18th World IMACS / MODSIM Congress, Cairns, Australia 13-17 July 2009
http://mssanz.org.au/modsim09

Mispricing in the Japanese Corporate Bond Market

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Abstract: The purpose of this paper is to determine whether there is any mispricing of publicly issued straight corporate bonds in Japan, and to determine what factors explain variations in the degree of mispricing. While there is an extremely large literature devoted to investigating the extent of mispricing of initial public offerings (IPOs) of equity in both the United States, and Japan, there appear to be very few studies examining the extent of mispricing of IPOs of straight corporate bonds in the United States and Japan. The key study for the United States is Datta *et al.* (1997) who find that IPOs of speculative grade ("junk") bonds are underpriced, but those rated investment grade are overpriced. Two later studies for the United States report underpricing rather than overpricing (see Helwege and Kleiman (1998) and Cai *et al.* (2007)). For Japan, Matsui (2000, 2006) finds that IPO and seasoned issues when analyzed together exhibit significant overpricing too.

In this paper, using data on initial (IPO) and seasoned issues of publicly issued straight bonds over the ten year period between March 1992 and March 2002, evidence is presented that suggests the existence of significant mispricing, in particular, *overpricing*, of these bonds. This overpricing has several features: it does not appear decline overtime; on average, it *increases* as the rating of the bond issued falls, it is smaller for IPO issues; and it is influenced by the degree of competition among lead underwriters. Compared to Matsui's (2000, 2006) analysis of 599 issues of straight bonds made between March 1995 and March 2000, the analysis in this paper makes several improvements: it covers a wider time period giving a far large sample size (between 1726 and 2247 issues depending on the analysis), and even when limited to the same period as Matsui (2000, 2006) the number of bonds covered is 1490; our data source provides price data on the first day that the bond is transacted in the secondary market rather than data on one day in the first week after the bond is transacted in the secondary market; we follow standard procedures for using matched government bonds of the same maturity as the corporate bond issued; and we take account of possible differences between IPO and seasoned issues.

Keywords: bond pricing, competition, IPOs, mispricing, overpricing, underpricing, underwriting

1. INTRODUCTION

The purpose of this paper is to determine whether there is any mispricing of publicly issued straight corporate bonds in Japan, and to determine what factors explain variations in the degree of mispricing. While there is an extremely large literature devoted to investigating the extent of mispricing of initial public offerings (IPOs) of equity in both the United States, and Japan, there appear to be very few studies examining the extent of mispricing of IPOs of straight corporate bonds in the United States and Japan. The key study for the United States is Datta *et al.* (1997) who find that IPOs of speculative grade ("junk") bonds are underpriced, but those rated investment grade are overpriced. Two later studies for the United States report underpricing rather than overpricing (see Helwege and Kleiman (1998) and Cai *et al.* (2007)). For Japan, Matsui (2000, 2006) finds that IPO and seasoned issues when analyzed together exhibit significant overpricing too.

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Section 2 discusses some important systemic features of the Japanese corporate bond market, while section 3 presents the regression model to be estimated and the hypotheses to be tested. Details of the data sources are presented in section 4, and the estimation results are discussed in section 5.

2. SYSTEMIC FEATURES OF THE JAPANESE MARKET[1]

The focus of our study is on how bond prices change between the time when the conditions for the bond are determined, and when the bond is first transacted in the secondary market. In Japan, the subscription period for the bond typically opens on the same day that the issuing conditions are decided or the following day. For corporate and government bonds in Japan, the subscription period is usually set for about three weeks. Prices in the secondary market are usually observed on the first week day following the issue day.

Since 1988, all straight bonds have been issued according to "the proposal method". Under this method, an issuing firms requests securities companies to present proposals concerning the bond's issuing conditions, the issuing firm then decides on a lead underwriter on the basis of the proposals presented and other relevant factors, issuing conditions are then finalized following discussions between the issuing firm and the chosen securities company, with the securities company acting on its own or as the representative of an issuing syndicate, and, finally, an underwriting syndicate is assembled. In order to prevent discount selling of bonds during the subscription period, in late 1991, a new method for issuing bonds, the 'fixed price reoffer method' (*kinitsu kakaku hanbai hoshiki*), which requires that during the subscription period the bonds are sold to investors at uniform price (the offer or issuing price) was introduced. The key point is that the offer price cannot be varied during the subscription period to eliminate excess demand or excess supply.

3. MODEL AND HYPOTHESES

The following model was assumed to explain variations in the excess return on bonds:

$$\text{Excess Return}_j = \alpha_0 + \alpha_1 \text{Maturity}_j + \alpha_2 \text{First Issue}_j + \alpha_3 \text{Competition}_j + \alpha_4 \text{DAA}_j + \alpha_5 \text{DA}_j + \alpha_6 \text{DBBB}_j + u_j \quad (1)$$

where Excess Return is the excess return on the initial issue; Maturity is the maturity of the bond, First Issue is a dummy variable taking the value unity if the issue is an IPO issue and zero otherwise, Competition is a variable that measures the degree of competition among lead underwriters in the market for underwriting straight corporate bonds, DAA is a 0-1 dummy variable taking the value unity if the issuing firm's rating is

[1] This section is based on information contained in Matsuo (1999) and Tokushima (2004).

AA+, AA or AA-, and zero otherwise; DA is a 0-1 dummy variable taking the value unity if the issuing firm's rating is A+, A or A-, and zero otherwise; DBBB is a 0-1 dummy variable taking the value unity if the issuing firm's rating is BBB+, BBB or BBB-, and zero otherwise, and u is an error term. From the definition of the dummy variables, it is obvious that AAA rated seasoned bonds are the base group. A positive (negative) value of Excess Return corresponds to underpricing (overpricing). Competition was measured in two alternative ways, the Herfindahl index computed from market shares in the market for lead underwriters denoted by Herfindahl, and the number of securities that actually were lead underwriters in the calendar year prior to the issue denoted by the Number of Competitors.

Given Datta *et al.*'s (1997) *empirical* finding that speculative grade debt tends to be underpriced, and investment grade bonds tend to be overpriced, it can be conjectured that the coefficients on these ratings variables should increase as the ratings fall, that is, $\alpha_4 \leqq \alpha_5 \leqq \alpha_6$. Matsui's (2000, 2006) *empirical* findings that AAA issuers tend to be overpriced compared with lower rated issues is consistent with this expectation. Matsui's (2008) model provides a theoretical justification for these empirical results. As the maturity of a bond declines, it might be expected that the pricing problem becomes easier because the period over which the net present value of the bond's income stream is calculated becomes shorter and less can go wrong in a shorter period, that is, longer maturities lead to greater mispricing, that is, $\alpha_1 \leqq 0$. The discussion in section 2 suggests that issuing firms try to induce underwriters to compete against one another over the conditions under which they will underwrite the bond. Treating this as a type of auction where the key condition is the issuing price, McAfee and McMillan's (1987) discussion indicates that an increase in the number of potential underwriters will lead on average to an increase in the price determined by the auction.

4. DATA

Three major data bases were used in this study: the IN Information System's (INIS) IN Firm Finance Data Base; the Nikkei NEEDS Government Bond Data Base; and the Nikkei NEEDS Over the Counter (OTC) bond data base. The sample period in this paper runs from 1 March 1992 to 31 March 2002, and this gives 2247 bonds for which the excess returns can be computed[2]. The starting point of March 1992 is chosen to avoid a short period where there are new bonds were issued using the old and new underwriting methods. The end point of the data is governed by the time we accessed the INIS Data Base. The INIS Data Base contains data on straight corporate bond issues within Japan by individual firms, and includes ratings information, issue prices, issue amounts, the date of the issue, the date when the conditions of the issue were decided, the maturity of the issue, the number of the issue, and the dates that interest payments are made.

The Nikkei NEEDS Over the Counter (OTC) bond data base contains information on over the counter reference prices (*tento baibai sankochi*) on a daily basis from February 1992 for publicly placed straight corporate bonds issued in Japan[3]. These OTC prices are published by Japan Securities Dealers Association (JSDA) on the basis of information provided by JSDA members to the JSDA[4]. This daily data enables us to identify the price on the first day of trading in the secondary market. With the data source used by Matsui (2000, 2006), price data is only available for one day in the first week after the bond is transacted in the secondary market.

The Nikkei NEEDS Government Bond Data Base contains daily observations on the prices of all types of Japanese Government bonds issued in Japan between 1987 and 2003. For each bond, the Data Base also contains details of date of issue, the issue price, the coupon rate, and the dates that interest payments are made. Up until December 1998, the prices of government bonds are those for transactions on the Tokyo Stock Exchange (TSE). From December 1998, OTC transactions in Government Bonds became possible.

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[2] Even when limited to the same period as Matsui (2000, 2006), March 1995 and March 2000, the number of bonds included is 1489 compared to Matsui's (2000, 2006) analysis that only uses 599 issues of bonds.

[3] In this paper, data on the average of the over the counter reference prices has been used to compute the one day excess returns. Data on the median OTC reference price, and the maximum and minimum OTC reference prices and the number of companies reporting prices did not become available until 5 August 2002, and 7 June 2001, respectively. As a result, this data was not used in the current analysis.

[4] Further details on these OTC prices can be obtained from the JSDA's homepage: see http://www.jsda.or.jp/html/saiken/kehai2/seido.html (accessed 14 August 2004). Prior to the abolition of the market centralization obligation (*shijo shuchu gimu*), price information for straight corporate bonds transacted on the Tokyo Stock Exchange is available for a limited number of issues. After the abolition of the market centralization obligation, the number of issues transacted on the TSE has fallen even further.

Although transactions continue on both the TSE and OTC, the majority of transactions are undertaken on over the counter. As a result, we use price data from OTC transactions from December 1998.

In computing excess returns on corporate bonds, we follow Handjinicolaou and Kalay (1984). As a benchmark for each corporate bond, a government bond with the closest maturity and closest coupon rate to the corporate bond in question was used[5]. This is a much more sophisticated method of matching than used in Matsui (2000, 2006), where the matching employs government bond indices for short-term (maturity less than three years), medium-medium (maturity between three to seven years) and long-term (maturity greater seven years) bonds.

In order to maximize the sample size, the maximum of the available issuer ratings in the INIS data base provided by four ratings institutions, Rating and Investment Information, Inc., Japan Credit Rating Agency, Japan Bond Rating Institute, and Standard and Poors, was used. All models were estimated using LIMDEP9.0 (see Greene (2007a, b)).

5. RESULTS AND CONCLUSIONS

Figure 1 presents a kernel estimate of the distribution of the Excess Returns, and this clearly demonstrates that the probability of observing overpricing, negative values, is far higher than the probability of underpricing. Table 1 presents some descriptive statistics on Excess Returns for the full sample, and for every calendar year between 1992 and 2002. With the exception of 1992 where the sample size if rather small, Excess Return is negative and significantly different from zero, that is, significant overpricing is observed in every year except 1992. A key finding is that this overpricing does not appear to decline over time. For most years, there is also strong evidence that the Excess Returns are not normally distributed. 'Proportion Overpriced' provides an estimate of the probability of observing overpriced bonds, and it can be seen that this estimated probability ranges from 58% to 85% depending on the year.

Table 2 presents some descriptive statistics on Excess Returns by ratings. Contrary to the findings of Data *et al.* (1987) for the United States and Matsui (2000, 2006) for Japan, we find that the degree of overpricing is smallest for bonds with an AAA rating, and is largest for bonds with a BBB rating. However, for each type of rating, the degree of overpricing is significantly different from zero. Even for AAA bonds which must be relatively close substitutes for government bonds of a similar maturity, underwriters and issuers appear to have trouble in pricing these bonds accurately.

The results of estimating equation (1) and various special cases are presented in Table 3. When all the data is used (equations (3.1)-(3.3)), the signs of the estimated coefficients on the ratings variables are completely consistent with the results reported in Table 2, namely, as the rating of a bond worsens, the degree of overpricing also worsens. Surprisingly, first issues would appear to have a smaller degree of overpricing than seasoned issues. For the full sample, the evidence of competition affecting the degree of overpricing is rather weak. However, when the bonds are grouped according to their rating, the significance of the impact of first issues is group dependent. The impact of the competition variables is much stronger when the bonds are grouped according to the rating, but the direction of the impact for one variable varies across groups, and for A rated bonds the impact of the two competition variables appear to work in opposite directions.

ACKNOWLEDGMENTS

Both authors gratefully acknowledge the financial assistance provided by the Japan Society for the Promotion of Science (JSPS) Grant in Aid for Scientific Research (B) No. 21330079 for a project on "A Dynamic Analysis of Price Formation in Securities Markets".

REFERENCES

Cai, N. J. Helwege and A. Warga (2007), Underpricing in the corporate bond market. *Review of Financial Studies*, 20(6), 2021-2046.

[5] For example, for a five year corporate bond we first searched for a five year government bond that was issued just before the corporate bond. If such a government bond was not available, we then searched for a six year bond that had a period to maturity that was as close as possible to the maturity of the corporate bond. If there were no such bonds, we used a ten year government with a remaining maturity that was as close as possible to the maturity of the corporate bond. In this case, the coupon rates could be quite different.

Datta, S., M. Iskandar-Datta and A. Patel (1997), The pricing of initial public offers of corporate straight debt., *Journal of Finance*, 52(1), 379-396.

Greene, W.H. (2007a), *LIMDEP Version 9.0 - Econometric Modeling Guide, Volume 1*, Econometric Software, Plainview, NY.

Greene, W.H. (2007b), *LIMDEP Version 9.0 - Econometric Modeling Guide, Volume 2*, Econometric Software, Plainview, NY.

Handjinicolaou, G. and A. Kalay (1984), Wealth redistributions or changes in firm value: An analysis of returns to bondholders and stockholders around dividend announcements. *Journal of Financial Economics*, 13(1), 35-63.

Helwege, J. and P. Kleiman (1998), The pricing of high-yield debt IPOs. *Journal of Fixed Income*, 8(2), 61-68.

Jarque, C.M. and A.K. Bera (1980), Efficient tests for normality, heteroskedasticity and serial independence of regression residuals. *Economics Letters*, 6, 2552-259.

Matsui, K. (2000), 'Futsu shasai no hikeuke kyoso to hakko rimawari (Underwriting competition for straight corporate bonds and issuing returns), *Gendai Fainansu*, 8, 55-83 (in Japanese).

Matsui, K. (2006), Overpricing of new issues in the Japanese straight bond market. *Applied Financial Economics Letters*, 2(5), 323-327.

Matsui, K. (2008), Application of the auction theory to the overpricing phenomenon in a corporate bond underwriting market. *Applied Financial Economics Letters*, 4(6), 457-460.

Matsuo, J. (1999), *Nihon no Shasai Shijo (Japanese Corporate Bond Market)*, Toyo Keizai Shinposha, Tokyo (in Japanese).

McAfee, R.P. and J. McMillan (1987), Auctions and bidding. *Journal of Economic Literature*, 25(2), 699-738.

Tokushima, K. (2000), *Gendai Shasai Toshi no Jitsuma: Shasai no Shijo no Ima wo Kangaeru (Current Business Practices for Corporate Bond Investment: Thnking about the Current State of the Corporate Bond Market)*, Zaikei Shohosha, Tokyo (in Japanese).

White, H. (1980), A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817-838.

Figure 1: Kernel Estimate of the Distribution of Excess Returns

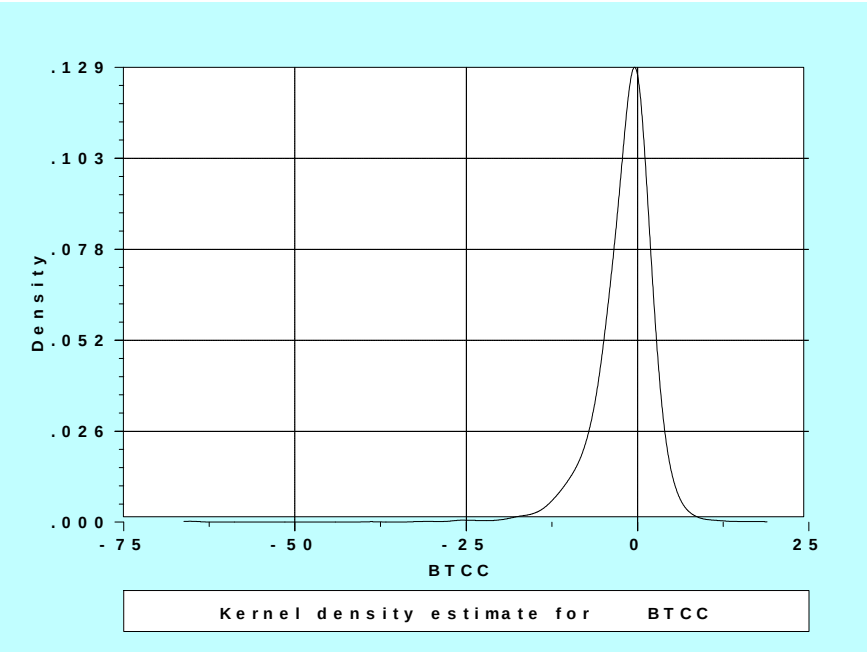

Table 1: Characteristics of Excess Returns over Time

	Full Sample	1992	1993	1994	1995	1996
Mean	−1.856	−0.786	−0.800	−2.086	−1.936	−1.920
t-Statistic	21.44***	1.73	4.00***	3.71***	5.51****	6.17***
Median	−1.038	−0.952	−0.629	−1.934	−1.084	−1.471
Maximum	18.046	4.156	3.048	3.484	5.222	2.179
Minimum	−38.840	−4.447	−9.437	−7.906	−11.380	−17.530
Jarque-Bera	7886***	1.62	443.7***	0.04	17.28***	318.6***
Proportion Overpriced	66.84	78.95	80.88	77.27	85.14	70.93
Sample Size	2247	19	68	22	74	86

	1997	1998	1999	2000	2001	2002
Mean	−1.836	−1.205	−3.709	−2.211	−0.897	−2.369
t-Statistic	7.85***	8.49***	13.54***	9.45***	4.13***	3.15***
Median	−0.938	−0.516	−2.777	−1.411	−0.630	−1.616
Maximum	8.649	12.226	18.046	4.796	14.999	7.484
Minimum	−22.408	−25.815	−31.920	−38.841	−17.829	−17.884
Jarque-Bera	263.8***	965.5***	420.2***	6075.0***	210.7***	5.10*
Proportion Overpriced	62.23	57.72	79.66	70.8	62.2	61.91
Sample Size	278	674	354	339	291	42

Notes:
(1) The t-statistic is the absolute value of the t statistic used to test the null hypothesis that the mean is zero.
(2)The Jarque-Bera (1980) test tests the normality of the observations
(3) ***, ** and * indicate the test statistic is significant at the 1%, 5% and 10% significance level, respectively.

Table 2: Characteristics of Excess Returns by Bond Rating

	AAA	AA	A	BBB
Mean	−0.755	−1.605	−2.030	−3.874
t-Statistic	3,76***	11.82***	16.27***	8.16***
Median	−0.370	−0.922	−1.238	−2.412
Maximum	15.000	11.713	12.226	18.046
Minimum	−22.408	−18.529	−38.841	−31.920
Jarque-Bera	857.9***	419.7***	4498.7***	245.1***
Percent Overpriced	55.99	65.85	68.66	81.18
Sample Size	284	238	1037	170

Notes:
(1) As for Table 1.

Table 3: Models Explaining the Degree of Overpricing

	Full Sample			AAA Rated Bonds		AA Rated Bonds		A Rated Bonds		BBB Rated Bonds	
Equation No	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)
Constant	−2.462	−2.302	−2.216	−3.619	−0.212	−1.761	−0.072	−2.526	−6.703	−9.73	−6.314
	(5.57)***	(3.85)***	(2.98)***	(2.28)**	(0.15)	(5.08)***	(0.59)	(3.80)***	(5.64)***	(3.55)***	(1.37)
Maturity	0.236	0.233	0.237	0.274	0.193	0.147	0.194	0.288	0.3	0.494	0.676
	(5.36)***	(4.96)***	(5.36)***	(2.29)**	(1.81)*	(5.08)***	(2.84)***	(3.97)***	(4.37)***	(0.95)	(1.68)*
First Issue	0.697	0.879	0.705	−0.875	−1.087	1.051	0.805	0.587	0.278	1.965	2.583
	(2.37)**	(2.93)***	(2.39)**	(0.99)	(1.16)	(5.08)***	(1.69)*	(1.62)	(0.77)	(1.59)	(2.13)**
Herfindahl		−0.0011		0.001		−0.002		−0.003		0.005	
		(1.81)*		(0.62)		(2.28)**		(2.92)***		(2.33)**	
Number of			−0.011		−0.079		−0.113		0.111		−0.064
Underwriters			(0.38)		(1.24)		(2.53)**		(2.74)***		(0.30)
DAA	−0.812	−0.592	−0.791								
	(2.86)***	(1.86)*	(2.68)**								
DAA	−1.065	−0.813	−1.043								
	(3.69)***	(2.50)**	(3.47)***								
DBBB	−2.953	−2.883	−2.956								
	(5.08)***	(4.12)***	(5.08)***								
Sample Size	2042	1726	2042	178	234	580	679	848	975	120	154
R^2	0.05	0.05	0.05	0.04	0.02	0.02	0.02	0.02	0.03	0.05	0.04

Notes:

(1) All figures in parentheses are the absolute values of asymptotic t−statistics computed using White's (1980) heteroskedastic consistent standard errors.

(2) The base case is a seasoned bond with an AAA rating.

(3) ***, ** and * indicate the coefficient is statistically significant at the 1%, 5% and 10% significance levels, respectively.