

Accounting information and disaggregated credit risk

Robert Hills*

Pennsylvania State University
roberthills@psu.edu

Matt Kubic

University of Texas at Austin
matt.kubic@mcombs.utexas.edu

Katherine Schipper

Duke University
katherine.schipper@duke.edu

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ABSTRACT

We examine the relation between accounting information and Moody's Investor Services' *ex ante* assessments of two credit risk components (probability of default (PD) and loss given default (LGD)), the relation between LGD and actual creditor recoveries following default, and the relation between defaulted obligor asset composition and default resolutions. We find accounting information explains substantial variation in PD and little variation in LGD, and income statement information explains more variation in PD, while balance sheet information explains more variation in LGD. Adjusting for non-cash income items strengthens the relation between accounting information and PD and adjusting for goodwill and intangibles slightly improves the weak association with LGD. We find evidence that intangible assets are informative to creditors after default events and tangible assets are not. For a sample of defaulted obligations, creditor recoveries (*ex post* realizations of LGD) are associated with interest coverage and intangibles. In a sample of fresh-start reporting asset remeasurements, we find intangible assets but not property, plant and equipment are frequently remeasured upwards, often by considerable amounts.

Keywords: Loss Given Default; Probability of Default; Debt; Debt Valuation; Credit Ratings; Default Resolution; Creditor Recoveries.

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1. INTRODUCTION

We analyze the relation between accounting information and two distinct and related components of credit risk: *ex ante* default risk, typically in the form of an ordinal ranking, and *ex ante* expected creditor losses in the event of default, typically in the form of a point estimate. Our analysis adopts two linked premises, first, that the objective of financial reporting is to provide information to financial resource providers to assess the returns they can expect from investing or lending, and, second, that resource providers consider *both* accounting and non-accounting information (Financial Accounting Standards Board (FASB) 2021, para. OB1-OB2, OB6). Our analyses largely confirm the generally acknowledged view that accounting information is informative about *ex ante* default risk, and we provide new evidence as to whether and how current and potential creditors (hereafter, creditors) use accounting information in combination with non-accounting information to estimate the returns they expect from lending (Barth et al. 1998; Kothari et al. 2010), including returns if the obligor defaults. Consistent with the FASB’s conceptual framework, we propose that creditors wish to assess *both* the payoff when the borrower does not default (interest and return-of-principal) *and* the payoff when the borrower defaults, as well as the likelihood of each outcome.

Our analysis takes the view that *ex ante* assessments of the likelihood of default are conceptually and empirically related to and distinct from estimates of the loss given a default event, implying the two assessments may not be based entirely on the same information.¹ The former is an entity-level judgment of the likelihood of default (probability of default or PD) and the latter is

¹ An analogy in financial reporting is the two distinct and related components of accounting for contingent losses in ASC 450-20, consisting of (1) the judgment as to whether it is probable a loss has been incurred (an assessment of likelihood) and (2) if so, what is the “best estimate” of the amount of loss. As discussed later, the former, a binary or yes/no assessment is likely to be less difficult than the latter, a point estimate.

an obligation-specific estimate of the amount of creditor loss after a default (loss given default or LGD).² Our empirical proxies for PD and LGD are expert judgments provided by Moody's Investor Services for speculative-grade borrowers.³ Conceptually, PD is an *ex ante* expert judgment of the relative likelihood an entity will default (not meet its obligations as they come due) and is therefore pertinent for any obligor, while LGD is pertinent only if the outcome is default. PD is ordinal and entity-specific: a PD rating ranks an entity's probability of default relative to the least risky issuers. LGD is an obligation-specific point estimate that can be compared to creditors' realized recoveries, while PD has no such "true-up" feature. Empirically, the Spearman (Pearson) correlation between decile-ranked Moody's PD and LGD estimates for our sample of 28,599 subordinated debt instruments is 0.24 (0.21), significant at the 0.01 level.

We first provide evidence on the associations between accounting information and the distinct components of *ex ante* credit risk, PD and LGD. In analyzing PD, we extend prior research (e.g., Altman 1968; Ohlson 1980) that demonstrates the predictive ability of accounting information for bankruptcy, an *ex post* outcome of credit risk that often but not always coincides with default. This prior research does not analyze creditor payoffs following bankruptcy. In analyzing LGD, we consider two alternative perspectives. Under the first perspective, creditors look to asset liquidation values after an obligor defaults, and, following Barth et al.'s (1998) reasoning, they use balance sheet information more than income statement information to assess

² Assessing default at the obligor level follows from the widespread use of cross-default provisions, in which a default on one obligation places all the defaulting obligor's obligations in default. Because we are concerned with payoffs, consistent with Moody's we define default as non-payment of contractual principal and/or interest, excluding technical defaults from violating a debt covenant (Emery 2022).

³ As explained in more detail later, in 2006 Moody's began issuing assessments of two distinct components of credit risk for speculative-grade borrowers. Moody's provides LGD only for speculative-grade issuers because "a default event is more remote for investment-grade issuers" (Ajzenman et al. 2015). PD is expressed as ordinal rankings of relative credit risk with AAA the lowest relative credit risk. LGD is an estimate of the loss a creditor could expect on a specific defaulted obligation, expressed as a percent of the amount owed.

amounts available to them in the event of default, that is, LGD.⁴ The second perspective is based on Lian and Ma's (2021) analysis of cash-flow-based lending. Under this perspective, following a default creditors look less to asset liquidations and more to the obligor's ability to generate cash flows from operations, based on the view that creditors generally expect more favorable post-default recoveries if the obligor continues to operate, as opposed to being liquidated. In analyzing LGD, we consider both accounting information and instrument-specific contractual features suggested by intuition and our reading of Moody's discussions (Cassidy et al. 2006; Emery 2022). We also provide evidence as to whether the associations between accounting information and the two components of credit risk vary based on the obligor's financial condition and the composition of its assets, and vary with four forms of default resolution (distressed exchange, acquisition, liquidation under a Chapter 7 bankruptcy filing, reorganization under a Chapter 11 bankruptcy filing). This evidence informs thinking about the asset-liquidation perspective vs the cash-flow perspective presented in previous research.

With respect to associations between accounting information and credit risk, we investigate the extent to which, controlling for firm size, two income statement measures (interest coverage and earnings volatility) and two balance sheet measures (book value of equity and leverage) explain variation in Moody's PD and LGD assessments issued during 2006-2022. These four accounting measures have been vetted by prior research and they figure prominently in debt contracts (Beaver 1966; Christensen and Nikolaev 2012). We restrict our sample to observations with issuer level-PD ratings and at least one subordinated debt LGD rating and focus on subordinated debt, rather than senior debt secured by specific collateral, based on the view that

⁴ Some prior research in finance and economics refers to this perspective as asset-based lending, in that its "focus has been the liquidation value of physical assets" (Lian and Ma, 2021, p. 234-235). Under this perspective, intangible assets and goodwill are of little interest to creditors in assessing post-default payoffs because these assets have low or no liquidation value.

accounting information is more useful for determining expected creditor recoveries given default for debt that is not secured by a specific asset. If an entity has multiple subordinated-debt LGD ratings (because it has more than one subordinated debt instrument), we use a weighted-average LGD rating; weights are based on the amounts of the entity's subordinated debt instruments.⁵

We find accounting information explains meaningful variation in PD, an *ex ante* credit risk assessment. A specification including all four accounting measures and size explains 38.1% of cross-sectional PD variation, with more explanatory power from income statement information. This result is consistent with Lian and Ma's (2021) finding that US non-financial firm debt is predominantly borrowing against cash flows, and points to earnings as the source of cash an entity uses to meet its obligations and avoid default. In contrast, and consistent with a conceptual and empirical distinction between PD and LGD, we find the four accounting measures plus size explain only 5.8% of the variation in LGD of subordinated debt. As suggested by Barth et al. (1998), balance sheet information explains more (5.7%) LGD variation than income statement information (1.6%) for subordinated obligations. The modest explanatory power of balance sheet information for LGD suggests creditors' *ex ante* assessments of post-default payoffs use some combination of accounting information and non-accounting information such as contractual features of specific obligations. Additional tests (section 5.2.2) show our main findings are robust to using nine additional accounting measures of profitability and asset composition.⁶

We analyze the finding of substantial explanatory power of accounting information for the PD component of credit risk vs the low explanatory power for the LGD component in four ways.

⁵ The weighted-average LGD rating is, in effect, an issuer-level measure based on subordinated debt instruments

⁶ We do not include conditional conservatism as an additional measure for two reasons. First, conservatism is not itself an accounting measure but rather a reporting practice and a (possible) attribute of reported amounts, and second, empirical measures of conditional conservatism are not reported amounts but instead rely on equity-market-participant perceptions in the form of returns.

First, we analyze how explanatory power varies with the obligor's financial condition. In an equity valuation context, Barth et al. (1998) find the value relevance of balance sheet (income statement) information increases (decreases) as a firm's financial condition deteriorates; we test whether this result applies to LGD ratings, reasoning that even within a sample of speculative-grade obligations, relatively poorer financial condition may increase the importance of balance sheet information in assessing LGD. When we separate the sample by rating (Ba1-B3 vs Caa1 and lower), we find leverage explains variation in LGD for both subsamples, and interest coverage explains variation in LGD only for issuers closer to default (Caa1 or lower). Explanatory power increases very slightly, from 5.7% for the Ba1-B3 subsample to 5.8% for the Caa1 and lower subsample. While we find no evidence for our sample of speculative-grade obligations that balance sheet information is more strongly associated with LGD as financial condition worsens, we do find that interest coverage, a measure of cash-generating ability, is statistically more strongly related to LGD for the Caa1 and lower subsample. This result contrasts with Barth et al.'s (1998) results, obtained in an equity valuation context not a debt context, and suggests that creditors of entities approaching default look to cash-generating capabilities not asset sales (Lian and Ma 2021).

Second, and based on the FASB's conceptual framework and previous research showing investors combine accounting and non-accounting information to make decisions (e.g., Beyer et al. 2010), we examine the relative importance of accounting information and debt-contract characteristics in explaining firm-level PD and LGD ratings. This analysis is based on the idea that debt contracts contain features intended to affect creditor payoffs in default. We focus on the four accounting measures previously considered and add three debt contract features: the proportion of a firm's Moody's rated debt with senior-secured status, bank lending facility and revolving credit facility. We find accounting information is of first-order importance in explaining PD and of least

importance in explaining firm-level LGD. The differences are striking. Accounting information explains 38.1% of variation in PD, while debt contract information explains only 8.3%. With respect to LGD, accounting information explains 5.8% of the variation, while the three debt contract features together explain 22.1%. Viewed in the context of previous results, we infer that, consistent with the FASB's conceptual framework description of the purpose of financial reporting, creditors combine accounting information and non-accounting information to analyze the two components of credit risk, and the latter is particularly important for LGD.

Third, and following prior research (Li 2016; Dyreng et al. 2017), we examine how adjusting income statement measures to remove transitory items and depreciation and amortization affects the association between accounting information and credit risk components. We find that adding non-cash depreciation and amortization to operating income increases the explanatory power of interest coverage and earnings volatility for PD, consistent with the idea that the cash component of obligor earnings is a key source of assets for meeting obligations as they come due. Also motivated by prior research, we adjust the balance sheet by removing intangibles and goodwill.⁷ These removals are consistent with Fabbri and Menichini (2010) who model collateral assuming intangibles have zero collateral value, and with Holthausen and Watts (2001) who refer to physical assets and investments but not intangibles as items that could be used as collateral and suggest lenders exclude intangibles and goodwill from financial covenants because these assets have zero liquidation values. However, Mann (2018) reports that 16% of patents produced by US corporations have been pledged as collateral, suggesting the possibility that at least one category of intangible assets has collateral value and Lian and Ma (2021) point specifically to patents as

⁷ Except for qualifying capitalized software development costs, these intangibles and goodwill are recognized from applying the purchase method of accounting for business combinations. In section 6.5, we analyze the special case of fresh-start reporting that recognizes certain *internally developed* intangible assets and goodwill at their fair values.

foundations for asset-based lending. We find excluding intangible assets and goodwill from balance sheet measures substantially diminishes the explanatory power of balance sheet information for PD, from 25.1% to 16.6%. We interpret these findings as confirming prior research in the case of the income statement—adjustments for non-cash items increase the association between accounting information and *ex ante* default assessments—and conflicting with some but not all prior research in the case of the balance sheet—adjustments to remove intangible assets decrease the association between accounting information and *ex ante* default assessments.

In analogous analyses of LGD, we find adjusting income for transitory and non-cash items results in minuscule effects on the explanatory power of income statement information, with adjusted R^2 between 1.6% and 1.7%. Adjusting the balance sheet to exclude identifiable intangible assets and goodwill acquired in business combinations increases explanatory power by 2.2 percentage points, from 5.9% to 8.1%, consistent with the view that creditors do not look to these assets as important determinants of post-default payoffs.

Our fourth analysis focuses on *ex post* creditor losses, the realizations of *ex ante* LGD assessments that undoubtedly measure realized losses with some error.⁸ This analysis considers creditor recoveries by type of default resolution and explores the potential usefulness to creditors of intangible assets as a function of how the default is resolved. While Barth et al. (1998) reason that the role of the balance sheet is to facilitate lending decisions by providing information on asset liquidation values, we find liquidations are the *least* common resolution for our sample of 727 defaults resolved during 1988-2020. Specifically, we find that 116 defaults (about 16%) are resolved by Chapter 7 liquidation, while the other 84% of sample resolutions continue the

⁸ For a subsample of 1,570 defaulted obligations, the correlations between LGD, an *ex ante* measure of creditor losses, and realized losses measured as the trading price of a defaulted obligation as a percent of par, are 0.35 (Spearman) and 0.31 (Pearson) for subordinated instruments.

defaulted entity's operations, possibly with new owners (437 Chapter 11 reorganizations, 127 distressed exchanges and 47 acquisitions.)⁹ Mean (median) creditor recovery rates are highest, 77% (83%), for distressed exchanges and lowest, 44% (36%), for Chapter 7 liquidations. Mean and median recovery rates for Chapter 11 reorganizations and acquisitions range from about 50% to 57%. Given that creditors must agree to distressed exchanges and Chapter 11 reorganizations, these results suggest creditors prefer, and have good reason to prefer, default resolutions that do not involve wholesale asset liquidations and instead involve an arrangement in which the defaulted entity continues to operate, possibly with new owners.

We use a multinomial logit model to analyze the associations between the form of resolution and both accounting information and obligor asset composition. We find intangible assets and interest coverage are positively associated with default resolution through distressed exchange, Chapter 11 reorganization and acquisition, all of which result in better creditor outcomes relative to Chapter 7 liquidation for our sample. Two other asset composition measures, goodwill and property, plant and equipment (PPE), have no statistically reliable associations with the form of resolution. This evidence is not consistent with the view that creditors assess post-default recoveries using mostly liquidation values of tangible assets such as PPE. Rather, and consistent with Lian and Ma's (2021) discussion of cash-flow based lending, the evidence suggests creditors use income statement information and intangible assets to determine whether the defaulted obligor can continue to operate, the outcome for 84% of observations in our defaulted obligation sample.

We extend the findings on income-related information and intangible assets but not PPE as determinants of default resolutions and consider the roles of income-related information and obligor asset composition in creditors' realized recovery rates. We find that for all but the

⁹ Similarly, Lian and Ma (2021, p. 237) report that Chapter 11 bankruptcy filings account for approximately 90% of US corporate bankruptcy filings by value.

distressed-exchange default-resolution method, intangibles as a percent of total assets is positively related to creditors' recovery rates at the 0.10 level or better, and interest coverage is positively related to recovery rates at the 0.01 level or better for Chapter 11 and distressed exchanges, the two most common default resolutions in our sample. These results confirm the importance to creditors of both intangible assets and income as indicators of future cash flows.

Our final analysis considers Chapter 11 reorganizations that qualify for fresh-start reporting which requires, among other things, the remeasurement of assets to fair value similar to the application of the purchase method of accounting for business combinations, except that there is a reorganization value rather than a business combination purchase price. Fresh-start balance sheets show both amortized cost and fair value amounts for PPE and other assets, including intangible assets and goodwill.¹⁰ We view the remeasurement amounts as informative about the post-default cash-generating potential of asset classes. For a sample of 243 instances of fresh-start reporting during 2000-2021 intangible assets are reduced in value in fewer than 10% of cases, and in 42% of cases these assets are remeasured upward by 100% or more. As a benchmark, PPE revaluations reduced values in 55% of cases, and upward remeasurements exceeded 100% in 4% of cases. As a result of revaluations, the balance sheet composition of assets, measured as the percent of total assets attributable to an asset class, shifts away from PPE, other long-term assets, and current assets and toward intangibles and goodwill. In multivariate regressions that consider seven asset classes (PPE, Intangibles, Goodwill, Other long-term assets, Inventory, Accounts receivable and Other current assets), we find the application of fresh start reporting significantly (at the 0.01 level or

¹⁰ ASC 852-45-19 and ASC 852-45-20 describe the qualifying conditions for fresh-start reporting and the principles to be applied, respectively. The principles are those of ASC 805-20 related to measurement of the acquired entity's identifiable assets and liabilities in a business combination. However, and importantly, an entity applying fresh-start accounting will recognize *internally-generated* intangibles and goodwill while application of the purchase method results in recognition of only *externally-acquired* intangibles and goodwill.

better) decreases the percent of total assets attributable to PPE and increases the percent of total assets attributable to intangible assets and goodwill.

Our findings make three kinds of contributions. First, we extend prior research that analyzes the predictive ability of accounting information for bankruptcy, an adverse realization of credit risk, not *ex ante* credit risk *per se* (Beaver 1966; Altman 1968; Ohlson 1980; Zmijewski 1984; Shumway 2001) or analyzes creditor recoveries in bankruptcy (e.g., Donovan et al. (2015)). Our research analyzes the association between accounting information and three credit-risk-related metrics, including *ex ante* ordinal default-likelihood assessments, *ex ante* assessments of loss given default and *ex post* creditor recoveries in four types of default resolution. We examine the ability of accounting information and non-accounting information to explain two distinct and related *ex ante* components of credit risk, PD and LGD, and show that accounting information has a stronger association with PD than LGD while non-accounting information matters more than accounting information for understanding LGD. The latter finding provides context for analyzing accounting research, for example, Barth et al.'s (1998) focus on the balance sheet as a key source of asset-liquidation values as a determinant of LGD.

Second, we contribute to research on rating agencies' expert judgments of credit risk. Previous research (DeHaan 2017; Bonsall et al. 2018; Sethuraman 2019; Gillette et al. 2020) has for the most part analyzed a single credit-risk metric that combines probability of default (PD) and loss in the event of default (LGD).¹¹ We show that PD and LGD capture linked and distinct aspects of credit risk and that the latter have reasonable construct validity as *ex ante* assessments of actual creditor recoveries after default.

¹¹ Moody's (2022, p. 8) describes these single ratings as Corporate Family Ratings that "reflect the relative likelihood of a default on a corporate family's debt and debt-like obligations and the expected financial loss suffered in the event of default."

Third, we provide new evidence on the relative importance of balance sheet vs income statement information for creditors, including whether relative importance changes with adjustments to reported amounts or as a function of borrowers' financial health (Barth et al. 1998; Givoly et al. 2017; Dyreng et al. 2017). We find that adjusting operating earnings for transitory items and non-cash depreciation and amortization strengthens the relation between earnings and PD, consistent with prior research documenting the use of EBITDA in debt contracts (Dyreng et al. 2017; Badawi et al. 2022), and adjustments to the balance sheet to remove goodwill and intangible assets weaken the association. Income statement adjustments have almost no influence on associations with LGD, while balance sheet adjustments strengthen the association, which remains modest. This finding supports conjectures that removing intangible assets and goodwill, acquired in business combinations, from balance sheet measures would make financial statements more useful for debt investors (Watts 2003a, 2003b), at least with respect to *ex ante* LGD assessments. Perhaps surprisingly, and consistent with Lian and Ma's (2021) cash-flow perspective on lending, we find that an income-related measure, interest coverage, becomes more important when obligors are closer to default.

In contrast, our analysis of post-Chapter 11 fresh-start reporting, which requires recognition and fair-value measurement of both the items on the obligor's pre-bankruptcy balance sheet and separately identifiable *internally-generated* intangible assets, shows reliable associations between balance-sheet intangibles and actual creditor recoveries, as well as evidence of frequent and substantial upward revaluations of intangible assets. These findings suggest financial statements are useful to creditors in part because they provide information about intangible assets, including those that are internally-generated, that are valuable to creditors in default. Collectively,

our evidence sheds new light on the usefulness of accounting information for debt investors (Bharath et al. 2008; Frankel et al. 2008; Li 2016; Badawi et al. 2022).

2. PREVIOUS RESEARCH AND OUR PREDICTIONS

Accounting research (Gjesdal 1981; Holthausen and Watts 2001; Lambert 2001; Kothari et al. 2010) posits a distinct stewardship role of accounting information, to mitigate contracting and coordination problems (Healy and Palepu 2001).¹² For example, accounting information can be used in debt contracts to mitigate agency problems or solve an incomplete contract problem.¹³ In contrast, the valuation role of accounting information is to assist in determining either or both enterprise and equity values, thereby helping equity investors (e.g., Lev and Sougiannis 1996; Francis and Schipper 1999; Barth et al. 2001) and creditors (e.g., Givoly et al. 2017)¹⁴ evaluate the expected returns from providing financial resources to an entity in the form of a financial instrument.

Equation 1 and Figure 1 show the relations of interest for our research in simplified forms.

$$E(\text{Return}) = r(1 - PD) - PD * LGD \quad (1)$$

Abstracting from a risk premium, Equation (1) shows that PD and LGD are related and distinct components of credit risk; r is the interest rate, PD is the probability of default, and LGD is loss given default (the difference between the amount owed and the creditor's actual recovery).

¹² These agency problems include but are not limited to the principal-agent conflict and shareholder-debtholder conflict (Jensen and Meckling 1976; Watts and Zimmerman 1978).

¹³ Because of differences in shareholder vs debtholder objective functions, shareholders may prefer high-risk projects since debtholders bear downside risk (Jensen and Meckling 1976; Myers 1977). An incomplete contract problem arises because at origination, it is not feasible to control or contract for all future contingencies, leading to potential hold-up problems (Aghion and Bolton 1992; Christensen et al. 2016). Analytical research surveyed and discussed by Lambert (2001) shows that contracts written on accounting information may mitigate both kinds of problems.

¹⁴ Givoly et al. (2017) examine the changing relevance of accounting information to debtholders over time. They find the association between accounting numbers and debt (equity) returns has increased (decreased) over time, and attribute the increase in debt value relevance to increases in conservatism and use of fair value.

Research examining the relation between accounting information and credit risk has primarily focused on the default component and has found that income statement and balance sheet information is associated with bankruptcy, an outcome that is often but not always associated with default (Beaver 1966; Altman 1968; Ohlson 1980; Zmijewski 1984; Shumway 2001). Because default/nondefault is binary, we believe analyzing and predicting PD is relatively less difficult than analyzing and estimating LGD which is a point estimate associated with, among other things, debt-contract features and how a default is resolved. LGD has recently been examined in the accounting literature from perspectives that differ from ours. For a sample of 347 bankrupt firms, Donovan et al. (2015) show conditional conservatism is negatively related to LGD (i.e., positively related to creditor recovery rates) for firms with previous covenant violations and posit (p. 2281) that conservatism increases the likelihood of covenant violation which transfers control to creditors. As explained in footnote 6, we do not consider conditional conservatism. For a sample of 582 defaulted bonds, Amiram and Owens (2023) analyze whether accounting information available at the debt-contracting date affects the design of lending agreements, under the view that accounting information is useful for contract design because the information is associated with LGD. We do not adopt this perspective, which views the *ex ante* assessment of post-default creditor losses as an input to contract design. Instead, we view contract design, for example, subordination status as an input into the *ex ante* estimation of LGD. As previously discussed, we also provide evidence that suggests accounting information is less associated with LGD than are debt contract features.

In our analysis of whether (and how well) accounting information explains variation in credit risk, we consider both the overall relations between accounting information and two distinct and related components of credit risk and whether the explanatory power for each credit-risk component comes from more income statement (earnings-related) information or more from

balance sheet (asset and liability) information. If accounting information provides estimates of asset liquidation values and creditors are primarily concerned with these values (Watts 2003a; Barth et al. 1998)¹⁵ there should be a stronger association between balance sheet information and LGD than between balance sheet information and PD. If accounting provides information about default, the inability to pay principal and/or interest when they are due, or provides an early warning of default to allow creditor intervention, there should be a stronger relation between income statement information and PD than between income statement information and LGD. Given this reasoning, we analyze three predictions:

Prediction 1: Income statement information is more associated with PD than is balance sheet information.

Prediction 2: Balance sheet information is more associated with LGD than is income statement information.

Prediction 3: Accounting information is equally associated with variation in PD and LGD.

3. CREDIT RATINGS

Conceptually, as shown in simplified form in Figure 1, the two components of credit risk, PD and LGD, are (unobservable) resource-provider expectations of uncertain outcomes. Empirically, researchers typically measure credit risk using expert assessments provided by credit rating agencies such as Moody's, S&P, and Fitch, who together account for more than 95% of credit ratings (White 2013). In 2006, Moody's began providing disaggregated credit ratings for speculative-grade loans, bonds and preferred stocks, those rated Ba1 or below, stating "[the]

¹⁵ Barth et al. (1998) describe the separate roles of income statement and balance sheet information as follows: "...a distinctive role of the balance sheet is to facilitate loan decisions and monitoring of debt contracts. It fulfills this role by providing information on liquidation values, the amount available to debtholders in the event of default. In contrast, the role of the income statement primarily is for valuing equity. It fulfills this role by providing information about the firms' abnormal earnings opportunities, i.e., unrecognized net assets." (References omitted)

initiative will increase the utility and transparency of speculative grade ratings” (Cassidy et al. 2006).¹⁶ PD and LGD, which are available for a broad sample of US firms, separate the *ex ante* assessment of credit risk into the likelihood of default (PD, assessed ordinally at the entity level relative to the least-risky category, AAA) and expected loss incurred in the event of default (LGD, a specific amount estimated at the instrument level).¹⁷

Moody’s describes PD as “the relative likelihood that any entity within a corporate family will default on one or more of its long-term debt obligations” (Emery 2016). Because nearly all debt agreements contain cross-default provisions, we assume a default on one obligation triggers a default on all obligations (Beatty et al. 2012). We use Moody’s definition of default: (1) missed or delayed payment of contractually-obligated interest or principal; (2) bankruptcy filing or legal receivership by the debt issuer or obligor; (3) distressed exchange (Emery 2016). Moody’s does not consider technical defaults (covenant violations) as defaults. Firm-level PD follows an alphabet-oriented ordinal scale, from AAA (lowest default risk) to C (highest default risk). Obligation-level LGD ranges from 0% to 100%. For example, LGD = 60% means that conditional on default Moody’s estimates creditors can expect to recover 40% (1-60%) of the amount owed.

4. SAMPLE SELECTION

We obtain PD and LGD from Moody’s Default and Recovery Database (DRD) from 2006 through September 15, 2022. A firm has a single entity-level PD and an LGD for each of its rated obligations. We match CUSIP and ticker symbols from Moody’s data to Compustat Global Company Key (GVKEY). If a firm’s CUSIP and ticker symbol from Moody’s ISSR_IDS table

¹⁶ Previously Moody’s issued aggregated corporate family credit ratings (CFR) that reflect the relative likelihood of default combined with the expected loss if a default occurs.

¹⁷ Moody’s calculates LGD as a “function of the probability distribution of different potential outcomes for the company’s firm-wide recovery rates at default, its expected liability structure at default, and the expected security and priority of those claims in bankruptcy”(Ajzenman et al. 2015).

match the same GVKEY we use that GVKEY. If the two GVKEYs differ, or if the firm is missing a CUSIP or ticker symbol, we manually compare names. We merge the PD-LGD sample with quarterly accounting information and require non-missing data for PD, LGD and accounting information needed to calculate the measures used in our analysis.¹⁸ As shown in Table 1, the final sample for the analysis of PD and LGD covers 2006-2022 and contains 28,599 firm-quarters and 1,504 unique firms.¹⁹

5. EMPIRICAL ANALYSIS

5.1. Validation assessments and descriptive statistics

We convert Moody's alphabet-oriented PD ratings to ordinal integer values from 1 (lowest default risk) to 10 (highest default risk).²⁰ Moody's obligation-specific LGD ranges from 0% (full recovery of contractual cash flows) to 100% (complete loss). To facilitate our analyses given measurement differences in PD and LGD, we sort LGD percentages into deciles so they are aligned with the 10 PD intervals.

Validation assessments. To document that PD and LGD capture distinct and related components of credit risk, we calculate correlations between firm-specific PD and our firm-specific LGD measure for 28,599 firm-quarter observations of subordinated instruments. Untabulated Pearson and Spearman correlations between PD and LGD are 0.21 and 0.24 respectively, both significant at the 0.01 level. We verify the construct validity of LGD by calculating correlations between LGD, an *ex ante* expert assessment, and actual recoveries

¹⁸ Moody's reports the beginning date and expiration or ending date of each rating. We match quarterly data for all quarters in which a firm's rating is active. If the ending date is missing we assume the rating is current as of September 15, 2022.

¹⁹ There are 17,230 firm-quarter observations in which the firm has more than one subordinated-debt obligation with an LGD rating. For 5,198 of these firm-quarters (30%) the LGD ratings differ by more than 2 percentage points, indicating that LGD ratings within a firm-quarter are often similar, if not identical, for subordinated debt.

²⁰ Each interval represents a distinct letter rating, except that 10 includes Ca, C and D ratings. Assigning separate integers to Ca, C and D ratings does not affect our results.

following defaults (LGD Actual) based on Moody's Default Price data. LGD Actual is the trading price of defaulted debt as a percent of par value as of the default date for distressed exchanges and 30 days after default for other default events. For 1,570 sample obligations with data on both LGD and LGD Actual, the untabulated Pearson (Spearman) correlation between LGD and LGD Actual is 0.35 (0.31), significant at the 0.01 level.

Descriptive statistics. We analyze the associations between credit risk components and both income statement and balance sheet information. Based on prior research (e.g., Kaplan and Urwitz (1979)), we use two income statement ratios, interest coverage (pre-tax income before interest expense divided by interest expense plus capitalized interest) and earnings volatility (standard deviation of earnings scaled by the standard deviation of cash from operations (Francis et al. 2004)), and two balance sheet variables, book value of equity and leverage. We decile-rank all accounting variables to facilitate comparisons across variables and regressions and to minimize the influence of outliers. Results are qualitatively similar if we winsorize all continuous variables at 1% and 99%. Appendix A provides variable definitions.

Table 2 reports mean and median decile-ranks of the four accounting variables we analyze, by firm-quarter PD category (Panel A) and LGD deciles (Panel B). As expected, Panel A shows PD is lower when interest coverage is greater and higher when earnings are more volatile, leverage is greater and book value of equity is lower. Panel B presents firm-level LGD by decile for subordinated obligations. LGD equals or exceeds 50% for about 97% of observations, and exceeds 90% for about 6.5% of observations. Panel B does not show a systematic relation between either income statement information or balance sheet information and LGD, pointing to non-accounting information as important in explaining variation in LGD.

5.2 Explanatory power of accounting information for PD and LGD

5.2.1 Analysis of Predictions 1, 2 and 3. To examine the explanatory power of accounting information for variation in PD and, separately, LGD, we estimate the following equations:

$$PD_{i,t} = \alpha_0 + \alpha_1 Interest\ Coverage_{i,t} + \alpha_2 Volatility_{i,t} + \alpha_3 BVE_{i,t} + \alpha_4 Leverage_{i,t} + \alpha_5 Size_{i,t} + \varepsilon$$

(2A)

$$LGD_{i,t} = \alpha_0 + \alpha_1 Interest\ Coverage_{i,t} + \alpha_2 Volatility_{i,t} + \alpha_3 BVE_{i,t} + \alpha_4 Leverage_{i,t} + \alpha_5 Size_{i,t} + \varepsilon$$

(2B)

We include a control for *Size*, measured as the natural log of assets. A market-based size measure, the natural log of market value of equity, yields similar inferences. Table 3 Panel A presents the results of estimating Equations 2A and 2B including all four accounting measures and Panel B presents results, discussed in Section 5.2.2, when we add nine additional accounting measures, considered one at a time.

We use the results in Panel A to analyze our predictions.²¹ Results in Columns 1-3 support Prediction 1, that income statement measures explain more variation in PD than do balance sheet measures. In Column 1, both income statement measures have the predicted associations with PD, and the coefficient estimates are significant at the 0.01 level. The adjusted R² is 30.6%, statistically greater (at the 0.01 level, based on a Vuong test) than the adjusted R² (25.1%) in the Column 2 model that includes only balance sheet variables. In Column 3, we include all four accounting variables and find that the coefficients on all accounting variables have the predicted signs and are significant at the 0.01 level. The adjusted R² is 38.1%.

Our second prediction is that the association between LGD and balance sheet information is stronger than the association between LGD and income statement information. Results in

²¹ We cannot use statistical tests to compare coefficients or adjusted R² across regressions using different dependent variables. Our analyses compare results across Columns 1-3, where PD is the dependent variable and, separately, across Columns 4-6, where LGD is the dependent variable.

Columns 4-6 of Table 3 Panel A support this prediction. Income statement measures (Column 4) explain 1.6% of the variation in LGD, and balance sheet measures (Column 5) explain 5.7% of this variation. A Vuong test confirms balance sheet measures explain more variation in subordinated obligation LGD than does income statement information. In contrast to results in Column 3, which show combining income statement and balance sheet information substantially increases explanatory power for PD, results in Column 6 show the adjusted R^2 for LGD barely increases (from 5.7% to 5.8%) when we combine income statement and balance sheet information.

Differences in results across the six columns are striking. First, all four accounting variables help explain variation in PD while only interest coverage and leverage help explain variation in LGD in all specifications considered; the coefficient on volatility is significant at the 0.10 level in the specification including both balance sheet and income statement information (Column 6). Second, the adjusted R^2 of the PD model (38.1%) is about 6.6 times the R^2 of the LGD model (5.8%). These results are not consistent with Prediction 3 and instead suggest accounting information explains substantially more variation in PD than in LGD.²² Viewed as a whole, the results in Table 3 Panel A show that accounting information has a statistically strong association with PD and a weak relation with LGD. Income statement information has a stronger relation with PD relative to balance sheet information, and the opposite is true for LGD.

5.2.2. Robustness of results to using other accounting measures. To ensure the results in Table 3 Panel A are not due to the selection of accounting variables, we examine the association between PD and LGD and each of nine additional accounting variables, defined in Appendix A: ROA, Profitability, change in net income (ΔNI), Special Items Ratio, CFO Volatility, Skewness,

²² To facilitate comparing adjusted R^2 across non-nested models, we measure the dependent variables on the same decile scale and use the same independent variables. The marked differences in magnitudes suggest our conclusions are not driven by model specification.

Tangibility, tangible net worth (TNW) and Working Capital. Table 3 Panel B, Column 1 (Column 2) reports the coefficient estimate (R^2) when we regress PD on the specified accounting variable. *BVE* and *Interest Coverage*, both included in our main tests, have the largest absolute coefficient magnitudes (0.310 and 0.280, respectively) and R^2 (0.223 and 0.182, respectively). Coefficients on all nine additional accounting variables are significant at the 0.01 level, but only *ROA* (an alternative profitability measure) and *TNW* (an alternative measure of shareholder equity) have coefficient estimates whose magnitudes exceed 0.15 and whose R^2 exceed 0.05. Columns 3 and 4 report results when we regress LGD for our sample of subordinated obligations on the specified accounting variable. *Leverage*, *BVE*, and *TNW* have the largest absolute coefficient magnitudes (0.096, 0.084, and 0.078 respectively) and these balance sheet measures have the largest R^2 (0.046, 0.035 and 0.032) among all variables. The other additional accounting variables do not explain much variation in subordinated obligation LGD. We conclude that the results in Table 3 Panel B are consistent with the view that accounting information does not explain much variation in LGD and that using alternative accounting measures will not overturn this conclusion.

6. ADDITIONAL ANALYSIS

Results in Section 5 show accounting information explains considerable variation in PD and little variation in LGD. We examine four possible explanations for this second result. First, building on Barth et al.'s (1998) finding that the value relevance (for equity) of accounting information depends on the borrower's financial health, we conjecture that accounting information explains more variation in LGD for obligors closer to default. This conjecture is based on Barth et al.'s (1998) reasoning that creditors focus on balance sheet information about assets because they are most interested in asset liquidation values in the event of defaults. However, reasoning and evidence in Lian and Ma (2021) suggests that what matters most to creditors is the obligor's ability

to generate cash from operations. Second, contextual non-accounting information related to creditor payoffs in default might be important in explaining variation in LGD, given that debt contracts contain provisions, for example, seniority provisions explicitly intended to affect those payoffs. Third, adjustments to reported amounts might improve the explanatory power of accounting information for LGD, based on reasoning in (Watts 2003a, p. 212) that “debt holders are concerned with the lower ends of the earnings and net asset distributions.” If reported amounts do not reasonably reflect information desired by debt holders, then adjustments to accounting information, such as removing transitory income items and/or intangible assets, might increase the explanatory power of accounting information for variation in LGD. Fourth, and notwithstanding the meaningful correlations between Moody’s *ex ante* LGD ratings and *ex post* LGD realizations (LGD Actual), the former almost certainly contain measurement error with respect to the latter. Therefore, we examine the relation between accounting information and realized losses for a sample of defaulted obligors.

6.1. Conditioning on Financial Health of the Obligor

Barth et al. (1998) provide evidence that balance sheet (income statement) information becomes more (less) useful for explaining equity prices as a borrower approaches default. Extending their analysis from equity to debt, we consider whether the obligor’s financial health as measured by PD affects the association between accounting information and components of credit risk by splitting our sample at the median based on whether the obligor’s PD is above or below B3 and repeat the Table 3 analyses of associations between accounting information and LGD. Table 4 reports the results.

For 26,776 observations with PD ratings of B3 or above, only *Leverage* and *Volatility* have reliably non-zero coefficients, at the 0.10 level or better and the R^2 is 5.7%. For 1,823 observations

with PD equal to Caa1 or lower, both *Interest Coverage* and *Leverage* have reliably non-zero coefficients, at the 0.05 level or better, and the R^2 is 5.8%, an increase of 0.1 percentage points relative to the explanatory power of regressions with higher PD ratings. Untabulated F-tests for equality of coefficients in the two regressions show the coefficient on *Interest Coverage* is statistically larger (at the 0.059 level) in the regression using lower-rated obligations than in the regression using higher-rated obligations. F-tests for coefficient equality on the other three accounting measures do not show statistically reliable differences. We draw two conclusions from these results. First, for our sample of speculative-grade obligations, accounting information has little, if any, additional explanatory power for LGD when the obligor is in poorer financial health as captured by PD ratings of Caa1 and lower. Second, and consistent with the view that creditors look to cash-generating capability even when the obligor is closer to default, *Interest Coverage* is statistically more related to LGD for these obligors.

6.2. Non-accounting Variables

The inclusion of non-accounting information in credit rating prediction models suggests this kind of information will be related to either PD or LGD or both (Kaplan and Urwitz 1979; Collin-Dufresne et al. 2001). We extend this research and focus on three contractual features of borrowing agreements: subordination status, revolving loan and bank lending. These variables have been shown to be related to either *ex ante* measures of credit risk (Kaplan and Urwitz 1979; Collin-Dufresne et al. 2001) or *ex post* defaults and recovery rates (Altman 1992; Denis and Mihov 2003; Franks and Torous 1994). To test the importance of these contractual features, we estimate the following equations:

$$PD_{i,t} = \alpha_0 + \alpha_1 size_{i,t} + \sum_a \alpha_a AcctVars^a_{i,t} + \sum_c \alpha_c Contract^c_{i,t} + \varepsilon \quad [3A]$$

$$LGD_{i,t} = \alpha_0 + \alpha_1 size_{i,t} + \sum_a \alpha_a AcctVars^a_{i,t} + \sum_c \alpha_c Contract^c_{i,t} + \varepsilon \quad [3B].$$

AcctVars^a includes the four accounting variables from Equations 2A/2B. *Contract*^c includes three contractual features: (1) bank facility, when the lender is a bank, (2) senior secured debt, when debt has this seniority feature or (3) revolving loan, when the borrower is permitted to repay/reborrow within certain limits in an indefinite-term arrangement. All the contract variables vary between 0 and 100%, representing the percentage of a given obligor's Moody's rated obligations with a given feature.

Table 5 presents the results of this analysis. Columns 1-3 present results for Equation 3A (PD regressions), and Columns 4-6 present results for Equation 3B (LGD regressions). Column 1 shows the association between the four accounting variables and PD, controlling for size, repeating the results in Column 3 of Table 3, Panel A. In Column 2, we replace the accounting variables with the contract variables; the adjusted R^2 declines to 8.3% from 38.1%, a decline of 29.8 percentage points. A Vuong test shows the decline in explanatory power is significant at the 0.00 level. In Column 3, when the regression includes all accounting and contract variables, the adjusted R^2 is 41.0%; coefficients on all four accounting variables and all three contract variables are significant at the 0.01 level. Overall, the results indicate that information about contract features augments and does not supplant accounting information in explaining variation in PD.

As previously discussed, we believe contractual features of borrowing agreements could help explain variation in LGD. Column 4 reports the results of estimating Equation 3B including only the accounting variables, repeating the results in Column 6 of Table 3, Panel A. When we replace the accounting variables with the three contract variables (Column 5), the adjusted R^2 is 22.1%, about 3.8 times the adjusted R^2 in Column 4, and coefficients on all three contract variables are significant at the 0.01 level. In Column 6, when we include all accounting and contract variables, the three contract variables retain significance at the 0.01 level or better and coefficients

on three of the four accounting variables (*Interest Coverage, Volatility and Leverage*) are significant at the 0.05 level. The adjusted R^2 is 24.6% as compared to the contract-variables-only R^2 of 22.1% in Column 5. These results point to the primary importance of contract features, not accounting information, in explaining variation in LGD.

6.3. *Adjustments to Reported Information*

Watts (2003a) argues that lenders prefer conservative accounting information and explains the relation among conservative accounting, liquidation values, and intangible assets as follows:

The orderly liquidation concept underlies conservative accounting. When estimating the value of net assets for interim distributions in accordance with claimants' contracted priorities, the liquidator anticipates all possible losses and no unverifiable gains. In other words, the liquidator employs conservative accounting...intangible assets typically are not included in net assets" 'conservatively,' because their values are not verifiable.

Leftwich (1983), Beatty et al. (2008) and Frankel et al. (2008) provide evidence that adjustments to amounts used in balance-sheet-based covenants may decrease reported net asset values.²³ Similarly, Holthausen and Watts (2001) argue that in liquidation many intangible assets are likely to have zero value; however, both Mann (2018) and Lian and Ma (2021) report that patents are sometimes pledged as collateral.

Beatty et al. (2019) and Badawi et al. (2022) show that debt covenants often use adjusted performance measures such as EBITDA which excludes certain transitory items and non-cash depreciation and amortization. This type of adjustment is consistent with Dechow and Ge (2006) finding that certain transitory and non-cash items are less predictive of future cash flows. Thus, prior research suggests adjusted earnings numbers, for example operating income plus depreciation and amortization, may predict future cash flows better than does unadjusted GAAP

²³ Beatty et al. (2008) note that approximately half the contracts they analyze exclude purchased intangible assets. They state (p. 156) "this exclusion is more likely when the borrower's probability of default is high."

income (Ball and Nikolaev 2022). However, from the perspective of a credit rating agency, Li (2016) reports that GAAP net income is better at explaining aggregate credit risk than other adjusted performance measures such as EBITDA.²⁴

Based on this prior research, we examine whether adjusted balance sheet and income statement measures improve the association between accounting information and either or both PD and LGD. We consider two measures of adjusted income: operating income which adds back nonoperating income and interest (Compustat item OIADP)²⁵ and EBITDA, earnings before interest, taxes, depreciation and amortization (Compustat item OIBDP), which prior literature shows is similar to an earnings measure used in debt contracts and exhibits asymmetric gain timeliness (Dyreng et al. 2017). Appendix B shows the Compustat standard income statement to demonstrate these adjustments. Using these adjusted income measures, we estimate the following equations:

$$PD_{i,t} = \alpha_0 + \alpha_1 Adj_InterestCoverage_{i,t} + \alpha_2 Adj_Volatility_{i,t} + \alpha_3 Size_{i,t} + \varepsilon \quad [4A]$$

$$LGD_{i,t} = \alpha_0 + \alpha_1 Adj_InterestCoverage_{i,t} + \alpha_2 Adj_Volatility_{i,t} + \alpha_3 Size_{i,t} + \varepsilon \quad [4B]$$

We consider two adjustments to balance sheet measures of leverage and book value of equity based on arguments that goodwill and intangible assets have little or no value in resolving defaults. First, we subtract goodwill from total assets and second, we subtract both goodwill and intangible assets from total assets and calculate leverage and book value of equity. Using these adjusted balance sheet measures, we estimate the following equations:

$$PD_{i,t} = \alpha_0 + \alpha_1 Adj_BVE_{i,t} + \alpha_2 Adj_Leverage_{i,t} + \alpha_3 Size_{i,t} + \varepsilon \quad [5A]$$

²⁴ While Li (2016) suggests including transitory items in accounting-based performance measures improves predictability, Dyreng et al. (2017) find accounting-based performance measures excluding transitory items are more predictive of future cash flows, an indicator of credit risk. Neither study separately examines the relation between accounting information and disaggregated credit risk.

²⁵ The difference between OIADP and our earnings measure – (PI + XINT) – is that OIADP excludes non-operating gains and losses and special items.

$$LGD_{i,t} = \alpha_0 + \alpha_1 Adj_BVE_{i,t} + \alpha_2 Adj_Leverage_{i,t} + \alpha_3 Size_{i,t} + \varepsilon \text{ [5B]}$$

We estimate equations 4A, 4B, 5A and 5B for each adjusted accounting measure, and test whether adjustments to accounting measures improve the associations with PD and LGD by comparing adjusted R² across specifications. To ensure proper comparisons across specifications, we remove observations with insufficient information to compute adjusted accounting measures.

Table 6 Panel A, Columns 1-3 report the results of estimating Equation 4A using unadjusted and adjusted interest coverage and earnings volatility. In Column 1, the adjusted R² is 30.8% for unadjusted measures, increasing to 33.7% in Column 2 when we use operating income and to 35.8% in Column 3 when we use operating income plus depreciation and amortization (EBITDA). Vuong tests confirm these increases are significant at the 0.00 level. We conclude that adjusting GAAP income improves the relation between PD and income statement information. Columns 4-6 show how removing goodwill and both goodwill and intangible assets affects the association between balance sheet measures and PD. In Column 4, the adjusted R² from estimating Equation 5A using unadjusted measures is 25.1%, declining to 17.8% when we subtract goodwill (Column 5) and to 16.6% (Column 6) when we subtract both goodwill and intangible assets. Vuong tests show these declines are significant at the 0.00 level. Our results suggest that, in contrast to arguments that intangible assets and goodwill are of little value to creditors, removing these assets from the balance sheet reduces the association between balance sheet information and PD.

Table 6 Panel B shows associations between LGD and adjusted income statement information (Columns 1-3) and balance sheet information (Columns 4-6). Results in Columns 1-3 show that adjusting the earnings number used to calculate interest coverage and earnings volatility has little effect on the very modest explanatory power of income statement information data for LGD. Adjusted R² range from 1.6% to 1.7% and the only reliably (at the 0.10 level or better) non-

zero coefficients are on unadjusted and adjusted *Interest Coverage*. In contrast, results in Columns 4-6 show that adjusting balance sheet information by removing either goodwill or both intangible assets and goodwill increases explanatory power from 5.9% (unadjusted data) to 7.0% (removing goodwill) and to 8.1% (removing both intangibles and goodwill). Vuong tests show that these increases are statistically reliable at the 0.00 level.

Viewed as a whole, our results show that replacing earnings with either operating income or EBITDA increases the explanatory power of interest coverage and earnings volatility for PD, and adjusting balance sheet measures by eliminating goodwill or both goodwill and intangible assets reduces explanatory power for PD. In the case of LGD, we find adjustments to income statement measures have negligible effects on explanatory power while removing goodwill or goodwill and intangibles from balance sheet measures increases explanatory power. Keeping in mind that LGD is an imperfect *ex ante* estimate of realized creditor recoveries after defaults, we next explore the latter finding by analyzing actual recoveries for a sample of 727 default resolutions.

6.4. Role of Accounting Information in Predicting Ex-post Recovery Rates

We analyze 727 default resolutions, using data from Moody's Recovery Events database, including both the recovery rate²⁶ and the default resolution mechanism (distressed exchange, Chapter 11 reorganization, Chapter 7 liquidation, acquisition) to assess the relation between accounting information available before defaults and actual recoveries (*ex post* realizations). In Table 7 Panel A shows the sample selection and Panel B presents descriptive statistics on recoveries for each of the four types of resolution we consider.

²⁶ Recovery rate is the actual amount recovered by the creditors on the defaulted obligation relative to the obligation amount.

Table 7 Panel B shows that about 17.5% of our sample (127 observations) are distressed exchange resolutions in which the borrower and lender agree to exchange the defaulted obligation for a new arrangement.²⁷ Mean and median recovery rates, 77% and 83%, respectively, are highest for distressed exchanges. Chapter 11 reorganizations are the most common form of resolution in our sample, with 437 observations (about 60.1%) and mean and median recovery rates of 52% and 50%, respectively. Importantly, and in contrast to the view that creditors look to asset liquidations to resolve defaults, under both Chapter 11 reorganizations and distressed exchanges (about 77% of our sample) the borrower continues to operate as an independent entity. In another 47 cases, (about 6.5% of the sample) the defaulted obligor is acquired, so that its operations continue under new ownership, with mean and median recovery rates of 54% and 57%, respectively. In about 16% of resolutions (N=116), the obligor is liquidated via Chapter 7. Mean (44%) and median (37%) recovery rates for liquidations are the lowest among the four types of resolution we consider.

Panels C and D of Table 7 show descriptive statistics and a correlation matrix for the variables in this analysis. All variables are calculated from the most recent pre-default fiscal quarter with available data. Interest coverage and book value of equity are negative for at least half the 727 observations, and the mean (median) leverage ratio is 0.839 (0.726), consistent with financially distressed obligors. With respect to asset composition, at least half the defaulted obligors have no goodwill or intangibles on their balance sheets; however, the mean values of Intangible % and Goodwill% are 0.048 and 0.066, respectively, indicating that some sample firms have substantial amounts of these assets. Recovery rates (about 55% on average for the sample as a whole) are, not surprisingly, positively correlated with interest coverage and book value of equity

²⁷ Moody's states a distressed exchange occurs when an issuer "1) offers creditors new or restructured debt, or a new package of securities, cash or assets, that amount to a diminished value relative to the debt obligation's original promise and 2) the exchange has the effect of allowing the issuer to avoid a likely eventual default" (Emery 2022).

and negatively correlated with leverage. In contrast to prior research arguing that intangible assets and goodwill are nearly worthless after a default event, we find reliably positive Spearman and Pearson correlations (between 0.13 and 0.19) between recovery rates and both types of assets, measured as percent of total debt. Intangible and goodwill percentages are positively correlated; combined with descriptive statistics indicating many sample firms lack both types of assets, we conjecture that creditors of defaulted obligors with past histories of sufficient financial success to have acquired other firms may achieve higher recovery rates.

The decision to settle defaulted obligations through a distressed exchange or Chapter 11 reorganization, and possibly an acquisition, requires agreement between creditors and the obligor. Chapter 7 liquidations are expected when there is no agreement to pursue another default resolution mechanism. We use multinomial regression with Chapter 7 liquidations as the reference sample to examine whether the four accounting measures previously considered and pre-default balance sheet asset composition explain variation in default resolution mechanisms.

Table 8 Panel A presents the results of these estimations. In the first three columns, *Interest coverage* is positively associated with acquisitions, Chapter 11 reorganizations and distressed exchanges, relative to Chapter 7 liquidations, while *Leverage* is associated with Chapter 11 reorganizations and distressed exchanges but not acquisitions. With respect to asset composition, we find that only *Intangible %* is positively related to all three types of default resolution, relative to Chapter 7 liquidation. In a specification including the four accounting measures and the three asset composition measures coefficients on *Interest coverage*, *Leverage* and *Intangible %* are significant at the 0.10 level or better. The coefficient on *Volatility* is reliably (at the 0.10 level) positive in explaining distressed exchanges relative to liquidations. Coefficients on *Goodwill %* and *PPE %* are not reliably nonzero in any specification.

Overall, the evidence in Table 8 Panel A suggests intangible assets, interest coverage and leverage together help explain cross-sectional variation in default resolutions, while neither PPE nor goodwill has statistically reliable explanatory power. This evidence is inconsistent with claims that creditors are concerned only with the lower bound value of tangible assets of a defaulted obligor. We probe this conclusion by analyzing recovery rates in the four default resolution mechanisms. Results in Table 8 Panel B show that recovery rates are positively and significantly (at the 0.10 level or better) linked to *Intangible %* in all cases, including notably Chapter 7 liquidations, except distressed exchanges. *Leverage* is negatively (at the 0.10 level or better) associated with recovery rates except in 45 instances of acquisitions. Finally, *Volatility* is positively linked to recovery rates for acquisitions and *Interest coverage* is positively linked to recovery rates for Chapter 11 reorganizations and distressed exchanges. We believe the weight of this evidence supports the inference that intangible assets are of value to creditors of defaulted obligors, even in Chapter 7 liquidations.

6.5. Asset Revaluations (Fresh-start Accounting) in Chapter 11 Reorganizations

To provide additional evidence as to whether intangible assets of defaulted obligors are of value to creditors, we analyze 243 instances of fresh-start reporting in which, under certain conditions, firms emerging from Chapter 11 reorganizations remeasure assets and liabilities to fair value following procedures similar to those used to apply the purchase method to account for a business combination. The resulting amounts are agreed to by creditors and subject to external assurance. A key difference between the purchase method and fresh-start reporting is that the purchase method results in the recognition and fair-value measurement of tangible net assets and identifiable intangible assets/goodwill that are *externally acquired*, while fresh-start reporting results in the recognition and fair-value measurement of identifiable tangible net assets and

intangible assets/goodwill already on balance sheets as well as identifiable intangible assets/goodwill that are *internally generated*. Fresh-start reporting, therefore, allows us to assess the usefulness of internally-generated intangibles to creditors of defaulted obligors.

Figure 2 shows the frequency of signed percentage changes in value for intangible assets and PPE (property, plant and equipment). Intangible assets were remeasured downward in only 23 of 243 cases; in the remaining cases, these assets were either not remeasured or remeasured to higher values, with 101 instances of remeasurements exceeding 100%. In contrast, PPE was remeasured downward in 136 of 243 cases and upward remeasurements exceeded 100% in only nine cases. These findings support inferences from the Table 8 Panel B analysis of recovery rates, in that both sets of findings contradict the view that after defaults, intangible assets have little value to creditors who focus mostly on PPE, including PPE liquidations.

As a basis for formal analysis of how fresh-start remeasurements affect reported values for various asset classes, we compute *Relative % Change* as the change in the relative proportion of total assets attributable to a specific asset class after remeasuring assets to fair value as required by fresh start reporting. For example, if recorded values of intangibles and total assets were 2 and 10 vs 4 and 12 before and after remeasuring assets to fair value then *Relative % Change* for intangibles would be 13%, that is 33% less 20%.

Table 9 Panel A reports the *Relative % Change* for seven asset classes for the 243 fresh-start observations. Among the seven asset classes we consider, only Intangibles and Goodwill have positive mean values for *Relative % Change*. The most positive *Relative % Change* is for intangibles with mean (median) value of 0.049 (0.004). The most negative change is for PPE, with mean and median values of *Relative % Change* of -.054 and -.027, respectively.

In Table 9, Panel B, we regress *Relative % Change* on indicators for respective asset classes, suppressing the constant.²⁸ Column 1 reports the results for three asset classes – PPE, Intangibles and Goodwill. The coefficient on PPE is -0.054, significant at the 0.01 level, suggesting that on average the proportion of total assets attributable to PPE decreases by 5.4% after assets are remeasured to fair value. The coefficient estimates on Intangibles and Goodwill are positive (0.049 and 0.037, respectively) and significant at the 0.01 level, suggesting the proportions of total assets attributable to these asset classes increase after assets are remeasured to fair value. In Column 2 we include four more asset classes and in Column 3 we add controls for size and leverage. We continue to find evidence that the relative proportions of total assets attributable to PPE (Intangibles and Goodwill) decreases (increases) after assets are remeasured to fair value. We interpret these results as reinforcing the value of intangible assets to creditors of defaulted obligors.

7. CONCLUSION

Using a sample of Moody’s Investors’ services *ex ante* assessments of two components of credit risk (probability of default and loss given default), we examine the relation between accounting information and the two components of credit risk and the relation between defaulted obligor asset composition and default resolutions. For our broad sample of non-investment grade borrowers, we show that accounting information is much better at explaining variation in probability of default than in explaining *ex ante* estimates of loss given default. Analysis of the relative explanatory power of accounting information vs debt contract attributes such as seniority status shows that accounting information is of first-order importance in explaining probability of default, and of little importance in explaining loss given default, and that debt contract attributes are of first-order importance in explaining loss given default.

²⁸ The number of observations (1,701) is based on 243 fresh-start reporting instances multiplied by 7 asset classes.

We find that tangible assets, specifically, plant, property, and equipment are a poor predictor of both the type of default resolution (distressed exchange, Chapter 11 reorganization, Chapter 7 liquidation or acquisition) and creditor recovery rates, an *ex post* measure of loss given default. In contrast, we find that recognized intangibles, the separately-identifiable intangible assets acquired in business combinations, are reliably associated with both default resolution and recovery rates, suggesting creditors assign value to the intangible assets of a defaulted borrower. These results support a conjecture that the non-recognition of internally generated intangibles could help explain the weak relation between accounting information and loss given default. To evaluate this conjecture, we analyze the results of fresh-start reporting, which remeasures all identifiable assets and liabilities to fair value, including identifiable internally-generated intangibles and goodwill, and requires both creditor consent and external assurance. We find that intangible assets, including those internally generated and those externally acquired, are often remeasured upward by more than 100%, while plant, property and equipment was often remeasured downward. We conclude that, at least in this specialized setting, internally generated intangibles can be measured reliably and can be of value to creditors of defaulted obligors. Overall, our paper points to a nuanced relation between accounting information and the two components of credit risk; specifically, accounting information is more useful in assessing the likelihood of default than in explaining variation in creditor losses after a default event.

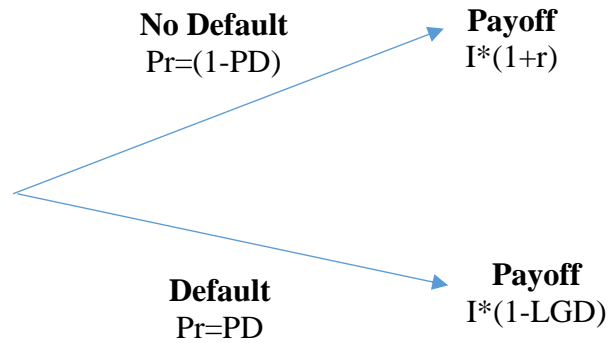
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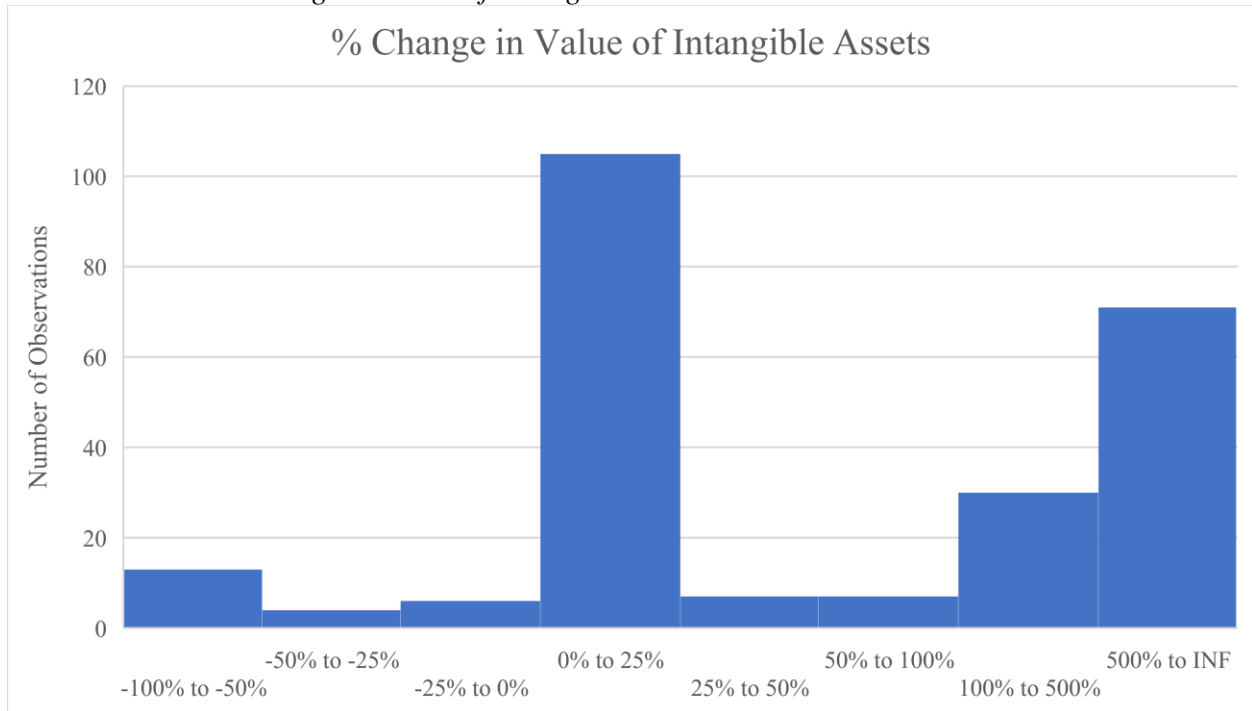
Figure 1: Simplified Payoff Structure to Investing in Debt Instruments, Abstracting from Accrued Interest



Abstracting from accrued interest as a component of the amount owed by the obligor, Figure 1 depicts a stylized characterization of a creditor's *ex ante* assessment of the payoff from investing an amount I to acquire a debt instrument with stated interest rate r . The first step is the assessment of the likelihood of default (probability of default or PD). The creditor receives $I*(1+r)$ if the outcome is no default. In the default outcome, the creditor receives $I*(1-LGD)$ where LGD is the amount of loss given the default outcome, expressed as a percent of the obligation.

Figure 2: Percent Changes in Recognized Values of Assets in Fresh Start Reporting (N= 243 Firm-Level Observations)

Panel A: Percent Change in Value of Intangible Assets



Panel B: Percent Change in Value of Property, Plant, and Equipment (PPE)

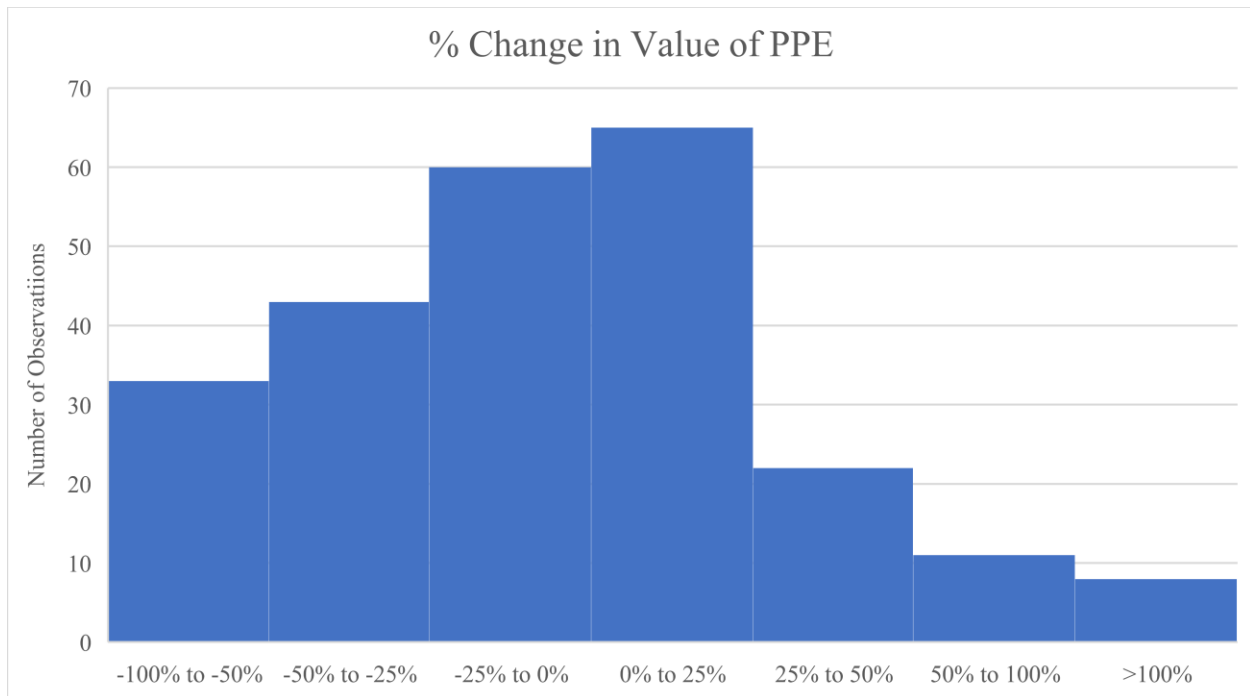


Figure 2 shows percent changes in the reported values of intangible assets (Panel A) and plant, property and equipment (Panel B) for 243 observations (2000-2021) in which a firm emerging from a Chapter 11 reorganization (a successor firm) applied fresh start reporting to remeasure assets and liabilities to fair value. *% Change* is computed as the successor firm's reported value after fresh-start reporting less the pre-bankruptcy reported value, scaled by the pre-bankruptcy reported value.

Table 1: Sample Selection for Probability of Default (PD) and Loss Given Default (LGD) Analysis

	Sample Selection
Unique Firms with PD/LGD Ratings (2006-2022)	7,407
Unique firms with Matched GVKEY	1,956
Matched firms with non-missing accounting data	1,504
Firm-Quarter Observations with PD Ratings	38,126
Firm-Quarter Observations with PD and LGD Subordinated Ratings	28,599

This table shows the sample selection procedure for the analyses of probability of default (PD) and loss given default (LGD) ratings. The unit of observation is a firm-quarter. To ensure comparable observations across tests, we restrict our analysis to firms with both a PD rating and at least one subordinated debt LGD rating. PD and LGD data are extracted from Moody's Default & Recovery Database.

Table 2: Descriptive Statistics of Accounting Information for Varying Probability of Default (PD and Loss Given Default (LGD))

Panel A: PD (Probability of default)

PD Rating	N	Interest Coverage		Volatility		Leverage		BVE	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Ba1	4,376	7.21	8	4.83	5	3.83	3	7.63	8
Ba2	5,158	6.80	7	4.78	4	4.91	5	6.53	7
Ba3	5,573	5.99	6	5.19	5	5.20	5	5.91	6
B1	5,053	5.21	5	5.35	5	5.77	6	4.98	5
B2	4,302	4.23	4	6.04	6	6.42	7	4.22	4
B3	2,314	3.43	3	6.77	7	6.66	7	3.78	3
Caa1	890	2.77	2	7.52	8	7.40	8	3.01	2
Caa2	454	2.54	2	7.69	9	7.96	9	2.78	2
Caa3	337	2.56	2	7.74	8	7.93	9	2.92	2
Ca,C,D	142	2.37	2	8.06	9	8.25	9	2.11	1

Panel B: LGD (Loss given default) ratings

LGD%	N	Interest Coverage		Volatility		Leverage		BVE	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
0-9.9%	0	-	-	-	-	-	-	-	-
10-19.9%	17	8.53	9	4.41	5	5.06	7	2.94	2
20-29.9%	76	5.34	5	4.61	4	4.89	4	4.97	5
30-30.9%	137	6.22	6	4.17	4	5.16	5	6.11	6
40-40.9%	512	6.03	6	5.00	4	4.71	5	5.99	7
50-50.9%	5,293	5.81	6	5.28	5	4.63	4	6.72	7
60-60.9%	6,507	5.45	6	5.67	6	5.21	5	5.55	6
70-70.9%	7,850	5.43	5	5.71	6	5.43	5	5.17	5
80-89.9%	6,362	5.40	5	5.31	5	6.32	7	5.00	5
90-100%	1,845	5.23	5	5.56	6	6.77	8	4.77	4

This table shows mean and median decile ranks of four accounting information measures by PD (Panel A) and LGD (Panel B) ratings. PD is Moody's *ex ante* ordinal measure of probability of default, assessed at the firm-level. LGD is Moody's *ex ante* estimate of the creditor's loss on a given obligation, in the event of default, expressed as a percent of par value. For firm-quarters with more than one subordinated debt instrument, we construct a firm-quarter measure by computing a weighted-average LGD rating, where weights are based on the amount of debt associated with the underlying instrument. The table shows the mean and median decile ranks of interest coverage ratio (*Interest Coverage*), earnings volatility (*Volatility*), leverage (*Leverage*) and book value of equity (*BVE*). Variable definitions are in Appendix A.

Table 3: Association between Accounting Information and Probability of Default (PD) and Loss Given Default (LGD)

Panel A: Multivariate regression results including income statement and balance sheet measures

		PD Analysis			LGD Analysis		
		1	2	3	4	5	6
Interest Coverage	-	-0.231*** (-23.370)		-0.179*** (-18.310)	-0.015* (-1.903)		0.014* (1.767)
Volatility	+	0.106*** (10.430)		0.115*** (11.660)	0.009 (0.970)		0.016* (1.822)
BVE	-		-0.182*** (-6.753)	-0.151*** (-6.851)		-0.023 (-1.211)	-0.023 (-1.164)
Leverage	+		0.136*** (8.291)	0.100*** (7.120)		0.082*** (5.925)	0.086*** (6.207)
Size		-0.207*** (-14.450)	-0.090*** (-3.492)	-0.098*** (-4.644)	-0.051*** (-4.220)	-0.030* (-1.803)	-0.030* (-1.825)
N		28,599	28,599	28,599	28,599	28,599	28,599
Adjusted R ²		30.6%	25.1%	38.1%	1.6%	5.7%	5.8%
Vuong Test P-Value		0.00			0.00		
Most Important		Income Statement			Balance Sheet		

Panel B: Univariate regression results for four main accounting measures and nine additional accounting measures

	PD		LGD	
	1	2	3	4
Main Accounting Measures	Coefficient	R²	Coefficient	R²
Interest Coverage	-0.280***	0.182	-0.021***	0.002
Volatility	0.194***	0.087	0.016***	0.001
BVE	-0.310***	0.223	-0.084***	0.035
Leverage	0.233***	0.125	0.096***	0.046
Other Accounting Measures				
ROA	-0.216***	0.108	0.001	0.000
Profitability	-0.072***	0.012	0.003	0.000
ΔNI	-0.025***	0.001	-0.004	0.000
Special Items Ratio	-0.016***	0.001	-0.016***	0.001
CFO Volatility	-0.056***	0.007	-0.025***	0.003
Skewness	0.076***	0.013	-0.002	0.000
Tangibility	0.071***	0.012	-0.015***	0.001
TNW	-0.157***	0.062	-0.078***	0.032
Working Capital	-0.097***	0.022	-0.024***	0.003

This table shows associations between accounting information and both PD (probability of default) and LGD (loss given default). Panel A shows results of regressing *ex ante* PD and LGD ratings on two income statement measures and two balance sheet measures. The two income statement measures are coverage ratio (*Interest Coverage*) and earnings volatility (*Volatility*). The two balance sheet measures are leverage (*Leverage*) and book value of equity (*BVE*). Standard errors are clustered by firm. The Vuong test compares the adjusted R² for the income-statement model to the adjusted R² of the balance sheet model. Panel B shows coefficients and adjusted R² from univariate regressions of PD and LGD on four main accounting measures and nine additional accounting measures. PD is Moody's *ex ante* probability of default, assessed at the firm-level. LGD is Moody's *ex ante* estimate of the creditor's loss on a given obligation, in the event of default, expressed as a percent of par value. For firm-quarters with more than one subordinated debt instrument, we construct a firm-quarter measure by computing a weighted-average LGD rating, where weights are based on the amount of debt associated with the underlying instrument. All accounting measures are defined in Appendix A. ***, ** and * indicate two-tailed significance at the 1%, 5% and 10% levels, respectively.

Table 4: Association between LGD and Accounting Information Conditional on PD Rating

		Ba1 - B3	Caa1 and Lower
		1	2
Interest Coverage	-	0.013 (1.595)	0.065** (2.424)
Volatility	+	0.017* (1.870)	-0.000 (-0.009)
BVE	-	-0.012 (-0.576)	-0.066 (-1.380)
Leverage	+	0.090*** (6.340)	0.080** (2.020)
Size		-0.043** (-2.534)	0.059* (1.760)
N		26,776	1,823
Adjusted R ²		5.7%	5.8%

This table shows results of regressing LGD (loss given default) ratings on two income statement measures and two balance sheet measures separately for obligations with PD ratings above Caa1 and for obligations with PD ratings equal to or lower than Caa1. LGD is Moody's *ex ante* estimate of the creditor's loss on a given subordinated obligation, in the event of default, expressed as a percent of par value. For firm-quarters with more than one subordinated debt instrument, we construct a firm-quarter measure by computing a weighted-average LGD rating, where weights are based on the amount of debt associated with the underlying instrument. The two income statement measures are coverage ratio (*Interest Coverage*), earnings volatility (*Volatility*). The balance sheet measures are Leverage (*Leverage*) and book value of equity (*BVE*). Standard errors are clustered by firm. ***, ** and * indicate two-tailed significance at the 1%, 5% and 10% levels, respectively.

Table 5: Associations between Probability of Default (PD) and Loss Given Default (LGD) and Accounting Information and Contract Variables

	PD Analysis			LGD Analysis		
	1	2	3	4	5	6
	Acct	Contract	All	Acct	Contract	All
<u>Accounting Variables</u>						
Interest Coverage	-	-0.179*** (-18.310)	-0.173*** (-18.440)	0.014* (1.767)		0.015** (2.269)
Volatility	+	0.115*** (11.660)	0.113*** (11.680)	0.016* (1.822)		0.019** (2.463)
BVE	-	-0.151*** (-6.851)	-0.134*** (-6.344)	-0.023 (-1.164)		0.011 (0.665)
Leverage	+	0.100*** (7.120)	0.073*** (5.207)	0.086*** (6.207)		0.032** (2.427)
Size		-0.098*** (-4.644)	-0.114*** (-5.658)	-0.030* (-1.825)		-0.070*** (-5.074)
<u>Contract Variables</u>						
Senior Secured			3.123*** (11.360)		1.838*** (8.400)	2.772*** (14.120)
Bank Facility			-2.022*** (-6.570)		-1.057*** (-4.313)	-0.791*** (-3.648)
Revolver			-2.301*** (-5.721)		-1.620*** (-5.091)	-0.965*** (-3.741)
N		28,599	28,599	28,599	28,599	28,599
Adjusted R ²		38.1%	8.3%	41.0%	5.8%	22.1%
Vuong Test P-Value						
<i>Acct vs. Contract</i>		0.00			0.00	
Most Important Variables		Accounting Variables			Contract Variables	
Least Important Variables		Contract Variables			Accounting Variables	

This table shows results of regressing PD (probability of default) and LGD (loss given default) on four main accounting measures and three contract variables. PD is Moody's *ex ante* probability of default, assessed at the firm-level. LGD is Moody's *ex ante* estimate of the creditor's loss on a given subordinated obligation, in the event of default, expressed as a percent of par value. For firm-quarters with more than one subordinated debt instrument, we construct a firm-quarter measure by computing a weighted-average LGD rating, where weights are based on the amount of debt associated with the underlying instrument. The main accounting measures are interest coverage (*Interest Coverage*), earnings volatility (*Volatility*), leverage (*Leverage*) and book value of equity (*BVE*). The accounting variables and contract variables are defined in Appendix A. Standard errors are clustered by firm. ***, **, * indicate two-tailed significance at the 1%, 5%, and 10% levels. The Vuong test compares the adjusted R² for the models using accounting information only to the adjusted R² of the models using contract variables only.

Table 6: Associations between Probability of Default (PD) and Loss Given Default (LGD) and Unadjusted and Adjusted Accounting Information

Panel A: Associations between PD ratings and unadjusted and adjusted accounting information

		I/S Adjustments			B/S Adjustments		
		1	2	3	4	5	6
		PD	PD	PD	PD	PD	PD
Int Cov: Earnings	-	-0.230*** (-23.210)					
Volatility: Earnings	+	0.108*** (10.520)					
Int Cov: Op Inc	-		-0.282*** (-25.540)				
Volatility: Op Inc	+		0.069*** (6.328)				
Int Cov: EBITDA	-			-0.296*** (-24.510)			
Volatility: EBITDA	+			0.081*** (7.635)			
BVE	-				-0.181*** (-6.643)		
Leverage	+				0.136*** (8.276)		
BVE: Less GW	-					-0.038 (-1.611)	
Leverage: Less GW	+					0.131*** (6.258)	
BVE: Less IA and GW	-						-0.034 (-1.395)
Leverage: Less IA and GW	+						0.115*** (5.035)
Size		-0.207*** (-14.440)	-0.200*** (-14.430)	-0.187*** (-13.550)	-0.090*** (-3.503)	-0.212*** (-12.160)	-0.221*** (-13.580)
N		28,187	28,187	28,187	28,187	28,187	28,187
Adjusted R ²		30.8%	33.7%	35.8%	25.1%	17.8%	16.6%
Rank		3rd	2nd	1st	1st	2nd	3rd
Vuong Test P-Value (Reference is Column #1 or #4)		-	0.00	0.00	-	0.00	0.00

Panel B: Associations between LGD Ratings and unadjusted and adjusted accounting information

		I/S Adjustments			B/S Adjustments		
		1	2	3	4	5	6
		LGD	LGD	LGD	LGD	LGD	LGD
Int Cov: Earnings	-	-0.016** (-2.019)					
Volatility: Earnings	+	0.009 (0.963)					
Int Cov: Op Inc	-		-0.018* (-1.942)				
Volatility: Op Inc	+		-0.001 (-0.075)				
Int Cov: EBITDA	-			-0.025** (-2.443)			
Volatility: EBITDA	+			0.004 (0.430)			
BVE	-			-0.020 (-1.035)			
Leverage	+			0.086*** (6.201)			
BVE: Less GW	-				-0.021 (-1.227)		
Leverage: Less GW	+				0.091*** (5.804)		
BVE: Less IA and GW	-						-0.029 (-1.611)
Leverage: Less IA and GW	+						0.093*** (5.435)
Size		-0.052*** (-4.282)	-0.053*** (-4.306)	-0.051*** (-4.118)	-0.033** (-1.998)	-0.045*** (-3.684)	-0.050*** (-4.305)
N		28,187	28,187	28,187	28,187	28,187	28,187
Adjusted R ²		1.6%	1.6%	1.7%	5.9%	7.0%	8.1%
Rank		2nd	3rd	1st	3rd	2nd	1st
Vuong Test P-Value (Reference is Column #1 or #4)		-	0.06	0.01	-	0.00	0.00

This table shows results of regressing PD (Panel A) and LGD (Panel B) on unadjusted and adjusted income statement and balance sheet measures, controlling for firm size. Columns 1-3 show results for unadjusted and adjusted interest coverage (*Interest Coverage*) and earnings volatility (*Volatility*) and Columns 4-6 show results for unadjusted and adjusted leverage (*Leverage*) and book value of equity (*BVE*). PD is Moody's *ex ante* probability of default, assessed at the firm-level. LGD is Moody's *ex ante* estimate of the creditor's loss on a given obligation, in the event of default, expressed as a percent of par value. For firm-quarters with more than one subordinated debt instrument, we construct a firm-quarter measure by computing a weighted-average LGD rating, where weights are based on the amount of debt associated with the underlying instrument. Column 1 shows results for unadjusted income statement measures. Column 2 shows results using operating income. Column 3 shows results using EBITDA measured as operating income plus depreciation and amortization. Column 4 shows results for unadjusted balance sheet measures. Column 5 shows results after removing goodwill (*GW*) from balance sheet assets. Column 6 shows results after removing goodwill (*GW*) and intangible assets (*IA*) from balance sheet assets. Standard errors are clustered by firm. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Default Resolution and Recovery Analysis*Panel A. Sample selection for default resolution analysis*

	NOBS
Moody's Recovery Events (1988-2020):	1,241
With Identified GVKEY Match	996
With quarterly filing in Compustat prior to default date	947
With quarterly filing within 365 days of default	824
With non-missing accounting data	727

Panel B: Descriptive statistics on realized creditor recovery rates by type of default resolution

Outcome	N	Mean	Std	P25	P50	P75
Distressed Exchange	127	0.77	0.21	0.66	0.83	0.93
Chapter 11 - Emergence	437	0.52	0.27	0.31	0.50	0.73
Chapter 7 - Liquidation	116	0.44	0.32	0.14	0.37	0.64
Acquired	47	0.54	0.29	0.28	0.57	0.72

Panel C: Descriptive statistics of variables used in the default resolution analysis

	N	MEAN	STD	P25	P50	P75
Recovery Rate	727	0.554	0.291	0.318	0.552	0.805
Int Cov	727	-2.132	10.052	-2.092	-0.360	0.356
Volatility	727	0.880	1.501	0.304	0.496	0.876
BVE	727	-158.573	1934.575	-250.424	-51.052	47.744
Leverage	727	0.839	0.641	0.526	0.726	0.991
Size	727	6.419	1.478	5.469	6.304	7.350
Intangible %	724	0.048	0.139	0.000	0.000	0.009
Goodwill %	724	0.066	0.162	0.000	0.000	0.015
PPE %	721	0.688	1.337	0.231	0.481	0.831

Panel D: Correlation matrix of variables used in the default resolution analysis

	1	2	3	4	5	6	7	8	9
1 Recovery Rate		0.04	-0.05	0.03	-0.15***	0.10***	0.17***	0.13***	0.01
2 Int Cov	0.19***		-0.20***	0.01	0.07**	-0.02	0.05	0.07*	-0.05
3 Volatility	-0.02	-0.26***		-0.07*	0.08**	0.03	-0.06	-0.08**	0.02
4 BVE	0.11***	-0.01	-0.12***		-0.14***	-0.02	0.21***	-0.02	0.08**
5 Leverage	-0.14***	0.17***	0.06*	-0.56***		-0.28***	-0.08**	-0.06	-0.23***
6 Size	0.07*	0.00	0.06	-0.01	-0.25***		0.18***	0.06*	0.10***
7 Intangible %	0.18***	0.10***	-0.08**	-0.13***	0.01	0.27***		0.25***	-0.06
8 Goodwill %	0.19***	0.21***	-0.13***	-0.12***	0.05	0.15***	0.55***		-0.08**
9 PPE %	0.08**	-0.22***	0.13***	0.36***	-0.53***	0.30***	-0.16***	-0.24***	

This table reports the sample selection and summary information for the default and recovery sample. Panel A shows the sample selection for the default resolution analysis. Data are from Moody's Recovery Events database. There is one firm-level observation per default event. Panel B shows realized creditor recovery rates for 727 default events, by type of default resolution. Recovery rate is the actual amount received by creditors relative to the amount of defaulted obligation. Panel C shows summary descriptive statistics for the variables used in the analysis of 727 default resolutions. Panel D shows Pearson (below the diagonal) and Spearman (above the diagonal) correlations for the variables in Panel C. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Associations between Accounting Information, Asset Composition and Default Outcomes, including Type of Default Resolution and Creditor Recoveries

Panel A: Associations between Accounting Information, Asset Composition and Type of Default Resolution

	Acquired	Chapter 11	Distressed Exchange	Acquired	Chapter 11	Distressed Exchange	Acquired	Chapter 11	Distressed Exchange
Int Cov (Decile)	0.160** (2.437)	0.167*** (3.977)	0.248*** (4.853)				0.133* (1.933)	0.163*** (3.801)	0.229*** (4.363)
Volatility (Decile)	-0.058 (-0.903)	0.023 (0.574)	0.074 (1.497)				-0.087 (-1.298)	0.022 (0.534)	0.086* (1.709)
BVE (Decile)	0.074 (0.881)	-0.007 (-0.140)	0.072 (1.209)				0.088 (1.001)	0.001 (0.029)	0.080 (1.319)
Leverage (Decile)	0.122 (1.522)	0.122** (2.565)	0.163*** (2.655)				0.167* (1.957)	0.131*** (2.627)	0.184*** (2.854)
Size (Decile)	0.053 (0.797)	0.167*** (4.073)	0.201*** (3.995)				0.034 (0.491)	0.159*** (3.840)	0.169*** (3.293)
Intangible %				6.022*** (2.796)	4.200** (2.077)	6.125*** (2.981)	5.747*** (2.850)	3.564* (1.902)	5.534*** (2.893)
Goodwill %				0.029 (0.022)	0.504 (0.579)	1.283 (1.363)	-0.750 (-0.570)	-0.215 (-0.246)	0.514 (0.541)
PPE %				-0.010 (-0.116)	-0.118 (-1.383)	-0.057 (-0.640)	0.039 (0.471)	-0.057 (-0.699)	-0.003 (-0.033)
N		727			721			721	
Pseudo R ²		4.70%			2.12%			6.47%	

Panel B: Associations between Accounting Information, Asset Composition and Recovery Rate

	Dep Var = Recovery Rate			
Int Cov (Decile)	0.003 (0.290)	0.007 (0.451)	0.022*** (4.370)	0.025*** (3.825)
Volatility (Decile)	0.005 (0.451)	0.028* (1.815)	0.000 (0.020)	0.007 (1.076)
BVE (Decile)	-0.005 (-0.376)	-0.000 (-0.015)	0.003 (0.629)	0.004 (0.482)
Leverage (Decile)	-0.045*** (-3.337)	-0.026 (-0.955)	-0.012** (-1.974)	-0.017* (-1.883)
Size (Decile)	-0.031*** (-2.901)	0.005 (0.295)	0.001 (0.222)	0.012* (1.718)
Intangible %	1.216** (2.526)	0.701** (2.391)	0.191* (1.647)	-0.102 (-1.119)
Goodwill %	0.027 (0.152)	-0.335 (-1.155)	0.093 (1.016)	0.062 (0.636)
PPE %	-0.000 (-0.029)	-0.037 (-1.252)	0.000 (0.003)	-0.044 (-0.982)
N	116	45	433	127
Adjusted R ²	16.0%	11.0%	6.4%	12.8%
Sample	Chapter 7 - Liquidations	Aquired	Chapter 11 - Emergence	Distressed Exchange

This table reports analyses of type of resolution and creditor recoveries for 727 default resolutions. Panel A reports multinomial logit regressions explaining default resolution type where the reference group is Chapter 7 liquidations and explanatory variables include income statement and balance sheet information and asset composition measures. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Panel B reports regressions of realized creditor recovery rates on accounting information and asset composition measures for four types of default resolution. The asset composition measures are *Intangible %*, *Goodwill %*, and *PPE%* are intangible assets, goodwill and plant property and equipment (PPE) as a percent of total debt, respectively. The accounting measures are defined in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Fresh Start Analysis*Panel A: Asset composition change measures for 243 instances of fresh-start accounting*

Relative % Change Variable	N	Mean	SD	25th Percentile	Median	75th Percentile
PPE	243	-0.054	0.147	-0.115	-0.027	0.013
Intangibles	243	0.049	0.125	0.000	0.004	0.085
Goodwill	243	0.037	0.163	0.000	0.000	0.053
Other LTA	243	-0.002	0.109	-0.012	0.000	0.008
Inventory	243	-0.002	0.043	-0.001	0.000	0.002
A/R	243	-0.010	0.066	-0.015	0.000	0.011
Other Current Assets	243	-0.003	0.107	-0.019	0.000	0.018

Panel B: Asset composition changes as a result of fresh-start accounting for seven asset classes

	Dep Var =		
	Relative % Change		
	1	2	3
PPE	-0.054*** (0.010)	-0.054*** (0.010)	-0.050*** (0.012)
Intangibles	0.049*** (0.008)	0.049*** (0.008)	0.053*** (0.010)
Goodwill	0.037*** (0.010)	0.037*** (0.010)	0.041*** (0.014)
Other LTA		-0.002 (0.007)	0.002 (0.010)
Inventory		-0.002 (0.003)	0.002 (0.008)
A/R		-0.010** (0.004)	-0.005 (0.008)
Other Current Assets		-0.003 (0.007)	0.001 (0.010)
Leverage (Pre)			0.000*** (0.000)
LNAT (Pre)			-0.001 (0.001)
N	729	1,701	1,701
Adjusted R ²	0.092	0.064	0.065

This table reports results of our analysis of fresh-start financial statements. Panel A reports descriptive statistics for seven asset classes' relative percentage change (*Relative % Change*) measured as the difference between the proportions of total assets attributable to given asset class after vs before fresh-start accounting remeasurements. The asset classes are net property, plant and equipment (PPE), intangibles, goodwill, other long-term assets (Other LTA), inventory, net accounts receivable (A/R) and other current assets. Panel B reports the results of regressing *Relative % Change* on indicator variables for the seven asset classes and controls for leverage and the natural log of total assets [LNAT]). ***, **, * indicate two-tailed significance at the 1%, 5%, and 10% levels, respectively.

APPENDIX A –Variable Definitions

Variable	Description
Acquired	An indicator variable equal to one if the defaulted obligor was acquired. (M-DRD)
Bank Facility	The proportion of a firm's Moody's rated debt associated with a bank facility. A debt instrument is considered to be a bank facility instrument if the debt class type is listed by Moody's is BCF. (M-DRD)
BVE	The book value of equity, measured as common equity [<i>ceqq</i>]. (Comp)
CFO Volatility	The standard deviation of cash from operating activities for the previous eight quarters scaled by lagged total assets (Comp)
Chapter 7 Liquidation	An indicator variable equal to one if a default results in a bankruptcy filing and eventual liquidation under Chapter 7 of the U.S. Bankruptcy Code. (M-DRD)
Chapter 11 Emerge	An indicator variable equal to one a default results in a bankruptcy filing and eventual reorganization under Chapter 11 of the U.S. Bankruptcy Code. (M-DRD)
Distressed Exchange	An indicator variable equal to one if a default is settled with creditors via a distressed exchange. (M-DRD)
Earnings	Sum of pre-tax income and interest expense [<i>piq</i> + <i>xintq</i>]. (Comp)
EBITDA	Operating income before depreciation and amortization [<i>oibdpq</i>]. (Comp)
Goodwill %	Goodwill [<i>gdwlq</i>] scaled by total debt. (Comp)
Op Inc	Operating income after depreciation and amortization [<i>oaidpq</i>]. (Comp)
Intangible %	Intangible assets [<i>intanoq</i>] scaled by total debt. (Comp)
Interest Coverage (Int Cov)	Earnings scaled by interest expense [<i>xintq</i> + <i>capint</i>]. <i>Capint</i> is capitalized interest measured at the quarterly level as the annualized capitalized interest amount divided by four. (Comp)
Leverage	Total debt divided by lagged total assets. (Comp)
LGD Rating	The loss given default rating issued by Moody's. (M-DRD)
Δ NI	The difference between current period net income and prior period net income scaled by prior period net income (Comp)
PD Rating	The probability of default rating issued by Moody's. (M-DRD)
PPE %	Net property, plant and equipment [<i>ppentq</i>] scaled by total debt. (Comp)
Profitability	Annualized operating income before depreciation and amortization scaled by annualized sales. (Comp)
ROA	Earnings scaled by lagged total assets (Comp)
Recovery Rate	The percent of the original obligation owed to the creditor that the creditor ultimately receives following a default. (1 – LGD). (M-DRD)
Revolver	The proportion of a firm's Moody's rated debt associated with a revolving loan. A debt instrument is considered to be a revolving loan instrument if the debt type listed by Moody's includes the term "revolving". (M-DRD)
Size	The natural log of one plus total assets [$\ln(1 + atq)$]
Senior Secured	The proportion of a given firm's Moody's rated debt for a particular firm that is senior secured debt. A debt instrument is considered to be a senior secured instrument if the debt seniority type listed by Moody's is Senior Secured. (M-DRD)

Variable	Description
Skewness	Following Beatty et al. (2008) and Donovan et al. (2015), we compute skewness as the difference between the skewness in cash from operating activities and skewness in net income over the previous 8 quarters (Comp)
Tangibility	Net property, plant and equipment scaled by lagged total assets (Comp)
TNW	The natural log total assets less intangible assets and total liabilities (Comp)
Total Debt	Sum of total long-term liabilities and current portion of long-term debt [$lltq + dlcq$]. (Comp)
Volatility	Standard deviation of earnings for the previous eight quarters scaled by standard deviation of cash from operations for the previous eight quarters (Comp)
Working Capital	Current Assets less current liabilities plus the current portion of long-term debt, all scaled by total assets [$(actq - lctq + dlcq) / atq$] (Comp)

* Data sources are Compustat (Comp) and Moody's Default and Recovery Database (M-DRD)

APPENDIX B – Standard Compustat Income Statement

Standard Annual Compustat Income Statement

Sales	SALE	
Operating Expenses	XOPR	
Cost of Goods Sold	COGS	
Selling, General and Administrative Expenses	XSGA	
Research and Development Expense	XRD	
Staff Expense	XLR	
Pension Expense	XPR	
Rental Expense	XRENT	
Advertising Expense	XAD	
Operating Income Before Depreciation	OIBDP	EBITDA Measure
Depreciation and Amortization - Total	DP	
Operating Income After Depreciation	OIADP	Operating Income
Interest and Related Expense	XINT	
Nonoperating Income (Expense) - Total	NOPI	
Special Items	SPI	
Pretax Income	PI	Earnings = PI + XINT
Income Taxes - Total	TXT	
Minority Interest - Income Account	MII	
Income Before Extraordinary Items	IB	

Components of Special Items

Acquisition/Merger (AQP), Gain/Loss on Sale of Assets (GLP), Impairment of Goodwill, (GDWLIP) Settlement - Litigation/Insurance (SETP), Restructuring Costs (RCP), Write-downs (WDP), Extinguishment of Debt (DTEP), and In-Process Research & Development (RDIP).

This Appendix shows the standard Compustat Income Statement and how we calculate our measures of adjusted earnings.