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Disagreement between rating agencies and bond opacity: A theoretical perspective[☆]

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HIGHLIGHTS

- We analyze the bond rating process.
- We show that rating splits may emerge when bonds are opaque or transparent.
- We derive conditions under which rating splits can serve as a proxy for opacity.

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ABSTRACT

In this paper, we explicitly model a bond rating process under varying degrees of bond opacity and derive conditions under which disagreements between rating agencies (rating splits) can serve as a useful proxy for opacity in empirical analyses.

1. Introduction

The term opacity refers to a situation in which risks are hard to observe for an outsider (see, e.g. Morgan, 2002). Opacity is a highly relevant and topical issue in economics. The opacity of financial products has been blamed for amplifying the recent turmoil on financial markets (see, e.g. Borio, 2008; Crouhy et al., 2008; Zingales, 2008; Hellwig, 2009; Dymski, 2010). Also, it is conventional wisdom that opacity of firms is a major obstacle for obtaining outside funding. Following Morgan (2002), numerous empirical studies have employed rating splits, i.e. disagreement between rating agencies on ratings, as a proxy for opacity.[1] This is usually motivated by an empirically observed positive correlation between rating splits and other commonly applied opacity measures (see, e.g. Morgan, 2002; Bonaccorsi di Patti and Dell'Ariccia, 2004; Livingston et al., 2007). Nevertheless, empirical results on opacity derived from rating splits have repeatedly been inconsistent with the results obtained from other measures of opacity.[2] Beyond this, we

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1 See, e.g. Bonaccorsi di Patti and Dell'Ariccia (2004) and Hyytinen and Pajarinen (2008) who investigate the opacity of young and old firms or Iannotta (2006) who studies the opacity of the financial and the non-financial sector. In more recent studies, rating splits serve as a proxy for the opacity of banks (see Bannier et al., 2010; Balasubramnian and Cyree, 2011; Jones et al., 2012), industries (see Beck et al., 2008), insurance companies (see Pottier and Sommer, 2006), corporate bonds (see Güntay and Hackbarth, 2010; Livingston and Zhou, 2010) and loans (see Drucker and Puri, 2009).

2 For example, Morgan (2002) concludes from rating splits that the banking sector is inherently more opaque than other sectors while Flannery et al. (2004),

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still lack a robust theory explaining the relationship between rating splits and opacity.

This paper fills this gap by explicitly modeling the bond rating process under varying degrees of bond opacity. Following Morgan (2002), opacity in our model means that a potential buyer and/or a rating agency finds it hard to estimate the true default probability of a bond. This will be particularly true if information about the bond issuing firm is scarce. Then, buyers have to rely on, e.g., the industry-wide distribution of default probabilities which tends to be easier to assess. The larger is the range of this distribution, the larger is the extent of a bond's opacity. In the model, there are two rating agencies that can reduce the opacity of bonds by applying a screening technology. The technology provides information about the bonds' default characteristics. It allows the agencies to update those expectations purely based on industry-wide information. The extent of opacity reduction increases in the quality of the screening technology. Consequently, the model captures two determinants of (post-screening) opacity of a bond: the range of possible default probabilities in an industry prior to screening and the quality of the rating agencies' screening technology. In addition to rating splits and opacity, the model also addresses the relationship between rating splits and the uncertainty about final returns of bonds.

We concentrate on a scenario in which one agency rates more conservatively than the other in the sense that it has stricter requirements for giving a favorable rating. This is strongly corroborated by empirical evidence (see, e.g. Pottier and Sommer, 1999; Morgan, 2002; Güttler, 2005; Van Roy, 2005; Livingston et al., 2010). For this scenario, we show that generally it is not useful to proxy opacity or uncertainty about final returns by rating splits because split ratings may be systematically observed even if opacity or uncertainty is completely absent. Moreover, we show that this can be avoided by controlling for specific variables and derive conditions under which rating splits can actually serve as a proxy for opacity or uncertainty.

2. The model

Consider two rating agencies and a large number of bonds. At a later date, each bond will either yield a return normalized to one or default and repay nothing. Half of the bonds are 'good'. They have a low default probability ρ_l. The other half is 'bad' and has a high default probability $\rho_h \geq \rho_l$. A potential buyer cannot tell whether a bond is actually good or bad. Without further information he expects a default with probability $\bar{\rho} = \frac{1}{2}\rho_l + \frac{1}{2}\rho_h$. This lack of information creates a useful role for the rating agencies. They have access to a screening technology providing a noisy signal s about a bond's true default probability.[3] The signal can be either s_l or s_h and satisfies

$$\Pr\left[s_l \mid \rho_l\right] = \Pr\left[s_h \mid \rho_h\right] = \frac{1+q}{2},$$

$$\Pr\left[s_h \mid \rho_l\right] = \Pr\left[s_l \mid \rho_h\right] = \frac{1-q}{2},$$

where $\Pr[s_i \mid \rho_j]$ with $i = l, h$ and $j = l, h$ denotes the conditional probability of s_i for a given ρ_j and $q \in [0; 1]$ reflects the quality of the screening technology.

The agencies use the signal to update their pre-screening expectations $\bar{\rho}$ according to Bayes' rule. After having obtained a 'good' signal s_l, post-screening expectations satisfy

$$E[\rho \mid s_l] = (1-q)\,\bar{\rho} + q\rho_l \leq \bar{\rho}. \tag{1}$$

The interpretation of (1) is straightforward. If the signal is useless, $q = 0$, the agencies will not update their expectations, $E[\rho \mid s_l] = \bar{\rho}$. If $q > 0$, the signal s_l will be informative implying an expected default probability (after screening) below $\bar{\rho}$. Moreover, since $\frac{\partial E[\rho|s_l]}{\partial q} < 0$, the probability will be lower, the higher is the quality of the signal. If $q = 1$, the signal will be perfectly informative. Then, the expected and the true default probability will coincide, $E[\rho \mid s_l] = \rho_l$. The implications of a 'bad' signal s_h are analogous. Bayes' rule then implies

$$E[\rho \mid s_h] = (1-q)\,\bar{\rho} + q\rho_h \geq \bar{\rho}, \tag{2}$$

so that $E[\rho \mid s_h]$ is increasing in q, equal to $\bar{\rho}$ for $q = 0$ and equal to ρ_h for $q = 1$.

A risk-neutral rating agency $r = 1, 2$ transforms the updated expected default probability $E[\rho \mid s_i]$ into a letter rating A or B. The agency aims at minimizing its expected costs $E[C_r^{mis}]$ of misrating. As in Morgan (2002), we use this term in an ex-post sense by distinguishing between two forms of misrating. First, ex-post *over*rating refers to a bond that defaults after having obtained an A. In this case, the rater incurs a cost $C_r^o > 0$. Consequently, for a given signal s_i, the expected costs of an A-rating are $E[C_r^{mis} \mid A] = E[\rho \mid s_i]C_r^o$. Second, ex-post *under*rating refers to a B-rated bond that does not default. Then, the cost to agency r is $C_r^u > 0$ so that the expected costs of a B-rating are $E[C_r^{mis} \mid B] = (1 - E[\rho \mid s_i])\,C_r^u$. The bond thus will obtain an A-rating from agency r only if $E[C_r^{mis} \mid A] \leq E[C_r^{mis} \mid B]$. This condition translates to

$$E\left[\rho \mid s_i\right] \leq \frac{C_r^u}{C_r^o + C_r^u} =: \hat{\rho}_r, \tag{3}$$

where $\hat{\rho}_r$ denotes the cutoff probability for converting the updated expected default probability into a letter rating. If the agency expects the bond to default with a small probability, $E\left[\rho \mid s_i\right] \leq \hat{\rho}_r$, the bond will receive an A. Otherwise, it will be rated B.

The threshold $\hat{\rho}_r$ is determined by the under- and overrating costs. Henceforth, let us assume as in Morgan (2002) that these costs, and therefore also the threshold $\hat{\rho}_r$, differ across the two agencies. To clarify our main point, it is sufficient to analyze the case $C_1^o > C_1^u$ and $C_2^u > C_2^o$, which implies $\hat{\rho}_1 < 1/2 < \hat{\rho}_2$. That is, consistent with the literature cited in Section 1, the first agency is more conservative than the second. It has stricter requirements for an A-rating as its overrating costs exceed its costs of underrating while the second agency finds overrating less costly than underrating.

A rating split will occur if one agency gives an A-rating while the other assigns a B to the bond. Using the decision rule (3) and expectations as given by (1) or (2) we obtain the following lemma.

Lemma 1. *Define $\Delta := \rho_h - \rho_l$. There will be a post-screening rating split only if*

(a) $\bar{\rho} \in \left(\hat{\rho}_1, \hat{\rho}_2\right]$ *and either* $s = s_l,\ \frac{1}{2}q\Delta < \bar{\rho} - \hat{\rho}_1$
or $s = s_h,\ \frac{1}{2}q\Delta \leq \hat{\rho}_2 - \bar{\rho}$,

(b) $\bar{\rho} \notin \left(\hat{\rho}_1, \hat{\rho}_2\right]$ *and either* $s = s_l,\ \frac{1}{2}q\Delta \in \left[\bar{\rho} - \hat{\rho}_2, \bar{\rho} - \hat{\rho}_1\right)$
or $s = s_h,\ \frac{1}{2}q\Delta \in \left(\hat{\rho}_1 - \bar{\rho}, \hat{\rho}_2 - \bar{\rho}\right]$.

using market microstructure data to measure opacity, do not find an unusually high degree of opacity of banks. With respect to insurance companies, there is a similar debate (see Morgan, 2002; Iannotta, 2006).

[3] The assumption that the two rating agencies have access to the same screening technology and obtain the same signal is purely made for the sake of expositional brevity. If we allowed for different screening technologies or signals, the qualitative results would remain unchanged.