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Research Article

Determinants Of Bond Yields: An Overview of The United States Fixed Income Market

Svetlana Sehgal[1], Dr Deepak Sehgal[2]

Abstract

The fixed income market of the United States is valued, as of 2021, at USD 46 trillion, almost double that of the domestic stock market, refuting common belief that stocks are a more favoured form of investment. Fixed income instruments however, are also not as secure and risk-free as was traditionally believed; they have ample scope for taking risk and earning higher returns. This paper attempts to study four main factors out of a multitude, that affect bond yields and build 5 models using Ordinary Least Squares Regression to confirm the direction and strength of these relationships. We use two types of Treasury Inflation Protected Yields (short-term and long-term) and three types of Corporate bond Yields (based on varying credit ratings) for the purpose. The influencing factors under study are inflation, policy rates and real economic growth. The paper uses data for a period of 21 years (2000-2021) and concludes its findings using econometrical techniques. We also later test our data for autocorrelation, multicollinearity and a structural break post December, 2019 owing to the pandemic. We find relationships in sync with our established a priori expectations and no structural break.

Key Words: Bond yields, Treasury inflation protected securities, Corporate bond yields, OLS regression, inflation, policy rates, real growth, stock market

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1. INTRODUCTION

Fixed income securities are a class of financial assets that provide a fixed amount of income to the holder at pre-determined time intervals. Hence, the issuer of such securities has to bear a fixed cost obligation. (Issuer is the borrower and the holder is the lender). These may include but are not limited to Treasury notes and bonds, corporate bonds, municipal bonds, mortgage securities and federal agency debt. They are usually recommended for more risk averse investors but the fixed income market was at the centre of the 2008-2009 crisis. They are no longer free of risk and experience high levels of volatility. They are classified as ‘debt’ in the capital structure of enterprises and referred to as debt instruments. A bond is a type of fixed income security,

[1]B.A. Economics Hons., Shri Ram College of Commerce, Delhi University
[2]Associate Professor, Deen Dayal Upadhyay College, Delhi University

usually issued in connection to a borrowing arrangement. But they are different from debentures in the sense that, debentures are usually secured against some assets of the issuer. The face value of the bond is the denomination on which regular coupon payments are made to the holder. This coupon rate is pre-specified. The issuer pays these interest payments till the end of the maturity period. The price that the holder of the bond pays at the time of buying the security is referred to as issue price and might be more, less or equal to the face value of the bond depending on if it is sold at a premium, discount, or at par. Similarly, redemption value i.e., value paid by the issuer at the time of maturity might also be more, less or equal to the face value depending on if the bond is redeemed at premium, discount or at par. But like every other financial asset, bonds have a measurement of return as well. While coupon rate is representative of the interest you receive on this lending arrangement, the average rate of return that you receive if you buy the bond today and hold it till maturity is referred to as Yield to Maturity. It is the internal rate of return computed so that it equates the discounted value all the future cash flows you will receive from this bond until maturity and the price you pay for it today. Throughout this paper, Yield to Maturity is referred to as 'yield'. Bond indenture is a document containing all terms and conditions agreed upon by the issuer and holder. This indenture for some bonds, sometimes specifies a call/put option. The 'call' option is the right of the issuer company to redeem or call off bonds after a specified period but before maturity. Generally they will exercise this right when the market interest rate declines and becomes less than the coupon rate. Conversely, the 'put' option is right of the bondholder to ask for redemption after a specified period but before maturity. This right is usually exercised when market interest rate goes up and beyond the coupon rate. Bonds are classified into multiple types on the basis of redemption, conversion, collateral, coupon rate, issuer, credit quality, and geography. In this paper however, we will only focus on two major classifications on the basis of issuer. The first is treasury bonds or sovereign bonds that are issued usually by the central government of a country and do not have a call/put option. They also do not have any explicitly mentioned coupon rate and are usually issued with maturities ranging from 10 to 30 years. They commonly make semi-annual interest payments. A type of treasury bonds are referred to frequently in the further sections of this paper, called Inflation Protected Treasury Bonds. They are issued in many countries including the USA and are bonds that have been linked to a cost of living index in order to allow investors to hedge inflation risk. For example, the Treasury Inflation Protected Securities (TIPS) in the States. The RBI also issued inflation indexed bonds in 2013 that were an enhancement of the Capital Indexed Bonds from 1997. A second classification on the basis of issuer is that of corporate bonds i.e., bonds issued by a company. These are further divided into majorly two types, based on the credit ratings the issuer companies receive from popular agencies like Standard & Poor and Fitch. The first is Investment Grade Bonds that are believed to have a lower risk of default and receive higher ratings by credit rating agencies i.e. Baa (By Moody's) or BBB (By S&P and Fitch) or above. Subsequently, they tend to be issued at lower yields. The second is junk bonds that have high default risk and as a result, have a high coupon rate and trade at higher yields. Usually subscribed by speculators, these are usually the bonds of companies having very low credit rating i.e., rated below BBB.

Now, one relationship that is centric to every bond is the inverse relationship between the price of the bond and its yield. Put quite simply, when the price we pay for a financial asset increases, the average return derived from holding it in the form of yield, falls. Further, there are 3 main factors and their relationships with bond yields that we shall study now. The factors in question

are inflation, policy rates and real economic growth. We have established a priori expectations as follows:

- Inflation and bond yields share a positive relationship. This is because as inflation rises, future inflation risk also rises. As a result, investors tend to demand higher yields as compensation.
- The Federal funds rate (policy rate) and bond yields share a positive relationship. As federal funds rate falls, the general market interest also tends to fall. This makes bonds, with their fixed coupon rate, a more attractive investment option then. There builds up a demand pressure for bonds, causing their prices to rise and thus, yields to fall.
- Real economic growth and bond yields share a negative relationship. As the economy grows, there is a higher tendency of companies to perform well. Subsequently, they will give lesser compensation in the form of yields, since risk is falling.

Now, we will empirically study these relationships. The rest of the paper is divided into 3 parts. Part 2 describes the data collected and the methodology used. Part 3 describes our results and inferences and part 4 concludes the paper.

2. DATA AND METHODOLOGY

All data used in this paper has been sourced from the Federal Reserve Economic Data. The period under study is 1-01-2001 to 1-04-2021 (21 years). The following variables were collected:

- **Trimmed Mean PCE**: Calculating the trimmed mean PCE inflation rate for a given month involves looking at the price changes for each of the individual components of personal consumption expenditures. The individual price changes are sorted in ascending order from "fell the most" to "rose the most," and a certain fraction of the most extreme observations at both ends of the spectrum are thrown out or trimmed. The inflation rate is then calculated as a weighted average of the remaining components. The trimmed mean inflation rate is a proxy for true core PCE inflation rate. The resulting inflation measure has been shown to outperform the more conventional "excluding food and energy" measure as a gauge of core inflation. Data as collected was in monthly format and was also converted to quarterly using Pivot tables.
- **Effective Fed Funds Rate:** The federal funds rate is the interest rate at which depository institutions trade federal funds (balances held at Federal Reserve Banks) with each other overnight. When a depository institution has surplus balances in its reserve account, it lends to other banks in need of larger balances. The federal funds rate is the central interest rate in the U.S. financial market. It influences other interest rates such as the prime rate, which is the rate banks charge their customers with higher credit ratings. Data in its original form is collected in a daily series. Using pivot tables, it is converted to monthly and quarterly series.
- **Real GDP :** Real gross domestic product is the inflation adjusted value of the goods and services produced by labor and property located in the United States. The data is collected at a quarterly frequency and kept unchanged.
- **Treasury Inflation Indexed Long term average yield:** Based on the unweighted average bid yields for all Treasury Inflation Protected Securities with remaining terms to

maturity of more than 10 years. Original frequency was daily but was converted to monthly and quarterly using pivot tables.

- **5-year treasury inflation indexed security, constant maturity:**It is the effective yield of the 5-year treasury inflation indexed security. Only available from 2003 and collected as daily rates and is converted to monthly and quarterly using pivot tables.
- **ICE BofA AAA US Corporate Index Effective Yield:**This data tracks the performance of US dollar denominated investment grade rated corporate debt publicly issued in the US domestic market. This subset includes all securities with a given investment grade rating AAA. Originally daily, later converted to monthly and quarterly.
- **ICE BofA BBB US Corporate Index Effective Yield:** This data tracks the performance of US dollar denominated investment grade rated corporate debt publicly issued in the US domestic market. This subset includes all securities with a given investment grade rating BBB. Originally daily, later converted to monthly and quarterly.
- **ICE BofA CCC & Lower US High Yield Index Effective Yield:** This data tracks the performance of US dollar denominated below investment grade rated corporate debt publicly issued in the US domestic market. This subset includes all securities with a given investment grade rating CCC or below. Originally daily, later converted to monthly and quarterly.

The 5 types of bond yields are regressed against federal funds rate, real GDP and inflation using a simple linear model as follows:

Bond yield = α (inflation) + β (federal funds rate) + γ (Real GDP)

We will then test our data for autocorrelation using the Durbin-Watson test and multicollinearity using variance inflation factors. We also suspect a structural break in our time series due to Covid-19 and test the same, using a Chow Test.

3. RESULTS AND INFERENCES

The OLS regression for the five bond yields gives us results as recorded in table 1.

Table 1

Regression results for models of bond yields

			t-stats				Coefficients			
	Models	R-Square	Intercept	Trimmed Mean	Fed Funds Rate	Real GDP	Intercept	Trimmed Mean PCE	Fed Funds Rate	Real GDP
1	TIPS Long-Term	0.841	14.375	-0.646	5.647	-14.444	8.181	-0.105	0.216	0.000
2	TIPS Short-Term	0.681	3.996	0.306	6.314	-4.972	3.471	0.074	0.413	0.000
3	AA Corporate Bonds	0.825	9.477	2.392	7.102	-8.507	7.653	0.552	0.386	0.000
4	BBB Corporate Bonds	0.703	10.224	2.720	1.564	-9.396	12.400	0.943	0.128	-0.001
5	CCC Corporate Bonds	0.384	6.002	2.801	-2.173	-5.982	35.463	4.733	-0.863	-0.002

All three explanatory variables are statistically significant at a 95% confidence level, i.e., have a value greater than 1.96 or less than -1.96. They also have signs that indicate relationships in sync with our a priori expectations. The R-square is significantly high for all models, also indicating the strength of linear dependence of bond yields on these factors. Worth noticing however, is how the relationship of fed funds rate is negative with junk bonds, in contrast to the other 4

models. To explain why, we will first mention a concept referred to as 'bond spread'. It is the interest rate differential between two bonds and is representative of the overall risk. The yield that we get on bonds might be made up of fed funds rate and the spread above it since fed funds rate is representative of the interest you will receive generally on so many instruments in the economy. As fed funds rate decreases, which will most likely happen when the economy is not doing well and the fed is inducing stimulus, the spread increases due to a general increase in risk. In case of investment grade bonds, this increase in spread, however, is less than the decrease in fed funds rate and thus, yield as a whole falls. But since junk bonds are more volatile and more reactive to risk, the increase in spread as a result of slashed fed funds rate is more than the decrease, and thus, yields tend to rise as a whole in this case.

Autocorrelation i.e., serial correlation of the error terms is a common phenomenon while dealing with macroeconomic variables. We did a Durbin-Watson test to check for the same and its results are as recorded in table 2.

Table 2

Results of the Durbin-Watson test

	Models	Durbin-Watson stat
1	TIPS Long-Term	0.331
2	TIPS Short-Term	0.410
3	AA Corporate Bonds	0.355
4	BBB Corporate Bonds	0.270
5	CCC Corporate Bonds	0.308

All the statistics calculated are extremely near to 0 and fall within the range of 0&2. The critical d_L value for Model 1,3,4 and 5 is 1.563 (with n=81) and it is 1.535 (with n=73) for model 2. We can safely conclude that the data suffers from first-order autocorrelation and is positively correlated.

We also tested our data for multicollinearity i.e., the presence of an exact linear relationship between explanatory variables. We calculated Variance inflation factors of each for the same and its results were recorded in table 3.

Table 3

Test for Multicollinearity

	Variance Inflation Factors
Trimmed Mean PCE	2.110272068
Fed Funds Rate	2.320694604
Real GDP	1.229039007

Since the values are less than 2.5, we can safely conclude that multicollinearity, even if there, is not a cause to worry as it is going to be moderate only.

Now, while dealing with time-series data, there is always a chance around important economic, financial or global events, that the data can be better explained with two different models or a dummy variable within one model. We also suspected that post December, 2019, like all other

markets, the bond market must also have experienced a structural break. We performed a Chow test for the same and its results were recorded in table 4.

Table 4

Results of Chow Test

Model 1		Model 2		Model 3		Model 4		Model 5	
CHOW	1.589	CHOW	1.591	CHOW	1.018	CHOW	0.761	CHOW	0.378
Chow Critical	2.49	Chow critical	2.513	Chow Critical	2.49	Chow Critical	2.49	Chow critical	2.49

Since all calculated chow statistics were less than the Chow critical values, we can conclude that there has been no structural break post December, 2019. This led us to infer that the bond market has not experienced an actual change due to the Fed constantly buying assets and keeping the fed funds rate at an all-time low since March,2020. We can expect the bond market to successfully register a break in the coming months in sync with Fed's announcement to start tapering off soon.

4. CONCLUSION

This paper studied the relationship bond yields hold with important macroeconomic factors in depth. We used two types of TIPS yields as well, to isolate the impact of factors other than inflation strongly. The further division into investment grade and junk bonds also gave us useful insights into the volatility of high yield bonds and their reactions to changes in the economy. While the data suffers from first-order autocorrelation, it can be corrected in further research using the same data in auto-regressive models. High multicollinearity and a structural break could not be proven. This also leads us to believe that we do not need any dummy variable for the pandemic yet, and our results are more or less meaningful. The bond market can further be studied in relation to the stock market or other types of fixed income instruments shall also make for interesting research. A similar study especially on Indian bond market on the similar lines shall be particularly interesting and may put the result in direct comparison to the results of a mature market like US. The present paper worked within the limits and this part is left for future researchers.

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