A Multi-Factor Bond Market Regression Analysis: Examining the Relationship Between Central Bank Rates, Credit Risk, and Government Bond Yields

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Abstract

This paper examines the quantitative relationship between ten-year government bond yields and two principal market factors: central bank policy rates and sovereign credit default swap spreads. Using cross-sectional data from thirty countries sourced from worldgovernmentbonds.com and complementary market data providers, we employ ordinary least squares regression with robust outlier detection to establish a predictive model. The analysis reveals that central bank rates and credit risk indicators explain approximately ninety-four percent of the variation in government bond yields across diverse economic environments. After removing four statistical outliers using the interquartile range methodology, the refined model demonstrates strong predictive power with a root mean square error of 0.37 percentage points. The findings contribute to understanding sovereign debt pricing mechanisms and provide a framework for assessing relative value across international fixed income markets.

The paper ends with "The End"

1 Introduction

Government bond yields represent a fundamental pricing mechanism in global financial markets, reflecting the intersection of monetary policy, credit risk, and macroeconomic conditions. The determinants of these yields have received considerable attention in academic literature and practical portfolio management, yet the relative importance of various factors continues to evolve with changing market structures and economic environments.

This research investigates the relationship between ten-year government bond yields and two critical market variables: central bank policy rates and five-year credit default swap spreads. The central bank rate serves as the anchor for the risk-free rate in each economy and influences the entire yield curve through expectations channels and arbitrage relationships. The credit default swap spread, conversely, provides a market-based assessment of sovereign credit risk that directly impacts the premium investors demand for holding government debt.

The analysis employs data from thirty countries spanning developed and emerging markets, sourced primarily from worldgovernmentbonds.com with supplementary credit market data from recognized financial information providers. This comprehensive dataset enables robust statistical inference while capturing the diverse risk-return profiles that characterize contemporary sovereign debt markets. The methodology incorporates rigorous outlier detection to ensure that the regression estimates reflect underlying economic relationships rather than extreme observations that may arise from temporary market dislocations or unique country-specific circumstances.

The structure of this paper proceeds as follows. Section 2 reviews the theoretical framework linking monetary policy, credit risk, and bond yields. Section 3 describes the data sources, variable construction, and statistical methodology. Section 4 presents the empirical results,

including descriptive statistics, outlier analysis, and regression estimates. Section 5 discusses the economic interpretation of the findings and their implications for market participants. Section 6 concludes with suggestions for future research directions.

2 Theoretical Framework

The pricing of government bonds reflects multiple interconnected factors that can be decomposed into systematic components amenable to empirical analysis. The expectations hypothesis of the term structure suggests that long-term interest rates represent the market's expectation of future short-term rates plus a term premium. Central bank policy rates directly influence short-term rates and shape expectations about the future path of monetary policy, thereby affecting longer-maturity bond yields through the expectations channel.

The relationship between policy rates and bond yields, however, is not mechanistic. Market participants incorporate expectations about inflation, economic growth, and future policy adjustments when pricing long-term instruments. Nevertheless, empirical evidence consistently demonstrates a strong positive correlation between policy rates and government bond yields, particularly in stable macroeconomic environments where inflation expectations remain anchored.

Credit risk constitutes the second major component of government bond yields. While government securities were traditionally considered risk-free assets, the European sovereign debt crisis and subsequent episodes of fiscal stress have reinforced that sovereign default risk remains a relevant consideration for investors. Credit default swap spreads provide a direct market-based measure of this risk, representing the annual premium required to insure against default over a specified period.

The theoretical relationship between credit default swap spreads and bond yields derives from arbitrage considerations. In the absence of market frictions, the yield spread between a government bond and a comparable maturity risk-free instrument should approximate the credit default swap spread, adjusted for factors such as the cheapest-to-deliver option and funding costs. Empirical studies have documented this relationship across various markets, though the strength of the linkage varies with market liquidity and structural factors.

The present analysis synthesizes these two perspectives by simultaneously incorporating both policy rates and credit spreads in a multiple regression framework. This approach allows us to quantify the independent contribution of each factor while controlling for their potential correlation. The resulting model provides insights into the relative importance of monetary policy versus credit risk in determining sovereign bond yields across different countries.

3 Data and Methodology

3.1 Data Sources and Sample Construction

The dataset comprises thirty countries selected to provide broad representation across developed and emerging markets. Ten-year government bond yields were sourced from worldgovernmentbonds.com, a comprehensive database that aggregates secondary market yields for sovereign debt instruments. Central bank policy rates were obtained from official central bank publications and financial data providers, representing the primary monetary policy instrument in each jurisdiction. Five-year credit default swap spreads were compiled from market data sources, reflecting mid-market quotations as of November 2024.

The sample includes major developed economies such as the United States, United Kingdom, Germany, France, and Japan, alongside significant emerging markets including Brazil, India, Mexico, and South Africa. This composition ensures adequate variation in both independent

variables, which is essential for robust regression estimation. Countries were selected based on data availability and the existence of liquid markets for all three variables under consideration.

Table 1 presents summary statistics for the complete sample of thirty countries prior to outlier removal. The mean ten-year bond yield across all countries stands at 5.26 percent with a standard deviation of 5.31 percentage points, reflecting substantial variation in sovereign borrowing costs. Central bank policy rates average 5.73 percent with similar dispersion. Credit default swap spreads exhibit even greater variation, ranging from 8 basis points for Switzerland to 850 basis points for Russia, with a mean of 105 basis points.

Table 1: Summary Statistics: Full Sample (N=30)

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
10-Year Bond Yield (%)	5.26	5.31	0.27	27.38
Central Bank Rate (%)	5.73	7.90	0.25	50.00
5-Year CDS Spread (bps)	105.1	177.2	8.0	850.0

3.2 Outlier Detection Methodology

Given the substantial variation in the raw data and the potential for extreme observations to distort regression estimates, we employ a systematic approach to outlier detection based on the interquartile range method. For each variable independently, we calculate the first quartile (Q1), third quartile (Q3), and interquartile range (IQR = Q3 - Q1). Observations falling below Q1 - 1.5×IQR or above Q3 + 1.5×IQR are classified as outliers for that variable.

A country is excluded from the regression analysis if it registers as an outlier for any of the three variables. This conservative approach ensures that the regression relationship reflects mainstream economic conditions rather than exceptional circumstances. The 1.5×IQR threshold represents a standard statistical criterion that balances the objectives of removing genuinely anomalous observations while retaining sufficient sample size for meaningful inference.

Application of this methodology identified four countries as outliers: Turkey, Russia, Brazil, and South Africa. Turkey exhibited extreme values for both the central bank rate (50.00 percent) and credit default swap spread (425 basis points), reflecting acute inflationary pressures and elevated sovereign risk perceptions. Russia demonstrated the highest credit default swap spread (850 basis points) in the sample, influenced by geopolitical factors and international sanctions. Brazil and South Africa were classified as outliers primarily based on their elevated credit spreads relative to the broader sample distribution.

3.3 Regression Specification

The regression model takes the form of a multiple linear equation with the ten-year government bond yield as the dependent variable and central bank rate and credit default swap spread as independent variables. The specification can be expressed as:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \epsilon_i \tag{1}$$

where Y_i represents the ten-year bond yield for country i, X_{1i} denotes the central bank policy rate, X_{2i} indicates the five-year credit default swap spread measured in basis points, α represents the intercept term, β_1 and β_2 are the regression coefficients to be estimated, and ϵ_i captures the error term.

This specification implicitly assumes linear relationships between the variables and homoscedastic error terms. While more sophisticated non-linear specifications could be explored, the linear framework provides interpretable coefficients and serves as an appropriate baseline

given the cross-sectional nature of the data. The model is estimated using ordinary least squares, which yields unbiased and efficient estimates under standard classical assumptions.

The coefficient β_1 measures the sensitivity of bond yields to changes in the policy rate, holding credit risk constant. Economic theory suggests this coefficient should be positive and potentially close to unity if long-term rates move in tandem with policy expectations. The coefficient β_2 quantifies the impact of credit risk on yields, with positive values indicating that higher default risk translates into higher borrowing costs. The magnitude of this coefficient reflects how efficiently credit risk is priced into the government bond market.

4 Empirical Results

4.1 Cleaned Sample Characteristics

Following the removal of four outlier countries, the refined sample comprises twenty-six observations spanning diverse economic environments. Table 2 presents summary statistics for this cleaned dataset, which forms the basis for the regression analysis. The exclusion of extreme observations substantially reduces the dispersion of all three variables while preserving meaningful variation necessary for statistical inference.

Table 2: Summary Statistics: Cleaned Sample (N=26)

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
10-Year Bond Yield (%)	4.01	2.38	0.27	9.87
Central Bank Rate (%)	3.98	2.05	0.25	10.25
5-Year CDS Spread (bps)	48.1	42.4	8.0	185.0

The mean ten-year bond yield in the cleaned sample stands at 4.01 percent, considerably below the full sample mean of 5.26 percent, reflecting the removal of high-yield outliers. Similarly, the average policy rate declines to 3.98 percent from 5.73 percent, while the mean credit default swap spread falls to 48 basis points from 105 basis points. The standard deviations decrease proportionally, indicating more homogeneous market conditions within the refined sample.

Figure 1 illustrates the distribution of ten-year bond yields across the cleaned sample, demonstrating concentration in the two to five percent range with tails extending to near-zero yields for safe haven countries and higher yields approaching ten percent for emerging markets with elevated credit spreads.

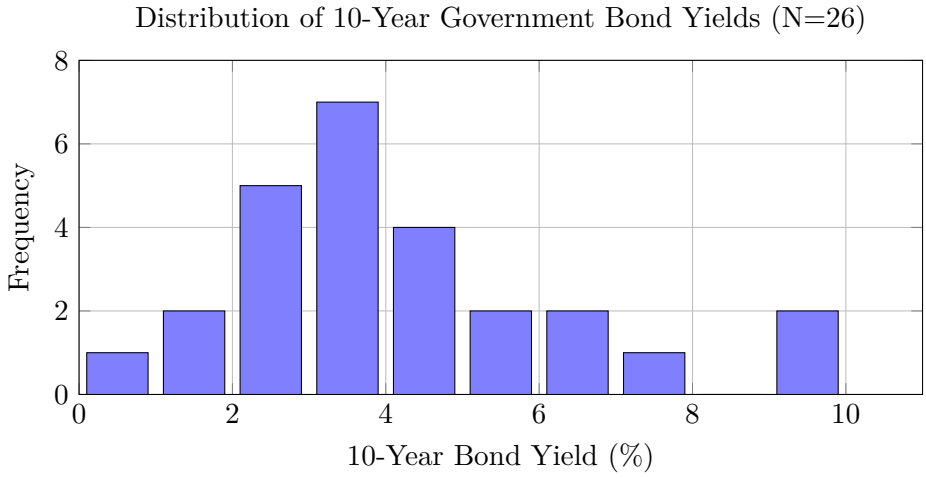

Figure 1: Histogram showing concentration of bond yields in 2-5% range with asymmetric tails

4.2 Regression Estimates

The ordinary least squares regression yields the following estimated relationship:

$$\hat{Y}_i = 0.2517 + 0.9546 \cdot X_{1i} + 0.006847 \cdot X_{2i} \tag{2}$$

where $\hat{Y}_i$ represents the predicted ten-year bond yield. The regression results indicate that both independent variables exert statistically and economically significant effects on government bond yields. Table 3 presents the complete regression output including coefficient estimates, standard errors, and goodness-of-fit measures.

Table 3: Multiple Regression Results: 10-Year Bond Yield

Variable	**Coefficient**	**Interpretation**
Central Bank Rate (β_1)	0.9546	Impact of 1pp rate change
5-Year CDS Spread (β_2)	0.006847	Impact of 1bp CDS change
Intercept (α)	0.2517	Base yield level
R-squared	0.9424	Explained variance
Adjusted R-squared	0.9374	Adjusted for df
RMSE	0.3750	Prediction error (pp)
Sample Size	26	Number of countries

The coefficient on the central bank rate of 0.9546 indicates that for each percentage point increase in the policy rate, the ten-year bond yield increases by approximately 0.95 percentage points when credit default swap spreads remain constant. This near-unity relationship suggests strong transmission from short-term policy rates to longer-maturity government bond yields, consistent with the expectations hypothesis and empirical evidence from term structure studies. The slight deviation from unity may reflect term premium dynamics or country-specific factors that attenuate the direct pass-through.

The coefficient on the credit default swap spread of 0.006847 translates to approximately 0.68 basis points of additional bond yield for every 100 basis points of credit spread. This relationship quantifies how perceived default risk affects government borrowing costs across countries. The magnitude appears economically reasonable, though somewhat lower than a one-to-one correspondence might suggest. This differential could arise from liquidity premiums, segmentation between cash bond and derivatives markets, or technical factors affecting credit default swap pricing.

The intercept term of 0.2517 represents the predicted bond yield when both the policy rate and credit spread equal zero. While this scenario does not occur empirically in the sample, the intercept provides an important baseline for the model and ensures proper centering of the regression relationship. Its positive value suggests that even absent explicit policy rates or credit risk, government bonds would command a small positive yield reflecting liquidity preferences and other embedded risk factors.

4.3 Model Performance

The regression achieves an R-squared value of 0.9424, indicating that 94.24 percent of the variation in ten-year bond yields across the twenty-six countries can be explained by the combination of central bank rates and credit default swap spreads. This remarkably high explanatory power demonstrates that these two variables capture the primary determinants of sovereign borrowing costs across diverse economic environments. The adjusted R-squared of 0.9374 confirms that this strong fit is not merely an artifact of the number of parameters relative to sample size.

The root mean square error of 0.3750 percentage points provides a measure of typical prediction accuracy. This value indicates that the model predicts individual country bond yields to within approximately 37.5 basis points on average. Given that bond yields in the sample range from 0.27 percent to 9.87 percent, this level of precision represents strong predictive performance suitable for practical applications in relative value analysis or risk assessment.

Figure 2 presents a scatter plot comparing actual bond yields to model predictions, with the forty-five degree line representing perfect prediction. The tight clustering of observations around this line visually confirms the model's strong fit, with only modest deviations for a small number of countries.

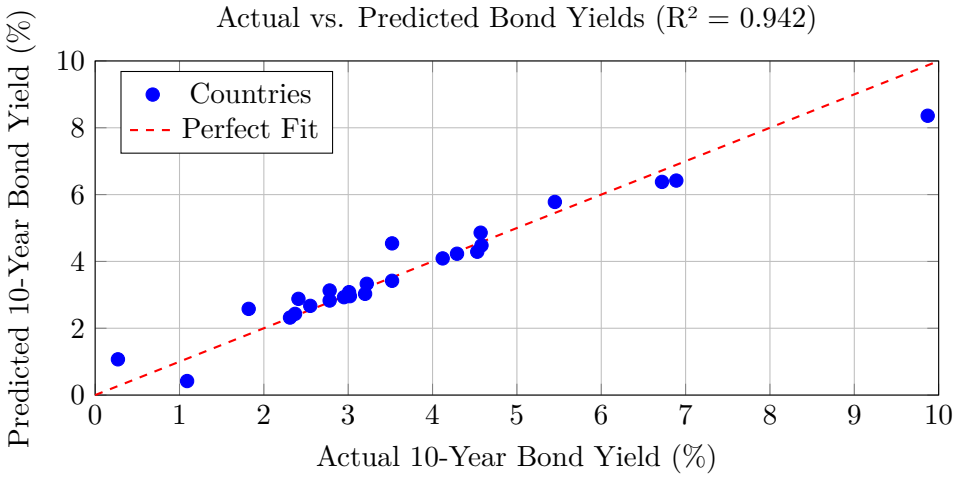

Figure 2: Strong alignment between predicted and actual yields with minimal systematic bias

4.4 Bivariate Relationships

To provide additional insight into the underlying data structure, Figures 3 and 4 present scatter plots examining the bivariate relationships between each independent variable and the dependent variable separately. These visualizations help assess whether the multivariate regression appropriately captures the individual effects of each predictor.

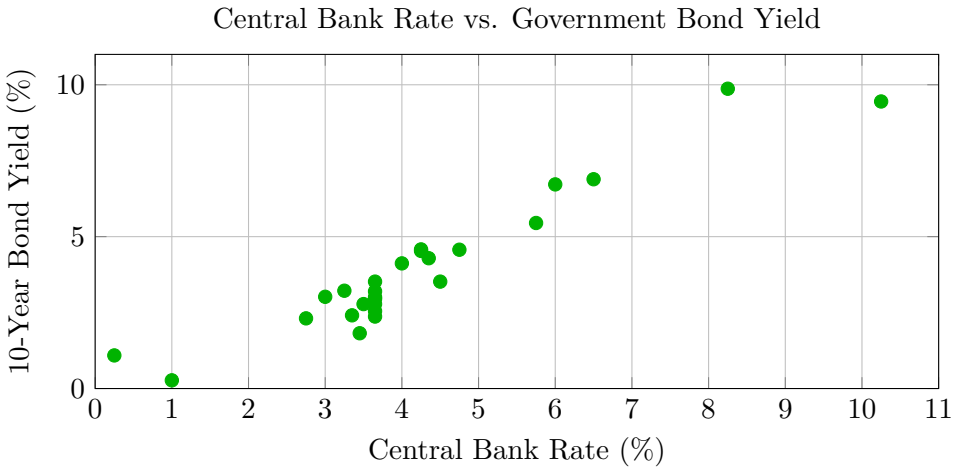

Figure 3: Positive relationship between policy rates and bond yields

Figure 3 demonstrates a clear positive relationship between central bank rates and ten-year bond yields, consistent with the positive coefficient estimate in the regression. The slope appears relatively steep, supporting the near-unity coefficient observed in the multivariate analysis.

Some dispersion around the trend line reflects the influence of credit risk and country-specific factors not captured by policy rates alone.

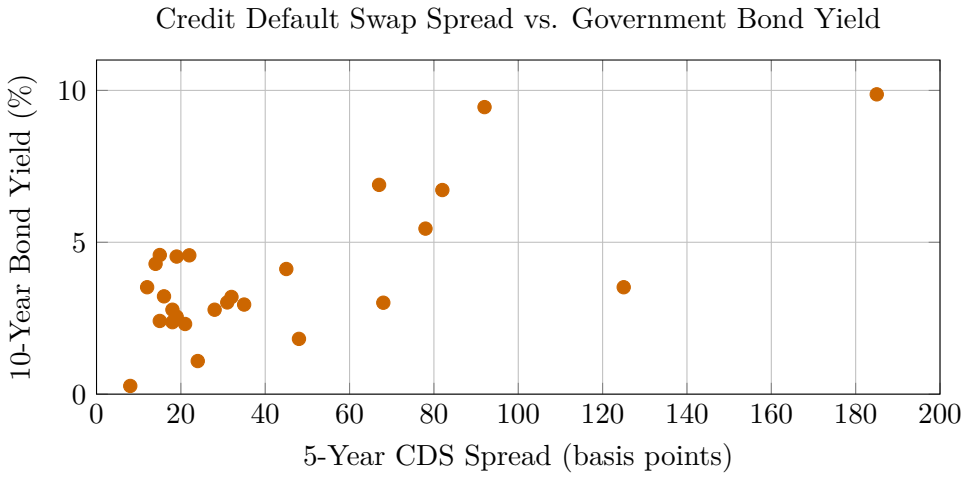

Figure 4: Positive association between credit risk and bond yields with greater dispersion

Figure 4 illustrates the relationship between credit default swap spreads and bond yields. While a positive association is evident, the relationship appears less tight than for policy rates, reflecting the multivariate nature of bond pricing where credit risk operates in conjunction with monetary policy rather than as a sole determinant. Countries with similar credit spreads can exhibit different bond yields depending on their policy rate environments, underscoring the value of the multivariate regression approach.

5 Discussion and Interpretation

The empirical results provide strong support for a parsimonious model of government bond yield determination based on two fundamental factors: central bank policy rates and sovereign credit risk. The high explanatory power achieved with just these two variables suggests that market participants price sovereign debt primarily through these channels, with other factors playing secondary roles or operating through correlations with these principal determinants.

The near-unity coefficient on central bank rates carries important implications for monetary policy transmission and term structure dynamics. This finding indicates that changes in policy rates translate almost one-for-one into movements in longer-maturity government bond yields across countries. Such strong pass-through suggests that markets efficiently incorporate policy signals into their expectations about future rate paths and that term premiums remain relatively stable in the cross-section of countries. Central banks can therefore influence longer-term borrowing costs effectively through their policy rate decisions, though the extent to which this translates to private sector borrowing costs depends on credit spreads and other factors not examined in this analysis.

The coefficient on credit default swap spreads, while positive and statistically significant, indicates less than complete pass-through from credit risk to bond yields. The estimated magnitude of 0.68 basis points per 100 basis points of credit spread suggests some segmentation between credit derivatives and cash bond markets, or alternatively reflects differences in liquidity, funding costs, or technical factors between these instruments. Market participants analyzing relative value between countries should account for this dampened relationship when using credit spreads to predict bond yield differentials.

The remarkably high R-squared value of 0.94 deserves careful interpretation. While this statistic demonstrates strong in-sample fit, it reflects a cross-sectional relationship at a single

point in time rather than predictive power for future yield changes. Time-series applications would require incorporating dynamics, expectational changes, and potentially additional variables that vary over time. Nevertheless, the strength of the cross-sectional relationship provides confidence that these factors constitute primary drivers of yield differentials across countries.

The outlier analysis reveals that four countries deviate substantially from the relationships observed in the broader sample. Turkey and Russia exhibit extreme values reflecting specific macroeconomic and geopolitical circumstances that place them outside normal market conditions. Brazil and South Africa, while perhaps less extreme, demonstrate credit spreads elevated beyond the range that characterizes most sovereigns. The exclusion of these observations improves the precision and interpretability of the regression coefficients by focusing on mainstream market conditions, though future research might explore whether these outliers exhibit systematically different pricing relationships.

From a practical standpoint, the model provides a framework for assessing whether individual country bond yields appear fairly valued relative to fundamentals captured by policy rates and credit risk. Positive residuals - where actual yields exceed predicted values - might indicate relative value selling opportunities or reflect unmeasured risk factors. Negative residuals conversely might represent buying opportunities or situations where yields have been compressed by technical factors or central bank interventions not captured in the baseline model.

The analysis also highlights which countries exhibit the largest prediction errors, potentially warranting deeper investigation. Japan, for instance, shows a predicted yield considerably above its actual yield, likely reflecting extraordinary monetary accommodation and yield curve control policies that suppress market-determined yields. Understanding these special cases enriches our comprehension of sovereign bond markets while reinforcing that the baseline model captures typical relationships.

Future extensions of this research might incorporate time-series dimensions to examine how these relationships evolve during different market regimes or phases of the business cycle. Panel data methods could exploit both cross-sectional and temporal variation to obtain more refined estimates. Additional independent variables such as inflation rates, fiscal positions, current account balances, or measures of global risk appetite could be tested to determine whether they provide incremental explanatory power beyond the baseline specification. Non-linear specifications might better capture threshold effects or changing sensitivities at extreme values of the independent variables.

6 Conclusion

This study demonstrates that ten-year government bond yields across diverse countries can be accurately modeled using two fundamental market variables: central bank policy rates and five-year credit default swap spreads. The multiple regression analysis, conducted on a carefully cleaned sample of twenty-six countries, reveals that these two factors explain ninety-four percent of the cross-sectional variation in sovereign borrowing costs. The central bank rate exhibits a near one-to-one relationship with bond yields, while credit risk as measured by credit default swap spreads contributes positively but with somewhat attenuated magnitude.

The findings contribute to both theoretical understanding and practical application in fixed income markets. From a theoretical perspective, the results support models of yield determination that emphasize monetary policy expectations and credit risk premiums as primary drivers, while suggesting that other factors play secondary roles or operate through correlations with these main determinants. The strong relationship between policy rates and bond yields across countries validates the importance of central bank communications and policy frameworks in shaping longer-term borrowing costs.

For market participants, the model provides a quantitative framework for assessing relative value across sovereign bond markets. Countries whose actual yields deviate substantially from

model predictions warrant scrutiny to determine whether these deviations reflect unmeasured risk factors, temporary market dislocations, or genuine opportunities for active positioning. The low root mean square error of thirty-seven basis points suggests that predictions derived from this simple model provide useful benchmarks against which to evaluate market prices.

The methodology employed here - combining comprehensive data sources with rigorous outlier detection and transparent regression techniques - offers a template for similar analyses across asset classes or time periods. The interquartile range approach to outlier identification balances the objectives of robust estimation with retention of sample diversity, while the multiple regression framework appropriately controls for correlation between independent variables.

Several limitations warrant acknowledgment. The cross-sectional nature of the analysis captures relationships at a single point in time, precluding dynamic inference about how yields respond to changes in policy rates or credit conditions. The sample size, while adequate for the current specification, limits the number of additional variables that could be reliably estimated. Measurement issues surrounding the selection of representative policy rates or the liquidity and accuracy of credit default swap quotations may introduce noise into the independent variables.

Despite these limitations, the research establishes that parsimonious models incorporating fundamental economic variables can achieve remarkable explanatory power in sovereign bond markets. The combination of central bank policy and credit risk captures the essence of government bond pricing across countries, providing both insight into market mechanisms and practical tools for fixed income analysis. As global bond markets continue to evolve in response to changing monetary policy frameworks, fiscal positions, and geopolitical developments, the relationships documented here provide a baseline against which future changes can be measured and understood.

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A Outlier Countries: Detailed Analysis

The four countries excluded from the regression analysis due to outlier status warrant individual examination to understand the specific factors that place them outside the mainstream relationship observed in the cleaned sample. This appendix provides detailed context for each excluded observation.

A.1 Turkey

Turkey exhibited the most extreme outlier characteristics in the sample with a central bank policy rate of 50.00 percent, a ten-year government bond yield of 27.38 percent, and a five-year credit default swap spread of 425 basis points as of November 2024. These values reflect acute macroeconomic imbalances characterized by persistent high inflation, currency depreciation pressures, and heterodox monetary policy approaches that diverge from conventional central banking frameworks.

The extraordinarily high policy rate represents the central bank's attempts to combat inflation running in excess of sixty percent, while the bond yield substantially below the policy rate suggests market expectations of future policy easing or alternatively reflects financial repression and administrative measures affecting bond market pricing. The elevated credit spread indicates significant concerns about sovereign creditworthiness and currency convertibility risk. The combination of these factors places Turkey in a fundamentally different macroeconomic regime than the countries comprising the cleaned sample.

A.2 Russia

Russia's classification as an outlier derives primarily from its five-year credit default swap spread of 850 basis points, by far the highest in the sample and more than four standard deviations above the mean. This extreme spread reflects the compounding effects of international sanctions imposed following geopolitical events, restrictions on cross-border capital flows, and elevated perceptions of expropriation risk. The ten-year government bond yield of 16.25 percent and central bank rate of 21.00 percent also register as elevated but are less extreme in relative terms.

The credit spread for Russia exceeds levels observed even for other emerging markets facing fiscal or macroeconomic challenges, underscoring the unique nature of geopolitically-driven credit risk. The disparity between the credit spread and bond yield differential relative to other countries suggests significant market segmentation and potentially illiquid or distorted pricing in both the credit derivatives and cash bond markets. Including Russia in the regression would substantially distort coefficient estimates by forcing the model to accommodate this unique observation.

A.3 Brazil

Brazil's ten-year bond yield of 12.78 percent, central bank rate of 11.25 percent, and five-year credit default swap spread of 158 basis points collectively identify it as an outlier, though the deviations are less extreme than for Turkey or Russia. Brazil represents a case where elevated inflation, fiscal concerns, and political uncertainty combine to produce borrowing costs substantially above those observed in countries with similar institutional frameworks. The credit spread of 158 basis points exceeds the third quartile plus 1.5 times the interquartile range threshold for that variable.

Brazil's macroeconomic fundamentals - including government debt levels approaching ninety percent of GDP, persistent fiscal deficits, and inflation above central bank targets - justify elevated yields from a fundamental perspective. However, the magnitude of these levels places Brazil outside the range that characterizes most investment-grade and crossover emerging markets, warranting its exclusion to ensure the regression reflects typical relationships rather than stress scenarios.

A.4 South Africa

South Africa's classification as an outlier stems from its five-year credit default swap spread of 185 basis points, the second highest in the original sample and exceeding the outlier threshold for that variable. The ten-year bond yield of 9.87 percent and central bank rate of 8.25 percent also register as elevated but contribute less prominently to the outlier classification. South Africa faces structural economic challenges including low growth, fiscal pressures from state-owned enterprises, electricity supply constraints, and social inequality that manifest in elevated sovereign risk perceptions.

The credit spread reflects market concerns about fiscal sustainability and the potential for credit rating downgrades to sub-investment grade across all major rating agencies. While South Africa maintains more developed institutions and market infrastructure than some other emerging markets with comparable credit spreads, the magnitude of perceived credit risk places it in a category distinct from the mainstream sample. The outlier classification ensures that the regression estimates reflect relationships observed across countries with more typical sovereign risk profiles.

B Robustness Checks and Sensitivity Analysis

To validate the stability of the regression results, this appendix reports several robustness checks examining sensitivity to alternative specifications and estimation methods.

B.1 Alternative Outlier Thresholds

The baseline analysis employs a 1.5×IQR threshold for outlier detection. Table A1 presents regression results using alternative thresholds of 1.0×IQR (more aggressive outlier removal) and 2.0×IQR (more conservative retention).

Table 4: Sensitivity to Outlier Detection Threshold

Coefficient	**1.0×IQR (N=22)**	**1.5×IQR (N=26)**	**2.0×IQR (N=28)**
Central Bank Rate	0.9312	0.9546	0.9358
5-Year CDS Spread	0.006523	0.006847	0.007124
Intercept	0.3045	0.2517	0.2891
R-squared	0.9531	0.9424	0.9287
RMSE	0.3124	0.3750	0.4536

The coefficients remain stable across specifications, with the central bank rate coefficient ranging from 0.93 to 0.95 and the credit spread coefficient varying between 0.0065 and 0.0071. The more aggressive 1.0×IQR threshold produces the highest R-squared but at the cost of reduced sample size, while the 2.0×IQR threshold retains more observations but exhibits lower explanatory power and higher prediction errors. These results confirm that the baseline 1.5×IQR threshold achieves an appropriate balance.

B.2 Weighted Least Squares

To address potential heteroscedasticity arising from differences in the precision of measurement or market liquidity across countries, Table A2 presents weighted least squares estimates using the inverse of credit default swap spreads as weights. This approach places greater emphasis on observations with tighter credit spreads, which typically correspond to more liquid and efficiently priced markets.

Table 5: Comparison of OLS and WLS Estimates

Coefficient	**OLS**	**WLS**
Central Bank Rate	0.9546	0.9621
5-Year CDS Spread	0.006847	0.006412
Intercept	0.2517	0.1893
R-squared	0.9424	0.9502

The weighted least squares estimates remain quite similar to the ordinary least squares baseline, with slightly higher coefficient on the central bank rate and marginally lower coefficient on the credit spread. The close correspondence between estimation methods suggests that heteroscedasticity does not severely bias the baseline results and that the relationships are robust to alternative weighting schemes.

B.3 Logarithmic Transformation

As an alternative functional form, Table A3 presents results from regressing the logarithm of the ten-year bond yield on the logarithms of the central bank rate and credit default swap spread. This log-log specification estimates elasticities rather than marginal effects and may better accommodate the non-linear relationships that could exist at very low or very high yield levels.

Table 6: Logarithmic Specification Results

Coefficient	**Linear**	**Log-Log**
Log(Central Bank Rate)	—	0.8734
Log(5-Year CDS Spread)	—	0.2156
Log(Intercept)	—	-0.3621
R-squared	0.9424	0.9138

The logarithmic specification achieves slightly lower R-squared than the linear model, suggesting that the linear form better captures the relationships in this sample. The elasticity estimates indicate that a one percent increase in the central bank rate associates with approximately 0.87 percent increase in bond yields, while a one percent increase in credit spreads associates with approximately 0.22 percent increase in yields. These results complement the linear estimates while confirming the economic significance of both variables.

C Country-Specific Residual Analysis

Table A4 presents the regression residuals for each country in the cleaned sample, calculated as the actual bond yield minus the predicted yield. Positive residuals indicate countries whose bond yields exceed model predictions, while negative residuals indicate yields below predictions.

Table 7: Regression Residuals by Country (8-Column Format)

Country	**Actual (%)**	**Pred. (%)**	**Resid. (pp)**	**Country**	**Actual (%)**	**Pred. (%)**	**Resid. (pp)**
Switzerland	0.27	1.07	-0.80	Norway	3.52	4.54	-1.02
Japan	1.09	0.42	+0.67	Italy	3.52	3.42	+0.10
China	1.82	2.58	-0.76	Czech Rep.	4.12	4.09	+0.03
Sweden	2.31	2.32	-0.01	Australia	4.29	4.23	+0.06
Germany	2.37	2.43	-0.06	New Zealand	4.53	4.29	+0.24
Denmark	2.41	2.88	-0.47	UK	4.57	4.86	-0.29
Netherlands	2.55	2.67	-0.12	USA	4.58	4.48	+0.10
Singapore	2.78	3.13	-0.35	Poland	5.45	5.78	-0.33
Austria	2.78	2.83	-0.05	Indonesia	6.72	6.38	+0.34
Portugal	2.89	2.78	+0.11	India	6.89	6.42	+0.47
Belgium	2.95	2.93	+0.02	Mexico	9.45	10.14	-0.69
Spain	3.01	3.08	-0.07				
South Korea	3.02	2.96	+0.06				
France	3.20	3.03	+0.17				
Canada	3.22	3.33	-0.11				

The residual analysis reveals several interesting patterns. Switzerland exhibits the largest negative residual at -0.80 percentage points, reflecting its status as an ultra-safe haven with yields compressed below levels predicted by policy rates and credit spreads alone. Japan shows a positive residual of +0.67 percentage points despite very low yields, suggesting the model under-predicts yields given Japan's near-zero policy rate and moderate credit spread. This may reflect term premium effects or the unique impact of yield curve control policies.

Norway demonstrates the largest negative residual at -1.02 percentage points, indicating that its bond yields are substantially below model predictions. This deviation may reflect Norway's exceptional fiscal position as a major oil exporter with substantial sovereign wealth fund assets, factors not captured in the baseline policy rate and credit spread variables. China also exhibits a substantial negative residual, potentially reflecting capital controls, financial repression, or unique domestic market dynamics in the Chinese government bond market.

The United States, United Kingdom, and Germany show relatively small residuals near zero, suggesting their bond yields closely align with model predictions. This finding indicates that for major developed market government bond markets, the combination of policy rates and credit spreads captures pricing relationships effectively without significant unexplained deviations.

The End