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## Ratings as regulatory stamps<sup>☆</sup>



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### ABSTRACT

This paper analyzes the implications of the regulatory benefits that the investors derive from holding highly rated securities for a credit rating agency's (CRA) rating policy. The CRA's endogenous rating fee is shown to be decreasing in the accuracy of the rating. The CRA provides a rating only when the investors' regulatory benefit exceeds a minimum threshold. The regulatory reliance on ratings unambiguously reduces rating quality. Strategic rating inflation is more likely for complex financial securities with high fixed evaluation costs, and regulatory reliance on ratings expands the class of assets where rating inflation can occur. The ratings solicited by issuers who are more exposed to negative balance sheet shocks are more likely to be inaccurately optimistic.

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## 1. Introduction

Following the financial crisis of 2007–2009, a significant policy debate has focused on the role that the credit rating agencies (CRAs) have played in the crisis. During the years leading to the crisis, the CRAs have been an instrumental part of the so called “originate-to-distribute” lending model. It has been widely argued that by providing favorable ratings, the CRAs have enabled the lending institutions to disseminate bad credit risk by structuring and selling financial securities based on low quality loan pools. For example, the [Financial Crisis Inquiry Commission's final report \(2011\)](#) concludes that “this crisis could not have happened without the rating agencies.” According to the conventional story in the popular financial press, most investors, especially those who invested in complex financial securities were too naive to understand the complex nature of these securities, and were fooled by the favorable ratings issued by the CRAs. Some recent empirical research on the credit rating industry and earlier scholarship in the financial regulation literature, however, paint a more comprehensive picture than a simple “investors' naivety” explanation. These studies emphasize the role that rating-contingent regulation has played in creating the demand for these highly rated securities, despite the ratings providing little, if any, information on security valuations. According to [Weber and Darbellay \(2008\)](#), as ratings by the private rating agencies have gained acceptance as a measure of credit worthiness, the regulators of financial institutions have increasingly used ratings to

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simplify the task of prudential oversight. For example, in the U.S. the credit ratings have been incorporated into hundreds of rules, releases and regulations in various areas, including pension, banking, insurance and real estate finance regulation.<sup>1</sup> [Partnoy \(2006\)](#) argues that the regulators in the U.S. have fundamentally changed the nature of the “product” that the CRAs sell: credit ratings have become valuable not only because of the information they contain about credit worthiness, but foremost due to the regulatory privileges that they provide to investors who purchase these highly rated securities. On the empirical side, recent work by [Stanton and Wallace \(2012\)](#) focuses on the regulatory changes implemented in January 2002 which mandated the reduction of risk based capital requirements for AA and AAA-rated commercial mortgage-backed securities (CMBS) by 80%.<sup>2</sup> They show that this dramatic regulatory shift was accompanied by a sizable decrease in the yields of AA and AAA-rated CMBS relative to the yields of AA and AAA-rated corporate bonds which did not experience any regulatory change. Furthermore, subsequent to the regulatory shift there was a large increase in the overall proportion of CMBS rated AA or above.<sup>3</sup> [Stanton and Wallace \(2012\)](#) conclude that these price and ratings differentials cannot be explained by market wide shifts in the risk perception of these securities, but are entirely consistent with the higher risk-based capital savings to regulated institutions who are the primary investors in those securities.<sup>4</sup> In short, rather than being naive, most investors who were buying the highly rated complex securities seem to be sophisticated institutions that were well aware of the regulatory benefits high ratings provided, and they paid a premium for these “regulatory benefits”.<sup>5</sup>

This excessive regulatory reliance on ratings in financial regulation prior to the crisis suggests an alternative explanation for the decline in rating standards prior to the financial crisis: the rating agencies might have effectively catered to the demands of sophisticated investors for regulatory arbitrage. The proposed elimination of rating contingent regulation in the Dodd-Frank Act of 2010 also aims to restore the role of CRAs as information intermediaries rather than being the providers of “regulatory stamps”. Therefore, a better understanding of the implications of rating contingent regulation for the information content of ratings across different asset classes and issuer characteristics is warranted.

This paper develops a simple model where favorable ratings are valued by fully rational investors due to the regulatory benefits that they provide. The model considers an issuer (seller) who owns a loan portfolio that can be thought of as a mortgage pool. The loan portfolio can default with a certain probability that depends on its unknown quality, which can be either good or bad. To exclusively restrict attention to the rating’s regulatory benefit channel, I assume that the issuer has no ex ante private information on the loan portfolio quality and shares the same prior as all other agents. The issuer’s motivation to sell the loan portfolio arises due to the incentives to eliminate a potential default cost. In particular, in case of portfolio default the issuer is assumed to suffer a monetary loss which creates the incentives to transfer risk by selling the loan portfolio.<sup>6</sup> The issuer seeks to obtain a favorable rating from a CRA to be able to sell the loan portfolio. A key feature of the model is that, due to the regulatory reliance on ratings, the investors who can buy the loan portfolio are willing to pay a “regulatory premium” if a security has a favorable rating.

Before the issuer decides whether to solicit a rating or not, the CRA adopts a costly rating technology that determines the accuracy of its information signal on the loan portfolio quality, adopts a disclosure rule that determines whether it strategically inflates ratings and also sets its fee for the rating.<sup>7</sup> The CRA’s incentives for providing informative ratings stem from reputational considerations: the CRA incurs a loss if the loan portfolio defaults subsequent to the CRA providing a good rating. In this framework, I analyze how the regulatory premium for a favorable rating affects the CRA’s fee structure and rating policy. The main results are as follows:

- The CRA’s endogenous rating fee is driven by the regulatory premium that the investors are willing to pay for a good rating and the issuer’s private default cost. Interestingly, the fee for a good rating is decreasing in the rating’s accuracy. Furthermore, the CRA does not provide a rating unless the regulatory premium exceeds a minimum threshold.
- The CRA provides informative ratings only when the regulatory premium is within an intermediate range and the CRA’s fixed information acquisition cost is below an endogenous threshold. Above this fixed information acquisition cost threshold, the CRA strategically inflates rating and only provides good ratings with no information content.
- The informativeness of ratings unambiguously decreases in the rating’s regulatory premium and the issuer’s default cost. Strategic rating inflation is more likely for complex financial securities with high fixed evaluation costs and those securities issued by institutions with high default costs. The regulatory reliance on ratings expands the class of assets where rating

<sup>1</sup> See [Partnoy \(2006\)](#) for an earlier assessment of this “regulatory outsourcing”.

<sup>2</sup> [Weber and Darbellay \(2008\)](#) also argue that within the Basel II framework that explicitly relies on credit ratings to determine regulatory compliance rules, the investors get a regulatory advantage if they hold highly rated positions that allow them to reduce their capital requirements.

<sup>3</sup> [Stanton and Wallace \(2012\)](#) reports that by 2007, about 95% of all outstanding CMBS were rated AA or above.

<sup>4</sup> In recent empirical work, [Bongaerts et al. \(2012\)](#) find evidence that issuers seek for multiple ratings not because additional ratings provide more information on creditworthiness, but primarily because of regulatory compliance restrictions on investors.

<sup>5</sup> Consistent with these observations, the International Organization of Securities Commissions’ (IOSCO) “Subprime Crisis Report” in May (2008) explicitly states that “A credit rating today is considered a seal of approval giving rise to favorable regulatory treatment.”

<sup>6</sup> It is well understood in the literature that securitization and loan sales allow to transfer the credit risk of lenders that primarily originate loans to particular classes of borrowers or geographical areas thus limiting concentrated risk exposure on their balance sheets (see [Parlour and Plantin, 2008](#)).

<sup>7</sup> Accordingly, the CRA may decline to provide a rating, provide truthful ratings based on its signal or disclose ratings with an upward bias (strategic rating inflation).

inflation can occur, since the threshold complexity above which rating inflation occurs decreases in the regulatory premium for a good rating.

These results provide interesting implications for a CRA's rating policy when investors derive regulatory benefits from holding favorably rated securities. First, the model illustrates that contrary to the popular narrative in most of the financial press, the investors' sophistication in the form of their ability to use favorable ratings for regulatory arbitrage purposes might have been a crucial reason why CRAs were able to find demand for ratings with little information content. Second, conditional on a rating being provided, the information content of the rating is decreasing in the regulatory benefit that the investors derive from the rating.<sup>8</sup> Third, and perhaps most crucially, the regulatory reliance on ratings expands the class of securities, in terms of their complexity captured by the evaluation costs, where rating inflation can occur. This result indicates that the loosening of capital requirements for highly rated CMBS in 2002 and the consequent regulatory premiums investors were willing to pay may have been instrumental for the CRAs to largely contribute to the issue boom of these complex financial securities during 2004–2006 period. This prediction seems consistent with an information brochure by the rating agency Fitch published in 2007 which reveals that the exotic financial securities received a much higher percentage of Aaa ratings (such as 60% for collateralized debt obligations) than do corporate bonds, indicating that rating inflation has been particularly prominent in the complex financial product space. Accordingly, the analysis suggests that the proposed measures in the Dodd-Frank Act of 2010 that aim to limit the ties between regulation and ratings are likely to result in more accurate and conservative rating standards. In the model, the motivation to transfer risk through the sale of the loan portfolio arises purely due to the possible private default cost the issuer faces. A novel prediction of the analysis is that the ratings solicited by those issuers who are poorly diversified and more exposed to negative balance sheet shocks, captured by higher default costs, are more likely to be inflated. Consistent with this prediction, [Titman and Tsyplakov \(2010\)](#) find that commercial mortgages underlying Commercial Mortgage Backed Securities (CMBS) originated by institutions with large negative stock returns prior to origination tend to have higher default rates. These and other implications that emerge from the analysis are discussed in further detail in Section 5.

The remainder of the paper is organized as follows. The next section discusses the related theoretical literature. Section 3 presents the model. Section 4 includes the analysis and the main results. Section 5 discusses the implications that emerge from the analysis. Section 6 concludes. The proofs of the results not presented in the text are included in [Appendix A](#).

## 2. Related literature

There is a quite recent and growing body of theoretical literature analyzing the conflict of interests in the relationship between issuers and rating agencies and the determinants of rating accuracy. The main contribution of this paper to this literature is to study the implications of rating-contingent regulation for the information content of ratings. The only other paper that focuses on the implications of regulatory reliance on ratings is the recent work by [Opp et al. \(2013\)](#). The differences between their basic model and this one, however, yield a different endogenous rating fee structure and somewhat different implications for CRA's rating policy. There is a screening model where the issuers have private information about the quality of their projects when they approach a CRA for a rating. Since the CRA's ratings serve a screening function by denying funding for bad projects, their CRA's fee for a good rating is *increasing* in the accuracy of the rating provided. In contrast, the endogenous rating fee that arises in my setting is *decreasing* in the accuracy of the rating. Furthermore, in the benchmark case with no regulatory benefits, the CRA in [Opp et al. \(2013\)](#) does provide informative ratings, whereas in my setting the CRA does not generate enough rents to provide a rating in the absence of any regulatory premium. Finally, in [Opp et al. \(2013\)](#) when the CRA acquires costly information and provides truthful ratings, the rating accuracy may increase or decrease in the rating's regulatory benefit depending on parameter values. In my setting, however, when information acquisition takes place, the accuracy of the rating unambiguously decreases in the rating's regulatory benefit. A strand of papers focuses on the implications of rating shopping by issuers when some investors are not fully rational. [Bolton et al. \(2012\)](#) develop a model with naive and trusting investors and show that competition between CRAs can actually reduce the information content of ratings as it facilitates rating shopping. In [Skreta and Veldkamp \(2009\)](#), the issuer's ability to select between CRAs leads to overly optimistic ratings even when all CRAs are honest. Their analysis also involves investors who do not rationally account for the upward bias in the reported ratings. In [Pagano and Volpin \(2012\)](#), only few potential buyers are sophisticated enough to understand the pricing implications of complex information from a rating, and hence releasing such information would create a winner's curse problem for unsophisticated investors in the issue market. Accordingly, the issuers can choose a more opaque rating structure to enhance the liquidity of their primary market at the expense of less liquidity in the secondary market. Unlike these studies which rely on naive investors, [Sangiorgi and Spatt \(2013\)](#) provide a model of rating shopping with fully rational investors and focus on the implications of opacity about the contacts between the issuer and rating agencies. Again with fully rational investors, [Faure-Grimaud et al. \(2009\)](#) show that issuers may suppress their ratings if they are too noisy, and competition between CRAs can result in inefficiently low information

<sup>8</sup> The analysis in this paper takes the rating-contingent regulation and the consequent regulatory benefits from favorable ratings as given, and investigates their implications for the information content of the ratings. The design of optimal regulation, and the question of whether regulation should rely on ratings by private and profit maximizing rating agencies in the first place, while clearly a very important issue, is beyond the scope of this paper.

disclosure. Rather than the implications of rating shopping, my paper focuses on the how regulatory reliance on ratings and the consequent regulatory benefits from a favorable rating affects rating quality. Furthermore, in contrast to some of these papers, all investors are fully rational in my setting and they are not “fooled” in equilibrium. Another body of literature addresses the CRA’s reputational concerns for delivering accurate ratings in dynamic models. [Mariano \(2012\)](#) investigates how reputational considerations discipline CRAs when public information is also available. Building on the dynamic setting of [Benabou and Laroque \(1992\)](#), [Mathis et al. \(2009\)](#) show that reputational concerns are not sufficient for accuracy when rating complex products become a major source of income for CRAs, as in this case the benefit of maintaining a reputation to capture income from other sources is lower. For the same reason, they also predict that rating quality is lower in boom times. The relationship between rating quality and the business cycle is further studied in a dynamic setting by [Bar-Isaac and Shapiro \(2013\)](#). They show that rating quality is lower in boom times, unless the economic conditions are too persistent. Other than having a different focus, these papers consider exogenously given fee structures for a good rating, whereas the rating fee is derived endogenously in this paper. In other recent work, [Fulghieri et al. \(2014\)](#) show how the CRAs can issue unsolicited credit ratings to extract higher fees from issuers by credibly threatening to punish those that refuse to acquire a rating. [Kartasheva and Yilmaz \(2013\)](#) extend the certification intermediary setting of [Lizzeri \(1999\)](#) by introducing fully rational but differentially informed investors and type-dependent gains from trade for issuers. In their setting, as ratings become less informative, high quality issuers prefer to hold the asset instead of selling it. They show that some proposed policy reforms such as rating standardization and expert liability can reduce market efficiency. [Manso \(2013\)](#) describes a model that incorporates the feedback effects of credit ratings on default risk, and shows that even when the CRAs adopt an accurate rating policy, immediate default can occur in response to small shocks to fundamentals and increased competition between rating agencies can reduce welfare by increasing default frequency.

### 3. The model

This section presents a single period model with an issuer, a monopolistic credit rating agency (CRA) and investors. All agents are risk neutral and fully rational. The details of the set-up are explained below.

#### 3.1. The issuer

The model features a financial institution (henceforth the issuer) that holds a risky loan portfolio with a fixed size normalized to one. The loan portfolio can be thought of as a mortgage pool and it has either Good (G) or Bad (B) quality. A good portfolio never defaults and yields a payoff that is normalized to one, whereas a bad portfolio always defaults and yields a zero payoff. The ex ante probability of the portfolio being good is given by  $\Pr(G) = \lambda$ . The issuer has no private information on the quality of the loan portfolio and shares the same prior on its default probability as everybody else.<sup>9</sup> The assumption that the loan portfolio (asset) quality is ex ante unknown also to the issuer is common in the literature (see ).<sup>10</sup> It can be justified especially in the context of the “originate to distribute” lending model, on the basis that the issuers typically do not invest in the resources to effectively evaluate the quality of the loans they originate and sell. [Mathis et al. \(2009\)](#) also argue that this “symmetric information” assumption fits well for the case of structured products where the CRAs have played an important advisory role in the design of the credit backed assets being sold. The issuer seeks to sell the loan portfolio to investors.<sup>11</sup> To model issuer’s incentives to engage in risk transfer through a loan sale, I assume that if the issuer holds the loan portfolio until its maturity, in case of default the issuer incurs a monetary loss given by  $d > 0$ . As in [Thompson \(2010\)](#), this default cost can be due to the issuer being forced to prematurely liquidate some other assets at a loss to generate funds (especially likely if the issuer is leveraged), or it may arise due to regulatory penalties for holding too much risk. The potential investors who can buy the loan portfolio do not suffer this default cost as they are assumed to hold only small portions of the portfolio. The issuer’s ex ante expected payoff from holding the portfolio without selling it to investors is hence given by  $V_n \equiv \lambda - (1 - \lambda)d$ .

#### 3.2. CRA

Due to regulatory restrictions, I assume that the sale of the loan portfolio can only take place if the issuer can receive a good rating from a CRA.<sup>12</sup> I consider a monopolistic CRA who can issue either a good rating ( $r=g$ ) or a bad rating ( $r=b$ ) for the loan portfolio.

<sup>9</sup> In [Parlour and Plantin \(2008\)](#) the issuer learns the type of the loan prior to loan sale. In their model, the investors do not know whether the issuer wants to sell the loan because of high default risk or because the issuer wants to redeploy capital by exploiting a new investment opportunity.

<sup>10</sup> Two exceptions are [Opp et al. \(2013\)](#) and [Kartasheva and Yilmaz \(2013\)](#) where the issuers know their type when they solicit a rating.

<sup>11</sup> As in most papers in the literature, in this simple framework with two possible outcomes (default or success) and zero payoff in the default state, the particular security being issued is not important. Accordingly, I abstract away from security design considerations.

<sup>12</sup> [Campbell and Taksler \(2003\)](#) report that more than half of the corporate bonds are held by institutions that are subject to rating based restriction on their holdings of risky credit assets.

### 3.2.1. Signal accuracy

The CRA has access to an information production technology which can generate an information signal  $s \in \{g, b\}$  on the portfolio type. In particular, the CRA receives a good signal  $s=g$  with probability one if the underlying portfolio is good, whereas a bad portfolio generates a bad signal  $s=b$  only with a probability  $z \in [0, 1]$ . Formally,

$$\Pr(s = g | G) = 1 \quad \text{and} \quad \Pr(s = b | B) = z \in [0, 1] \quad (1)$$

This simple formulation, which is also adopted by [Bar-Isaac and Shapiro \(2013\)](#), intends to capture the main concern regarding the rating industry, that is, the CRA inaccurately issuing a favorable rating for a security with high default probability. With the signal technology in (1), the accuracy of the CRA's signal refers to the likelihood that the CRA observes a bad signal when the portfolio is indeed bad. I refer to the parameter  $z$  as the CRA's signal accuracy which is endogenously chosen by the CRA and is observable by the issuer and investors. Observing an accurate signal is costly. The cost to CRA of adopting a signal technology with accuracy  $z$  is given by  $C(z) = k + \phi(z^2/2)$  where  $\phi > 0$  is a scale parameter for the variable part of the information acquisition cost, and  $k > 0$  is the fixed cost of information acquisition.

### 3.2.2. Strategic rating inflation

Other than choosing the accuracy  $z$  of its signal, I also allow the CRA to engage in strategic misreporting. To this end, I follow [Opp et al. \(2013\)](#) and assume that the CRA can provide a good rating despite observing a bad signal with a positive probability. Formally, the CRA adopts a disclosure rule  $\sigma \in [0, 1]$  where

$$\sigma \equiv \Pr(r = g | s = b) \quad (2)$$

is the probability that the CRA issues a good rating despite observing a bad signal and hence inflates the rating. The disclosure rule  $\sigma$  is also observable to the issuer and investors. If the CRA chooses a signal accuracy  $z$  and a disclosure rule  $\sigma$ , the ex ante probability that it issues a good rating is given by

$$\Pr(r = g) = 1 - (1 - \lambda)(1 - \sigma)z. \quad (3)$$

For a signal accuracy  $z$  and a disclosure rule  $\sigma$ , the conditional probability that the loan portfolio is of good quality given a good rating can also be computed as

$$\Pr(G | r = g) = \frac{\Pr(r = g | G)\Pr(G)}{\Pr(r = g)} = \frac{\lambda}{1 - (1 - \lambda)(1 - \sigma)z}. \quad (4)$$

### 3.2.3. Fee for a good rating

Following the common industry practice, I assume that the CRA operates under the issuer-pays business model. In particular, the CRA charges the issuer a fee  $\pi$  only if the rating is good.<sup>13</sup> The fee  $\pi$  is endogenous and optimally set by the CRA. In practice, the issuers pay a CRA only when they ask the CRA to make the rating public. Given the signal technology specification in (1), a bad rating perfectly reveals that the portfolio is bad, and hence it will default with probability one. Since the issuer's incentive to solicit a rating in the model is to make the loan portfolio eligible for sale, the issuer would not pay the CRA to make a bad rating public.

### 3.2.4. Reputational cost

In this single period model, I assume that the incentives of the CRA to provide accurate ratings stem from reputational considerations described as follows: if the loan portfolio defaults subsequent to a good rating, the CRA incurs an exogenously given monetary loss  $\beta > 0$ . This cost can be thought as the discounted sum of future profits lost by the CRA if its rating proves to be at odds with the actual performance of the loan portfolio.<sup>14</sup> As in [Bolton et al. \(2012\)](#), this simple formulation aims to capture the idea that the future profits of the CRA depend on providing ratings that prove to be in line with the actual performance of the asset being rated. It can be justified on the basis that in case of default despite a good rating, the investors are likely to be reluctant to rely on the ratings of the CRA due to diminished confidence.<sup>15</sup> Formally, for a given signal accuracy  $z$  and disclosure rule  $\sigma$ , the ex ante expected reputational loss  $L(\cdot)$  that the CRA suffers from an inaccurate good rating is given by

$$L(z, \sigma; \beta) = [(1 - \lambda)(1 - z(1 - \sigma))]\beta. \quad (5)$$

<sup>13</sup> In [Bolton et al. \(2012\)](#), [Bar-Isaac and Shapiro \(2013\)](#), [Mathis et al. \(2009\)](#) and [Skreta and Veldkamp \(2009\)](#), the CRA is only paid for a good rating as well.

<sup>14</sup> [Bolton et al. \(2012\)](#) argue that this lost future business may be more likely in the case of newer financial instruments like structured finance products where demand for the product may dry up.

<sup>15</sup> The one shot reputational cost from providing a rating that ex post proves to be at odds with the portfolio's actual performance is admittedly a reduced form approach, but as in [Bolton et al. \(2012\)](#), it helps to introduce incentives for providing informative ratings in a simple manner. In the dynamic model of [Bar-Isaac and Shapiro \(2013\)](#), the CRA (who is always truthful by assumption) can also identify a bad portfolio as good. Upon committing this error, all future profits of the CRA are lost as investors follow grim-trigger strategies to punish the CRA and no longer rely on its ratings.



### 3.3. Investors and regulatory relief

The investors who can buy the loan portfolio are risk neutral and competitive. A key motivation of this paper is to incorporate the observation that a security with a favorable rating from the CRA is valued by investors not only based on its final expected cash flow, but also due to the regulatory relief it provides. Rating contingent regulation has been pervasive in the US prior to the financial crisis in 2007–2009, and can be found in bank capital requirements, investment class restrictions faced by regulated institutions and collateral requirements. While I do not model the specific purpose of such regulation, I incorporate the observation that all forms of rating contingent regulation imply lower regulatory compliance costs for better rated securities. To this end, I assume that the investors are willing to pay a premium for the loan portfolio with a good rating due to the reduction in their cost of regulatory compliance. Formally, the price that the issuer can get when selling the loan portfolio subsequent to a good rating is given by

$$p = \Pr(G | r = g) + v \quad (6)$$

where the regulatory premium is captured by the parameter  $v > 0$ . The above formulation is consistent, for example, with capital requirement regulation. White (2010) points out that for banks and savings institutions, mortgage-backed securities that were issued by non-governmental entities and rated AA or better qualified for the same reduced capital requirements (1.6% of asset value) that applied to the mortgage backed securities issued by Fannie Mae and Freddie Mac, instead of the higher capital requirements (4% of asset value) that applied to mortgages and lower rated mortgage securities.

The formulation in (6) captures in a simple form the observation that the security prices are affected by the regulatory reliance on ratings.<sup>16</sup> There is ample evidence that favorable credit ratings are valuable to investors not only because they contain valuable information, but also due to the regulatory privileges that they provide (see Partnoy, 2006; Weber and Darbellay, 2008; White, 2010; Kisgen and Strahan, 2010; Stanton and Wallace, 2012; Bongaerts et al., 2012). For example, Stanton and Wallace (2012) find that the spread between the commercial mortgage backed securities (CMBS) and corporate bond yields fell significantly for ratings AA and AAA after a loosening of capital requirements for the highly rated CMBS in 2002.<sup>17</sup> Similarly, Kisgen and Strahan (2010) focus on the SEC's accreditation of Dominion Bond Rating Services (DBRS) in 2003 as an agency whose ratings qualify in the implementation of various kinds of regulation.<sup>18</sup> They show that a one notch better rating by DBRS after the regulatory status change corresponds to a 39 basis points reduction in bond yields. Their finding also supports the notion that investors are willing to pay a premium for highly rated securities due to the regulatory advantages the favorable rating provides, independent of the expected cash flow of the security.

### 3.4. Sequence of events

For the reader's convenience, the sequence of events in the model is summarized below.

- Stage 1: The issuer holds a loan portfolio. All agents share the same prior on the portfolio's default probability given by  $1 - \lambda$ .
- Stage 2: The CRA chooses the accuracy  $z$  of its information signal, adopts a disclosure rule  $\sigma$  and posts a fee  $\pi$  for a good rating.
- Stage 3: After observing  $z$  and  $\pi$ , the issuer decides whether to solicit a rating or not. If a rating is solicited, the CRA observes a signal with accuracy  $z$  and discloses a truthful rating based on the signal.
- Stage 4: If the rating is good, the issuer pays the CRA the fee  $\pi$  and sells the loan portfolio to investors. If the rating is bad, no loan sale takes place. If the loan portfolio defaults while the issuer is holding it, the issuer incurs a private default cost  $d$ .
- Stage 5: The loan portfolio's cash flow is realized. If the portfolio defaults subsequent to a good rating, the CRA suffers a reputational cost  $\beta$ .

## 4. Analysis

This section analyzes the equilibrium of the model. To facilitate the exposition of the subsequent analysis, the definition of the equilibrium is stated formally below.

Definition: The equilibrium has the following requirements.

- (i) The CRA posts a fee  $\pi$  for a good rating, chooses a signal accuracy  $z$  and a disclosure rule  $\sigma$  to maximize its ex ante expected payoff given by

$$\Psi(z, \sigma, \pi) \equiv \Pr(r = g)\pi - c(z) - L(z, \sigma; \beta), \quad (E1)$$

<sup>16</sup> A feature of the formulation in (6) is that all investors in the current setting are fully rational and are not fooled by the rating agency or the issuer. The investors' valuation of the security depends on the 'correct' rating accuracy of the CRA and the regulatory benefit that they derive from a favorable rating.

<sup>17</sup> In January of 2002, the risk based capital weights for AA and AAA CMBS were reduced by 80%.

<sup>18</sup> Kisgen and Strahan (2010) use this exogenous change in DBRS's regulatory status as an experiment to focus exclusively on any price differential due to the regulatory benefits DBRS's ratings provide.

where  $\Pr(r=g) = [1 - (1 - \lambda)(1 - \sigma)z]$  and  $L(z, \sigma; \beta) = [(1 - \lambda)(1 - z(1 - \sigma))\beta]$ . If the maximized value  $\Psi^* < 0$ , the CRA does not provide a rating.

(ii) Given  $\pi$ , and  $\sigma$ , the issuer solicits a rating only if

$$\Pr(r = g)[p - \pi] - \Pr(r = b)d \geq V_n \equiv \lambda - (1 - \lambda)d. \tag{E2}$$

where  $p = \Pr(G | r = g) + v$ .

#### 4.1. Endogenous fee for a good rating

Using the issuer’s participation constraint (E2), one can derive the CRA’s endogenous fee  $\pi$  for a good rating. The CRA sets the fee such that the issuer is ex ante indifferent between soliciting a rating and not soliciting, and (E2) holds as an equality. Substituting the price  $p$  in (6) into (E2), one can rewrite the issuer’s indifference condition in (E2) as

$$\Pr(r = g) \left[ \left( \frac{\Pr(G)\Pr(r = g | G)}{\Pr(r = g)} \right) + (v - \pi) \right] - \Pr(r = b)d = \lambda - (1 - \lambda)d.$$

Solving for the rating fee  $\pi$  then yields

$$\pi = \underbrace{v}_{\text{regulatory value to investors}} + \underbrace{\left( \frac{\Pr(r = g) - \Pr(G)}{\Pr(r = g)} \right) d}_{\text{default cost elimination value to issuer}} \tag{7}$$

The above expression for  $\pi$  decomposes the issuer’s willingness to pay for a good rating into two components. The first part of the fee reflects the premium that the investors are willing to pay for the loan portfolio due to the regulatory benefit the good rating provides. The second component of the fee stems from the issuer’s desire to eliminate the default cost  $d$  by selling the loan portfolio. This second part is increasing in  $\Pr(r = g) - \Pr(G)$ , the difference between the probability that CRA issues a good rating and the ex ante probability that the loan portfolio is actually good. Using the expression for  $\Pr(r = g)$  in (3), one obtains that the difference  $\Pr(r = g) - \Pr(G)$  is given by

$$\Pr(r = g) - \Pr(G) = (1 - \lambda)(1 - z(1 - \sigma)). \tag{8}$$

which is decreasing in the accuracy  $z$  of the CRA’s signal and increasing in the probability of rating inflation  $\sigma$ . Accordingly, through this second part of the fee driven by  $d$ , the issuer’s willingness to pay for a good rating is decreasing in the accuracy of the rating. This observation follows, because a lower signal accuracy  $z$  and/or higher likelihood of rating inflation  $\sigma$  increases the probability that the CRA inaccurately provides a good rating for a bad loan portfolio and enables the issuer to eliminate the default cost  $d$  through the sale of the portfolio. Indeed, when the CRA’s signal is perfectly accurate ( $z = 1$ ) and the CRA is fully truthful ( $\sigma = 0$ ), then the wedge  $\Pr(r = g) - \Pr(G)$  disappears, and the fee for a good rating is only driven by the regulatory premium  $v$ . Combining (3), (7) and (8), one obtains the following endogenous fee structure for a good rating.

**Proposition 1.** *The CRA’s fee for a good rating is given by*

$$\pi = v + \underbrace{\left( \frac{(1 - \lambda)(1 - A(z, \sigma))}{1 - (1 - \lambda)A(z, \sigma)} \right) d}_{\text{decreasing in accuracy}} \tag{9}$$

where  $A(z, \sigma) \equiv (1 - \sigma)z$  is the accuracy of the rating.

**Proof.** See Appendix A. □

A few remarks on the model’s assumptions that generate the fee structure in (9) are in order. To exclusively restrict attention to the rating’s “regulatory benefit” channel, I consider a setting with no ex ante asymmetric information between the issuer and investors. Given this assumption, the CRA’s ratings in this model do not serve a screening function between different loan portfolio types. The function that a good rating serves here is “regulatory compliance” as the loan sale can take place only with a good rating. When the loan portfolio is sold to the investors subsequent to a good rating, the issuer and fully rational investors share the same posterior. Therefore, while the quality of the information in the rating does affect the price  $p$  in (6) that the investors pay for the asset, the gains from trade is always given by the right hand side of (9) which is decreasing in the accuracy of the rating. This surplus is completely captured by the monopolist CRA’s fee  $\pi$ .<sup>19</sup>

<sup>19</sup> It should be noted that the only economic rationale for improving rating’s accuracy in this model is that higher accuracy reduces the ex ante probability that the CRA incurs a reputational penalty  $\beta$ . Implicit in the CRA’s reputational penalty assumption, however, is the idea that the investors do care about the CRA providing a rating that is not ex post revealed to be at odds with the loan performance. While the explicit channel why the investors are better off from more informative ratings is not modeled explicitly here, the analysis takes the conventional view that it is socially desirable that the CRA provides informative ratings.

## 4.2. Optimal rating policy

To analyze the CRA's optimal choice of signal accuracy  $z$  and disclosure rule  $\sigma$ , one can substitute the endogenous fee  $\pi(\cdot)$  from (9) into (E1), and rewrite the CRA's expected payoff as

$$\Psi(z, \sigma) = [1 - (1 - \lambda)(1 - \sigma)z]v - c(z) - (1 - \lambda)(1 - (1 - \sigma)z)(\beta - d) \quad (10)$$

Given the linearity of  $\Psi(z, \sigma)$  in the disclosure rule  $\sigma$ , in equilibrium either full truthfulness ( $\sigma = 0$ ) or complete rating inflation ( $\sigma = 1$ ) obtains. To characterize the equilibrium rating policy ( $z^*, \sigma^*$ ), I now proceed to analyze the CRA's payoff under these two disclosure rules separately.

### 4.2.1. Fully truthful disclosure ( $\sigma = 0$ )

Under the fully truthful disclosure rule ( $\sigma = 0$ ), the CRA chooses the signal accuracy  $z$  to maximize

$$\Psi_{TD}(z, \sigma = 0) = [1 - (1 - \lambda)z]v - c(z) - (1 - \lambda)(1 - z)(\beta - d) \quad (11)$$

The CRA's expected payoff  $\Psi_{TD}$  in (11) reveals the CRA's trade-off in choosing its signal accuracy  $z$  under fully truthful disclosure. The first term in (11) reflects the CRA's expected fee due to the regulatory benefit of the good rating. Since, a higher signal accuracy  $z$  reduces the likelihood that the CRA provides a good rating, the expected fee due to the regulatory benefit  $v$  is decreasing in signal accuracy  $z$ . The last term in (11) indicates that the issuer's default cost  $d$  and its consequent willingness to pay a higher fee for a less accurate rating dilutes the incentive effect of the CRA's reputational cost  $\beta$ . Indeed, regardless of the regulatory premium  $v$ , a necessary condition for the CRA to be acquiring an informative signal is that  $\beta > d$ , which I assume is satisfied. An immediate observation that follows from (11) is that in the absence of any regulatory premium (when  $v = 0$ ), the CRA does not provide a rating under the fully truthful disclosure regime. This observation follows, since

$$\Psi_{TD}(z, \sigma = 0)|_{v=0} = -c(z) - (1 - \lambda)(1 - z)(\beta - d) < 0$$

The intuition is as follows. The endogenous fee for a good rating in this model is driven by the regulatory benefit the rating provides to investors. As a result, the CRA finds it viable to provide a rating only when the regulatory premium  $v$  is sufficiently high so that the fee for a good rating provides enough rents to cover for information acquisition and expected reputational costs. By requiring that the expected payoff  $\Psi_{TD}(z, \sigma = 0) \geq 0$ , one can describe the minimum regulatory benefit which ensures that the CRA provides a rating under fully truthful disclosure ( $\sigma = 0$ ).

**Proposition 2.** *Under fully truthful disclosure ( $\sigma = 0$ ), the CRA provides a rating only when*

$$v \geq v_{\min} \equiv (1 - \lambda)(\beta - d) + c(z^*) \quad (12)$$

where

$$z^* = \text{Max} \left\{ \text{Min} \left\{ \frac{\beta - d - v}{\phi}, 1 \right\}, 0 \right\} \quad (13)$$

For  $v \geq v_{\min}$ , the CRA's signal accuracy is given by  $z^*$  in (13). For  $v < v_{\min}$ , the CRA does not provide a rating.

**Proof.** Follows from maximizing (11) with respect to  $z$  and requiring the maximized expected payoff  $\Psi_{TD}(z^*, \sigma = 0) \geq 0$ . When providing a rating is viable under the fully truthful disclosure rule, it follows from (11) and (13) that the CRA's maximized expected payoff from full truthfulness can be written as

$$\Psi_{TD}^*(z^*, \sigma = 0) = [v - (1 - \lambda)(\beta - d)] - k + \frac{(1 - \lambda)^2(\beta - d - v)^2}{2\phi} \quad (14)$$

□

### 4.2.2. Complete rating inflation ( $\sigma = 1$ )

Consider now the case where the CRA sets  $\sigma = 1$ , completely inflates the ratings and issues a good rating with probability one even after observing a bad signal. Under the complete rating inflation policy, note that the CRA sets its signal accuracy as  $z^* = 0$  and receives completely uninformative signals. This observation follows, because when the CRA always issues a good rating regardless of the signal it observes, it is optimal not to acquire any costly information. Setting  $z = 0$  and  $\sigma = 1$  in (10), one can write the CRA's expected payoff under complete rating inflation as

$$\Psi_{RI}(z = 0, \sigma = 1) = v - (1 - \lambda)(\beta - d) \quad (15)$$

The above expression for  $\Psi_{RI}$  indicates that under complete rating inflation, the CRA provides a rating (which is completely uninformative) as long as the regulatory premium  $v$  is sufficiently high, that is,  $v \geq (1 - \lambda)(\beta - d)$ . This condition follows, because the CRA finds it viable to provide a completely uninformative good rating only when its expected fee under no information acquisition, given by  $v + (1 - \lambda)d$ , is high enough to cover the expected reputational cost, which is now given by  $(1 - \lambda)\beta$  under a policy that sets  $z = 0$  and  $\sigma = 1$ .



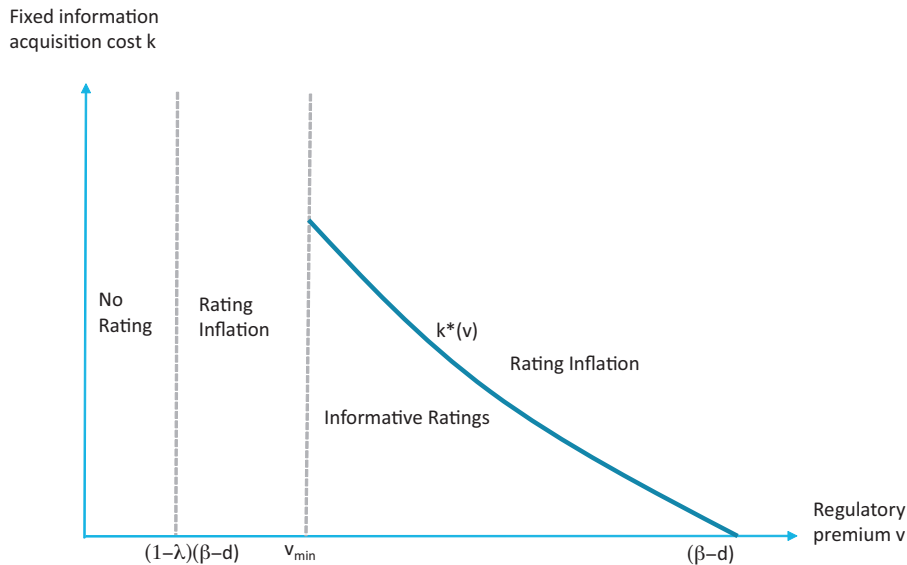


Fig. 1. The CRA's equilibrium rating policy.

4.2.3. Characterization of equilibrium rating policy

One can now provide a complete characterization of the CRA's equilibrium rating policy by comparing the CRA's payoff under fully truthful disclosure ( $\sigma = 0$ ) and complete rating inflation ( $\sigma = 1$ ). Suppose that  $v \geq v_{\min}$  and hence providing a rating is viable under  $\sigma = 0$ . For fully truthful disclosure to be an equilibrium, one requires

$$\Psi_{TD}^*(z^*(v), \sigma = 0) \geq \Psi_{RI}(z = 0, \sigma = 1) \tag{16}$$

Using (14) and (15), it can be shown that whether fully truthful disclosure ( $\sigma = 0$ ) or complete rating inflation ( $\sigma = 1$ ) obtains depends on the size of the fixed cost of information acquisition  $k$ . Formally, the CRA adopts a fully truthful disclosure rule ( $\sigma = 0$ ) when  $k$  is below an endogenous threshold given by

$$k < k^* \equiv \frac{(1 - \lambda)^2(\beta - d - v)^2}{2\phi} \tag{17}$$

The result below describes the CRA's equilibrium rating policy ( $\sigma^*, z^*$ ) which is also illustrated in Fig. 1.

**Proposition 3.** Depending on the regulatory premium  $v$  and the CRA's fixed information acquisition cost  $k$ , there are three different rating policy regimes involving no rating, informative ratings and complete rating inflation.

- (i) For  $v < (1 - \lambda)(\beta - d)$ , the CRA does not provide a rating.
- (ii) For  $v \in ((1 - \lambda)(\beta - d), v_{\min})$  where  $v_{\min}$  is given by (12), the CRA sets ( $\sigma^* = 1, z^* = 0$ ) and engages in complete rating inflation.
- (ii) For  $v \geq v_{\min}$ , the CRA adopts

$$\begin{aligned} \sigma^* = 0 \text{ and } z^* = \text{Max} \left\{ \text{Min} \left\{ \frac{\beta - d - v}{\phi}, 1 \right\}, 0 \right\} & \text{ for } k \leq k^* (\text{Informative Ratings}) \\ \sigma^* = 1 \text{ and } z^* = 0 & \text{ for } k > k^* (\text{Complete Rating Inflation}) \end{aligned}$$

where the information acquisition cost threshold  $k^*$  is given by (17).

**Proof.** See Appendix A. □

The CRA's optimal rating policy depends on (i) the threshold fixed information acquisition cost  $k^*$  that determines whether CRA acquires information or engages in rating inflation, (ii) the minimum regulatory premium  $v_{\min}$  that determines whether the CRA provides a rating if truthful disclosure is optimal and, (iii) the optimal signal accuracy  $z^*$  the CRA adopts when information acquisition takes place. The next section provides some comparative statics results on  $k^*, v_{\min}$  and  $z^*$  and relates them to the model's exogenous parameters.

#### 4.2.4. Comparative statics

4.2.4.1. *Determinants of  $k^*$ .* The analysis illustrates that when the fixed cost of information acquisition  $k$  is sufficiently high, the CRA does not acquire any information and engages in complete rating inflation. The threshold value of fixed information acquisition cost  $k^*$  above which CRA strategically inflates ratings is given by (17). The Corollary below describes how  $k^*$  depends on the model's parameters.

**Corollary 1.** (*Determinants of  $k^*$* ): *The threshold fixed information acquisition cost  $k^*$  above which the CRA engages in complete rating inflation is*

- (i) *decreasing in the regulatory premium  $v$  for a good rating,*
- (ii) *decreasing in the issuer's private default cost  $d$ ,*
- (iii) *increasing in the CRA's reputational cost  $\beta$ ,*
- (iv) *decreasing in the variable cost  $\phi$  of information acquisition.*

**Proof.** The comparative statics results above follow directly from (15).  $\square$

If the regulatory premium  $v$  is higher, the threshold value of  $k^*$  decreases, making strategic rating inflation more likely. This relationship follows, because regulatory premium  $v$  provides a fee source for the CRA independent of the rating's information content. Therefore, higher values of  $v$  makes strategic rating inflation more attractive for a given fixed cost of information acquisition. If one views the fixed evaluation cost  $k$  as a measure of the complexity of the asset under consideration, an increase in the regulatory premium  $v$  expands the set of assets (in terms of their complexity) where CRA engages in strategic rating inflation. This implication is further discussed in Section 5. The comparative static result that  $k^*$  is increasing in the CRA's reputational cost  $\beta$  follows because higher  $\beta$  makes rating inflation less attractive by increasing the cost of providing inaccurately optimistic ratings. Higher issuer default cost  $d$ , on the other hand, makes rating inflation more likely by reducing  $k^*$ . This follows, since default cost  $d$  dilutes the incentive effect of the CRA's reputational cost  $\beta$  by introducing a fee component that is actually decreasing in the accuracy of the rating. Finally, the threshold  $k^*$  is decreasing in the variable cost  $\phi$  of information acquisition. This result obtains, since when signal accuracy is more costly to attain, strategic rating inflation becomes more attractive.

4.2.4.2. *Determinants of  $v_{\min}$ .* A feature of the model is that the value of a good rating stems primarily from the regulatory premium that investors pay for a good rating. As a result, the CRA finds it viable to provide a rating only when the regulatory premium  $v$  is sufficiently high so that the fee for a good rating provides enough rents to cover for information acquisition and expected reputational costs. The Corollary below describes how this minimum regulatory premium  $v_{\min}$  depends on the model's parameters.

**Corollary 2.** (*Determinants of  $v_{\min}$* ): *The minimum regulatory premium  $v_{\min}$  which ensures that the CRA provides a rating is*

- (i) *increasing in the CRA's information acquisition cost parameters  $\phi$  and  $k$ .*
- (ii) *decreasing in the issuer's default cost  $d$*
- (iii) *increasing in CRA's reputational cost  $\beta$ .*

**Proof.** The results follow directly from (12) and (13).  $\square$

As the CRA's information production cost parameters  $\phi$  and/or  $k$  increase, the CRA requires a larger fee to be able to cover its information acquisition costs. Accordingly, the minimum regulatory premium  $v_{\min}$  increases as  $\phi$  and  $k$  increase. On the other hand, the issuer's default cost  $d$  dilutes the incentive effect of the CRA's reputational cost parameter  $\beta$ . Consequently, as  $d$  increases, the rent the CRA requires to cover its net expected reputational costs is lower. Therefore,  $v_{\min}$  decreases as the issuer's default cost  $d$  increases. The effect of  $\beta$  on the minimum threshold  $v_{\min}$  is just the opposite of the effect of  $d$ . As the CRA's reputational cost  $\beta$  from providing an inaccurate rating increases, the CRA now requires higher rents to break even and cover the higher expected reputational costs for a given accuracy. As a result,  $v_{\min}$  increases as the CRA's reputational cost  $\beta$  increases.

4.2.4.3. *Determinants of  $z^*$ .* When the CRA finds it optimal to adopt a fully truthful disclosure rule and acquires information (for  $k \leq k^*$ ), the CRA's optimal signal accuracy  $z^*$  is given by (13). The Corollary below describes how the minimum regulatory premium  $z^*$  depends on the model's parameters.

**Corollary 3.** (*Determinants of  $z^*$* ): *Under full truthful disclosure (which obtains when  $k \leq k^*$ ), the CRA's signal accuracy  $z^*$  is*

- (i) *decreasing in the fixed regulatory premium  $v$  for a good rating,*
- (ii) *decreasing in the issuer's private default cost  $d$*
- (iii) *increasing in the CRA's reputational cost  $\beta$ ,*
- (iv) *decreasing in the variable cost of  $\phi$  of information acquisition*

**Proof.** The results follow directly from (13). □

The relationship between the optimal signal accuracy  $z^*$  and the CRA's reputational cost  $\beta$  and the variable information acquisition cost parameter  $\phi$  are straightforward. The reason that optimal signal accuracy  $z^*$  is decreasing in the regulatory benefit  $\nu$  from a good rating is that  $\nu$  inflates the CRA's expected fee through introducing an information insensitive component into the fee structure. The CRA's trade-off in this framework is between securing the fee for a good rating through adopting a lower signal accuracy  $z$  (since the probability of a good rating is decreasing in  $z$ ) versus the consequent expected reputational costs from providing an inaccurate rating. Since the regulatory benefit  $\nu$  inflates the fee independent of the rating's information content, a higher  $\nu$  reduces the incentives to acquire precise signals, as higher accuracy reduces the ex ante probability that a good rating is provided and the fee is secured. The result that the signal accuracy is decreasing in the issuer's default cost  $d$  follows from the fact that when information acquisition takes place (for  $k \leq k^*$ ), the CRA can increase its fee with less accurate ratings if facing an issuer with a higher default cost  $d$ . Therefore, as  $d$  increases the CRA's optimal signal accuracy  $z^*$  decreases.

## 5. Implications

This section provides a discussion of some implications that emerge from the analysis.

### 5.1. Inaccurate ratings and full investor rationality

The analysis illustrates that regulatory reliance on ratings alone can create demand for favorable ratings with little information content even when all agents are fully rational. The fee structure in Proposition 1 reveals that fully rational and sophisticated investors' valuation of highly rated securities due to their preferential regulatory treatment can result in favorable ratings being valued regardless of their information content. This implication is all the more relevant as some considerable amount of criticism on the poor performance of the rating industry during the financial crisis of 2007–2009 has focused on rating agencies and issuers exploiting naive and trusting investors. It should be noted that especially in the case of complex financial products where this popular criticism has been most frequently voiced, the investors were typically sophisticated financial institutions (Stanton and Wallace, 2012). Accordingly, it is unlikely that these investors were completely unaware of the conflict of interests in the ratings process and thus were fooled because of their unfamiliarity with the complex nature of the financial products that they were investing. The framework in this paper proposes, on the contrary, that these sophisticated investors valued favorable ratings not because of their information content, but due to the regulatory advantages these ratings provided.

### 5.2. Rating inflation, asset complexity and regulatory reliance on ratings

An implication of the analysis, which follows from Proposition 3 and Corollary 1, relates the likelihood of strategic rating inflation to asset complexity and the regulatory benefits from favorable ratings. The model illustrates that strategic rating inflation is more likely for complex financial securities with high fixed evaluation costs for the CRA. Furthermore, the regulatory reliance on ratings expands the class of assets, in terms of their complexity, for which rating inflation is more likely. In the light of this implication, the analysis suggests that the loosening of capital requirements for highly rated Commercial Mortgage Backed Securities (CMBS) in 2002 may have been instrumental for the CRAs to largely contribute to the issue boom of these complex securities during 2004–2006 by providing overly optimistic ratings. Interestingly, the comparative statics results in Corollary 2 suggests that an increase on regulatory reliance on ratings for complex financial products might have rendered the business of rating these products viable for those CRAs whose ratings were used for regulatory purposes. The results that relate rating quality to the regulatory benefits from favorable ratings indicate that rating contingent regulation unambiguously reduces the accuracy of ratings (Proposition 3, Corollary 1 and Corollary 3). Accordingly, a policy implication of the analysis is that cutting ties between regulation and ratings, as proposed in the Dodd-Frank Act of 2010, is likely to improve rating accuracy and make CRAs issue more conservative ratings.

### 5.3. Rating quality and issuer characteristics

A novel implication of the analysis is that the ratings solicited by those issuers that are poorly diversified, more exposed to negative balance sheet shocks and have higher default costs are likely to be more inaccurately optimistic (Corollary 1-ii and Corollary 3-ii). Providing empirical support for this implication, Titman and Tsyplakov (2010) find that the commercial mortgages underlying the CMBS originated by institutions with large negative stock returns prior to origination tend to have higher default rates and are sold into CMBS pools more quickly after origination. Their evidence suggests that institutions who have experienced negative balance sheet shocks are more anxious to securitize and sell the mortgages they originate. In the context of the model, this corresponds to an issuer with a higher default cost  $d$ , and hence more eager to pay a larger fee for an inaccurately good rating. Similarly, Faltin-Traeger et al. (2011) find strong evidence that securitizations sponsored by better capitalized, more diversified, or vertically integrated issuers perform better and are less likely to be downgraded by rating agencies. They also find that issues sponsored by banks tend to be downgraded later than those sponsored by non-bank

entities holding less liquid assets with presumably higher default costs, again supporting the prediction that ratings solicited by issuers with healthier balance sheets tend to be more accurate.

## 6. Conclusion

In this paper, I analyze the implications of rating-contingent regulation and the consequent regulatory benefits rational investors enjoy from favorable ratings for a monopolistic CRA's rating policy. The main results that emerge from the analysis are as follows. The CRA's endogenous rating fee is shown to be decreasing in the accuracy of the rating. The CRA provides a rating only when the investors' regulatory benefit exceeds a minimum endogenous threshold. The regulatory reliance on ratings unambiguously reduces rating quality. Strategic rating inflation is more likely for complex financial securities with high fixed evaluation costs, and regulatory reliance on ratings expands the class of assets where rating inflation can occur. Finally, the ratings solicited by those issuers who are more exposed to negative balance sheet shocks are more likely to be inaccurately optimistic.

To be able to focus on the "regulatory benefit channel", the model I present abstracts away from a number of relevant issues in the rating industry that have been studied in previous theoretical work. First, the model considers a monopolistic CRA. Hence, it does not incorporate competition between CRAs and implications of rating shopping by issuers. Second, the specific function that a rating serves in the model is regulatory compliance as it is assumed that the issuer does not have superior information on the quality of the portfolio for sale. Third, rather than a dynamic setting the CRA's reputational considerations are modeled by a one-shot reduced form reputational cost that the CRA suffers if the portfolio defaults subsequent to a favorable rating. Incorporating these considerations would make the model richer, however the main insights developed in the model regarding the implications of rating-contingent regulation for rating accuracy are likely to continue to be valid. Finally, the analysis in this paper takes the rating-contingent regulation and the consequent regulatory benefits from favorable ratings as given, and investigates their implications for the information content of the ratings. The design of optimal regulation, and the question of whether regulation should rely on ratings in the first place is an important open research question.

## Appendix A.

**Proof of Proposition 1.** In equilibrium (E2) holds as an equality and the CRA extracts all the surplus. Substituting the price  $p$  in (6) into (E2), one can rewrite the issuer's participation constraint (E2) as

$$Pr(r = g)Pr(G | r = g) + Pr(r = g)(v - \pi) - Pr(r = b)d = \lambda - (1 - \lambda)d \quad (\text{A.1})$$

Noting that  $Pr(r = g)Pr(G | r = g) = Pr(G) = \lambda$ , the above expression in (A.1) becomes

$$Pr(r = g)(v - \pi) = [Pr(r = g) - \lambda]d \quad (\text{A.2})$$

Using the expression for  $Pr(r = g)$  in (3) and solving for  $\pi$  yields the result.  $\square$

**Proof of Proposition 3.** For parts (i) and (ii), first note from (15) that the threshold minimum regulatory premium for complete rating inflation is given by

$$v = (1 - \lambda)(\beta - d). \quad (\text{A.3})$$

One can establish that at  $v = (1 - \lambda)(\beta - d)$ , full truthful disclosure ( $\sigma = 0$ ) yields a strictly negative expected payoff. This observation follows, since from (13) we have

$$z^*_{|v=(1-\lambda)(\beta-d)} = \frac{\lambda(\beta - d)}{\phi}. \quad (\text{A.4})$$

Therefore, from the definition of  $v_{\min}$  in (12), one obtains

$$v_{\min|v=(1-\lambda)(\beta-d)} > (1 - \lambda)(\beta - d) \Rightarrow \Psi_{TD}^*(z^*_{|v=(1-\lambda)(\beta-d)}, \sigma = 0) < 0 \quad (\text{A.5})$$

As a result,

$$\Psi_{RI}(z^* = 0, \sigma^* = 1) > 0 > \Psi_{TD}^*(z^*(v), \sigma = 0) \text{ for } v \in ((1 - \lambda)(\beta - d), v_{\min}). \quad (\text{A.6})$$

and hence the CRA engages in complete rating inflation by setting ( $\sigma^* = 1, z^* = 0$ ). For part (iii), note that from (14) and (15), one can write

$$\Psi_{TD}^*(z^*, \sigma = 0) = \underbrace{[v - (1 - \lambda)(\beta - d)]}_{\Psi_{RI}(z^*=0, \sigma=1)} - k + \frac{(1 - \lambda)^2(\beta - d - v)^2}{2\phi} \quad (\text{A.7})$$

Therefore, fully truthful disclosure obtains if and only if

$$\Psi_{TD}^*(z^*(v), \sigma = 0) \geq \Psi_{RI}(z = 0, \sigma = 1) \Rightarrow k < k^* \equiv \frac{(1 - \lambda)^2(\beta - d - v)^2}{2\phi}. \quad (\text{A.8})$$

□

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