

2. Cointegration



3. Engle-Granger Test for Cointegration	
Alpha	5%
Max Lags	10
Criteria	none
tau-stat	-1.963566036
tau-crit	-3.793444211
Cointegrated	No
Lags	10
p-value	> .1

From the table, we derive that the two-time series are not cointegrated

Hence, there is a possibility of them deviating from the equilibrium in the long term

Also, we got a p value which greater than 0.1 indicating that the residuals are not stationery and the two-time series are not cointegrated

The lag length is how many terms back down the process you want to test for serial correlation

A lag number of 10 indicates that we should check the cointegration in groups of 10 or less than 10 values

3.Mann Kendall Trend Analysis

The null hypothesis (H0) for this test is that there is no monotonic trend in the series. The alternate hypothesis (H1) is that a trend exists. This trend can be positive, negative or non-null.

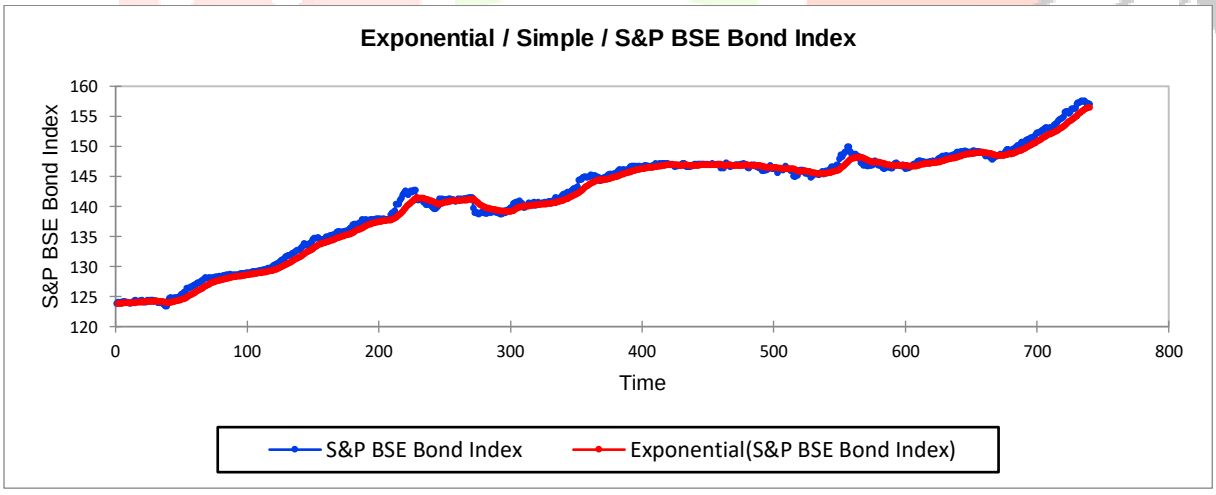
Series / Test	Kendall's tau	p-value	Sen's slope
Difference	-0.682	< 0.0001	-2.389

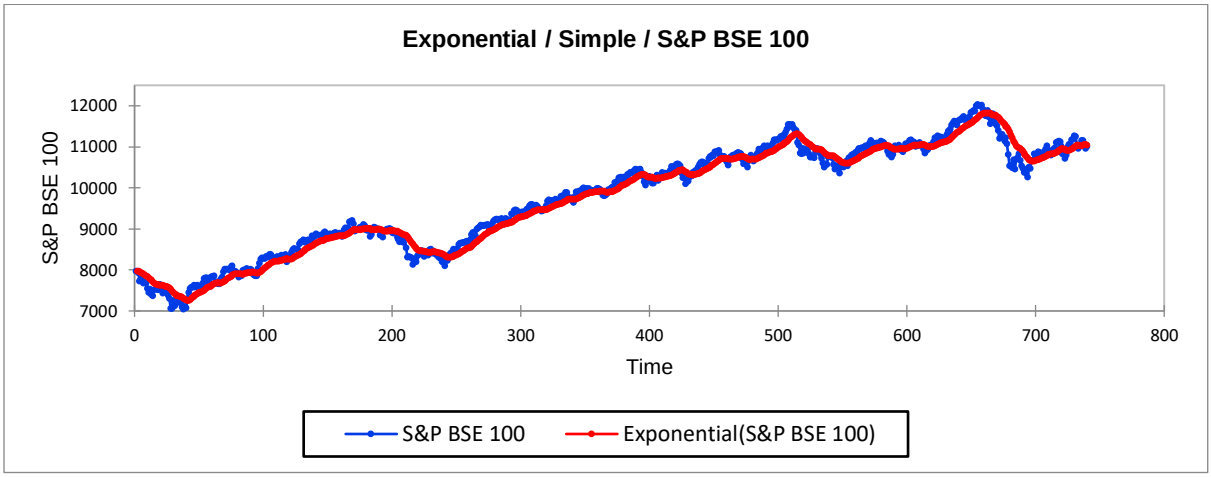
A Kendall's tau-b correlation was performed to derive the interrelationship between stock and bond markets. Kendall's correlation coefficient came to be -0.682 indicating that there is a relationship between the stock and bond markets.

By Sen's slope, one can calculate the magnitude of change in a variable. A Sen's slope of -2.389 indicates that there has been not much change in the magnitude of relationship between stock and bond markets.

4. Exponential Smoothening

Exponential smoothing also helps in examining and determining if our Model fits the data. Here, we can see in both the cases that the fits closely follow the actual data so we can use other techniques like moving averages or moving correlation to compare the data. Accuracy measures were also used to compare to fit of the two models. It was found that S&P BSE Bond Index Model provides a better than the S&P BSE 100 Model because it has a lower MAPE value.





5. Multivariate Regression

The null hypothesis (H0) for this technique is there is no relationship between bond index and BSE 100 index and gold petal futures. The significant f is less than the confidence level (1- 0.95).

The alternate hypothesis (H1) for this technique is there is a relationship between bond index and BSE 100 index and gold petal futures. The significant f is more than the confidence level (1- 0.95).

The independent variable here is the S&P BSE Bond Index and the dependent variables are S&P BSE 100 index and gold petal futures. There is high correlation between the three which is of 90.54%.

The regression equation for this is:

$Y=77.67+0.0058X1+0.0025X2$

When the statistical technique was performed it was found that significant F is 6.865 which is more than the confidence level. Therefore, we accept the alternate hypothesis. This means there is a relationship between the three. The main outcome of the technique is that gold petal futures are more profitable when the other two indices do not perform well. This says that people may consider gold to be an alternate source of investment.

Findings and Inferences

Throughout the study it has been observed that the relationship between the bond market and the stock market is erratic. The markets have shown strong positive relationship in some periods and a strong negative relationship in other periods. From an econometric standpoint, the two series are not cointegrated. In fact, the difference between them (the two indexes) has its own trend (which explains absence of cointegration). Exponential Smoothing tries to gain a deeper insight into this trend. Finally, the study concludes with bringing out the relationship between gold, stocks and bonds. The reason why gold is used in this analysis is because it is widely viewed as a haven investment when other assets fail.

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