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Abstract

This study examines empirically whether there is a safety premium in the design of bond contracts by highlighting a safety attribute of general mortgage bonds in Japan, which can give especially strong protection to bondholders, who would have priority in the event of legal liquidation. The effects of a safety attribute were not prominent at first in difference-in-differences analysis. However, the methods for analyzing selectivity bias allow us to provide a safety premium in the design of bond contracts, such as lower spread, lower commission, and larger issue size. The resulting bias would depend on the reputation of the bookrunner. This study uncovers the underlying link for the connection between a safety attribute and the observed and unobserved issuer and bookrunner characteristics, to indicate that a safety premium is related to various terms of bond contracts, including the bookrunner-issuer match.

JEL classification numbers: G10, G24, K20

Keywords: Corporate bonds, general mortgage bonds, Japan, safety premium, special Acts

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1 Introduction

What followed the nuclear disaster at the Fukushima Daiichi Nuclear Power Plant owned by the Tokyo Electric Power Co. (TEPCO) on March 11, 2011, was a traumatic shock to the Japanese society and economy. Once the nuclear damage compensation became an issue, the costs for decommissioning the stricken nuclear power plant, compensating the victims, and cleaning up the radioactive disaster zone were found significantly higher than the existing capped liability limits.[1] However, from a practical perspective, it seemed unreasonable to allow TEPCO, the nuclear operator in charge, to become bankruptcy only because of the huge outstanding TEPCO corporate bonds of up to 5 trillion yen ($60.9 billion) as of the disaster (The Nikkei, April 21, 2011). The reasons behind this were not just the huge outstanding TEPCO bonds, but also the priority that would be given to TEPCO bondholders in the event of legal liquidation. This implied that the claims against nuclear damage are subordinate to those of general priorities such as the TEPCO bonds and the compensation to the victims would not be given priority, as OECD (2012) pointed out.[2]

Two types of secured bonds prevail in the Japanese corporate bond market. One is the bond type secured by pledge of a specific asset of the issuer, such as land, factory, machinery, or vessel, under the Secured Bonds Trust Act (Act No. 52 of 1905). The other is the general mortgage bond type issued by a company founded under a special Act granting bondholders the right to have their claim satisfied in preference to other creditors, for which the mortgage provision under the Secured Bonds Trust Act is not required. The corporate bonds issued by companies founded under the special Acts are naturally backed by all the property of the issuer (Takeda et al. (2010)). Since TEPCO is founded under a special Act (Electricity Business Act (Act No. 170 of 1964)), the TEPCO bond, which is backed by all the property of the issuer, falls into the general mortgage bond type, and in the event of default, the assets of TEPCO would go to settle the bondholders' claims, rather than the claims of those affected by the disaster. This TEPCO case is a striking example of general mortgage bonds giving strong protection to bondholders, who would be given priority in the event of legal liquidation, relative to the rest of the corporate bonds. For example, the pari pass clause in a bond indenture means only "inter-bond" pari passu in Japan.

A safety premium is difficult to measure because investors value liquidity and safety in the same way they do government bonds. Previous studies have documented how investors value

[1] See Heffron et al. (2016) for a review of the nuclear liability limits and regime.

[2] See OECD (2012) for a detailed explanation about the compensation system for nuclear damage.

these attributes by analyzing the spread between assets having different safety levels (but similar liquidity), mostly considering government bonds data. For example, liquidity premium is examined using swap spreads in Cortes (2003) and the spread between Refcorp bonds in Longstaff (2004); also, liquidity and safety attributes of Treasuries are documented in Krishnamurthy & Vissing-Jorgensen (2012) by focusing on the changes in Treasury supply. In addition to the insights of these studies, this study shows that a bond contract reflects the safety attribute by using issue-level corporate bond data, assuming similar liquidity within an asset market. In fact, only investment-grade bonds can be issued in the Japanese corporate bond market, and the flight-to-liquidity premium in corporate bond prices across credit rating classes is assumed to be small or negligible.

In theory, protecting the rights of bondholders increases the value of bonds, and less risky bonds provide lower returns than unprotected bonds (Leland (1994)). Bonds with a collateral or protective covenants are examples of protecting the rights of bondholders (see Sergei & Ilya (2007)). A number of studies, for example, Rajan & Winton (1995) and Chava et al. (2010), have shown that bond issuing companies choose collaterals and covenants strategically to signal their financial condition. Unlike with the case of bonds having a collateral and protective covenants, bond issuers cannot choose a general mortgage bond type strategically, because companies that are not founded under the special Act cannot issue general mortgage bonds. Also, the bonds issued by companies founded under special Acts shall be general mortgage bonds. In such cases, one cannot expect the bond type to convey any information about the issuer's financial condition or serve as a signal to the investor. In particular, one might expect the absence of a safety premium in general mortgage bond prices. However, some players are well-informed about the risk of investors in both the buy and sell sides of the corporate bond market. The purpose of this paper is to empirically examine whether the safety premium in corporate bond contracts includes the pricing and non-pricing terms.

The major contribution of this paper is to show that the bookrunner's reputation is critical, and that a safety premium is related to various bond contract terms, including the bookrunner-issuer match. While an enormous literature addresses the important role of the bookrunner, some studies point out the endogeneity in issuer-underwriter matching. However, this study uncovers the underlying link connecting a safety attribute and the observed and unobserved issuer and bookrunner characteristics. Note that both measured and unmeasured heterogeneity prevails among bond issuers and bookrunners. While unobserved heterogeneity in bond issuers (issuer fixed effects) is important, observed heterogeneity, particularly bookrunner reputation, is deterministic and cannot be over-emphasized.

The safety is a critical driving force behind the history of financial intermediaries. He et al. (2005) use the search-theory approach and explain the safety is a key role of financial institution. Clients with safe assets count on the financial institution on the basis of reputation. Thus, from a theoretical perspective, bond safety features interact with bookrunner reputation.

This paper is structured as follows. Section 2 briefly discusses the institutional background of general mortgage bonds and the Japanese corporate bond market. Section 3 describes the data used for model estimation. Section 4 details the models to be estimated, while the estimation results are provided in Section 5. The concluding remarks are presented in Section 6.

2 Institutional background

A series of corporate bond defaults during the Showa Depression (1929–1931) led to a highly regulated corporate bond market in Japan. In 1933, a para-public advisory council (Itsukakai) prohibited the issuance of unsecured corporate bonds in order to regain the lost trust in them and to protect the bondholder. Also, in sharp contrast to the American corporate bond market, which recognized and widely used bond credit rating to evaluate the creditworthiness of a bond issuer and a security after the Great Depression, the Council for Regulating Bond Issues (Kisai Chōsei Kyōgikai) enacted laws authorizing only the largest and most profitable corporations to issue bonds (see Flath (2000)). Thereafter, Japanese firms relied more on banks for external finance, thus characterizing the Japanese economy as bank-centered. Although the Japanese corporate bond market has been highly regulated since then, the country's rapid economic growth forced Japanese firms to raise funds from the relatively regulation-free overseas market.

As the Japanese firms gained extensive access to the euro-markets in the late 1980s, the Council for Regulating Bond Issues relaxed the eligibility criteria such as amount of net assets, dividend rate, and interest coverage ratio for issuing domestic corporate bonds (see Omura & Toshino (2014)). In 1985, TDK Corporation issued the first public offering of straight corporate bonds with no collateral, and by 1993, 800 firms were eligible to issue straight corporate bonds with no collateral. As part of the country's "big bang" deregulation in 1996, the eligibility rule was finally abolished, making bond credit rating the single creditworthiness measure for corporate bonds. Subsequently, unsecured corporate bonds predominated in the market.

Two types of secured corporate bonds prevail in Japan. One is the bond type secured by the issuer's pledge of a specific asset such as land, factory, machinery, and vessel under the Secured Bonds Trust Act (Act No. 52 of 1905). The other is the general mortgage bond type issued by a company founded under a special Act granting its bondholder the right to have his or her claim satisfied in preference to other creditors. The mortgage provision under the Secured Bonds Trust Act is not required in this case. The issuance of general mortgage bonds is limited to corporations founded under special Acts, and corporate bonds issued under special Acts are naturally secured (Takeda et al. (2010)).

The general mortgage bondholder takes priority in repayment over other creditors who have no security interest. The order of statutory lien shall be subordinate to the general statutory lien under the provisions of the Civil Code (Act No. 89 of 1896); the order of major statutory lien includes the following: tax claims, social insurance fees, general statutory lien under the Civil Code provisions (Act No. 89 of 1896), and general mortgage bonds (Taga & Ishii (2011)).

Not all corporations founded under special Acts issue corporate bonds. Among the corporations, nineteen issued corporate bonds during the period from January 1, 1995, to March 31, 2015. Table 1 shows the list of general mortgage bond issuers and their special Acts entitling them to issue general mortgage bonds.[3] General mortgage bonds have been issued in the corporate bond market for a long time, but arguments over this type of secured bond have appeared only after the nuclear disaster.

Following the huge damage inflicted by the nuclear disaster, TEPCO had to incur a net loss of 1.2 trillion yen ($15.4 billion) for the fiscal year ended March 2011. This was in addition to the huge amount of compensation to those affected by the disaster and the uncertain costs to decontaminate areas around the plant. In fact, the compensation to be paid was too huge to calculate and the reported net loss did not include this calculation.

Before the nuclear disaster, TEPCO was the largest corporate bond issuer in Japan. At the time of the disaster, the outstanding TEPCO corporate bonds amounted to approximately 5 trillion yen ($60.9 billion) and was the largest bond issue among Japanese firms (The Nikkei, April 21, 2011).

[3] Specific Purpose Companies issue Specified Bonds with general mortgage under the Act on the Securitization of Assets (Act No. 105 of 1998), but the scope of this paper does not include Specified Bonds.

One major factor that pointed to the possibility of TEPCO's bankruptcy was the large amount of its outstanding bonds. Since the general mortgage bondholder takes priority over the victims of a disaster in the event of bankruptcy, the assets of TEPCO would go to the bondholders instead of to the victims of the disaster. Arguments over the TEPCO bonds recurred when the Electricity System Reform was introduced.

TEPCO was in an extremely poor condition following the nuclear disaster and could not raise funds from the publicly offered bond market. However, it issued private placement bonds amounting to 726.4 billion yen ($8.4 billion), 479.7 billion yen ($4.6 billion), and 99.6 billion yen ($0.8 billion) in fiscal years 2012, 2013, and 2014, respectively.[4] TEPCO had no private-placement bonds before the nuclear disaster. Reports indicate that banks prefer not bank loans, but private placement bonds, because the repayment of general mortgage bonds takes priority over bank loan repayments in the event of bankruptcy (The Nikkei, March 24, 2014).[5] Consequently, the events after the nuclear disaster shed light on high safety that general mortgage bonds have.

3 Data

The aim of this paper is to explore the safety premium in the design of bond contracts. We use the data on straight corporate bonds publicly issued by individual corporations from January 1, 1995, until March 31, 2015, including the details of the mortgages and guarantees, to analyze this issue. The dataset includes the credit spread (spread over the Japanese government bonds with same maturity), commission (the fees bookrunners receive for arranging and underwriting, a percentage of the principal amount), issue amounts, maturity of the issue, mortgages associated with the issue, names of the bookrunners, issue number, and ratings information. The data on individual corporate bond issues are taken from the Thomson One Investment Banking database, and the details of any other mortgages and guarantees associated with the issue are collected from the Nikkei newspaper database, Nikkei Telecom 21. The market share of each bookrunner is calculated from the annual league tables for bookrunners in the Thomson One Investment Banking

[4] Exchange rates are as of year-end each year.

[5] One might expect protective covenants to be effective for investor protection, as Sergei & Ilya (2007) demonstrate. About 80% of bond issues in Japan are unsecured, having only a negative pledge clause (Tanigawa & Katsura (2013)). This clause is to protect the status of unsecured bondholders by limiting the bond issuer's ability to create mortgages of other bonds. This negative pledge has only "inter-bond" validity, unlike in the US, and is subordinate to bank loans when banks require additional collateral. Hence, this is not considered influential in Japan.

database. In order to maximize the sample size, we use the lowest of the available ratings provided by four ratings institutions, the Rating and Investment Information (hereafter R&I), Japan Credit Rating Agency, Japan Bond Rating Institute, and Standard and Poors (hereafter S&P). The monthly market size proxied by the total value of new straight corporate bond issues in a month is based on data obtained from the Japan Securities Dealers Association.

While this dataset includes nineteen issuers of the general mortgage corporate bonds, as shown in Table 1, Table 2 shows 13.2% of all issues as general mortgage bonds because electric power companies are the main issuers in the Japanese corporate bond market. The mean values of various bond characteristics are given in Table 2. Columns 2 and 3 of the table show that the credit spread of general mortgage bonds is significantly low. This implies that general mortgage bonds are considered to be less risky and provide lower return. The dataset also contains bonds secured by the issuer's pledge of a specific asset under the Secured Bonds Trust Act. While the mean values of these issues are not tabulated in this paper because of the small sample size (five BBB-rated issues in 1995), note that the credit spreads for these issues are significantly low.

[Table 2 around here]

This paper focuses on the design of bond contracts, that is, the pricing and non-pricing contract terms. Columns 2 and 3 of Table 2 suggest that the commission is lower, the amount of issue is much larger, and the maturity is longer for general mortgage bonds. However, this is a simple comparison using cross-sectional means, without controlling for other important factors. For example, the general mortgage bonds sample shows no BBB-rated bond issues, although 11.57% of all bond issues are BBB rated. Compared to the full sample results, general mortgage bonds are highly rated on average.

After the nuclear disaster, TEPCO took about six and a half years to resume public corporate bond issuance, on March 3, 2017. Rating companies have downgraded the ratings of other Japanese electric power companies as well, following greater regulatory uncertainty and lower profitability and cash flows. Columns 4 and 5 of Table 2 present cross-sectional mean values based on a subset of observations for bond issues by the issue date. The pattern of general mortgage bonds across the issue dates indicates significant difference between two groups. After March 11, 2011, the average issue amount is smaller and the credit spread is much higher than earlier. Some other general mortgage bond issuers such as Narita International Airport Corporation, Nippon Telegraph and Telephone Corporation, and Tokyo Metro Co.,Ltd., did not suffer the ratings downgrade. Therefore, in the subsample after March 11, 2011, in the group of general mortgage bond issuers, only electric power companies suffered the ratings downgrade.

In contrast to the issue size and credit spread, the mean value of commission is lower after March 11, 2011. This implies that the protection that general mortgage bonds provide for bondholders can help the bookrunner's marketing and selling efforts. The average of issues underwritten by bank subsidiary securities companies doubled after the disaster, but less than 1% of general mortgage bonds are underwritten by the foreign bookrunner. These cross-sectional mean values are simple comparisons ignoring the impact of all the other variables that differ between groups. However, these results suggest significant difference between bond types, that is, between general mortgage bonds and the others.

4 Pricing and non-pricing bond contract terms

We carry out an empirical test using issue-level data to examine whether there is a safety premium in the pricing and/or non-pricing terms of bond contracts. The hypothesis of the pricing term in this paper is that a safety attribute increases the value of bonds. We estimate the following credit spread equation:

$$Credit\ Spread_{i,j} = b'Z_{i,j} + \alpha_i + \theta_k + u_{1i,j}, \tag{1}$$

where CREDIT SPREAD$_{i,j}$ is the credit spread for issue j made by issuer i, $Z_{i,j}$ is a vector of time-varying explanatory variables, b is a vector of parameters, α_i is the issuer effect, θ_k is the bookrunner effect, and $u_{1i,j}$ is an error term. Further to the literature on credit spreads, the variables assumed to influence credit spreads are as follows: AA (A and BBB) rating is a 0-1 dummy variable taking the value of unity when the issuing firm's rating is AA+, AA, or AA- (A+, A, or A-, and BBB+, BBB, or BBB-) and zero otherwise. MATURITY is a term between the issue date and maturity date in years. GENERAL MORTGAGE BOND is a 0-1 dummy variable taking the value of unity when the bond is a general mortgage bond and zero otherwise. LN(SIZE) is the logarithm of size of the market for straight corporate bonds. ΔIIP is the annual growth rate of the index of industrial production (IIP, 2010 base). Finally, BOOKRUNNER'S MARKET SHARE is the bookrunner's market share in the year preceding the issuing year.

The rating variables AA (A and BBB) relate to the issuer's financial condition.[6] The existing

[6] We use no other variables for the issuer's financial condition in the baseline model to maximize the sample size,

literature suggests that stronger financial conditions of issuing firms can reduce the probability of default; that is, their credit spread is lower. Compared with the base rating of AAA, AA ratings (A and BBB ratings) indicate deterioration of firm's financial condition, and this can increase the credit spread. The variable relating to maturity, MATURITY, is included to reflect the term premium. As the term to maturity increases, the investor is more concerned about the future economic situation. We would expect a higher credit spread for bonds with a long-term maturity due to the risk associated with time. LN(SIZE) and the annual growth rate of the IIP, ΔIIP, control for the changes in market conditions and business cycle fluctuations. When the corporate bond market size is growing, investors might require a higher risk premium to hold corporate bonds, and so a higher credit spread would be expected. Because increased business activity is likely to boost investor confidence and reduce the riskiness of corporate bonds, an increase in annual growth rate of the IIP can lower the credit spread (Athanassakos & Carayannopoulos (2001)). BOOKRUNNER'S MARKET SHARE is used as a proxy for a bookrunner's ability, following previous studies (Carter & Manaster, 1990, Krigman et al., 2001) and because many studies such as Beatty & Ritter (1986) and Carter (1992) show that the reputation effect can help lower fund-raising costs. Thus, we expect a lower spread for a bond issue underwritten by a bookrunner having a large market share. The variable of interest is GENERAL MORTGAGE BOND. The hypothesis for the pricing term that a safety attribute increases the value of bonds would be supported if the credit spread of general mortgage bonds is lower.

To highlight the non-pricing terms in bond contracts, the second hypothesis that relates to non-pricing terms in this paper is that less risky bonds will mitigate the bookrunner's marketing and selling efforts and lead to lower commission for general mortgage bonds. From the models in Gande et al. (1999) and Roten & Mullineaux (2002), the following equation is assumed to determine the commission:

$$Commission_{i,j} = b'Z_{i,j} + \alpha_i + \theta_k + u_{2i,j}, \quad (2)$$

where $\text{COMMISSION}_{i,j}$ is the fee the bookrunner receives from the issuing firm i to cover the cost of the underwriting services for issue j and the right-hand side is similar to equation (1) for the credit spreads. The rating variables AA (A and BBB) indicate that the base ratings group is AAA. The commissions are expected to increase with the deterioration of the firm's financial condition.

because this dataset includes many unlisted companies whose financial data are not available.

The variable relating to maturity, MATURITY, is expected to show that commissions are larger for longer maturity bonds. Forecasting economic activity is hard, and predictive ability generally deteriorates as the forecast horizon extends. A bond with long-term maturity makes the bookrunner put in greater effort to search for information and material and evaluate the issuing firm more accurately. LN(SIZE) and ΔIIP are included to control for the changes in market conditions and business cycle fluctuations. The fee serves as a signal of underwriting service quality in theory, where an investment increases its quality, since quality is persistent. This leads to the increase in future revenue; see Board & Meyer-ter-Vehn (2013) for the relation between reputation and investment incentives. Thus, a higher fee is the compensation for investment in service quality and its reputation. Fang (2005) finds empirically that reputable underwriters charge higher fees. We anticipate a positive coefficient on BOOKRUNNER'S MARKET SHARE, the proxy for bookrunner's ability. A less-risky bond, that is, GENERAL MORTGAGE BOND, is assumed to require less effort to sell and to provide some sort of marketing advantage. The hypothesis that a safety attribute decreases the bond underwriting commission would be supported if the commissions for the general mortgage bonds were lower.

The third hypothesis relating to another non-pricing term is that a safety attribute helps raise a larger bond issue. Because the investor is assumed to evaluate a corporate bond backed by all the property of the issuer as less risky, its repayment ability is highly evaluated. The following equation is assumed to explain the issue size:

$$Ln(Amount)_{i,j} = b'Z_{i,j} + \alpha_i + \theta_k + u_{3i,j}, \tag{3}$$

where $Ln(Amount)_{i,j}$ is the logarithm of the amount for issue j made by issuer i and the right-hand side is similar to equations (1) and (2). The issue size is expected to increase with improvement in the firm's financial condition. Compared to the base ratings group AAA, we anticipate negative coefficients on the rating variables (AAA, AA, and A). MATURITY is included to take account of the relationship between maturity and issue size. LN(SIZE) and ΔIIP are included to control for the changes in market conditions and business cycle fluctuations. A reputable bookrunner is supposed to have access to an extensive distribution network and superior marketing ability. A bond issue underwritten by a reputable bookrunner is expected to have a larger size. Equations (1), (2), and (3) include also a quarterly trend variable. The hypothesis that a safety attribute increases the issue size would be supported if the issue size for general mortgage bonds is larger.

In addition to these observable variables, the unobserved component of individual effect (issuer/bookrunner) is also an important source of variation in equations (1), (2), and (3). The bookrunner's role in the issuance of new equity, debt, or security instruments is extensively recognized in the literature. Both issuer and bookrunner effects are used to estimate the models above. We present the issuer- and bookrunner-level heterogeneity and look for issuer-bookrunner matches in the next section.

5 Estimation Results

5.1 Difference-in-Differences estimation

We use issuer-level panel data for estimating the effects of a safety attribute. We begin with difference-in-differences analysis, focusing on bond issuers who were originally founded under the special Act, and who issued general mortgage bonds but were excluded from application of the special Act due to its organizational restructuring; see Table 1 for the relevant issuers. The set up outcomes are observed for two groups for the whole sample period. The first group consists of the initial general mortgage issuers who were excluded from application of the special Act during the sample period. The second group consists of the issuers or non-issuers of the general mortgage bonds through the sample period. The estimates in Table 3 give the results for the corporate bond spread, commission, and issue size. The coefficient of interest is that on the dummy variable GENERAL MORTGAGE BOND, which takes a fixed number (0 or 1) for the second group through the sample period and 1 for the first group until exclusion from application of the special Act, and thereafter 0. This coefficient shows how a policy change affects the outcome, assuming the change in treatment status uncorrelated with the changes in idiosyncratic errors.

[Table 3 around here]

The first column gives the results for the spread. The coefficient on a general mortgage dummy variable is not significant after controlling for other characteristics; that is, the safety attribute of the general mortgage bond is not priced. The second and third columns give the dependent variables for the non-pricing terms. Estimates in the second columns show that the safety attribute does not affect commission. On the other hand, the results in the third column indicate that the safety attribute helps to raise the amount of bond issue significantly. This result implies that a safety attribute can make the investor evaluate the repayment ability highly and thus facilitate a large fundraising.

The pricing and non-pricing contract terms are heterogeneous even among observably equivalent issuers, such as those in the same credit rating class. We examine the extent to which this heterogeneity can be related to permanently unobserved differences among the issuers, which is called the issuer effect, and among the bookrunners, which is called the bookrunner effect. Table 3 indicates that both the issuer effect and bookrunner effect are important.[7] Now, the next issue is the extent to which these components may be correlated. The concern here is that they are correlated substantially, and that the outcome stems from the issuer-bookrunner matches based on the unmeasured heterogeneity in issuers and bookrunners, rather than from the observable characteristics.

Figures 1, 2, and 3 graphically show the difference in strength of the relation between the issuer (bookrunner) effect and average bookrunner (issuer) effect with the fitted regression line. Figure 1 plots the issuer effect against the average bookrunner effect from the spread model. The issuer or bookrunner effect is the time-invariant issuer- or bookrunner-specific intercepts (standardized). For example, a low-spread issuer is an issuer with the spread lower than expected on the basis of observable characteristics, such as credit rating or maturity. A low-spread bookrunner is a bookrunner with a spread lower than expected, given the same observable characteristics. The issues of one issuer are underwritten by different bookrunners through the sample period, and the issuer and the bookrunner are not in one-to-one correspondence, like the employer-employee match. We compute the average of the issuer or bookrunner effect to associate with each bookrunner or issuer. The average issuer effect is for the bookrunner k, at which issuer i asks for underwriting at the issue j. Similarly, the average bookrunner effect is for the issuer i, at which bookrunner k is employed at the issue j. The same explanation applies to the commission and issue size models.

[Figures 1, 2, and 3 around here]

The relation between the bookrunner effect and average issuer effect in Figures 1, 2, and 3 seems stronger than that between the issuer effect and average bookrunner effect. Although these components seem to be correlated arbitrarily, the graphical display shows a weak relation, especially in the issue size model. Thus, unmeasured heterogeneity in the issuers and their bookrunners, while important, is not as important as the observed components or the source of the obtained estimates.

[7] All the test statistics are not reported here to conserve space.

To further assess the effect of the issuers' bookrunner choices, the next section investigates the bookrunner effects by focusing on an observed characteristic, reputation.

5.2 Propensity score matching

The results in Table 3 are from the difference-in-differences approach, which has both advantages and disadvantages. For example, one disadvantage is that, as Heckman & Smith (1999) point out, the conventional difference-in-differences estimator does not sufficiently capture the underlying choice leading to differences in unobserved variables between the participants and non-participants. In this subsection, we use one of the non-experimental approaches, propensity score matching, to reduce this selection bias. A voluminous literature has established this methodology, for the details of which, see Heckman et al. (1997, 1998a, b) among others. We use this approach to estimate the effect of a safety attribute on the pricing and non-pricing terms in bond contracts by matching observations based on propensity scores.

We begin by calculating the propensity score using an estimated logit binary choice model. Let O denote an outcome variable and T denote a treatment dummy variable such that for an observation which has experienced the treatment, the model estimates are

$$P(T = 1|\mathbf{x}) = P(\mathbf{x}) = \Lambda(\beta'\mathbf{x}) \tag{4}$$

where T is a 0-1 dummy variable taking the value of unity when issue j is a general mortgage bond, and zero otherwise. The vector of the observed characteristics (background variables) $\mathbf{x}$ includes the age of the issuer (number of years elapsed since the company was formed), the logarithm of the issuer's total assets, the logarithm of the issuer's latest fiscal year revenue, and the issuer's credit rating dummies (AA, A, and BBB); see Table 4 for the descriptive statistics. The fitted probabilities are used for the propensity score. The data used here comprise 5,664 control and 913 treatment observations on the variables used in (4).

[Table 4 around here]

The set of matching results uses the kernel estimator for neighbors, considering only the observations in common support. We first partition the range of probabilities and then estimate the average treatment effect on the treated (ATT) for each outcome, that is, the spread, commission, and issue size. We locate the counterpart control observations, O_c^*, which are similar in characteristics, using closeness of the propensity scores for each treated observation O_t. We also estimate the treatment effect for this observation with $O_t - O_c^*$. The average over the treated observations is then the estimated ATT. We repeat this step with a set of bootstrapped samples in order to estimate the standard error for this estimate. The estimates for spread, commission, and issue size are shown in Table 5.

[Table 5 around here]

From Table 5, a safety attribute significantly lowers the spreads and commissions for corporate bonds and thus increases the issue size. While both Tables 3 and 5 support the hypothesis that a safety attribute increases the issue size, Table 3 differs in that it observes no effect for spreads and commissions. This difference implies selectivity bias in the bond contract pricing and non-pricing terms. We explore a source of this bias in the next section.

6 Reputable bookrunner choice

A bond contract is a mutual agreement between an issuer and a bookrunner. The bias implied in the previous section is important when measuring the effect of a safety attribute on the terms of bond contracts, because the selection varies widely in bookrunner choices. The selection by issuers is partly based on the commissions and benefits paid by the reputable bookrunner to lower the spread, and the selection by bookrunners is based on their client target policies. Fernando et al. (2005) find the positive assortative matching (PAM) of issuers and underwriters in the US equity offerings; that is, higher (lower)-quality issuers associate with higher (lower)-ability underwriters. They measure the underwriter ability by their market share based on previous studies.

This section explores the effect of bookrunner-issuer matches, in particular, the reputable bookrunner choice effect on the pricing and non-pricing terms of bond contracts. Reputation is undoubtedly critical in financial markets; an issuer matching with a bookrunner who has a good reputation expects to issue a bond with a lower spread due to the certification role of good reputation. According to the PAM hypothesis, a reputable bookrunner matches with a higher-quality issuer. In this study, a safety attribute is a sign of higher issue quality. Hence, we test whether the safety attribute of an issue leads to matching with a reputable bookrunner, implying that the choice of a reputable bookrunner is not exogenously determined. Note that there are several possible empirical measures for underwriter reputation. In this study, we use the market share of a bookrunner as a measure of reputation. A substantial variation occurs in each bookrunner market share over the sample period, as shown in Figure 4. Figure 4 displays the distribution of each bookrunner's annual market share, ordered by its mean. This time-varying bookrunner feature is used to classify bookrunners in terms of reputability. When the market share of a bookrunner for the year preceding the issuing year is above the mean market share value over the sample period (15.6%), a bookrunner is classified as "reputable," and the rest is classified as "less reputable."[8] Bookrunners can be classified in several other ways too, but most trials yield a similar set of reputable bookrunners.

We model bookrunner selection by reputation status in the course of estimating the safety effect. For estimating the model, the method used is two-stage least squares, where the probabilities predicted for a reputable bookrunner from probit equation are used as the instruments for a reputable bookrunner, following Barnow et al. (1980). The initial model to test the hypothesis that a safety attribute of an issue increases the likelihood to match with a reputable bookrunner assumes two bookrunner choices, a reputable bookrunner and a less reputable bookrunner. The model estimation assumed a probit model, where REPUTABLE is the dependent variable. If z_j is a vector of factors influencing the choice of bookrunner for the jth observation and θ is the associated vector of parameters, then the following probit model is assumed to determine REPUTABLE:

$$\text{REPUTABLE}_j = \begin{cases} 1, \text{ if } z_j'\theta + e_j \geq 0, \\ 0, \text{ if } z_j'\theta + e_j < 0. \end{cases} \tag{5}$$

where REPUTABLE is a 0-1 dummy variable taking the value of unity when the bookrunner is a reputable bookrunner, and zero otherwise. The following are the variables assumed to influence the bookrunner choice: GENERAL MORTGAGE BOND is a 0-1 dummy variable taking the value of unity if the bond is a general mortgage bond, and zero otherwise. AGE is the number of years elapsed since the company was formed. AA (A and BBB) is a 0-1 dummy for the issuer's rating category. MATURITY is a term between the issue date and maturity date in years. H.I. is the Herfindahl index for the bookrunner market in the year preceding the issuing year. LN(SIZE) is the logarithm of size of the underwriting market for straight corporate bonds. Finally, ΔIIP is the annual growth rate of the IIP, and a quarterly trend variable is included. AGE is used as one of the measures for issuer reputation in the market. An issuer who survives long is considered a reputable issuer and a long-established firm. H.I. is included to control for competitiveness in the bookrunner market. The hypothesis that a safety attribute of an issue increases the likelihood to match with a reputable bookrunner would be supported if the marginal effect of the general mortgage bond in 5 is positive.

[8] When a bond contract has multiple bookrunners, we use the bookrunner who is listed first among them.

The estimates in Table 6 provide evidence related to the hypothesis. The positive and statistically significant marginal effect on GENERAL MORTGAGE BOND indicates significant relationship between the probability of a reputable bookrunner being chosen and the safety attribute. While rating information is not statistically significant in the bookrunner selection model, the significant marginal effect of AGE indicates that the longer the issuer survives in the market, the more likely it is for the reputable bookrunner to be chosen. In order to treat REPUTABLE$_j$ in place of bookrunner market share in equations (1), (2), and (3) as endogenously determined, we rewrite equations (1), (2), and (3) as follows:

$$y_{i,j} = b'X_{i,j} + \delta REPUTABLE_j + u_j, \tag{6}$$

which can be rewritten as:[9]

$$y_{i,j} = b'X_{i,j} + \delta REPUTABLE_j + h_j(\theta)\mu + \eta_j, \tag{7}$$

where y is the dependent variable in equation (1), (2), or (3); $h_j(\theta) = \phi_j(REPUTABLE_j - \Phi_j)/((1-\Phi_j)\Phi_j)$; $\phi_j = \phi(z_j'\theta)$; $\Phi_j = \Phi(z_j'\theta)$; $\phi(\cdot)$ and $\Phi(\cdot)$ are the probability density and cumulative distribution functions for the standard normal distribution, respectively; $\mu = E(u_j e_j)$; and η_j is an error term. If $\mu = 0$ in (7), then the errors are not correlated, and REPUTABLE can be treated as exogenously determined. The results of applying the Barnow et al. (1980) method to spread, commission, and issue size models indicate that the coefficients of $h_j(\tilde{\theta})$ are statistically significant,[10] that is, the endogeneity of REPUTABLE cannot be ignored. Thus, we use two-stage least squares estimation in view of the inconsistency of ordinary least squares; see Greene (2016) for the details.

The reason why bookrunner reputation interacts with bond safety features stems from the core of role for financial intermediaries. The safety is a critical driving force behind the history of financial institutions. Clients with safe assets rely on the financial institution on the basis of reputation. Thus, high safety that bonds have increases the probability that its issuer chooses the reputable bookrunner.

Table 7 provides the two-stage least squares specification results, using as the instrumental variables, z, the predicted probabilities from the probit equation. For both pricing and non-pricing terms of bond contracts, the coefficients on a reputable bookrunner dummy in all columns are

[9] See Barnow et al. (1980) for the derivation.

[10] The results are not tabulated here to conserve space.

significant. Moreover, the coefficients on the general mortgage bond are statistically significant, and the signs are consistent with the expectations for spread, commission, and issue size models, that is, lower spread, lower commission, and larger issue size. Thus, evidence indicates that a safety attribute increases the probability of matching with a reputable bookrunner; this is a source of the safety attribute effects on spread, commission, and issue size. Otherwise, a safety premium will not arise because, as Table 3 shows, it is not significant for spread and commission models.

7 Conclusion

A safety premium is difficult to measure because, for an investor, the liquidity and safety of an asset have similar value as those of government bonds. This study highlights the safety attribute of general mortgage bonds in Japan, which give especially strong protection to bondholders by giving them priority in the event of legal liquidation over the rest of the corporate bonds, and compares the pricing of the non-pricing terms in bond contracts with the rest of corporate bonds. Effects of safety attributes in the design of bond contracts were not prominent at first in difference-in-differences analysis. However, the methods to analyze selectivity bias allow us to design bond contracts with a safety premium.

The bookrunner-issuer match and pricing and non-pricing terms of bond contracts are critical and result in causality bias. The resulting bias depends on the reputation of the bookrunner. A safety attribute is more likely to increase the match with a reputable bookrunner. Correcting for the endogeneity of bookrunner choice can lead to a safety premium in bond contracts, such as lower spread, lower commission, and larger issue size. A comparison with the difference-in-differences analysis results indicates a strong bias for the effects on yield spread and commission. The evidence presented in this study indicates a significant safety premium related to various conditions of issuance, including the bookrunner-issuer match.

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Table 1: List of General Mortgage Bond Issuers

Issuer	Special Act
Electric Power Companies	
Chubu	
Chugoku	
Hokkaido	
Hokuriku	
Kansai	Electricity Business Act
Kyushu	(Act No. 170 of 1964)
Okinawa	
Shikoku	
Tohoku	
Tokyo (TEPCO)	
Japan Broadcasting Corporation	The Broadcast Act (Act No. 132 of 1950)
Japan Tobacco Inc. (JT)	Act on Japan Tobacco Inc. (Act No. 69 of 1984)
KDD	KDD Act (Act No. 301 of 1952, abolished in March, 1998) Thereafter KDD bonds are not general mortgage bonds.
Narita International Airport Corporation	Narita International Airport Corporation Act (Act No. 124 of 2003)
Nippon Telegraph and Telephone Corporation	Act on Nippon Telegraph and Telephone Corporation, etc. (Act No. 85 of 1984)
Tokyo Metro Co.,Ltd	Act on Teito Rapid Transit Authority (Act No. 51 of 1941, abolished in April, 2004), Act on Tokyo Metro Co., Ltd. (Act No. 188 of 2002)
Railway Companies Companies	
Central Japan	Act concerning Passenger Railway Companies and Japan Freight Railway Company (Act No. 88 of 1986). The exclusion from application of this act in June, 2001 made these three companies' bonds non general mortgage bonds thereafter.
East Japan	
West Japan	

Source: Ministry of Internal Affairs and Communications

Table 2: Characteristics of bonds

	All bonds	General Mortgage Bonds		
		Whole period	Before 3/11/2011	After 3/11/2011
Amount (millions of yen)	19,687	30,511	31,942	21,832
Credit Spread (bps)	45.96	17.98	15.12	35.34
Commission (%)	0.39	0.34	0.35	0.28
Maturity (years)	6.98	9.55	9.76	8.26
Rating				
AAA (%)	6.02	33.78	39.35	0
AA (%)	34.67	57.13	60.65	35.77
A (%)	47.75	9.09	0	64.23
BBB (%)	11.56	0	0	0
Bookrunner				
Market share (%)	15.54	17.24	16.65	20.81
Reputable Bookrunner (%)	52.9	58.37	55.60	75.18
Sample Size	7,338	968	831	137

Notes: This table contains cross-sectional means of various characteristics.

Table 3: A safety premium in bond contracts: issuer fixed-effects specification

	Spread	Commission	In(Amount)
General mortgage bond	3.65	0.02	0.35
	(0.59)	(0.20)	(3.81)***
AA rating	18.23	-0.07	-0.39
	(8.87)***	(2.25)**	(12.57)***
A rating	39.33	-0.06	-0.43
	(15.50)***	(1.63)	(11.20)***
BBB rating	72.03	-0.02	-0.47
	(22.85)***	(0.34)	(9.89)***
Maturity	0.17	0.01	-0.01
	(1.49)	(5.59)***	(4.85)***
ln(Size)	12.73	0.01	0.004
	(16.22)***	(0.01)	(0.32)
ΔIIP	-0.78	-0.001	-0.0004
	(18.45)***	(1.06)	(0.63)
Bookrunner's market share	-0.63	0.003	0.002
	(6.87)***	(1.84)*	(1.66)*
Bookrunner dummies	YES	YES	YES
No. Issuers	646	646	646
Sample Size	7,338	7,338	7,338
R^2	0.62	0.05	0.70

$Notes$: The dependent variables are $Spread$ over the Japanese government bonds with same maturity in basis points, $Commission$ percentage of principal amount, and $ln(Amount)$, respectively. The estimated equations also include a quarterly trend variable. The estimated coefficients and t-ratios of the quarterly trend variable and fixed effects are not reported. Figures in parentheses are the absolute values of asymptotic t-statistics computed using estimates of standard errors adjusted by White's (1980) method. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Descriptive statistics for observed characteristics

Variable	Mean	Std.Dev.	Minimum	Maximum	Sample size
General mortgage bond	0.139	0.346	0	1	6,577
Age	59.826	27.016	0	133	6,577
ln(Assets)	14.123	1.274	8.722	17.540	6,577
ln(Sales)	13.515	1.507	7.698	17.085	6,577
Rating					
AA	0.329	0.470	0	1	6,577
A	0.486	0.500	0	1	6,577
BBB	0.125	0.331	0	1	6,577

Notes: This table gives the descriptive statistics for the observed characteristics used to calculate the average treatment effects on the treated.

Table 5: Propensity score matching analysis

	Outcome		
	Spread	Commission	ln(Amount)
Estimated average treatment effect	-13.615	-0.047	0.086
Estimated asymptotic standard error	0.907	0.019	0.041
t-statistic	-16.125	-2.466	2.077
Average Bootstrap estimate of ATT	-13.270	-0.046	0.086
ATT minus average bootstrap estimate	-0.345	-0.001	0.00008
Number of observations		3,606	
Observations: Treated		913 (25.32%)	
Observations: Controls		2,693 (74.68%)	

$Notes$: ATT represents the average treatment effects on the treated.

Table 6: Determinants of the choice of bookrunner

	Bookrunner type: Reputable	
	Marginal Effect	t-ratio
General mortgage bond	0.07	3.91***
Age	0.001	2.82***
AA rating	-0.01	-0.59
A rating	-0.03	-0.97
BBB rating	-0.03	-0.99
Maturity	0.001	0.57
H.I.	0.001	15.43***
ln(Size)	-0.05	-4.34***
ΔIIP	0.001	1.95*
Estimation method	Probit	
Proportion	0.73	
Log likelihood	-4000.65	
Sample Size	7,067	

Notes: The dependent variable is *Reputable*, which takes the value of unity when the market share of a bookrunner in the year preceding the issuing year is above the mean market share over the sample period. The estimated equations also include a quarterly trend variable. H.I. stands for the bookrunner market's Herfindahl index. The quarterly trend variable's estimated coefficients and t-ratios are not reported. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 7: A safety premium in bond contracts: reputable bookrunner choice

	Spread	Commission	In(Amount)
General mortgage bond	-10.53	-0.03	0.30
	(2.12)**	(3.96)***	(2.03)**
AA rating	33.48	0.01	-0.50
	(9.68)***	(0.70)	(4.99)***
A rating	62.70	0.04	-0.78
	(16.43)***	(3.22)***	(7.21)***
BBB rating	111.26	0.09	-0.99
	(23.64)***	(5.15)***	(8.22)***
Maturity	0.99	0.01	0.01
	(3.99)***	(20.82)***	(2.75)***
ln(Size)	10.08	0.05	0.83
	(13.91)***	(4.06)***	(42.85)***
ΔIIP	-0.55	-0.0003	-0.004
	(7.17)***	(0.63)	(2.17)**
Reputable	-140.59	0.10	3.88
	(13.34)***	(6.21)***	(13.32)***
Bookrunner dummies	YES	YES	YES
Industry dummies	YES	YES	YES
Estimation Method	Two stage least squares		
Sample Size	7,067	7,067	7,067
Log likelihood	-37457	-3863	-11683
Sample Size	7,338	7,338	7,338

$Notes$: Models for $Spread$ over the Japanese government bond with the same maturity in basis points, $Commission$ percentage of the principal amount, and $ln(Amount)$ are estimated using two-stage least squares. The instrumental variables for the predicted probabilities from the probit equation are in Table 6. The estimated equations include a constant and a quarterly trend variable. The figures in parentheses are the absolute asymptotic t-statistic values. The estimated coefficients and t-ratios of the quarterly trend variable and constant are not reported. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

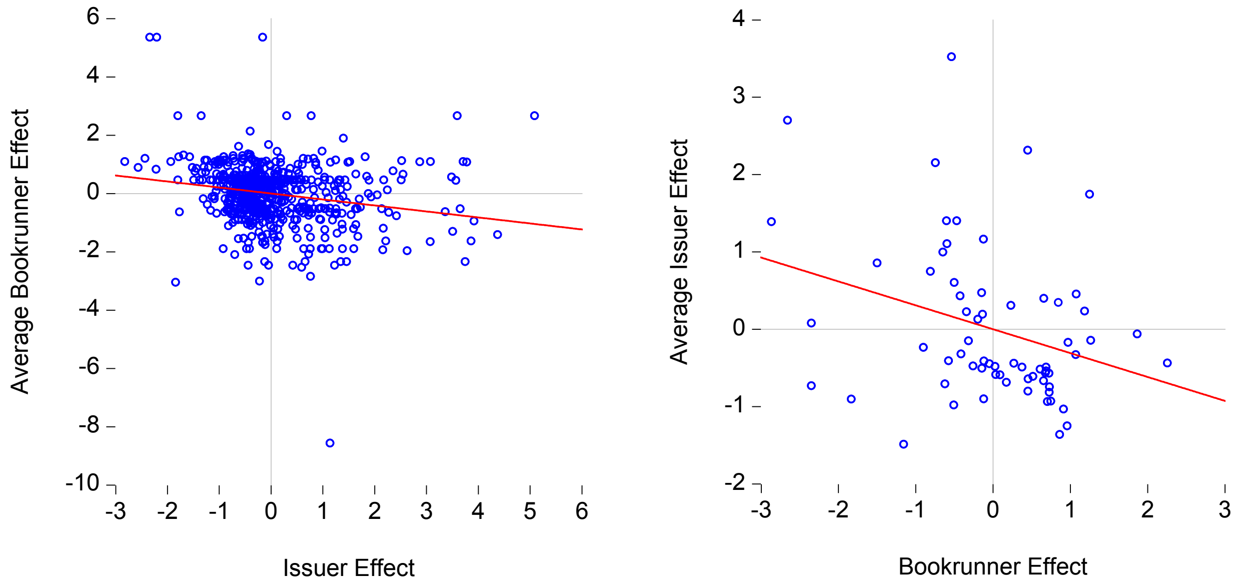

Figure 1: Issuer effects and underwriter effects based on spread model

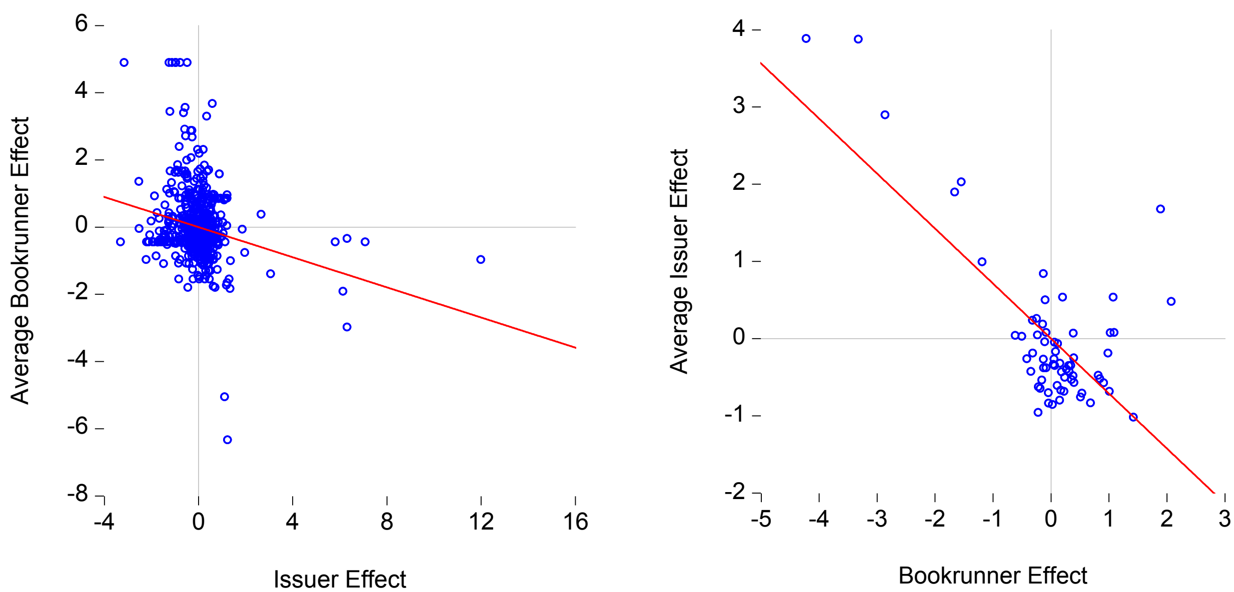

Figure 2: Issuer effects and underwriter effects based on commission model

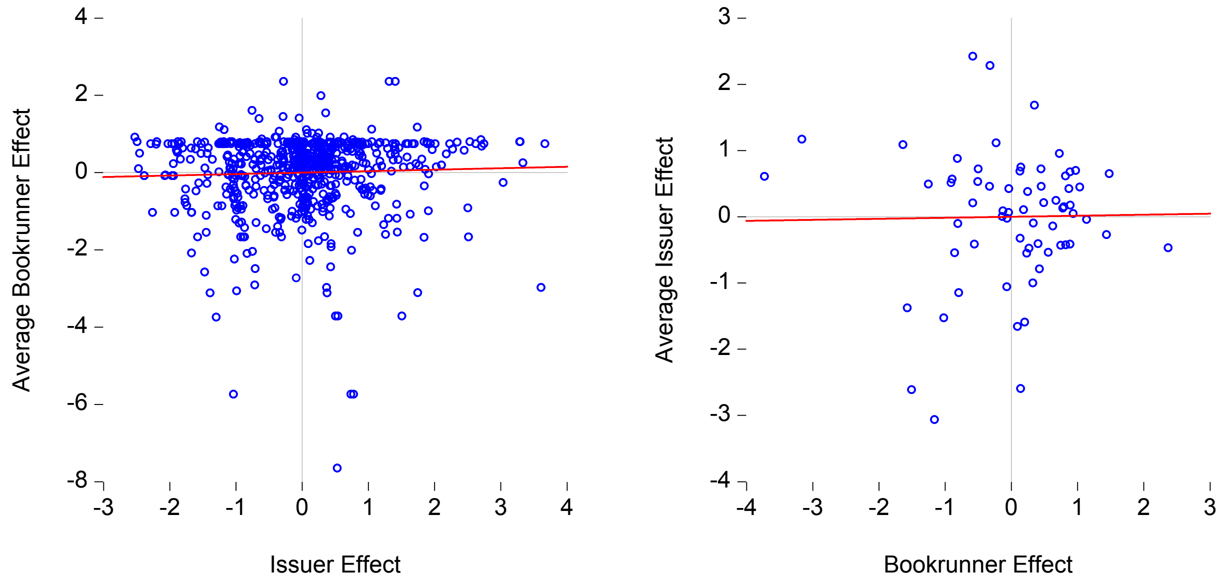

Figure 3: Issuer effects and underwriter effects based on issue size model

$Notes$: Issuer or bookrunner effect is the time-invariant issuer- or bookrunner-specific intercepts (standardized). Average issuer effect is for the bookrunner, when issuer i asks to underwrite at an issue j. Similarly, average bookrunner effect is for the issuer i, when the bookrunner is employed at an issue j. The same explanation applies to the commission and issue size models. The red line represents the fitted regression line.

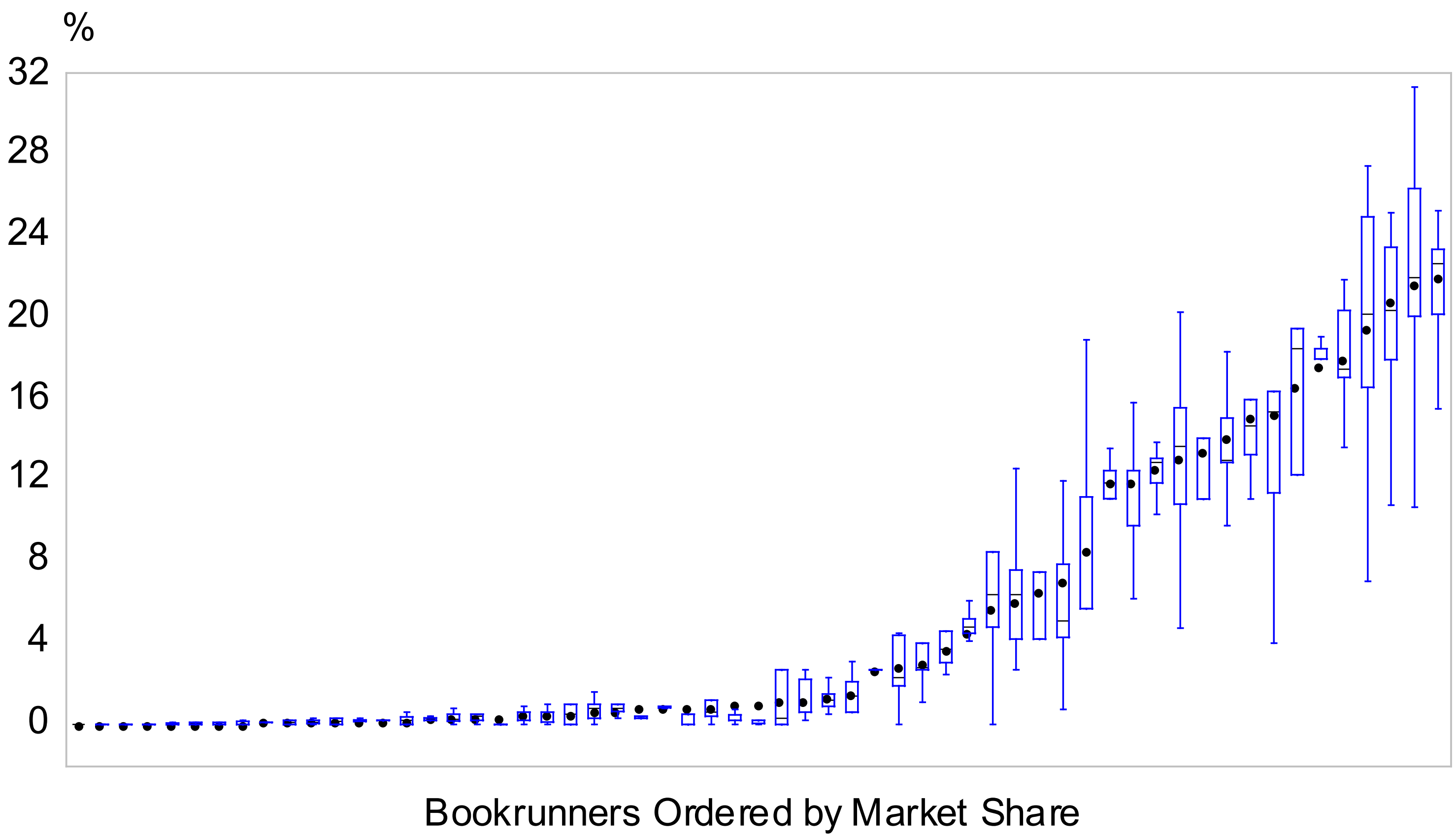

Figure 4: Variation in bookrunner reputation

Source: Author's calculation using data from the Thomson One Investment Banking Database.

Note: The box portion of the boxplot represents the first quartile, median, and third quartile. The mean is drawn using a black bullet.