CREDIT RATINGS AND LITIGATION RISK

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Abstract

We develop a model of a credit rating agency in which the rating agency expends due-diligence effort to learn about the issuer’s credit risk, and the precision of its rating is predicated both on this effort and the rating agency’s a priori unknown ability. We model the communication of ratings as a cheap-talk game. The coarseness of ratings is endogenously solved for. Reputational concerns motivate the rating agency to expend effort to learn more in a setting in which the agency optimally chooses coarse ratings ex ante. With this model in place, we examine the impact of legal liability for “misrating” on the rating agency’s behavior. Like reputational concerns, legal liability is a two-edged sword. On the one hand, as the legal penalty for suspected misrating increases, the rating agency expends greater due-diligence effort, holding fixed the number of ratings. On the other hand, higher legal liability induces the rating agency to reduce the number of ratings. If the legal liability increases asymmetrically – higher legal liability only for ratings deemed ex post to be too high – the rating agency responds by increasing its downward bias in ratings. We also discuss other possible implications of recent legislative changes that have increased rating-agency legal liability.

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I Introduction

The current financial crisis has generated considerable consternation about distorted incentives on part of the key players in the financial market, and the extent to which these contributed to the crisis. Prominent among the players whose incentives have been examined are the credit rating agencies (CRAs). This has led to calls for greater regulatory oversight of credit rating agencies, including the expansion of legal sanctions. Congress is considering legislation aimed at addressing these issues.

The Dodd-Frank Wall Street Reform and Consumer Protection Act was recently passed by the US House of Representatives and awaits a Senate vote. The provisions in Title IX Subsection C - Improvements to the Regulation of Credit Ratings Agencies - are intended to impose stricter regulation of CRAs, referred to as Nationally Recognized Statistical Rating Organizations or NRSROs. Although the legislation has many features, the main ones are that the SEC would impose fines and censure a CRA for failure to ensure that ratings remain current and reliable, and that CRA would be required to disclose substantially more information about how a rating was arrived at. This greater information disclosure would pertain to information inputs as well as features of the underlying models used to process them. Moreover, CRAs would be subject to the same legal liability as auditors and security analysts, implying a loss of the special protection historically afforded to CRAs as providers of forward-looking statements.

If Congress passes this legislation, what will be its effect? This is the question we address in this paper. We start with the recognition that three forces must be part of the analysis. The first is the moral hazard embedded in the CRA’s incentive to engage in underprovision of (unobservable) privately-costly inputs in performing the analysis needed to provide accurate ratings. This is ostensibly part of the rationale for the proposed legislation. The second is the CRA’s reputational motivation for providing the necessary due diligence for accurate ratings. And the third is the endogeneity of variables like the number of rating categories used by the CRA.
The theoretical model we develop accounts for all these features. It is a two-period model in which the CRA: (i) chooses due-diligence effort it will expend in discovering the issuer’s creditworthiness; (ii) chooses the number of rating categories to use; and (iii) takes into account the impact of a currently-assigned rating on its future reputation. We analyze credit ratings as part of the communication that occurs in a “cheap-talk” game. After examining the basic model, we introduce legal liability for inaccurate ratings as well as asymmetric legal liability wherein the CRA may incur a legal liability for giving what is interpreted ex post as too high a rating but not for giving a rating that may be deemed too low.

Our main results are as follows. First, holding fixed the number of rating categories and ignoring reputational concerns and conflicts of interests, an increase in legal liability for the CRA elicits greater due-diligence effort by the CRA and a higher equilibrium price paid for ratings by issuers. Second, when the incentives of the CRA and the investors are not aligned in the cheap talk game, credit ratings will be coarse indicators of issuer default risk. Third, reputational concerns on the part of the CRA act as a “two-edged sword.” On the one hand, they induce the CRA to expend greater due-diligence effort. On the other hand, they induce the CRA to engage in greater obfuscation in ratings (truth-telling is not an equilibrium). Fourth, an increase in legal liability for the rating agency causes an increase in rating coarseness. Fifth, if the rating agency’s legal liability increases asymmetrically for suspected rating inflation only, then there is an increase in the downward bias in ratings. Finally, even when investors can “undo” the effect of ratings bias via rational inference, the increased coarseness leads to lower efficiency of investors’ portfolio decisions.

This paper is related to the emerging literature on credit ratings. The early work of Allen (1990), Fishman and Hagerty (1995a, 1995b), Millon and Thakor (1985), and Ramakrishnan and Thakor (1984) provided the theoretical foundations for thinking about rating agencies as diversified information producers and sellers. More recently, Boot, Milbourn, and Schmeits (2006) have proposed that a CRA can arise to resolve a specific kind of coordination problem in financial markets.\footnote{This is somewhat similar to the role ascribed to the banks by Da Rin, and Hellmann (2002).} In particular, they show that two institutional features – “credit watch” and the reliance on ratings by investors – can allow CRAs to serve as the focal point and provide the necessary incentives for firms to expend the necessary “recovery effort.”
to improve their creditworthiness. Bongaerts, Cremers, and Goetzmann (2009) provide evidence about why issuers choose *multiple* credit rating agencies. They show that their evidence is most consistent with the need for certification with respect to regulatory and rule-based constraints.

There is also an emerging literature on failures in the credit rating process. Bolton, Freixas, and Shapiro (2009), Opp, Opp, and Harris (2010), Sangiorgi, Sokobin, and Spatt (2009) and Skreta and Veldkamp (2009) examine competition among rating agencies, the practice of "ratings shopping" by issuers and the incentives of rating agencies to manipulate ratings. Both Sangiorgi, Sokobin, and Spatt (2009) and Skreta and Veldkamp (2009) model ratings shopping, something that occurs because issuers can choose which credit ratings to purchase, thereby creating incentives to publish only the most favorable ratings. An empirical analysis of the role of ratings shopping is provided by Benmelech and Dlugosz (2009). Becker and Milbourn (2009) empirically examine the affect of an increase in competition among CRAs on their reputational incentives.²

Our paper is also related to the IPO literature on how litigation risk affects IPO underpricing. Tinic (1988) argues that IPO underpricing was the consequence of litigation risk for investment banks. Hughes and Thakor (1992) show formally that this argument does *not* hold generally even when litigation risk exists for investment banks. They derive sufficiency conditions for litigation risk to affect IPO underpricing.

Our marginal contribution relative to this literature is that we focus on the endogenous determination of rating categories in a reputation-cum-legal-liability framework. This allows us to explore the economic consequences of the proposed change in legislation. In this sense, our paper is normative in nature, and we hope that it serves as a starting point for debate on the appropriate regulatory framework for NRSROs.

The rest of the paper is organized as follows. Section II discusses the proposed legislation. Section III contains the model. Section IV has the analysis. Section V determines the effect of legal liability for CRAs. Section VI discusses the implications of the analysis for the possible consequences of the proposed legislation. Section VII concludes. All proofs are in

²Benabou and Laroque (1992) and Morgan and Stocken (2003) consider the incentives of informational financial intermediaries to manipulate information.
the Appendix.

II The Proposed Legislation

In June 2010, the US House of Representatives passed important legislation pertaining to CRAs. We quote below portions to highlight the content and intent of the legislation relevant to our paper.

Congress finds the following:

(1) Because of the systemic importance of credit ratings and the reliance placed on credit ratings by individual and institutional investors and financial regulators, the activities and performances of credit rating agencies, including nationally recognized statistical rating organizations, are matters of national public interest, as credit rating agencies are central to capital formation, investor confidence, and the efficient performance of the United States economy.

(2) Credit rating agencies, including nationally recognized statistical rating organizations, play a critical gatekeeper role in the debt market that is functionally similar to that of securities analysts, who evaluate the quality of securities in the equity market, and auditors, who review the financial statements of firms. Such role justifies a similar level of public oversight and accountability.

(3) Because credit rating agencies perform evaluative and analytical services on behalf of clients, much as other financial gatekeepers do, the activities of credit rating agencies are fundamentally commercial in character and should be subject to the same standards of liability and oversight as apply to auditors, securities analysts, and investment bankers.

(4) In certain activities, particularly in advising arrangers of structured financial products on potential ratings of such products, credit rating agencies face conflicts of interest that need to be carefully monitored and that therefore should be addressed explicitly in legislation in order to give clearer authority to the Securities and Exchange Commission.
(5) In the recent financial crisis, the ratings on structured financial products have proven to be inaccurate. This inaccuracy contributed significantly to the mismanagement of risks by financial institutions and investors, which in turn adversely impacted the health of the economy in the United States and around the world. Such inaccuracy necessitates increased accountability on the part of credit rating agencies.

The legislation also changes the legal liability that CRAs will face in the future. Given below are relevant excerpts from SEC. 933. State of Mind in Private Actions:

IN GENERAL. The enforcement and penalty provisions of this title shall apply to statements made by a credit rating agency in the same manner and to the same extent as such provisions apply to statements made by a registered public accounting firm or a securities analyst under the securities laws, and such statements shall not be deemed forward looking statements for the purposes of section 21E.

Taking the proposed pieces of legislation together, the key points that emerge are the following:

1. The SEC can impose fines and censure a CRA for failure to ensure that credit ratings remain current and reliable.

2. The SEC will require a form associated with issuance of each rating. The form will disclose a wide range of information pertaining to quantitative models, qualitative inputs, data, and assumptions about the correlation of defaults across obligors for structured products.

3. CRAs will be subject to the same legal liability that auditors and security analysts face. To claim economic damages, it shall be sufficient to show that the CRA knowingly or recklessly violated securities law. CRAs will lose the special protection previously provided to them on the basis that ratings were considered forward-looking statements true only at the time of writing with no requirement to update the statements as conditions change.

Once we have the model in place, we will discuss the possible effects of these features of this legislation.
III Model

Consider a two-period model in which all agents are risk neutral. The first period starts at date 1 and ends at date 2 while the second period starts at date 2 and ends at date 3. In each period, there is an issuer who needs to communicate some information to investors. For concreteness, we interpret this information as the quality or the risk of the securities issued by the issuer and call it the issuer’s creditworthiness. The creditworthiness for period $t$ can be represented by a real number $x_t$ and is made public to everyone at the end of period $t$. However, investors value access to this information at the beginning of the period. A friction is that the issuer cannot credibly communicate this information itself either because it lacks the expertise to collect and communicate this information or because its communication is not credible due to moral hazard. There is a credit rating agency (CRA) that has the capability to noisily learn this information and report it to investors.\(^3\) We shall henceforth call this report a “credit rating” or simply a “rating” and denote it with $r_t$. Acquiring information and reporting a rating is costly for the CRA. However, the CRA cannot charge investors for the rating, so the CRA reports ratings only if the issuer pays it for doing so.

It is common knowledge that $x_t$ is independently and identically distributed across the two periods with the common probability density function $f(x_t)$ supported on $[0, 1]$. We follow the convention that the cumulative distribution function (CDF) associated with a probability distribution function is denoted with the corresponding upper case letter; thus, the CDF of $x_t$ is $F$. The credit rating agency observes a noisy signal $s_t$ about that period’s issuer’s creditworthiness at the beginning of period $t$. The signal $s_t$ is a real number with the probability distribution $g(s_t|x_t, q_t)$ dependent on the creditworthiness $x_t$ and the quality $q_t$ of the signal. A higher value of the signal is associated with a higher creditworthiness in the first-order-stochastic-dominance sense - for a fixed value of $q_t$ and for $x^H > x^L$, $G(s_t|x^H, q_t) \leq G(s_t|x^L, q_t)$ for all $s_t$. Further, the signal is more informative about creditworthiness if its quality is higher in the sense of Blackwell (1951).\(^4\) Specifically, for $q^H > q^L$, there exists a

\(^3\)The CRA may have special advantages as a diversified information producer, as in Allen (1990) and Ramakrishnan and Thakor (1984).

\(^4\)Blackwell (1952) generalizes the result in Blackwell (1951), Marschak and Miyasawa (1968) provide a synthesis of related results, and Green and Stokey (2007) use the result in an application.
function $Q(s, s')$ such that $G(\hat{s} | x, q^L) = \int_{s' = -\infty}^{\hat{s}} \int_{s = -\infty}^{\infty} Q(s, s') g(s | x, q^H) ds ds'$.

The quality of the rating in period $t$ is determined by the CRA’s ability $a_t$ and its effort $e_t$ in period $t$; that is, $q_t = q(a_t, e_t)$ where $q$ is increasing in both arguments. The CRA privately chooses the level of effort to exert and this choice is not observed by others. The ability of the CRA is unobservable to all, including the CRA. The CRA and the investors share common prior beliefs in the first period ($t = 1$) that the probability density function of the CRA’s ability is $h$. In the second period, the CRA and the investors update their beliefs based on their respective information sets. The information set of the investors includes the credit rating issued in the first period and the creditworthiness $x_1$ revealed at the end of the first period. The information set of the CRA consists of the information of the investors and its effort choice in the first period.

In each period, investors choose an action $k_t \in \mathbb{K}$, represented by a real number. Investors maximize expected value of $U(k_t, x_t)$ in period $t$, where the function $U$ depends on their action $k_t$ and the issuer’s creditworthiness $x_t$. The objective function $U$ can be interpreted as the aggregate surplus of investors. Investors’ action $k_t$ is a choice variable and may be interpreted as the portfolio holding of the issuer’s security by more risk averse investors. Investors take the creditworthiness as given and rely on credit rating to update their beliefs about the issuer’s creditworthiness. The function $U$ is twice continuously differentiable and concave in investor action ($\partial^2 U / \partial k_t^2 < 0$), and for each value of creditworthiness $x_t$, $U$ has a unique maximum in $k_t$ at which $\partial U / \partial k_t = 0$. Moreover, we assume that $\partial^2 U / \partial x_t \partial k_t > 0$ so the optimal action for investors is strictly increasing in the issuer’s creditworthiness. The assumption $\partial^2 U / \partial x_t \partial k_t > 0$ implies that the surplus-maximizing holding of the issuer’s security by more risk averse investors is increasing in the issuer’s creditworthiness if we interpret $k_t$ as a measure of portfolio allocation. The value of a credit rating to the investors equals the expected increase in the value of their objective $U$ as a result of using the information from the credit rating.

The issuer requests rating to communicate information about its creditworthiness to investors. We assume that the value of the rating to the issuer equals the expected value of the rating to investors.\textsuperscript{5} The CRA exerts costly effort to produce ratings. The cost of

\textsuperscript{5}The issuer values a rating not for its true informativeness but for its value as perceived by investors.
exerting effort \( c(e_t) \) is minimized at the effort level \( e \) and is an increasing and convex function for higher effort levels; that is, \( c'(e_t) > 0 \) and \( c''(e_t) > 0 \) for \( e_t > e \). We assume that the value of a rating to the issuer exceeds the cost of effort to the CRA regardless of the CRA’s ability \( a \) or effort choice \( e_t \). Thus, it is efficient for the issuer to hire the CRA to produce a credit rating in each period. The sharing of the surplus from this transaction is an outcome of a bargaining game. Without modeling the bargaining game explicitly, we assume that the payment made by the issuer to the CRA equals a fraction \( \theta \) of the expected value of the rating to the issuer plus a fraction \( 1 - \theta \) of the expected cost of the rating agency to generate a rating, where \( 0 < \theta < 1 \) can be thought of as the bargaining power of the rating agency. Thus, at the beginning of period \( t \), the issuer pays the following fee to the CRA:

\[
\phi_t \equiv E^t[\theta U(k_t(r_t), x_t) + (1 - \theta)c(e_t)].
\]  

The expectation in the above expression is conditional on investors’ beliefs at the beginning of the period \( t \). The expression \( k_t(r_t) \) indicates investors’ action \( k_t \) conditional on observing a credit rating \( r_t \).

The investors’ action in period \( t \) has a direct effect on the issuer represented by payoff \( W(k_t, x_t) \). Like the investors’ payoff \( U \), the issuer’s payoff \( W \) is also twice continuously differentiable, concave in investor action \( k_t \), and has a unique maximum in \( k_t \), that is increasing in creditworthiness \( x_t \). However, we assume that \( W \) is maximized at a higher value of \( k_t \) than \( U \). Since the issuer pays the CRA to generate credit rating, the CRA may have an incentive to act in the interest of the issuer by inducing a higher action from investors. To model this, we assume that a part of the CRA’s objective in the first period depends on the action induced by the rating. Specifically, in addition to the fixed upfront fee in (1), the CRA earns a payoff of

\[ \alpha W(k_1, x_1). \]  

This distinction does not play a role in our analysis because the issuer and the investors share common beliefs about the value of the rating. Further, we do not expect results to change if the value of the rating to the issuer doesn’t equal the expected value of the rating to investors but the two are related through a monotonically increasing transformation.

\[ ^6 \text{In practice, issuers do not explicitly condition the payment made to the CRA for issuing a credit rating on the actual rating assigned. However, reports in the media and research both indicate that issuers’ choice of the CRA that they provide business to seems to depend on the willingness of the CRA to assign the} \]
Finally, we accommodate ex post legal liability for ratings by introducing a penalty $P(r_1, x_1)$ that is imposed on the CRA at the end of the first period and which depends on the reported rating as well as the observed creditworthiness.\footnote{Incorporating legal liability for second period rating does not change the results qualitatively but makes analysis more complex.}

The CRA’s incentives discussed above are summarized with the following objective function:

$$V = \phi_1 - c(e_1) + \alpha W(k_1, x_1) - P(r_1, x_1) + \beta \times \{\phi_2 - c(e_2)\}. \quad (3)$$

where $\beta$ is the factor used to discount second period payoffs. The sequence of events in any period is as illustrated in \textit{Figure 1}. 

\footnote{issuer a higher rating (e.g., see Bolton, Freixas, and Shapiro (2009), Opp, Opp, and Harris (2010), Sangiorgi, Sokobin, and Spatt (2009) and Skreta and Veldkamp (2009) for a discussion of “ratings shopping”). This ratings shopping practice implicitly conditions the payoff of the CRA on the rating it assigns to the issuer. Nonetheless, most of the results in this paper do not rely on this assumption and obtain even when we set $\beta = 0$.}
IV Analysis

In this section, we present our analysis of the model. We first provide an example to motivate the economic significance of ratings and why informativeness of ratings is a good metric to evaluate credit rating agencies. We next analyze the CRA’s credit reporting as a “cheap talk” game and examine the due-diligence effort choices of the CRA in the two periods. Then we examine the equilibrium in which the CRA is paid up-front for issuing a rating and there are no conflicts of interest, reputational concerns, or legal liability for ratings. This provides the benchmark case - the CRA’s rating is completely informative in each of the two periods. We then proceed to examine the equilibrium with an up-front payment and legal liability, but no CRA-investor conflicts of interest and no reputational concerns. We show that in this case there exists a legal liability for the CRA that aligns the interests of the CRA and investors, leads to higher due-diligence effort by the CRA and more informative ratings. In the next section, we introduce reputational concerns, suppressing conflicts of interest due to issuer influence on the CRA and legal liability. We show that truth-telling by the CRA does not occur in equilibrium, but reputational concerns make the CRA expend greater due-diligence effort.

IV.A Credit Ratings and Social Welfare

In this subsection we discuss welfare implications of credit ratings and possible objective of a social planner. The agents in our model consist of the issuer of security, the CRA, and the investors. First consider the welfare of the issuer. A narrowly defined objective of the issuer is to maximize the proceeds from the issue of securities. In absence of other market frictions, credit ratings do not affect the expected proceeds from the issuance of securities because the expected creditworthiness of the securities conditional on a rating must equal unconditional creditworthiness. Introduction of frictions such as moral hazard on the part of the issuer may cause the issuer’s expected proceeds from the issuance of securities to be increasing in the precision of the information communicated to investors by ratings. While this transfer of wealth from investors to the issuer does not affect social welfare, the increased efficiency of real investment decisions arising from better information of investors improves social welfare.
We do not model this rationale for the social planner to prefer more informative ratings.

Next consider the welfare of the CRA. The objective of the CRA is to maximize its profits from current and future periods. We abstract from issues relating to competition among credit rating agencies and take the bargaining power of the CRA with respect to the issuer as fixed. Since, the fee for ratings is determined so that the CRA’s participation constraint binds, a change in regulatory landscape does not affect the objective of the CRA after appropriate adjustment in the rating fee charged by the CRA.

We now show that investors are strictly better off with more informative credit ratings. Consider a stylized model of portfolio allocation with two investors: Investor 1 and Investor 2. Each investor starts a period with an endowment of 0.5 units of asset 1 and 0.5 units of asset 2. Asset $i$’s payoff at the end of the period is stochastic with expected value 1 and variance $1/\eta_i^2$. The parameter $\eta_1$ is known while the parameter $\eta_2$ can be $\eta_H$ with probability $\pi_H$ and $\eta_L$ with probability $\pi_L$ such that $\pi_H + \pi_L = 1$ with $\eta_H \neq \eta_L$.

If the CRA issues rating about asset 2, investors use rating to update their beliefs about the payoff distribution of asset 2. Then, they trade, taking the relative price $p$ of asset 2 in terms of asset 1 as given, and form portfolios that maximize their expected utilities $E[u_1]$ and $E[u_2]$, respectively. Asset payoffs are realized at the end of the period. Investor 1 is risk neutral and her expected utility equals her expected payoff. Investor 2 is risk averse and her expected utility equals her expected payoff minus $\tau$ times the variance of her payoff.

The risk neutral Investor 1 is indifferent between a unit of asset 1 and a unit of asset 2 as both have same expected payoff so the equilibrium price $p$ of asset equals 1. If the risk averse Investor 2 holds $\omega$ units of asset 2, she calculates her expected utility to be

$$E[u_2] = 1 - \omega(1 - p) - \tau \left[ \frac{(0.5 + (0.5 - \omega)p)^2}{\eta_1^2} + \pi_H \frac{\omega^2}{\eta_H^2} + \pi_H \frac{\omega^2}{\eta_H^2} \right]. \quad (4)$$

Substituting price $p = 1$, the first-order condition for Investor 2’s portfolio choice yields

$$\omega = \frac{\eta_H^2 \eta_L^2}{\eta_H^2 \eta_L^2 + \eta_H^2 (\pi_H \eta_L^2 + \pi_L \eta_H^2)^2}. \quad (5)$$

If we assume that asset 2’s risk decreases as its creditworthiness $x_t$ increases (for example, $\eta_H > \eta_L$ and $\pi_H$ is increasing in $x_t$) and interpret action $k_t$ as Investor 2’s holding of asset 2, (5) shows that optimal action $k_t$ is increasing in creditworthiness $x_t$, consistent
with our assumption in Section III. We now define the social welfare function as $SW = E[u_1] + E[u_2]$ without loss of generality as risk neutral investor’s utility $E[u_1]$ equals 1 regardless of any information communicated by rating. Credit rating affects the social welfare by communicating information about $\eta_2$ and influencing investors’ portfolio choices. The social planner’s problem is to induce credit rating that maximizes social welfare.\(^8\)

**Proposition 1.** Social welfare is higher when rating communicates more precise information about $\eta_2$ than when rating provides coarse information. Social welfare is also higher when rating communicates unbiased value of $\eta_2$ than when it communicates a biased value of $\eta_2$.

The proposition shows that more informative and unbiased credit rating results in higher social welfare. The intuition is that credit rating communicates information about the risk of asset 2 and more informative rating allows investors to better allocate their portfolios given risk differences across assets. When an asset is revealed to be riskier, more risk averse investors reduce their holding of that asset while less risk averse investors increase their holding of that asset. The creditworthiness information communicated by credit rating is a measure of risk that investors use in their portfolio allocations. More informative rating allows investors to better adjust their portfolios to obtain optimal risk sharing. The proposition shows that social welfare increases when the bias in the information communicated by rating declines and also when ratings communicate more precise information.

A key requirement for this result is that there are assets with different risk characteristics and investors have heterogeneous risk preferences so that an investor’s portfolio holding of an asset depends on investor risk preference as well as asset risk. If all investors are homogeneous, information communicated by rating may impact prices but will have no portfolio implications and hence no welfare effects. Similarly, if investors are heterogeneous but all assets have same risk characteristics (that is there is effectively only one asset), again, information communicated by rating has no portfolio implications. Thus, information communicated by credit ratings improves welfare by enhancing efficiency of the match between assets and investors.

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\(^8\)This definition of social welfare ignores possible increase in cost associated with producing credit rating that communicates more information.
IV.B Credit Ratings as Induced Actions

The CRA’s reporting of a credit rating is an information-transmission mechanism and is a “cheap talk” game. The reason is that the CRA’s payoff is not directly affected by the credit rating it reports. The payoff is only indirectly affected by the action taken by investors which depends on the investor’s interpretation of the credit report rather than the actual content of the rating. In particular, a change in the language, scale, or presentation of the rating will have no impact on the payoffs of the game as long as investors are aware of the change and can extract the same information out of the rating. Following the classic analysis of “cheap talk” games in Crawford and Sobel (1982), we represent a credit rating $r_t$ by the investor action $k_t$ it induces. Two comments are in order. First, a credit rating $r_t$ can induce only one action $k_t$ from investors because their objective $U$ is concave in $k_t$. Second, the representation of rating $r_t$ with the induced action $k_t$ is without loss of generality.

If the CRA and investors have perfectly aligned preferences, then the credit rating can perfectly communicate CRA’s information. However, as pointed out by Crawford and Sobel (1982), when the sender and the receiver of the information have divergent interests, information communication is imprecise. In our model, the CRA’s interests may diverge from those of the investors for two reasons. First, the CRA’s objective in the first period is to maximize its second-period payoff which may depend on what investors learn about the CRA’s ability in the first period. Investors do not share this concern about the CRA’s second-period payoff. Second, the practice of the issuer paying the CRA for ratings leads to a conflict of interest between the CRA and the investors and this means that the CRA prefers to induce a higher investor action. These conflicts of interest may limit the informativeness of credit ratings.

We now define equilibrium. An equilibrium consists of

- the CRA’s first-period effort $e^*$,
- the CRA’s rule for the first-period rating $\rho_1(r_1|e_1, s_1)$ such that $\int_K \rho_1(r_1|e_1, s_1) dr_1 = 1$
- the CRA’s second-period effort $e_2$ and

\[9\text{See Farrell and Rabin (1996) for a survey.}\]
• the CRA’s rule for the second-period rating $\rho_2(r_2|e_1, s_1, x_1, s_2)$ such that $\int_k \rho_2(r_2|.)dr_2 = 1$,

such that

• The action choice of $k_1 = r_1$ maximizes investors’ objective:

$$
    r_1 = \arg \max_{k_1} \int_0^1 U(k_1, x_1)dF_1^r(x_1|r_1)
$$

(6a)

given their beliefs $f_1^r$ about the creditworthiness $x_1$. If $\rho_1(r_1|e^*, s_1) > 0$ for some $s_1$, then the beliefs are obtained from Bayes Rule:

$$
    f_1^r(x_1|r_1) = \frac{\iint \rho_1(r_1|e^*, s_1)dG(s_1|x_1, q(a, e^*))dH(a) \times f(x_1)}{\iiint \rho_1(r_1|e^*, s_1)dG(s_1|x, q(a, e^*))dH(a)dF(\chi)}.
$$

(6b)

• The second-period rating fee is obtained from (1) as:

$$
    \phi_2(r_1, x_1) = (1 - \theta)c(\chi) + \theta \iint \hat{\phi}_2(r_1, x_1, a, s_1)\mu(a, s_1|r_1, x_1)
$$

(7a)

where

$$
    \hat{\phi}_2(r_1, x_1, a, s_1) = \iint \int U(r_2, x_2)\rho_2(r_2|e^*, s_1, x_1, s_2)dr_2 dG(s_2|x_2, q(a, e^*)) dF(x_2)
$$

(7b)

and investors’ posterior beliefs $\mu$ about the CRA’s ability and first-period signal are obtained from Bayes Rule if $\rho_1(r_1|e^*, s_1) > 0$ for some $s_1$:

$$
    \mu(a, s_1|r_1, x_1) = \frac{\rho_1(r_1|e^*, s_1) \times g(s_1|x_1, q(a, e^*)) \times h(a)}{\iiint \rho_1(r_1|e^*, s^{'})dG(s'|x_1, q(a', e^*))dH(a')}.
$$

(7c)

• The action choice of $k_2 = r_2$ maximizes investors’ objective:

$$
    r_2 = \arg \max_{k_2} \int_0^1 U(k_2, x_2)dF_2^r(x_2|r_1, x_1, r_2)
$$

(8a)

given their beliefs $f_2^r$ about the creditworthiness $x_2$. If $\rho_1(r_1|e^*, s_1) > 0$ and $\rho_2(r_2|e^*, s_1, x_1, s_2) > 0$ for some $s_1$ and $s_2$, then the beliefs are obtained from Bayes Rule:

$$
    f_2^r(x_2|r_1, x_1, r_2) = \frac{\iiint \rho_2(r_2|e^*, s_1, x_1, s_2) dG(s_2|x_2, q(a, e^*)) \rho_1(r_1|e^*, s_1) dG(s_1|x_1, q(a, e^*)) dH(a) \times f(x_2)}{\iiint \rho_2(r_2|e^*, s_1, x_1, s_2) dG(s_2|x, q(a, e^*)) \rho_1(r_1|e^*, s_1) dG(s_1|x_1, q(a, e^*)) dH(a)dF(\chi)}.
$$

(8b)
• The CRA’s first-period rating maximizes its objective $Z$:

$$
\rho_1(r_1|s_1, e_1) > 0 \implies r_1 \in \text{arg max}_r Z(r, s_1, e_1)
$$

(9a)

where the objective $Z$ follows from (3) as

$$
Z(r_1, s_1, e_1) \equiv \int_{x_1} \{\alpha W(r_1, x_1) - P(r_1, x_1) + \beta \phi_2(r_1, x_1)\} \ dF_1^C(x_1|s_1, e_1)
$$

(9b)

given the CRA’s beliefs $f_1^C$ about creditworthiness $x_1$:

$$
f_1^C(x_1|s_1, e_1) = \int_a dG(s_1|x_1, q(a, e_1)) \ dH(a) \times f(x_1)
$$

(9c)

• The CRA’s first-period effort maximizes its objective:

$$
e^* \in \text{arg max}_e \int \int \int_{a, x_1} \text{max}_r \ Z(r_1, s_1, e_1) \ dG(s_1|x_1, q(a, e_1)) \ dH(a) - c(e_1).
$$

(10)

Note that the equilibrium specifies the CRA’s second-period effort to be $e^*$ because the CRA has no incentive to exert costly effort exceeding $e^*$ in the second period. Further, the CRA is indifferent to the ratings it reports in the second period. We shall confine attention to equilibria in which the CRA reports the most informative rating as the action that maximizes investors’ expected second-period payoff:

$$
r_2 \in \text{arg max}_{k_2} \int \int_{a, x_2} U(k_2, x_2) g(s_2|x_2, q(a, e_2)) \ g(s_1|x_1, q(a, e_1)) \ dH(a) dF(x_2)
$$

(11)

Thus, there is a “truth-telling” equilibrium in the second-period where a truth-telling equilibrium is one in which the CRA’s rating induces the same investor action that they will choose if they had the information of the CRA:

**Definition 1.** An equilibrium in period $t$ is a truth-telling equilibrium if it induces the action that maximizes investors’ objective $E[U(k_t, x_t)]$ given the information set of the CRA. That is,

$$
r_t \in \text{arg max}_{k_t} \int \int_{a, x_t} U(k_t, x_t) g(s_t|x_t, q(a, e_t)) \ dH_t(a) dF(x_t)
$$

(12)

where $H_t$ is the probability distribution function of the CRA’s ability based on its information in period $t$. 

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Note that the definition of truth-telling depends on the action induced by rating rather than the language used to communicate rating so the choice of language used to communicate rating can result in multiple truth-telling equilibria that are equivalent from an economic viewpoint. Clearly, an equilibrium in which investors can infer the information of the CRA must be a truth-telling equilibrium. Thus, any equilibrium in which the CRA’s equilibrium effort choice is deterministic and each realization of credit rating uniquely reveals the CRA’s signal is a truth-telling equilibrium.

IV.C Equilibrium with Only Up-front Payment for Ratings

In this subsection, we focus on the case in which the CRA is paid an up-front fee for issuing a rating and there are no reputational concerns, conflicts of interest, or legal liability for ratings. Specifically, assume that the CRA’s ability \( a \) is known to everyone and \( W = P = 0 \).

In the absence of uncertainty about the CRA’s ability, there is no opportunity for learning, so the actions of the CRA, the issuer and the investors in the second period are independent of the outcome in the first period. The model reduces to a sequence of two independent games, each of which can be solved in isolation of the game in the other period. Since the issuer pays for the ratings in advance, the CRA’s payment is not affected by the quality/value of ratings. The CRA chooses to exert the least effort, \( e^* = e \), because exerting greater effort is costly and the CRA is not rewarded in the future for the resulting improved quality of its signal. Since there is no conflict of interest between the CRA and the investors (other than CRA’s effort aversion), there exists a truth-telling equilibrium in which the CRA’s rating is completely informative in each of the two periods.\(^{10}\) That is, the rating in period \( t \) is given by

\[
    r_t \in \arg \max_{k_t} \frac{\int_{x_t} U(k_t, x_t) g(s_t|x_t, q(a, e)) \, dF(x_t)}{\int_{x_t} g(s_t|x_t, q(a, e)) \, dF(x_t)}.
\]

This benchmark case shows that upfront payment for ratings results in the issuance of unbiased ratings as long as the credit rating agency does not face any conflicts of interests. However, the credit rating agency underinvests in effort in the absence of any reputational

\(^{10}\)There can be other equilibria in which the CRA provides less informative ratings and the issuer accordingly pays lower fees to the CRA.
or other explicit incentives.

IV.D Equilibrium with Up-front Payment and Legal Liability

We now incorporate legal liability for the rating in the first period while maintaining the previous section’s assumptions of perfect information about the CRA’s ability and no conflict of interest ($W = 0$). Since there is no learning about the CRA’s ability, the two games in the two periods can again be solved independently of each other. We focus on the first period. Equations (9a)-(10) yield:

$$\rho_1(r_1|e_1, s_1) > 0 \implies r_1 \in \arg\max_r - \int_{x_1} \frac{P(r, x_1) dG(s_1|x_1, q(a, e_1)) dF(x_1)}{\int_{x_1} dG(s_1|x_1, q(a, e_1)) dF(x_1)}$$

and

$$e^* \in \arg\max_{e_1} - \int \int \int P(r_1, x_1) \rho_1(r_1|e_1, s_1) dr_1 dG(s_1|x_1, q(a, e_1)) dF(x_1) - c(e_1).$$

Thus, the CRA reports a rating to minimize its expected legal liability and chooses its effort to trade off the reduction in expected legal liability with a higher effort against the added cost of exerting higher effort. However, for the rating to be credible and induce the corresponding investor action, it must satisfy constraint (6a). The solution to these equations depends on the nature of legal liability, that is, the shape of the function $P$. Suppose legal liability is designed to provide an additional incentive to the CRA to perfectly align its interest with the interest of the investors. That is,

$$P(r_1, x_1) = \gamma - \delta U(r_1, x_1)$$

where $\gamma$ and $\delta$ are constants with $\delta > 0$. We can now prove the following result.

**Proposition 2.** If the credit rating agency has no reputational concerns and has no conflict of interest due to issuer influence, an increase in legal liability parameter $\delta$ that aligns interest of the CRA with the interest of investors leads to greater effort choice by the CRA and more informative ratings.

IV.E Coarse Ratings

The purpose of this section is to demonstrate that credit ratings will be inherently coarse in an equilibrium when the interests of the investors and the credit rating agency are not aligned.
The incentives of the credit rating agency arise from the dependence of the second-period fee on the CRA’s reputation, the conflict of interest due to the influence of the issuer, and the legal liability for inaccurate ratings. The result that ratings are coarse is an application of Crawford and Sobel’s (1982) result that “cheap talk” models have equilibria with noisy signalling unless agents’ interests coincide. Crawford and Sobel derive these results with exogenously assumed differences in the objectives of the sender of the information and the receiver of the information. Ottaviani and Sorensen (2006a) consider a setting in which the sender of the information is an expert concerned about maintaining a reputation about his ability. They show that in this case, reputational concerns endogenously result in conflicts of interest and preclude truth-telling equilibria. Thus, these two papers suggest that ratings will be coarse in equilibrium both because of the conflict of interest due to the influence of the issuer on the CRA and also due to the reputational concerns of the CRA. Incorporating both aspects in the equilibrium analysis is difficult, so we make some assumptions below on the CRA’s objective function to show that ratings will be coarse in equilibrium.

**Assumption 1.** The credit rating agency’s objective $Z$ in (9b) satisfies: \[ \frac{\partial^2 Z(r_1, s_1, e_1)}{\partial r_1^2} < 0 \] and \[ \frac{\partial^2 Z(r_1, s_1, e_1)}{\partial r_1 \partial s_1} > 0. \]

This assumption imposes two conditions on the CRA’s first-period objective. First, it is assumed that the objective is concave in the reported rating. Second, the marginal value of a higher rating is assumed to be increasing in the CRA’s signal. In the absence of reputational concerns, both these conditions follow in a straightforward way from corresponding assumptions on the issuer’s objective and the penalty function: \[ \frac{\partial^2 W(r_1, x_1)}{\partial r_1^2} < 0, \frac{\partial^2 W(r_1, s_1)}{\partial r_1 \partial s_1} > 0, \frac{\partial^2 P(r_1, x_1)}{\partial r_1^2} > 0, \text{ and } \frac{\partial^2 P(r_1, s_1)}{\partial r_1 \partial s_1} < 0. \] With reputational concerns, the objective $Z$ of the CRA also includes the expected value of next-period’s fee, $\phi_2$, which depends on the equilibrium beliefs of the investors. A sufficient condition for the above assumption to be satisfied is that reputational incentives are not too strong, which requires that $\beta$ is sufficiently small, there is little uncertainty about CRA’s ability $a$, or the CRA’s ability has a small effect on the quality of its signal $q(a, e)$. Competition among credit rating agencies (not modeled here) will weaken reputational incentives.
We define two functions to indicate the preferred ratings of the CRA and the investors:

\[
R^C(s_1) \equiv \arg \max_{r_1} Z(r_1, s_1, e^*) \quad (17)
\]

\[
R^I(s_1) \equiv \arg \max_{r_1} E[U(r_1, x_1)|s_1, e^*] \quad (18)
\]

**Definition 2.** Rating in period \( t \) is “coarse” if there exists \( \epsilon > 0 \) such that \( |r - r'| \geq \epsilon \) for all \( r \) and \( r' \neq r \) such that \( \rho_t(r|e_t, s_t) > 0 \) and \( \rho_t(r'|e_t, s'_t) > 0 \) for some \( s_t \) and \( s'_t \).

Thus, rating in a period is coarse if the actions induced by ratings are discrete - there exists \( \epsilon > 0 \) such that any two actions that can be induced in equilibrium must differ by at least \( \epsilon \). Notice that investors’ objective continuously depends on their action \( k_t \) so the optimal action with full information about creditworthiness should be a continuous function of creditworthiness. Clearly investors cannot achieve the full-information outcome with coarse ratings. Note that if ratings are coarse then the equilibrium is not a truth-telling equilibrium. However, there may be an equilibrium that is not truth-telling equilibrium even though the rating in that equilibrium is not coarse.

**Proposition 3.** The credit rating is coarse in equilibrium. Specifically, if \( |R^C(s_1) - R^I(s_1)| \geq \epsilon \) for \( s \in s_L, s_H \) and if \( r \) and \( r' \) are two ratings reported by the CRA based on signals in \( s_L, s_H \), then \( |r - r'| \geq \epsilon \).

The above proposition, based on Lemma 1 of Crawford and Sobel (1982), shows that if the interests of the CRA and the investors are not aligned, the CRA will issue discrete ratings, and ratings become more coarse as the gap in the interests of the investors and the CRA (measured by \( \epsilon \) in the proposition) increases.

**IV.F Reputational Concerns**

In this section, we examine how the reputational concerns of the CRA influence its effort choice and rating strategy. We suppress both the conflict of interest due to the influence of the issuer on the CRA and legal liability concerns by assuming \( \alpha = 0 \) and \( P \equiv 0 \) in the CRA’s objective (3). Thus, the only source of divergence between the interests of the CRA and the investors is the dependence of the CRA’s second-period fee on the CRA’s reputation.
Proposition 4. Truth-telling is not an equilibrium in the first period. That is, there is no equilibrium in which credit rating induces investor action that maximizes investor objective given CRA’s information:

\[ k_1 = \arg \max_k E[U(k, x_1)|s_1, e^*]. \] (19)

The proposition shows that since the reputational concerns of the credit rating agency cause its interests to deviate from those of investors, truthful reporting of ratings is not credible. The intuition is as follows. If the equilibrium were a truth-telling equilibrium, rating will induce action that maximizes investor objective given the CRA’s objective. Without loss of generality, this equilibrium involves the CRA recommending to investors the action that is optimal for them and the investors accepting the recommendation. However, even though the investors accept the CRA’s recommendation, they still rationally update their beliefs about the CRA’s ability. The CRA has an incentive to manipulate investors’ beliefs to raise their perception of its ability and this prevents the CRA from committing to the strategy of always recommending the action that is optimal for investors. Thus, reputational concerns preclude a truth-telling equilibrium. This cost of reputational concerns must be contrasted with the benefit described in the following result.

Proposition 5. The credit rating agency’s first-period effort choice \( e^* \) is increasing in its reputational concern as measured by \( \beta \).

The proposition establishes that reputational concerns partially alleviate the moral hazard involved in the CRA’s due-diligence effort provision. The moral hazard arises because the CRA’s effort is unobservable to the issuer and investors and exerting effort is costly for the CRA. This means that the payment that the CRA receives for issuing a rating is independent of its effort choice. This can lead to an outcome described in Section IV.C in which the CRA exerts the minimum feasible effort, and anticipation of this leads the issuer to pay the CRA a relatively low price for issuing a rating. The above proposition shows that when the ability of the CRA is positively autocorrelated, the CRA makes an intertemporal tradeoff between the marginal cost of effort and marginal benefit of effort. The marginal benefit of effort arises because higher effort leads to higher rating quality, something investors
observe. Investors can attribute a higher observed rating quality to greater effort chosen by the CRA or higher ability of the CRA or both. Since investors cannot observe the CRA’s effort choice, they expect the CRA to exert the equilibrium level of effort and attribute observed variations in rating quality to (unobservable) variations in the CRA’s ability. Thus, a higher effort choice by the CRA elevates investors’ perception of the CRA’s ability in this period as well as the CRA’s expected ability in the following period; higher perceived ability in the next period leads to a higher next-period price that the CRA receives for ratings. In equilibrium, investors rationally anticipate the effort choice of the CRA and thus untangle the effect of effort from that of ability to correctly infer the CRA’s ability. Nonetheless, in a Nash equilibrium, the CRA will be induced to exert the costly effort anticipated by investors because lower effort provision will cause investors to underestimate the CRA’s ability, with a consequent decrease in the payment made by the issuer to the CRA for ratings in subsequent periods.

This result obtains in a setting in which we have ignored the effect of competition on the strength of reputational incentives. The empirical evidence in Becker and Milbourn (2009) indicates that competition actually dilutes reputational incentives. Thus, taking the effect of inter-agency competition in future research is an important task.

The results of this Section point out that the reputational concerns of the CRA have two opposing influences on the informativeness of the ratings. On the one hand, reputational concerns provide the CRA an incentive to exert effort in order to build its reputation as a high-ability CRA. On the other hand, these concerns create incentives for the CRA to report strategically in an attempt to bias upwards investors’ beliefs about its ability. When investors anticipate these strategic reporting incentives, they are not fooled in equilibrium. Nonetheless, truthful reporting of credit ratings does not occur in equilibrium and the informational efficiency of ratings is weakened. Thus, reputation is a two-edged sword. Reputational concerns provide the CRA with incentive to exert costly unobservable effort in generating information for ratings, but the same concerns cause the CRA to obfuscate the ratings it generates based on that information.
V Legal Liability for Credit Ratings

We have shown in the previous sections that the CRA’s choices of effort and rating-coarseness are driven by reputational concerns, conflicts of interest due to the influence of the issuer, and potential legal liability associated with ratings. We now examine how legal liability for the CRA influences the informativeness of ratings. One can think of this along the lines of our discussions in Sections I and II.

V.A Legal Liability for Inaccurate Rating Category

Our interest is in examining how the legal liability $P$ influences the actions of the CRA. As a first step, we must identify the intent behind the regulatory initiative and then determine how effective the initiative will be in meeting its intended purpose, and also what its unintended consequences might be.

We examined the effect of legal liability on the CRA’s effort choice in Section IV.C, ignoring (for tractability) the reputational concerns of the CRA or conflicts of interest due to the influence of the issuer. Proposition 2 shows that when legal liability is fine-tuned to align the interests of the CRA and investors, higher legal liability results in higher effort by the CRA and more informative credit ratings. The intuition is that an increase in the potential penalty that could be imposed on the CRA causes the CRA to work harder to reduce the expected value of the penalty.

However, the incentives provided by legal liability regulations influence CRA’s effort choice as well as its reporting strategy. The following result shows that regulations designed to increase CRA’s effort may have unintended adverse effects on its reporting strategy.

Proposition 6. Suppose the credit rating agency receives only upfront payment for ratings. In absence of legal liability regulations, the CRA reports continuous ratings in a truth-telling equilibrium but the equilibrium with legal liability for inaccurate credit ratings has coarse ratings.

The proposition shows that legal liability for inaccurate credit ratings may distort the incentives of the credit rating agency preventing them from accurately disclosing their information to investors. Thus, a regulation that aims to solve CRA’s moral hazard problem
arising from the inobservability of effort by introducing legal liability for inaccurate ratings ends up introducing another problem of strategic reporting in which the CRA does not accurately communicate the information it unearths through its costly effort.

We now focus on the effect of legal liability on the rating-reporting strategy of the CRA. For this, we focus on the conflict of interest that arises due to the influence of the issuer on the CRA and ignore reputational concerns for tractability. That is, we assume $\beta = 0$ and focus on the first-period for the following analysis. With this simplification, the definition of equilibrium simplifies as following:

We now define equilibrium. An equilibrium consists of

- The CRA’s first-period effort $e^*$,
- The CRA’s rule for first-period rating $\rho_1(r_1|e_1, s_1)$ such that $\int_K \rho_1(r_1|e_1, s_1) dr_1 = 1$ such that
- The action choice of $k_1 = r_1$ maximizes investors’ objective:
  \[ r_1 = \arg \max_{k_1} \int_0^1 U(k_1, x_1) dF^I_1(x_1|r_1) \]  
  \[ \text{given their beliefs } f^I_1 \text{ about the creditworthiness } x_1. \]
  If $\rho_1(r_1|e^*, s_1) > 0$ for some $s_1$, then the beliefs are obtained from Bayes Rule:
  \[ f^I_1(x_1|r_1) = \frac{\int \int \rho_1(r_1|e^*, s_1) dG(s_1|x_1, q(a, e^*)) dH(a) \times f(x_1)}{\int \int \int \rho_1(r_1|e^*, s_1, q(a, e^*)) dG(s_1|x_1, q(a, e^*)) dH(a) dF(\chi)} \]  
  (20b)
  - the CRA’s first-period rating maximizes its objective $Z$:
  \[ \rho_1(r_1|s_1, e_1) > 0 \implies r_1 \in \arg \max_r Z(r, s_1, e_1) \]  
  where the objective $Z$ follows from (3) as
  \[ Z(r_1, s_1, e_1) \equiv \int_{x_1} \{ \alpha W(r_1, x_1) - P(r_1, x_1) \} dF^C_1(x_1|s_1, e_1) \]  
  (21b)
  given the CRA’s beliefs $f^C_1$ about creditworthiness $x_1$:
  \[ f^C_1(x_1|s_1, e_1) = \frac{\int_{a, \chi} dG(s_1|x_1, q(a, e_1)) dH(a) \times f(x_1)}{\int \int dG(s_1|x_1, q(a, e_1)) dF(\chi) dH(a)} \]  
  (21c)
the CRA’s first-period effort maximizes its objective:

$$e^* \in \arg \max_{e_1} \int \int \max_{r_1, x_1, s_1} Z(r_1, s_1, e_1) dG(s_1|x_1, q(a, e_1)) dF(x_1) dH(a) - c(e_1).$$

(22)

We first note that this equilibrium involves coarse ratings as shown in Proposition 3. This is because of the conflict of interest manifested in the difference between the CRA’s objective and the investors’ objective. The following result shows that appropriately-designed legal liability can address this problem and lead to more informative ratings.

**Lemma 1.** There is a truth-telling equilibrium if the legal liability for ratings is of the form

$$P(r_1, x_1) = \gamma - \delta U(r_1, x_1) + \alpha W(r_1, x_1)$$

with non-negative $\delta$. Further, a higher value of $\delta$ leads to a higher effort choice by the CRA.

The above lemma shows that if legal liability can be designed to completely align the interests of the CRA with those of the investors, it can improve the informativeness of ratings. However, this ideal form of legal liability may not be attainable in practice because of several reasons. First, the legal liability specified here assumes precise knowledge of the objective functions of the CRA and the investors, and hence of the conflict of interest. Second, the legal liability specified here appears to be a tax that is a continuous function of ratings the issuer’s and creditworthiness revealed *ex post*, rather than the typical legal liability which is zero unless the CRA is determined to have violated a law. Third, and probably most important, legal liability based on institutional details and specific ratings terminology but not directly on investor inference will not be able to capture any change that a regulation may produce in investors’ inference based on a given rating. We now analyze how these differences between the theoretical optimum and what is implemented in practice weaken the effectiveness of legal liability.

Consider a form of legal liability in which a penalty is imposed on the CRA whenever the creditworthiness $x_1$ differs sufficiently from a range considered “reasonable” based on the rating $r_1$. For concreteness, we assume that the range of the CRA’s signal is partitioned into disjoint intervals and each interval is associated with an equilibrium rating.\(^{11}\) If we denote

\(^{11}\)Crawford and Sobel (1982) show that all equilibria are equivalent to such partitioning equilibria under our assumptions.
ratings by \( r^1, r^2, \ldots, r^N \) where \( N \) is the number of equilibrium ratings, rating \( r^i \) is associated with the range \( M^i \equiv \{ m^{i-1}, m^i \} \) of the CRA’s signal. Further assume that the distribution of creditworthiness \( x_t \) conditional on signal \( s_t \) is symmetric around \( s_t \). Thus, if the signal \( s_t \) lies in the range \( M^i \), then the expected value of \( x_t \) also lies in \( M^i \). Suppose a penalty \( P > 0 \) is imposed whenever \( x_1 \in M^i, r_1 = r_j, \) and \( i \neq j \).

Crawford and Sobel (1982) show that a cheap talk game like the one we are discussing can have multiple equilibria and these equilibria differ in the number of different actions induced by the sender of the information. A more coarse equilibrium induces fewer actions with ratings that are based on wider ranges of signals. Consider two equilibria, one with \( N_1 \) ratings and another with \( N_2 > N_1 \) ratings. Suppose the CRA can determine which equilibrium is chosen by preannouncing the ratings categories. Further, the CRA has a preference for the equilibrium with finer ratings. We show below that legal liability regulations of the form discussed above can influence this choice.

**Proposition 7.** The CRA will choose the equilibrium with \( N_2 \) ratings for a sufficiently small penalty \( P \) and it will choose the equilibrium with \( N_1 < N_2 \) ratings for higher penalty.

The equilibrium shows that higher legal liability concerns can result in more coarse ratings. The intuition is that higher legal liability provides additional incentive to the CRA to report credit ratings “conservatively” such that the creditworthiness revealed ex post is more likely to lie in the range determined by the reported credit rating. This causes the CRA to prefer ratings that correspond to wider ranges and may result in equilibria with more coarse ratings. This outcome goes against an objective of maximizing investors’ aggregate surplus as section IV.A shows that more coarse rating that is less informative results in lower aggregate utility of investors. Note that this reduction in investor utility need not be compensated with lower cost of producing ratings for the CRA because the decline in informativeness of ratings results in obfuscation of rating-reporting rather than lower effort choice by the CRA.

\(^{12}\)A more realistic alternative would be one in which the penalty is imposed only when \( x_1 \) is sufficiently distant from the interval implied by the rating \( r_1 \).
V.B Legal Liability for Upward Bias in Rating

Recent discussions of credit ratings have suggested that CRAs tend to engage in “ratings inflation,” probably due to the conflict of interest created by the “issuer pays” model. It is also quite likely that legal penalties will be imposed on CRAs only when the ratings issued by these agencies are deemed ex post to be too high. Here, we point out that the link from the issuer’s presumed influence on the CRA to the alleged outcome of inflated ratings is tenuous. The significance of ratings lies in the inference investors draw based on these ratings. If CRA assigns systematically high ratings, rational investors should understand this and be able to adjust for the bias and make inferences about issuer creditworthiness that are uncontaminated by the bias. In fact, in equilibrium, whatever the scale of ratings or the language used to communicate ratings, the actions of investors based on these ratings should not display any bias on average. We emphasize this point with the following result.

Proposition 8. Investors’ equilibrium action is not systematically biased upwards compared to the action they would take if they could observe the credit rating agency’s information, even if the CRA’s interests conflict with those of investors.

The proposition argues that as long as CRA’s objective is common knowledge, investors can anticipate CRA’s incentives to bias ratings and their translation of ratings into actions overcome CRA’s attempt to manipulate ratings upwards. While this conflict is not costless as it leads to ratings that are less informative than they would be in the absence of any conflict of interest, the actions induced by these ratings are not systematically biased. For some instances of the credit rating agency’s information, the actions induced in the equilibrium are higher than the actions the investors would take with the credit rating agency’s information, while in some other instances of the credit rating agency’s information, the opposite holds.

In light of the previous result, regulations that impose penalty on the credit rating agency for ratings that are considered to be upwards biased will not eliminate any bias in ratings or actions that ratings induce from investors. The intent behind such regulations should be to improve informativeness of ratings by reducing the divergence between the interests of the CRA and the investors. Since the signal of the credit rating agency used to arrive at the rating is not observable to others, an inference of biased rating must be based on a
comparison of the ex-post observation of creditworthiness with the rating assigned by the CRA. Suppose a penalty is imposed when the creditworthiness $x_1$ is less than a threshold than depends on the rating.

The threshold of creditworthiness used to determine the imposition of penalty on the CRA must be based on the definition of rating categories. However, the introduction of legal liability for the credit rating agency may change its behavior and lead to a new equilibrium in which ratings categories communicate different information. Thus, a regulation that specifies penalty for CRA based on a comparison of the issuer’s creditworthiness with the rating category will be ineffective in achieving its purpose as rating categories may change with the introduction of new regulation, as shown in Proposition 7. In fact, one way the CRA can overcome liability implications of such a regulation is by introducing $l$ additional rating categories for lowest creditworthiness and changing the reporting strategy so that instead of reporting the rating category that it would have reported in an equilibrium prior to regulation, it reports a rating category that is $l$ levels lower, where a lower category is one that indicates lower creditworthiness. Such a change leaves informational content of ratings unchanged.

Finally, consider regulation that recognizes the endogenous nature of rating categories and specifies legal liability based on a comparison of the issuer’s creditworthiness with the information communicated by the rating which can be interpreted as the investor action induced by the rating. Implementing and enforcing such a regulation may be difficult but we ignore this constraint for now. Suppose the regulation imposes a liability on the CRA only when credit rating is deemed to be too high ex post. That is, the penalty imposed on the CRA, $P(k_1, x_1)$ is non-negative, weakly increasing in $k_1$, weakly decreasing in $x_1$ and equals zero for sufficiently low $k_1$ or sufficiently high $x_1$. Such a penalty may counter the conflicts between the interests of the CRA and the investors that are created by the influence of the issuer on the CRA and that provide CRA with incentives to induce higher investor action through rating. If penalty $P$ bridges the gap between the objectives of the CRA reduce rating coarseness and maximize social welfare. On the other hand, excessive asymmetric penalty for ratings deemed too high, particularly when the CRA’s information $s_1$ is a less precise signal of creditworthiness $x_1$, can cause the CRA to be more conservative.
in reporting rating in the sense that it will report more coarse ratings with fewer categories as shown in Proposition 7.

VI Implications of the Analysis for the Proposed Legislation

Our analysis has some implications for the potential consequences of the legislation being considered by Congress. We focus primarily on the effect of the increases in legal liability for inaccurate ratings, due to adoption of a liability standard.

We begin by noting that the proposed legislation is likely to achieve some of its intended objectives. For example, greater liability can complement the CRA’s reputational incentive to exert higher due-diligence effort in rating issues, thereby reducing moral hazard. The consequence would be more accurate credit ratings.

The intent of the legislation, however, is to not only improve the accuracy of ratings, but to also induce more frequent changes in ratings in response to changes in issuers’ default risk due to environmental shocks. On this front, our analysis implies that the exact opposite may occur. We know from our analysis that rating agencies will respond to increased legal liability by reducing the number of ratings categories. This will result in ratings responding even more sluggishly to changes in the underlying default probability of the issuer.

Two other points are worth noting in this context. First, greater coarseness in ratings is likely to lead to less innovation by rating agencies, since there will be weaker incentives to create a system to more finely match ratings to default risks. With fewer rating categories, a greater diversity of risk characteristics can be accommodated within a rating category, so there is a lesser need to innovate when newer securities and credit risks are introduced into the market. This seems to be a potentially unanticipated consequence of the legislation.

Second, greater coarseness in ratings means that investors will find ratings to be less informative, rather than more, as intended by the legislation. Perhaps there will be more (costly) signaling by firms to compensate for the lower information content of ratings, or more information production by investors capable of being informed. Both may be socially
wasteful, the former because the signaling is dissipatively costly, and the latter because costly information production by investors solely for trading purposes has pure wealth-transfer consequences and the information production cost is a social waste.\footnote{This assumes that firms do not predicate investment decisions on the information gleaned from market prices as in Boot and Thakor (1997).} Moreover, a higher percentage of trading being done by informed investors may connote lower liquidity for the firm’s securities.\footnote{See, for example, Goel and Thakor (2002).}

Our analysis also indicates that ratings may become more downward biased (Section V.B). Absent the ratings coarseness result, this would be of little import since investors can always rationally anticipate the bias and adjust their inferences accordingly. However, numerous contracts contain provisions that are conditional on one or more of the parties to the contract maintaining a particular credit rating. An example is a loan contract in which a lowering of the borrower’s credit rating can cause a covenant violation and trigger actions against the borrower that increase its cost of borrowing and lower its liquidity. So, unless all agents in the economy understand this phenomenon and all rating-contingent contracts are rewritten, this downward bias in ratings can have potentially serious economic consequences.\footnote{Just the rewriting of contracts can be quite costly from a social efficiency standpoint.}

While it is difficult to predict all the economic ramifications of the proposed legislation, there are some specific developments that are predicted by our theoretical model, and these should give us reason to pause. In particular, one has to assess the empirical significance of the moral-hazard reduction benefit associated with higher legal liability for CRAs. How important is this benefit to investors and issuers? To what extent is this potential benefit offset by the unintended consequences of increased legal liability that we have discussed?

\section*{VII Conclusion}

In this paper we have discussed some proposed legislation pertaining to CRAs that significantly changes the regulatory landscape for this industry. We have developed a theoretical model whose purpose is to examine some of the ways in which CRAs are likely to adapt their
behavior in light of this legislation. As the legislation intends, increased legal liability may reduce the moral hazard associated with CRA due-diligence in ratings. However, our analysis also predicts that the legislation may generate unintended consequences due to other ways in which CRAs will modify their behavior. The two most important of these ways are that CRAs will reduce the number of rating categories and exhibit a downward bias in ratings. In sharp contrast to the intent of the proposed legislation, ratings may actually change less frequently in response to shocks to default probabilities.

There are numerous provocative questions raised by our analysis, and one might argue it has raised more questions than it has answered. For example, how will the proposed legislation affect the interaction between issuers and rating agencies? How will it affect competition among rating agencies? How will it affect the nature of contracting where contracts involve triggers that are based on ratings? How will it affect “ratings shopping” by issuers? These are all interesting questions for future research.
APPENDIX

**Proof of Proposition 1:** Consider coarse rating that communicates that $\eta_2$ equals $\eta_H$ with probability $\pi_H$ and $\eta_L$ with probability $\pi_L$. Using (4) and (4), the social welfare equals

$$SW = 2 - \frac{2\tau(\pi_H \eta_H^2 + \pi_L \eta_L^2)}{\eta_H^2 \eta_L^2}.$$  \hspace{1cm} (23)

If on the other hand, the credit rating is fine and reveals whether $\eta_2 = \eta_H$ or $\eta_2 = \eta_L$, the social welfare equals $2 - \tau/(\eta_H^2 + \eta_L^2)$ with probability $\pi_H$ and $2 - \tau/(\eta_L^2 + \eta_H^2)$ with probability $\pi_L$ so the unconditional social welfare function equals

$$SW = 2 - \tau \left( \frac{\pi_H}{\eta_H^2 + \eta_L^2} + \frac{\pi_L}{\eta_L^2 + \eta_H^2} \right).$$  \hspace{1cm} (24)

A little algebra shows that social welfare in (24) exceeds that in (23). For the second result in the Proposition, suppose $\eta_2 = \eta_H$. If the credit rating communicates this value in an unbiased manner to the investor, the social welfare, obtained by replacing $\pi_H = 1$ in (24), equals

$$SW = 2 - \tau \left( \frac{\pi_H}{\eta_H^2 + \eta_L^2} \right).$$  \hspace{1cm} (25)

If instead, credit rating communicates biased value of $\eta_2 = \eta_L$, portfolio holding $\omega$ is obtained by substituting $\pi_L = 1$ in (5). Substituting the expression for $\omega$ in (4) and substituting $\pi_H = 1$ yields the social welfare:

$$SW = 2 - \tau \left( \frac{\pi_H}{\eta_H^2 + \eta_L^2} \right) \left( \frac{\eta_H^4}{\eta_L^2 + \eta_H^2} + \eta_L^2 \right).$$  \hspace{1cm} (26)

Some algebra shows that the value of social welfare in (25) exceeds that in (26).  \hspace{1cm} $\square$

**Proof of Proposition 2:** We show that an increase in $\delta$ causes an increase in $e^*$ and leads to more informative earnings. Substituting (16) in (14) yields

$$\rho_1(r_1|e_1, s_1) > 0 \Rightarrow r_1 \in \arg \max_r \frac{\int_{x_1} U(r, x_1) dG(s_1|x_1, q(a, e_1)) dF(x_1)}{\int_{x_1} dG(s_1|x_1, q(a, e_1)) dF(x_1)}.$$

and this also satisfies (6a). Substituting (16) and (27) in (15) yields

$$e^* \in \arg \max_{e_1} \delta E[\max_{r_1} E[U(r_1, x_1)|s_1, e_1] ] - c(e_1).$$  \hspace{1cm} (28)
The first term in the expression being maximized represents the benefit of effort while the second term represents the cost of effort. A higher value of \( \delta \) magnifies the effort and leads to higher optimal effort choice. This makes the signal \( s_1 \) more informative about creditworthiness \( x_1 \) and increases informativeness of ratings because (27) shows that the CRA communicates most informative rating given its signal.

**Proof of Proposition 3:** Suppose \( r < r' \), \( \rho_1(r|e^*, s) > 0 \) and \( \rho_1(r'|e^*, s') > 0 \) with \( s, s' \in s_L, s_H \). Then, \( Z(r, s, e^*) \geq Z(r', s, e^*) \) and \( Z(r, s', e^*) \leq Z(r', s', e^*) \). By continuity, \( \exists \bar{s} \in s_L, s_H \) such that \( Z(r, \bar{s}, e^*) \geq Z(r', \bar{s}, e^*) \). By concavity of \( Z \),

\[
\rho_1(r', 1) \frac{\partial^2 Z(r_1, s_1, e_1)}{\partial r_1 \partial s_1} > 0 \Rightarrow r_1 = \arg \max_r E[U(r, x_1)|s_1, e^*].
\]

Since \( \partial^2 Z(r_1, s_1, e_1)/\partial r_1 \partial s_1 > 0 \), \( r \notin R^C(s) \) for \( s > \bar{s} \) and \( r' \notin R^C(s) \) for \( s < \bar{s} \). Thus, when investors observe \( r \), they infer \( s \leq \bar{s} \) and when they observe \( r' \), they infer \( s' \leq \bar{s} \). Since \( \partial^2 U(r_1, s_1)/\partial r_1 \partial s_1 > 0 \), this means

\[
r < R^I(\bar{s}) < r'.
\]

Combining the above two equations with \( |R^C(\bar{s}) - R^I(\bar{s})| \geq \epsilon \) leads to \( |r - r'| \geq \epsilon \).

**Proof of Proposition 4:** Assume the contrary, that is, there exists a truth-telling equilibrium satisfying (19). Since investor action depends on rating, assume \( r_1 = k_1 \) without loss of generality. Thus, the CRA’s rating strategy is

\[
\rho_1(r_1|s_1, e^*) > 0 \iff r_1 = \arg \max_r E[U(r, x_1)|s_1, e^*].
\]

Since there is a one-to-one relationship between \( s_1 \) and \( r_1 \) in the above equation, the reporting strategy is equivalent to the CRA truthfully revealing its signal \( s_1 \). The CRA’s objective is to maximize its expected second-period fee which depends on investors’ posterior beliefs about its ability. Since the second-period equilibrium is a truth-telling equilibrium, second-period rating is more informative to investors if CRA’s signal is more informative about \( x_t \) and the signal’s informativeness is increasing in the CRA’s ability \( a \). So the CRA’s second-period fee is an increasing function \( \phi_2(a) \) of CRA’s ability \( a \). If the CRA communicates its signal to be
\( \hat{s} \) and the creditworthiness is \( x_1 \), the fee will be determined from the posterior distribution (7c) of \( a \) as

\[
\phi_2(\hat{s}, x_1) = \frac{\int_a \phi_2(a) \times g(\hat{s}|x_1, q(a, e^*)) \times dH(a)}{\int_a g(\hat{s}|x_1, q(a, e^*))dH(a)}
\]

(32)

and its expected value based on the CRA’s true signal \( s_1 \) is

\[
E[\phi_2(\hat{s}, x_1)|s_1] = \frac{\int\int_{a',x_1} \phi_2(\hat{s}, x_1) \times g(s_1|x_1, q(a, e^*)) \times dF(x_1)dH(a')}{\int\int_{a',x_1} dG(s'|x_1, q(a', e^*)))dF(x_1)dH(a')}
\]

(33)

Since the value of \( \hat{s} \) that maximizes the above expression does not identically equal \( s_1 \), truth-telling is not an equilibrium.

\[\square\]

**Proof of Proposition 5:** Consider the equilibrium conditional on a fixed choice \( e^* \) of the CRA’s first-period effort. A Nash equilibrium (possibly with mixed strategies) must exist in which the CRA chooses a reporting rule and investors determine the CRA’s second-period fee as a function of the reported rating \( r_1 \) and the observed creditworthiness \( x_1 \). Let \( Z(e^*) \) be the expected second-period fee of the CRA in this equilibrium. Now, if the CRA can choose first-period effort, it solves the following maximization problem:

\[
max_{e^*} \beta Z(e^*) - c(e^*)
\]

(34)

The above problem may have multiple maxima representing multiple equilibria. However, a higher value of \( \beta \) will lead to higher values of equilibrium effort \( e^* \) in each of these equilibria.

\[\square\]

**Proof of Proposition 6:** When the CRA earns only upfront payment for ratings and \( \beta = 0 \), there is no conflict of interest (constraint (9a) does not bind) and the CRA truthfully communicates its information as (13). If the legal liability is not of the form (16), there is a conflict of interest between the CRA and the investors \( (R^C(s_1) \neq R^I(s_1)) \) so proposition 3 shows that ratings will be coarse when legal liability is imposed on the CRA.

\[\square\]

**Proof of Lemma 1:** The CRA’s objective reduces to \( Z = E[\gamma + \delta U(r_1, x_1)|s_1, e_1] \) which is maximized when investors’ objective \( E[U(r_1, x_1)|s_1, e_1] \) is maximized, so the CRA’s rating
recommends the action that is optimal for investors. The CRA’s tradeoff for effort choice reduces to

\[ e^* \in \arg \max_{e_1} \delta E[\max_{r_1} E[U(r_1, x_1)|s_1, e_1]] - c(e_1). \] (35)

A higher \( \delta \) increases the benefit of effort provision compared to the cost of effort provision and thus leads to a higher effort choice.

**Proof of Proposition 7:** First note that each equilibrium continues to hold despite the introduction of legal liability. This is because the possibility of penalty reinforces the CRA’s equilibrium ratings choice, as the penalty is more likely to be imposed if the CRA deviates to report a rating that deviates from the equilibrium rating. The CRA’s choice of equilibrium is driven by its preference for an equilibrium with finer ratings and its concern for legal liability. Since the legal liability is more likely to be imposed in the equilibrium with more (and finer) ratings, the CRA will prefer the equilibrium with \( N_2 \) ratings for \( P = 0 \), and will prefer the equilibrium with \( N_1 \) ratings for sufficiently high \( P \).

**Proof of Proposition 8:** The proposition is a requirement of the definition of equilibrium (see (6a) and (6b)).

\[ \square \]
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