Economics Bulletin

Volume 32, Issue 3

Do Bond Issues Mitigate Hold-up Costs? Evidence from Japan's financial liberalization period

Taisuke Uchino
Faculty of Economics, Daito Bunka University

Abstract

This study is an empirical attempt to investigate whether firms' bond issues mitigate rent extraction by their banks. To that end, I focus on the cash holdings of Japanese listed firms in the early 1980s, when Japanese banks used compensation balances as a device to extract rent from their client firms. Concretely, this study examines if firms' bond issues lead to a decrease in their cash holdings. The unique feature of this study is that it exploits the eligibility for bond issues—i.e., Bond Issue Criteria—that formerly existed in Japan to address a possible endogeneity problem. Estimation results from 2SLS and an instrumental variable quantile regression model show that (1) a decline in cash holdings is accompanied by bond issues; and (2) the magnitude of decline becomes larger as the quantile of the conditional distribution of cash holding levels increases. These results imply that bond issues mitigate bank rent extraction, and that the effect is larger for firms facing severe bank power.

I would like to express my sincere gratitude to an anonymous referee, Masahisa Fujita, Yoko Konishi, Masayuki Morikawa, Norio Nakazawa, Etsuro Shioji, Hideaki Tomita, and Munehisa Yamashiro for their helpful comments and encouragement. This research is financially supported by Grant-in-Aid for Scientific Research No.23830126, Japan Society for the Promotion of Science. Of course, any remaining errors are my own.

Citation: Taisuke Uchino, (2012) "Do Bond Issues Mitigate Hold-up Costs? Evidence from Japan's financial liberalization period", *Economics Bulletin*, Vol. 32 No. 3 pp. 2085-2102.
Contact: Taisuke Uchino - tuchino@ic.daito.ac.jp.
Submitted: July 02, 2012. **Published:** July 26, 2012.

1. Introduction

To date, a number of empirical studies have focused on the benefits of so-called relationship banking (Berger and Udell 1995, Bharath et al. 2011, Petersen and Rajan 1994, and others). However, it has also been pointed out that there exists inefficiency arising from close bank–firm relationships. For example, Rajan (1992) demonstrates that informed banks can hold up borrowers when they renegotiate on the debt rollover of a short-term loan. According to Rajan's (1992) model, the borrower chooses not bank loans but arm's-length debts (e.g., corporate bonds)—the cost of which depends on *ex ante* public information—when the bank's bargaining power is quite large.

For Japanese firms, the results of some empirical studies—such as those of Weinstein and Yafeh (1998) and Pinkowitz and Williamson (2001)—imply that banks extract rents from bank-dependent firms by charging high interest rates or forcing cash holdings.[1] From a theoretical viewpoint, firms can mitigate bank rent extraction by issuing bonds, but empirically it is difficult to identify the effects of bond issues on firms' borrowing conditions, owing to a possible endogeneity problem.

To investigate the effects of bond issues, this study focuses on Japanese firms' cash holdings during the financial liberalization period, when restrictions on firms' bond issues were first being removed. I make use of the eligibility criteria for bond issues—called Bond Issue Criteria (*Tekisai Kijun*)—as an instrumental variable in firms' making of bond-issuing decisions. The satisfaction of Bond Issue Criteria, as set by the Japanese government, was assessed on the basis of a firm's past performance; these criteria were frequently altered in the early 1980s as a part of overall financial liberalization efforts. These criteria could, therefore, collectively work as an exogenous shifter that affected firms' bond-issuing decisions. For the estimation of treatment effects, this study employs not only the usual two-step least squares (2SLS) model but also the instrumental quantile regression (IV-QR) model to account for the heterogeneity of treatment effects.

The empirical results of this study are summarized as follows. First, the treatment effects of bond issues estimated by 2SLS and IV-QR show that firms can reduce their cash-holding levels by issuing bonds, and the extent of those effects are larger than those from OLS or the quantile regression model. These findings imply that firms can mitigate bank rent extraction by issuing bonds, and that firms suffering from severe bank power are more likely to issue bonds, *ceteris paribus*. Second, the treatment effects estimated by IV-QR show that the magnitude thereof becomes larger as the quantile of the conditional distribution of cash-holding levels increase. This implies that bond issues are more effective for firms facing severe bank rent extraction.

The rest of this paper is organized as follows. In the next section, I describe the empirical strategy of this study. Section 3 describes estimation results, and section 4 concludes the paper.

2. Empirical Strategy

This study investigates whether firms can mitigate bank rent extraction by reducing bank dependency; it does so by using micro-level data on listed firms in the Japanese manufacturing industry. If the theoretical prediction is true, banks extract less rent from firms with access to corporate bond markets—and such firms would be expected to see lower

[1] Weinstein and Yafeh (1998) show that Japanese firms that belong to large Japanese firm groups (*keiretsu*) face higher interest rates, and Pinkowitz and Williamson (2001) find the tendency that, in Japan, firms with higher bank-loan ratios hold more cash. I will explain later the reason as to why banks can extract rents from firms by forcing cash holdings. Recently, Hale and Santos (2009) and Ioannidou and Ongena (2010) have each found evidence of hold-up problems.

borrowing costs, other things being equal.[2]

It is, however, difficult to investigate this hypothesis empirically using Japanese data, for the following reasons. First, it is difficult to estimate bank loan interest rates from firms' financial statements, because reported "interest expenses"—which mainly indicate interest payments made to banks—often include items other than interest paid on bank loans.[3] Second, since whether or not to issue bonds is a decision made at the firm level, we must consider endogeneity carefully when we estimate the treatment effect model.

To deal with these problems, this study focuses on the cash holdings of Japanese listed firms in the early 1980s. As Pinkowitz and Williamson (2001) suggest, Japanese banks might have used corporate deposits as a rent-extraction device during this time.[4] This commercial custom prevailed before the 1990s and was also recognized by authorities like the Ministry of Finance and the Fair Trade Commission.[5]

By focusing on the early 1980s, I can also make use of a potential instrumental variable for overcoming the possible endogeneity problem. Consider the following simple linear regression model, to see the source of endogeneity.

$$\begin{aligned} CASH_i &= \alpha BOND_i + X_i\beta + u_i \\ u_i &= bankpower_i + \varepsilon_i, \quad \mathrm{E}[u_i BOND_i | X_i] \neq 0 \end{aligned} \tag{1}$$

Here *CASH*, *BOND*, *X*, and ε stand for firms' cash holdings, bond issue statuses, the vector of covariates (including a constant term), and the disturbance term, respectively. In this model, the treatment effect of bond issues on cash holdings is measured by α. Since firms suffering from severe bank rent extraction are more likely to issue bonds, and the extent of the effect of that issue—defined as *bankpower* in equation (1)—is unobservable for econometricians, an omitted-variable problem might arise, thus biasing the treatment effects estimated by OLS.[6] Therefore, we need to find an appropriate instrumental variable that is not dependent on *bankpower* but which correlates with *BOND*. To that end, this study focuses on the Bond Issue Criteria that formerly existed in Japan. These criteria, set by the Japanese government, established the conditions vis-à-vis net worth, profitability, and healthiness that must be satisfied by firms that attempt to issue bonds in the public markets.[7] As the eligibility for bond issues were judged based on firms' past financial statements and the criteria were frequently deregulated in the early 1980s, they collectively work as an exogenous shifter that affects firms' bond-issuing decisions.

This study employs several econometric methods to estimate the treatment effect of bond

[2] Hale and Santos (2009) point out two reasons why firms' entry to corporate bond markets could lead to a reduction in the spreads on bank loans. The first one is a decline in their banks' informational rents, and the second one is an increase in bargaining power of firms. The latter suggests that firms with access to corporate bond markets can use it as a bargaining tool in their loan negotiations.

[3] Weinstein and Yafeh (1998) also point out this problem. In my dataset, some firms are suspected to amalgamate interest paid on corporate bonds, under this term.

[4] To see how banks can extract rent from firms, consider the counterfactual case where a bank offers a 1-billion-yen loan at a rate of 10% to a firm and forces the firm to make a time deposit of 0.5 billion yen at a rate of 5%. Effectively, the firm borrows only 0.5 billion yen in this case, and the bank extracts an additional rent of 25 million yen. Therefore, banks can extract rent from firms by forcing them to retain a portion of the deposit balances, as long as the lending rates are higher than the deposit rates.

[5] Aoki (1988) and Rajan (1992) also point out this commercial custom.

[6] In this case, the so-called strongly ignorable assignment assumption would be invalid, and the treatment effects estimated by OLS or matching estimators become biased. As *BOND* and *bankpower* are thought to correlate positively, the results derived from these methods are suspected of being upward-biased. For details, see Wooldridge (2010), for example.

[7] I provide the details of these criteria in the Appendix.

issues on firms' cash holdings. First, I estimate the effect via the usual 2SLS model, using a Bond Issue Criteria dummy as an IV for the decision of bond issues (hereafter called "IV estimation 1"). I also use the predicted probabilities of bond issues obtained from the logit as an instrument (hereafter called "IV estimation 2").[8] This study is also going to examine whether bond issues are more effective for firms suffering from severe bank rent extraction. The usual linear models, however, cannot handle this problem, because they assume that coefficients are the same for all agents. To take heterogeneity in treatment effects into account, this study utilizes the quantile regression model, which allows coefficients to be dependent on agents' unobservable factors. This study applies the IV-QR model developed by Chernozhukov and Hansen (2005).

The IV-QR model is expressed as follows. Here I relate the model to the case of this study, and the definitions of *CASH*, *BOND*, and *X* are the same as in equation (1).

$$\begin{aligned} CASH &= \alpha(U)BOND + X\beta(U)\,, \\ U|Z,X &\sim U(0,1), \quad BOND = \delta(X,Z,V) \end{aligned} \tag{2}$$

where *Z* is an instrumental variable that accounts for the bond-issue decision (*BOND*), but does not correlate with *CASH*; and *U* is a random variable called rank variable that follows a uniform distribution after conditioning exogenous variables and which reflects an unobservable factor that affects cash holdings. A function δ defines the bond-issue decision, and a random variable *V* represents an unobservable factor and is dependent on *U*. This dependence makes the bond-issue decision (*BOND*) endogenous.

In equation (2), $\alpha(U)$ captures the quantile treatment effect of bond issues on cash holdings, and the effect is allowed to be dependent on the rank-variable level. This study interprets *U* as the extent of bank power that each firm faces.[9] Since Rajan's (1992) model predicts that the effect of bond issues is larger for firms suffering from severe bank rent extraction, the magnitude of $\alpha(U)$ is expected to be larger as *U* becomes larger. Here, lowercase letters (*bond*, *x*, *z*) represent potential values that random variables (*BOND*, *X*, *Z*) may take; then, the structural quantile function (*S*) satisfies the following condition:

$$\begin{aligned} S_{CASH}(\tau|bond,x) &= \alpha(\tau)bond + x\beta(\tau)\,, \quad \tau \in [0,1], \\ Pr[CASH \le S_{CASH}(\tau|BOND,X)|Z,X] &= \tau. \end{aligned} \tag{3}$$

where τ indicates the quantile levels. Chernozhukov and Hansen (2005) propose a feasible estimation procedure that combines the grid-search method with linear programming.

3. Estimation

3.1 Data

The current study utilizes information from the Development Bank of Japan database, which contains comprehensive financial statements and corporate information on Japanese listed firms. The sample period is from FY1980 to FY1985, during which Bond Issue Criteria were dependent only on firms' past observable information. The sample size is 6,430, after removing inconsistent values. Because fixed effects cannot be controlled for via

[8] In the estimation of the logit model, the Bond Issue Criteria dummy is included as an excluded exogenous variable. For the detailed procedure, I refer readers to Wooldridge (2010).

[9] A larger value of *U* means that a firm is at a higher quantile of conditional distribution of cash holdings: the firm holds more cash than that predicted by explanatory variables. The current study therefore assumes that firms with a large *U* value suffer higher rent extraction. Chernozhukov and Hansen (2004), who investigate the effect of 401(k) adoptions on U.S. households' wealth accumulations, interpret this rank variable as being representative of households' unobservable preference for savings.

Chernozhukov and Hansen's (2005) method, I treat the data as a repeated cross-section.

As for the selection of covariates (*X*), this study follows Almeida, Campello, and Weisbach (2004), who investigate the determinants of U.S. firms' cash holdings; and Hoshi, Kashyap, and Scharfstein (1992) and Uchino (2011), each of whom analyze the bond-issuing decisions of Japanese firms. Specifically, I control for Tobin's Q, firm size (natural log of assets), cash flows, credit scores (Altman's revised Z scores), leverages, corporate group (*Keiretsu*) dummy, industry dummies, and year dummies.[10] The dependent variable *CASH* is the ratio of cash and deposit to total assets; the treatment status *BOND* is the dummy variable, which takes a value of 1 if the firm's outstanding corporate bonds are positive; and the instrumental variable *CRITERIA* is the dummy variable, which takes a value of 1 if the firm meets the Bond Issue Criteria more than once in the five previous years. Detailed definitions and descriptive statistics of these variables are provided in Table I and Appendix 2, respectively.

3.2 Results from Linear Models

Before moving on to the estimation results, let us check the distributional differences of cash holdings between bond-issuing firms and nonbond-issuing firms. Figure 1 shows the distribution of *CASH* for two firm groups: firms that became bond issuers by FY1985 but after FY1979, and firms that remained nonbond issuers until FY1985. No large distributional differences were found between the two at the time of FY1979, but in FY1985 the distribution for bond issuers had apparently shifted leftwards compared to firms that remained nonbond issuers. This fact roughly implies that a firm's bond-issuing status and amount of cash holdings correlate negatively.

Estimation results of the treatment effects by OLS and 2SLS are shown in Table III, while Table II shows the results of first-stage regressions. The latter demonstrates that *CRITERIA* correlates significantly positively with *BOND* in both the OLS and logit models, and they indicate that firms' bond-issue probabilities are increased by 18.54% (OLS) and 21.71% (logit) when *CRITERIA* changes from 0 to 1. Besides, F statistics from OLS—under the null hypothesis that the coefficient of *CRITERIA* is 0—show a very large value (F = 142.02); this implies that the problem pertaining to weak instruments is not serious. For two-stage regressions, the results of OLS are shown on the left of Table III, and those of IV estimations 1 and 2 are shown in the middle and right table panels, respectively.

According to the OLS results, bond issues reduce a firm's cash ratio by 1.04 percentage points, all else being equal. Likewise, the results from 2SLS show a reduction of cash ratio by 2.37 or 2.82 percentage points. Apparently, the magnitude of the treatment effects as estimated by 2SLS is more than twice that estimated by OLS. These findings imply that firms can mitigate bank rent extraction by issuing bonds, and that there exists a positive correlation between *BOND* and an unobservable factor that this study interprets as bank power.

3.3 Results from IV-QR

To investigate whether bond issues have a comparatively larger effect on firms that face severe bank rent extraction, this study employs the IV-QR model. I also employ the usual quantile effect model (QR), in order to check for the existence of endogeneity.

In Tables IV and V, I report the results of the QR and IV-QR models, respectively, for the 25th, 50th, and 75th quantiles. We can see a tendency with both QR and IV-QR, wherein the treatment effects measured by the coefficient of *BOND* become larger as the quantile levels become higher, and are significant at higher quantiles. The magnitudes of those effects,

[10] *Keiretsu* are defined as the six major corporate groups (Mitsubishi, Mitsui, Sumitomo, Sanwa, Fuyo, and Dai-Ichi Kangyo). The dummy variable is generated following the definition provided by Nakatani (1984). All covariates are lagged by one period.

however, differ between the two methods. For example, at the 75th quantile, the result of IV-QR indicates a decline of cash ratio by 4.74 percentage points, while that of QR show a decline by 1.46 percentage points. This finding implies the existence of endogeneity: a positive correlation between *BOND* and an unobservable factor (*U*).

To present the results visually, Figure 2 reports the distributional impacts of bond issues at 0.05-unit intervals, from the 10th quantile to the 90th quantile. QR estimates are plotted with 95% confidence intervals in the right panel, and IV-QR estimates are plotted in the left panel, both in the same way. It can be confirmed that estimates from IV-QR are almost uniformly smaller than those from QR. The interesting point is that the magnitudes of the treatment effects become monotonically larger at higher quantiles. These results are consistent with the hypothesis that bond issues have a larger effect for firms that face severe bank rent extraction.

To determine by how much firms can reduce their amounts of cash holdings, I also estimate the percentage impact of treatment (PIT), defined as follows for each quantile (τ) following Abadie et al. (2002) and Chernozhukov and Hansen (2005).

$$PIT(\tau) = \frac{\alpha(\tau)}{\bar{x}\beta(\tau)} \tag{4}$$

PIT indicates the percentage-change of *CASH* when a firm's bond-issuing status changes from 0 to 1, compared to the counterfactual situation in which a firm remains a nonbond issuer. To implement the calculation, I evaluate the covariates at sample means ($x = \bar{x}$). Similarly, I report the PITs of bond issues at 0.05-unit intervals, from the 10th quantile to the 90th quantile. The PITs from the QR estimates are plotted in the right panel of Figure 3, and those from the IV-QR estimates are plotted in the left panel. The findings also imply that the treatment effects estimated by IV-QR are uniformly larger in magnitude than those by QR. For example, at the 75th quantile, the results from IV-QR suggest that the cash ratios of bond issuers will be 23.7% lower than the counterfactual situation in which they are assumed to remain nonbond issuers. On the other hand, results from QR indicate a reduction of only 7.8% at the same quantile. In addition, we can also confirm that firms at higher quantiles have larger PITs, for either estimation method. Therefore, this study concludes that firms' bond issues curb rent extraction by their banks, and the effects are larger for firms considered to be facing more severe bank powers.

4. Conclusions

This study investigates whether firms' bond issues reduce rent extraction by their banks, by focusing on the cash holdings of Japanese manufacturing firms in the early 1980s—a time during which Japanese banks forced firms to maintain compensation balances, to extract rents from those firms. By estimating the treatment effects of bond issues on firms' cash holdings via OLS, 2SLS, QR, and IV-QR, this study proves that bond issues curb banks' rent extractions, and that the magnitude of those effects becomes larger for firms considered to be facing severe bank power. This study also attempts to deal with a possible endogeneity problem by exploiting information on the eligibility of bond issues or "Bond Issue Criteria," which formerly existed in Japan. Using this information, it becomes apparent that the treatment effects derived via 2SLS and IV-QR are larger than those derived via OLS and QR, the latter two of which do not take the endogeneity problem into account. In cash-holding equations, this finding implies a positive correlation between bond issues and an unobservable factor that this study interprets as bank power.

Since Japanese listed firms did not have access to bond markets and consequently were highly bank-dependent before the 1980s, their past situation has much in common with recent small and medium-sized enterprises (SMEs). Therefore, it is not an overstatement to say that the empirical evidence offered by this study contains some policy implications for

present-day SME finance. Based on the findings of this study, policy that promotes diversification vis-à-vis SME funding sources may be beneficial in reducing rent extraction by banks. Following the theoretical results of Rajan (1992), reductions in rent extraction increase firms' effort levels and capital investments. Future research, therefore, should focus on the effects of bond issues from this vantage. In Japan, the SME agency of the Japanese government has been undertaking a policy that promotes private bond issues by SMEs, by introducing a new set of Bond Issue Criteria that are very similar to those examined in this study. It will be fruitful to evaluate this type of policy while focusing on the effects of SMEs' bond issues on their borrowing costs and overall performance.

References

Abadie, A., J. Angrist and G. Imbens (2002) "Instrumental Variables Estimates of the Effect of Subsidized Training on the Quantiles of Trainee Earnings" *Econometrica* **70**, 91–117.

Almeida, H., M. Campello and M.S. Weisbach (2004) "The Cash Flow Sensitivity of Cash" *Journal of Finance* **59**, 1777–1804.

Aoki, M. (1988) *Information, Incentives and Bargaining in the Japanese Economy*, Cambridge: Cambridge University Press.

Berger, A. and G. Udell (1995) "Relationship Lending and Lines of Credit in Small Firm Finance" *Journal of Business* **68**, 351–381.

Bharath, S., S. Dahiya, A. Saunders, and A. Srinivasan (2011) "Lending Relationships and Loan Contract Terms" *Review of Financial Studies*, **4**, 1141–1203

Chernozhukov, V. and C. Hansen (2004) "The Impact of 401(K) on Savings: An Instrumental Quantile Regression Analysis" *Review of Economics and Statistics* **86**, 735–751

Chernozhukov, V. and C. Hansen (2005) "An IV Model of Quantile Treatment Effects" *Econometrica* **73**, 245–261.

Hale, G. and J.A.C. Santos (2009) "Do Banks Price their Informational Monopoly?" *Journal of Financial Economics* **93**, 185–206.

Hoshi, T., A. Kashyap and D. Scharfstein (1993) "The Choice between Public and Private Debt: An Analysis of Post-Deregulation Corporate Financing in Japan," NBER Working Papers, No. 4421.

Ioannidou, V. and Ongena, S. R. G. (2010) "Time for a Change: Loan Conditions and Bank Behavior when Firms Switch Banks" *Journal of Finance*, **65**, 1847–1877.

Nakatani, I. (1984) "The Economic Role of Financial Corporate Grouping" in *The Economic Analysis of the Japanese Firm* by M. Aoki, Ed., 222–258, Amsterdam: North Holland.

Petersen, M.A. and R.G. Rajan (1994) "The Benefits of Lending Relationships: Evidence from Small Business Data" *Journal of Finance* **49**, 3–37.

Pinkowitz, L. and R. Williamson (2001) "Bank Power and Cash Holdings: Evidence from Japan" *Review of Financial Studies* **14**, 1059–1082.

Rajan, R.G. (1992) "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt" *Journal of Finance* **47**, 1367–1400.

Uchino, T. (2011) "Bank Dependence and Financial Constraints on Investment: Evidence from the Corporate Bond Market Paralysis in Japan," RIETI Discussion Paper Series, No. 11-E-073.

Weinstein, D.E. and Y. Yafeh (1998) "On the Costs of a Bank-centered Financial System: Evidence from the Changing Main Bank Relations in Japan" *Journal of Finance* **53**, 635–672.

Wooldridge, J.M. (2010) *Econometric Analysis of Cross Section and Panel Data*, Cambridge: The MIT Press.

Appendix 1: Bond Issue Criteria

This study exploits the Bond Issue Criteria that formerly existed in Japan, in order to estimate the cash-holding equation explained in section 2. The criteria, set by the Ministry of Finance, established the financial conditions that firms needed to fulfill, if they wished to issue bonds in public markets. The conditions differed according to the types of corporate bonds (straight bonds, convertible bonds, warrant bonds, etc.). By and large, the criteria for unsecured straight bonds were the strictest; on the other hand, those for convertible bonds and warrant bonds were relatively less stringent. In the early 1980s, the criteria were deregulated every year except FY1980, either the Ministry's alteration of existing criteria or by its creation of criteria for new types of bonds (see Table VI). When criteria were altered, firms were able to issue bonds in public markets if they had met the altered conditions in the previous year. Alterations to Bond Issue Criteria, therefore, would have worked as an exogenous shifter vis-à-vis firms' bond-issuing decisions.

Based on information regarding Bond Issue Criteria procured from the Annual Report on Government and Corporate Bond (*Koshasai Nenpo*) published by the Association of Government and Corporate Bond Underwriters (*Koshasai Hikiuke Kyokai*), this study uses a dummy variable that takes a value of 1 if the firm fulfilled at least one of the criteria for unsecured straight bonds, unsecured convertible bonds, unsecured convertible bonds with retained assets, warrant bonds, foreign-denominated bonds, and euroyen bonds. These criteria basically comprised six parts: restrictions on the amount of net assets, capital ratios (CAP), net asset ratios (NAR), return on assets (ROA), interest rate coverage ratios (ICR), and dividend per share (DPS). Firms face different lists of conditions on CAP, NAR, ROA, ICR and DPS, according to their amounts of net assets, and they were required to satisfy some of them. In any case, firms with net assets lower than the minimum level set by the criteria were never allowed to issue bonds in public markets.

In Table VII, as an example, I show the Bond Issue Criteria for unsecured convertible bonds in FY1985 and the changes from previous criteria. This table shows us the tendency for criteria-enabled firms with greater net assets to issue bonds under less-strict conditions, and that firms were asked to have paid dividends successively in the previous five years. This latter fact implies that firms might have had difficulty adjusting their financial conditions quickly so as to become able to issue bonds. Therefore, this study considers that Bond Issue Criteria alterations were sufficiently exogenous for firms, after controlling for the factors that affect bond-issue decisions.

Appendix 2: Descriptive statistics

Descriptive statistics for the outcome variable (*CASH*), the treatment variable (*BOND*), the instrumental variable (*CRITERIA*), and covariates are shown in Table VIII; those for the subsample, split according to the value of *BOND*, are similarly shown in Table IX. The data in these tables imply that firms with relatively larger total assets, cash flows, Tobin's Q, and capital ratios are more likely to issue corporate bonds, and that bond-issuing firms hold less cash than nonbond-issuing firms, on average.

The year-by-year ratios of bond-issuing firms are reported in Table X. In this table, I show the subsample ratios grouped according to the value of *CRITERIA*, in addition to those calculated from the full sample. In Table XI, the numbers of firms that satisfied *CRITERIA* and were bond-issuing firms are reported. These tables demonstrate that about one-half of the firms that met the Bond Issue Criteria issued corporate bonds, and the ratios became larger toward the end of the sample period (64.31% in FY1985). However, it also shows that firms that did not meet the criteria also had an opportunity to issue corporate bonds. This result may reflect the fact that the Bond Issue Criteria collectively represented a restriction on publically issued bonds. Put differently, it can be presumed that firms could issue private placement bonds under less-stringent criteria.

Table I: Definitions of variables

Variable	Definition
CASH	**Cash-holdings**: the ratio of cash and deposit to total assets.
BOND	**Bond-issuing-dummy**: the dummy variable that takes 1 if the firm's outstanding balance of corporate bonds are positive, otherwise 0.
CRITERIA	**Bond-Issue-Criteria-dummy**: the dummy variable that takes 1 if the firm has met the bond issue criteria more than once within the last 5 years, otherwise 0.
Q	**Tobin's Q**: the ratio of market capitalization plus total assets minus net assets to total assets.
lnASSET	**Firm-sizes**: the natural log of total assets.
CF	**Cash-flows**: the sum of net income and depreciation divided by total assets
SCORE	**Credit-scores**: Altman's revised Z-scores.
CAP	**Leverages**: the ratio of net assets to total assets.
KEIRETSU	**Keiretsu-dummy**: the dummy variable that takes 1 if the firm is belongs to any of the six major Japanese corporate groups (Mitsubishi, Mitsui, Sumitomo, Sanwa, Fuyo and Dai-Ichi Kangyo), otherwise 0.
INDUSTRY1-10	**Industry-dummies**: 1: Manufacture of food, 2: Manufacture of textile, 3: Manufacture of wood, pulp, and paper, 4:Manufacture of chemistry, petrochemical, and rubber, 5: Manufacuture of ceramic, stone, and clay, 6: Manufacture of metal, and metal products; 7: Manufacture of machinery, 8: Manufacture of electrical appliances, 9: Manufacture of transportation equipment, 10: Other manufacturing.

Table II: Estimation results from first-stage regressions

	First stage regression, Dependent variable: BOND								
	OLS Estimation			Logit Estimation			Logit (Marginal effect)		
	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.	m.e.	p>|z|	std.err.
CRITERIA	0.1854	***	0.0156	1.0333	***	0.0981	0.2171	***	0.0200
lnASSET(t-1)	0.1590	***	0.0046	1.0089	***	0.0371	0.2099	***	0.0080
CF(t-1)	0.2981	*	0.1540	3.0194	**	1.2372	0.6283	**	0.2571
Q(t-1)	-0.0059		0.0123	-0.0918		0.0658	-0.0191		0.0137
SCORE(t-1)	-0.1212	***	0.0125	-0.9366	***	0.1020	-0.1949	***	0.0209
CAP(t-1)	0.1802	***	0.0425	1.3372	***	0.3214	0.2783	***	0.0671
KEIRETSU	-0.0446	***	0.0144	-0.3206	***	0.0841	-0.0639	***	0.0160
const.	-2.1717	***	0.0886	-16.6213	***	0.6829			
Industry dummies	Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes		
N of Obs.	6,430			6,430			6,430		
R squared	0.3444			0.3083					
F-value(1)	F(21, 6408)=242.35								
(P-value)	(0.000)								
F-value(2)	F(1, 6408)=142.04								
(P-value)	(0.000)								
Wald test(1)				chi2(21)=1491.43					
(P-value)				(0.000)					
Wald test(2)				chi2(1)=111.03					
(P-value)				(0.000)					

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. F-test (1) shows the F-value under the null hypothesis that all coefficients are zero, and F-test (2) describes the F-value under the null hypothesis that the coefficient of CRITERIA is zero. Results for Wald-test (1) and Wald-test (2) show Wald statistics under the same null hypothesis.

Table III: Estimation results from OLS and 2SLS

	Dependent variable: CASH								
	OLS Estimation			IV Estimation 1			IV Estimation 2		
	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.
BOND	-0.0104	***	0.0021	-0.0237	**	0.0117	-0.0282	***	0.0076
lnASSET(t-1)	-0.0085	***	0.0009	-0.0060	**	0.0023	-0.0051	***	0.0016
CF(t-1)	-0.3075	***	0.0351	-0.3038	***	0.0351	-0.3026	***	0.0354
Q(t-1)	0.0148	***	0.0039	0.0148	***	0.0040	0.0147	***	0.0040
SCORE(t-1)	0.0011		0.0023	-0.0005		0.0026	-0.0011		0.0025
CAP(t-1)	0.0249	***	0.0082	0.0309	***	0.0101	0.0329	***	0.0089
KEIRETSU	-0.0033	*	0.0019	-0.0038	**	0.0019	-0.0040	***	0.0019
const.	0.2770	***	0.0175	0.2408	***	0.0358	0.2283	***	0.0268
Industry dummies	Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes		
N of obs.	6,430			6,430			6,430		
R squared	0.1264			0.1206			0.1159		
F-value	F(21,6408)=45.79			F(21,6408)=43.50			F(21,6408)=43.61		
(P-value)	(0.000)			(0.000)			(0.000)		

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity robust standard errors are reported.

Table IV: Estimation results from the quantile regression (QR)

	Dependent variable: CASH								
	QR: Quantile=0.25			QR: Quantile=0.5			QR: Quantile=0.75		
	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.
BOND	-0.0024		0.0018	-0.0057	***	0.0020	-0.0146	***	0.0026
lnASSET(t-1)	-0.0096	***	0.0007	-0.0127	***	0.0008	-0.0121	***	0.0010
CF(t-1)	-0.2567	***	0.0269	-0.3068	***	0.0271	-0.3779	***	0.0339
Q(t-1)	0.0031	*	0.0018	0.0108	***	0.0018	0.0233	***	0.0021
SCORE(t-1)	-0.0052	***	0.0018	-0.0041	**	0.0020	0.0015		0.0025
CAP(t-1)	-0.0315	***	0.0059	-0.0110	*	0.0063	0.0401	***	0.0082
KEIRETSU	0.0047	**	0.0020	0.0010		0.0022	-0.0047	*	0.0028
const.	0.2955	***	0.0128	0.3720		0.0137	0.3639	***	0.0177
Industry dummies	Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes		
N of obs.	6,430			6,430			6,430		
Pseudo R squared	0.1134			0.0989			0.0954		
F-value	F(21,6408)=54.00			F(21,6408)=55.95			F(21,6408)=50.39		
(P-value)	(0.000)			(0.000)			(0.000)		

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Results for selected quantiles (25th, 50th, and 75th quantiles) are reported.

Table V: Estimation results from the instrumental variable quantile regression (IV-QR)

	Dependent variable: CASH								
	IVQR: Quantile=0.25			IVQR: Quantile=0.5			IVQR: Quantile=0.75		
	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.	coef.	p>|z|	std.err.
BOND	-0.0078	**	0.0033	-0.0198	***	0.0030	-0.0474	***	0.0033
lnASSET(t-1)	-0.0086	***	0.0011	-0.0094	***	0.0010	-0.0051	***	0.0011
CF(t-1)	-0.2621	***	0.0384	-0.3069	***	0.0348	-0.3589	***	0.0385
Q(t-1)	0.0025		0.0025	0.0085	***	0.0023	0.0224	***	0.0025
SCORE(t-1)	-0.0066	**	0.0028	-0.0041		0.0025	-0.0017		0.0028
CAP(t-1)	-0.0265	***	0.0101	-0.0075		0.0091	0.0551	***	0.0101
KEIRETSU	0.0047		0.0031	0.0000		0.0028	-0.0055	*	0.0031
const.	0.2859	***	0.0205	0.3223	***	0.0186	0.2638	***	0.0205
Industry dummies	Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes		
N of obs.	6,430			6,430			6,430		
Wald test	chi(21)=522.32			chi(21)=826.91			chi(21)=945.86		
(P-value)	(0.000)			(0.000)			(0.000)		

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Results for selected quantiles (25th, 50th, and 75th quantiles) are reported.

Table VI: Alterations to and introductions of Bond Issue Criteria in the early 1980s

	Unsecured straight bonds	Unsecured convertible bonds	Unsecured convertible bonds with retained assets	Warrant bonds	Foreign currency denominated bonds	Euroyen bonds
FY1979	No alteration	No alteration				
FY1980	No alteration	No alteration		Criteria introduced in October 1980		
FY1981	No alteration	No alteration		No alteration		
FY1982	No alteration	Deregulated as of January 1983	Criteria introduced in January 1983	No alteration	Criteria introduced in October 1982	
FY1983	No alteration	No alteration	No alteration	No alteration	No alteration	Criteria introduced in March 1983
FY1984	Deregulated as of March 1984	Deregulated as of March 1984	No alteration	No alteration	No alteration	No alteration
FY1985	Deregulated as of October 1985	Deregulated as of June 1985	No alteration	No alteration	No alteration	No alteration

Note: Japan's fiscal year starts in April, and ends in March.

Table VII: Bond Issue Criteria for unsecured convertible bonds in FY1985

Net asset	Capital ratio (CAP)	Net asset ratio (NAR)	Return on asset (ROA)	Interest coverage ratio (ICR)	Dividend per share (DPS)
Greater than 150bn yen	Greater than 15%	Greater than 1.5	Greater than 6%	Greater than 1.2	Dividend per share has beer successive five years, and ha successive three years.
(Previous Criteria)	(Greater than 15%)	(Greater than 1.5)	(Greater than 6%)	(Greater than 1.2)	(same as above)
Greater than 110bn yen but less than 150bn yen	Greater than 20%	Greater than 2	Greater than 7%	Greater than 1.5	Dividend per share has beer successive five years, and ha successive three years.
(Previous Criteria)	(Greater than 40%)	(Greater than 4)	(Greater than 10%)	(Greater than 4)	(Dividend per share has exce successive three years)
Greater than 55bn yen but less than 110bn yen	Greater than 40%	Greater than 4	Greater than 10%	Greater than 4	Dividend per share has exce successive five years.
(Previous Criteria)	(Greater than 50%)	(Greater than 4)	(Greater than 10%)	(Greater than 4)	(same as above)
Greater than 33bn yen but less than 55bn yen	Greater than 50%	Greater than 5	Greater than 12%	Greater than 5	Dividend per share has exce successive five years.
(Newly introduced)	(-)	(-)	(-)	(-)	(-)

Note: Capital ratio (CAP), net asset ratio (NAR), return on asset (ROA), and interest coverage ratio (ICR) are respectively defined as net assets divided by total ass profit and interest and discount received divided by total assets, and the sum of operation profit and interest and discount received divided by interest and discount p

Table VIII: Descriptive statistics of variables

Variable	NOBs	Mean	Std.Dev.	Min	Max
CASH	6,430	0.1481	0.0684	0.0008	0.7297
BOND	6,430	0.3586	0.4796	0.0000	1.0000
CRITERIA	6,430	0.4471	0.4972	0.0000	1.0000
lnASSET(t-1)	6,430	17.1946	1.3628	13.7631	22.0193
CF(t-1)	6,430	0.0529	0.0373	-0.2662	0.2931
Q(t-1)	6,430	1.3782	0.4984	0.5043	14.0577
SCORE(t-1)	6,430	1.8856	0.6078	-0.1005	6.1428
CAP(t-1)	6,430	0.3038	0.1820	-0.6500	0.9256
KEIRETSU(t-1)	6,430	0.1941	0.3955	0.0000	1.0000
INDUSTRY1	6,430	0.0883	0.2838	0.0000	1.0000
INDUSTRY2	6,430	0.0638	0.2444	0.0000	1.0000
INDUSTRY3	6,430	0.0367	0.1880	0.0000	1.0000
INDUSTRY4	6,430	0.1630	0.3694	0.0000	1.0000
INDUSTRY5	6,430	0.0591	0.2358	0.0000	1.0000
INDUSTRY6	6,430	0.1400	0.3470	0.0000	1.0000
INDUSTRY7	6,430	0.1557	0.3626	0.0000	1.0000
INDUSTRY8	6,430	0.1586	0.3654	0.0000	1.0000
INDUSTRY9	6,430	0.0953	0.2937	0.0000	1.0000
INDUSTRY10	6,430	0.0395	0.1948	0.0000	1.0000

Table IX: Subsample descriptive statistics

	Full sample			Subsample: BOND = 1			Subsample: BOND = 0		
Variable	NOBs	Mean	Std.Dev.	NOBs	Mean	Std.Dev.	NOBs	Mean	Std.Dev.
CASH	6,430	0.1481	0.0684	2,306	0.1322	0.0601	4,124	0.1571	0.0711
BOND	6,430	0.3586	0.4796	2,306	1.0000	0.0000	4,124	0.0000	0.0000
CRITERIA	6,430	0.4471	0.4972	2,306	0.7212	0.4485	4,124	0.2939	0.4556
lnASSET(t-1)	6,430	17.1946	1.3628	2,306	18.1910	1.2648	4,124	16.6375	1.0659
CF(t-1)	6,430	0.0529	0.0373	2,306	0.0554	0.0284	4,124	0.0515	0.0414
Q(t-1)	6,430	1.3782	0.4984	2,306	1.3986	0.5202	4,124	1.3668	0.4855
SCORE(t-1)	6,430	1.8856	0.6078	2,306	1.8199	0.5420	4,124	1.9223	0.6388
CAP(t-1)	6,430	0.3038	0.1820	2,306	0.3240	0.1591	4,124	0.2924	0.1927
KEIRETSU(t-1)	6,430	0.1941	0.3955	2,306	0.2918	0.4547	4,124	0.1394	0.3464
INDUSTRY1	6,430	0.0883	0.2838	2,306	0.1002	0.3003	4,124	0.0817	0.2740
INDUSTRY2	6,430	0.0638	0.2444	2,306	0.0512	0.2204	4,124	0.0708	0.2565
INDUSTRY3	6,430	0.0367	0.1880	2,306	0.0377	0.1906	4,124	0.0361	0.1866
INDUSTRY4	6,430	0.1630	0.3694	2,306	0.1847	0.3882	4,124	0.1508	0.3579
INDUSTRY5	6,430	0.0591	0.2358	2,306	0.0529	0.2239	4,124	0.0626	0.2422
INDUSTRY6	6,430	0.1400	0.3470	2,306	0.1206	0.3257	4,124	0.1508	0.3579
INDUSTRY7	6,430	0.1557	0.3626	2,306	0.1487	0.3559	4,124	0.1596	0.3662
INDUSTRY8	6,430	0.1586	0.3654	2,306	0.1774	0.3821	4,124	0.1482	0.3553
INDUSTRY9	6,430	0.0953	0.2937	2,306	0.0893	0.2853	4,124	0.0987	0.2983
INDUSTRY10	6,430	0.0395	0.1948	2,306	0.0373	0.1895	4,124	0.0407	0.1977

Table X: Year-by-year ratios of bond-issuing firms

	FY1980	FY1981	FY1982	FY1983	FY1984	FY1985
Firms with CRITERIA = 0	30.54%	23.27%	20.09%	16.35%	15.11%	13.98%
Firms with CRITERIA = 1	36.08%	47.22%	48.90%	52.02%	57.25%	64.31%
Total	31.54%	31.99%	31.97%	33.12%	36.23%	40.77%

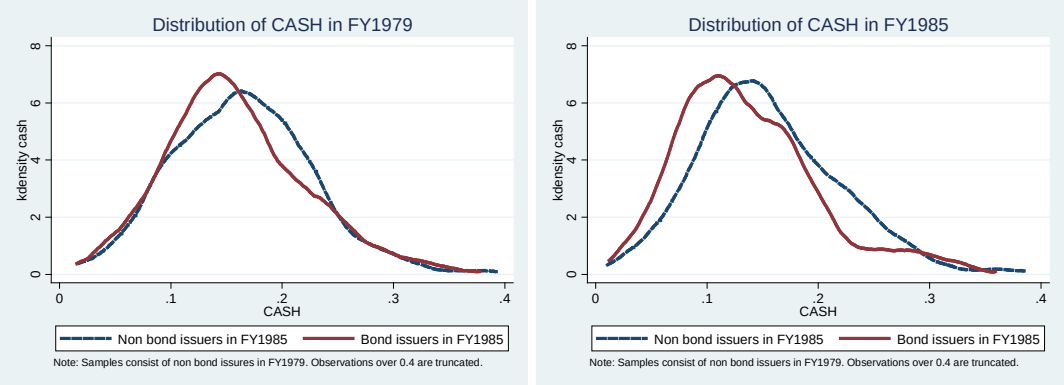
Note: Japan's fiscal year starts in April, and ends in March.

Table XI: Numbers of bond-issuing firms and criteria-satisfying firms

	FY1980	FY1981	FY1982	FY1983	FY1984	FY1985
CRITERIA = 0	698	660	596	560	535	506
CRITERIA = 1	354	400	479	517	544	581
BOND = 0	710	717	730	700	647	620
BOND = 1	342	343	345	377	432	467
Total	1,052	1,060	1,075	1,077	1,079	1,087

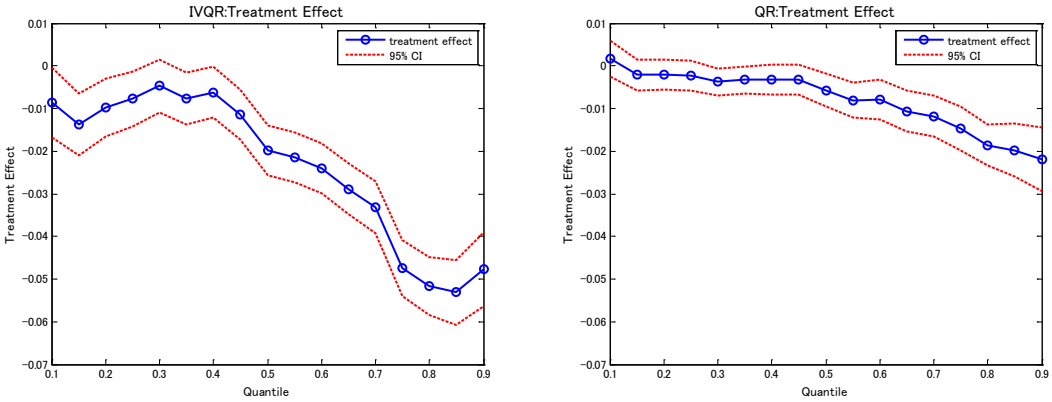
Note: Japan's fiscal year starts in April, and ends in March.

Figure 1: Distribution of *CASH* in FY1979 (left panel) and FY1985 (right panel)



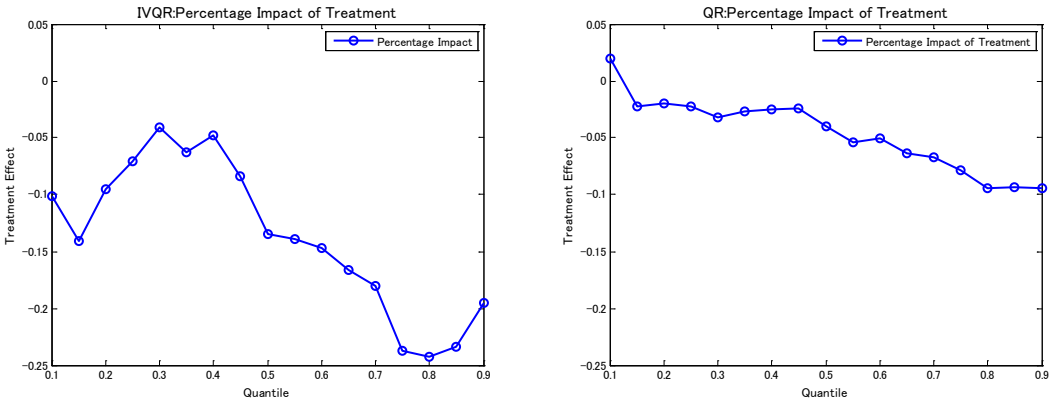
Note: Solid lines indicate the distributions of *CASH* for firms that became bond issuers by FY1985, and dotted lines indicate those for firms that remained non-bond issuers until FY1985. The fiscal year in Japan starts in April, and ends in March.

Figure 2: Treatment effects estimated by IV-QR (left panel) and QR (right panel)



Note: The treatment effects of bond issues on cash holdings are estimated by IV-QR and QR at 0.05-unit intervals from the 10th quantile to the 90th quantile, which are reported with 95% confidence intervals.

Figure 3: Percentage impact of treatment (PIT) estimated by IV-QR (left panel) and QR (right panel)



Note: The percentage impacts of treatments are estimated by IV-QR and QR at 0.05-unit intervals from the 10th quantile to the 90th quantiles.