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Pricing of Corruption Risk

U.S. Case Study for the Municipal Bond Market

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Abstract

Existing research suggests a positive relationship between corruption and bond yields. However, previous studies have overlooked two crucial aspects: the incomplete decomposition of pricing factors and the need for examining corruption at more localized levels, considering the decentralization of political power. This study investigates the extent to which municipal bonds price in corruption risk in the United States. Specifically, we examine the relationship between the corruption measure (Convictions per Capita) and annualized issuance cost, which comprises the yield to maturity and annualized gross spread—representing the sum of the cost of debt and the search costs incurred by underwriters. Our findings reveal a positive and significant association between annualized issuance costs and our corruption measure. Robustness checks largely support these results but also emphasize the necessity of conducting investigations over an extended period and utilizing multiple corruption measures to provide more comprehensive evidence.

Keywords: Corruption – Municipal Bonds – Bond Yield – Annualized Issuance Costs – Gross Spread

1. Introduction

This study examines the extent to which corruption risks are priced into annual issuance costs of municipal bonds, using the example of municipal bonds issued by counties in the United States. Each year, Transparency International publishes a ranking that examines perceptions of corruption at the country level. The Corruptions Perceptions Index (CPI) indicates how corruption is perceived in different countries, with the scale ranging from 0 to 100, with 0 being very corrupt and 100 being very clean (Transparency International, 2023). According to Transparency, more than two-thirds of the 180 countries listed are at a score below 50, and more than 85% of countries are stagnant in their development (i.e., their score is not moving upward, or it is falling) (ibid).

The development of the United States also appears to be stagnating. In the last decade, the highest CPI score was 76 in 2015, and has fallen continuously since then. Since 2019, the score has fluctuated between 67 and 69, putting the United States in 24th place in the international rankings (ibid). However, Transparency's data only depicts the corruption situation at a domestic level. To understand the causes and diversity of corruption, however, attention must be paid to the variety of factors within a country that encourages corruption: With relevance to understanding which institutions have responsibilities in the fight against corruption. States, namely, decentralize their political power to municipalities (de Asis, 2006). This decentralization of power can be a decisive factor, as power can be applied for or against the fight against corruption (ibid), making it important to examine corruption at the municipal level.

Secondly, it goes without saying that corruption affects societal and economic life at many levels, including but not limited to the health sector, and industry – serving as a causal factor to poverty (Transparency International, 2023a). Showcasing a negative correlation between corruption and GDP per capita, affecting long-term economic digress ((Mauro, 1995), (Alfada, 2019)). This is important to mention as, corruption, ultimately, also damages our financial system. The question that arises is to what extent corruption, to put it in economic terms, is priced in our financial system or taken into account. To solve this question, it is reasonable to examine financial instruments due to their ability to act as reflections of the dynamics present in the financial market. The following observations can be made in the stock market, respectively: Stock markets react negatively to low corruption risk scores (Krishnamurti et al., 2021). The study of Lin et al. (2016) suggests that anti-corruption reforms are associated with a positive effect on the value of shareholders' investments. These findings are significant, but insufficient, as understanding how corruption interacts with the financial market at a more local level requires a more granular examination of appropriate financial instruments.

The consideration of municipal bonds is ideal as it gives leeway to the trend of the decentralization factor. Even if in modified form, this study refers to Painter's (2020) study in its design: It highlights the increasing risks and costs faced by municipalities due to climate-related events, namely physical risks. The article emphasizes the need for investors, policymakers, and municipalities to consider climate change as a significant factor in assessing the risks associated with municipal bonds. In doing so, he looks at how total issuance costs factor in climate change risks, a strategy that is also used in this work, as it reflects the particular structure of municipal bonds (i.e. the indirect costs that underwriters can incur if, for example, there is more corruption). Painter's idea must be thought of in terms of the absorption of relevant information in bond markets, which in his case refers to climate-related information (ibid). In this work, the concept is abstracted: On the one hand, corruption data is used, whereas the study Painter focused on sea-level data to proxy for climate change risk (ibid). On the other hand, it must be considered that Painter addresses an important aspect in his work that is very explicitly adapted to his case: the adaptive capacity of municipalities about their specific (climate) risk. This cannot be part of the following analysis because corruption is not a physical climate risk in the narrower sense. However, the process underlying the paper's findings, namely the investigation of total annual issuance costs, can still be applied. Given the assumption of imperfectly efficient markets in this study (Grier & Katz, 1976), it can be inferred that greater corruption risks are linked to higher annual issuance costs resulting from incomplete absorption of information in bond prices.

This study contributes to two streams of academic literature. First, this study adds to the literature focused on the pricing of corruption risk. Previous studies have focused on country-level corruption investigations. When looking at municipal bonds, bond yields have been defined as the primary outcome variable to be considered whilst finding out that corporate bonds' yields and coupons are higher in countries with more corruption (Alonso et al., 2022). The second stream of academic literature to which this study contributes is focused on the determinants of municipal bond issuance costs. While other studies have focused on climate change risk and the adaptive capacities of municipalities (Painter 2020; Huisman and van Nijen 2022), this is the first study to focus on the interdependence of corruption and municipal bonds while emphasizing the extent of pricing such risk.

This research examines whether corruption is factored into the pricing in the municipal bond market, drawing upon previous findings by Butler et al. (2009) that higher state corruption is correlated with increased credit risk and higher bond yields. Building upon Painter's (2020) study on municipal bonds and climate change risks, this research employs two approaches. Firstly, corruption conviction cases per capita are used as a proxy for data in the respective municipalities. Secondly, corruption is not considered as a physical risk, but rather as a factor affecting market efficiency. Therefore, assuming imperfectly efficient markets and adopting the underlying mechanism from Painter's study, it is posited that higher corruption risks are associated with higher annual issuance costs due to information asymmetry in bond pricing. Consequently, it is expected that counties within states with a higher likelihood of corruption will incur higher total annualized issuance costs.

This paper finds that municipal bonds are significantly affected by their level of exposure to corruption risk. A positive association between the corruption measure and the dependent variable "annual issuance costs" is found. This finding is broadly robust when the individual components of the dependent variable, the bond yield, and the annualized gross spread, are regressed against the corruption measure and the control variables. A significant effect is found, in particular, in the association between the corruption measure and the bond yield variable, suggesting an underlying compensation mechanism of risky financial instruments. For the gross spread, a positive but not significant correlation could be identified. One assumption behind this is that the sample (for the bond data) only refers to the year 2019 and that several studies for a more extended period are, therefore, necessary to lend more weight to the relevance of the respective variable.

The remainder of this paper is structured as follows: First, relevant theoretical implications from financial instruments, corruption, and economic theory are processed to develop the basis for the theoretical framework. This chapter elaborates on the hypotheses that are the cornerstones for the empirical strategy and the data used for the relevant strategy, which are described in the following chapter. Subsequently, the results are presented, robustness checks are conducted, and the limitations of the study are discussed. The work concludes with the conclusion section, summarizing the essential findings and implications.

2. Literature Review

The inclusion of risk in investment decisions is a common practice. Pioneering models that have already attempted to formalize these risks and are well-established in the literature include the Capital Asset Pricing Model (CAPM) as well as the Fama and French model (Womack & Zhang, 2003). While both models represent valid frameworks for risk-return relationships (Bello, 2008), they have fallen short to provide sufficient insights to risk analysis. A significant criticism in this regard for the CAPM model mainly is that it cannot live up to it its assumptions in empirical tests (O'Sullivan, 2018). Accordingly, failing to account for the multiplicity and complexity of risk factors that exist in the financial market (Elbannan, 2014).

For financial instruments such as stocks, there is already a wide spectrum of findings on which corruption has been investigated. Some studies that have looked at the impact of corruption on financial markets, such as that of David Ng (2006), found that corruption is associated with higher firm borrowing costs, lower stock valuation, and worse corporate governance. Others (Krishnamurti et al., 2021) have conducted sector-specific studies and found, for example in the case of the defense industry, that stock markets react negatively to low corruption risk scores. The study from Lin et al. (2016), on the other hand, suggests that anti-corruption reforms in China are associated with a positive effect on the value of shareholders' investments. Interestingly, these studies seem to share the commonality that their findings indicate that corruption seems to hurt financial performance, or that anti-corruption measures have a better impact. However, this direct link has not always been so evident in the literature, which is why in the following, we will focus on a definitional restriction that is relevant for the rest of the paper before continuing the discussion on municipal bonds.

There is no single definition of corruption, in other words: There are several definitions of corruption, which are context dependent. The understanding of corruption as implied in this paper refers to Transparency International's definition of corruption as 'the abuse of entrusted power for private gain or advantage' (Transparency International Germany, 2023). However, it has been argued in the literature that, contrary to the consensus, corruption can have an instrumental character: Initially, unethical behaviors such as paying "speed money" can offer people a way to bypass bureaucratic red tape. Additionally, when government officials have the authority to accept bribes, they tend to exert more effort, mainly when they serve as a piece-rate incentive (Mauro, 1995). Yet, empirical data paint a less favorable picture—pointing to a correlation between corruption and GDP per capita (Mauro, 1995); thereby connoting corruption's effects on economic digress (Alfada 2019). A look at different industries supports the detrimental character of corruption. In the most severe cases, corruption has profound consequences: The misappropriation of an estimated $500 billion annually, intended for health services has been associated with the estimated death of 140,000 children annually, the exacerbation of global anti-microbial resistance, hindrances in the fight against HIV/AIDS, and impaired responses to public health emergencies such as COVID-19 (Transparency International, 2023a). Based on the findings related to the negative impact on the financial system and economic growth, a corresponding stance on corruption is therefore assumed for the rest of the paper.

The correlation between profit, risk, and return on corporate bonds has already been established in early literature. Using duration as a measure of bond sensitivity to changes in interest rates, Boquist et al. (1975) and Jarrow (1978) highlight that higher revenues are associated with higher risks and higher potential returns (ibid). Even though these relationships are established and accepted today, the discourse has shifted. Over the years, many possible risks, ranging from Corporate Governance (Bhojraj & Sengupta, 2003) have been identified and scientifically worked out; not least the rise of green bonds has significantly driven the corresponding discussion about the associated risks of green bonds (Billah et al., 2023; Tiwari et al., 2023; Zhang et al., 2023). Corruption also ranks as a risk factor alongside these discussion points in the area of bonds: In terms of corruption and its relationship to bond pricing, there is already evidence at the transnational level. Evidence at a transnational level shows that there is a positive correlation between bond ratings and the Transparency International Corruption Perception Index (Connolly, 2007): Better scores in the CPI are associated with better credit ratings (ibid). Others (Alonso et al., 2022) have investigated the role of corruption on an aggregate country level, finding that corporate bonds' yields and coupons are higher in countries with more corruption (ibid).

What is neglected in these studies, nevertheless, is the role of municipalities and the effect decentralization has on circumventing corruption. World Bank data reveal that the more significant the political and economic role of municipalities, where power is decentralized, the lower the power imbalance between the central government and local actors. Because of its localized nature, municipal power can be instrumentalized either in favor of or against the fight against corruption. (de Asis, 2006).

A look at this development shows that the focus on municipal bonds has a particularly high relevance accordingly: Butler et al. (2009) examined the relationship between corruption, political connections, and municipal finance in the United States. The authors use data from 12,000 municipalities and find that politically connected firms receive higher levels of municipal contracts and loans which, if we remember the different positive views on corruption, might sound like an argument in favor of corruption. They, on the other hand, also find out that higher state corruption is associated with greater credit risk and higher bond yields (Butler et al., 2009) which is more or less in line with the findings of Alonso et al. (2022). This in turn reinforces our view of corruption as more harmful than condoning (Mauro, 1995; Alfada, 2019).

Before an understanding of any hypotheses and the theoretical framework can be built, it is necessary to look again into the functionality of municipal bonds, as laid out by Painter (2020). In the paper, the authors study the cost of issuing municipal bonds, which are a way for local governments to raise money for public projects. Two cost streams need to be addressed here. On the one hand, we have the cost of debt: When a government issues a municipal bond, they are – similar to every other bond – essentially borrowing money from investors who buy the bond with a respective interest rate, which is the amount that the government will pay the investor for the use of their money over the life of the bond (also known as yield to maturity). The repayment over time can come from tax revenues or from the revenue generated by the project that the bond funded.

A second cost stream relates to the costs incurred by underwriters: According to Painter (2020), a government issuing a bond works with an underwriter, which is an individual or a financial institution that helps them structure the deal and sell the bond to investors. The underwriter will charge a fee for their services, which is called the gross spread. The gross spread is the difference between what the underwriter pays to buy the bond from the government and what they sell it for to the investor (ibid). In summary, when a bond is issued, there are two cost streams: One is the yield to maturity, and the other is the gross spread. Together they form the so-called total issuance costs. Because we look at the yield to maturity at issuance and annualize the gross spread, we can also call the costs “total annualized issuance costs” (ibid).

This understanding is crucial because it shifts the focus from what has been previously studied to what has received little attention in research. Most previous studies have based their analysis on the transnational level, sidelining corruption as a significant risk factor. In places where corruption has been considered a risk factor, the outcome variable of research was limited to the bond yield where the presence of corruption risk is associated with higher compensation for that risk, i.e. a higher yield (Alonso et al., 2022). The outcome variable that has not yet been studied is the variable of the annualized cost of issuance. The idea in the following is retrieved from Painter (2020): As worked out, the total annualized cost of issuing a bond is the annualized gross spread plus the bond yield. The higher the gross spread, the higher the search costs for underwriters to complete the issuance, indicating higher demand for the bond. If investors perceive corruption (in the case of Painter, climate change risk was investigated) as a potential risk, this might not only result in higher search costs but also higher costs of debt (Alonso et al., 2022). The main idea, ultimately, is that municipal bonds with higher exposure to corruption risk will have higher issuance costs, on average. This paper follows the model of Painter (2020) and focuses on municipal bonds in the United States of America.

Finally, the following should be taken into account, a crucial aspect: The aspect of information itself. Corruption data are published for all countries (Transparency International, 2023), and in the USA corruption data for all states (The United States Department of Justice, 2020). If this information were perfectly indicative of the degree of prevalent corruption, then the risks of corruption would be perfectly priced ex-ante (Malkiel, 1989). However, corruption has a secretive character, it happens in a hidden way, and the extent is unknown (Christensen, 2012), which is reflected not least in the different existing attempts at how corruption is measured. Accordingly, no perfect ex-ante pricing can be assumed (Grier & Katz, 1976). Even though Painter's (2020) idea is applied here, the vital difference to be named is that the issue to be addressed does not involve climate risk, but addresses a social issue, namely corruption. This has important implications because the idea of physical risks and the argument of adaptive capacity do not apply in this case (corruption is not a physical climate change risk in the strict sense). Nevertheless, the mechanism behind the paper can be transferred. Since imperfectly efficient markets are assumed in this work, it can be assumed that higher corruption risks are also associated with higher annual issuance costs due to imperfect information absorption in bond prices. The question that might arise from this is how such a pattern can then hold over the years - which is not examined here but is nevertheless an important topic for discussion: The answer is that if corruption and its depth and diversity cannot be measured in such a way that its full extent is known, then there will always be incomplete information. As long as it remains unfinished, it cannot be fully priced in.

Accordingly, it can be deduced that our work contributes to the existing literature in two different ways. First, the paper focuses on an expanded notion of the pricing of corruption risks: For example, previous studies have found a positive association between bond yields and corruption risks

(Alonso et al., 2022). The lesson drawn from this is that the market prices corruption as a risk. However, on the one hand, such an investigation only took place at the national level, making it necessary to study it with a view to the argument of power decentralization at the municipal level. On the other hand, the concept of pricing is too short-sighted about (municipal) bonds, because how expensive a bond is when it is issued is ultimately determined by the sum of the bond yield and the gross spread, i. e. the search costs incurred by the underwriters in finding suitable investors. The second stream of contribution is related to the fact that corruption as a risk has not yet been investigated as a determinant factor of municipal bond issuance costs. Determinants already identified in the literature are related to climate change risk or adaptive capacity (Painter 2020; Huisman and van Nijen 2022). As has already been noted, corruption is a variable that is economically negatively related to growth ((Mauro, 1995), (Alfada, 2019)). Accordingly, the presence of this variable can affect many variables, such as the performance of financial instruments. A corresponding investigation is therefore indispensable.

In the following, the theoretical framework can now be established, which will further explore the expected direction regarding the development of relevant variables (such as total annual issuance costs). The special features of the structure of municipal bonds are discussed. Relevant hypotheses will be established and justified.

3. Theoretical Framework

To examine whether corruption is recognized as a determinant factor of risk in the municipal bond market, the dependent variable of the total annualized issuance cost is to be regressed against corruption as a measure, with corruption being approximated by the corruption conviction cases per capita in the respective states. The primary focus of the analysis is a cross-sectional regression for the year 2019. The choice of this particular year is deliberate, as it will be demonstrated that the economic circumstances during the subsequent COVID-19 pandemic introduce noise in the bond data. To provide a rationale for this approach, we will develop a theoretical framework based on the findings obtained from the literature review.

The main source for the theoretical framework is provided by the elaboration of Painter (2020): The study aimed to investigate whether the risk associated with climate change is factored into the total annualized issuance costs. However, this study focuses specifically on the risk of corruption. Nevertheless, the implications from an investor perspective (cost of debt) and an underwriter perspective (search cost) remain consistent. In summary: When investors suspect corruption to be associated with a bond, it can create challenges for underwriters in selling the bond. Underwriters may need to invest more time and resources in finding buyers. Additionally, potential investors may perceive the bond as riskier due to corruption concerns, leading them to demand higher yields as compensation for taking on the perceived increased risk. The critical implication that has already been mentioned and assumed in the literature research is that corruption has an uncertain character and the risk arises from missing information and is persistent due to limited and different assessment bases. Considering both the components of search costs and the cost of debt, it can be inferred that when a municipal bond is perceived to be exposed to corruption risks, it is likely to result in higher issuance costs for the bond. Accordingly, the following hypothesis can be derived:

$\boldsymbol{Ho}$: $Counties\ in\ states\ more\ likely\ to\ be\ affected\ by\ corruption\ face\ the\ same\ issuance\ costs\ as\ other\ counties$

$\boldsymbol{H1}$: $Counties\ in\ states\ more\ likely\ to\ be\ affected\ by\ corruption\ face\ higher\ issuance\ costs\ as\ other\ counties$

Further robustness checks are performed as a follow-up to the principal analysis. These refer to the dependent variable, the total annualized issuance costs. As explained, this variable comprises the bond yield and the annualized issuance costs or the annualized gross spread, which are related to the search costs for the underwriters. To test the plausibility of the results (in both directions of the hypothesis), the individual components are examined along the main independent variable and the control variables.

Let us first use the bond yield variable for this purpose. The study by Butler (2009) has shown that higher corruption risk can be associated with higher bond yields. We should be able to test this part of the composite variable accordingly. The conjecture that can be applied to our study is that municipalities in states with higher corruption risk are associated with higher bond yields due to the compensation logic associated with a higher risk in financial instruments. If we assume that the market, however, has absorbed this risk information, one should think with the logic of the semi-strong market efficiency hypothesis considered in this study. This would lead to the statement that municipal bonds within states with increased corruption risk do not necessarily have to be associated with higher bond yields. The respective hypotheses can be broken down as follows.

$\boldsymbol{H2}$: $Municipal\ bonds\ in\ counties\ within\ states\ more\ likely\ to\ be\ affected\ by\ corruption\ are\ associated\ with\ higher\ bond\ yields$

$\boldsymbol{H3}$: $Municipal\ bonds\ in\ counties\ within\ states\ more\ likely\ to\ be\ affected\ by\ corruption\ are\ not\ associated\ with\ higher\ bond\ yields$

In addition to bond yields, underwriting costs or gross spreads are also subject to the main variable. If investors see corruption risk as a potential investment risk, then underwriters would have higher search costs when marketing a bond issuance. This idea is congruent with the underlying hypothesis in the example of Painter (2009). Consequently, the corresponding hypotheses are to be formulated as follows:

$\boldsymbol{H4}$: $Municipal\ bonds\ in\ counties\ within\ states\ more\ likely\ to\ be\ affected\ by\ corruption\ are\ associated\ with\ higher\ search\ costs\ for\ underwriters$

$\boldsymbol{H5}$: $Municipal\ bonds\ in\ counties\ within\ states\ more\ likely\ to\ be\ affected\ by\ corruption\ are\ not\ associated\ with\ higher\ search\ costs\ for\ underwriters$

In the preceding section, the hypothetical framework for this study was established, including the formulation of hypotheses for the primary independent variable. In the following section, the statistical methodology will be elaborated upon. Subsequently, a description of the data will be provided, encompassing not only the aforementioned variables but also crucial control variables.

4. Methodology and Empirical Strategy

4.1. Methodology

The primary objective of this study is to determine the extent to which corruption is effectively incorporated as a risk factor within the financial system. Specifically, this research focuses on the pricing implications of corruption for the financial instrument of municipal bonds. Corruption as a variable here describes the conviction cases within the state where the municipalities are located. To comprehensively capture the pricing effects, the analysis extends beyond the conventional consideration of bond yield and encompasses the assessment of annual issuance costs. These costs encapsulate two components: The debt costs and the search costs, collectively shaping the overall annual issuance costs. To ensure the relevance and timeliness of the findings, the investigation primarily concentrates on the year 2019, which predates the global outbreak of the COVID-19 pandemic. By deliberately excluding data affected by subsequent crises, the aim is to maintain data integrity and isolate the impact of corruption on pricing dynamics within the financial system. The latter aspect will be further elaborated upon in the data section of the study.

To, therefore, examine the effects of an increase in corruption risk (in a respective state) on the cost to issue a municipal bond, the following cross-sectional model is estimated which is approximately in line with the study of Painter (2020):

$$Total\ annualized\ issuance\ cost = \beta_1 * Corruption\ Risk + \beta_i * Bond\ control_i + \cdots + \varepsilon \qquad \textbf{(I)}$$

Alongside the corruption variable and following Huisman and van Nijen's (2022) paper, the model incorporates six commonly used control variables for municipal bonds, including credit risk (as indicated by the initial Moody credit rating of the bond), amount (measured in millions of USD), time to maturity (measured in years), insurance (represented by an indicator variable, indicating the insurance status of a bond), negotiation (represented by an indicator variable, depicting whether a bond was negotiated), and the number of issues (which reflects the number of bonds issued by a given county within the specific time frame). Another variable that is also controlled for is population (for each state investigated; to control for distorting effects of the main independent variable). All variables are further specified in the data section.

In congruence with the elaboration in the literature review, the theoretical framework, and under the assumption of the semi-strong market efficiency hypothesis counties that are more affected by corruption (ceteris paribus) are expected to pay more in total annualized issuance costs. Therefore, β_1 is expected to be positively associated with total issuance costs. Following these assumptions, a detailed description of the data will be provided.

4.2. Data

4.2.1. Corruption Data

To integrate corruption as a suitable measure in the cross-sectional analysis, which will be further elaborated on in the following part, we need a suitable and scalable variable, respectively. The big challenge here is that there are often only corruption measures that can assess corruption at the national level and not at the local level. Another challenge is that corruption is and should be measured in different ways, as corruption can also take various forms and depends on the context of the institution in which it occurs. This, in turn, raises the challenge that there is no standardized quantification of corruption, ultimately. As this states a limitation of this study, there will be led a discussion in more detail in the limitations section of this paper - with a view to the results that emerge. In the following, the number of corruption convictions per capita (for each respective state) will be considered as the corruption measure of the study and discussed in the following part of this section. A corresponding argumentation is presented. The following discussion refers to the findings of Butler et al. (2009).

As noted earlier, corruption, when assessed, is always approximate and related to the context in which it is approximated and measured. One variable that accounts for corruption risk and has found currency in the Anglo-American context, is the number of corruption convictions per capita of local, state, and federal officials. Butler et al. (2009) refer to this as a measure of a state's political integrity. The US Department of Justice's Public Integrity Section publishes these data annually for every state of the US. Corruption convictions per capita are a common measure referred to when estimating corruption within academia (Dincer, 2020; Wei & Zhu, 2023). In the paper of Butler et. al (2009), several advantages of the measure are stated.

On the one hand, the number of corruption convictions per capita provides information about the types of crimes investigated by the Department of Justice (DOJ), which includes conflict of interest, fraud, campaign-finance violations, and obstruction of justice. Secondly, the number gives an idea about the number of cases prosecuted by the DOJ per year (The United States Department of Justice, 2020). Thirdly, it explains the main channels through which the DOJ comes to know about the cases, which can be helpful for people to understand how the system works. Next, the number shows how the DOJ handles cases that involve individuals with close ties to local government, multiple jurisdictions, and those that require an unusual amount of resources or special supervisory assistance. And ultimately, it provides statistics about corruption convictions, which is helpful for people to understand the extent of the problem.

To summarize, the major advantage that arises from this measure is that, first, it is a numerical statistical measure, and second, it takes into account multiple channels and sources of corruption at once. An alternative, which is discussed further in the paper by Butler et. al (2009) but will not find support in the remainder of this paper, is the Better Government Association (BGA) Integrity Index, whereby states receive ratings from the BGA that are determinants of the relative strength of their integrity laws. It is important to note that other measurement bases on corruption exist and have their raison d'être because they can make better statements about corruption in their specific design contexts. However, this measure is excluded because more subjective measures define a rating and, in this case, are limited to one aspect: The law. As already elaborated, the figures on conviction cases offer the advantage of referring to a range of corruption-associated determinants. In what follows, this paper refers accordingly to the latter.

Concerning the cross-sectional analysis, data are collected and processed for all states in the United States. For the cross-sectional analysis, we refer to a period of one year. We want to get as up-to-date a picture as possible. The data, therefore, refer to 2019, before the COVID-19 pandemic, as we can assume that with the Corona pandemic starting, there could be much noise in the bond data, meaning that random or unpredictable factors that can affect the variability or unpredictability of financial markets. Thus, in a study that examined the consistency of stock prices and bond yields regarding data during the corona pandemic, it was found that bond yields varied depending on the maturity date and the specification of the error term, whilst supporting the argument of the exhibition of mean reversion on the long run (Caporale et al., 2022).

Data collection is performed according to the following logic: Attorney offices are the official agencies that collect individual conviction cases. There are states where several attorney offices are located (e.g. Florida North and Florida South) and have corresponding jurisdiction over the respective districts in the individual states. The conviction events are aggregated so that there is ultimately a single representation of conviction cases for each state. Thus, the results of the 95 Attorney Offices in the United States are compressed into an overview of 51 states, as visible in Table 1 (including Puerto Rico).

Table 1: Corruption Convictions per Capita per state in the US for the population basis of 2019

State	Convictions 1976-2019	Residents 2019	Convictions per Capita
Alabama	813	4,903,185	16.5811
Alaska	150	731,545	20.5045
Arizona	549	7,278,717	7.5425
Arkansas	289	3,017,804	9.5765
California	2,949	39,512,223	7.4635
Colorado	227	5,758,736	3.9418
Connecticut	318	3,565,287	8.9193
Delaware	95	973,764	9.7560
District of Columbia	1,189	705,749	168.4735
Florida	2,289	21,477,737	10.6575
Georgia	1,147	10,617,423	10.8030
Hawaii	137	1,415,872	9.6760
Idaho	109	1,787,065	6.0994
Illinois	2,152	12,671,821	16.9826
Indiana	553	6,732,219	8.2142
Iowa	188	3,155,070	5.9587
Kansas	207	2,913,314	7.1053
Kentucky	764	4,467,673	17.1006
Louisiana	1,223	4,648,794	26.3079
Maine	126	1,344,212	9.3735
Maryland	830	6,045,680	13.7288
Massachusetts	723	6,892,503	10.4897
Michigan	851	9,986,857	8.5212
Minnesota	231	5,639,632	4.0960
Mississippi	660	2,976,149	22.1763
Missouri	651	6,137,428	10.6070
Montana	254	1,068,778	23.7655
Nebraska	134	1,934,408	6.9272
Nevada	128	3,080,156	4.1556
New Hampshire	49	1,359,711	3.6037
New Jersey	1,165	8,882,190	13.1161
New Mexico	186	2,096,829	8.8705
New York	2,935	19,453,561	15.0872
North Carolina	576	10,488,084	5.4919
North Dakota	131	762,062	17.1902
Ohio	1,578	11,689,100	13.4998
Oklahoma	651	3,956,971	16.4520
Oregon	116	4,217,737	2.7503
Pennsylvania	1,927	12,801,989	15.0523
Puerto Rico	751	3,193,694	23.5151
Rhode Island	110	1,059,361	10.3836
South Carolina	452	5,148,714	8.7789
South Dakota	206	884,659	23.2858
Tennessee	1,037	6,829,174	15.1849
Texas	2,310	28,995,881	7.9666
Utah	97	3,205,958	3.0256
Vermont	42	623,989	6.7309
Virginia	1,253	8,535,519	14.6798
Washington	272	7,614,893	3.5719
West Virginia	294	1,792,147	16.4049
Wisconsin	379	5,822,434	6.5093
Wyoming	100	578,759	17.2783

In presenting the level of corruption, a reference is made to the report from the University of Chicago (University of Illinois Chicago, 2023). In its interpretation, this cumulates the numbers of convictions from 1976 to 2019, and divides these by the current population year, in our case also 2019. This can be assessed as a legitimate procedure since the drastic nature of corruption only becomes visible over time, as also how well or poorly it can be overcome. For comparison, a regression is run that focuses on the corruption numbers in 2019 only (see Results in 5.3).

Since the University of Chicago lists only the most corrupt cities, the procedure applied within their paper was applied equally to all states. Data for population comes from the U.S. Census Bureau (Census Bureau, 2023). Corruption figures from the Department of Justice and the population figures from the Census Bureau yield the summary in Table 1.

4.2.2. Bond Data

4.2.2.1. Bond Data: Controls

This section conforms to the assumptions outlined in the paper of Huisman and van Nijen (2022) about the usual assumptions for municipal bond controls.

As illustrated within the methodological framework, supplementary control variables are integrated with the principal independent variable (the corruption measure). It is paramount to delineate these variables on an individual basis meticulously. The data were drawn via Refinitiv Eikon. Eikon is a financial information platform developed by Refinitiv, a financial market data and infrastructure provider. The platform is designed to provide real-time and historical financial data, news, analytics, and trading tools to financial professionals in various industries, including banking, investment management, and trading (Eikon Financial Analysis & Trading Software, 2023). In this regard, the search, as elaborated, was filtered to include bonds that were issued from January 1, 2019, to December 31, 2019, to prevent there being noise in the data. In the following, we will look at the individual control variables, and in particular elaborate on what relationship we would expect with the dependent variable, the annual issuance costs.

Moody's Credit Rating is a credit rating agency that assesses the creditworthiness of various entities, such as governments, corporations, and financial institutions. Its ratings provide investors and other market participants with an indication of the risk associated with lending money to or investing in these entities (Moody's, 2023). Starting with the variable of credit risk, the bonds were filtered based on their respective positions within Moody's rating spectrum. This spectrum ranges from the "Aaa" rating, representing the highest or best possible creditworthiness, to the "C" rating, indicating the lowest possible creditworthiness. To enable the statistical processing of these data, it becomes necessary to transform the letter-based rating levels into corresponding numerical values. In this context, the rating level "Aaa" is assigned the numerical translation of "1", while the rating level "C" is assigned the numerical translation of "21". It is important to highlight this aspect, as numerical gradation implies a linear relationship to the dependent variable. With a corresponding gradation of the variable, and under the assumption of our methodological framework holding, we would expect a positive association between credit risk and annual issuance costs (When a credit rating is downgraded, it can be assumed that the default risk of the bond increases. As a result, investors may require higher compensation for taking on this increased risk, leading to higher issuance costs for the bond issuer). Bonds that are not rated were excluded from the initial set as no such relationship could be imputed to them.

The "Amount issued" variable is a focal point of interest in this study. In line with the approach employed by (Cicchiello et al., 2022) we utilize the logarithm of this variable as a proxy for bond size. By employing a logarithmic transformation, the scale of bond sizes is adjusted, enabling a more appropriate representation of differences in bond sizes and potentially emphasizing the impact of smaller bonds (ibid.). It is hypothesized that larger bond sizes are associated with a lower degree of corruption. Put differently, as the bond size increases, the costs related to corruption or unethical practices are anticipated to decrease. This could be attributed to the notion that larger bond sizes attract greater attention and scrutiny from investors, regulatory bodies, and the public (Lassen, 2005). However, it is important to note that further empirical investigation is necessary to evaluate these hypotheses. Nevertheless, one could expect that increased transparency and accountability in the issuance process, due to larger bond sizes, would make it more challenging for corrupt practices to go unnoticed. An alternative explanation could also be that the higher stakes involved in larger bond issuances might deter individuals from engaging in corrupt activities due to the potentially severe consequences. As a result, a negative correlation between the "Amount issued" variable and the main dependent variable would be anticipated.

In this paragraph, the relationship between the costs incurred and the time to maturity is presented. As Painter (2020) says, municipal bonds are heterogeneous in their term structure. According to his research on the anticipated consequences of sea level rise, it can be inferred that municipal bonds with longer maturities are more susceptible to the impacts of climate change. Similarly, in the context of corruption, a mirrored perspective suggests that the repercussions of corruption within the financial system may disproportionately affect bonds with longer maturities. This is due to the prolonged exposure of such bonds to the circumstances prevailing in countries with higher levels of corruption. As a result, the potential ramifications of corruption on the financial system are expected to have a more pronounced effect on bonds with extended maturities. It is anticipated that there exists a positive relationship between issuance costs and time to maturity. However, caution should be exercised in making this assumption, as there is a distinction between this study and Painter (2020) regarding the nature of the relationship examined. This study focuses on a cross-sectional association, while Painter (2020) observes the phenomenon over multiple years, thereby necessitating prudence in drawing direct comparisons.

Next, we have the control variable “Negotiated” (Issuance Method). Negotiated underwriting in municipal bond markets can enhance liquidity by facilitating market search and giving issuers flexibility in timing their bond offerings. This increased liquidity enables municipal issuers to access funds effectively, adjust to market conditions, and potentially reduce transaction costs (Kriz, 2003). Accordingly, one could assume that a negative sign is associated with this variable. However, considering the underlying complexity and risks in a more corrupt environment, such as lack of transparency, costs can be driven in the opposite direction and increase themselves. This inverse relationship can be substantiated by demonstrating a negative correlation between the corruption variable and the indicator variable. This signifies that corruption may have a detrimental impact on the likelihood of bond negotiation, meaning that as the level of corruption increases, the probability of bond negotiation decreases. The positive sign of the indicator variable on the other hand suggests that negotiated bonds tend to exhibit higher issuance costs. This observation may indicate that negotiated bonds incur additional expenses due to corruption or inefficient negotiation processes. In summary, corruption diminishes the probability of negotiation, and negotiated bonds may entail elevated costs. We would therefore expect a positive association between the indicator variable “negotiated” and the main dependent variable (The correlation output is to be found in Appendix 1).

The following variables are derived from Painter's (2020) findings and are logically deducible, thus relatively straightforward. It can be posited that the presence of insurance for the bonds is associated with higher costs, rendering it a plausible assumption for the control variable "Insurance." Another variable of interest is the "Number of Issues per county," which has been assigned a numerical sequence within the dataset and aggregated at the bond level to establish a suitable control measure. Two hypotheses can be considered in this context. On the one hand, it is possible to posit a positive association between the variable of interest and the main dependent variable, as the cumulative costs associated with multiple issuances may also be associated with higher dependent variable values. However, the study conducted by (Monk & Perkins, 2020) for the example of green bonds suggests that there are falling internal costs of issuing bonds as the scale of issuance increases. Consequently, both positive and negative associations are plausible in this scenario.

4.2.2.2. Bond Data: Dependent Variable

The primary dependent variable is the total annualized issuance cost, which comprises the yield to maturity and the annualized gross spread.

Refinitiv defines the latter as the discrepancy between an underwriter's purchase price and the resale price of a bond, which is precisely the variable we are looking for (Refinitiv Eikon, 2023). Following the approach of Painter (2020), the values were annualized by taking the geometric average with the maximum possible maturity. The par value, also known as the face value or nominal value, represents the initial value assigned to a bond at the time of its issuance (Hawkins, 2009). In this study, we adopt the par value as the base rate for calculating the gross spread, which captures the costs associated with bond issuance. By using the par value as the base rate, we align our analysis with the valuation of the bond at its initial issuance, providing a reference point for assessing the associated costs.

In relation to the yield to maturity, we employ the formula presented in Appendix 2, which incorporates the coupon payments associated with the bonds. To ensure the accuracy of our analysis, we source the relevant price data from the Wharton Research Data Services at the University of Pennsylvania (WRDS, 2023). By incorporating this formula and relying on comprehensive price data, our assessment of the yield to maturity for the bonds under investigation considers not only the coupon rate but also factors such as the present value, face value, and the number of compounding periods. This approach enables us to provide a more comprehensive and accurate evaluation of the yield to maturity for the bonds. In our dataset, we have effectively controlled for the inclusion of bonds with a yield to maturity greater than zero, ensuring a meaningful analysis.

4.2.3. Other Control Variables: Population

“Population” was included as a control variable in the analysis. Although it is not directly related to the other bond controls in a financial understanding, it is used to depict Conviction Cases per Capita. A potential distortion in this representation arises if states with larger populations also exhibit higher levels of corruption. To account for this potential distortion, which could occur in either direction, the population variable is introduced as a control variable which represents the population of the respective state investigated. By including the population as a control variable, we aim to address these potential biases.

4.2.4. Data: Concluding Remarks and Summary Statistics

Finally, the sample was refined by excluding missing observations in all regression analyses. The comprehensive collection of data posed challenges within the given timeframe, necessitating the utilization of two separate data providers to ensure data set completeness in terms of variables. After reconciling these two datasets and applying the aforementioned restrictions, the initial dataset comprising four-digit bonds was reduced to a population of 207 bonds. The implications of this sample size are further discussed in the limitations section. Subsequently, drawing on the theoretical framework, data foundation, and methodology employed, we proceed to present the key findings of this study.

5. Results

5.1. Summary Statistics

Table 2 entails the summary statistics of all the variables considered. The bond issues range from January 2019 up until and including December 2019. The inclusion of the counties in this summary overview would not make sense, as their coded translation cannot be translated into a meaningful statistical context. With regard to the other variables, the following findings can be found: On average, municipalities issuing respective bonds pay 3.3171% in total annualized issuance costs. The average issue size is $28.14 million, and the average maximum maturity stands at 23.428 years. The standard deviation of the variable “amount issued” seems to look high but relates to the variety of possible amounts that can be issued in reality. The variation itself is also roughly congruent with the findings in the work of Huisman and van Nijen (2020). 13% of the municipal bonds in our sample, on average, are insured, and 88.48% are negotiated. The yield to maturity of an issued bond by a county is 3.3231%, while the annualized gross spread is 0,0168%, on average. These numbers, too, are roughly in line with the findings of Painter (2020) and Huisman and van Nijen (2022). The variable of the credit rating needs an adequate translation for interpretation: The average credit rating of a municipal bond stands at 4.1937. This would correspond to a rating between AA3 and A1. At this point it may make sense to use the median: With a value of "4", this value is at the AA3 rating level for a municipal bond. The corruption measure or the mean for corruption convictions per capita stands at 10.436, meaning when a bond is issued, the latter number on average represents the level of corruption for an issued bond. The standard deviation is 5.2108, indicating a relatively high level of dispersion, which is related to the different numbers of cases of corruption in the respective states.

Table 2: Summary Statistics

	Mean	Median	Minimum	Maximum	Standard Deviation	Skewness	Kurtosis
Annualized Issuance Cost (%)	3.3171	3.4723	0.011592	5.1229	0.84125	-1.1041	2.3482
Annualized Gross Spread (%)	0.016807	0.015114	0.00019962	0.046646	0.012114	0.62303	-0.44955
Yield to Maturity (%)	3.3231	3.4500	0.010000	5.1100	0.78360	-0.75114	1.0839
Corr. Convictions per Capita	10.436	8.9193	2.7503	26.308	5.2108	0.75365	0.46041
Amount Issued (in $ million)	28.14	10.00	0.06	191.35	36.305	1.5503	2.0612
Insurance	0.13089	0.00000	0.00000	1.0000	0.33817	2.1887	2.7906
Issue Method	0.88482	1.0000	0.00000	1.0000	0.32008	-2.4108	3.8120
Credit Rating	4.1937	4.0000	1.0000	14.000	2.3100	0.97030	1.3342
Time to Maturity (in years)	23.428	24.937	4.8770	39.893	7.9903	-0.51891	-0.34284
Population (in million)	14.181	9.9848	0.58012	39.438	11.874	0.87836	-0.41395

5.2. Regression Results: Main Results

In this section, the regression results are discussed. Table 3 shows the OLS estimates of the parameters in the regression model specified in (I). The dependent variable is the annualized issuance costs. The procedure employed was as follows: In all presentations involving regressions, only estimates that exhibited statistical significance at the 10% level or lower were reported. Model (I) was initially executed using all specified variables. Subsequently, in cases where the regressions yielded one or more non-significant variables, a stepwise approach was employed to progressively remove variables with the highest p-values. This process was iteratively repeated until only statistically significant values were retained and reported.

As elaborated in the literature review, the theoretical framework, and under the assumption of the semi-strong market efficiency hypothesis counties that are more affected by corruption (ceteris paribus) are expected to pay more in total annualized issuance costs. Therefore, β_1 is expected to be positively associated with total issuance costs. The findings presented in Table 3 provide significant insights regarding the association between the variables under investigation. The positive coefficient of the corruption measure stands at 0.0238588. This indicates a positive association between the corruption measure and the annualized issuance costs. This implies that as the corruption measure increases by one unit, there is, on average, a corresponding increase of 0.0238588% in annualized issuance costs. The statistical significance at the 5% level allows us to reject the null hypothesis. The regression model yields an R-squared value of 30.16%, consistent with the findings reported by Painter (2020). The statistically significant result supports the notion that corruption plays a role in influencing the financial costs associated with issuance, aligning with the findings of Butler et al. (2009) and Alonso et al. (2022), who examined the incorporation of corruption as a relevant risk factor in bond yields. The results are also consistent with the findings of Painter (2020) and Huisman and van Nijen (2022), which highlight the relevant positive association between risk factors (although not explicitly focusing on corruption) and annualized issuance costs in general.

The underlying assumption within this work is that corruption has a detrimental character, which can undermine the proper functioning of institutions, distort market mechanisms, and erode public trust (Mauro, 1995; Alfada, 2019). When observing a positive relationship between corruption and issuance costs, it is reasonable to assume that the presence of corruption introduces inefficiencies, uncertainties, and additional risks in the market for municipal bonds. Two variables at the center of the pricing consideration are search costs, expressed by the annualized gross spread, and the yield to maturity, which captures the risk and compensation associated with increased risk. These factors can increase the costs associated with issuing bonds, as investors may demand higher compensation to account for the perceived risks and potential losses related to corruption on the one hand. On the other hand, the increased difficulties and associated costs faced by underwriters in their search for suitable opportunities can contribute to higher pricing. When corruption is prevalent, underwriters may encounter challenges in identifying reputable issuers and conducting thorough due diligence. This can result in higher underwriting costs, as additional resources and efforts are required to ensure the legitimacy and reliability of the bond issuance. To further examine and validate these considerations, subsequent robustness checks will be conducted in the following sub-section. Specifically, separate regressions will be performed, regressing the two individual variables (search costs and yield to maturity) against the independent variables.

Table 3: Main Results

	Coefficient	Standard Error	t-value	p-value
Constant	1,56456	0,220365	7,100	2,08e-011 ***
Corruption Measure	0,0238588	0,00942633	2,531	0,0121 **
Credit Rating	0,0595272	0,0202224	2,944	0,0036 ***
Issue Method	0,270657	0,144191	1,877	0,0620 *
Time To Maturity	0,0443536	0,00576370	7,695	6,13e-013 ***
Mean of Dep. Variable	3,314121	**Standard Dev. of the Dep. Variable**	0,805775	
Sum of Squared Residuals	93,40714	**Standard Error of Regression**	0,680009	
R-Squared	0,301631	**Adjusted R-Squared**	0,287802	
F(4, 202)	21,81134	**P-Value (F)**	5,63e-15	

As a concluding remark on the initial findings, let us briefly discuss the control variables. Among the bond control variables included in the initial set, the following variables exhibited a positive sign: Credit Rating, Insurance Method, Time to Maturity, and County of Issuance. On the other hand, the following bond control variables showed a negative sign: Insurance and Amount. These signs align with the expectations outlined in the data section, except for the Insurance variable. The positive sign observed for the Insurance variable is consistent with the findings reported by Painter (2020). This suggests that the presence of insurance may positively affect the pricing considerations in the municipal bond market, indicating that insured bonds are not randomly distributed among the bonds issued.

In the following subsections, we will delve into the components of the dependent variable to examine the overall consistency of the results.

5.3. Regression Results: Robustness Checks

5.3.1. Robustness-Checks: Introduction

To further validate our main findings, we will conduct robustness checks. Firstly, we will regress each component of the dependent variable against all independent variables to examine more closely the associations between the corruption measure and the respective components, i.e. the bond yields and the gross spreads. Secondly, we will perform an additional test focusing on a specific year, namely 2019, to assess the long- and medium-term relationship between corruption and the proposed hypotheses. The results of these analyses will be briefly described in this section, and the corresponding data can be found in Appendix 4.

5.3.2. Robustness Checks: Components of the dependent variable

5.3.2.1. Bond Yield

Based on the literature review, we anticipate a positive association between bond yield and our corruption measure. This is based on the rationale that if a market-recognized risk prevails, a corresponding compensation logic comes into play. In other words, higher risks are associated with higher costs of debt. The results in Table 4 precisely reflect this relationship:

Table 4: Robustness Check – Dependent Variable – Bond Yield

	Coefficient	Standard Error	t-value	p-value
Constant	1.53586	0.220443	6.967	4.47e-011 ***
Corruption	0.0235514	0.00942966	2.498	0.0133 **
Credit Rating	0.0559008	0.0202295	2.763	0.0063 ***
Issue Method	0.266441	0.144242	1.847	0.0662 *
Time To Maturity	0.0455915	0.00576573	7.907	1.68e-013 ***
Mean of Dep. Variable	3.290914	**Standard Dev. of Dependent Variable**	0.808589	
Sum of Squared Residuals	93.47304	**Standard Error of Regression**	0.680248	
R-Squared	0.305994	**Adjusted R-Squared**	0.292251	
F(4, 202)	22.26590	**P-Value (F)**	3.03e-15	

The findings in Table 4 are consistent with Butler et al. (2009) and Alonso et al. (2022), who investigated the inclusion of corruption as a significant risk factor in bond yields. The positive coefficient of 0.0235514 with a p-value of 0.0133 indicates a positive and statistically significant association between the corruption measure and annualized issuance costs. This implies that as the corruption measure increases by one unit, there is, on average, a corresponding increase of 0.0235514% in annualized issuance costs. Here, the statistical significance at the 5% level allows us to reject the null hypothesis, suggesting that the market effectively incorporates corruption as a priced risk factor, indicating a higher cost of debt, due to higher bond yields associated with a higher level of corruption.

5.3.2.2. Annualized Gross Spread

Lastly, we will discuss the annualized gross spread variable. As a reminder, this variable describes the discrepancy between an underwriter's purchase price and the resale price of a bond, which aligns with the variable we are investigating (Refinitiv Eikon, 2023), representing the component of search costs in the dependent variable. If corruption exists, and we assume its drawbacks, we would expect underwriters to be directly affected by these drawbacks, for example, it would be more challenging to find suitable investors for the bonds. We would therefore have to reckon with higher search costs for underwriters. The results are summarized in Table 5.

Table 5: Robustness Check – Dependent Variable – Annualized Gross Spread

	Coefficient	Standard Error	t-value	p-value
Constant	0.110405	0.0133281	8.284	1.63e-014 ***
Corruption	0.000372706	0.000311229	1.198	0.2325
Credit Rating	0.00310384	0.000671660	4.621	6.79e-06 ***
Time To Maturity	-0.00110538	0.000191662	-5.767	2.99e-08 ***
ln Amount Issued	-0.00506335	0.000783318	-6.464	7.50e-010 ***
Mean of Dep. Variable	0.023207	**Standard Dev. of Dep. Variable**	0.027926	
Sum of Squared Residuals	0.102516	**Standard Error of Regression**	0.022528	
R-Squared	0.361862	**Adjusted R-Squared**	0.349225	
F(4, 202)	28.63644	**P-Value (F)**	7.43e-19	

What we observe in these results is that the direction of the main independent variable remains positive (coefficient is at 0.00037). However, we also see that this value is not statistically significant at the 10% level (p-value is at 0.2324). Therefore, we cannot reject the null hypothesis. It is noteworthy that as each non-significant variable was removed from the analysis, the p-value decreased from 0.1725 to 0.2325. Considering the overall result, which includes the expected direction of the corruption measure but an insignificant outcome, it is possible to speculate that this lack of significance may be attributed to examining only one year of data. Likewise, the data set of 207 bonds for the year 2019 is also relatively small. Therefore, an additional test was conducted to control for eventual outliers in the gross spreads. Outliers can take on greater weight in smaller data sets. For the last robustness check we, therefore, only included spreads below the value of 0.1. This analysis reveals a p-value of 0.1106, which is close to the 10% significance threshold (see Appendix 3). Accordingly, it can be deduced that future research with more time and resources in data may have the ability to further substantiate the results presented here.

5.3.3. Robustness-Check: The Case of a Single Year

The following analysis is conducted using the same methodology, with the only difference being that we focus solely on the corruption measure for the year 2018, instead of using the cumulative measure from 1976-2019. The underlying rationale for this approach is that corruption is a condition whose extent becomes clear over time, and a state can only be assessed as more or less corrupt as time progresses (University of Illinois Chicago, 2023). In this analysis, we focus specifically on the year 2018 and approximate the year-end level of corruption to represent the level for 2019. The remaining data can be used in alignment with this approach to ensure consistency in the analysis. The possible results of this additional analysis are as follows:

The hypotheses developed in the theoretical framework should still hold for this investigation. Given our findings in the literature review, a positive relationship is not only to be expected between the corruption measure and the annualized issuance costs but also between the corruption measure and the individual components of the issuance costs: the bond yield and the gross spread. As mentioned earlier, the significance of the results can vary with less data. It should be, therefore, noted that the obtained results may not reach the level of statistical significance. However, this also would reinforce the argument that if corruption is to be included as a variable in the analysis, it must also be meaningful. This means that the value of the corruption variable is determined by its magnitude: The extent of corruption, which ideally should be reflected in the variable, may only become apparent over time.

The results of this analysis, documented in the table in Appendix 4, led to the following results: When the main dependent variable "issuance costs" is regressed against the adjusted corruption measure, its positive coefficient stands at 0.00793148. This indicates a positive association between the adjusted corruption measure and the annualized issuance costs. This implies that as the corruption measure increases by one unit, there is, on average, a corresponding increase of 0.00793148% in annualized issuance costs. However, the significance level falls to the 10 percent level with a p-value of 0.556. A similar result is obtained when our dependent variable is bond yield: The coefficient of the corruption measure stands at 0.00803516 with a p-value of 0.0524, indicating a positive and statistically significant association between the adjusted corruption measure and annualized issuance costs. This implies that as the corruption measure increases by one unit, there is, on average, a corresponding increase of 0.00803516 % in bond yield. Here, too, the significance falls to the 10 percent level (p-value at 0,0524). A striking result is observed when the dependent variable is the gross spread. The coefficient of our corruption measure is not only statistically insignificant but also negative. This result must be evaluated in the totality of the other results, which will be done in the following paragraph.

What all three results have in common is that they are based on a much smaller dataset when it comes to the corruption variable. This may explain why two of the three results slip to the 10% significance level, but also why the adjusted corruption variable does not match the assumptions of our theoretical framework when the dependent variable is the gross spread. In other words: The results in their entirety and their variety in significance may be attributed to the need for a larger dataset for analysis. As elaborated, this might imply that a single year of observation is not substantial for our corruption measure. Observing data for only one year can lead to distortions in the analysis: For example, if no corruption cases were reported for a specific year but were reported in previous years, it may suggest that the corruption measure for that year is underestimated or inaccurately represented.

These results indicate three things: firstly, there is a need for sufficiently substantial data, and secondly, they suggest that the actual measure of corruption cannot be based on a single year due to fluctuations in conviction cases. It should also be mentioned that the measure used here is just one among many measures by which corruption is assessed. This can substantially influence results. Lastly, despite obtaining a mixed outcome for the gross spread as a dependent variable, it can be inferred that our results remain robust, even when considering a shortened period. Likewise, it is reasonable to posit that an increased quantity of data would yield different outcomes. The following subchapter will discuss all the results and their implications in their entirety.

5.4. Further Discussion

Within this research, a positive and statistically significant association between the total annualized issuance costs and the corruption measure was established for our main analysis. Although the data may be a cause for the lack of significance on the side of the gross spread, we can overall assume robustness for our results. However, we still recognize a discrepancy in the partial results. The association between bond yield and corruption risk seems to be more prominent than the association between gross spread and corruption measure. In this chapter, we will break down these terms again to understand what this might mean for the underlying pricing and underlying market mechanisms.

As mentioned, a significant relationship between bond yields and the corruption measure enforces the underlying compensation mechanism: More assumed risk should translate into higher compensation for the respective assumed risk. On the other hand, we have the underwriting costs. When municipalities issue debt, they provide underwriters to structure the deal and sell the respective bonds to investors. The gross spread compensates underwriters for the difference in price between what the underwriter pays to buy the bonds from the municipality and what they earn when they sell the respective bonds. In the presence of corruption, higher levels of corruption should be associated with higher costs for the underwriter. The former can be equated with the cost of debt, the latter with search costs.

The findings of this analysis indicate that the market incorporates the risk of corruption into pricing, leading to a higher compensation demanded bearing such risk. However, our analysis also shows that there seems to be a discrepancy: A similarly strong relationship cannot be found between the corruption measure and the gross spread, i.e. the variable that indicates the search costs. This has important implications for investors and underwriters. From an investor's perspective, corruption is acknowledged as a potential risk, and our results demonstrate that this risk is indeed significant, assuming other bond controls remain constant. On the other hand, the disparity observed in the results concerning search costs suggests that other financial factors such as bond ratings, issuance amounts, and maturity periods more strongly account for the pricing effect in the gross spread.

Two implications can be derived from the aforementioned: Investors may hold back from investments due to the increased corruption risk. If fewer investors are in the pool, fewer people have to share the risk, so it can be assumed that the compensation for the individually borne risk must increase. This, however, implies a decrease in demand for such bonds, directly affecting issuers as they may have difficulties in placing these bonds. Underwriters are responsible for placing bonds at a reasonable price (Painter 2020). If investors, however, demand higher yields due to the increased risk of corruption, underwriters may have to offer additional incentives to attract investors. This may lead to higher placement costs for issuers and reduce the profitability of underwriters. We, therefore, can observe a relationship between the cost of debt and search costs.

It would be of academic interest to delve into the underlying factors contributing to the heightened influence of the search costs' pricing effect on the other control variables, namely bond ratings, issuance amounts, and maturity periods. Consequently, conducting an analysis to explore potential interaction effects between these variables and the corruption variable would be relevant. Such an investigation could yield valuable insights into the interplay between corruption and other determinants of bond controls, thereby shedding light on the role corruption plays in shaping these aspects.

On a practical and political level, our findings also show that awareness of corruption has not yet sufficiently reached the structural level. The summary statistics indicate that there are states such as Florida, Texas, and New York where there have been four-digit corruption cases in the past decades. Knowledge of the extent of corruption-at least an approximate picture of it-is made public by the Department of Justice, a thoroughly significant institution, and thus accessible. In this sense, our results only reflect this societal development: If the preoccupation with corruption is not ostensibly anchored in the consciousness of individuals and institutions (one could assume that the internalization of knowledge may well lead to an improvement of a possible situation), then the integration of the factor corruption cannot be part of any financial analytical practice.

Against this background, there is also a practical implication: The results of this work may well serve to establish cooperation between political actors at the federal level and issuers at the municipal level. It is their task to talk about the interactions of corruption in the financial system. Only through sufficient communication and collaboration can the knowledge become more widely known and the inefficiencies that corruption has on the financial system be resolved. The interaction between higher compensation associated with increased corruption risk and the derived increase in search costs for underwriters suggests that appropriate policy measures could have a positive impact. It can be assumed that such policy measures might lead to reduced funding costs for municipalities. Therefore, it would be crucial for further research to conduct a causal analysis that specifically reinforces this relationship. The reduction of corruption not only contributes to cost savings but also ultimately fosters a healthy financial system with favorable competitive conditions. This outcome is in the long-term interest of the economic stability of the United States.

5.5. Results: Concluding Remarks

The previous analysis led to the following results: We found a positive and significant relationship between total annualized issuance costs and the corruption measure at a 5% significance level. In the next step, we further examined this relationship by replacing the dependent variable with bond yield. This logic aligns with existing literature and supports the notion that increased substantial risk recognized by the market demands greater compensation. Similarly, when we replaced the main dependent variable of annualized issuance costs with the variable "annualized gross spread," we observed a positive but non-significant relationship. We attribute this lack of significance to the one-year timeframe of the analysis, which may not have been sufficient for this particular variable. Furthermore, when examining a specific corruption measure (namely 2018 as a proxy for 2019) rather than a cumulative measure, we observed mixed results. In this context, we interpret our results in a way that suggests that a significant amount of data (which, in our case, is only achievable over the years for the corruption measure) is necessary to provide meaningful insights regarding the relationship between the corruption variable and the dependent variables.

Overall, this thesis demonstrated that the market incorporates corruption as a risk factor, aligning with previous findings. However, it is noteworthy that there is a discrepancy in the results concerning the search costs. We observe that other bond controls, in contrast, account more significantly for the relationship with the search costs. Therefore, further research should aim to investigate the interaction effects between the corruption measure and these bond controls. This investigation would not only provide more clarity on the relationship between these variables but also offer insights into how corruption impacts search costs and, subsequently, the implications this has on the interaction with the cost of debt.

To the best of my knowledge, this is the first study of its kind to test corruption as a measure against annualized issuance costs. However, the following limitations section will discuss considerations for future studies in subsequent investigations.

6. Limitations

At this stage, it is crucial to critically assess the limitations of the study. The primary limitations revolve around the corruption measure variable. Firstly, it is important to acknowledge that the measure used, namely "Convictions per Capita," represents a specific aspect of corruption. While this variable captures various corruption-related offenses, it is not comprehensive and cannot fully encompass the entirety of corruption. Secondly, it is worth considering that there may be hidden or unreported corruption cases, which could lead to underestimating the true extent of corruption. This potential underreporting bias may impact the interpretation of the results, as the measured level of corruption might be lower than the actual level in reality.

Another vital restriction that encompasses this work is that the level of corruption is captured at a state level. Within counties, therefore, there may be significant variations from state-level corruption. To the best of my knowledge, there is no database on corruption in counties that is publicly available. Therefore, it is crucial to push for more data collection at the municipal level to implement the measurability of corruption at a more local level. In this context, it should also be pointed out that only a small sample was examined in the course of the time allotted for this master's thesis: It is expected that a larger sample could further substantiate our results.

A final limitation, which should also be critically added at this point, is that the study gives a cross-sectional analysis: The subject of the study has not yet been investigated in this context, so the study aimed to get as up-to-date a picture as possible of the pricing effect of corruption on municipal bonds. However, the results also show through their relevance that it is interesting to conduct observations over a longer period and to analyze them accordingly. A general recommendation common to all the points mentioned within the limitations is to diversify the object of study: The variable of corruption. For future studies, it may be useful to draw a longer period for analysis, as mentioned above, but also to use other measures that express corruption. Only in this way can an approximate picture of the state of corruption be obtained and the interdependence of its extent in the financial system and the pricing of municipal bonds be measured.

7. **Conclusion**

The impact that corruption risk has on the municipal bond market is meaningful. This paper finds that municipal bonds are significantly affected by their level of exposure to corruption risk. This finding is broadly robust when the individual components of the dependent variable, the bond yield, and the annualized gross spread, are regressed against the corruption measure and the control variables. A significant effect is found in particular in the association between the corruption and the bond yield variable, suggesting an underlying compensation mechanism of risky financial instruments. For the gross spread, a positive but not significant correlation could be identified. One assumption behind this is that the sample (for the bond data) only refers to the year 2019, limited data was observed and several studies for a more extended period are therefore necessary to lend more weight to the relevance of the respective variable.

For this paper, it was important to assume that corruption develops a detrimental character over time. We performed an additional robustness check, whereby we modified the corruption measure in a way that we did not assume a cumulative corruption value, as is usually the case, but instead, the corruption measure referred to the figures from 2018, approximately for 2019. Although we were able to establish a positive and significant relationship between the adjusted corruption measure and the annual issuance costs, we also observe that the significance level decreases to the 10% level. A similar consideration applies when taking 'bond yield' as the dependent variable. The negative sign (although non-significant in this case) for our adjusted corruption measure, when using 'gross spread' as the dependent variable, indicates the need for a more comprehensive dataset to conduct a meaningful analysis. In other words: The results in their entirety and their variety in significance may be attributed to the need for a larger dataset for analysis. As elaborated, this might imply that a single year of observation is not substantial for our corruption measure. Observing data for only one year can lead to distortions in the analysis.

Finally, we discussed that there was a fundamental discrepancy in the results about the individual parts of the dependent variable. We observe that, in contrast to the corruption measure, other control variables exhibit stronger associations with the gross spread. Further investigations could provide insights into the existence and nature of interaction effects between the corruption measure and other control variables, as well as their influence on the relationship with the cost of debt. On a practical and political level, our findings also show that awareness of corruption has not yet sufficiently reached the structural level. Accordingly, there is a need for joint work by actors at the political and local levels, as it can be assumed that policy measures might not only lead to reduced funding costs for municipalities but also to decreased corruption levels in the respective states. In this context, further studies should also examine different forms of corruption (measures) in municipal bonds since different measures may lead to different conclusions.

Although corruption as a risk in the market mechanism has been previously investigated, this paper represents the first comprehensive examination of the positive correlation between corruption as a risk and annualized issuance cost. It goes beyond considering solely the cost of debt and incorporates the search costs associated with underwriters, thereby accounting for a broader spectrum of costs. The findings of this study could serve as a catalyst for counties to initiate essential measures to combat corruption, and keep the dialogue about this topic alive, thereby ultimately enhancing their overall national corruption situation and the broader financial system.

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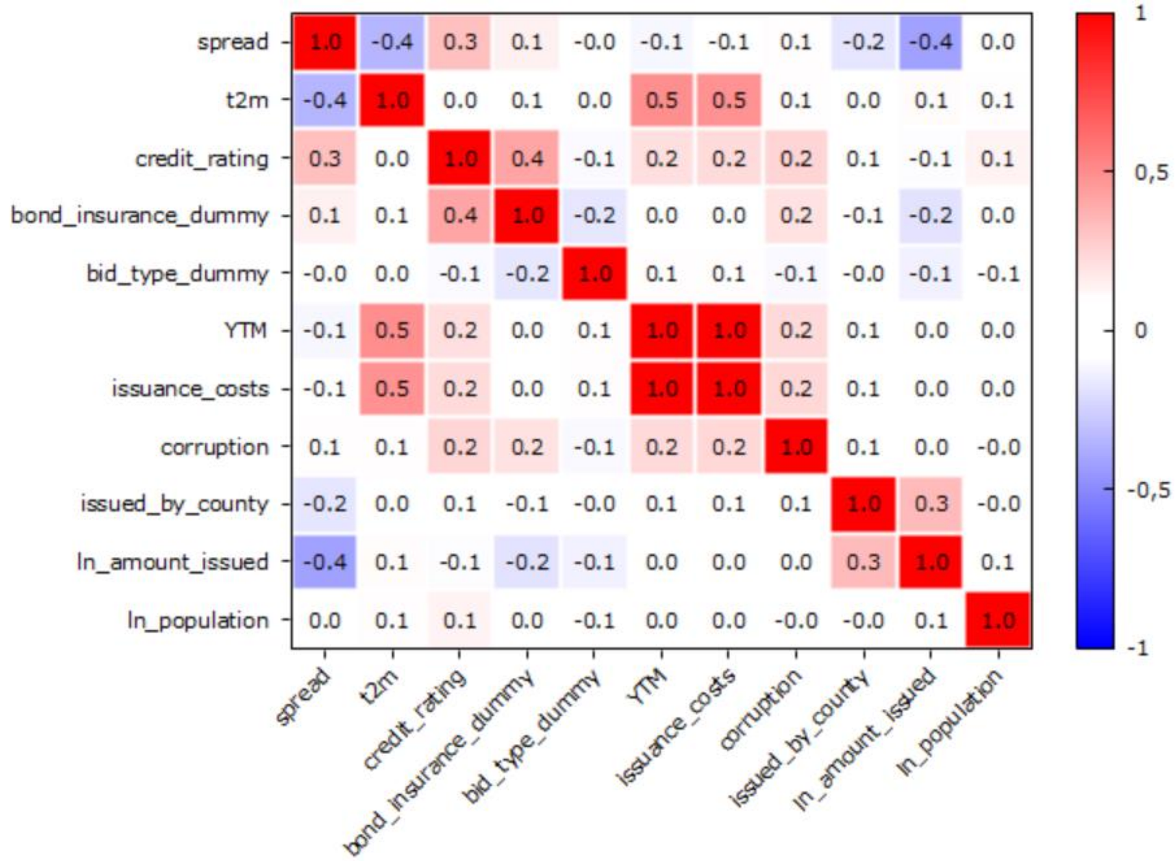
10. Appendix

10.1. Appendix 1 – Correlation Output



Variables:

- ln_population = Logarithm of Population (2019)
- ln_amount issued = Logarithm of Amount Issued
- issued_by_county = Issuance by County
- corruption = Corruption Measure
- issuance_costs = Total Annualized Issuance Costs
- bond_insurance_dummy = Variable that indicates the insurance of a bond
- bid_type_dummy = Issuance Method
- spread = Annualized Gross Spread
- t2m = Time to Maturity
- credit_rating = Credit Rating (Moody's)
- YTM = Yield to Maturity

10.2. Appendix 2 – Formula Yield To Maturity

$$\text{Yield-to-Maturity (YTM)} = \frac{C + \frac{FV - PV}{n}}{\frac{FV + PV}{2}}$$

- C = Coupon Rate
- FV = Face Value
- PV = Present Value
- n = Number of Compounding Periods

Source: (Wallstreetprep, 2023)

10.3. Appendix 3 – Robustness Check

(Spread < 0.1; n= 199)

	Coefficient	Standard Error	t-value	p-value
Constant	0.0812841	0.0157526	5.160	6.19e-07 ***
Corruption	0.000280069	0.000174707	1.603	0.1106
Credit rating	0.00130823	0.000423705	3.088	0.0023 ***
Bond Insurance Dummy	-0.00680037	0.00289668	-2.348	0.0199 **
Issuance Method	0.000719449	0.00276362	0.2603	0.7949
Time to Maturity	-0.000484471	0.000109223	-4.436	1.55e-05 ***
Issuance by County	-1.87335e-05	1.05498e-05	-1.776	0.0774 *
ln Amount Issued	-0.00355402	0.000474605	-7.488	2.55e-012 ***
ln Population	-0.000147555	0.000899475	-0.1640	0.8699
Mean of Dep. Variable	0.018645	**Standard Dev. of Dep. Variable**	0.015051	
Sum of Squared Residuals	0.027707	**Standard Error of Regression**	0.012076	
R-Squared	0.382244	**Adjusted R-Squared**	0.356233	
F(8, 190)	14.69561	**P-Value (F)**	1.20e-16	

10.4. Appendix – Robustness Check: Corruption Measure 2018

10.4.1. Dependent Variable: Annualized Issuance Costs

	Coefficient	Standard Error	t-value	p-value
Constant	4.35208	1.20663	3.607	0.0004 ***
Corruption Measure 2018	0.00793149	0.00411887	1.926	0.0556 *
Credit Rating	0.0736563	0.0224607	3.279	0.0012 ***
Bond Insurance Dummy	-0.202949	0.154223	-1.316	0.1897
Issuance Method	0.243558	0.151421	1.608	0.1093
Time To Maturity	0.0464834	0.00588797	7.895	1.95e-013 ***
Issuance by County	0.000263120	0.000597863	0.4401	0.6603
ln Amount Issued	-0.0258092	0.0268483	-0.9613	0.3376
ln Population	-0.148107	0.0710890	-2.083	0.0385 **
Mean of Dep. Variable	3.314121	**Standard Dev. of Dep. Variable**	0.805775	
Sum of Squared Residuals	93.09369	**Standard Error of Regression**	0.685690	
R-Squared	0.303975	**Adjusted R-Squared**	0.275852	
F(8, 198)	10.80904	**P-Value (F)**	1.36e-12	

10.4.2. Dependent Variable: Yield To Maturity

	Coefficient	Standard Error	t-value	p-value
Constant	4.28237	1.20607	3.551	0.0005 ***
Corruption Measure 2018	0.00803516	0.00411697	1.952	0.0524 *
Credit Rating	0.0701247	0.0224503	3.124	0.0021 ***
Bond Insurance Dummy	-0.200738	0.154152	-1.302	0.1944
Issuance Method	0.245490	0.151350	1.622	0.1064
Time To Maturity	0.0475606	0.00588524	8.081	6.21e-014 ***
Issuance by County	0.000282621	0.000597586	0.4729	0.6368
ln Amount Issued	-0.0211035	0.0268359	-0.7864	0.4326
ln Population	-0.150723	0.0710561	-2.121	0.0352 **
Mean of Dep. Variable	3.290914	**Standard Dev. of Dep. Variable**	0.808589	
Sum of Squared Residuals	93.00748	**Standard Error of Regression**	0.685372	
R-Squared	0.309450	**Adjusted R-Squared**	0.281549	
F(8, 198)	11.09101	**P-Value (F)**	6.55e-13	

10.4.3. Dependent Variable: Annualized Gross Spread

	Coefficient	Standard Error	t-value	p-value
Constant	0.0697102	0.0398971	1.747	0.0821 *
Corruption Measure 2018	-0.000103668	0.000136190	-0.7612	0.4474
Credit Rating	0.00353165	0.000742660	4.755	3.81e-06 ***
Bond Insurance Dummy	-0.00221085	0.00509939	-0.4336	0.6651
Issuance Method	-0.00193201	0.00500671	-0.3859	0.7000
Time To Maturity	-0.00107720	0.000194685	-5.533	9.89e-08 ***
Issuance by County	-1.95008e-05	1.97683e-05	-0.9865	0.3251
ln Amount Issued	-0.00470564	0.000887738	-5.301	3.06e-07 ***
ln Population	0.00261652	0.00235055	1.113	0.2670
Mean of Dep. Variable	0.023207	**Standard Dev. of Dep. Variable**	0.027926	
Sum of Squared Residuals	0.101778	**Standard Error of Regression**	0.022672	
R-Squared	0.366453	**Adjusted R-Squared**	0.340855	
F(8, 198)	14.31578	**P-Value (F)**	2.12e-16	