BONDS RESEARCH REPORT

FINANCE AND INVESTMENT CELL
SHRI RAM COLLEGE OF COMMERCE

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ABSTRACT

This report investigates the factors affecting Indian bond yields, with a particular emphasis on the 10-year government bond, during the period from 2003 to 2023. The analysis is organized into distinct sections, each dedicated to a specific factor affecting bond yields. The report begins with an exploration of the relationship between crude oil prices and Indian bonds, followed by an examination of inflation's impact on yields. Subsequent sections investigate the correlations with gold prices, a comparative analysis of Indian and US bond yields, The report also addresses the relationship between the Indian stock market and bond yields, emphasizing the complexities that arise from varying economic conditions and investor sentiment.

INTRODUCTION

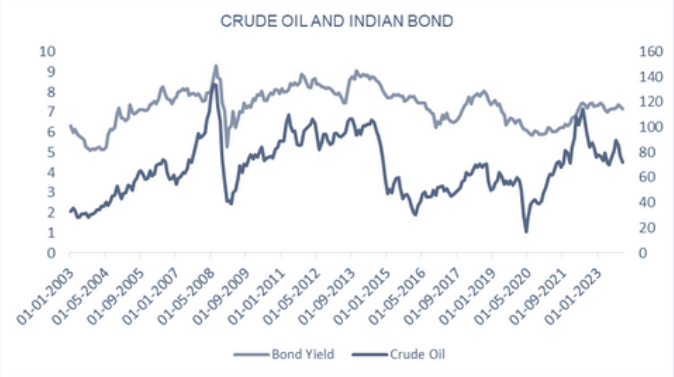
This report provides a comprehensive analysis of the intricate relationships between various economic factors and the Indian bond market. The study explores how key elements such as crude oil prices, inflation expectations, economic growth, risk perception, and monetary policy influence bond yields in India. By examining historical data and trends, the report aims to elucidate the dynamics that govern the bond market, offering insights into how external economic conditions, including global financial trends, impact local yields.

Through a detailed exploration of these factors, this report aims to provide valuable insights for various stakeholders interested in understanding the nuances of the Indian bond market and its response to both domestic and global economic shifts.

CRUDE OIL AND INDIAN BONDS

To understand the relationship between Crude Oil and the Indian 10-year bond yield we undertook a linear regression with Crude Oil as the independent variable and the 10-year bond yield as the dependent variable. The time for the study is from January 2003 to December 2023, with the data set being the monthly data for both of these variables.

The results of the statistical study are as follows:



Regression Statistics	
Multiple R	0.731349425
R Square	0.534871981
Adjusted R Square	0.533011469
Standard Error	0.624394628
Observations	252

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	112.0819481	112.0819	287.4864335	1.92082E-43
Residual	250	97.46716285	0.389869		
Total	251	209.549111			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.34053797	0.121700685	43.88256	1.8705E-119	5.100848666	5.580227274	5.100848666	5.580227274
X Variable 1	0.028627909	0.001688422	16.95542	1.92082E-43	0.025302565	0.031953253	0.025302565	0.031953253

The value of R^2 came out as .534 or 53.4% which suggests Crude Oil Prices have a high contribution to the variation shown by the bond yield over the years. Further, when adjusted for errors the R^2 does not change much at 53.30%

The Significance F and P value is below .05 which is an indication that the model is acceptable as we find no conclusive evidence to the null hypothesis which states that both of these variables have no relationship.

SUMMARY OF KEY TRENDS (2003-2022):

1. **2003-2007:** High economic growth, rising oil prices, and elevated bond yields.
2. **2008:** Global financial crisis, oil price spike, inflation surge, and higher bond yields.
3. **2010-2012:** Post-crisis recovery, high oil prices, increased FPIs, and rising bond yields.
4. **2014-2015:** Oil price crash, reduced inflation, accommodative monetary policy, and lower bond yields.
5. **2018:** Oil price surge, inflation concerns, and RBI rate hikes leading to higher bond yields.
6. **2020-2021:** Pandemic-induced oil price decline, accommodative monetary policy, and lower bond yields.

FACTORS IMPACTING THE RELATIONSHIP

The following are the factors which could suggest the correlation between Inflation and Bond yields:

1. Inflation Expectations

India's dependence on oil imports makes it particularly vulnerable to fluctuations in global oil prices. Since oil is a fundamental input for various sectors, a rise in oil prices can trigger cost-push inflation. This type of inflation occurs when production costs increase, leading to higher prices for goods and services. In response, the Reserve Bank of India (RBI) may implement tighter monetary policies, such as raising interest rates, to keep inflation in check. Higher interest rates, in turn, lead to higher bond yields, as investors demand a better return to compensate for the increased inflation risk.

Example with Past Data (2003-2022):

In 2008, during the global financial crisis, crude oil prices spiked to over $140 per barrel, leading to significant inflationary pressures in India. The inflation rate surged to over 9%, prompting the RBI to raise interest rates. Bond yields followed suit, with the 10-year government bond yield rising above 8%. Similarly, in 2018, oil prices rose sharply again, contributing to inflationary pressures. The RBI responded by hiking the repo rate twice in 2018, leading to an increase in bond yields. These instances underscore the strong correlation between inflation expectations and bond yields, driven by fluctuations in oil prices.

2. Economic Growth

Rising oil prices often coincide with periods of global economic growth. For India, this can be a double-edged sword. On one hand, higher global growth can boost India's exports and attract foreign investment. On the other hand, higher oil prices increase India's import bill, leading to a potential trade deficit. To manage this deficit, India may offer higher bond yields to attract

foreign capital and maintain a stable current account balance.

Example with Past Data (2003-2022):
Between 2003 and 2007, India experienced a period of robust economic growth, with GDP growth rates averaging around 8-9%. During this time, global oil prices also rose steadily, reaching around $90 per barrel by 2007. To attract foreign investment and manage the rising trade deficit, India maintained relatively high bond yields, with the 10-year bond yield averaging around 7-8%. Similarly, during the recovery phase post-2010, India had to balance economic growth with rising oil prices, leading to adjustments in bond yields to attract necessary capital inflows.

3. Risk Perception
Investor sentiment towards emerging markets like India can be heavily influenced by changes in oil prices. When oil prices rise, signaling strong global demand, investors often perceive emerging markets as attractive destinations for higher returns. This influx of capital into Indian equities and bonds can push bond yields higher as investors seek better returns in a growing economy. Conversely, falling oil prices may reduce investor appetite for emerging market assets, leading to lower bond yields.

Example with Past Data (2003-2022):
In the early 2010s, oil prices averaged around $100 per barrel, and India witnessed a surge in foreign portfolio investments (FPIs). The perception of strong global growth and India's growth potential attracted significant capital inflows, which influenced bond yields. During this period, bond yields remained elevated as investors anticipated better returns from the growing Indian economy. However, during the oil price crash in 2014-2015, when prices dropped below $50 per barrel, there was a noticeable decline in FPIs, and bond yields moderated accordingly.

4. Supply and Demand Dynamics
High oil prices can have varied effects on the fiscal balance of oil-exporting nations. For oil-rich countries, higher prices lead to improved fiscal positions, which can result in increased investments in emerging markets like India. Additionally, higher oil prices often lead to increased remittances from Indians working in the Gulf region, boosting domestic consumption and investment. This uptick in economic activity can drive up bond yields as demand for capital increases.

Example with Past Data (2003-2022):
During the early 2000s, when oil prices were on the rise, India experienced substantial remittances from the Gulf region. This inflow of funds bolstered domestic consumption and investment, leading to increased economic activity. To accommodate the growing demand for capital, bond yields rose during this period. The trend was also observed in the 2010s, particularly during the oil price boom, where remittances peaked, further influencing bond yields.

5. Monetary Policy
The RBI closely monitors oil prices due to their significant impact on inflation expectations. When oil prices rise, the central bank often adopts a tighter monetary policy stance to control inflation, resulting in higher bond yields. Conversely, when oil prices fall, the RBI may pursue a more accommodative monetary policy to stimulate growth, leading to lower bond yields.

(Supply side issue. Might not be the proper

solution to cost push inflation.)

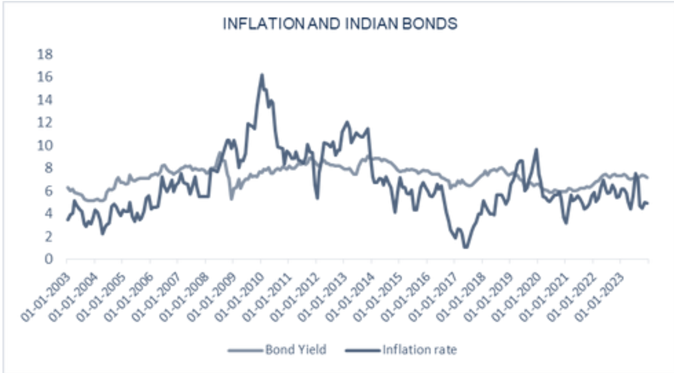
Example with Past Data (2003-2022):
In 2013, India faced a challenging economic environment with high oil prices and inflation. The RBI responded by raising interest rates to combat inflation, leading to higher bond yields. The 10-year government bond yield surged to over 9% during this period. Conversely, in 2020, when oil prices plummeted due to the COVID-19 pandemic, the RBI adopted an accommodative monetary policy, slashing interest rates and leading to a decline in bond yields. The 10-year bond yield dropped to around 6%, reflecting the central bank's efforts to support economic recovery.

This period from 2003 to 2022 demonstrates the intricate link between inflation, economic growth, risk perception, supply-demand dynamics, and monetary policy, with oil prices playing a crucial role in shaping bond yields in India.

INFLATION AND INDIAN BONDS

To understand the relationship between Inflation and the Indian 10-year bond yield we undertook a linear regression with Inflation as the independent variable and the 10-year bond yield as the dependent variable. The time for the study is from January 2003 to December 2023, with the data set being the monthly data for both of these variables.

The results of the statistical study are as follows.



Regression Statistics	
Multiple R	0.494148778167136
R Square	0.244183014964073
Adjusted R Square	0.24115974702393
Standard Error	0.795941649343668
Observations	252

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	51.1683337060523	51.1683337060523	80.7679040688886	0.000000000000000063911372510045
Residual	250	158.38077728998	0.633523109159918		
Total	251	209.549110996032			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	6.22328546409797	0.129186173019067	48.172999622641	0.00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000162912730617037	5.96885350388469	6.4777174243112 4	5.9688535038469	6.47771742431124
X Variable 1	0.162241929302305	0.0180527636185105	8.98709653163291	0.0000000000000000639113372510105	0.126687040358837	0.19779681824577 3	0.126687040358837	0.197796818245773

The value of R^2 came out as .244 or 24.4% which suggests that inflation has a moderate contribution to the variation shown by the bond yield over the years. Further, when adjusted for errors the R^2 does not change much at 24.11%

The Significance F and P value is below .05 which is an indication that the model is acceptable as we find no conclusive evidence to the null hypothesis which states that both of these variables have no relationship.

SUMMARY OF KEY TRENDS (2003-2022):

1. **2003-2007:** Moderate inflation and steady bond yields as the economy experienced stable growth.
2. **2008-2009:** High inflation driven by the global financial crisis and rising commodity prices led to increased bond yields.
3. **2011:** Inflation expectations rose, prompting investors to shift away from bonds, resulting in higher yields.
4. **2013:** CPI inflation exceeded 10%, causing a significant rise in bond yields as Example with Past Data (2003-2022):investors demanded higher returns to offset inflation risks.
5. **2018:** The RBI raised rates in response to inflationary pressures, leading to higher government bond yields.
6. **2020-2021:** Lower inflation during the pandemic and accommodative monetary policy led to a decline in bond yields, reflecting the central bank's efforts to support economic recovery.

FACTORS IMPACTING THE RELATIONSHIP

The following are the factors which could suggest the correlation between Inflation and Bond yields:

1. Inflation Risk Premium

The inflation risk premium is the additional yield that investors demand to compensate for the risk that inflation will erode the purchasing power of future cash flows from bonds. In India, when inflation expectations rise, investors seek higher returns on both government and corporate bonds. This is because, in an inflationary environment, the real value of fixed-interest payments diminishes. Therefore, bond yields rise as a reflection of the inflation risk premium embedded in the market.

Example with Past Data (2013):

In 2013, India experienced high inflation, with the Consumer Price Index (CPI) inflation rate exceeding 10%. This surge in inflation was driven by rising food and fuel prices. Investors, concerned about the eroding value of their returns, demanded higher yields on government bonds. As a result, the 10-year government bond yield rose to over 9%. Similar trends were observed in 2008-2009 during the global financial crisis when inflationary pressures led to an increase in bond yields.

2. RBI's Monetary Policy

The Reserve Bank of India (RBI) uses monetary policy as a key tool to manage inflation. When inflation rises, the RBI may increase the repo rate—the rate at which it lends to commercial banks—to curb inflationary pressures. This increase in policy rates leads to a rise in borrowing costs across the economy, including for the government. As a result, bond yields increase as investors expect higher returns to compensate for the higher cost of borrowing.

Example with Past Data (2003-2022):

In 2018, inflationary pressures prompted the RBI to increase the repo rate from 6.00% to 6.50%. This move was part of the central bank's efforts to control rising inflation, particularly due to increasing crude oil prices. Following the rate hikes, government bond yields also rose, with the 10-year bond yield reaching around 8%. A similar pattern was seen in 2011 when the RBI raised rates to combat inflation, leading to higher bond

yields.

3. Supply and Demand Dynamics
Inflation can have a direct impact on the demand for bonds. When inflation expectations rise, bonds become less attractive to investors because their fixed returns may not keep pace with rising prices. Investors may shift their portfolios towards assets that offer better inflation protection, such as equities, real estate, or commodities like gold. This shift reduces the demand for bonds, causing their prices to fall and yields to rise.

***Example with Past Data (2003-2022)**:*
In 2011, rising inflation expectations led investors to seek out assets like gold and real estate, which are traditionally viewed as better hedges against inflation. As a result, demand for bonds decreased, and bond yields increased. This trend was also evident during the inflationary periods of 2008-2009 and 2013, where the shift away from bonds towards other asset classes contributed to higher bond yields.

4. Expected Real Returns
Investors seek to achieve positive real returns, meaning returns that are adjusted for inflation. When inflation expectations rise, nominal yields on bonds must also rise to maintain attractive real returns. If nominal bond yields do not adjust accordingly, investors may opt for alternative investments that offer better inflation-adjusted returns.

***Example with Past Data (2003-2022)**:*
For instance, if the expected real return on a bond is 2% and inflation expectations rise from 4% to 6%, the nominal yield on the bond would need to increase from 6% to 8% to preserve the same real return. This adjustment was evident in periods such as 2008-2009 and 2013 when rising inflation expectations led to corresponding increases in bond yields to maintain real returns for investors.

5. Government Borrowing Costs
High inflation can increase the cost of borrowing for the Indian government. In an inflationary environment, investors demand higher yields to compensate for the erosion of purchasing power. This is particularly significant for India, given its fiscal deficit and reliance on borrowing to finance public expenditures. The government may need to offer higher yields on its bonds to attract investors, especially during periods of high inflation.

Example with Past Data (2003-2022):
During the inflationary period of 2008-2009, the Indian government's borrowing costs rose as it had to offer higher yields on its bonds to attract investors. The yield on 10-year government bonds increased as inflation concerns grew, and the government faced higher costs to finance its fiscal deficit. A similar scenario occurred in 2013 when high inflation led to a spike in government bond yields as the government sought to attract capital in a challenging economic environment.

This analysis highlights the intricate relationship between inflation, bond yields, and various macroeconomic factors in India over the past two decades. The data underscores the importance of inflation risk premium, RBI's monetary policy, supply-demand dynamics, expected real returns, and government borrowing costs in shaping bond yields during inflationary periods.

Gold and Indian Bond

To understand the relationship between Gold prices and the Indian 10-year bond yield we undertook a linear regression with gold prices as the independent variable and the 10-year bond yield as the dependent variable. The time for the study is from January 2003 to December 2023, with the data set being the monthly data for both of these variables.

The results of the statistical study are as follows.

Regression Statistics	
Multiple R	0.17240811
R Square	0.029724557
Adjusted R Square	0.025843455
Standard Error	0.901821172
Observations	252

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	6.228754391	6.22875439	7.65879336	0.006072079
Residual	250	203.3203566	0.81328143		
Total	251	209.549111			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	6.899861255	0.153090547	45.0704592	4.967E-122	6.598349669	7.20137284	6.5983 4967	7.20137284
X Variable 1	0.000326816	0.000118093	2.7674525	0.00607208	9.42327E-05	0.0005594	9.4233E-05	0.0005594

The value of R^2 came out as .0297 or 2.97% which suggests that the gold prices have a very minimal contribution to the variation shown by the bond yield over the years. Further, when adjusted for errors the R^2 does not change much at 2.58%

The Significance F and P value of .00607 is below .05 which is an indication that the model is acceptable as we find no conclusive evidence to the null hypothesis which states that both of these variables have no relationship.

The coefficient of gold prices is positive which illustrates a strength of .17 in their relationship between the gold prices and the bond yield which is quite plausible as both of the assets are hedge assets.

The relationship can be further explained by the fact that many researchers like Ghosh, Levin, Macmillan and Wright (2002) and Aye, Chang and Gupta (2015) have found the relationship between gold and inflation to be erratic, however, they have concluded that at several instances it can be positive owing to their similar nature.

Cycle	Gold	Stock	Bond
Mar 2004 - Mar 2007	17.1 %	33.4 %	1.4 %
Apr 2008 - Jul 2008	45.7 %	-50.9 %	-14.7 %
Jan 2010 - Oct 2011	34.3 %	6.3 %	4.9 %
Jul 2013 - Jan 2014	8.1 %	13.5 %	4.8 %
Apr 2018 - Aug 2018	-7.6 %	35.8 %	4.2 %
Average	19.5 %	7.6 %	0 %

The following are the factors which could suggest the correlation between Gold and Indian Bond yields:

SUMMARY OF KEY TRENDS (2003-2022):

1. **2003-2008**: Gold prices rose with inflation fears, while bond yields stayed high due to economic growth. A slight inverse relationship was seen as both responded to inflation differently.
2. **2008-2012**: Gold surged as a safe haven, while bond yields dropped with monetary easing. The inverse relationship continued, but both responded to economic uncertainty.
3. **2013-2016**: Gold prices fell as bond yields spiked during the taper tantrum, but both stabilized with economic reforms, showing moments of parallel movement.
4. **2017-2020**: Gold rose due to uncertainties, while bond yields stayed low. A minimal positive correlation appeared as both reacted to low-interest environments.
5. **2020-2023**: Gold reached new highs during the pandemic, and bond yields initially dropped, then rose with recovery. Both showed a slight parallel trend during economic instability

The positive correlation between gold prices and Indian bond yields can be understood through various macroeconomic factors that link the two assets. While traditionally, gold prices and bond yields often exhibit an inverse relationship, in certain economic contexts, they can move in tandem. Below are the key reasons behind this positive correlation, along with detailed examples from 2003 to 2022:

FACTORS IMPACTING THE RELATIONSHIP

The following are the factors which could suggest the correlation between Inflation and Bond yields:

1. Inflationary Pressures:
When inflation expectations rise, both gold and bond yields can increase simultaneously. Gold is seen as a hedge against inflation, so its price tends to rise when inflation is expected to climb. Similarly, bond yields increase because investors demand higher returns to compensate for the loss of purchasing power due to inflation.

Example with past data (2008-2009)
Inflationary pressures surged due to the global financial crisis, which led to increased demand for gold as a safe haven. During this time, gold prices surged from around INR 12,500 per 10 grams in early 2008 to INR 15,000 by the end of 2009. Simultaneously, Indian bond yields also increased, with the 10-year government bond yield peaking at around 9% as the RBI tightened monetary policy to combat inflation.

2. Global Economic Uncertainty and Safe-Haven Demand:
During times of global economic uncertainty, both gold and bond yields can rise as investors seek safe-haven assets. Gold prices increase due to heightened demand, while bond yields may rise as governments issue more debt to finance economic stimulus measures.

Example with past data (2011-2012)
Concerns about the European sovereign debt crisis and the US credit rating downgrade led to a surge in gold prices, which reached a peak of around INR 32,000 per 10 grams in 2012. At the same time, Indian bond yields remained elevated, with

the 10-year government bond yield averaging around 8%. The global economic uncertainty increased demand for both gold and higher-yielding government bonds as investors sought safety.

3. Monetary Policy and Interest Rates:
Changes in monetary policy, especially during periods of tightening, can lead to a simultaneous rise in both bond yields and gold prices. While higher interest rates generally lead to higher bond yields, they can also increase inflation expectations, driving up gold prices.

Example with past data (2013)
The RBI increased interest rates to combat inflation, raising the repo rate from 7.25% to 8%. This led to an increase in bond yields, with the 10-year government bond yield rising to around 9%. At the same time, gold prices remained elevated, hovering around INR 31,000-32,000 per 10 grams, as investors anticipated further inflationary pressures due to the rising cost of borrowing.

4. Supply and Demand Dynamics in Global Commodities:
Rising commodity prices, particularly for gold and oil, can lead to higher inflation expectations, pushing up both gold prices and bond yields. Additionally, higher commodity prices can increase government borrowing needs, raising bond yields.

Example with past data (2011-2012)
Global commodity prices, including gold and oil, rose significantly. Gold prices peaked at INR 32,000 per 10 grams in 2012 due to increased global demand. During the same period, Indian bond yields remained high, with the 10-year government bond yield around 8%-9%, as the government borrowed more to finance its fiscal deficit amid rising inflation.

5. Fiscal Deficits and Government Borrowing:
When governments run large fiscal deficits and need to borrow more, bond yields can rise as the supply of bonds increases. Simultaneously, fears of inflation or currency depreciation due to high government borrowing can drive up gold prices as investors seek protection.

Example with past data (2019-2020)
The Indian government's fiscal deficit expanded significantly as it implemented large stimulus measures. Bond yields initially fell due to accommodative monetary policy, but by 2022, as inflationary pressures mounted, bond yields began to rise, reaching around 7%-7.5%. At the same time, gold prices surged to record highs, exceeding INR 56,000 per 10 grams in August 2020, driven by fears of inflation and currency depreciation.

6. Currency Depreciation and Capital Flows:
When the Indian rupee depreciates, both gold prices and bond yields can rise. Gold prices increase as the cost of importing gold (priced in dollars) rises, and bond yields may rise as foreign investors demand higher returns to compensate for currency risk.

Example with past data (2018)
The Indian rupee depreciated significantly against the US dollar, falling by nearly 9%. This led to a surge in gold prices, which reached around INR 32,000 per 10 grams by the end of 2018. At the same time, bond yields increased, with the 10-year government bond yield rising to around 8%, as foreign investors demanded higher

returns to offset currency risks.

7. Market Sentiment and Risk Perception: During periods of heightened market sentiment and risk perception, both gold prices and bond yields can rise. Investors may flock to gold for safety, while bond yields rise as governments issue more debt to stabilize the economy.

Example with past data (2018)
As global inflation surged and central banks, including the RBI, began tightening monetary policy, both gold prices and bond yields increased. Gold prices stabilized around INR 50,000-52,000 per 10 grams, while the 10-year government bond yield rose to around 7%-7.5%, reflecting increased market risks and inflation concerns.

CONCLUSION

The positive correlation between gold prices and Indian bond yields from 2003 to 2022 is influenced by various factors, including inflation expectations, global economic uncertainty, monetary policy, fiscal deficits, and currency depreciation. While these two assets often move inversely, during periods of economic stress and inflationary pressures, they can exhibit a positive correlation as investors seek safety and higher returns in an uncertain environment.

US 10-YEAR AND INDIA 10-YEAR BONDS

The bond market of India in the 1990s relied heavily on bilateral transactions ie. OTC contracts that lacked price discovery and transparency. The market was so underdeveloped that it was compared to a 'club' as the majority of the market was dominated by traders located in one square kilometer of south Bombay. Many argued that this underdevelopment was owing to the mindset of the policymakers who felt that the equity market was more important in raising resources for private firms from both domestic and foreign investors.

For instance, the Economic Survey of 1992-93 writes: "Major modernisation of the stock exchanges, to bring them in line with world standards in terms of transparency and reliability, is also necessary if foreign capital is to be attracted on any significant scale."

As the new century began the size of the bond market relative to the GDP rose to 36.7% in 2001 compared to just 28% seven years ago. While many believed this would bring the necessary liquidity to the market, the situation did not change much. However, the growing size did catch the regulator's eyes which prompted the much-needed changes in the development of the debt market. To keep our study free of this lack of transparency that persisted, we have based our research on the year 2003 to 2023.

	Rs. billion		Percent of GDP	
Year	Equity	GOI Bond	Equity	GOI Bond
1993-94	3681	2457	42.0	28.0
1994-95	4334	2665	41.8	25.7
1995-96	5265	3079	43.2	25.3
1996-97	4639	3445	32.9	24.4
1997-98	5603	3890	33.8	25.7
1998-99	5429	4597	30.9	26.0
1999-00	9128	7143	46.6	36.5
2000-01	6255	8045	28.6	36.7

OUR STUDY

Our research covers the analysis of the 10-year bond of India and the United States from 2003 to 2023. We have broken our analysis into three phases:

1. 2003-2007
2. 2008-2013
3. 2014-2023

THE 2003-2007 ERA

The results of the statistical study are as follows:

Regression Statistics	
Multiple R	0.5552
R Square	0.3083
Adjusted R Square	0.2964
Standard Error	0.8542
Observations	60

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	18.8692	18.8692	25.8576	4.126E-06
Residual	250	42.3246	0.7297		
Total	251	61.1939			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.4751	1.2535	0.3790	0.7060	-2.0339	2.9843	-2.0339	2.9843
X Variable 1	1.4512	0.2854	5.0850	4.13E-06	0.8799	2.0225	0.8799	2.0225

The value of R^2 came out as .308 or 30.8% which suggests that the US bond yield plays a considerable role in determining the variation shown by the Indian bonds, which is quite plausible given that the US has the biggest and the most liquid bond market in the world. Further, when adjusted for errors the R^2 does not change much at 30.8%.

The Significance F and P value of 4.13E-06 is below .05, indicating that the model is acceptable as we find no conclusive evidence to the null hypothesis which states that both of these variables have no relationship.

The correlation of bond yields of both the markets is positive as mostly emerging markets like India tend to follow the US in case of Interest rate hikes and other economic actions to maintain the delta. This is done to retain the foreign money that is invested in the domestic market by incentivising foreign portfolio investors.

Further, US bonds are usually viewed as a benchmark of global confidence in the resilience of the economic system. A fall in bond prices or a sharp increase in yields can foster a negative sentiment in the market which prompts investors to look towards haven assets, further explaining the correlation.

While there exists a healthy correlation between the two assets, they also compete with each other for investor funds. When the interest rates rise in the US, foreign money flows flow out of the country hence negatively impacting the bond market.

THE 2008-2013 ERA

Regression Statistics	
Multiple R	0.1653
R Square	0.0273
Adjusted R Square	0.0134
Standard Error	0.7574
Observations	72

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1.1287	1.1287	1.9675	0.1651
Residual	70	40.1587	0.5736		
Total	71	41.2874			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	4.2057	1.004	4.1862	8.1189E-05	2.2020	6.2094	2.2020	6.2094
X Variable 1	-0.1772	0.1263	-1.4026	0.16512896	-0.4293	0.0747	-0.4293	0.0747

Findings of our research during this period are very distorted. The value of R^2 stands at .0298 which is very insignificant when compared to .3339 in the same period. Further the degree of correlation between both the markets reverses to -.1727 during the period.

Additionally, as the P value is greater than .05 it indicates that we have conclusive evidence to accept the null hypothesis, hence the regression model is valid.

REASONS FOR MISALIGNMENT BETWEEN 2008-2013:

The misalignment of the data can be attributed to various factors, with the primary reason being the 2008 US Subprime Mortgage Crisis. To tackle the downturn, interest rates hit the zero lower bound to revive the economy. These low rates continued until the fall of 2015, highlighting the drastic impact the crisis had on the US market.
The low interest rate explains the bond yield, which continued to decline over the years from 2008, reaching a low of 1.47% in 2013. The quantitative easing that started in 2008 led to the tripling of the balance sheet from $1 trillion in 2008 to over $3 trillion by 2013.

On the other hand, India remained insulated from the first-order impacts of the crisis due to a lack of financial integration with the rest of the world. The banking sector remained strong due to limited exposure to real estate and shrewd management by the apex body.
However, the indirect impacts did not spare India.

Compared to net inflows of $20.3 billion in FY 2007-2008, the economy saw a net outflow of $15 billion in FY 2008-2009. Given the presence of unutilised liquidity inthe global market, and India being one of the few countries with positive growth, FIIs once again started flowing back to India, with the first two months witnessing a flow of $5 billion.

According to M. Bianconi et al. in Emerging Markets Review 14 (2013), the volatility in the Indian bond markets due to the financial crisis was very minimal even when compared to other emerging markets that were part of BRIC. While all other BRIC countries saw their bond indices fall after the crisis, the Indian market continued its upward journey.

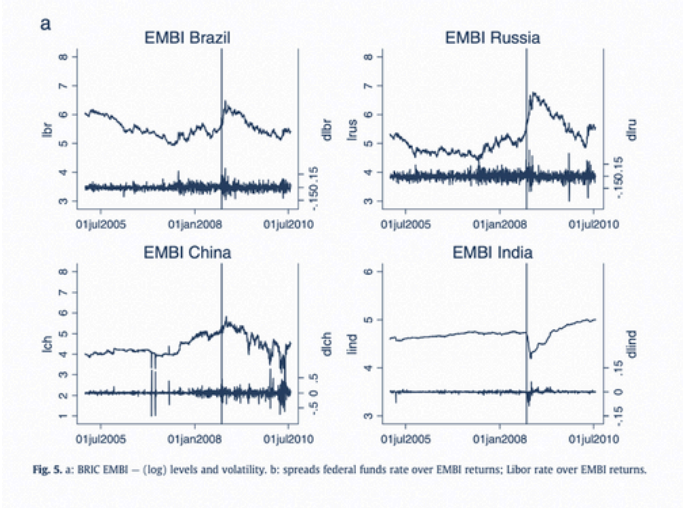


Fig. 5. a: BRIC EMBI – (log) levels and volatility. b: spreads federal funds rate over EMBI returns; Libor rate over EMBI returns.

**The line here represents the Lehman Brothers fall in September 2008.*

THE 2014-2023 ERA

Regression Statistics	
Multiple R	0.5066
R Square	0.2566
Adjusted R Square	0.2503
Standard Error	0.7790
Observations	120

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	24.7312	24.7312	40.7444	3.5506E-09
Residual	118	71.6243	0.6069		
Total	119	96.3556			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-1.995	0.6758	-2.9530	0.0037	-3.3341	-0.6574	-3.3341	-0.6574
X Variable 1	0.5997	0.0939	6.3831	3.55056E-09	0.4137	0.7858	0.4137	0.7858

During this period, the data reverts to normal. The R^2 stands at 0.2566, which is a considerable increase from 0.0298 in the previous period.

Similarly, from a negative correlation of -0.17 during 2008-2013, the correlation turns positive again at 0.5066.

The P value also remains in the required range of less than 0.05, indicating that the results of the study are not baseless, given we have no considerable evidence for it.

Hence, we conclude that the Indian and US bond markets are positively related during times when economic conditions remain normal, exhibiting a positive correlation of nearly 0.50 over the years. However, the situation reverses during economic downturns when the correlation turns negative.

While in 2008 this was due to the lack of integration of India with the global capital markets, the same cannot be commented on now given that Indian bonds are set to be included in multiple bond indices starting June 30, 2024, in the JP Morgan Emerging Bond Index.

the positive correlation between Indian and US bond yields over the period from 2003 to 2022 can be attributed to several interconnected factors. Both global and domestic influences affect the movement of bond yields in these two economies, resulting in periods where they rise or fall together. Below are the key reasons behind this positive correlation, supported by examples from the data:

SUMMARY OF KEY TRENDS

1. **2003-2008:** US and Indian bond yields rose in response to economic growth and inflation, showing a minimal positive correlation
2. **2008-2012**: During the financial crisis, both markets saw yields fall due to global monetary easing, maintaining a moderate positive correlation.
3. **2013-2016**: The taper tantrum caused spikes in yields in both markets, reinforcing their link.
4. **2016-2020**: Both markets experienced low yields due to accommodative policies, showing a mild correlation
5. **2020-2023**: The pandemic led to synchronized declines and subsequent recoveries in yields, demonstrating moderate correlation.

FACTORS IMPACTING THE RELATIONSHIP

1. Global Monetary Policy Synchronization: The US Federal Reserve (Fed) and the Reserve Bank of India (RBI) often adjust their monetary policies in response to global economic conditions. When the Fed tightens or loosens monetary policy, central banks in emerging markets like India may follow suit to manage capital flows, inflation, and currency stability.

This leads to a positive correlation between US and Indian bond yields.

Example with past data (2004-2006):
The Fed gradually increased interest rates from 1% to 5.25%. In response, the RBI also raised its policy rates to manage inflation and maintain currency stability, which led to a rise in Indian bond yields. The 10-year Indian government bond yield increased from around 5% in 2004 to nearly 8% by 2006, closely following the upward trajectory of US yields.

2. Capital Flows and Risk Perception:
Changes in US bond yields influence global capital flows, as investors often shift funds between emerging markets and developed economies based on relative yields and risk perception. When US bond yields rise, investors may pull out of emerging markets like India, causing Indian bond yields to rise as well due to higher borrowing costs and reduced demand for Indian assets.

Example with past data (2013):
During the "taper tantrum" when the Fed announced its intention to reduce its bond-buying program, US bond yields surged, with the 10-year Treasury yield rising from 1.6% in May 2013 to over 3% by the end of the year. This led to capital outflows from emerging markets, including India, causing the Indian rupee to depreciate and Indian bond yields to rise. The 10-year Indian government bond yield increased from around 7.2% in May 2013 to over 9% by September 2013.

3. Inflation and Growth Expectations:
Both US and Indian bond yields respond to global inflation and growth expectations. When global growth prospects improve, inflation expectations rise, leading to higher bond yields in both the US and India. Conversely, concerns about economic slowdowns can drive yields lower in both countries.

Example with past data (2017-2018):
Global growth picked up, and inflation expectations rose. The US economy was growing steadily, leading to a series of rate hikes by the Fed. The 10-year US Treasury yield increased from around 2.4% in late 2017 to nearly 3.2% by October 2018. Simultaneously, Indian bond yields also rose due to higher inflation expectations and RBI rate hikes, with the 10-year Indian government bond yield increasing from 6.6% in late 2017 to over 8% by mid-2018.

4. Currency and Interest Rate Differentials:
The interest rate differential between Indian and US bonds often drives capital flows. When US yields rise relative to Indian yields, foreign investors may demand higher returns from Indian bonds to compensate for currency risks and lower differentials. This can push Indian yields higher, leading to a positive correlation between the two.

Example with past data (2017-2018):
As US yields rose due to Fed rate hikes, the interest rate differential between Indian and US bonds narrowed.

This led to capital outflows from India, putting pressure on the Indian rupee and forcing Indian bond yields higher to attract foreign investment. The 10-year Indian government bond yield increased from 7.2% in January 2018 to around 8.2% by September 2018, in line with rising US yields

5. Global Liquidity Conditions:
Global liquidity conditions, driven by US monetary policy, impact bond yields worldwide. When the Fed tightens liquidity, it reduces the availability of cheap capital, leading to higher bond yields globally,

including in India. Conversely, during periods of loose monetary policy, yields may fall in both markets.

Example with past data (2019-2020):
COVID-19 pandemic in 2020, the Fed implemented unprecedented monetary easing, bringing down US bond yields. The 10-year US Treasury yield fell to historic lows of around 0.5% in August 2020. Similarly, Indian bond yields also declined as the RBI followed a loose monetary policy, with the 10-year Indian government bond yield falling to around 5.8% in the same period. However, as the global economy began to recover in 2021, both US and Indian yields rose in tandem due to tightening liquidity conditions.

6. Commodity Prices and Global Inflation:
Movements in global commodity prices, particularly oil, impact inflation and bond yields in both the US and India.

Higher oil prices can lead to increased inflation expectations, pushing bond yields higher in both countries as central banks respond to inflationary pressures.

Example with past data (2008):
As global oil prices surged to over $140 per barrel, inflation spiked in both the US and India. This led to higher bond yields, with the 10-year US Treasury yield rising from around 4% in early 2008 to over 4.7% by mid-year. In India, the 10-year government bond yield also rose from around 7.5% in early 2008 to over 9% by mid-year as inflation concerns mounted.

7. Federal Reserve's Quantitative Easing (QE) and Tapering:
The Fed's QE programs, and subsequent tapering have significant effects on global financial markets. During periods of QE, global yields, including those in India, tend to fall due to increased liquidity. Conversely, when the Fed tapers or ends QE, yields rise globally as liquidity tightens.

Example with past data (2013-2014):
The Fed's QE programs kept US yields low, with the 10-year Treasury yield hovering around 2%-3%. This also supported lower yields in India, with the 10-year Indian government bond yield staying between 7%-8%. However, when the Fed began tapering QE in 2013, US yields spiked, and Indian yields followed, both rising significantly as global liquidity conditions tightened.

CONCLUSION

The positive correlation between Indian and US bond yields from 2003 to 2022 is driven by factors such as global monetary policy synchronization, capital flows, inflation and growth expectations, interest rate differentials, global liquidity conditions, commodity prices, and the Federal Reserve's QE and tapering programs.

During periods of global economic stress or synchronized monetary tightening, both US and Indian bond yields tend to rise, reflecting shared economic and financial conditions.

INDIAN STOCK MARKET AND INDIAN BONDS

UNDERSTANDING THE BASIC RELATIONSHIP BETWEEN BONDS AND EQUITIES

Bonds:
Bond prices and yields move inversely. When interest rates rise, bond yields increase, and bond prices fall. The reasons are relatively straightforward: higher interest rates reduce the present value of future cash flows from bonds, making existing bonds with lower rates less attractive.

Equities:
For equities, the relationship between interest rates and economic conditions is more nuanced. While higher rates can increase the cost of borrowing, potentially slowing down economic growth and reducing corporate profits, they can also reflect a strong economy with positive earnings growth potential.

FACTORS

Factors which could suggest the correlation between Indian Equity Market and Bond yields:

1. Monetary policy transmission
India's monetary policy transmission mechanism has historically been less efficient compared to developed markets. This can lead to a more complex relationship between bond yields and equity markets, as changes in policy rates may not immediately or fully reflect in bond yields or impact equity valuations.

2. Foreign portfolio investment (FPI) flows
India's equity and bond markets are significantly influenced by FPI flows. Changes in global risk sentiment can lead to simultaneous movements in both markets, potentially strengthening their correlation. However, regulatory limits on FPI investments in bonds can sometimes cause divergent behavior between equity and bond markets.

3. Fiscal Deficit and Government Borrowing
India's large fiscal deficit and substantial government borrowing can lead to higher bond yields due to the increased supply of government securities. High bond yields can attract capital away from equities, especially foreign investors looking for safer, risk-free returns in Indian bonds, potentially causing equity market outflows.

4. Currency and Bond-Equity Dynamics
Rising bond yields in India may strengthen the rupee as foreign investors demand higher-yielding Indian bonds. A stronger rupee can impact export-oriented companies in the equity market, particularly in sectors like IT and pharma, creating a negative correlation between bond yields and equity performance in these sectors.

5. Banking sector dynamics
Indian banks hold a significant portion of government bonds due to regulatory requirements. Changes in bond yields can impact bank profitability and lending capacity, which in turn affects the equity market, particularly bank stocks and sectors dependent on bank financing.

6. Inflation expectations and food prices
Given the high weightage of food in India's consumer price index, food price volatility

can significantly impact inflation expectations. This can lead to rapid changes in bond yields, which may not always align with equity market movements, especially for sectors less sensitive to food inflation.

7. RBI's intervention in the bond market
The Reserve Bank of India (RBI) frequently intervenes in the bond market to manage yields, especially during periods of high government borrowing. This intervention can sometimes create a disconnect between bond yields and economic fundamentals, potentially affecting the correlation with equity markets.

8. Gold as an alternative investment
In India, gold is a significant alternative investment. Fluctuations in gold prices can influence both bond and equity markets, potentially affecting their correlation, especially during times of economic uncertainty.

OTHER CONTRIBUTING FACTORS

1. Stage of the Economic Cycle
Early Cycle: In the early stages of an economic recovery, both stocks and bonds might perform well. Stocks benefit from improved earnings prospects, while bonds may still offer attractive yields from previous higher-rate periods. The correlation may be positive as both asset classes can rise together in response to improving economic conditions.

Late Cycle: As the economy moves into the later stages of the cycle, growth begins to slow, and inflationary pressures may increase. Investors may anticipate a slowdown, leading to a divergence in performance: stocks might start to underperform due to fears of declining earnings, while bonds could see rising yields (falling prices) as central banks might raise interest rates to combat inflation. This divergence can lead to a negative correlation between the two asset classes.

2. Inflation
Impact on Bonds: Inflation is generally negative for bonds. As inflation expectations rise investors demand higher yields to compensate for the erosion of purchasing power, leading to lower bond prices. This inverse relationship between inflation and bond prices is well-established.

Impact on Stocks: The effect of inflation on stocks is more mixed: In the **short term**, moderate inflation can be positive for stocks, as it might indicate strong demand and allow companies to raise prices, boosting nominal earnings. However, in the **long term**, high or accelerating inflation can be negative for stocks, as it leads to higher input costs, lower consumer spending, and reduced real earnings. Additionally, central banks may raise interest rates to combat inflation, which can negatively impact stock valuations.

WHY IS THE EQUITY MARKET RESPONSE COMPLEX?

Unlike bonds, which are more directly influenced by current interest rates and inflation expectations, equities are inherently forward-looking. Stock prices reflect not just current economic conditions but also future growth prospects, risks, and opportunities. This forward-looking nature means that equity markets are highly

sensitive to changes in market expectations and investor sentiment.

Earnings Growth vs Interest Rate Impact: Equity markets can react differently depending on the balance between the the impact of higher interest rates and the outlook for earnings growth. For instance:

Positive Correlation: When investors are optimistic about the future, they may be willing to pay higher prices for stocks even in the face of rising interest rates, expecting that strong future earnings will offset the cost of higher borrowing. This can lead to a positive correlation between bond yields and equity prices.

Negative Correlation: On the other hand, if investors become risk-averse due to concerns about economic downturns, geopolitical risks, or other uncertainties, they might sell off equities in favor of safer assets like bonds, regardless of the interest rate environment. This shift in sentiment can cause equity markets to decline while bond prices rise, leading to a negative correlation.

Market Reactions to Policy Announcements: Markets can react more to perceptions and expectations than to actual economic data, Equity markets can also react unpredictably to policy changes or economic data releases.

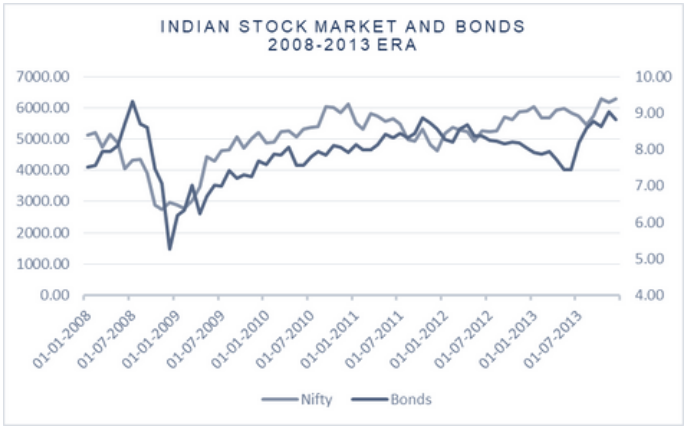
For instance, an announcement of higher-than-expected interest rates might initially cause a sell-off in equities, but if investors later interpret the move as a sign of a strong economy, they might reverse course, buying stocks back. This behavior adds another layer of complexity to the equity market response.

OUR STUDY

Our research covers the analysis of the 10-year GOI Bond and the Indian Equity Market from 2003 to 2023. We have broken our analysis into three phases:

1. 2003- 2007
2. 2008-2013
3. 2014-2023

THE 2003-2007 ERA



Regression Statistics	
Multiple R	0.8003
R Square	0.6406
Adjusted R Square	0.6344
Standard Error	0.6157
Observations	60

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	39.2013	39.2013	103.3838	1.66939E-14
Residual	58	21.9925	0.3791		
Total	59	61.1939			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.1606	0.1819	28.3662	1.07953E-35	4.7965	5.5248	4.7965	5.5248
X Variable 1	0.0006	6.10038E-05	10.1677	1.67E-14	0.0004	0.0007	0.0004	0.0007

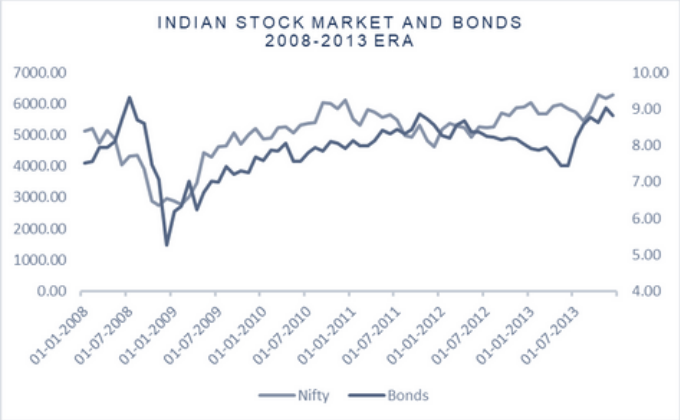
Rapid growth, fueled by increased foreign investment, strong domestic demand, and significant economic reforms, led to improved corporate earnings prospects and

a strong equity market rally. Investor confidence in sustained economic expansion drove equity prices higher.

At the same time, expectations of strong growth led to concerns about rising inflation. Anticipating the need to control inflation, central banks were expected to raise interest rates, driving bond yields higher. Investors demanded greater returns to offset inflation risks and the opportunity cost of holding bonds during a period of rising rates.

The simultaneous rise in equity prices and bond yields resulted in a strong positive correlation between the two asset classes. Both responded to the same underlying economic dynamics—growth and inflation expectations—but in different ways, leading to the unusually high correlation observed during this period.

THE 2008-2013 ERA



Regression Statistics	
Multiple R	0.5484
R Square	0.3007
Adjusted R Square	0.2906
Standard Error	0.5963
Observations	71

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	10.5568	10.5568	29.6829	7.3709E-07
Residual	69	24.5401	0.3556		
Total	70	35.0969			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	5.6454	0.4208	13.4145	6.65992E-21	4.8058	6.4850	4.8058	6.4850
X Variable 1	0.0004	8.19335E-05	5.4482	7.37E-07	0.0002	0.0006	0.0002	0.0006

In contrast, the R^2 value for the period from 2008 to 2013 dropped to 0.30, or 30%. This decrease reflects the increased uncertainty and market volatility following the global financial crisis, where unconventional monetary policies and fluctuating investor sentiment weakened the direct link between bond yields and equity performance.

The Significance F and P value of 7.3709E-07, also well below 0.05, suggesting that the null hypothesis was not true for this period as well. The relationship between bond yields and equities remained statistically significant despite the global financial crisis and the subsequent economic uncertainty.

The period from 2008 to 2013 was defined by economic turbulence following the global financial crisis of 2008, which triggered widespread uncertainty and a sharp contraction in global economic activity. In response, central banks, including the Reserve Bank of India, implemented unconventional monetary policies like quantitative easing to stabilise markets and stimulate growth.

Both the Nifty index and 10-year GOI Bond yields exhibited a sideways trend during this period, reflecting cautious and uncertain market sentiment. Equity markets, initially hit hard by the crisis, began a slow and uneven recovery as investor sentiment fluctuated with concerns over-growth sustainability

and the effects of ongoing monetary easing. Low interest rates supported equity valuations, but persistent global growth concerns kept investors cautious.

On the bond side, the massive liquidity injections and low rates aimed at reviving economic activity kept yields stable but low, as demand for safer assets remained high.

The correlation of 0.55 between equities and bonds during this period reflects the alternating market focus between cautious optimism and risk aversion, leading to a moderate yet significant positive correlation.

THE 2014-2023 ERA

Regression Statistics	
Multiple R	0.3665
R Square	0.1343
Adjusted R Square	0.1269
Standard Error	0.7131
Observations	119

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	9.2381	9.2381	18.1633	4.1247E-05
Residual	117	59.5082	0.5086		
Total	118	68.7463			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	8.0038	0.2102	38.0746	9.24635E-68	7.5875	8.4201	7.5875	8.4201
X Variable 1	-7.18617E-05	1.68616E-05	-4.2618	4.1247E-05	-0.0001	-3.8468E-05	-0.0001	-3.8468E-05

Finally, the R^2 for the period from 2014 to 2023 was further reduced to 0.13, or 13%. This suggests that the correlation between bond yields and equity returns became increasingly complex and less predictable.

The Significance F and P value of 4.1247E-05, which, although higher than the previous periods, is still well below the 0.05 threshold. This result further rejects the null hypothesis, indicating that a statistically significant correlation persisted between bond yields and equity returns, even as the nature of this relationship evolved due to various economic and geopolitical factors.

The period from 2014 to 2023 saw significant economic shifts in India. Major reforms like demonetisation and GST led to increased economic formalisation and boosted investor confidence, driving NIFTY's steady rise.

nitially, bond yields increased due to inflation concerns and growth expectations but began declining from 2018 as inflation moderated and global uncertainties, particularly the US-China trade tensions, surfaced.

The COVID-19 pandemic caused sharp drops in both Nifty and bond yields, followed by a rapid recovery in Nifty, fueled by strong fiscal and monetary support. Bond yields remained low due to accommodative monetary policies by the Reserve Bank of India, which kept interest rates low to stimulate economic growth.

Post-2021, Nifty continued its upward trend, reflecting economic recovery and strong corporate performance, while bond yields rose due to inflation concerns and anticipated monetary tightening.

This period illustrates a negative correlation between Nifty and bond yields, with Nifty's upward trend contrasting with the more volatile and opposite movement of bond yields. This decoupling suggests that equity markets were driven by growth expectations and corporate performance, while bond markets responded primarily to monetary policy and inflation concerns.

The distinct behavior of these markets potentially indicates a maturation of Indian financial markets, with different asset classes becoming more responsive to their specific drivers.

SUMMARY OF KEY TRENDS

2003-2008: Strong economic growth & subsequent high inflation expectation drove both equities and bond yields up, showing a high positive correlation.

2008-2012: Financial crisis led to low yields and stable equities, with a moderate positive correlation.

2013-2016: Reforms like demonetisation and GST boosted economic formalisation, investor confidence, and equities, while bond yields rose due to growth and inflation expectations.

2016-2020: Accommodative policies kept yields and equities stable, resulting in a mild correlation.

2020-2023: Pandemic-driven fiscal and monetary support led to a rapid stock market recovery, outpacing bond yields, which stayed low due to accommodative policies.

CONCLUSION

The relationship between bond yields and equity returns is more complex than the traditionally observed inverse correlation. The analysis of Indian Nifty and 10-year GOI Bond yields from 2003 to 2023 shows that this correlation fluctuates with growth expectations, economic cycles, monetary policies, and global events.

The shifts from strong positive to moderate positive and eventually negative correlation highlight the multifaceted interplay between bonds and equities, influenced by a range of factors.

This nuanced relationship isn't unique to India; for instance, in the U.S., after two decades of negative correlation, bond and equity markets displayed a positive correlation post-covid in 2022, driven by collective concerns over inflation and monetary tightening.

These insights emphasise the need to consider broader economic contexts when analysing the bond-equity dynamic. The correlation between equities and bonds fluctuates over time, influenced by economic growth, market conditions, and investor expectations. Therefore, careful investment in the Indian bond market requires a clear understanding of its relationship with the equity market and the prevailing economic environment.

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