

Corporate Solvency and Capital Structure: The Case of the Electric Appliances Industry Firms of the Tokyo Stock Exchange

Chikashi Tsuji¹

¹ Faculty of Economics, Chuo University, Tokyo, Japan

Correspondence: Chikashi Tsuji, Faculty of Economics, Chuo University, 742-1 Higashinakano Hachioji-shi, Tokyo 192-0393, Japan. Tel: 81-42-674-2211. E-mail: mail_sec_low@minos.ocn.ne.jp

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Abstract

This study examines the linkages between corporate solvency and capital structure of the electric appliances industry firms which are listed on the Tokyo Stock Exchange. When we consider and use some theories, different relationships between corporate solvency and leverage ratio are derived. In this study, we clarify that in the Japanese electric appliances industry, the linkages between corporate solvency and debt ratio are generally negative. Further, we also reveal that about 50% to 60% of the ratio of total debt to total asset can be explained by our corporate solvency variables.

Keywords: capital structure, debt ratio, corporate solvency, Japanese electric appliances industry, panel data analysis

1. Introduction

There exist several important and interesting theories of corporate capital structure and they suggest some determinants of corporate leverage ratio. For instance, the trade-off theory argues that taxation and bankruptcy costs are important for firms' leverage structures. In addition, the pecking order theory suggested by Myers (1984) insists that firms' financing orders (firstly retained earnings, secondly debt, and finally equity) are important for firms' leverage structures. Furthermore, a recent concept of the market timing hypothesis indicates that the financing timing based on the conditions of capital markets is important for corporate leverage structures. Further, agency theory advocates that the free cash flow problems and being disciplined by leverage are important for firms' debt structures. Based on these theories, in the US, many corporate capital structure determinants were empirically tested by such studies as Frank and Goyal (2009), Lemmon et al. (2008), Hartford et al. (2009), Margaritis and Psillaki (2010), Gungoraydinoglu and Öztekin (2011), and Fier et al. (2013). Moreover, there are further several recent studies on the corporate capital structure in the US such as Cook and Tang (2010), Bliss and Gul (2012), Colla et al. (2012), Devos et al. (2012), Dudley (2012), Duru et al. (2012), Lin et al. (2012), Paligorova and Xu (2012), and Eisdorfer et al. (2013); however, as far as we know, there would be little empirical research on the capital structure with a focus on the corporate solvency as our present study.

Based on the above research backgrounds and motivations, the objective of this study is to investigate the relations between corporate solvency and corporate capital structure. In this study, we focus on the corporate solvency and debt ratios of the electric appliances industry firms listed on the Tokyo Stock Exchange (TSE) First Section. This Japanese electric appliances industry is one of the most representative industries in the Japanese stock markets. Our contributions of this paper are as follows. First, we clarify that in the Japanese industry, the linkages between corporate solvency and debt ratio are generally negative. Next, we also reveal that about 50% to 60% of the ratio of total debt to total asset can be explained by our variables of corporate solvency. Third, we also find that in the Japanese electric appliances industry, liquid debt plays more important role in considering the linkages between corporate solvency and capital structure. The rest of this paper is organized as follows. First, Section 2 discusses several related matters, Section 3 explains our data and methodologies of analyses, Section 4 describes our empirical results and interpretations, and Section 5 concludes the paper.

2. Discussion

In this section, we discuss the relationships between corporate solvency and corporate leverage by using the predictions from several theories. First, when companies have high solvency, these firms' financial distress costs

should be low. Thus for the high solvency firms, the tax shield effects should be more valuable. As a result, from the viewpoints of the tax shield effect and lower distress cost, theoretically, high solvency firms can borrow more and have high debt ratios.

Second, from the agency cost viewpoint (Jensen (1986)), high solvency firms have a tendency to face severe free cash flow problems and should have more debt to be disciplined by the debt. Thus in accordance with the agency theory, ideal linkages between corporate solvency and debt ratio should be positive.

Third, as Myers (1984) suggests, the pecking order theory advocates that firms use internal funds first, and then use external funds. In general, stronger solvency firms have more internal funds; hence they should use less debt. Hence from the viewpoint of the pecking order theory, the relations between corporate solvency and firm leverage should be negative.

Apart from the above theoretical predictions, we can discuss as follows. First, high corporate solvency firms are generally profitable and sound companies. In such firms, there are enough internal funds, and there is little need to borrow so much in general. Therefore, without using the pecking order theory, we can generally predict that the linkage of corporate solvency ratios and leverage ratio shall be negative.

3. Data and Methodology

Our data in this paper are the stacked firm data. The sample period is from the fiscal year of 1981 to 2011, and the data to make all variables are from the Quick Corp. In our analyses, we exploit the panel regressions. The dependent variables in our regressions are the TSE First Section electric appliances industry firms' debt ratios; more concretely, we use two types of leverage ratios. Namely, the first is the variable LDA, which is the (book-value) fixed liability to (book-value) total asset ratio, and the second is the variable TDA, which is the (book-value) total debt to (book-value) total asset ratio.

As to the explanatory variables, ICR denotes the interest coverage ratio, LIQ denotes the short-term liquidity ratio, DI denotes the interest rates of the debt with interest, IEBIT denotes the interest and discount received to the earnings before interest and tax ratio, IEBITDA denotes the interest and discount received to the earnings before interest, taxes, depreciation, and amortization ratio, EBITEQ denotes the earnings before interest and tax ratio to the shareholders' equity ratio, and EBITDAEQ denotes the earnings before interest, taxes, depreciation, and amortization to the shareholders' equity ratio. Moreover, we exploit three sorts of control variables: LNSIZE denotes the log natural of market capitalization; TANG means the tangible fixed asset to total asset ratio, and OLD means the number of the years after the establishment of each firm.

In our panel data analyses, we exploit several models. The first is the single corporate solvency variable models with three control variables as the following pooled regressions (1) and (2).

$$LDA_{i,t} = \delta_0 + \delta_1 X_{i,t} + \delta_2 LNSIZE_{i,t} + \delta_3 TANG_{i,t} + \delta_4 OLD_{i,t} + \mu_{i,t} \quad (1)$$

$$LDA_{i,t+1} = \delta_0 + \delta_1 X_{i,t} + \delta_2 LNSIZE_{i,t} + \delta_3 TANG_{i,t} + \delta_4 OLD_{i,t} + \mu_{i,t+1} \quad (2)$$

Where $X_{i,t}$ is the corporate solvency variable, namely, ICR, LIQ, DI, IEBIT, IEBITDA, EBITEQ, or EBITDAEQ. We also test the following two types of full models (3) and (4).

$$LDA_{i,t} = \varphi_0 + \varphi_1 ICR_{i,t} + \varphi_2 LIQ_{i,t} + \varphi_3 DI_{i,t} + \varphi_4 IEBIT_{i,t} + \varphi_5 IEBITDA_{i,t} + \varphi_6 EBITEQ_{i,t} + \varphi_7 EBITDAEQ_{i,t} + \varphi_8 LNSIZE_{i,t} + \varphi_9 TANG_{i,t} + \varphi_{10} OLD_{i,t} + \kappa_{i,t} \quad (3)$$

$$LDA_{i,t+1} = \varphi_0 + \varphi_1 ICR_{i,t} + \varphi_2 LIQ_{i,t} + \varphi_3 DI_{i,t} + \varphi_4 IEBIT_{i,t} + \varphi_5 IEBITDA_{i,t} + \varphi_6 EBITEQ_{i,t} + \varphi_7 EBITDAEQ_{i,t} + \varphi_8 LNSIZE_{i,t} + \varphi_9 TANG_{i,t} + \varphi_{10} OLD_{i,t} + \kappa_{i,t+1} \quad (4)$$

Next, our second single corporate solvency variable models are the following pooled regression models (5) and (6).

$$TDA_{i,t} = \delta_0 + \delta_1 X_{i,t} + \delta_2 LNSIZE_{i,t} + \delta_3 TANG_{i,t} + \delta_4 OLD_{i,t} + \mu_{i,t} \quad (5)$$

$$TDA_{i,t+1} = \delta_0 + \delta_1 X_{i,t} + \delta_2 LNSIZE_{i,t} + \delta_3 TANG_{i,t} + \delta_4 OLD_{i,t} + \mu_{i,t+1} \quad (6)$$

Where $X_{i,t}$ is the same corporate solvency variable as in regressions (1) and (2). Moreover, we also test the following two full models (7) and (8) for explaining TDA.

$$TDA_{i,t} = \varphi_0 + \varphi_1 ICR_{i,t} + \varphi_2 LIQ_{i,t} + \varphi_3 DI_{i,t} + \varphi_4 IEBIT_{i,t} + \varphi_5 IEBITDA_{i,t} + \varphi_6 EBITEQ_{i,t} + \varphi_7 EBITDAEQ_{i,t} + \varphi_8 LNSIZE_{i,t} + \varphi_9 TANG_{i,t} + \varphi_{10} OLD_{i,t} + \kappa_{i,t} \quad (7)$$

$$TDA_{i,t+1} = \varphi_0 + \varphi_1 ICR_{i,t} + \varphi_2 LIQ_{i,t} + \varphi_3 DI_{i,t} + \varphi_4 IEBIT_{i,t} + \varphi_5 IEBITDA_{i,t} + \varphi_6 EBITEQ_{i,t} + \varphi_7 EBITDAEQ_{i,t} + \varphi_8 LNSIZE_{i,t} + \varphi_9 TANG_{i,t} + \varphi_{10} OLD_{i,t} + \kappa_{i,t+1} \quad (8)$$

4. Empirical Results and Interpretations

First, we display the descriptive statistics for our variables of the TSE First Section electric appliances industry firms in Table 1. Those displayed are the statistics of the stacked data for the fiscal year from 1981 to 2011. Thus we can overview the statistic characteristics of the data from this table. The numbers of the pooled data are in cross-section, 72, in time-series, 31-years, and 2232 stacked data.

Table 1. Descriptive statistics for the analyzed variables of the Tokyo Stock Exchange electric appliances industry firms: Balanced panel data for the fiscal year from 1981 to 2011

	TDA	LDA	LNSIZE	TANG	OLD	ICR
Mean	0.575	0.178	4.519	0.175	58.856	52.945
Median	0.574	0.170	4.280	0.162	57.321	5.048
Std. Dev.	0.161	0.089	1.635	0.076	15.682	542.180
Skewness	-0.151	0.426	0.566	0.882	0.539	18.963
Kurtosis	2.592	2.760	2.727	4.161	2.904	410.674
Obs.(CS)	72	72	72	72	72	72
Obs.(TS)	31	31	31	31	31	31
Obs.(Panel)	2232	2232	2232	2232	2232	2232
	LIQ	DI	IEBIT	IEBITDA	EBITEQ	EBITDAEQ
Mean	2.221	4.054	52.997	72.802	0.113	0.208
Median	1.684	3.014	4.892	8.902	0.109	0.182
Std. Dev.	3.230	4.187	553.959	689.487	0.207	0.173
Skewness	16.206	6.934	19.113	18.538	-18.060	-0.526
Kurtosis	379.366	88.488	413.774	385.181	562.845	54.080
Obs.(CS)	72	72	72	72	72	72
Obs.(TS)	31	31	31	31	31	31
Obs.(Panel)	2232	2232	2232	2232	2232	2232

Notes: This table shows the descriptive statistics for the variables of the electric appliances industry firms listed on the Tokyo Stock Exchange First Section. The data are balanced panel data from the fiscal year of 1981 to 2011. In the table, TDA denotes the total debt (book-value) to total asset (book-value) ratio and LDA denotes the fixed liability (book-value) to total asset (book-value) ratio. These two are the dependent variables of our pooled regressions. In addition, LNSIZE denotes the log natural of market capitalization, TANG denotes the tangible fixed asset to total asset ratio, and OLD denotes the number of the years after the establishment of each firm. These three are the control variables of our pooled regressions. Further, ICR denotes the interest coverage ratio, LIQ denotes the short-term liquidity ratio, DI denotes the interest rates of the debt with interest, IEBIT denotes the interest and discount received to the earnings before interest and tax ratio, IEBITDA denotes the interest and discount received to the earnings before interest, taxes, depreciation, and amortization ratio, EBITEQ denotes the earnings before interest and tax ratio to the shareholders' equity ratio, and EBITDAEQ denotes the earnings before interest, taxes, depreciation, and amortization to the shareholders' equity ratio. These seven variables are the explanatory variables of our pooled regressions. Furthermore, Std. Dev. denotes the standard deviation of each variable, Obs. (Panel) means the number of the pooled data, Obs. (TS) means the number of the time-series data, and Obs. (CS) means the number of the cross-sectional data in each year.

Table 2. The relations between corporate solvency and the same year's capital structure measured by the fixed liabilities to total asset ratio: The case of the Tokyo Stock Exchange electric appliances industry firms

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Const.	0.091***	0.084***	-13.800***	0.091***	0.091***	0.099***	0.095***	0.127***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ICR	-2.0E-05***							-0.0003***
<i>p</i> -value	0.000							0.002
LIQ		0.002***						0.002***
<i>p</i> -value		0.000						0.000
DI			0.426***					-0.004***
<i>p</i> -value			0.000					0.000
IEBIT				-1.9E-05***				0.001***
<i>p</i> -value				0.000				0.000
IEBITDA					-1.6E-05***			-0.0003***
<i>p</i> -value					0.000			0.000
EBITEQ						-0.031***		-0.079***
<i>p</i> -value						0.001		0.000
EBITDAEQ							-0.014	0.070***
<i>p</i> -value							0.132	0.000
LNSIZE	0.002*	0.001	-1.605***	0.001*	0.002*	0.001	0.001	0.002*
<i>p</i> -value	0.096	0.611	0.000	0.100	0.100	0.197	0.204	0.053
TANG	0.118***	0.124***	0.034	0.118***	0.118***	0.117***	0.125***	0.081***
<i>p</i> -value	0.000	0.000	0.335	0.000	0.000	0.000	0.000	0.000
OLD	0.001***	0.001***	-0.046	0.001***	0.001***	0.001***	0.001***	0.001***
<i>p</i> -value	0.000	0.000	0.205	0.000	0.000	0.000	0.000	0.000
<i>Adj. R</i> ²	0.060	0.071	0.071	0.060	0.061	0.055	0.052	0.136
Obs.(CS)	72	72	72	72	72	72	72	72
Obs.(Panel)	2232	2232	2232	2232	2232	2232	2232	2232

Notes: This table shows the results of the panel data analyses with respect to the capital structure determinants of the Japanese electric appliances industry firms listed on the Tokyo Stock Exchange First Section. The analyzing period is from the fiscal year of 1981 to 2011. In this table, the dependent variable is the same year's Japanese electric appliances industry firm's capital structure variable, the fixed liability (book-value) to total asset (book-value) ratio. As to the explanatory variables, ICR denotes the interest coverage ratio, LIQ denotes the short-term liquidity ratio, DI denotes the interest rates of the debt with interest, IEBIT denotes the interest and discount received to earnings before interest and tax ratio, IEBITDA denotes the interest and discount received to earnings before interest, taxes, depreciation, and amortization ratio, EBITEQ denotes the earnings before interest and tax to shareholders' equity ratio, and EBITDAEQ denotes the earnings before interest, taxes, depreciation, and amortization to shareholders' equity ratio. Moreover, we employ three control variables in all regressions: LNSIZE denotes the log natural of market capitalization, TANG denotes the tangible fixed asset to total asset ratio, and OLD denotes the number of the years after establishment of each firm. In addition, Const. in this table means the constant term of regressions. Further, Obs. (Panel) means the number of pooled data, Obs. (CS) means the number of cross-sectional data in each year, and *Adj. R*² is the adjusted *R*-squared value. Furthermore, *** denotes the statistical significance of the coefficients at the 1% level, ** denotes the statistical significance of the coefficients at the 5% level, and * denotes the statistical significance of the coefficients at the 10% level, respectively.

Table 3. The relations between corporate solvency and the next year's capital structure measured by the fixed liabilities to total asset ratio: The case of the Tokyo Stock Exchange electric appliances industry firms

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Const.	0.095***	0.085***	0.129***	0.095***	0.094***	0.100***	0.098***	0.121***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ICR	-2.0E-05***							-0.0003***
<i>p</i> -value	0.000							0.004
LIQ		0.003***						0.002***
<i>p</i> -value		0.000						0.000
DI			-0.003***					-0.004***
<i>p</i> -value			0.000					0.000
IEBIT				-1.9E-05***				0.001***
<i>p</i> -value				0.000				0.000
IEBITDA					-1.6E-05***			-0.0002***
<i>p</i> -value					0.000			0.000
EBITEQ						-0.019**		-0.033*
<i>p</i> -value						0.041		0.051
EBITDAEQ							-0.013	0.029*
<i>p</i> -value							0.157	0.085
LNSIZE	0.002**	0.001	0.003***	0.002**	0.002**	0.002**	0.002**	0.003***
<i>p</i> -value	0.012	0.153	0.004	0.013	0.012	0.038	0.034	0.004
TANG	0.127***	0.132***	0.120***	0.127***	0.128***	0.127***	0.134***	0.109***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OLD	0.001***	0.001***	0.0005***	0.001***	0.001***	0.001***	0.001***	0.001***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Adj. R</i> ²	0.055	0.062	0.075	0.055	0.056	0.048	0.047	0.107
Obs.(CS)	72	72	72	72	72	72	72	72
Obs.(Panel)	2160	2160	2160	2160	2160	2160	2160	2160

Notes: This table shows the results of the panel data analyses with respect to the capital structure determinants of the Japanese electric appliances industry firms listed on the Tokyo Stock Exchange First Section. The analyzing period is from the fiscal year of 1981 to 2011. In this table, the dependent variable is the next year's Japanese electric appliances industry firm's capital structure variable, the fixed liability (book-value) to total asset (book-value) ratio. As to the explanatory variables, ICR denotes the interest coverage ratio, LIQ denotes the short-term liquidity ratio, DI denotes the interest rates of the debt with interest, IEBIT denotes the interest and discount received to earnings before interest and tax ratio, IEBITDA denotes the interest and discount received to earnings before interest, taxes, depreciation, and amortization ratio, EBITEQ denotes the earnings before interest and tax to shareholders' equity ratio, and EBITDAEQ denotes the earnings before interest, taxes, depreciation, and amortization to shareholders' equity ratio. Moreover, we employ three control variables in all regressions: LNSIZE denotes the log natural of market capitalization, TANG denotes the tangible fixed asset to total asset ratio, and OLD denotes the number of the years after establishment of each firm. In addition, Const. in this table means the constant term of regressions. Further, Obs. (Panel) means the number of pooled data, Obs. (CS) means the number of cross-sectional data in each year, and *Adj. R*² is the adjusted *R*-squared value. Furthermore, *** denotes the statistical significance of the coefficients at the 1% level, ** denotes the statistical significance of the coefficients at the 5% level, and * denotes the statistical significance of the coefficients at the 10% level, respectively.

Table 4. The relations between corporate solvency and the same year's capital structure measured by the total debt to total asset ratio: The case of the Tokyo Stock Exchange electric appliances industry firms

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Const.	0.593***	0.610***	0.561***	0.593***	0.592***	0.552***	0.471***	0.507***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ICR	-0.51E-05***							-0.001***
<i>p</i> -value	0.000							0.000
LIQ		-0.006***						-0.002**
<i>p</i> -value		0.000						0.013
DI			0.004***					-0.001***
<i>p</i> -value			0.000					0.001
IEBIT				-4.9E-05***				0.001***
<i>p</i> -value				0.000				0.000
IEBITDA					-4.2E-05***			-0.0004***
<i>p</i> -value					0.000			0.000
EBITEQ						0.193***		-0.743***
<i>p</i> -value						0.000		0.000
EBITDAEQ							0.461***	1.089***
<i>p</i> -value							0.000	0.000
LNSIZE	-0.024***	-0.024***	-0.025***	-0.024***	-0.024***	-0.024***	-0.024***	-0.022***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TANG	0.076	0.098***	0.070**	0.076**	0.078**	0.069**	-0.160***	-0.472***
<i>p</i> -value	0.020	0.003	0.030	0.021	0.018	0.031	0.000	0.000
OLD	0.001***	0.001***	0.002***	0.001***	-0.001***	0.002***	-0.002***	0.002***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Adj. R</i> ²	0.202	0.199	0.206	0.202	0.203	0.237	0.432	0.568
Obs.(CS)	72	72	72	72	72	72	72	72
Obs.(Panel)	2232	2232	2232	2232	2232	2232	2232	2232

Notes: This table shows the results of the panel data analyses with respect to the capital structure determinants of the Japanese electric appliances industry firms listed on the Tokyo Stock Exchange First Section. The analyzing period is from the fiscal year of 1981 to 2011. In this table, the dependent variable is the same year's Japanese electric appliances industry firm's capital structure variable, the total debt (book-value) to total asset (book-value) ratio. As to the explanatory variables, ICR denotes the interest coverage ratio, LIQ denotes the short-term liquidity ratio, DI denotes the interest rates of the debt with interest, IEBIT denotes the interest and discount received to earnings before interest and tax ratio, IEBITDA denotes the interest and discount received to earnings before interest, taxes, depreciation, and amortization ratio, EBITEQ denotes the earnings before interest and tax to shareholders' equity ratio, and EBITDAEQ denotes the earnings before interest, taxes, depreciation, and amortization to shareholders' equity ratio. Moreover, we employ three control variables in all regressions: LNSIZE denotes the log natural of market capitalization, TANG denotes the tangible fixed asset to total asset ratio, and OLD denotes the number of the years after establishment of each firm. In addition, Const. in this table means the constant term of regressions. Further, Obs. (Panel) means the number of pooled data, Obs. (CS) means the number of cross-sectional data in each year, and *Adj. R*² is the adjusted *R*-squared value. Furthermore, *** denotes the statistical significance of the coefficients at the 1% level, ** denotes the statistical significance of the coefficients at the 5% level, and * denotes the statistical significance of the coefficients at the 10% level, respectively.

Table 5. The relations between corporate solvency and the next year's capital structure measured by the total debt to total asset ratio: The case of the Tokyo Stock Exchange electric appliances industry firms

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Const.	0.571***	0.600***	0.531***	0.571***	0.570***	0.546***	0.459***	0.497***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ICR	-0.51E-05***							-0.001***
<i>p</i> -value	0.000							0.000
LIQ		-0.010***						-0.004***
<i>p</i> -value		0.000						0.000
DI			0.004***					-0.0004
<i>p</i> -value			0.000					0.383
IEBIT				-4.8E-05***				0.001***
<i>p</i> -value				0.000				0.000
IEBITDA					-4.1E-05***			-0.0003***
<i>p</i> -value					0.000			0.000
EBITEQ						0.124***		-0.713***
<i>p</i> -value						0.000		0.000
EBITDAEQ							0.400***	0.995***
<i>p</i> -value							0.000	0.000
LNSIZE	-0.023***	-0.023***	-0.024***	-0.023***	-0.023***	-0.024***	-0.023***	-0.021***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TANG	0.097***	0.129***	0.091***	0.097***	0.098***	0.093***	-0.091***	-0.393***
<i>p</i> -value	0.004	0.000	0.006	0.004	0.003	0.005	0.003	0.000
OLD	0.002***	0.001***	0.002***	0.002***	0.002***	0.002***	0.003***	0.002***
<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Adj. R</i> ²	0.209	0.210	0.215	0.209	0.210	0.220	0.373	0.512
Obs.(CS)	72	72	72	72	72	72	72	72
Obs.(Panel)	2160	2160	2160	2160	2160	2160	2160	2160

Notes: This table shows the results of the panel data analyses with respect to the capital structure determinants of the Japanese electric appliances industry firms listed on the Tokyo Stock Exchange First Section. The analyzing period is from the fiscal year of 1981 to 2011. In this table, the dependent variable is the next year's Japanese electric appliances industry firm's capital structure variable, the total debt (book-value) to total asset (book-value) ratio. As to the explanatory variables, ICR denotes the interest coverage ratio, LIQ denotes the short-term liquidity ratio, DI denotes the interest rates of the debt with interest, IEBIT denotes the interest and discount received to earnings before interest and tax ratio, IEBITDA denotes the interest and discount received to earnings before interest, taxes, depreciation, and amortization ratio, EBITEQ denotes the earnings before interest and tax to shareholders' equity ratio, and EBITDAEQ denotes the earnings before interest, taxes, depreciation, and amortization to shareholders' equity ratio. Moreover, we employ three control variables in all regressions: LNSIZE denotes the log natural of market capitalization, TANG denotes the tangible fixed asset to total asset ratio, and OLD denotes the number of the years after establishment of each firm. In addition, Const. in this table means the constant term of regressions. Further, Obs. (Panel) means the number of pooled data, Obs. (CS) means the number of cross-sectional data in each year, and *Adj. R*² is the adjusted *R*-squared value. Furthermore, *** denotes the statistical significance of the coefficients at the 1% level, ** denotes the statistical significance of the coefficients at the 5% level, and * denotes the statistical significance of the coefficients at the 10% level, respectively.

We next exhibit the results of our panel regressions in Tables 2 to 5. From Tables 2 to 3, we first understand that the relationships between corporate solvency and debt ratio used the fixed liability are statistically significantly negative in general. Further, the results of our full models (3) and (4) shown in Tables 2 and 3 indicate that only about 10% of the LDA can be explained by our corporate solvency variables. Next, from the results shown in Tables 4 to 5, we understand that the linkages between corporate solvency and debt ratio used the total debt are

also statistically significantly negative in general. Moreover, the results of our full models (7) and (8) displayed in Tables 4 and 5 suggest that about 50% to 60% of the TDA can be successfully explained by our corporate solvency variables.

Next is the interpretation of our results. We consider that first, (1) our discussions and predictions based on the tax shield effect and the distress cost perspectives are not empirically supported. Next, (2) our discussions and predictions based on the agency cost theory are not empirically supported either. Third, (3) our discussions and predictions based on the pecking order theory are empirically supported. Fourth, (4) our following predictions documented in the discussion section are generally empirically supported. Namely, because high corporate solvency firms are profitable and sound companies, thus there is little need to borrow so much and hence the relationships between corporate solvency ratios and leverage ratio are generally negative.

We should also interpret the strong explanatory power of EBITEQ and EBITDAEQ with positive signs as shown in Tables 4 and 5 as follows. Namely, we consider that these two might not be pure corporate solvency variables but ones that measure the effectiveness of corporate profitability. Thus we may judge that, in general, in the Japanese electric appliances industry, corporate solvency and leverage ratio are negatively related.

5. Conclusions

This paper investigated the relations between corporate solvency and leverage ratio in the Japanese electric appliances firms of the TSE First Section. We clarified that the connections between corporate solvency and leverage ratio were generally negative. Further, our empirical tests revealed that 50% to 60% of the total debt to total asset ratio could be successfully explained by our corporate solvency variables. In addition, we can derive several interpretations from our results by discussing related theories and their predictions. First, in analyzing the relations between corporate solvency and capital structure, (1) the distress cost and the tax shield effect perspectives cannot be applied; second, (2) the agency cost theory cannot be applied either, on the other hand; third, (3) the pecking order theory can be effectively applied. Moreover, we revealed that the explanatory power of our corporate solvency variables for the total debt to total asset ratio is much stronger than for the fixed liabilities to total asset ratio. This would be one of the most representative characteristics of the capital structures of the Japanese electric appliances industry firms. Therefore, we note that it is important to pay attention to the operating and financing characteristic in each industry in order to understand the corporate capital structure in the real world.

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