Gambling Preference and Bond Return

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ABSTRACT

The culture of different regions can affect the financial behaviors of their residents. A substantial body of prior research has shown that the yield rates of the bonds are subject to multiple influences, including macroeconomic and microeconomic factors. Drawing upon data sampled from 2014 to 2022, this study aims to examine the relationship between high gambling preferences and excess municipal bond returns. Following the Hausman test, which proved that the random effects model is more efficient and consistent, the study adopts this model for the analytical framework.

Adopting the Random Effect Model, the study discovered that in the short-run, higher gambling preference is associated with higher municipal bond return. However, when considering a long-term perspective, there is evidence of potential conflict. Specifically, higher per capita casino revenue over this period may indicate a more stable and diversified revenue base for the state. This reduction in perceived risk might lead to lower yields or returns. Therefore, due to this observed conflict in the evidence, it's important to approach the interpretation of these results with caution. The author acknowledges the need to carefully consider both short-term and long-term dynamics before drawing any definitive conclusions.

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Introduction

Motivated by their active engagement in the realm of gambling, a group of MFIN students has embarked on a compelling exploration. In a world where financial markets and cultural landscapes intersect, the dynamics of a company's success often intertwine with the cultural tapestry of its local environment (Hilary and Hui, 2009; Kumar et al., 2011; Chen et al., 2014; Callen and Fang, 2015). As these aspiring financial minds explore the complex connections between culture and finance, their focus sharpens on a captivating hypothesis: the strong attraction people have toward local gambling habits might have an unexpected influence on the trend of municipal bonds.

Prior research has consistently demonstrated that the yields of bonds are affected by both macroeconomic variables, such as inflation rates and interest rates, and microeconomic indicators like issuer creditworthiness and market liquidity. The conjecture concerning the potential impact of gambling preferences on municipal bond returns rests upon two distinct rationales. Firstly, we hypothesize that individuals with a penchant for gambling may lean towards more aggressive investment profiles, thus potentially reducing demand for the bond. Secondly, regions with strong gambling preferences might prioritize such activities over sound fiscal policies, potentially diminishing the creditworthiness of municipal bonds.

Anticipating lower demand and subsequently reduced prices for municipal bonds within regions of elevated gambling preferences, our objective is to establish a correlation between high gambling preferences and high access returns in the context of municipal bonds. Utilizing an Random Effect Model, the study is built upon panel data from the year 2014 to 2022, aiming to investigate the interrelationships.

Research Design

2.1 Literature Review and Hypothesis Development

Building on the research by Qiong et al. (2021), we aim to further explore how gambling culture might impact the U.S. financial market. We believe that gambling culture could influence not just corporate decisions but also the financial decisions of local governments, subsequently affecting the returns on municipal bonds.

In regions with a pronounced gambling culture, local governments might be more exposed to higher bond risks due to their strong reliance on the highly volatile gambling revenue. Additionally, the gambling industry is subject to regulatory shifts and legal challenges, which can impact revenue streams and present risks to bondholders. A strong emphasis on gambling can lead to concern regarding diversification and the region's economic stability, thus, impacting the demand for their bonds. The municipalities with a significant gambling focus might be viewed as less creditworthy by investors who need stable investment instruments like municipal bonds, leading to lower demand for municipal bonds in the region. However, this speculative approach to the bond market might elevate its volatility, presenting astute investors with opportunities for higher returns.

H_0: Municipal bonds from regions with a high gambling preference are not producing higher excess returns.

H_1: Municipal bonds from regions with a strong gambling preference are more likely to produce high excess returns.

2.2 Variables selection

The choice of the S&P Municipal Bond Index returns as the target variable stems from its representation of a diverse range of municipal bonds, rendering it more broadly representative.

In regard to independent variable selection, we considered multiple factors. Firstly, in states with higher gambling revenues, the cultural and societal acceptance of risk might be greater. This heightened risk tolerance might lead local governments to adopt more aggressive and speculative financial strategies. To capture this effect, we use a dummy variable to indicate whether a state has extensive gambling operations. Secondly, the level of education might also play a role in financial decision-making. For instance, a higher proportion of the population with education below the high school level in a state might influence perceptions of investment risk, impacting the returns of its municipal bonds. For this reason, the percentage of the population that only completed high school level of education for each state is included in our input. Moreover, the population size and economic condition of a state might also relate to its financial decisions and municipal bond returns. For instance, states with larger populations might have more extensive financial markets and higher bond liquidity. In contrast, states with higher levels of poverty might face more considerable fiscal pressures, potentially influencing the returns on their municipal bonds. Therefore, the study is designed to delve into how factors like gambling revenue (on a per capita dollar value), education level, population, and poverty levels collectively impact municipal bond returns. Through this study, we hope to gain deeper insights into how gambling culture indirectly affects the financial market.

2.3 Data and Sources

The dataset employed in this study spans from 2014 to 2022 and encompasses the S&P Municipal Bond Index along with Casino Revenue for each state. The chosen timeframe commences from 2014, the earliest year for which data was accessible. Data for the S&P Municipal Bond Index was sourced from S&P Dow Jones Indices. Meanwhile, the Casino Revenue information was gathered from the "State of the States 2023: THE AGA ANALYSIS OF THE COMMERCIAL CASINO INDUSTRY" report published by the American Gaming Association. High School Population data,

Poverty Rate data, and State Population data were sourced from reliable government sources like the U.S. Census Bureau and the American Community Survey. To ensure the authenticity of local gambling preferences states, Nevada and New Jersey were excluded from the analysis given that their gambling demographics could be skewed by external individuals traveling to these states specifically to gamble. Consequently, the final dataset incorporates observations from 25 states over an 8-year period, 225 data slices in total.

2.4 Preliminary Test

Before delving into the intricacies of panel data analysis, it is essential to ensure that the data meets certain assumptions. Violations of these assumptions can lead to biased or inconsistent estimators, thereby affecting the validity of the conclusions drawn. This section discusses the preliminary tests carried out on the dataset comprising municipal bond returns across various U.S. states. These tests include:

1. Stationarity Test
2. Heteroskedasticity Test
3. Autocorrelation Test

Stationarity Test

Stationary bias is crucial to address in Random Effect Model modeling to prevent misleading results stemming from spurious relationships in non-stationary time series data.

Stationarity in the dataset was tested using the Augmented Dickey-Fuller (ADF) test. The result is shown in the table in Appendix 1.

Most variables appear to be stationary except for `Revenue from gambling per capita` and `Population`.

For the non-stationary variables, first-order differencing was applied to transform them into stationary series. After applying first-order differencing, both variables were found to be stationary,

The p-value of the first-order differential of "Per Capita Gambling Revenue" is 2.9×10^{-11}, which suggests stationarity, and that of "Population" is 2.36×10^{-13}, confirming that the transformed variables can be used in the panel data analysis without violating the stationarity assumption.

Heteroskedasticity Test

Heteroskedasticity bias can lead to unreliable and inefficient coefficient estimates in regression analysis, making it difficult to accurately assess the relationships between variables and potentially invalidating statistical inferences. We adopted the Breusch-Pagan test to examine the heteroskedasticity bias. The p-values are above 0.05, indicating that the data is homoskedastic.

Autocorrelation Test

Autocorrelation bias can lead to inefficient and biased coefficient estimates in Random Effect Model regression, and testing for autocorrelation is essential to ensure that the assumption of uncorrelated error terms holds, avoiding flawed statistical inferences. In this study, Autocorrelation was assessed using the Durbin-Watson statistic. The Durbin-Watson statistic was found to be 2.13, suggesting slightly negative autocorrelation in the dataset.

Most assumptions for panel data analysis hold, with some concerns regarding stationarity. These issues have been addressed through first-order differencing and as such, the dataset is now ready for panel data analysis.

2.5 Empirical Model

To investigate the impact of gambling preference on historical municipal bond return, we estimate the following model:

$$MunicipalBond\_r_{it} = \beta_0 + \beta_1 GambleRev_{it} + \beta_2 Poverty_{it} + \beta_3 Edu + \beta_4 GambleRev\_d_{it} + \beta_5 Pop_{it} + u_{it}$$

$$Where: i = State,\ t = Time\ period\ (2014 - 2022)$$

MunicipalBond_r : Time-series data from 2014 to 2022 on per capita casino revenue

Gamb_Rev: Time-series data from 2014 to 2022 allows for dynamic analysis

Poverty : Represents the poverty rate in each state. Higher poverty rates could indicate a less stable economic environment, potentially affecting bond returns.

Edu : Indicates the percentage of the population with less than a high school diploma. Lower educational attainment could be associated with lower economic productivity and higher risk, which may influence bond yields.

GambRev_d : Dummy variable for 2022, 1 if average gambling revenue > mean

Pop : Represents the total population of each state. Larger populations might offer a broader tax base, potentially stabilizing bond returns.

Chapter 3 Empirical Analysis

3.1 Baseline Regression Analysis

Table 2 reports the regression result ,using the model we introduced before.

Per Capita Casino Revenue (GambleRev_r): Having a negative coefficient (-3.195) that is statistically significant at the $p<0.01$ level. To our surprise, the rise in local Per Capita Casino Revenue was associated with a concurrent decline in municipal bond returns. This discovery brings attention to the potential negative repercussions of heightened casino activity on the municipal bond market, influencing investor returns. One possible explanation is that higher casino revenue per capita over time indicates a stable revenue base, reducing perceived risk and leading to lower yields. However, this interpretation remains uncertain and calls for scrutiny, as it is contradictory to the actual correlation and other findings. We are inclined to consider the explanation that, in history, unpredictable external shocks may hold a more significant influence in this scenario.

High School Population Percentage (Edu): The coefficient is −0.367, and it is not statistically significant. As the proportion of the population with an education level below high school increased, municipal bond returns tended to decrease. This association suggests the broader impact of socio-economic considerations on market dynamics, influencing investor sentiment and overall market health. Higher education possibly leads to more rational behavior, increasing the investors' confidence and contributing to a more stable investment environment.

Poverty Rate (Poverty): The coefficient is 0.0229 and is not statistically significant (no asterisks). The coefficient of Poverty Rate suggests a positive relationship between the bond yield and the poverty rate. However, since the coefficient is not statistically significant at any conventional level.

The logarithm of State Population (Pop): The coefficient is −0.101 and is not statistically significant. An increase in the logarithm of state population was linked to reduced municipal bond returns. Although the coefficient is not statistically significant, this observation may reflect the intricacies of supply and demand dynamics within the market, influenced by population shifts.

Higher than Average Gambling Dummy Variable (GambleRev_d): The coefficient is 0.689 and is statistically significant at $p<0.05$. The presence of above-average Per Capita Casino Revenue was associated with increasing municipal bond returns. With a significance level of above 95%, this supported our argument.

3.3 Robustness Check

3.3.1 Multicollinearity Test

Multicollinearity was assessed using the Variance Inflation Factor (VIF). Table 3 shows the result of VIF. The average VIF is 2.998, which is below 5 suggesting that multicollinearity bias is not a major concern.

Conclusion

In this study, our hypothesis posited that municipal bonds originating from regions with a strong gambling preference would likely yield higher excess returns in the future. However, upon applying a random effects model to our analysis, we uncovered results that diverge from our original expectations. Specifically, we observed a statistically significant negative correlation between casino revenue and municipal bond returns. This relationship held even after controlling for variables such as the percentage of individuals with a high school education or below, poverty levels, and the logarithm of the state population. Additionally, the model's explanatory power (R-squared) remained 0.334·, suggesting that the model could not fully account for the variance in municipal bond returns.

This unexpected outcome could stem from various factors. Firstly, the preference for gambling might only be one of numerous factors influencing municipal bond returns, as other elements like economic conditions, interest rate fluctuations, and policy changes equally impact market performance. Secondly, the connection between gambling preferences and municipal bond returns might be influenced by control variables that were not taken into account, such as levels of education within the population, poverty conditions, and the size of the state's population. Additionally, factors like delayed effects over time and non-linear relationships could potentially contribute to the variations in outcomes that we observed.

The intricacies and uncertainties within financial markets can lead to disparities between expectations and actual outcomes. Although the results deviated from the initial hypothesis, they provide valuable insights by illustrating that financial market performance is shaped by a multitude of factors, and the impact of a single factor may be counteracted or weakened by others. In brief, this study underscores the complex dynamics of financial markets, where a variety of factors

collaborate to shape results. While the original hypothesis wasn't confirmed, the study presents a chance to gain a deeper insight into financial market behavior.

Limitations and Future Research

5.1 Regression model limitation

The Random Effects (RE) model may introduce its own set of limitations and potential biases. The RE model assumes that individual-specific effects are uncorrelated with predictor variables, which might not hold if unobserved factors influence both gambling preference and bond return, leading to endogeneity concerns. To mitigate this, employing instrumental variables correlated with individual-specific effects but not directly tied to outcomes can enhance causal inference. However, the RE model might overemphasize time-invariant effects, potentially overlooking significant changes over time. To address this, considering a Fixed Effects (FE) model that explicitly controls for time-invariant individual-specific effects might offer more accurate insights. Additionally, the RE model's assumptions regarding the distribution of individual-specific effects can result in efficiency loss if not met. Conducting a Hausman test to compare RE and FE models can guide the choice of the appropriate model. Omitted variable bias remains a concern in the RE model, especially when omitting time-invariant variables correlated with both predictors and outcomes. This can be alleviated by incorporating control variables that reflect potential omitted factors. Generalizability can also be limited to the specific panel data used. To enhance external validity, validating the model's findings with different datasets or time periods is recommended. Lastly, small panel sizes may introduce biased estimates. To counteract this, robust standard errors can be employed to ensure reliable hypothesis testing results. By addressing these limitations with corresponding mitigations, the use of a Random Effects model can yield more robust and meaningful insights into the relationship between gambling preference and bond return.

5.2 Missing Variable

When examining the relationship between gambling preference and bond return using variables like gambling revenue per person, gambling revenue above the mean, population, educated population, and poverty population, several limitations and potential biases arise. The potential for omitted variable bias to distort outcomes is notable, given its exclusion of influential factors. For instance, the omission of distinct inflation levels across various states due to data unavailability could be illustrative. There are also many non-casino gambling profits such as sports betting that are closely related to gambling preferences. Collinearity between variables could lead to instability. For instance, if both the "educated population" and the "poverty population" are highly correlated, it might be challenging to isolate their separate effects. What's more, measurement inaccuracies might affect precision. Conduct an exhaustive literature review to identify potential variables. Integrating relevant variables into the analysis can help mitigate the risk of omitted variable bias. Mitigating collinearity involves employing techniques such as principal component analysis (PCA) or ridge regression. Performing sensitivity analyses by adding and removing variables can help to assess the stability of results. Transparent documentation of variable selection and robustness checks could enhance the validity of findings.

5.3 Future Research

Future research exploring the complex relationship between gambling preference and the bond return has the potential to address the identified limitations and enrich our understanding. Longitudinal studies remain a promising avenue, enabling the observation of how gambling preferences and bond returns evolve over time. Additionally, multilevel modeling can uncover regional variations and provide nuanced insights into this relationship. Qualitative research, including interviews and surveys, offers the opportunity to delve into the underlying motivations

and decision-making processes behind gambling preferences and financial choices. Controlled experiments could serve as a means to establish causal links, particularly by examining the impact of interventions on gambling preferences and subsequent bond return fluctuations. Exploring unconventional data sources such as sentiment analysis from social media could unveil real-time public sentiment dynamics and their potential influence on financial behaviors. Dynamic modeling, machine learning algorithms, cross-country analyses, and alternative outcome variables contribute to a more comprehensive perspective. Alongside these, investigating policy effects, potential mediation factors, and robustness testing can provide deeper insights into the mechanics of the relationship. Including mechanism tests would enable a more thorough exploration of the causal pathways that connect gambling preferences to bond return, shedding light on intermediate factors and contributing to a holistic understanding. Collectively, these research directions offer avenues to transcend limitations, enhance methodological robustness, and advance our knowledge of the intricate interplay between gambling preference and bond return.

Appendix

Table 1:Stationary test result

Variables	P-value
Municipal bond return	0.0004 (Stationary)
Per Capita Gambling Revenue	0.097 (Non-stationary)
Poverty	0.016 (Stationary)
Education variable	0.038 (Stationary)
Gambling Revenue Dummy	0.020 (Stationary)
Population	0.102 (Non-stationary)

Table 2: Regression Result

	(1)
VARIABLES	MunicipalBond_r
GambleRev_r	-3.195***
	(0.954)
Poverty	0.0229
	(0.495)
Edu	-0.367
	(0.337)
GambleRev_d	0.689**
	(0.315)
Pop	-0.101
	(0.144)
Constant	-1.496***

	(0.495)
Observations	225
Number of state_id	9

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: VIF table

Variables	VIF
Revenue from gambling per capita	1.62
Poverty	5
Education variable	5.35
Gambling Revenue Dummy	1.5
Population	1.52

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