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Viability of a Government Run Credit Rating Agency

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Viability of a government-run credit rating agency*

Dong Woo Noh

May 10, 2013

Abstract

This paper considers a hypothetical government-run credit rating agency with a “fixed compensation” scheme. Taking as granted the fact that investors ascribe higher value for highly rated assets, the model attempts to see whether government intervention can lead to a more socially desirable solution. The model features a free rating agent who can either choose to work for the government agency or the private sector. We find that if the regulatory advantage of highly rated assets is high enough so that the rating agent has an incentive to cater to the investors and overrate the assets, the government may improve social welfare by offering a very high fixed compensation. However, it shows that intervention is undesirable when the regulatory advantage is not large enough. The result implies that different economic environments, such as the regulatory regime, macroeconomic conditions, etc., warrant different solutions.

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1 Introduction

During the 2008/2009 financial crisis, we have seen an extreme case of liquidity crunch that stemmed from an amalgam of misjudgments. Always among the list is the discussion about the inaccurate Aaa ratings dispersed by the major credit rating agencies. According to The Financial Crisis Inquiry Commission, “the failures of credit rating agencies were essential cogs in the wheel of financial destruction The mortgage-related securities at the heart of the crisis could not have been marketed and sold without their seal of approval.” It is difficult to deny that the abrupt series of downgrades grossly contributed to the dry-up of liquidity. Neither is it reasonable to argue that the Aaa ratings given to multiple mortgage backed securities (MBS) did not misrepresent their underlying risk.

Once we acknowledge these facts, important questions to be asked are where this phenomenon of “overrating” is rooted and the normative question of whether there are regulatory actions that can resolve, or at least relieve this problem. With regards to the first question, a popular argument is that the micro-prudential factors were mainly driving this problem. That is, inadequate staffing, shirking of responsibilities, and misaligned incentives at the rating agencies were the main driver of inaccurate ratings. It is true that in the recent crisis there has been cases where the rating agencies actually consulted with the issuers about which kinds of debts would earn which levels of ratings (Mason and Rosner 2007) raising serious concerns about the micro-prudential credibility of the business.

However, recent findings suggest that there is more to this question than just the micro-prudential loopholes. As summarized by Opp, Opp, and Harris (2013) recent academic studies provide evidence that ratings inflation varies across different asset classes and time periods in a way that suggests a relationship between ratings quality and regulatory use of ratings. It is also noted in an IMF study done that ratings inflation tend to be pro-cyclical which also limits the extent to which the one-dimensional conflicts of interest argument can explain the phe-

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1See Financial Crisis Inquiry Commission (2011)
2See Sy (2009)
nomenon. In addition, we also observe that the information embedded in the ratings are rather marginal to the already public information such as the spreads between the debt product in question and the Treasury bond. Still, market participants react sensitively to sudden changes in ratings independent of what the comparable public information indicates, suggesting the existence of other motives such as regulatory considerations.

To address the second question of what policy actions should be taken to ameliorate the current issue, the regulators have again mainly focused on decreasing barriers of entry and increasing transparency, hoping to urge the incumbents to “behave.” The efficacy of these actions are questionable. White (2010) comments on this as follows: “This regulatory response— the credit rating agencies made mistakes; lets try to make sure that they don’t make such mistakes in the future—is understandable. But it would not alter the rules that have pushed the judgments of the credit rating agencies into the center of the bond information process.” However, as noted in the IMF study, the systemic and regulatory aspect is what seems more relevant.

This paper will build on the aforementioned view of the ratings market that regulatory use of ratings is one of the important factors in ratings standards. In particular, my model incorporates the regulatory benefits of highly rated assets in the same way as Opp et al. (2013). It is taken as given that the marginal investors assign a certain value to high ratings apart from the information about risk conveyed by the ratings, and investors are assumed to be rational so that they are not fooled by the published ratings that may be subject to ratings inflation. In addition to this framework, I introduce a government-run rating agency that offers a “fixed compensation” to the rating agent with the information acquisition technology, as opposed to the traditional private rating agencies whose compensations are generally dependent on the amount of business attracted. The intent is to observe how this alternative would result in terms of amount of misreporting in ratings, information production, and ultimately social welfare defined as the amount of positive NPV projects filtered through the ratings process. Given these two agencies with differing compensation schemes and the general state of the world which is described by parameters, the rating agent will choose to work for the agency that maximizes her profits.

As in Opp et al. (2013), a large enough regulatory benefit of high ratings may cause the private rating
agency to stop producing information and engage instead in regulatory arbitrage by providing regulatory relief to investors in my model as well. Because the private rating agency’s compensation is dependent on the amount of business it attracts it is sensitive to the clients needs. Hence, there are not one but two channels through which investors affect the rating agents action: investors induce the agent to produce valuable information to be used for identifying undesirable projects-in specific, the more valuable of the value or the disaster component-and at the same time they may prefer simply a “higher” rating rather than an informative one if the benefit of having one is large enough.

On the other hand, the government rating agency’s fixed compensation scheme - this will be specified further in Section 3 - will relieve the rating agent from the need to attract more business while deteriorating the ratings quality by choosing to overrate. At the same time, the government cares more about public criticism in case of failing to prevent blatantly unhealthy projects from being financed. For this reason, the government needs a means to discipline the rating agent. In particular, the government mandates the inspection of the single existing issuer and oversees whether the published rating is indeed accurate, penalizing the rating agent by dismissing her in case of “noncompliance.”

To analyze this aspect in specific and to observe the different incentives that the public agency would face compared to its private counterpart, I introduce a second component to the issuer firms project. In this paper, there is a single issuer-entrepreneur endowed with a project whose payoff depends on two random factors, namely the “value” component and the “disaster” component, rather than one random component. The rating agents limited resources force the agent to make a choice between these two: the agent can either acquire information on the value component, the disaster component, or no information at all. In this model, a disaster is a rare event so that information about the value component is more valuable in terms of overall NPV of financed projects than is information about the disaster component, and this introduces the main tradeoff between the public and the private sectors.

The remaining of the paper is organized as follows. Section 2 discusses related literature on ratings inflation
and provides the motivation of this paper. Section 3 first describes the model setup and introduces the agents, and then provides an analysis of the equilibrium. Section 4 includes some concluding takeaways from the model and Section 5 discusses further work to be done.

2 Related Literature

For the reasons discussed above, a large number of academic studies regarding credit rating agencies have been published since the 2008/2009 financial crisis. Unsurprisingly, various empirical studies analyze the track record of major rating agencies to identify cases of deteriorating ratings quality.

Notably, Jing, Stanford, and Xie (2012) attempt to evaluate the claim that the issuer-pays model leads higher ratings. They consider the brief period during the 1970s in which Moody’s was charging the issuers while S&P was charging the investors. They consider a sample of 797 corporate bonds to see whether there was a significant difference between the two companies’ ratings and conclude that Moody’s ratings systematically exceeded that of S&P’s. Xia and Strobl (2012) compare S&P ratings to Egan-Jones Rating Company which adopts an invest-pays model. They also find that the S&P ratings are significantly more likely to receive higher ratings.

Along with these empirical evidence, various theoretical frameworks were developed to explain the ratings market and many to comment on the flaws of the issuer-pays model. One popular argument involves the discussion of discretionary disclosure. Because the current practice of the rating market allows the issuer to receive some sort of indicative rating, there is room for selective publication of ratings–ratings shopping. Earlier works on ratings inflation like Skreta and Veldkamp (2009) assumes the naïveté of investors and demonstrates how this together with ratings shopping leads to ratings inflation. The basic idea is that even for unbiased rating agencies, accumulated error and upward biased selection in publication may lead to inflated ratings. Bolton, Freixas, and Shapiro (2012) also explain the ratings inflation by incorporating a world with sufficient number of naïve investors who take the ratings at face value.
However, for reasons briefly discussed in the introduction, the assumption that investors are naïve seem rather dangerous. In particular, there seems to exist much evidence that investors were well aware of the quality issues in ratings. Sangiorgi and Spatt (2013) and other later works develop a rational expectations framework rather than assuming investors to be naïve. They show that if the investors are unaware of the fact that firms have obtained unpublished ratings, firms can still cherry pick the highest ratings and cause ratings inflation. The main theme is that the fact that indicative ratings are private may be playing an important role in the current ratings market.

Kashyap and Kovrijnykh (2013) also provide a very interesting insight. They analyze optimal compensation contracts that would yield the most desirable ratings outcome. They find that rating errors are larger when issuers order ratings rather than investors. In addition this study, a recent call for policy responses seems to suggest that many commentators believe that investor-pays model may be a possible alternative. Putting aside whether or not this is a viable solution, it seems clear that the compensation scheme of the ratings market is a very important factor in deciding the rating agencies’ behavior.

Opp et al. (2013) develops a rational expectations framework the regulatory use of ratings affect the ratings quality. The study takes into account the fact that ratings-contingent rules such as minimum capital requirements affect investors’ taste for assets with different ratings. Kisgen and Strahan (2010) find empirical evidence that investors treat marginally different ratings holding risk constant, providing grounds for exposition about regulatory benefits and ratings. In Opp et al. (2013), the model’s comparative statics enable it to explain the differing ratings quality across asset classes and economic environments as well.

3 The Model

My model builds on Opp et al. (2013) in terms of the basic setup regarding the regulatory benefit of high ratings. In addition to the original setup, it introduces a government rating agency, but the essence of this new aspect is

\[ \text{See World Bank (2009)} \]
the differing compensation scheme. The specifics will follow in this section.

3.1 Model setup

3.1.1 Agents and ratings technology

The model features a world with an issuer-entrepreneur, a private credit rating agency (CRA), government rating agency (GRA), and investors. Although the agencies are different entities, a single agent with access to a proprietary information production technology chooses to work for either of the rating agencies. All players are risk-neutral and profit-maximizing except the GRA. The issuer firm is owned by an entrepreneur with no cash. The entrepreneur has access to a risky project that requires an initial investment of 1. The project’s type is defined by two components, namely “value” and “disaster components. These components can be expressed as the vector \( n = (n_v, n_d) \), where \( n_v \in \{g, b\} \) and \( n_d \in \{d, nd\} \). The “value” component can either be of “good” or “bad” (respectively represented by \( g \) and \( b \)) while the disaster component may turn out to be “disastrous” or “not disastrous (respectively represented by \( d \) and \( nd \)). These two component determine the payout of a project as follows:

\[
V = (R + \alpha \cdot 1_{n_v=h}) \cdot 1_{n_d=nd}.
\]

(1)

Where \( R \) is the realized payout of the project, and \( \alpha > 0 \) the incremental cash flow rewarded to a good value type firm. \( 1_{\{n_d=nd\}} \) is an indicator function whose value is 1 if and only if the firm is not disastrous. Consequently, a disastrous firm has a payoff of zero with certainty, but a firm being disastrous is a very rare event that happens only with a small probability \( \pi_d > 0 \). Also, a firm is of good value with probability \( \pi_g \) while is of bad value with probability \( \pi_b \). These probabilities can be viewed to depend on the overall economic conditions and are common knowledge to all players. On average, a project would have the expected value

\[
E[V] = \pi_{nd} \cdot (R + \pi_g \alpha).
\]

(2)
Without any informative signal, the NPV of a given project to the investors \( \pi_{nd} (R + \pi_g \alpha) - 1 \) is assumed to be negative. The firm seeks financing through the public debt market. Since on average a project yields negative NPV, a given project will not be financed unless informative signals resolve the asymmetry of information. However, a firm of type \( n = (g, nd) \) is assumed to have an alternative financing option so that the rating agency cannot extract all the surplus from the firm in this case. However, in order to signal its type the \( (g, nd) \) type firm has to engage in inefficient signalling activity so that the social welfare is assumed to be zero in this case.

**Assumption 1.** A firm of type \( n = (g, nd) \) can finance its project by an alternative financing option that is equivalent to a bond with face value \( R < \bar{N} < R + \alpha \).

With regards to the asymmetry of information, a free agent who has access to an information production technology is introduced. The technology generates a perfect private signal \( s \in \{A, B\} \) about the firm’s type. Here, it is assumed that the agent has limited resources and can only produce a signal that carries information about either of the value or the disaster component. To be more concrete, the free agent is endowed with a resource of amount \( c \) and there is a cost of amount \( c \) associated with obtaining either component of the signal (value or disaster component). Hence, the produced private signal can either mean that 1) the value component of the firm yielded the signal \( A \) or \( B \), or that 2) the disaster component of the firm yielded the signal \( A \) or \( B \). The signal is perfect in the following sense: in case the rating agent exerts effort on the value component, \( s \) perfectly identifies whether a firm is of good or bad value, and the same mechanism holds for the disaster component as well. Therefore, the agent faces the decision of choosing to inspect either the value component or the disaster component, or choosing not to exert any effort at all. We denote the information acquisition decision of the agent by \( \iota \in \{\iota_v, \iota_d, \iota_0\} \) which respectively represents the aforementioned choices. If the agent does not exert effort to obtain information, she will rely solely on the common knowledge \( \pi \)'s. The signal mechanism is summarized as
Pr \left( s = A \mid n_v = g, v = t_v \right) = Pr \left( s = B \mid n_v = b, v = t_v \right) = 1,
Pr \left( s = A \mid n_d = n, v = t_d \right) = Pr \left( s = B \mid n_d = d, v = t_d \right) = 1.

The publication of a rating involves two steps as does in practice. First, the rating agency provides a free indicative rating $\tilde{r} \in \{A, B\}$. Second, the rating becomes the public rating $r = \tilde{r}$, if the issuer decides to purchase the rating for a fee $f > 0$. This purchase decision would depend on the firm’s type and $p_n (\tilde{r}) = 1$ signifies that an $n$ type firm decides to purchase a $\tilde{r}$ rating. Otherwise, the issuer remains unrated ($U$). Since the signals are not publicly available, rating agencies may offer indicative ratings such that $\tilde{r} \neq s$. This is modeled by the probability $\varepsilon$ that the rating agency offers a high indicative rating when the observed signal is a low one. This disclosure practice applies in an identical way to both value and disaster components.

3.1.2 Compensation scheme

The free agent has the choice of working for either the CRA or the GRA. The government rating agency offers the free agent a fixed compensation $f'$ instead. In order to incentivize accurate reporting, the government punishes the agent in case of “noncompliance” by dismissing the agent from the position. Here, the noncompliance signifies the case in which the agent fails to predict the rare disaster because the government cares about the public criticism of not foreseeing a disaster. To be exact, if a firm with $n_d = d$ gets an $A$-rating and is financed this is a case of noncompliance. A disaster can be seen as something comparable to an economy or industry wide collapse, hence the government does have a significant reason to care about such an event. For the sake of simplicity, I denote this penalty is expressed as a numerical value denoted by $k$ that will be incurred in case of noncompliance$^4$

$^4$This will be discussed again in Section 5. Along with other assumptions, this should be justified later on.
The private rating agency has different incentives. It is less worried about failing to predict disasters but more about providing more informative signals on average so that the clients are willing to pay a better price for their service. Here, we introduce an important part of the model which states that the information about the value component is more valuable than that of the disaster component because a disaster is such a rare event.

\[(R + \alpha)\pi_{nd} > (R + \alpha\pi_g).\]  

(3)

Now, we specify the order of events in the game as follows:

1. The rating agency sets a fee $f$ (the GRA also sets the fixed payment $f'$).
2. The free agent decides whether to work for the GRA or the CRA, sets information acquisition $\iota$, and the disclosure rule $\epsilon$.
3. The rating agent incurs information-acquisition cost $c$ and receives a perfect signal $s$.
4. The rating agent reports an indicative rating $\tilde{r}$ to the firm.
5. The firm decides whether to agree to pay the fee $f$ to publish its rating, and if it does agree the rating is published.
6. Investors decide to provide financing to the firm.
7. If the firm receives funding, it pays the fee $f$ and invests the remainder to the project.
8. Cash flows are realized at the end of the period, and debt is repaid if possible.

In the following section, it is assumed that the continuation value of staying in business is high enough for the rating agent so that she can commit to her choices regarding information acquisition and disclosure rule.

3.1.3 Regulatory benefit

As discussed in the previously sections, a key component of the model is the existence of rating-contingent regulation and its effect on the investors’ decision choices. For the ease of exposition, let the following assumption incorporate the price effects of all the various ratings related provisions.

\footnote{Without this assumption, the rating agent always has an incentive to misreport entirely and avoid incurring the information acquisition cost. For a more meaningful discussion a repeated-game version should be considered. This will be discussed in Section 5 again.}
Assumption 2. The marginal investor assigns a value of $y$ to an A-rated bond compared to a B-rated bond. In addition, this applies to both the value and the disaster components.

Hence, the investors not only care about the face value of a bond but also about the regulatory benefit as well. In other words, the investors will provide financing if the sum of the expected repayments and the regulatory benefit is greater or equal to the sum of the initial investment and the rating fee. Here, the rating fee is also included due to the fact that the issuer is endowed with no cash. For an $r$-rated bond, the following expresses this statement.

$$E[N|r] + y \cdot 1_{r=A} \geq 1 + f.$$  (4)

Here, $y$ is exogenous and in the following discussions, different regions of $y$’s will yield different outcomes. Also, it should be noted that $E[N|r]$ is an expectation which is different from the actual face value that the investors set, $N_r$, since the realization of payoff is not guaranteed by the ratings.

3.2 Analysis: value & private agency

In this section, I attempt to find a Perfect Bayesian Equilibrium of the model. First, an equilibrium is defined as the following:

Definition 1. Equilibrium

1. The issuer makes a purchase decision respective to its type, $p_n(\tilde{r}) \in \{0, 1\}$, where $p = 1$ denotes a purchase of the indicative rating by a firm of type $n$. The decision is made to maximize the net cash flow after repayment given indicative rating $\tilde{r}$, type $n$, information acquisition decision $\iota$, the disclosure rule $\varepsilon$, and the financing term $N_r$, however it is assumed that the issuer will take the financing when indifferent.\(^6\)

2. Investors set face values $N_r$ for $r$-rated bonds such that the investors break even when taking both the

\(^6\)This can be interpreted as a project having a benefit or enjoyment apart from the net profit it may provide.
face values and the regulatory benefit into account given the purchase decision \( p \), the regulatory benefit \( y \), information acquisition decision \( \iota \), disclosure rule \( \varepsilon \), and the fee \( f \).

3. The rating agent decides whether to work for the government or the private rating agency, sets the fee \( f \) (if she decides to work for the private rating agency), information acquisition decision \( \iota \), and disclosure rule \( \varepsilon \) to maximize her profits given the firm’s purchase decision \( p \), and the face value \( N_r \).

In analyzing the equilibrium, different cases of rating agent’s decisions (information acquisition, and whether to work for the government/private agency) can be assumed beforehand to find the agent’s profits for each of the cases and compared afterwards. Because of the repeated game environment and rational expectations each player can extrapolate the optimal decision of the rating agent through the same procedure. The following analysis will follow this method to solve the rating agent’s problem. Hence, the analysis provided in this section is the case in which the rating agent investigates the value component and decides to work for the private rating agency (case 1). In the following section only the final results of the different cases (2–4) will be presented and compared because the procedure is identical.

3.2.1 Firm problem – case 1

Because the private signals are assumed to be perfect, the only way for a firm to receive a \( B \)-rating is to either have \( n_v = b \) or \( n_d = d \), both of which have negative NPV by the assumption in equation (2). This directly implies that a \( B \)-rated bond will not receive financing from investors, yielding \( p(B) = 0 \) for any firm type \( n \). In the following sections, \( p(A) = 1 \) and \( p(B) = 0 \) will be assumed.\(^7\)

\(^7\)It should be shown that for all possible cases, an \( A \)-rated bond can receive financing.
3.2.2 Investor problem – case 1

Now, the investors set face values while taking into account the conditions $p(A) = 1$ and $p(B) = 0$ for all types $n$. Because the signals are perfect, a firm may receive an $A$-rating only by 1) being good(non-disastrous) type or by 2) being bad(disastrous) but overrated. A firm receiving an $A$-rating on the value(disaster) component is

$$\pi_{A,v} = \pi_g + \varepsilon \pi_b.$$  \hspace{1cm} (5)

Given above and the signal structure, the posterior probability of good(non-disastrous) and bad(disastrous) types can be worked out as

$$\Pr [n_v = g \mid r = A] = \frac{\pi_g}{\pi_g + \varepsilon \pi_b}. \hspace{1cm} (6)$$

Because the investors can only recover what is available in case the firm cannot return $N_A$, the investors’ constraint in equation (4) can be rewritten as below for the $A$-rated bonds.

$$E[N|A] + y = \left(\frac{\pi_g}{\pi_g + \varepsilon \pi_b}N_A + \frac{\varepsilon \pi_b}{\pi_g + \varepsilon \pi_b}R\right)\pi_{nd} \geq 1 + f \hspace{1cm} (7)$$

Competition among investors forces this constraint to bind, and the face value $N_A$ satisfies

$$N_A = \frac{\pi_g + \varepsilon \pi_b}{\pi_g} \left[\frac{1}{\pi_{nd}}(1 + f - y) - \frac{\varepsilon \pi_b}{\pi_g + \varepsilon \pi_b}R\right]. \hspace{1cm} (8)$$

Notice that the face value that the investors require is decreasing with the regulatory benefit $y$.

3.2.3 Rating agent problem – case 1

Because the investors require the $n = (g, nd)$ type to participate, the face value should be at a level such that it induces the $(g, nd)$ type to purchase the rating, which translates to the constraint $N_A(\iota, \varepsilon, f, y) \leq \bar{N}$. Also, the
fee $f$ is collected with probability $\pi_g + \varepsilon \pi_b$ since this is the probability of a firm receiving an $A$-rating. Hence, the rating sets the fee to solve the following:

$$\max_{\iota, \varepsilon, f} \Pi(\iota, \varepsilon, f, y) = (\pi_g + \varepsilon \pi_b)f - c \cdot 1_{\iota=t_w}.$$  \hfill (9)

We can rewrite the constraint on the face value as

$$f \leq f^* = \frac{\pi_{nd}}{\pi_g + \varepsilon \pi_b} \left[ \pi_g \bar{N} + \varepsilon \pi_b R \right].$$  \hfill (10)

To maximize profit, the maximum fee will be charged. Substituting in the maximum fee and rearranging, it is easy to find that the optimal profit has a linear term in $\varepsilon$. This means that the profit maximization of the rating agent implies $\varepsilon \in \{0, 1\}$. Using this fact to further simplify the expression we get,

$$\Pi^* = (\pi_{nd} \bar{N} + y - 1) \pi_g - c + \varepsilon \pi_b \left( \pi_{nd} R + y - 1 + \frac{c}{\pi_b} \right).$$  \hfill (11)

To further simplify the above when $\varepsilon = 1$ and $\varepsilon = 0$,

$$\Pi^*_1 = \begin{cases} 
\pi_{nd} \left( \pi_g \bar{N} + \pi_b R \right) + (y - 1) & \text{if } y > \pi_{nd} R - 1 + \frac{\varepsilon}{\pi_b}, \varepsilon = 1, \\
\pi_g \left( \pi_{nd} \bar{N} + \pi_g (y - 1) \right) - c & \text{if } y < \pi_{nd} R - 1 + \frac{\varepsilon}{\pi_b}, \varepsilon = 0.
\end{cases}$$

### 3.2.4 Social welfare – case 1

From society’s perspective, the amount of positive NPV projects financed and undertaken, and the amount of bad projects filtered are of primary interest. Hence, let’s define the NPV of the projects financed as the social welfare for the purpose of this analysis. Using the probability weighted NPV, we get

$$SW_1 = \pi_g \left( \pi_{nd} (R + \alpha) - (c + 1) \right) + \pi_b \varepsilon \left( \pi_{nd} R - (c + 1) \right).$$  \hfill (12)
We see that when the cost is large enough, it is wasteful to produce information and social welfare is larger when the rating agent stops acquiring information and simply rates any firm $A$. However, in this case all firms get $A$-ratings and the NPV of the $A$-rated projects is the ex-ante average project $((R + \alpha \pi_g)\pi_{nd} - 1)$ which was assumed to negative. Hence, we already see that misreporting produces a socially suboptimal outcome.

$$SW_1 = \begin{cases} 
(R + \pi_g \alpha) \pi_{nd} - 1 & \text{if } \varepsilon = 1 \\
\pi_g (\pi_{nd}(R + \alpha) - (c + 1)) & \text{if } \varepsilon = 0.
\end{cases}$$

### 3.3 Analysis: across cases 1–4

For cases 2 through 4, a similar process yields $\Pi_i^*$ and $SW_i$ for $i = 2, 3, 4$ as well.

**Case 2: rating agent investigates disaster component and works for the private rating agency**

$$\Pi_2^* = \begin{cases} 
\pi_{nd} (\pi_g \bar{N} + \pi_b R) + (y - 1) & \text{if } y > \frac{c}{\pi_d} - 1, \varepsilon = 1, \\
\pi_{nd} (\pi_g \bar{N} + \pi_b R + y - 1) - c & \text{if } y < \frac{c}{\pi_d} - 1, \varepsilon = 0.
\end{cases}$$

$$SW_2 = \begin{cases} 
(R + \pi_g \alpha) \pi_{nd} - 1 & \text{if } \varepsilon = 1 \\
\pi_g (\pi_{nd}(R + \alpha) - (c + 1)) & \text{if } \varepsilon = 0.
\end{cases}$$

**Case 3: rating agent investigates value component and works for the government rating agency**

$$\Pi_3^* = \begin{cases} 
f' - k\pi_d & \text{if } c > \pi_d \pi_b k, \varepsilon = 1, \\
f' - k\pi_d \pi_g - c & \text{if } c < \pi_d \pi_b k, \varepsilon = 0.
\end{cases}$$

$$SW_3 = \begin{cases} 
(R + \pi_g \alpha) \pi_{nd} - 1 & \text{if } \varepsilon = 1 \\
\pi_g (\pi_{nd}(R + \alpha) - (c + 1)) & \text{if } \varepsilon = 0.
\end{cases}$$
Case 4: rating agent investigates disaster component and works for the government rating agency

\[
\Pi^*_4 = \begin{cases} 
  f' - k\pi_d & \text{if } c > \frac{\pi_d}{\pi_{nd} + \varepsilon \pi_d} k, \varepsilon = 1, \\
  f' - c & \text{if } c < \frac{\pi_d}{\pi_{nd} + \varepsilon \pi_d} k, \varepsilon = 0.
\end{cases}
\]

\[
SW^*_4 = \begin{cases} 
  (R + \pi_g \alpha) \pi_{nd} - 1 & \text{if } \varepsilon = 1 \\
  \pi_{nd} (R + \pi_g \alpha - (c + 1)) & \text{if } \varepsilon = 0.
\end{cases}
\]

Notice that for large enough penalty \( k \), the rating agent will choose not to misreport and it also follows that she will choose to investigate the disaster component. These decisions are rather obvious from the construction, but it still presents an intuitive result: if the regulatory benefit is large enough so that the rating agent resorts to misreporting, the government can discipline the agent by offering a high enough fixed pay \( f' \) and incurring a large penalty \( k \).

### 3.4 Equilibrium

Now I present the results of the analysis.

**Proposition 1.** For \( y < \min\{\pi_{nd} R + \frac{\pi_d}{\pi_b} - 1, \frac{\pi_d}{\pi_d} - 1\} \), the rating agent will produce valuable information and report truthfully. Also, in this region of \( y \) the rating agent’s decision yields the socially optimal outcome except for the small region of parameters where \( 1 - y < \frac{\pi_d R}{\pi_{nd} - \pi_g} < 1 + c \).

**Proof.** The first part of the proposition follows from the previous section. The second part can be shown by considering the differences

\[
\Delta \Pi^* = \Pi^*_1 - \Pi^*_2 = (1 - y)(\pi_{nd} - \pi_g) - \pi_{nd} \pi_b R \\
\Delta SW = SW_1 - SW_2 = (1 + c)(\pi_{nd} - \pi_g) - \pi_{nd} \pi_b R
\]
We see that whenever \( \Delta \Pi^* \) is positive, \( \Delta SW \) is positive as well but not vice versa. We can rearrange the terms to show that except for the region where \( 1 - y < \frac{\pi_b \pi_{nd} R}{\pi_{nd} - \pi_g} < 1 + c \), the agent’s optimal decision coincides with the socially optimal decision.

It directly follows that when we are in a region where the rating agent is maximizing social welfare as above, the government has nothing to add to social welfare by intervening. However, when the regulatory benefit is large enough, social welfare may be improved by intervention.

**Proposition 2.** For \( y > \max\{\pi_{nd} R + \frac{c}{\pi_b} - 1, \frac{c}{\pi_d} - 1\} \), the rating agent will engage in misreporting and her optimal solution yields negative social welfare. In this case, the government can pay a large enough compensation and incur a large enough penalty to improve social welfare as long as the cost of information acquisition \( c \) is small enough.

**Proof.** The first part of the proposition follows directly from our assumption regarding equation (2). For the second part, when the government induces the rating agent to report truthfully, the rating agent will automatically focus on the disaster component to produce information. In this case, the social welfare is equal to \( \pi_{nd} (R + \pi_g \alpha - (c + 1)) \) which is positive for small \( c \).

\[ \square \]

4 Conclusion

The model suggests that different economic environment warrants different socially optimal solutions. For instance, we see that for a low enough regulatory benefit, the rating agent takes the socially optimal solution most of the time (except for the small region of parameters mentioned above). On the other hand, when the regulatory benefit of high ratings is large enough to distort the rating agent’s incentive the rating agent will engage in misreporting and destroy social welfare. In this case, the government may intervene to improve social welfare by offering a high enough fixed compensation \( f' \) and penalty \( k \). Indeed, the government may also
intervene when we have a small regulatory benefit and this may produce a marginally better outcome (in the “small” region mentioned before) or produce an equivalent outcome. However, in this case the government may run a deficit to attract the rating agent and the marginal improvement may not worth the trouble. Hence, we see that without distortion of incentives the market solution is most likely to be optimal.

Although the exposition discusses a rather arbitrarily designed government rating agency, the intuition can be expanded. For instance, notice that the government rating agency differs mainly in terms of its compensation scheme. Therefore, instead of interpreting the government rating agency as a possible policy alternative we may as well consider mandating certain compensation regimes to the existing rating agencies. Even in this case, the argument discussed before still holds: a large enough regulatory benefit may warrant for intervention, while moderate regulatory benefit leaves the market solution to be optimal.

5 Remaining Work

The paper is currently omitting certain components that are necessary to justify the analysis. In this section, these missing aspects will be discussed.

First of all, the solution for the firm problem is not complete. Although $p(B) = 0$ for all types $n$ follows by construction, it is not obvious that all types purchase the $A$-rating. It should be shown that ex-post, $A$-rated bonds are indeed financed and that financing through this channel is a cheaper strategy for a $(g, nd)$ typed firm.

Second, the government’s penalty system warrants discussion. At this point, the penalty $k$ is exogenous. However, I discussed earlier that the source of the penalty comes from the agent’s dismissal (i.e. forgone compensation). Although a large enough fixed compensation will also make this penalty larger as well, this part still needs to be polished.

Third, optimal market solution does not fall naturally from the assumption that the value component is on
average more relevant to the disaster component. Although it is more profitable for the rating agent to focus on the value component whenever $\pi_d$ is very small, it is also true that in this case the rating agent has a higher probability of receiving a fee if she investigates the disaster component since $\pi_{nd}$ is large. This fact together with the fact that the project produces a minimum of $R$ if the agent investigates the disaster component imply that if $R$ is large enough the rating agent may still want to investigate the disaster component even though the assumption is that the value component is on average more relevant to the project’s value.

Lastly, the socially optimal solution and the rating agent’s optimal choice does not coincide for certain parameter values in the market solution case. At this point, I do not have a good explanation for this artifact and this warrants further investigation.
References


