THE ROLE OF OPERATING CASH FLOW IN CREDIT RATING: INVESTMENT-GRADE FIRMS VS. SPECULATIVE-GRADE FIRMS

Xu (Frank) Wang*, Jenny Zhang**, William Sanjian Zhang*

Abstract

Despite Standard and Poor's long-standing claim that cash flow is a critical aspect of its rating decisions, the credit rating literature has failed to document a significant relation between credit rating and cash flow measures. A possible explanation of this discrepancy is that the rating agency weighs operating cash flow differently between investment-grade and speculative-grade issuers. Performing an ordered probit analysis of a panel of firms from 1989 to 2006, we find operating cash flow is positively associated with credit ratings for speculative-grade issuers, but not for investment-grade issuers. In contrast, accrual-based earnings are found to be positively associated with credit ratings, but only for investment-grade firms. Our study thus solves a discrepancy between industry documents and the academic literature.

Keywords: Credit Rating, Accounting Quality, Value Relevance, Distress

JEL Classification: G14, G32, M41

*John Cook School of Business, St. Louis University
**Faculty of Management, Dalhousie University
***Corresponding Author. Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, Quebec, Canada H3A 1G5
Tel: 514-398-7807
Fax: 514-398-3876
Email: sanjian.zhang@mcgill.ca

1 Introduction

Accounting information plays an important role in the credit market. Recent research has shown that earnings are useful to participants in both the credit derivative market (Callen et al., 2009) and the bond market (Easton et al., 2009; DeFond and Zhang, 2010). As a bond market intermediary, rating agencies also rely on accounting information in their rating decisions (Standard and Poor's, 2003, 2006, 2008).

However, empirical evidence from credit rating studies seems to contradict the long-standing claim of one major rater, Standard and Poor's (hereafter, S&P). In its rating manual, S&P (2003, 2006, 2008) lists several earnings-based ratios, but also repeatedly highlights the role of cash flows, saying that "cash flow analysis is the single most critical aspect of all credit rating decisions". But in the credit rating literature, Pinches and Mingo (1973) find that cash flow-based ratios are insignificant when they explore the relation between ratings and multiple accounting measures. Employing a more advanced probit analysis procedure, Kaplan and Urwitz (1979) find that cash flows are insignificant in their credit rating model. Since then, several well-cited credit rating models entirely neglect cash flow-based measures (e.g., Ederington, 1985; Blume et al., 1998).

How can this apparent inconsistency between industry documents and empirical studies be reconciled? After a careful reading, we find that a possible explanation is buried in the S&P manual (2003, 2006). The rater explicitly states that "cash-flow analysis … takes on added importance for speculative-grade issuers". Therefore, we conjecture that S&P might weigh accrual-based earning numbers and cash flow numbers differently for investment-grade firms than for speculative-grade firms.

In this study, we address two particular research questions: 1) whether operating cash flow is an important credit rating factor and, thus is significantly associated with credit rating, especially for speculative-grade issuers; 2) whether there is a structural divergence between speculative-grade firms and investment-grade firms in terms of the relative importance of earnings and operating cash flow.

Using newly available cash-based operating cash flow data [55] for firms for the period 1989 to 2006, we

[55] Cash flow statement was not required for publicly traded companies in the U.S. until 1987. The cash flow measures

study the relation between S&P credit ratings and two accounting variables, namely operating earnings and operating cash flows. We employ an ordered probit approach since the dependent variable, credit rating, is an ordinal variable. We incorporate the same set of accounting and financial variables used in Blume et al. (1998) model, but run the tests on investment-grade firms and speculative-grade firms separately. We find that earnings-based operating margin ratio is positively and significantly related to credit rating for the investment-grade sample, but insignificant for the speculative-grade firm. The results continue to hold after controlling for industry effect since S&P (2003, 2006) list industry difference as one important rating factor. In addition, we add operating cash flow to the probit model and find that results are consistent with the S&P statement: for speculative-grade firms, operating cash flow is positively and significantly related to credit rating, but operating margin is not; for investment-grade firms, operating cash flow is statistically insignificant, while operating margin is positively and significantly associated with credit rating. These results are robust after eliminating the common information component between operating margin and operating cash flow, observations from the earliest sample year (1989), the category with the fewest observations (CC/C), and issuers from two specially regulated industries (financials and utilities industries). We are concerned that there might be fundamental structural changes in rating practice before and after 2002 when the Sarbanes-Oxley Act (hereafter, SOX) was enacted. To address this concern, we separate our investment-grade and speculative-grade sample into the pre- and post-SOX sub-samples and re-run the tests. We obtain similar results with the same pattern.

This study makes several contributions. First, we document, for the first time, a notable difference in the usefulness of accrual-based earnings and operating cash flow between speculative-grade and investment-grade firms. Prior studies either only study investment-grade firms (e.g., Blume et al., 1998) or pool the two groups together (e.g., Kaplan and Urwitz, 1979), allowing results to be dominated by the investment-grade sub-sample. We show that division into different rating groups provides important insights and helps to reconcile a surprising inconsistency between the S&P documents (S&P, 2003, 2006) and empirical evidence in the literature. Second, this study also contributes to the literature on the role of accounting information in credit rating decisions. We highlight the relevance of operating cash flow to credit rating and document a circumstance in which weight shifts in its favor. Finally, we also contribute to the literature on the value-relevance of accounting information from the creditor perspective. Prior value-relevance studies have focused mainly on the value-relevance of accounting numbers to the equity market. But "what is relevant for one user or user group, may not be relevant for another" (Holthausen and Watts, 2001). Our study partially answers this need and provides further evidence on the value-relevance of cash flow information to the credit market.

The remainder of the paper is organized as follows. Section two reviews the relevant literature and develops our hypotheses. Section three describes data and descriptive statistics for our sample. Section four presents empirical results. Section five discusses robustness tests and Section six sets forth our conclusions.

2 Literature review

Credit rating agencies play an important role in the U.S. capital market. The three largest raters dominate the American market: S&P, Moody's and Fitch. According to the S&P methodology, there are ten main rating categories (from high to low: AAA, AA, A, BBB, BB, B, CCC, CC, C and D). Firms with the first four ratings (i.e., AAA, AA, A and BBB) are called investment-grade firms, while firms with the remaining ratings, except for D, are called speculative-grade firms. Bonds issued by speculative-grade firms are sometimes called "junk bonds."

Ratings are widely used for three main purposes: credit evaluation, private contracting, and financial regulation (Frost, 2007). Credit ratings are deeply intertwined in American capital market regulations, especially after 1975, when the Securities and Exchange Commission (hereafter, SEC) formally established the designation of Nationally Recognized Statistical Rating Organization (hereafter, NRSRO). According to Covitz and Harrison (2003), the term NRSRO is now cited by at least eight federal statutes, forty seven federal regulations, and many state-level laws and regulations.

Given the important role played by rating agencies, researchers are interested in understanding how these rating agencies use business, financial, and accounting information to determine corporate credit ratings. Since credit rating is ordinal in nature, researchers have attempted several sophisticated approaches to capture the link between credit rating and accounting and financial information, most notably, the discriminant analysis of Pinches and Mingo (1973) and the ordered probit approach of Kaplan and Urwitz (1979). Despite their model differences, both studies reach an interesting and surprising conclusion: cash flow-based accounting measures are not significantly associated with credit ratings. This stands in direct contrast with practitioner articles (e.g., Mills and Yamamura, 1998) that highlight cash flow measures over earnings in distress analysis. It also contradicts the statement by S&P (2003, 2006, 2008) that "cash-flow analysis is the most critical aspect of all credit rating decisions."

used in earlier publications are adjusted accrual-based numbers.

How to reconcile this inconsistency between the academic literature and rating practice? The following excerpt from S&P (2003, p. 24) provides an interesting insight.

"Cash-flow analysis is the single most critical aspect of all credit rating decisions. It takes on added importance for speculative-grade issuers. While companies with investment-grade ratings generally have ready access to external financing to cover temporary cash shortfalls, junk-bond issuers lack this degree of flexibility and have fewer alternatives to internally generated cash for servicing debt." (Emphasis added.)

We conjecture that there is a structural break in rating models when S&P weighs operating cash flow measures in rating speculative-grade issuers versus investment-grade issuers. First, speculative-grade issuers have higher debt load and less "flexibility" to leverage up to service existing creditors. S&P (2003, p. 50) provides median total debt leverage ratios across major rating categories for all industrial firms. Firms in the speculative-grade category tend to be deeply in debt (BB: 57.7%; B: 75.1%; CCC: 91.7%), while investment-grade issuers can boast of relatively clean balance sheets (AA: 35.9%; A: 42.6%; BBB: 47%). [56] Naturally, credit raters pay more attention to operating cash flow ("internally generated cash" from operations) when rating speculative-grade firms. Second, speculative-grade issuers, with lower profitability, higher debt load, and lower interest coverage (S&P, 2003, p. 50), are more likely to breach debt covenants. Beneish et al. (2001) show that firms closer to covenant limits are usually smaller, more leveraged, and less profitable than other firms in the Compustat database. [57] Management of these firms manipulates earnings up to delay the breach so that they can sell out shares to maximize personal benefits. Another study by DeFond and Jiambalvo (1994) also shows that those covenant violators aggressively manage their earnings in the past to avoid covenant breach. In sum, credit raters anticipate poor earnings quality when they rate speculative-grade issuers. Consequently, they shift weight from accrual-based earnings to cash-based operating cash flow, which is more difficult to manipulate. Such an argument is also supported by the S&P rating manual (2003, p. 24 and 2006, p. 30).

"Interest or principal payments cannot be serviced out of earnings, which is just an accounting concept; payment has to be made with cash" (Emphasis added).

"Analysis of cash-flow patterns can reveal a level of debt-servicing capability that is either stronger or weaker than might be apparent from earnings."

Third, the statistically insignificant association between credit rating and cash flow (e.g., Kaplan and Urwitz, 1979) may be due to measurement errors in the cash flow variables. Cash flow statements are available only after 1987. The so-called cash flows or free cash flows in earlier publications are actually accrual-based numbers adjusted from earnings (Kaplan and Urwitz, 1979; Largay and Stickney, 1980; Gombola and Ketz, 1983; Casey Bartczak, 1985; Lehn and Poulsen, 1989). Therefore, it is important to revisit the relation between cash flow and credit rating with true cash-based cash flow data.

Taken together, industry documents and prior studies imply that, for speculative-grade firms, there should be a statistically significant and positive association between operating cash flow and credit rating. Thus our first hypothesis is as follows:

H1: For speculative-grade issuers, there is a positive relation between credit rating and operating cash flow.

In a large-sample study, Barth et al. (1998) show that, as financial health improves, the incremental explanatory power of accrual-based earning increases as well. This result implies that the accrual-based earnings of investment-grade firms should be more informative to various users than those of speculative-grade firms. Dechow (1994) shows that, on average, accrual-based earnings outperform cash flow measures as a performance measure, since the latter suffer from matching and timing problems. In addition, investment-grade firms have "ready access to external financing" to service existing creditors; therefore, historical operating cash flow could be a less relevant indicator to creditors and rating agencies. In conclusion, we expect that cash flow might not have a significant association with rating for investment-grade firms, while earnings do. Thus, our second hypothesis as follows:

H2: For investment-grade issuers, there is a positive relation between credit rating and operating profit. [58]

3 Sample selection and descriptive statistics

3.1 Sample

We obtain credit rating data (i.e., data item 280, S&P long-term issuer credit rating) from the legacy North American Compustat database during 1985 and 2006. [59] The availability of operating cash flow data (data item 308) in Compustat limits our sample period to start from 1987. We require the final sample have the required accounting information to construct four accounting ratios that are often used in prior credit rating studies (Blume et al., 1998; Jorion et al., 2009).

[56] We document a similar pattern in Table 2 between Panel A and Panel B for the LT debt leverage variable.
[57] This is the typical profile of speculative-grade issuers.

[58] Operating Profit can also be called Operating Earnings or Operating Margin.
[59] Compustat began to include the S&P long-term issuer rating since1985. After 2006, credit rating information is provided separately under a new Compustat database, to which our subscription does not provide access.

These accounting ratios are: interest coverage, operating margin, long-term debt leverage, and total debt leverage. [60] Our variables of interest are operating cash flow (Compustat data item 308) and operating margin. [61] As S&P calculates the three-year averages for all accounting ratios, we follow its practice (as does Blume et al., 1998) and use the three-year averages in our ordered probit model. Calculating the three-year average of operating cash flow further limits the final sample period to 1989-2006. Our final sample, after merger of Compustat data and CRSP information, consists of 16,836 firm years: 10,125 firm years with investment-grade ratings (1,336 unique obligors) and 6,711 firm years with speculative-grade ratings (1,522 unique obligors).

3.2 Descriptive Statistics

Panels A and B of Table 1 provide sample distribution by year and rating class in number and percentage, respectively. Over time, the proportions of AAA, AA and A issuers in the sample experience marked declines. This decline is partially offset by a steady increase in the percentage of BBB, BB, and B issuers. For example, Panel B shows that BBB firms' market share has increased from 22.4% in 1989 to 34.3% in 2006. Overall, investment-grade firms steadily yield "market share" to speculative-grade firms whose fraction climbs from 35% in 1989 to 45.4% in 2006. Hence, it is obvious that we can no longer ignore speculative grade firms and draw conclusions about credit rating models using investment-grade firms only.

Panels A and B of Table 2 present descriptive statistics of accounting and financial variables for investment-grade issuers and speculative-grade issuers, respectively. The means and medians of the accounting and financial variables show that investment-grade issuers are generally less risky than speculative-grade issuers. For example, the former are more profitable, in terms of operating margin, (mean=0.209, median=0.177) than the latter (mean=0.159, median=0.122); they also have lower long-term debt leverage, with a mean of 0.231 and a median of 0.226, than speculative-grade firms (mean=0.398, median=0.372). In the investment-grade sample, there are more utility firms (15.9%) and financial services firms (12.8%) than in the speculative-grade firms (3.9% and 5.2% respectively). Therefore, it is important to control the industry effect in the ordered probit regression to ensure that the results documented in Table 5B are not driven by industry composition differences.

4 Empirical results

Following the credit rating literature (Kaplan and Urwitz, 1979; Iskandar-Datta and Emery, 1994; Jorion et al., 2009), we employ an ordered probit regression. We control a group of accounting and financial variables shown to be proxies for financial distress. It is important to point out that our ordered probit model is a simplified approximation of complex rating work such that we are not able to fully capture rating agency private information or the "subjectivity in assessing these (risk) factors" (S&P, 2006). Nevertheless, we focus on one key issue here: whether S&P incorporates issuer's cash flow information in the rating decision, and whether cash flow information "takes on added importance for speculative-grade issuers." as claimed by S&P.

4.1 Original Blume et al. (1998) Model

An ordered probit model estimates coefficients through maximum likelihood techniques. [62] In our model, the ordinal variable, also the dependent variable in the ordered probit regression, is assigned a value of 8 for each observation with the highest rating of AAA and 1 for firm-observations with the lowest rating of CC or C. [63]

Blume et al. (1998) point out two issues associated with this the interest coverage ratio: 1) negative interest coverage, though not meaningful for rating, could exist due to a negative operating income; and 2) there might be a non-linear relation between interest coverage ratio and credit ratings. To address these concerns, we transform the raw interest coverage ratios(*C*) into four separate variables, *k1*, *k2*, *k3*, and *k4*, for our ordered probit regression following Blume et al. (1998). The transformation procedures are as follows:

1) If *C* is negative, then all four variables are set to 0 (i.e., *k1*=*k2*=*k3*=*k4*=0);
2) If *C* falls in (0,5), then *k1*=*C* and *k2*,*k3* and *k4* are set to 0;
3) If *C* falls in [5,10), then *k1* is set to 5 and *k2*=*C*-5. *k3* and *k4* are set to 0;
4) If *C* falls in [10,20), then *k1* and *k2* are set to 5 and *k3*=C-10. *k4* is set to 0;
5) If *C* falls in [20,100), then *k1* and *k2* are set to 5 with k3 set to 10. *k4* is the difference between *C* and 20.

[60] Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34), and average short-term borrowing (data item 104) to total assets (data item 6).

[61] Operating cash flow is deflated by total assets (data item 6). It is also a measure of cash-based profitability.

[62] Details on ordered probit model are covered in Greene (2008) and Blume et al. (1998).

[63] Rules for value assignment: 8 for AAA firms, 7 for AA firms, 6 for A firms, 5 for BBB firms, 4 for BB firms, 3 for B firms, 2 for CCC firms, 1 for CC or C firms.

Table 1. Sample Distribution, by Year and Credit Rating

Panel A. In raw number

			Credit Rating						Grade		
Year	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**CC/C**	**Investment**	**Speculative**	**Total**
1989	3	12	46	32	25	22	3	0	93	50	143
1990	16	77	173	148	101	79	15	0	414	195	609
1991	15	80	188	152	102	81	13	2	435	198	633
1992	18	76	187	177	126	88	9	4	458	227	685
1993	15	73	204	188	154	93	5	1	480	253	733
1994	16	76	210	214	161	104	7	0	516	272	788
1995	18	71	235	229	179	114	7	0	553	300	853
1996	20	69	253	261	200	136	5	1	603	342	945
1997	19	64	260	306	224	184	7	1	649	416	1,065
1998	12	74	268	327	255	179	11	5	681	450	1,131
1999	13	67	262	332	263	178	12	1	674	454	1,128
2000	12	56	243	336	267	181	18	2	647	468	1,115
2001	11	50	241	356	276	172	17	3	658	468	1,126
2002	10	33	226	329	261	156	21	3	598	441	1,039
2003	6	36	225	406	338	206	23	1	673	568	1,241
2004	5	32	222	446	341	205	22	2	705	570	1,275
2005	4	32	236	422	337	195	13	1	694	546	1,240
2006	3	27	191	373	300	179	12	2	594	493	1,087
Total	**216**	**1,005**	**3,870**	**5,034**	**3,910**	**2,552**	**220**	**29**	**10,125**	**6,711**	**16,836**

Panel B. In percentage (%)

				Credit Rating						Grade	
Year	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**CC/C**	**Investment**	**Speculative**	**Total**
1989	2.1	8.4	32.2	22.4	17.5	15.4	2.1	0.0	65.0	35.0	100
1990	2.6	12.6	28.4	24.3	16.6	13.0	2.5	0.0	68.0	32.0	100
1991	2.4	12.6	29.7	24.0	16.1	12.8	2.1	0.3	68.7	31.3	100
1992	2.6	11.1	27.3	25.8	18.4	12.8	1.3	0.6	66.9	33.1	100
1993	2.0	10.0	27.8	25.6	21.0	12.7	0.7	0.1	65.5	34.5	100
1994	2.0	9.6	26.6	27.2	20.4	13.2	0.9	0.0	65.5	34.5	100
1995	2.1	8.3	27.5	26.8	21.0	13.4	0.8	0.0	64.8	35.2	100
1996	2.1	7.3	26.8	27.6	21.2	14.4	0.5	0.1	63.8	36.2	100
1997	1.8	6.0	24.4	28.7	21.0	17.3	0.7	0.1	60.9	39.1	100
1998	1.1	6.5	23.7	28.9	22.5	15.8	1.0	0.4	60.2	39.8	100
1999	1.2	5.9	23.2	29.4	23.3	15.8	1.1	0.1	59.8	40.2	100
2000	1.1	5.0	21.8	30.1	23.9	16.2	1.6	0.2	58.0	42.0	100
2001	1.0	4.4	21.4	31.6	24.5	15.3	1.5	0.3	58.4	41.6	100
2002	1.0	3.2	21.8	31.7	25.1	15.0	2.0	0.3	57.6	42.4	100
2003	0.5	2.9	18.1	32.7	27.2	16.6	1.9	0.1	54.2	45.8	100
2004	0.4	2.5	17.4	35.0	26.7	16.1	1.7	0.2	55.3	44.7	100
2005	0.3	2.6	19.0	34.0	27.2	15.7	1.0	0.1	56.0	44.0	100
2006	0.3	2.5	17.6	34.3	27.6	16.5	1.1	0.2	54.6	45.4	100
Total	1.3	6.0	23.0	29.9	23.2	15.2	1.3	0.2	60.1	39.9	100

The final sample consists of a panel of 16,836 firm-year observations with valid issuer credit ratings from S&P. The sample period is from 1989 to 2006. S&P ratings are from the 2006 Compustat Annual file.

Table 2. Panel A. Descriptive Statistics for the Investment-Grade Firms (1989-2006), N=10,125

Variables	Mean	Median	Std. Dev	Min.	Max.
Interest coverage, k1	4.357	5	0.945	0	5
Interest coverage, k2	1.876	0.642	2.139	0	5
Interest coverage, k3	1.523	0	3.234	0	10
Interest coverage, k4	2.439	0	11.055	0	80
Operating Margin	0.209	0.177	0.135	-0.129	0.771
LT Debt Leverage	0.231	0.226	0.129	0.004	1.027
Total Debt Leverage	0.294	0.294	0.154	0.015	1.124
Market Value of Equity (natural logarithm)	4.523	3.551	2.946	-0.578	11.964
Adj. Market Model Beta	0.975	0.908	0.603	-0.426	3.616
Adj. Standard Error	0.931	0.880	0.321	0.290	2.214
Utilities Dummy	0.159	0	0.365	0	1
Financials Dummy	0.128	0	0.335	0	1
Industrials Dummy	0.679	1	0.467	0	1
Transportation Dummy	0.033	0	0.179	0	1
Operating Cash Flow	0.097	0.091	0.059	-1.017	0.487

Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. To deal with the non-linearity nature of the interest coverage ratio, it is adjusted and transformed into four independent variables: k1, k2, k3 and k4. These four variables are defined in the middle section on page 9. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34) and average short-term borrowing (data item 104) to total assets (data item 6). Following the guideline of S&P (2003, 2006), three-year averages of these four accounting ratios are used in the ordered probit regressions. Market value is the natural log-normalized market value of equity after deflated by the annual CPI. Market model beta and standard error are derived from the market model with daily stock returns in each calendar year and we follow the Dimson (1979) approach to control non-synchronous trading effects. Adjusted market model beta is the market model beta divided by the cross-sectional mean of betas for all the firms in the same year. Standard error is derived from the market model too, and it is a proxy of idiosyncratic risk. Adjusted standard error is the standard error divided by the cross-sectional mean of standard errors for all the firms in the same year. Following the rating practice of S&P (2003), we classify our observations into four industry groups (utilities, financials, industrials, transportations) and set the industry dummy to one if one firm belongs to one specific industry group and zero otherwise. In the final ordered probit model, only three dummies are included (utility dummy, financial dummy and industrial dummy) to avoid dummy trap. Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006).

Table 2. Panel B. Descriptive Statistics for the Speculative-Grade Firms (1989-2006), N=6,711

Variables	Mean	Median	Std. Dev	Min.	Max.
Interest coverage, k1	3.062	2.905	1.451	0	5
Interest coverage, k2	0.622	0	1.467	0	5
Interest coverage, k3	0.483	0	1.983	0	10
Interest coverage, k4	1.085	0	7.959	0	80
Operating Margin	0.159	0.122	0.154	-0.558	0.769
LT Debt Leverage	0.398	0.372	0.209	0.010	1.367
Total Debt Leverage	0.446	0.420	0.219	0.019	1.480
Market Value of Equity (natural logarithm)	2.815	1.714	3.257	-3.625	10.835
Adj. Market Model Beta	1.030	0.964	0.673	-0.869	4.223
Adj. Standard Error	1.064	0.954	0.536	0.306	14.481
Utilities Dummy	0.039	0	0.195	0	1
Financials Dummy	0.052	0	0.222	0	1
Industrials Dummy	0.868	1	0.338	0	1
Transportation Dummy	0.040	0	0.197	0	1
Operating Cash Flow	0.062	0.060	0.064	-0.462	0.775

Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. To deal with the non-linearity nature of the interest coverage ratio, it is adjusted and transformed into four independent variables: k1, k2, k3 and k4. These four variables are defined in the middle section on page 9. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34) and average short-term borrowing (data item 104) to total assets (data item 6). Following the guideline of S&P (2003, 2006), three-year averages of these four accounting ratios are used in the ordered probit regressions. Market value is the natural log-normalized market value of equity after deflated by the annual CPI. Market model beta and standard error are derived from the market model with daily stock returns in each calendar year and we follow the Dimson (1979) approach to control non-synchronous trading effects. Adjusted market model beta is the market model beta divided by the cross-sectional mean of betas for all the firms in the same year. Standard error is derived from the market model too, and it is a proxy of idiosyncratic risk. Adjusted standard error is the standard error divided by the cross-sectional mean of standard errors for all the firms in the same year. Following the rating practice of S&P (2003), we classify our observations into four industry groups (utilities, financials, industrials, transportations) and set the industry dummy to one if one firm belongs to one specific industry group and zero otherwise. In the final ordered probit model, only three dummies are included (utility dummy, financial dummy and industrial dummy) to avoid dummy trap. Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006).

In our model, we include a natural logarithm of inflation adjusted market value of equity [64] as a control variable because prior studies document a positive relation between credit ratings and firm size (Pinches and Mingo, 1973; Kaplan and Urwitz, 1979). In addition, as suggested by Blume et al. (1998), we control two risk factors based on the market model, namely beta and standard error from the return regression. We require that each firm have at least 200 daily stock returns each year in order to construct its annual beta and standard error. In deriving beta and standard error, we follow the Dimson (1979) procedure and include one leading and one lagging value of the CRSP value-weighted market return in the return regression to adjust for non-synchronous trading effects. In our probit model, we use adjusted beta and adjusted standard error (i.e., each firm's beta and standard error are adjusted by the cross-sectional mean standard error and mean standard error, respectively) to eliminate time-specific variation in some volatile years. [65]

In Table 3, we replicate the Blume et al. (1998) model within two subsamples, namely the investment-grade and the speculative-grade issuers. Results for investment-grade issuers, as reported on the left side of Table 3, are consistent with those reported in Blume et al. (1998). Signs of coefficients are consistent with expectations: operating margin is positively and significantly associated with ratings (coefficient estimated = 1.285, significant at 1% level), suggesting that higher margin firms are more likely to have higher investment-grade ratings. Long-term debt leverage is negatively and significantly associated with ratings (coefficient estimated = -4.002, significant at 1% level). It is notable that the coefficient estimated on total debt leverage is significantly positive. We argue this unusual coefficient for "total debt leverage" is due to the high correlation between long-term debt leverage and total debt leverage (correlation=0.82 and significant at the 0.001 level). Once long-term debt leverage is dropped from the probit regression, the coefficient of total debt leverage becomes negative and statistically significant.

Results for speculative-grade issuers are reported on the right side of Table 3. They are in line with the general expectation: market value of equity, adjusted market model beta and adjusted standard error have same signs compared with the investment-grade sample, and the results are statistically significant. But the coefficient for operating margin is different: negative, though not statistically significant. This negative and insignificant result continue to hold after we drop the long-term debt leverage ratio: the new coefficient is -0.123, with a *p*-value of 0.28. [66] These results are suggesting that, for speculative-grade firms, past earnings might be a poor indicator of future debt-servicing capability. Therefore, they are not significantly associated with credit ratings.

Collectively, out of the four accounting variables commonly used in credit rating studies, we find operating margin is not associated with credit rating among speculative-grade issuers, but positively associated with credit rating among investment-grade issuers, indicating that raters weigh cash flow numbers differently when they move from investment-grade firms to speculative-grade firms.

4.2 Model with Industry Effects

Blume et al. (1998) fails to consider industry differences, which play an important role in S&P rating assignment (S&P, 2003). To ensure our results reported in Table 3 are not driven by industry composition differences, we perform the ordered probit analysis again by adding industry dummies in the model employed in Section 4.1. Following rating industry practice (S&P, 2003), we classify our observations into four broad industry groups: utilities, financials, transportations, and industrials. In the model, the transportation dummy is suppressed to avoid the dummy trap.

The accounting ratios retain identical signs for the investment-grade sample as those reported in Table 3. The coefficient estimated on operating margin continue to be significantly positive (coefficient estimated = 0.861, significant at 1% level), while the coefficient estimated on long-term debt leverage is, once again, significantly negative (coefficient estimated = -4.394, significant at 1% level). The utility dummy is positive and much higher than the financial and industrial dummies, suggesting that if a utility firm and a transportation firm have the same level of accounting and financial variables (those listed in Table 4), the utility firm will have a higher rating than the transportation firm.

Among speculative-grade issuers, operating margin is statistically insignificant for the speculative-grade sample (coefficient estimated = -0.204, *p*-value = 0.08). The result for speculative-grade firms is not driven by correlated leverage variables: when we drop long-term debt leverage, the coefficient estimated on operating margin becomes -0.177, still insignificant, with a *p*-value of 0.125.

Industry difference does not explain the insignificant association between operating margin and credit rating for speculative-grade issuers.

[64] The natural logarithm of total assets is also used to control for size. Results are similar; therefore, we do not report them here.

[65] In our robustness tests, we re-run all the tests with unadjusted beta and standard error from the market return regression. Results are little changed in Tables 3, 4, 5A and 5B. Thus, the same conclusions still hold. We discuss these results in the robustness check section.

[66] We follow Blume et al. (1998) and retain two leverage ratios here. For speculative-grade firms, the long-term debt leverage and total debt leverage variables are highly correlated (correlation=0.91, significant at the 0.001 level). The unusual coefficients of these two leverage ratios in Table 3, 4, 5A and 5B disappear after we retain only one leverage ratio in our probit regression.

Table 3. Ordered Probit Model Estimates for Investment-Grade and Speculative-Grade Firms. The Original Blume Model (1989-2006)

	Investment-Grade			Speculative-Grade		
	Coefficient	Clustered Standard Error	P-Value	Coefficient	Clustered Standard Error	P-Value
Interest Coverage k1	0.261	0.019	0.00	0.291	0.016	0.00
Interest Coverage k2	0.036	0.010	0.00	-0.065	0.021	0.00
Interest Coverage k3	0.043	0.006	0.00	-0.016	0.016	0.32
Interest Coverage k4	-0.005	0.001	0.00	-0.001	0.003	0.70
Operating Margin	1.285	0.101	0.00	-0.153	0.115	0.19
LT Debt Leverage	-4.002	0.182	0.00	0.562	0.187	0.00
Total Debt Leverage	1.751	0.151	0.00	-0.784	0.181	0.00
Market Value	0.391	0.011	0.00	0.317	0.015	0.00
Adj. Market Model Beta	-0.281	0.025	0.00	-0.177	0.027	0.00
Adj. Standard Error	-1.266	0.053	0.00	-0.680	0.042	0.00
Year Fixed Effects	Included			Included		
N	10,125			6,711		
Percent Concordant (%)	83.4			82.6		
Pseudo-R-square	0.423			0.338		

The dependent variable is S&P long-term issuer credit rating (Compustat data item 280). Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. To deal with the non-linearity nature of the interest coverage ratio, it is adjusted and transformed into four independent variables: k1, k2, k3 and k4. These four variables are defined in the middle section on page 9. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34) and average short-term borrowing (data item 104) to total assets (data item 6). Following the guideline of S&P (2003, 2006), three-year averages of these four accounting ratios are used in the ordered probit regressions. Market value is the natural log-normalized market value of equity after deflated by the annual CPI. Market model beta and standard error are derived from the market model with daily stock returns in each calendar year and we follow the Dimson (1979) approach to control nonsynchronous trading effects. Adjusted market model beta is the market model beta divided by the cross-sectional mean of betas for all the firms in the same year. Standard error is derived from the market model too, and it is a proxy of idiosyncratic risk. Adjusted standard error is the standard error divided by the cross-sectional mean of standard errors for all the firms in the same year. Following the rating practice of S&P (2003), we classify our observations into four industry groups (utilities, financials, industrials, transportations) and set the industry dummy to one if one firm belongs to one specific industry group and zero otherwise. In the final ordered probit model, only three dummies are included (utility dummy, financial dummy and industrial dummy) to avoid dummy trap. Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006). Clustered standard errors are robust standard errors after adjustment of the clustering on firms. P-values are two-sided.

Table 4. Ordered Probit Model Estimates for Investment-Grade and Speculative-Grade Firms Respectively, After Controlling Industry Effect (1989-2006)

	Investment-Grade			Speculative-Grade		
	Coefficient	Clustered Standard Error	P-Value	Coefficient	Clustered Standard Error	P-Value
Interest Coverage k1	0.311	0.021	0.00	0.299	0.016	0.00
Interest Coverage k2	0.074	0.010	0.00	-0.063	0.021	0.00
Interest Coverage k3	0.036	0.006	0.00	-0.017	0.016	0.28
Interest Coverage k4	-0.005	0.001	0.00	-0.001	0.003	0.74
Operating Margin	0.861	0.109	0.00	-0.204	0.116	0.08
LT Debt Leverage	-4.394	0.197	0.00	0.465	0.189	0.01
Total Debt Leverage	2.024	0.155	0.00	-0.722	0.182	0.00
Market Value	0.455	0.011	0.00	0.318	0.015	0.00
Adj. Market Model Beta	-0.222	0.025	0.00	-0.174	0.027	0.00
Adj. Standard Error	-1.002	0.055	0.00	-0.688	0.040	0.00
Utilities Dummy	1.005	0.090	0.00	0.123	0.124	0.32
Financials Dummy	0.326	0.091	0.00	-0.653	0.109	0.00
Industrials Dummy	0.174	0.083	0.04	-0.369	0.085	0.00
Year Fixed Effects	Included			Included		
N	10,125			6,711		
Percent Concordant (%)	84.5			82.8		
Pseudo-R-square	0.444			0.344		

The dependent variable is S&P long-term issuer credit rating (Compustat data item 280). Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. To deal with the non-linearity nature of the interest coverage ratio, it is adjusted and transformed into four independent variables: k1, k2, k3 and k4. These four variables are defined in the middle section on page 9. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34) and average short-term borrowing (data item 104) to total assets (data item 6). Following the guideline of S&P (2003, 2006), three-year averages of these four accounting ratios are used in the ordered probit regressions. Market value is the natural log-normalized market value of equity after deflated by the annual CPI. Market model beta and standard error are derived from the market model with daily stock returns in each calendar year and we follow the Dimson (1979) approach to control nonsynchronous trading effects. Adjusted market model beta is the market model beta divided by the cross-sectional mean of betas for all the firms in the same year. Standard error is derived from the market model too, and it is a proxy of idiosyncratic risk. Adjusted standard error is the standard error divided by the cross-sectional mean of standard errors for all the firms in the same year. Following the rating practice of S&P (2003), we classify our observations into four industry groups (utilities, financials, industrials, transportations) and set the industry dummy to one if one firm belongs to one specific industry group and zero otherwise. In the final ordered probit model, only three dummies are included (utility dummy, financial dummy and industrial dummy) to avoid dummy trap. Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006). Clustered standard errors are robust standard errors after adjustment of the clustering on firms. P-values are two-sided.

4.3 Model with Industry Effects and Operating Cash Flow

Though prior studies fail to find a link between cash flow and credit rating (e.g., Kaplan and Urwitz, 1979), S&P [67] has repeatedly claimed that "cash flow analysis is usually the single most critical aspect of credit rating decisions". In response to this long-standing claim, we re-run our ordered probit regression by including additional industry dummies as well as the three-year average of operating cash flows into the model we adopt in Section 4.1. Results are reported in Table 5A. Once again, operating margin is still positive and statistically significant for the investment-grade sample. This result is not driven by correlated leverage variables: when we drop long-term debt leverage, the coefficient of operating margin falls to 0.863 and is still positive with a *p*-value <0.001. For investment-grade sample, the coefficient of operating cash flow is negative and insignificant. In sum, for investment-grade issuers, operating margin has a positive and significant relation with S&P credit rating. In addition, operating margin appears to be more important for credit rating decisions than operating cash flow.

For the speculative-grade sample, consistent with our expectation, the coefficient of the operating cash flow is positive and statistically significant (coefficient estimated = 1.488, *p*-value<0.001). Unfortunately, the newly introduced operating cash flow variable is correlated with the operating margin variable (correlation = 0.407) and may distort the latter's coefficient. Thus, we conduct a two-step analysis: First, we regress operating cash flow on operating margin to derive a residual term, which is supposed to capture the additional credit-related information content from operating cash flow; second, we include the regression residual in the ordered probit analysis, replacing the cash flow-based variable with the variable denoted as "Residual", which is derived from the first step. We repeat this step for the investment-grade sample, even though there is a weak correlation (correlation = 0.144) between operating cash flow and operating margin for the investment-grade sample. Results are reported in Table 5B. Interestingly, for speculative-grade issuers, the operating margin variable retains negative coefficient, but is no longer statistically significant. However, the residual component of operating cash flow is still positive and significant (coefficient=1.488, *p*-value<0.001). In contrast, investment-grade issuers show the opposite result: operating margin remains positive and significant, while the residual term is statistically insignificant (coefficient= -0.217, *p*-value=0.435).

In sum, our results lend support to S&P's repeated claim that "cash flow analysis… takes on added importance for speculative-grade issuers". Our results show that operating cash flow has a significant and positive relation with S&P credit ratings for speculative-grade issuers, but not for investment-grade issuers. In contrast, accrual-based earnings (proxied by operating margin) are found to be significantly and positively associated with S&P credit ratings, but only for investment-grade firms, not for speculative-grade firms. There seems to a structural break in terms of the relative weights assigned to operating margin and operating cash flow when S&P rates investment-grade firms and when it rates speculative-grade firms.

5 Robustness checks

5.1 Before and After the SOX

SOX has had a major impact on the capital market. It also influences the rating behavior of the major raters in the American market. Cheng and Neamtiu (2009) show that, facing intense public pressure around 2002, rating agencies improve the timeliness and accuracy of their ratings. It is possible that there might be some rating methodology changes after 2002. Thus, we further separate our investment-grade and speculative-grade samples into two sub-groups, pre-2002 and post-2002, and re-run the ordered probit regression (Table 5B) for the sub-groups separately.

Panels A and B of Table 6 present the coefficients for the two key variables, operating margin and residual of operating cash flow after regressing on operating margin. Results from both periods, before and after 2002, show the same pattern: for investment-grade issuers, higher operating margin is significantly associated with higher credit ratings, but the residual component of operating cash flow does not provide additional information content for credit rating decisions; in contrast, for speculative-grade issuers, higher residual component of operating cash flow is significantly associated with higher credit rating, but accrual-based operating margin is not significantly related to ratings.

In summary, results for the two sub-periods are consistent with the main results for the whole period, 1989-2006, and results reported in Table 5B are not driven by inter-period changes in rating behavior. Cash flow analysis does "take on added importance for speculative-grade issuers" (S&P, 2003, p. 24), both before and after the implementation of SOX.

5.2 Use of Unadjusted Beta and Standard Error

We follow Blume et al. (1998) and adjust both beta and standard error with their cross-sectional means in each year. This adjustment eliminates the effect of inter-period variation in market risk (beta) and firm-specific risk (proxied by standard error).

[67] See S&P (2003, p. 24), S&P (2006, p. 30) and S&P (2008, p. 24).

Table 5A. Ordered Probit Model Estimates for Investment-Grade and Speculative-Grade Firms Respectively, After Controlling Industry Effect and Operating Cash Flows (1989-2006)

	Investment-Grade			Speculative-Grade		
	Coefficient	Clustered Standard Error	P-Value	Coefficient	Clustered Standard Error	P-Value
Interest Coverage k1	0.315	0.021	0.00	0.283	0.016	0.00
Interest Coverage k2	0.075	0.011	0.00	-0.068	0.021	0.00
Interest Coverage k3	0.036	0.006	0.00	-0.018	0.016	0.26
Interest Coverage k4	-0.005	0.001	0.00	-0.001	0.003	0.67
Operating Margin	0.878	0.111	0.00	-0.392	0.122	0.00
LT Debt Leverage	-4.366	0.201	0.00	0.389	0.190	0.04
Total Debt Leverage	2.019	0.156	0.00	-0.670	0.183	0.00
Market Value	0.456	0.011	0.00	0.314	0.015	0.00
Adj. Market Model Beta	-0.223	0.025	0.00	-0.162	0.027	0.00
Adj. Standard Error	-1.003	0.055	0.00	-0.684	0.042	0.00
Utilities Dummy	1.001	0.090	0.00	0.161	0.125	0.20
Financials Dummy	0.313	0.093	0.00	-0.595	0.109	0.00
Industrials Dummy	0.174	0.083	0.04	-0.354	0.085	0.00
Operating Cash Flow	-0.217	0.278	0.43	1.488	0.299	0.00
Year Fixed Effects	Included			Included		
N	10,125			6,711		
Percent Concordant (%)	84.5			83.0		
Pseudo-R-square	0.447			0.347		

The dependent variable is S&P long-term issuer credit rating (Compustat data item 280). Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. To deal with the non-linearity nature of the interest coverage ratio, it is adjusted and transformed into four independent variables: k1, k2, k3 and k4. These four variables are defined in the middle section on page 9. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34) and average short-term borrowing (data item 104) to total assets (data item 6). Following the guideline of S&P (2003, 2006), three-year averages of these four accounting ratios are used in the ordered probit regressions. Market value is the natural log-normalized market value of equity after deflated by the annual CPI. Market model beta and standard error are derived from the market model with daily stock returns in each calendar year and we follow the Dimson (1979) approach to control nonsynchronous trading effects. Adjusted market model beta is the market model beta divided by the cross-sectional mean of betas for all the firms in the same year. Standard error is derived from the market model too, and it is a proxy of idiosyncratic risk. Adjusted standard error is the standard error divided by the cross-sectional mean of standard errors for all the firms in the same year. Following the rating practice of S&P (2003), we classify our observations into four industry groups (utilities, financials, industrials, transportations) and set the industry dummy to one if one firm belongs to one specific industry group and zero otherwise. In the final ordered probit model, only three dummies are included (utility dummy, financial dummy and industrial dummy) to avoid dummy trap. Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006). Clustered standard errors are robust standard errors after adjustment of the clustering on firms. P-values are two-sided.

Table 5B. Ordered Probit Model Estimates for Investment-Grade and Speculative-Grade Firms Respectively, After Controlling Industry Effect and Residual from the Regression of Operating Cash Flow over Operating Margin (1989-2006)

	Investment-Grade			Speculative-Grade		
	Coefficient	Clustered Standard Error	P-Value	Coefficient	Clustered Standard Error	P-Value
Interest Coverage k1	0.315	0.021	0.00	0.283	0.016	0.00
Interest Coverage k2	0.075	0.010	0.00	-0.068	0.021	0.00
Interest Coverage k3	0.036	0.006	0.00	-0.018	0.016	0.26
Interest Coverage k4	-0.005	0.001	0.00	-0.001	0.003	0.67
Operating Margin	0.864	0.109	0.00	-0.139	0.117	0.24
LT Debt Leverage	-4.366	0.201	0.00	0.389	0.190	0.04
Total Debt Leverage	2.019	0.156	0.00	-0.670	0.183	0.00
Market Value	0.456	0.011	0.00	0.314	0.015	0.00
Adj. Market Model Beta	-0.223	0.025	0.00	-0.162	0.027	0.00
Adj. Standard Error	-1.003	0.054	0.00	-0.684	0.042	0.00
Utilities Dummy	1.000	0.090	0.00	0.161	0.125	0.19
Financials Dummy	0.313	0.093	0.00	-0.595	0.109	0.00
Industrials Dummy	0.174	0.083	0.04	-0.354	0.085	0.00
Residual	-0.217	0.278	0.44	1.488	0.299	0.00
Year Fixed Effects	Included			Included		
N	10,125			6,711		
Percent Concordant (%)	84.5			83.0		
Pseudo-R-square	0.445			0.347		

The dependent variable is S&P long-term issuer credit rating (Compustat data item 280). Interest coverage is the ratio of operating income after depreciation (Compustat data item 178) plus interest expense (data item 15) to interest expense. To deal with the non-linearity nature of the interest coverage ratio, it is adjusted and transformed into four independent variables: k1, k2, k3 and k4. These four variables are defined in the middle section on page 9. Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Long-term debt leverage ratio is calculated as total long-term debt (data item 9) divided by total assets (data item 6). Our total debt leverage is the ratio of the sum of total long-term debt (data item 9), debt in current liabilities (data item 34) and average short-term borrowing (data item 104) to total assets (data item 6). Following the guideline of S&P (2003, 2006), three-year averages of these four accounting ratios are used in the ordered probit regressions. Market value is the natural log-normalized market value of equity after deflated by the annual CPI. Market model beta and standard error are derived from the market model with daily stock returns in each calendar year and we follow the Dimson (1979) approach to control nonsynchronous trading effects. Adjusted market model beta is the market model beta divided by the cross-sectional mean of betas for all the firms in the same year. Standard error is derived from the market model too, and it is a proxy of idiosyncratic risk. Adjusted standard error is the standard error divided by the cross-sectional mean of standard errors for all the firms in the same year. Following the rating practice of S&P (2003), we classify our observations into four industry groups (utilities, financials, industrials, transportations) and set the industry dummy to one if one firm belongs to one specific industry group and zero otherwise. In the final ordered probit model, only three dummies are included (utility dummy, financial dummy and industrial dummy) to avoid dummy trap. Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006). Residual is derived from the OLS regression of Operating Cash Flow over Operating Margin. It captures the additional credit-related information content from the operating cash flow. Clustered standard errors are robust standard errors after adjustment of the clustering on firms. P-values are two-sided.

In Panel C of Table 6, we restore the unadjusted beta and standard error to re-run our tests (full model from Table 5B) for investment-grade and speculative-grade issuers. As shown in Panel C of Table 6, we obtain the same pattern for both investment-grade and speculative-grade issuers. Therefore, our results are robust with respect to the modified market risk measure (unadjusted beta) and idiosyncratic risk measure (unadjusted standard error).

5.3 Exclusion of the 1989 Firms

Cash-based operating cash flow is available only after 1987, when the cash flow statement came into use. Some rated issuers might not have had cash flow statement ready until 1988. As a result, these firms will not appear in our 1989 sample due to the fact that we require three year data to calculate average operating cash flow. According to the sample distribution (see Table 1), our 1989 sub-group appears abnormally smaller than those in other years. There might be sample selection bias in 1989, which could potentially influence our probit analysis. Hence, we exclude the 1989 firms and re-run our full-model ordered probit regressions for the investment-grade and speculative-grade samples. Panel D of Table 6 presents coefficients for the two key variables. Results are qualitatively unchanged to those from the full period, 1989-2006. Therefore, our main results remain robust and they are not driven by sample selection bias.

5.4 Exclusion of the CC/C Firms

In our final sample, 29 firms have the very low ratings CC or C, accounting for only 0.4% of a sample of 6,711 speculative-grade firms. Given their relatively poorer accounting and financial ratios, they might influence results as extreme observations. Therefore, we delete the entire CC/C category and re-run the full model probit test (Table 5B) for the speculative-grade sample. Key results are presented in Panel E of Table 6. For the remaining speculative-grade issuers, operating margin ratio is not significant and the residual component of operating cash flow is significant and positive, implying that S&P closely monitors operating cash flow numbers when rating speculative-grade firms.

5.5 Exclusion of Financial Service Firms

The structure of balance sheet and income statements of financial firms is quite different from that of utility, transportation and industrial firms. In this section, we exclude all financial service firms and re-run the ordered probit regression for investment-grade and speculative-grade samples. Key results are reported in Panel F of Table 6. We see a familiar pattern: for investment-grade issuers, operating margin is significantly associated with credit rating, while the residual component of operating cash flow is not; for speculative-grade issuers, the result is the opposite, and the residual component of operating cash flow is a significant rating factor.

The utility industry used to be highly regulated in the U.S., and traditional accounting literature also excludes utility firms from final samples. Here, we repeat the full-model tests after excluding both financial firms and utility firms (results not tabulated), and reach the same conclusion. Therefore, our results in Table 5B are robust with respect to different industries.

In Section 5, we follow S&P practice and classify investment-grade and speculative-grade samples into four broad industry groups: utilities, financial, transportations, and industrials. As a robust check, we refine our industry classification based on the two-digit standard industry classification code (SIC). We produce findings similar to those reported in Table 5B. Results are not tabulated here.

In summary, the documented results in Table 5B are robust after excluding regulated industries (i.e., financial and utility industries) and employing a refined industry classification.

6 Conclusion

Accounting information is an important input to credit rating models. Despite the repeated claim by S&P that cash flow is a critical factor in rating decisions, prior empirical studies present evidence contradicting this claim. This contradiction has remained unresolved for years.

We revisit the relation between operating cash flow and credit rating with hints from S&P's rating manual (S&P, 2003, 2006, 2008). We argue that S&P might shift the relative weights of accrual-based earnings and cash-based operating cash flows when rating two different groups of issuers: investment-grade and speculative-grade issuers. Our results are consistent with our conjecture and robust under several robustness tests. Taken together, this study demonstrates that operating cash flow is an important credit rating factor, especially for speculative-grade firms.

This paper contributes to several streams in the literature. We document a structural difference in rating models between investment-grade and speculative-grade firms. In addition, we formally introduce operating cash flow into credit rating model and lend the first empirical support to S&P's claim on the role of cash flow. Our results could be useful to both researchers and credit market participants.

Table 6. Robustness Tests, Ordered Probit Model Estimates for Investment-Grade and Speculative-Grade Firms Respectively, After Controlling Industry Effect and Residual from the Regression of Operating Cash Flow over Operating Margin

	Investment-Grade			Speculative-Grade		
	Coefficient	**Clustered Standard Error**	**P-Value**	**Coefficient**	**Clustered Standard Error**	**P-Value**
Panel A. Pre-2002 Sub-sample						
Operating Margin	1.237	0.137	0.00	-0.184	0.149	0.22
Residual	-0.179	0.336	0.59	1.029	0.356	0.00
Panel B. Post-2002 Sub-sample						
Operating Margin	0.405	0.188	0.03	-0.117	0.192	0.54
Residual	-0.456	0.509	0.37	2.460	0.560	0.00
Panel C. With Unadjusted Beta and Standard Error						
Operating Margin	0.866	0.109	0.00	-0.139	0.117	0.23
Residual	-0.240	0.279	0.39	1.517	0.299	0.00
Panel D. 1989 Firms Excluded						
Operating Margin	0.870	0.109	0.00	-0.158	0.117	0.18
Residual	-0.195	0.279	0.48	1.483	0.301	0.00
Panel E. Observations from the CC/C Category Excluded						
Operating Margin	N/A	N/A	N/A	-0.088	0.119	0.46
Residual	N/A	N/A	N/A	1.656	0.306	0.00
Panel F. Financial Firms Excluded						
Operating Margin	0.926	0.136	0.00	-0.166	0.125	0.19
Residual	0.290	0.306	0.34	1.669	0.318	0.00

Operating margin is calculated as operating income before depreciation (data item 13) divided by net sales (data item 12). Operating cash flow is the three-year averages (data from the current year and the last two years) of annual operating cash flow (Compustat data item 308) deflated by total assets. We calculate the three-year average to ensure consistency with S&P (2003, 2006). Residual is derived from the OLS regression of operating Cash Flow over Operating Margin. It captures the additional credit-related information content from the operating cash flow. Clustered standard errors are robust standard errors after adjustment of the clustering on firms. P-values are two-sided.

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