Capital structure and the financial crisis

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ABSTRACT

The financial crisis on the late 2000s had a major impact on the financial markets, greatly reducing security issuance by firms and lending by financial institutions. One of the consequences of the disruption of the capital and lending markets caused by the financial crisis was to significantly increase the amount of debt in firm capital structures. Specifically, it is shown that between 2006 and 2008 the financial crisis and simultaneous recession caused sample firms to increase their market debt ratios (MDRs) by, on average, 5.5%. After eliminating the effects of the recession on firm capital structure it was found that almost all (5.1%) of the debt accumulation that occurred was a consequence of the financial crisis. Additionally, it was found that the effect of the financial crisis on firm capital structure was almost completely reversed by the end of 2010. An analysis using book debt ratios (BDRs) found similar, but smaller, financial crisis effects.

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INTRODUCTION

In the late 2000s, a financial crisis began in the United States and quickly spread to Europe and other parts of the world (Aubuchon and Wheelock (2009)). The net effect of the financial crisis was to greatly disrupt the financial markets, reduce the amount of debt and equity capital financing available to businesses and to create a severe recession in the U. S. and other countries. The genesis of the crisis was defaults on subprime mortgage loans and debt instruments backed by those types of loans (Mizen 2008)). One of the first indications that defaults on subprime mortgages were going to create problems in other sectors of the financial industry occurred in July of 2007 when Bear Stearns announced that the assets held by two of its subprime hedge funds had become nearly worthless. The major indication that subprime mortgage defaults were creating problems in other markets was the collapse of the auction rate securities market in February of 2008. The failure of buyers to bid at the auction of these securities essentially ended the market for these securities. The first collapse of a major financial institution came in March of 2008 when Bear Stearns approached bankruptcy. The purchase of Bear Stearns by JP Morgan Chase, in a transaction financed by the NY Fed, forestalled an official bankruptcy but left little doubt that subprime mortgage loans and their associated collateralized debt obligations and credit default swaps threated many other large financial institutions in the U. S. This became even more apparent in early September of 2008 with the bankruptcy and government takeover of Fannie Mae and Freddie Mac. The next major event in the financial crisis was the bankruptcy of Lehman Brothers in mid-September of 2008. The next day the New York Fed bailed out a rapidly failing AIG with an $85 billion credit facility. As a consequence of the Bear Stearns, Lehman and AIG failures many financial institutions greatly reduced their lending to other financial institutions and business customers. To try to forestall further financial market effects of the subprime mortgage mess the TARP Act was passed and became law in October of 2008. Although TARP was successful in preventing the financial crisis from becoming worse, it did not result in a significant increase in lending by financial institutions (Kwan, *et al*. (2008)). As a result, the credit markets remained tight through at least 2010. As will be discussed in more detail below, the security issuance markets were also disrupted by the financial crisis.

The main purpose of this study is to ascertain the effect of the financial crisis on firm capital structure. Confounding the analysis is the fact that the financial crisis created a recession which, by itself, would be expected to affect firm capital structure. By adjusting for factors like reduced firm profitability that result from a recession, the capital structure effects attributable to the financial crisis can be identified. The analysis below shows that the financial crisis and recession of the late 2000s did result in significant changes in firm capital structure over the period. Specifically, the amount of debt in the sample firms' capital structures increased, on average, by 5.5% between 2006 and 2008. Once the worst part of the financial crisis passed, its effects were quickly reversed and by the end of 2010 the sample firms' capital structures had returned to near their pre-crisis levels.

SAMPLE SELECTION

For each year from 2001 through 2010 an initial sample of firms was taken from all firms listed on the current and research files of the COMPUSTAT data base. Firms in the financial services or utilities industries were excluded from all annual samples. To be included in the

initial sample for a year a firm must have had sufficient data available to calculate the firm's market and book debt ratios. A firm's market debt ratio (MDR) is defined to be book long-term debt divided by the market value of the firm. Firm market value is calculated as total assets less book common equity plus market common equity (common shares outstanding times share price). A firm's book debt ratio (BDR) is defined to be book long-term debt divided by total assets. This procedure yielded initial annual sample sizes ranging of from 4,008 to 5,452 firms.

EMPIRICAL ANALYSIS

Table 1 contains data on global debt and equity offering from 2007 through 2010 obtained from various issues of the year-end review published by the *Wall Street Journal*. Looking first at equity issuance, global equity issuance declined from $876 billion in 2007 to $471 billion in 2008 (a 46.2% decline). This decline was completely reversed in 2009 with global equity issuance rising to $903 billion. In 2010, equity issuance remained above the 2007 level at $893 million. In sum, this data suggests that the financial crisis significantly disrupted the new equity issuance market in 2008 but the effects of the financial crisis were completely reversed in 2009 and did not reappear in 2010. The financial crisis also appears to have had a significant effect on the new debt issuance market as debt issuance declined from $6,634 billion in 2007 to $4,244 billion in 2008 (a 36.0% decline). Debt issuance rebounded to $6,112 billion in 2009 and $6,048 billion in 2010 but still remained below 2007 levels. Looking at the debt issuance divided by equity issuance ratio (D/E) it is evident that the financial crisis also changed the financing mix of security issuers. The D/E ratio indicates that firms went from issuing 7.57 dollars of debt for every dollar of equity issued in 2007 to 9.01 dollars in 2008. In 2009, the D/E ratio declined to 6.77, a level lower than that in 2007, and remained at 6.77 in 2010. Evidently, the shift to more debt financing was a temporary artifact of the financial crisis and once the crisis passed firms attempted to reverse the debt accumulation that occurred in 2008. The above findings suggest that, on average, there should be a noticeable increase in the amount of debt in firms' capital structures in 2008 and that this debt accumulation should be reversed in subsequent years.

Table 2 contains the mean values of the MDRs and BDRs of the sample firms for each sample year. The mean MDR drifts up slightly from .143 in 2001 to .147 in 2002 and then, beginning in 2003, declines significantly through 2006. The major decreases in MDR occurred in 2003 and 2004 with the mean MDR dropping to .119 in 2003 and declining further to .102 in 2004. The MDR was relatively stable through 2006 when the mean was .100. Fosberg (2010) attributes this decrease (increase) in the amount of debt (equity) in firms' capital structures to the 2003 tax cuts. These tax cuts lowered the cost of equity capital for firms and, thereby, induced them to use more equity financing in their capital structures. Beginning in 2007, as the financial crisis takes hold, the amount of debt in the sample firms' capital structures begins to rise again. In 2007 the mean MDR rises to .111 and then rises dramatically to .155 in 2008. The difference in the mean values of the MDR in 2006 and 2008 of .055 is significant at the 1% level ($t = 15.9$). Thus, from 2006 to 2008 firms, on average, increased the amount of debt in their capital structures by 5.5%. Beginning in 2009 the upward trend in MDR trend reverses itself and MDR falls to .126 in 2009 and to .116 in 2010. To summarize, the data indicates that the effect on firm capital structure of the financial crisis and recession of the late 2000s began in 2007 and continued through 2008. However, once financial markets were stabilized in 2009 firms began to quickly reverse the debt accumulation that occurred in the previous two years. By the end of

2010, 70% of the debt accumulation that occurred in 2007 and 2008 had been reversed. A similar but weaker pattern of debt ratio changes is observed when capital structure is measured by BDR. The mean BDR declines from .172 in 2001 to .151 in 2004 and remains relatively stable through 2006 when it attains a value of .153. Mean BDR begins rising in 2007 and by 2008 reaches its peak of .169. The difference in the mean values of the BDR in 2006 and 2008 of .016 is significant at the 1% level (t = 4.09). Thereafter, mean BDR falls to .159 in 2009 and to .154 in 2010. Consequently, by the end of 2010, firms have reversed almost all the debt accumulation of 2007 and 2008. In sum, the data from table 2 shows the combined effects of the financial crisis and recession of the late 2000s resulted in a significant increase in the amount of debt in firm capital structures in 2007 and 2008 and that the debt accumulation was almost completely reversed by the end of 2010. Evidently, firms found the increase in debt in their capital structures that occurred in 2007 and 2008 undesirable and reversed it as soon as the financial crisis waned.

The data in table 2 shows the combined effects of the financial crisis and recession of the late 2000s on firm capital structure. Next, an empirical analysis is conducted in which the capital structure effects of the recession are controlled for and the effects of the financial crisis alone are ascertained. Numerous studies have shown that certain variables, like firm profitability and growth prospects, affects the amount of debt a firm employs in its capital structure. Any recession would be expected to cause changes in firm profitability and other capital structure determinants and, therefore, cause a change in firm capital structure. In the regression analysis which follows, control variables that have been shown to affect firm capital structure will be used to capture the effect of the recession on firm capita structure. Annual dummy variables will be added to the regressions to capture the effects of the financial crisis on firm capital structure in specific years. The set of control variables used in this analysis is similar to that used by Fama and French (2002) and Flannery and Rangan (2006). A brief discussion of these variables follows. For a more detailed discussion of these variables and their effect on firm capital structure see the above cited papers. As larger firms have been found to employ more debt in their capital structures, the natural log of total assets (Assets) is used as a size proxy. The profitability measure used is earnings before interest and taxes divided by total assets (EBIT). Firm profits have been shown to be inversely related to the amount of debt capital a firm employs. Property, plant and equipment divided by total assets (PPE) is used to proxy for the amount of tangible assets that a firm owns. More tangible assets are associated with a greater use of debt financing. Depreciation and amortization expense divided by total assets (Depr) is used to measure the quantity of non-debt tax shields a firm has available. Non-debt tax shields are inversely correlated with the amount of debt in a firm's capital structure. The market to book ratio (M/B) is used to capture company investment opportunities. The market to book ratio is calculated as total assets less book value of common equity plus market value of common equity divided by total assets. Firms with more investment opportunities generally employ less debt in their capital structures. Assets uniqueness is measured by research and development expense divided by total assets (R&D). The more unique a firm's assets the less debt they usually have in their capital structure. Annual dummy variables for each year from 2002 through 2010 (D02 through D10) are used to capture any effects on firm capital structure not accounted for by the control variables mentioned above. For example, D02 takes on a value of 1 is the capital structure data is from 2002 and zero, otherwise. Since the control variables should account for the effects of the recession on firm capital structure, the coefficients of the dummies should be

measuring the effects of other things, like the financial crisis of the late 2000s, on firm capital structure.

The dependent variable in the regressions is either MDR or BDR. $MDR_{i,t}$ represents the market debt ratio of firm i in year t. Lagged values of the control variables are used to mitigate any endogeneity problems associated with the regressions. The data from each year is combined and a single regression of the form

$$MDR_{i,t} = a_1 + a_2 Assets_{i,t-1} + a_3 EBIT_{i,t-1} + a_4 PPE_{i,t-1} + a_5 Depr_{i,t-1} + a_6 M/B_{i,t-1} + a_7 R\&D_{i,t-1} + Dummies + \varepsilon_{i,t}$$

is used to analyze the sample data. It is possible that the financial crisis could affect the values of the control variables in the above regression. To the extent that occurs, the coefficients of the dummy variables D07 through D10 will underestimate the effects of the financial crisis on firm capital structure. The results of this analysis, using MDRs as the dependent variable, are contained in the first two columns of Table 3. The t values of the regression coefficients in all regressions are calculated using White (1980) heteroscedasticity adjusted standard errors. With the full sample of firms, all of the coefficients of the control variables except one have the expected sign and four of those five coefficients are significant at the 5% level or better. Evidently, the traditional model of firm capital structure fits the sample data well.

Moving to the annual dummy variables, a negative coefficient indicates that the firm has less (more) than the predicted amount of debt (equity) in its capital structure. The coefficient of D02 (.002) is positive, small and insignificant suggesting that in 2002 the control variables, on average, accurately predict a firm's capital structure. That is, there is no tendency in 2002 for the sample firms to have more or less than the predicted amount of debt in their capital structures. For 2003, the dummy variable coefficient (-.028) is much larger (in absolute value), negative and significant at the 1% level. The dummy variable coefficient rises to -.042 in 2004 and continues drifting higher through 2006 (-.046). The dummy variable coefficients for 2004 through 2006 are all significant at the 1% level. Thus, by 2006 the sample firms have, on average, 4.6% less debt (more equity) in their capital structures than predicted by the control variables. Fosberg (2010) shows that the negative values of the coefficients of the dummy variables for 2003 through 2006 are likely caused by the cuts in personal tax rates that occurred in 2003. The dummy variable coefficient for 2007 (-.036) remains negative but is noticeably smaller than the 2006 coefficient. In 2008, the dummy variable coefficient (.005) becomes slightly positive and statistically insignificant. The .051 difference in the values of the coefficients of the dummy variables in 2006 and 2008 is significant at the 1% level (t = 11.3). The difference in the values of the coefficients for 2006 and 2008 indicates that, on average, the financial crisis caused the sample firms to employ 5.1% more debt in their capital structures in 2008 than they would have had otherwise. Comparing this to the 5.5% increase in mean MDR over this time period shown in table 2 indicates that the financial crisis caused almost all the debt accumulation observed between 2006 and 2008. The dummy coefficient declines to -.030 in 2009 and declines further to -.040 in 2010. This indicates that the debt accumulation caused by the financial crisis in 2007 and 2008 is almost completely reversed by the end of 2010.

Next, the analysis is repeated after trimming the sample to exclude firms with large operating losses and those with little or no debt in their capital structures. Firms with large operating losses may be in such poor financial condition that they are largely excluded from the capital markets and, therefore, could not fully adjust their capital structures to the desired level

during the financial crisis. Including these firms in the analysis would tend to result in an under estimation of the capital structure adjustment firms made during the financial crisis. A firm is defined to have a large operating loss if EBIT ≤ -.5. Firms with little or no debt in their capital structures could not significantly reduce the debt in their capital structures during the financial crisis even if they wished. Including these firms in the analysis might result in an overestimate of the amount of the increase in debt capital financing firms employed during the financial crisis. Low debt firms are defined to be firms with a MDR ≤ .03. Excluding these two groups of firms from the sample removes two possible sources of bias from the analysis. The results of the regression using the trimmed sample of firms in contained in column two of table 3 (Trim). Looking first at the control variables, the coefficients of all the control variables have the predicted sign and are significant at the 1% level. Thus, the control variables in the analysis with the trimmed sample are better capturing the effects of the recession on firm capital structure than they did in the full sample regression. The annual dummies are indicating a stronger effect of the financial crisis on firm capital structure than was observed in the full sample regression. The coefficients of the annual dummy variables went from -.058 in 2006 to .025 in 2008. The difference in their values of .083 is significant at the 1% level (t = 13.7). This suggests that the financial crisis caused firms to employ 8.3% more debt in their capital structures in 2008 than they would have otherwise. For the trimmed sample of firms, the mean MDR went from .182 in 2006 to .263 in 2008. This 8.1% increase in mean MDR over the 2006 to 2008 period is almost exactly the same as the 8.3% increase in leverage attributable to the financial crisis and implies that all the debt accumulation that occurred over this period is due to the financial crisis. The coefficient of the 2010 dummy of -.046 indicates that the debt accumulation had almost been completely reversed by the end of 2010.

The last two columns of table 3 contain the results of a similar regression analysis conducted using BDR as the dependent variable. The coefficient of the annual dummy variables in the full sample regression went from -.024 in in 2006 to -.013 in 2008. The .011 difference in coefficient values is significant at the 5% level (t = 2.24). This result is similar to, but smaller in magnitude, than the financial crisis effect on firm capital structure noted in the MDR regressions. The coefficient of the 2010 dummy of -.035 indicates that the debt accumulation caused by the financial crisis had been completely reversed by the end of 2010. A last regression using the trimmed sample of firms provided results very similar to those obtained using the full sample of firms.

CONCLUSION

The financial crisis on the late 2000s had a major impact on the financial markets, greatly reducing security issuance by firms and lending by financial institutions. One of the consequences of the disruption of the capital and lending markets caused by the financial crisis was to significantly increase the amount of debt in firm capital structures. Specifically, it is shown that between 2006 and 2008 the financial crisis and simultaneous recession caused sample firms to increase their market debt ratios (MDRs) by, on average, 5.5%. After eliminating the effects of the recession on firm capital structure it was found that almost all (5.1%) of the debt accumulation that occurred was a consequence of the financial crisis. Additionally, it was found that the effect of the financial crisis on firm capital structure was almost completely reversed by the end of 2010. An analysis using book debt ratios (BDRs) found similar, but smaller, financial crisis effects.

Table 1

Global Security Issuance

	Equity	Debt	D/E
2007	876b	6,634b	7.57
2008	471b	4,244b	9.01
2009	903b	6,112b	6.77
2010	893b	6,048b	6.77

b = billion

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Table 2

Firm Debt Ratios

	MDR	BDR
2001	.143	.172
2002	.147	.169
2003	.119	.164
2004	.102	.151
2005	.100	.151
2006	.100	.153
2007	.111	.160
2008	.155	.169
2009	.126	.159
2010	.116	.154

Table 3

Regression Analysis of Market and Book Debt Ratio Changes

Assets is the natural log of total assets. EBIT is the firm's earnings before interest and taxes divided by total assets ratio. Assets is the natural log of total assets. EBIT is the earnings before interest and taxes to total assets ratio. PPE is the net property, plant and equipment to total assets ratio. Depr is the depreciation and amortization expense to total assets ratio. M/B is the firm market value to book value ratio. R&D is the research and development expense to total assets ratio. D02 through D10 are the annual dummy variables for years 2002 through 2010. They take a value of one in the indicated year and zero, otherwise. The numbers in parentheses are t-values.

	MDR		**BDR**	
	Full	Trim	Full	Trim
Inter.	.018**	.262**	.017**	.210**
	(6.82)	(49.5)	(5.92)	(44.1)
Assets	.015**	.002**	.020**	.007**
	(53.1)	(5.23)	(63.0)	(14.1)
EBIT	-.001**	-.171**	-.001**	-.106**
	(2.70)	(16.4)	(2.81)	(9.97)
PPE	.197**	.133**	.218**	.131**
	(55.6)	(27.3)	(57.6)	(26.1)
Depr	-.005	-.248**	-.001	-.067*
	(1.76)	(8.53)	(0.45)	(2.00)
M/B	.000	-.028**	-.000	.005**
	(1.35)	(12.2)	(1.43)	(4.95)
R&D	-.010**	-.336**	-.007**	-.165**
	(2.70)	(14.6)	(3.81)	(8.00)

Table 3 continued

D02	.002	-.002	-.007**	-.015**
	(0.55)	(0.40)	(2.06)	(3.44)
D03	-.028**	-.045**	-.012**	-.012**
	(9.41)	(11.3)	(3.72)	(2.83)
D04	-.042**	-.058**	-.022**	-.026**
	(14.8)	(15.0)	(6.76)	(6.12)
D05	-.045**	-.058**	-.025**	-.027**
	(15.7)	(14.7)	(7.64)	(6.14)
D06	-.046**	-.058**	-.024**	-.022**
	(16.0)	(14.6)	(7.22)	(4.98)
D07	-.036**	-.037**	-.018**	-.012**
	(11.8)	(8.95)	(5.24)	(2.69)
D08	.005	.025**	-.013**	-.009
	(1.34)	(5.34)	(3.66)	(1.93)
D09	-.030**	-.032**	-.031**	-.018**
	(9.43)	(7.19)	(8.80)	(3.81)
D10	-.040**	-.046**	-.035**	-.027**
	(12.7)	(10.5)	(10.1)	(5.82)
N	44,891	24,896	44,891	24,896
Adj. R^2	.20	.17	.20	.06

* and ** represent significance at the 5% and 1% levels, respectively.

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