The Trust Alternative*

Indraneel Chakraborty Alessio Saretto Malcolm Wardlaw

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Abstract

We substantiate the feasibility of a market mechanism that addresses ratings shopping, ratings inflation, and encourages competition over rating accuracy among credit rating agencies (CRAs). An issuer strategically delegates the task to acquire ratings, from CRAs, to a pass-through non-monitoring platform (the "trust"). The trust operates as a commitment mechanism for the issuer and pays outcome-contingent fees, a large portion of which is paid upfront. In turn, high credit rating accuracy assures investors' participation in the market, creating the surplus that guarantees voluntary participation of CRAs and issuers. Overall, the mechanism creates a Pareto-improving equilibrium that requires minimal regulatory intervention.

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The recent financial crisis and the debacle of asset-backed securities have brought public attention to the possibility that the credit worthiness of a large fraction of highly rated securities issued before the crisis was overstated. Since credit rating agencies (CRA) are responsible and compensated for determining such credit worthiness, they have been under the scrutiny of regulators, industry experts and academicians ever since the height of the crisis. In particular, the current set up, where issuers/underwriters pay a handful of CRAs for the publication of credit ratings has been questioned as one of the possible culprits for the severity of the financial crisis.

In a recent study, the Government Accountability Office (2012) discusses several alternatives to the current "issuer-pays" model but finds a resonating lack of sufficiently detailed analyses. Since then, further progress on alternative proposals has been limited. In February of 2015, the SEC finally responded to the policy requests laid forth by the Dodd Frank Act by adopting a set of rules (Staff of the Division of Trading and Markets, 2014) that revises the Rating Agency Act of 2006 and asks for a heightened level of disclosure, compliance and due-diligence within the framework of the "issuer-pays" model.

One might question how effective the SEC rules will be at aligning incentives in the rating industry, given that a large academic literature has already identified important issues that arise from the current "issuer-pays" model. In particular, CRAs have an incentive to inflate ratings to attract more business, "ratings inflation", and issuers have an incentive to only buy the best rating available, "ratings shopping" (e.g., Benmelech, 2009; Mathis, McAndrews, and Rochet, 2009; Skreta and Veldkamp, 2009; White, 2010; He, Qian, and Strahan, 2012; Bolton, Freixas, and Shapiro, 2012; Opp, Opp, and Harris, 2013; Griffin, Nickerson, and Tang, 2013; Sangiorgi and Spatt, 2016); the competitive environment in the industry is limited (Skreta and Veldkamp, 2009; Becker and Milbourn, 2011); there generally is a widespread lack of due diligence by CRAs (Griffin and Tang, 2011; Kashyap and Kovrijnykh, 2016); accuracy and diligence are inversely affected by economic conditions (Bar-Isaac and Shapiro, 2011); large financial institutions rely excessively upon ratings for capital requirements purposes (Acharya and Richardson, 2009).[1] While the SEC's intervention appears unable to correct most of those issues, no other regulatory intervention has been planned.

[1]Even beyond ratings agencies, Lizzeri (1999) has shown that in a class of environments, a certification intermediary reveals minimal information but extracts a large share of the surplus.

One alternative to the current system was identified by a few academics (e.g., Acharya and Richardson, 2009; Mathis, McAndrews, and Rochet, 2009) and in the study by the Government Accountability Office (2012) as the introduction of an intermediary that is responsible for compensating CRAs in lieu of the issuers, a "platform–pays" model.[2] However, despite its supposed theoretical advantages, the platform-pays proposal has not gained wide support due mainly to practical concerns that the cost of an additional layer of bureaucracy might not outweighed by the benefits created by it.

We believe our paper is the first to formally consider such an intermediary, analyze its implementability, and juxtapose it to other suggestions. We take the policy environment adopted by the SEC as given (i.e., there is no mandatory disclosure or any higher degree of regulatory intervention). In such an environment, we focus on the normative theoretical analysis of the policy issues at stake: What are the necessary and sufficient set of contracting features that improve ratings accuracy, thereby eliminating ratings inflation and ratings shopping? How should such a platform-pays mechanism be designed with minimum disruption and regulatory oversight?

The findings of our analyses are comforting. First, confirming the general intuition of Acharya and Richardson (2009) and Mathis, McAndrews, and Rochet (2009), we show that a market-driven platform-pays mechanism design is feasible, and in its simplest form can be Pareto-optimal. Second and quite surprising, we illustrate how the cost of implementing a "platform–pays" model might not be as large as previously anticipated. As a result, the designed mechanism could exist side-by-side with the present issuer-pays model without disruption, and should gain participation from CRAs and issuers due to its own merits.[3]

[2]Sangiorgi and Spatt (2016) have studied a different alternative that introduces mandatory disclosure of interaction between CRAs and issuers. Bongaerts (2014) and Kashyap and Kovrijnykh (2016) compare issuer–pays and investor-pays models. Kashyap and Kovrijnykh (2016) show that ratings bias is larger in the issuer–pays than in the investor–pays model, and that the first-best contract would have outcome contingency due to future business loss. They refer to Bolton, Freixas, and Shapiro (2012), who have modeled future business loss. The elegant setup of Bolton, Freixas, and Shapiro (2012) is our starting point. Bongaerts (2014) argues that irrespective of who pays for the ratings (issuer, investor, or co-investment) a high degree of regulatory intervention would be necessary to eliminate distortions in the rating process. However, the rule adopted by SEC did not require mandatory disclosure or a high degree of regulatory intervention.

[3]Our analysis is in comparison to costly regulatory intervention, which, we argue, may not even address the deficiencies of the present market organization. In June 2008, New York State Attorney General Cuomo announced reform agreements with the nation's three principal CRAs. International Organization of Securities Commissions (IOSCO), a body of regulators has revised the code of conduct for CRAs, asking them to scrutinize their own models and to improve transparency. In July 2010, U.S. Congress passed the Dodd-Frank Wall Street Reform and Consumer Protection Act ("Dodd-Frank Act"), which, among other things, amended Section 15E of the Securities Exchange Act of 1934 to enhance the regulation, accountability and transparency of CRAs. As mandated by the Dodd-Frank Act, the Office of Credit Ratings was created. See Coffee Jr. (2011) for additional background and a survey of reform proposals from a legal perspective.

From a modeling perspective, we rely heavily on the elegant setup proposed by Bolton, Freixas, and Shapiro (2012). This has the added advantage that we are utilizing an arm's-length model to show the feasibility of a market mechanism. In their, and hence our model, three risk neutral types of players (issuer, CRAs, investors) participate in the credit rating evaluation and issuance of a security, the proceeds of which are used to finance a real investment. The security is evaluated by investors on the basis of the credit report compiled by the rating agency, if such report becomes public. Investors can choose how much of the project to finance: a large investment will be made only if the quality of the project is reported to be good. In our version of the model, we allow the issuer to delegate to an intermediary, a trust, the task of acquiring a credit rating for the security. The trust is designed as a pass-through structure that collects enough funds from the issuers to pay the rating fees, which are independently negotiated with the CRAs. The amount paid by the issuers also covers the cost of operations of the trust. On the one hand, by approaching the trust, issuers forgo the option not to purchase any negative report, as the funding of the trust happens before ratings are communicated. On the other hand, issuers benefit from the fact that the trust structures payments to the CRAs in order to incentivize truth telling, which increases investors' participation to the project thus creating higher surplus.

The trust has two key features. First, the trust enables strategic delegation: issuers may, and in equilibrium will, voluntarily delegate the task of obtaining a rating to the trust.[4] Strategic delegation observably commits the issuers to not shopping, and obtaining whatever rating the CRAs choose to give. Issuers, therefore, can signal that they did not shop for the rating, and can separate themselves in equilibrium from other issuers who choose not to delegate. Strategic delegation also frees CRAs from the necessity of catering to issuers in order to obtain business, leaving them free to publish any rating they see fit. Thus, the first feature of the trust helps eliminate ratings shopping.

Second and similar to Kashyap and Kovrijnykh (2016), the trust pays outcome contingent fees according to a publicly available schedule. From a practical perspective, outcome contingent payments might appear problematic due to the infrequent realization of measurable events (i.e., bond defaults and full repayments

[4]The literature on strategic delegation to an agent – as a commitment device by a principal – includes seminal work by Schelling (1960); Vickers (1985); Fershtman and Judd (1987); Sklivas (1987). The ability to bind oneself to a clear path of competitive action, is valuable because it allows the other parties to also update their expectations, and reach an equilibrium that is advantageous to the committing party. Other applications of strategic delegation as a commitment device have been studied in different settings, for example, by Melumad and Mookherjee (1989); Bolton and Scharfstein (1990); Katz (1991). The literature on delegation is vast and also includes but is not limited to Holmstrom (1984); Caillaud, Jullien, and Picard (1995); Alonso and Matouschek (2008); Bond and Gresik (2011); Gerratana and Kockesen (2012).

of principal). We show however that this is not a concern. On the one hand, entities similar to the trust would serve entire pools of securities issued by different issuers, at different time and with different maturities (i.e., there will not be one trust for each bond). Thus, after a brief transition interval, CRAs will receive some payment in each period. On the other hand, the outcome-contingent nature of the fee does not mean that the entire payment needs to be deferred to the complete resolution of uncertainty. Using a simple calibrated example, we show how the CRA's truth-telling incentive can be preserved even with a fee structure wherein a significant portion of the total outcome contingent payment can be made upfront.

Besides facilitating truth telling from the CRAs, outcome contingent fees are advantageous inasmuch as they can be properly designed to increase a CRA's effort to produce more precise signals. Kashyap and Kovrijnykh (2016) study optimal compensation schemes for a CRA when a social planner, firm, or investors order the rating. They point out that outcome contingent contracts can be interpreted as rewarding the CRA for establishing a reputation for accuracy. In our paper where we investigate a market mechanism, we show that a fee schedule that pays more for a correct prediction of failure (i.e., the less likely outcome) than for a correct prediction of success will encourage effort. Moreover, when multiple CRAs are present, the trust can induce them to compete over accuracy, by exerting more effort, thus leading to an equilibrium where competition among CRAs creates welfare enhancement, as opposed to reducing it (e.g., Skreta and Veldkamp, 2009 and Bolton, Freixas, and Shapiro, 2012).[5] Thus, the second feature of the trust helps eliminate ratings inflation and ensures that the CRAs prefer publishing the most accurate rating, while exerting the highest effort.

It is worth noting that the two features that characterize the trust, outcome–contingent fees and ex-ante commitment by issuers (through strategic delegation), are not *independently* sufficient to induce truth telling by the CRA. Both features are necessary. Particularly important is the ability of the platform to enforce ex-post commitment from the issuers through ex-ante contracting. A situation in which the issuer approaches the CRA directly and ex-ante commits to purchasing any rating is in fact not renegotiation proof, and leads to ratings shopping. Similarly important is the fact that both features can be applied

[5]Previous theoretical results and empirical evidence, such as for example Skreta and Veldkamp (2009), Becker and Milbourn (2011) and Bolton, Freixas, and Shapiro (2012), suggest that competition among CRAs does not lead to better outcomes for investors. Competition among CRAs is considered problematic because it eventually leads CRAs to exert lower efforts. We consider competition and endogenous effort by the CRAs in the context of our model and show that outcome contingent fees are an important feature in addressing the problem.

to any other platform-pays model, and do not necessarily need the intermediary described in this paper. Although we believe the trust structure to be the simplest of such mechanisms that can be modeled and executed in practice, any alternative proposal that has similar features should achieve a similarly efficient truth-telling equilibrium.

From an organizational perspective, the trust can be envisioned as a transparent pass-through structure that is not subject to any conflict of interests. Before approaching a CRA, the trust in fact collects funding from issuers and holds them in an escrow account. After a rating is published by a CRA, the trust agrees to pay outcome contingent fees according to a schedule that is publicly available before said rating is released. The trust does also not monitor firms, as the occurrence of default can, for example, be determined by an independent entity such as International Swaps and Derivatives Association, Inc. (ISDA). In this scenario, the trust is paid a volume based fees which is independent of ratings.

However, we are quick to note that an alternative setting, where the trust operates to maximize profits, as opposed to simply exist as a pass-through, and some informational asymmetry exists about the characteristics of the CRA, might lead to situations in which the trust colludes with the CRA and the issuer at the expense of investors. The extent to which collusion is a problem depends on the nature of said asymmetric information. If the investors' beliefs are too widespread, it is reasonable to conjecture that they would revert to the equilibrium in which ratings are considered completely uninformative, thus making the presence of the trust moot. In such case, the only optimal action of the trust would be to refuse to collude and instead align its interests with the investors (possibly by letting them participate in the funding of the trust itself).

Another important question regarding the implementability of the trust is related to its cost. We propose a calibrated example that shows that the operation cost of the trust would be minimal and easily recuperated by the benefits that accurate ratings bring to the fixed income market. In our model, such benefits are simply model by participation of some sophisticated investors. While this is a difficult input to calculate in real life, we note that one might gauge an indication by considering the relative magnitude of the structured finance market before and after the 2008 financial crisis: the lack of investor confidence can literally shut down a very market in a very short span of time.

One might ask why, if it is Pareto-optimal, such mechanism does not already exist. We believe coordination frictions may be partially responsible, and could be overcome through private or public initiative. Notably, this would not the first example of an intermediary that is privately organized by market participants to eliminate conflicts of interest within the financial community. One notable example is the Financial Industry Regulatory Authority (FINRA). FINRA is a non-governmental independent not-for-profit organization that regulates the securities industry, and seeks investor protection. It does so by writing and enforcing compliance from participating firms.[6] Another recent example is given by the Treasury Market Practices Group, which was created in February of 2015 to support integrity and efficiency of the Treasury, agency debt and agency MBS markets.[7]

1. Related Literature

Our paper is related to a growing strand of the theoretical literature that formalizes the conflicts of interest present in the current rating system which lead to rating inflation and rating shopping. Mathis, McAndrews, and Rochet (2009) study whether reputation concerns are sufficient to induce CRAs to truthfully report their signals. Bolton, Freixas, and Shapiro (2012) consider how ratings issued by a CRA with reputation concerns, are affected by the presence of investors who are not strategic and believe any published rating. In a similar framework, Bar-Isaac and Shapiro (2013) endogenize reputation as a function of macro-economic conditions, and derive conditions for rating inflation that are related to the business cycle. A number of papers consider how CRAs can be manipulated by issuers. Skreta and Veldkamp (2009) and Sangiorgi, Sokobin, and Spatt (2013) focus on the issuers' ability to shop for ratings, and the impact that has on different types of assets. Pagano and Volpin (2012) focus on conditions that would lead issuers of asset-backed securities to choose to release coarse information to enhance liquidity in the primary market. Manso (2013) points out that CRAs should not only focus on the accuracy of ratings but also on the effects

[6] The 1938 Maloney Act amendments to the Securities Exchange Act of 1934 allows FINRA (and its predecessor National Association Of Securities Dealers (NASD)) to supervise the conduct of its members subject to oversight by SEC. See more at `http://www.finra.org/about`. New York Stock Exchange itself was created by the Buttonwood Agreement between 24 stockbrokers on May 17, 1792. For a full list of present SROs that work with SEC, please visit `http://www.sec.gov/links.shtml`. For an economic analysis of incentives within SRO, see for example DeMarzo, Fishman, and Hagerty (2005).

[7] The Charter of the Treasury Market Practices Group, a private-sector organization sponsored by the Federal Reserve Bank of New York is available here: `http://www.newyorkfed.org/TMPG/tmpg_charter_02262015.pdf`.

of their ratings on the probability of survival of the borrower, and shows that competition between CRAs may lead to rating downgrades, increasing defaults and reducing welfare.

Goel and Thakor (2015) show that at present, coarse ratings arise in equilibrium where CRAs trade-off preferences of issuers (who prefer inflated ratings) against preferences of investors (who want to limit the amount of inflation). The trust mechanism reduces the benefits of coarse ratings for CRAs, and thus encourages more accurate ratings. In a more general context, Ramakrishnan and Thakor (1984) and Millon and Thakor (1985) analyze situations in which agents engaged in production of information find it beneficial to form coalitions. Ramakrishnan and Thakor (1984) finds that information intermediaries can improve welfare in presence of information asymmetry and unreliable information. Millon and Thakor (1985) introduces moral hazard in addition to information asymmetry, and finds that coalitions can help information intermediaries diversify risk and share information. Even though the trust is not a coalition of CRAs, one feature of the trust mechanism is that it also aggregates information regarding performance of each CRA over all its ratings, and thus improves welfare by paying CRAs based on aggregate performance.

Researchers have also examined the role of new and old regulations. Bongaerts, Cremers, and Goetzmann (2012) and Cole and Cooley (2014) argue that most of the distortions in the rating process are created by excessive regulatory reliance on credit ratings, rather than by mis-aligned incentives of CRAs. Opp, Opp, and Harris (2013) show that if, due to some regulation, investors have a large incentive to hold highly rated securities, CRAs will not exert any effort in trying to produce a signal about the quality of the project, but instead will rate every issuer as of the highest quality. Becker and Opp (2013) study a new system wherein the regulator pays for credit assessments, in place of ratings, for asset backed securities held by insurance companies. Bongaerts (2014) argue that regardless of the pay structures (issuer, investor, or co-investment) a high degree of regulatory intervention would be necessary to eliminate distortions in the rating process. Kashyap and Kovrijnykh (2016) show that ratings bias is larger in the issuer–pays than in the investor–pays model.

Because in our model the trust does not pay up-front fees and the CRAs can voluntarily decide to produce a rating to participate in the game, our paper is also related to the literature on unsolicited ratings, including but not limited to Poon, Lee, and Gup (2009) and Fulghieri, Strobl, and Xia (2014). Our work is also related to the general literature on self-regulation (see DeMarzo, Fishman, and Hagerty, 2005, among others). Moreover, because we analyze the efficiency differences produced by oligopolistic CRAs relative to a monopoly, our work is related to papers that analyze the impact of the industrial organization of financial certification on the quality of ratings, such as for example Faure-Grimaud, Peyrache, and Quesada (2009) and Becker and Milbourn (2011). Since by approaching the trust, issuers abandon the option to not disclose certain ratings, our analysis is linked to papers that study the disclosure incentives of issuers, such as Faure-Grimaud, Peyrache, and Quesada (2009), Sangiorgi and Spatt (2016) and Cohn, Rajan, and Strobl (2014).

Our paper is also related to the empirical literature that analyzes the performance of credit ratings across different assets classes and periods of time. This literature includes but is not limited to Benmelech (2009) and Benmelech and Dlugosz (2009) who document early manifestation of the problems with credit ratings during the financial crisis. Griffin and Tang (2012) report how CRAs applied several discretionary adjustments to their models in order to assign higher ratings to structured finance products. He, Qian, and Strahan (2012) find that large issuers received more favorable ratings during the runup to the financial crisis. Bongaerts, Cremers, and Goetzmann (2012) explore the economic role of CRAs and conclude that marginal additional ratings seem to matter primarily for regulatory purposes. Griffin, Nickerson, and Tang (2013) discuss the role of multiple ratings, and how the dynamics that lead an issuer to obtain more than one rating adversely affected the quality of the securities created during the crisis. Kisgen and Strahan (2010) utilize the SEC certification of an additional CRA for use in bond investment regulations, to find that ratings-based regulations impact issuers' cost of capital. Chen, Lookman, Schürhoff, and Seppi (2014) document a new channel for rating-based bond market segmentation based on nonregulatory investment management practices. They show that asset-class-sensitive institutional investors respond to exogenous classification changes (from high yield to investment grade), even though the regulatory standing of the bonds was unaffected. Xia (2014) investigates how the entry of an investor-paid CRA affects information quality of ratings by an issuer-paid CRA. Bruno, Cornaggia, and Cornaggia (2016) exploit an investor-paid rating agency's designation as a Nationally Recognized Statistical Rating Organization (NRSRO) to test whether this certification affects the agency's information production. Cornaggia, Cornaggia, and Hund (2014) offer a historical perspective on the quality of ratings across different asset classes and over 30 years.

2. The model

2.1. Setup

Our initial setup follows from Bolton, Freixas, and Shapiro (2012). Their work provides an elegant framework that illustrates how ratings inflation and ratings shopping emerge from the issuer pays model, which is currently in use in much of the world. As mentioned before, using their setup has the added advantage that we are utilizing an arm's-length model to show the feasibility of a market mechanism.

2.1.1. Agents and investment opportunities

There are three types of risk neutral agents in the economy: issuers who have no capital, CRAs, and investors who provide capital to issuers. The agents interact in a one period game. Investment opportunities are of type $\omega \in \{g, b\}$, where good g or bad b have an unconditional probability of $\frac{1}{2}$. Good investments do not fail, and bad investments fail with probability $p > 0$. If successful, investments return R for each unit of capital invested. In case of failure, all capital is lost.

The investors have unit measure, and are sub-divided into two types, a fraction α of investors are trusting and the remaining $1 - \alpha$ are sophisticated investors. Trusting investors take CRAs at face value, while sophisticated investors recognize the possibility that CRAs might have incentives not to report the signals they observe.[8] In spirit, they are similar to the "noise" traders in market-microstructure literature (seminal work includes Kyle, 1985; Black, 1986, among others).

2.1.2. Information, CRAs and reputation

Investors and issuers cannot discern the quality of investments. They only know that the unconditional probability of each type is $\frac{1}{2}$. CRAs have a costless technology that allows them to obtain a private signal, $\theta \in \{g, b\}$, regarding the type of investment at time $t = 0$.[9] The signals are not perfect, and are characterized by a precision level, e, defined as the conditional probability of identifying the true type:

$$Pr(\theta = g|\omega = g) = Pr(\theta = b|\omega = b) = e.$$

[8] The trusting investors may be taking ratings at face value because of regulatory reasons, or because they have high costs of due-diligence.

[9] In Section 6, we relax the assumption that precision e of signal θ is exogenous, to allow CRAs to improve the precision of the signal they obtain by exerting costly effort.

If $e = \frac{1}{2}$, the signal is uninformative beyond what the investors and issuers already know from unconditional probabilities. If $e = 1$, the signal is perfectly informative, and there is no uncertainty. Hence, we assume that $\frac{1}{2} < e < 1$. In the game sequence, the CRA first observe the signal and then publishes a report, in the form of a message $M = \{G, B\}$ to all investors, if the issuer agrees to buy one.

CRAs have a reputation ρ at time $t = 0$, which can be thought of as an expected discounted sum of future profits. At $t = 1$, the project succeeds or fails. If the project fails, the issue will be audited and the true signal will be revealed. In this case, the CRA can be in one of two predicaments. Either the signal is discovered to be the same as the message and the CRA is not punished, or the signal is found to not match the report and the CRA suffers a permanent loss of reputation.

For value to be created, some additional surplus must be generated by the presence of rating reports. The marginal value to the investor, depends on the expected return of the investment and the reservation utility that the investor requires for funding a particular amount of the project. The expected return depends on the conditional probability of failure and on the return of a successful investment. Upon observing a good report, the investor will expect that with probability e the project is in fact good and will then return R, and that with probability $(1 - e)$ the project is bad, even if the message is good, but might succeed with probability $(1 - p)$ and once again return R. Therefore the excepted return to the investor will be $(1 - (1 - e)p)R$.

The investor has a choice regarding how much of the project to fund. Similar to Bolton, Freixas, and Shapiro (2012), and in line with the empirical regularities, we assume that investors have a preferences for good securities, and expects a higher per unit investment return for investing more. Therefore, if an investor decides to fund two units of the project, his marginal reservation utility equals U; if he funds one unit, his marginal reservation utility is u, and if he funds half of a unit, his marginal reservation utility is v, with $U > u > v$.

Also, we make some basic assumptions about the payoffs of the security. In particular, the expected return of the security if the report is g is greater than the reservation utility if the investor funds the maximum amount: $(1 - (1 - e)p)R > U$. The expected return of the security if there is no signal, or conflicting reports, is greater than the reservation utility that the investors demands for purchasing one unit, and lower than the reservation utility that he requires to purchase two units, $u < (1 - p/2)R < U$.

Finally, the expected return of the security if the truthful message is bad, or believed to be bad, is greater than the reservation utility required to fund half of a unit, and lesser than the reservation utility required to fund one unit, $v < (1 - ep)R < u$. These assumptions determine the marginal value to and the quantity funded by investors. If the investor believes the security to be good,[10] it will attach the highest marginal value, V^G, and fund two units of the project. If he entirely bases his judgment on the unconditional probabilities, the investor will attach a median valuation, V^0, and fund one unit. Finally, if the investor believes the security to be bad he will attach a low valuation, V^B, and fund half a unit of the project. The marginal values are therefore as follows:

$$
\begin{aligned}
V^G &= (1 - (1 - e)p)R - U \\
V^0 &= (1 - \frac{p}{2})R - u \\
V^B &= (1 - ep)R - v,
\end{aligned}
$$

where $V^G > V^0 > V^B$. As, in Bolton, Freixas, and Shapiro (2012), this is a way to capture the demand function for securities. For example, Acharya and Richardson (2009) indicate that there is a large demand for highly rated (i.e., AAA) securities that is linked to regulatory capital requirements.

2.1.3. Timeline

An issuer approaches a CRA regarding an upcoming issue. The CRA posts a fee schedule (ϕ_G, ϕ_B) conditional on the ratings it may give $M = \{G, B\}$. After posting a fee schedule, the CRA receives a signal θ about the upcoming issue. The CRA then produces (to the issuer) a credit report. The issuer may purchase the report and pay fees ϕ or choose not to purchase the report and issue the security without a rating.

If the issuer purchases the report, then the CRA publishes the rating as a message $M = \{G, B\}$. The issuer then sets a price for the issue, and investors decide whether and how much of the security to purchase. A representation of the sequence of actions is shown in Figure 1.

[10] After a truthfully revealed good rating, the security is actually good with probability $1 - (1 - e)p$.

Later, in presence of a trust, the only modification to the timeline is that the issuer approaches the trust, and the trust approaches CRAs. The trust has a mandate to ensure participation and truth-telling by CRAs, and thereby maximize the surplus of the issuer.[11]

2.2. One credit rating agency

Without a trust, because an issuer can observe the report before buying it, and because a bad report triggers the lowest valuation from the investor, a bad report will never be purchased. Thus, the relevant actions of the CRA are limited to two: "truth-telling", in which case the CRA gets paid only when it receives a good signal, or "rating inflation", in which case the CRA reports a G message regardless of the signal. Obviously if the CRA inflates the rating, it will get paid whether it receives the good or the bad signal. However, issuing a good report when the signal is bad exposes the CRA to the possibility that the issue fails and the CRA is discovered to have lied. As highlighted by Mathis, McAndrews, and Rochet (2009) and Bolton, Freixas, and Shapiro (2012), the relevant tradeoff is between the fee that the CRA can extract from the issuer, ϕ_G, and the expected reputation cost, $ep\rho$. As in their work, if the fee is large enough ($\phi_G \geq ep\rho$), the CRA will choose to inflate ratings, otherwise truth-telling will prevail.

We focus our analysis on the inflation equilibrium, since the equilibrium where CRAs choose to report truth is already optimal. In the inflation equilibrium, given a good rating, i.e. $m = G$, an issuer invites investors to buy the security at price V^G. Sophisticated investors, who know the parameters of the game, infer that the CRA is better off inflating the ratings, and therefore refuse to buy the issuance at any price higher than V^0 (at that price they will buy only one unit). On the other hand, the trusting investors will participate by acquiring two units of the security. The total amount issued is therefore equal to $\max(2\alpha V^G, V^0)$, where α is the fraction of trusting investors.

In such a case, the CRA maximizes its profits by extracting all the surplus created from the credit report and therefore sets the fee, ϕ_G, equal to the the total marginal surplus of $\left[\max(2\alpha V^G, V^0) - V^0\right]$.[12]

[11] As we will discuss later, the CRAs in presence of trust extract equal or more surplus than without the trust. The issuer also has a higher surplus. Thus the presence of trust can be Pareto-optimal.

[12] As shown in Bolton, Freixas, and Shapiro (2012), endogenous reputation does not change the results in the setup. In that case if the discount rate of payoff in the next period is given by β, then the cost of foregone profits in the future are given by $\rho = \beta(\alpha 2V^G - V^0)$. This leads to the result that if discount rate is less than $\frac{1}{ep}$, CRAs inflate. In this paper, we focus on solving the ratings problems in the inflation equilibrium, given they arise in some cases theoretically and in practice. Our results remain robust to endogenous reputation.

2.3. Two credit rating agencies

In the case of two CRAs, Bolton, Freixas, and Shapiro (2012) show that the marginal value of investment based on two identical reports is:

$$V^{GG} = \left(1 - \frac{(1-e)^2}{(1-e)^2 + e^2} p\right) R - U,$$
$$V^{BB} = \left(1 - \frac{e^2}{(1-e)^2 + e^2} p\right) R - v.$$

If the CRAs issue contrasting reports, then the marginal value to all investors is V^0, which is the ex-ante marginal value. The reputation of each CRA is given by ρ^D, where $\rho^D < \rho$ since the discounted sum of future profits is lower in case of duopoly than it is in case of a monopoly.

As in the case of a monopoly, if the fees, ϕ, are greater than the expected reputation loss, then the CRAs choose to inflate ratings. The issuer is now at a slight advantage, relative to the monopoly case, as it can threaten one CRA to move his business to the other. Consequently, the fee charged by each CRA is lower, than in case of a monopoly, as each CRA can only extract the marginal surplus of the second (additional) rating, $\phi^D = 2\alpha(V^{GG} - V^G)$.

In summary, competition among CRAs does not mitigate the incentives to inflate ratings. It only facilitates ratings shopping. The fact that competition leads to worse rating is not a result specific to the setup of Bolton, Freixas, and Shapiro (2012). Skreta and Veldkamp (2009) for example, also find that competition leads to worse ratings with a model that relies on a very different set of assumptions. These theoretical predictions are confirmed by existing empirical findings. Becker and Milbourn (2011) for example, document that the entrance of Fitch in the ratings business led to more biased ratings from Moody's and Standard and Poor's.

3. The trust

In this section, we provide conditions under which the trust ensures truth telling by CRAs, and voluntary participation by issuers and CRAs. We only consider the parameter space that generates the inflation equilibrium, as described in Section 2. In Section 4, we introduce a more realistic, although less tractable, framework that allows us to consider multiple types of issuers and therefore multiple ratings.

3.1. One credit rating agency

We start by describing the fees and the relative profits of a CRA. The trust pays outcome contingent fee upon the realization of the project. If the CRA's report is good ($M = G$) and the project succeeds (S), the fee will be ψ_S. On the other hand, if the report is bad ($M = B$) and the project fails (F), then the fee will be ψ_F.[13]

The CRA profits, corresponding to a certain report and conditional on a signal being observed, are as follows:

$$\begin{aligned}\pi(M = G|\theta = g) &= (1 - p + ep)\psi_S + \rho \\ \pi(M = B|\theta = b) &= ep\psi_F + \rho \\ \pi(M = G|\theta = b) &= (1 - ep)\psi_S + (1 - ep)\rho \\ \pi(M = B|\theta = g) &= (p - ep)\psi_F + (1 - p + ep)\rho\end{aligned}$$

where the respective equations reflect the fact that fees are paid only when the outcome matches the message, and the reputation ρ suffers when the CRA is caught lying. This happens only in failure when the issue is audited.[14]

The CRA will truthfully report the signal if the profit from doing so is higher than the profit from misreporting:

$$\pi(M = G|\theta = g) - \pi(M = B|\theta = g) \geq 0$$

$$\pi(M = B|\theta = b) - \pi(M = G|\theta = b) \geq 0$$

[13] As we show in Section 4, a fee schedule could be designed so that CRAs receive a certain fee for all securities that succeeds within a certain rating class, and a certain fee for all securities that fail within the same rating class. Success fees will generally be decreasing with rating class, while failure fees will be increasing (i.e. $\psi_S(AAA) > \psi_S(AA)$ and $\psi_F(AAA) < \psi_F(AA)$). Moreover, because both $\psi_S(.) > 0$ and $\psi_F(.) > 0$, the CRA can be paid some quantity upfront equal to $\min(\psi_S(.), \psi_F(.))$.

[14] For example, if the CRA observes a bad signal and sends a bad report, it will be paid only if the investment fails. With probability e the signal is accurate, in which case the investment fails with probability p. Hence, the CRA receives the fee ψ_F with probability ep. On the other hand, if the CRA decides to publish a good report, it will receive a payment only if the investment does not fail, which happens with probability $1 - ep$.

To facilitate economic interpretation, we express the above truth telling conditions, as a relationship between the two fees next.

Lemma 1. *(CRA Truth Telling Condition) For the CRA to truthfully report the signal (θ), a trust must ensure that fees $\{\psi_S, \psi_F\}$ satisfy the following inequalities respectively:*

$$\psi_F \leq \left(\frac{1}{p(1-e)} - 1\right)\psi_S + \rho \tag{1}$$

$$\psi_F \geq \left(\frac{1}{ep} - 1\right)\psi_S - \rho \tag{2}$$

If inequality (1) is violated, ψ_F is too high relative to ψ_S and the CRA will have an incentive to always send a report that predicts failure. On the other hand, if inequality (2) is violated, then ψ_F is too low relative to ψ_S and the CRA will have an incentive to always send a report that predicts success.

One important implication of truth telling is that it assures that sophisticated investors will accept the ratings as informative and fund the project in any case. Because the trust can deliver truth telling even in an economy that would generally lead to the inflation equilibrium, it has the ability to generate some surplus. The presence of such surplus makes relying on the trust an incentive compatible choice for the issuer, preferable to approaching a CRA directly. At the same time, the presence of the trust also improves the situation for a CRA that can be paid now regardless of whether the signal is good or bad.

In the following proposition we present conditions for voluntary participation of the issuer and the CRA, as a relationship between the two fees.

Proposition 2. *(Participation Constraint) The following conditions must hold respectively for the issuers and the CRA to participate in the trust:*

$$\psi_F \leq \frac{1}{ep}\left(2V^G + \frac{1}{2}V^B - 2V^0\right) - \psi_S\left(1 + \frac{1-p}{ep}\right) \tag{3}$$

$$\psi_F \geq \frac{1}{ep}\left(4\alpha V^G - 2V^0 - 2ep\rho\right) - \psi_S\left(1 + \frac{1-p}{ep}\right) \tag{4}$$

Proof is in the appendix.

Inequality (3) describes the condition that guarantees participation of the issuer, who will approach the trust if the total amount funded net of the transfer to the trust is larger than the net amount raised when dealing directly with the CRA. If the condition is violated than ψ_F is too large relative to ψ_S and the issuer will prefer to approach the CRA directly. Inequality (4) describes the trade-off faced by the CRA. Voluntary participation of the CRA requires that the expected fees paid if the CRA reveals its signal to the trust is larger than the fee that the CRA can extract without a trust.[15] An important side effect of the CRA participation constraint is that the truth telling constraints automatically bind in equilibrium. If the fees paid by the trust violate the truth-telling constraint, generating an inflation equilibrium, there are insufficient funds to make the CRA prefer the trust relative to an issuer pays model. Consequently, the CRA and the issuer both prefer a fee schedule which is set to induce truth telling.

Figure 3 provides a graphical representation of Lemma 1 and Proposition 2. The set of inequalities forms a space with possible interior solutions for the fees if the slope of inequality (1) is larger than the slope of (2), and if the intercept of (3) is larger than the intercept (4). The first requirement is immediately verified by the assumption that $e > \frac{1}{2}$. The second is a function of all the model's parameters.

Importance of trusting investors

A critical determinant of the equilibrium is the fraction of trusting investors α in the economy. Inequalities (3) and (4) yield the following upper bound on trusting investors for participation of all agents $\alpha \leq \frac{1}{2} + \frac{V^B}{8V^G} + \frac{ep\rho}{2V^G}$. Similarly, a large fraction of trusting investors reduces the incentives of CRAs to truthfully report the rating. If surplus available from trusting investors is large enough to overcome reputation costs of inflation, i.e. $2\alpha V^G - V^0 \geq ep\rho$, then a CRA will inflate the rating.

Combining the two conditions, we obtain the range of values for α in which the trust ensures truth telling and participation of all agents:

$$\frac{V^0 + ep\rho}{2V^G} \leq \alpha \leq \frac{1}{2} + \frac{V^B}{8V^G} + \frac{ep\rho}{2V^G}$$

[15] The CRA participation constraint is not formally necessary. However, we recognize through this conservative participation constraint, that real world CRAs enjoy market power in the industry. We assume, for simplicity, that CRAs retain their bargaining power, but do not share in the additional surplus created in presence of a trust, and that surplus is retained by the issuer. However, an alternative assumption where a CRA extracts all the additional surplus (or a fraction of the additional surplus) can also be made. Such an assumption also leads to similar results, where the trust remains feasible, and assures truth telling by the CRA and participation by issuers and the CRA. The issuer participation constraint will bind in this alternative scenario where the CRA extracts all the surplus.

If $\alpha \in [0, \frac{V^0+ep\rho}{2V^G}]$ then truth telling is the only equilibrium, and the trust is implementable but unnecessary. If $\alpha \in [\frac{V^0+ep\rho}{2V^G}, \frac{1}{2} + \frac{V^B}{8V^G} + \frac{ep\rho}{2V^G}]$, a region in which there would have been inflated ratings without the presence of the trust, the trust guarantees truth-telling. If $\alpha \in [\frac{1}{2} + \frac{V^B}{8V^G} + \frac{ep\rho}{2V^G}, 1]$, then issuers will choose to forego the trust and directly interact with CRAs because there is little value to accurate ratings. Therefore, the presence of trust allows us to ensure truth telling equilibrium over a range of values of $\alpha \in [\frac{V^0+ep\rho}{2V^G}, \frac{1}{2} + \frac{V^B}{8V^G} + \frac{ep\rho}{2V^G}]$, where the truth telling equilibrium would not exist without a trust.

3.2. Two credit rating agencies

In presence of another CRA in Bolton, Freixas, and Shapiro (2012), fees are competed down so that both CRAs receive only the marginal revenue from the additional rating, $\phi^D = 2\alpha(V^{GG} - V^G)$. As in the case of Section 3.1, we start with the assumption that we are in the inflation equilibrium, where CRAs will choose to inflate in the absence of the trust (i.e., $\phi^D > ep\rho^D$).

The truth telling conditions of CRAs remain similar to inequalities (1) and (2), with reputation ρ replaced by reputation in a duopoly ρ^D. Participation constraints will also change as a function of the fact that with two CRAs receiving independent signals, it is possible that contradicting report are published. In this case, investors revert to the valuation when no information exists, V^0, and only finance one unit of the project. The CRA participation constraint changes, relative to 3, as the payoff in duopoly is different than the one in monopoly, under the scenario where no trust is present.

Proposition 3. *(Participation Constraint in CRA Duopoly) The following conditions must hold respectively for the issuers and the CRAs to choose to participate in the trust:*

$$\psi_F \leq -\psi_S\left(1 + \frac{1-p}{ep}\right) + \frac{1}{ep}\left((\frac{1}{2} - e + e^2)(2V^{GG} + \frac{1}{2}V^{BB}) + 2(e - e^2)V^0 - \alpha(4V^G - 2V^{GG})\right) \tag{5}$$

$$\psi_F \geq -\psi_S\left(\frac{1-p+ep}{ep}\right) + \frac{1}{ep}\left(4\alpha(V^{GG} - V^G) - ep\rho^D\right) \tag{6}$$

Proof is in the appendix.

As in the case of a monopolistic CRA, a set of fees that insures participation of the CRAs and the issuer exists if the intercept of (5) is larger than the intercept of (6). Moreover, as previously discussed in

Section 3.1, the presence of a trust induces truth telling for a range of the fraction of trusting investors larger than in the case without a trust: $\alpha \in [0, \frac{(\frac{1}{2}-e+e^2)(2V^{GG}+V^B/2)+2(e-e^2)V^0+ep\rho^D}{2V^{GG}}]$.

3.3. Alternative proposals

A significant benefit of the trust mechanism is that it requires minimal regulatory intervention, as it is preferred by all parties under fairly general conditions (i.e., it is Pareto improving). The trust has also a number of advantages when compared to other proposals and the issuer–pays system. For example, one might argue that regulatory fiat could be used to achieve more accurate and efficient ratings by forcing CRAs to disclose any contact with an issuer, and such is in fact the argument contained in the June 2008 Cuomo plan and in Sangiorgi and Spatt (2016). However, the set of rules adopted by the SEC in February 2015 does not require mandatory disclosure of contact. We argue that a platform-pays model, with private voluntary strategic delegation is an alternative market-based solution.

The trust mechanism can also be compared to the investor–pays model. For example, Cornaggia and Cornaggia (2013) find that investor paid rating services tend to downgrade issuers more frequently, although they seem to be more timely in adjusting them for bonds that eventually defaults and thus appear to have some advantage over issuer–paid ratings. Relative to the investor–pays model, the trust avoids the possibility of a rating deflation equilibrium. Notably, although not presently modeled, nothing prevents investors from participating in the funding of the trust. Thus, a trust mechanism can be implemented as a hybrid model where both issuers and investors could contribute to funding the trust.

We describe in more details how these different alternatives compare to the trust in Internet Appendix G.

4. Outcome contingent contracts with multiple types

Section 3 uses a stylized setup with two types of investment opportunities $\omega \in \{g, b\}$ and therefore two rating categories. In this section, we show that the stylized setup is without loss of generality. Hence, we analyze the general case which allows for multiple types and therefore ratings. We also present a simple calibrated example of outcome contingent fees that matches the empirical distribution of corporate and structure finance defaults. The example is illustrative but describes an actual implementation of a fee schedule that induces truth-telling on the part of CRAs. We discuss in the Internet Appendix H several aspects that are related to the practical implementation.

4.1. Outcome contingent fees

Moving from two to many types forces us to redefine the concept of outcome contingent fees that was introduced in Section 3.1. The basic idea is that CRAs will get paid for any security that they rate, but the payment will be different according to the outcome. If the project succeeds, the CRA will get paid a certain amount ψ_S; if the project fails the CRA will be paid a different amount ψ_F. The payments will also be different according to the rating category, so that the success fee for a AAA rating will be different than the success fee for a BBB rating. Moreover, this definition of outcome-contingency implies that there will always be a minimum payment corresponding to the issuance of a rating, and that such payment could be paid up-front.

In practice, we envision the trust posting a fee schedule for success (i.e., full repayment of the principle) and failure (i.e., default) for each rating category, along side historical default probabilities corresponding to each rating. Conditional default probabilities are necessary for two reasons: first, they allow CRAs to standardize the meaning of ratings by using the posted probabilities as a reference point. Note that establishing conventions for unobserved parameters is commonplace in financial markets.[16] Second, having standardized the meaning of ratings, the trust will use the posted conditional default probabilities as a basis to compute the relative fees. Intuitively, the trust will pay fees in case of success, ψ_S, that are decreasing with the likelihood of default implied by the rating (i.e., $\psi_S(AAA) > \psi_S(AA) > \ldots \psi_S(BB) > \ldots$). Similarly, fees in case of failure increase with the implied default probability (i.e., $\psi_F(AAA) < \psi_F(AA) < \ldots \psi_F(BB) < \ldots$).

The intuition is quite straightforward. Because there are only two outcomes, repayment and default, the remuneration for success should be the highest when the CRA indicates that the security is more likely to be repaid in full (AAA) while the remuneration for failure should be the highest when the CRA indicates that the security is more likely to default (CCC). The opposite is also true, $\psi_S(.)$ ($\psi_F(.)$) should be the lowest when the CRA indicates that the security is in the class that is most likely to default (succeed).

[16] For example, credit default swap contracts trade openly in the market under the assumption that the bond recovery rate is fixed at some conventional level. Similarly, option prices are quoted in Black and Scholes implied volatility levels under the convention that the risk-free rate used is the one month LIBOR rate.

Thus, $\psi_S(.)$ should an decreasing function of p (i.e., $\frac{d\psi_S(p)}{dp} < 0$) and $\psi_F(.)$ should an increasing function of p (i.e., $\frac{d\psi_F(p)}{dp} > 0$).

4.2. Investment opportunities, information and reputation

We generalize the type of investment opportunities to a continuum, $\omega = p \in (0, 1)$, where investment of quality ω fails with probability p. Without loss of generality, we assume that the unconditional expectation of p, $E[p]$ is known to all parties and it is completely uninformative. As before, the CRA(s) obtains a private signal, θ, regarding the type of investment ω. Given that ω is drawn from a continuum, θ too is drawn from a continuum. The signal θ has precision level e, such that it reveals the true default probability p with probability e and is completely uninformative with probability $(1-e)$. Based on the signal, the CRA forms a conditional expectation of the investment type $\hat{p} = E[p|\theta]$. In practice, as we discuss in Section 6, the CRA can exert some effort to increase the precision of the signal. As the CRA's effort increases, the precision of the signal approaches one and $\hat{p} = E[p|\theta] \to p$.

After forming an expectation about the investment type, the CRA discloses a message (i.e., M) that assigns the security to one rating category. Thus, even though the signal is drawn from a continuum, ratings are discrete, which is the case in practice. As the trust has posted default probabilities that are implied by ratings, the message can be interpreted as the CRA reporting its own conditional expected default probability. Accordingly, the CRA can place the security in the rating group that has a posted default probability equal to $\hat{p}$, or place it above (i.e., inflation) or below (i.e., deflation). As in the two rating case, if the security fails, an audit will be conducted that will reveal the signal observed by the CRA, and therefore the CRA's expectation of the default probability. If the CRA is found to have reported a message different than $\hat{p}$, it loses reputation in proportion to the rating inflation or deflation (where the magnitude of deviation is given by $\epsilon > 0$).

The expected profits, conditional on the information available to the CRA, can therefore be expressed as follows:

$$\begin{aligned}
\pi(M = \hat{p}|\theta) &= (1-\hat{p})\ \psi_S(\hat{p}) + \hat{p}\ \psi_F(\hat{p}) + \rho \\
\pi(M = \hat{p}-\epsilon|\theta) &= (1-\hat{p})\ \psi_S(\hat{p}-\epsilon) + \hat{p}\ \psi_F(\hat{p}-\epsilon) + (1-\epsilon\hat{p})\rho \\
\pi(M = \hat{p}+\epsilon|\theta) &= (1-\hat{p})\ \psi_S(\hat{p}+\epsilon) + \hat{p}\ \psi_F(\hat{p}+\epsilon) + (1-\epsilon\hat{p})\rho \qquad (7)
\end{aligned}$$

Based on the expected profits, it is possible to define conditions for the outcome contingent fees such that the CRA will prefer to report a rating consistent with the conditional default probability $\hat{p}$ rather than deflating (i.e., reporting a rating that implies a higher default probability, $\hat{p}+\epsilon$), or inflating (i.e., reporting a rating that implies a lower default probability, $\hat{p}-\epsilon$).

Proposition 4. *(Generalized truth telling conditions) The fee schedule, $\{\psi_S(\hat{p}, \psi_F(\hat{p}\}$, chosen by the trust, must be in the following space to satisfy the CRA's truth telling conditions:*

$$-\hat{p}\rho \leq (1-\hat{p})\frac{d\psi_S(\hat{p})}{d\hat{p}} + \hat{p}\frac{d\psi_F(\hat{p})}{d\hat{p}} \leq \hat{p}\rho \tag{8}$$

Proof is in the Appendix. Eq. 8 is the necessary and sufficient condition for truth telling as long as the magnitude of deviation is positive, i.e. $\epsilon > 0$, which is the case for us.

In practice, deviation ϵ is meaningful only when it is large enough that the rating category changes. However, truth telling conditions in the above proposition ensure that CRAs do not engage in even small deviations even in a world where ratings granularity is very fine. Thus, the conditions above are more conservative than discrete conditions, and also more tractable as we shall see below.

4.3. Fee schedule example

While many functional forms may satisfy the truth telling conditions presented in (8), for simplicity we chose the following parametrization:

$$\begin{aligned} \psi_S(\hat{p}) &= a + b\ln(1-\hat{p}) \\ \psi_F(\hat{p}) &= c + d\ln\hat{p}, \end{aligned}$$

where ln represents natural logarithm and with $\hat{p} \in [\hat{p}_{\min}, \hat{p}_{\max}]$, and $\hat{p}_{\min} > 0; \hat{p}_{\max} < 1$, the boundary conditions are well-defined. The choice is particularly convenient as it underscores the basic principle that the success fees should be decreasing with $\hat{p}$ (i.e., $\frac{d\psi_S(\hat{p})}{d\hat{p}} < 0$), while the failure fee should be increasing with $\hat{p}$ (i.e., $\frac{d\psi_F(\hat{p})}{d\hat{p}} > 0$). In such a case, the inequalities in Eq. 8 can be rewritten as:

$$-\hat{p}\rho < d - b < \hat{p}\rho \tag{9}$$

For any arbitrary value of ρ, there exists an infinite number choices of b and d that satisfy both inequalities; the simplest is to set $b = d$.

We provide below a simple calibrated example that uses the empirical distribution of historical default probabilities for corporate debt and structured finance products.[17] We impose one additional restriction to the calibration in that minimum expected fee (i.e., the one corresponding to the AAA class) is slightly larger than the up-front fee that CRA currently charge (i.e., approximately six basis points for rating corporate issuances and eleven basis points for structured finance products).[18] Notably, as discussed in the previous section the average fee paid to the CRA could be higher than the current standard, depending on the size of the surplus generated by introducing the trust. Setting $a = 6$, $b = d = 3$ and $c = 33$ for corporate issuances, and $a = 11$, $b = d = 4.2$ and $c = 33$ for structured finance issuances yields the following fees structure:

	Corporate				Structured Finance			
Rating	Default Prob.	ψ_S	ψ_F	E[ψ]	Default Prob.	ψ_S	ψ_F	E[ψ]
AAA	0.01%	6.000	5.369	6.000	0.40%	10.983	9.810	10.978
AA	0.02%	5.999	7.448	6.000	0.75%	10.968	12.450	10.979
A	0.06%	5.998	10.744	6.001	1.10%	10.954	14.059	10.988
BBB	0.20%	5.994	14.356	6.011	2.00%	10.915	16.570	11.028
BB	1.20%	5.964	19.731	6.129	3.50%	10.850	18.920	11.133
B	4.50%	5.862	23.697	6.664	7.50%	10.673	22.121	11.531
CCC	15.50%	5.495	27.407	8.891	25.00%	9.792	27.178	14.138

The calibrated example of fee schedule above matches the intuition regarding the relative magnitudes of fees described in Section 4.1. Although the actual fees presented in the table are function and parameter specific, the exercise allows us to draw some very basic conclusions. First, one important implication of the example reported in the table is that the CRA is paid a positive amount in each state of the world (i.e., for each rating that is issued). For example, in case the CRA rates a corporate security as AAA, the worst case scenario is that the security fails and the CRA is paid 5.369 basis points. For a security that is issued as a CCC, the worst case scenario for the CRA is that the security succeeds, in which case the

[17] For corporate debt historical default rates see Moody's Investor Service (2011); for structured finance historical default rates see Standard & Poor's Ratings Services (2013) and DBRS (2013).

[18] Standard & Poor's Standard & Poor's Ratings Services (2015) reports charging up to 6 basis points for corporate issuances and up to 11 basis points for structured finance. The numbers seem to be relatively unchanged in the recent years. For example, the Financial Crisis Inquiry Commission (2011) reports that CRA were charging between $250,000 and $500,000 to rate a CDO. Griffin, Lowery, and Saretto (2014) report that the average CDO size was about 450 million USD. Hence rating fees for structured finance were likely between six and 11 basis points during the crisis.

trust will pay 5.495 basis points. Because the minimum payments are “guaranteed” to be positive, they could also be paid up-front in a similar fashion to what currently happens under the issuer-pays model. If each CRA rates enough securities through the trust, the minimum fee could even be larger and based on the performance of a basket based on the worst case scenario (i.e., all securities that are CCC are given a rating equal to AAA).

Second, the magnitude and the dispersion of default probabilities across rating classes are major determinants of fee differences across ratings. Outcome contingent fees are much more important for securities for which default probabilities separate across ratings, as for example structured finance, than they are for securities that have low separation, as for example corporate debt.

Third, some guarantee would have to be put in place so that the trust does not become insolvent. A major deviation in actual default probabilities from the ones used as a reference by the CRA and by the trust, for example similar to what happened during the financial crisis, could force the trust to make very large payments. The market offers protection and the trust could in fact buy insurance in the CDS market and transfer the cost to the issuers. Note that in this particular case, the protection would have to cover only a small fraction of the principal amount. For example, if all CCC securities were to default, the trust would have to pay 25 basis points in rating fees to CRA, as opposed to having to pay an expected fee between 8.891 and 14.138 basis points, for corporate and structured finance respectively. The trust would hence need to buy insurance for a notional amount equal to the difference (i.e., about 11 to 16 basis points), either by purchasing single name CDS or a basket contract such as the CDX NA High Yield (which historically has averaged at 102 basis points). Assuming an average life of 10 years, the total additional cost to the issuer would amount to a one or two basis points.

Altogether, the exercise suggests that convincing the CRAs of the benefits of the new system might not be hard, since the magnitude of surplus needed to incentivize participation and truth telling by CRAs is not that big. In expectation, the CRAs receive higher expected fees under the trust alternative than fees paid in the current system. These additional fees are paid from the surplus generated due to investment by sophisticated investors in a truth-telling equilibrium under the trust.

5. Incentives of the trust

An important question arises as to what incentives the trust has and, consequently, whether it is possible that strategic actions taken by issuers or the CRA can eliminate the benefits to investors suggested in the previous section, specifically more accurate ratings. As presently stated, the trust's only source of revenues comes from the administrative fee charged to the issuers upon accepting to procure a rating for the newly issued (to be issued) security.

If we consider that the trust may be a profit maximizing organization, as opposed to a simple pass-through structure, then one could envision that placing an intermediary between the issuer and the CRA would only move the agency conflict one step away in the economics of the rating industry. Instead of compromised CRAs, we could end up with compromised trusts.

Essentially the possibility is that, in order to increase profits, the trust could promise an inflated rating to issuers and then actually deliver on such a promise. A simple request to the CRA to provide an inflated rating however does not lead to compliance because the fees structure maximizes the CRA's profits only if the CRA is truthfully revealing its signal (See Eqs. 2 and 8). Thus, the only two ways such an arrangement could work are by means of (i) side payments from the issuer (or the trust) to the CRA and/or (ii) rating fees that departs from truth telling.

5.1. Unobservable side-payments

The first concern is that issuers provide side-payments to the CRAs through or without the trust. The trust could, on behalf of the issuer, approach the CRA with a proposal for a cash bonus in exchange for a good rating. Such a bonus would have to be large enough to compensate the CRA for the expected reputation and future business losses due to always providing a good rating, in spite of the rating fee structure that rewards truth telling. The issuer could also directly approach the CRA with a similar proposal. After obtaining the unenforceable contract from the CRA that an inflated rating will be issued, the issuer would then proceed to contact the trust, which could be uninformed regarding the side deal. The sophisticated investor would also be uninformed in both cases, as it would only be able to observe that the fee structure put forth by the trust respects the truth-telling conditions.

Side payments are not really tractable in the context of our model. Differently from Jackson and Wilkie (2005), for example, the side contract could not be publicly observable or enforceable as in our context it basically constitutes securities fraud. In the U.S., the applicable crime is "honest services fraud" as defined in 18 U.S.C. §1346 (the federal mail and wire fraud statute). Therefore, as it is the case for many other types of commercial transactions, the only defense against such actions would reside in the legal system.

5.2. Information asymmetry regarding CRA primitives

Another relevant concern is that the only source of information asymmetry in the model is regarding the actual signal that only CRAs observe. The issuer, the trust and the sophisticated investors are all aware of the precise value of the parameters that are needed to construct the truth telling conditions (i.e., the fee structure). Therefore, in the context of the model, a fee structure that deviates from the truth telling conditions would be immediately recognized by the sophisticated investors, who would then revert back to the equilibrium in which ratings are completely uninformative (to them) of the true value of the security. Upon discovering that the truth telling conditions have been compromised, the sophisticated investors would withdraw from the market. At that point the issuer would be better off avoiding the trust all-together and approaching the CRA directly. If that happens the trust would have no reason to exist and the mechanism unravels.

It is important to note, however, that this internal robustness of the trust mechanism depends heavily on the assumptions that we have made. In particular, the fact that certain investors infer the exact structure of the optimal fees might seem unrealistic. In particular, it is not unreasonable to assume that some information asymmetry might exist relative to the parameters that characterize the rating agency, such as the value of reputation, ρ, or the precision of the signal, e.

For example, let's assume that the reputation cost can be either high (ρ_H) or low (ρ_L) and only the CRA has private information about its true type (ρ_H/ρ_L), where $\rho_H > \rho_L$. When the sophisticated investor believes the cost to be high, the CRA and the trust can collude by confirming the investor beliefs, even if the true reputation cost is low. This would lead to a situation where the trust could set up a fee structure that effectively violates the true truth-telling conditions (i.e., the ones based on the true reputation cost; see Eqs. 2 and 8). In collusion with the issuer, the trust could set the fees such that the CRA would have an incentive to give a good rating (even if the signal is bad), thus creating an inflation equilibrium. A similar situation could arise if the uncertainty regards the precision parameter e (i.e., if the sophisticated investors believe precision to be high, when in fact it is low). Notably, information asymmetry here has more to do with whether the sophisticated investors are sophisticated enough regarding CRA primitives, rather than with the trust organization. Yet, the case serves as a reasonable background to analyze how the incentives of the trust can be different than our main analysis.

There are two possible mechanisms that can ensure that the trust alternative survives such information asymmetry. First, the fees structure could include an additional payment to ensure that the no-inflation condition holds with a "margin of error." Second, in a repeated game setting, the sophisticated investors would update their beliefs, and therefore eventually the trust is punished for colluding with the CRA and the investor. Essentially, the sophisticated investors punish the trust by refusing to buy the security every time the specific trust intermediary is involved. At this point the trust would have no reasons to exist and would lose all business to competing trusts.

Thus, from the point of view of a profit maximizing trust, there exists an inter-temporal trade-off similar to the one presented to the CRA in the original game (i.e., the trust could collude with the issuer and CRA against the investors and therefore increase profits in the short term or refuse any side deal and maximize long term stream of profits). However, unlike the CRAs in Bolton, Freixas, and Shapiro (2012), who maintain survival despite inflating ratings due to their ability to obtain signal about issuance quality and extract surplus, a colluding trust loses its entire purpose of existence if ratings are inaccurate. This is because issuers can always directly approach CRAs. We do not analyze this problem in detail due to the above discussed similarity, but note that (i) participation of the sophisticated investor in the funding of the trust, (ii) competition among trusts, and (iii) the sole purpose of the existence of the trust as a mechanism to ensure accuracy, can eliminate the short term incentives of a profit maximizing trust to increase revenue at the expense of long term profits.

6. Endogenous effort choice

In this section, we return to the more tractable setup described in section 3 and allow CRAs to exert effort to improve the precision of the signal they receive. The extension enables us to address questions about the optimal level of due-diligence chosen by the CRAs, and provides several key insights into the incentive compatible payment scheme by the trust.

Moreover, the addition of effort choice allows us to analyze the effect of competition among CRAs. In Section 3, we have described how the trust mechanism can remove the ability of issuers to shop for ratings that when CRAs can only compete on the dimension of price (i.e., the fees required to issue a rating). This section shows that the trust alternative can create additional positive externalities that improve the welfare of investors, by forcing CRAs to compete along the dimension of effort and ratings accuracy.

6.1. Effort and signal precision

We define $\underline{e}$ as the precision that corresponds to zero effort, and e as the precision level that can be chosen in the domain $[\underline{e},\ 1]$ by exerting some costly effort. The cost of effort is equal to $\frac{c}{2}(e-\underline{e})^2$ for a chosen precision e, where c is a scaling parameter. The effort exerted by the CRA is not observable. However, the trust and the sophisticated investors can infer from the outcomes what the precision of the signal e is. In other words, we assume that the sophisticated investors and the trust understand the mapping of effort to outcome in terms of accuracy of ratings, and that the mapping of effort to outcome is the same for every issuance rated by a CRA. Even though an individual issue's outcome may provide a noisy estimate of the effort of the CRA, in practice, sophisticated investors and the trust will observe the outcomes of a large number of issuances that the CRA rates. This will allow an estimate of the effort of a CRA with converging estimation error, as long as the errors are not perfectly correlated.

6.2. One CRA

In the original setup, a CRA does not choose an effort level higher than the least costly one (i.e., $\underline{e}$). In fact, in the inflation equilibrium, where the CRA always issues the good report, and the fees are paid up front, there is no way for a CRA to credibly signal the amount of effort exerted.

In contrast, in presence of the trust, the fees are paid upon verification of outcome. This provides a CRA incentive to increase the precision of the signal. The truth telling and participation constraints in presence of effort in case of one CRA are in Appendix D.

Let the minimum fees that ensures truth-telling and participation of the CRA be denoted by $\left\{\hat{\psi_S^M}, \hat{\psi_F^M}\right\}$, where the superscript M indicates that those are the monopoly fees. Given the posted fees, the CRA optimizes signal precision choice e^* as a function of the payoff from truthfully rating the security and the cost of effort:[19]

$$e^*_M = \underset{(e>\underline{e})}{\arg\max}\left\{\frac{1-p+ep}{2}\hat{\psi}^M_S + \frac{ep}{2}\hat{\psi}^M_F + \rho - \frac{1}{2}c(e-\underline{e})^2\right\}$$

First order condition with respect to e yields:

$$e^*_M = \underline{e} + \frac{p}{2c}(\hat{\psi}^M_S + \hat{\psi}^M_F) \tag{10}$$

Note that, for any positive fees, the optimal precision chosen is higher than $\underline{e}$. Therefore, in presence of the trust, a CRA exerts more effort than in the situation where there is no trust and issuers face CRAs directly. Also, the optimal precision depends on the sum of the fees. Given that success and failure of an issuance are not equally likely, the trust can therefore induce a higher effort by choosing an appropriate combination of ψ_F and ψ_S.

Proposition 5. *(Fees chosen by the trust to induce optimal effort) The trust chooses fees, $\{\hat{\psi}^M_S, \hat{\psi}^M_F\}$, to induce the CRA to exert optimal effort e^* such that:*

1. $\hat{\psi}^M_F > \hat{\psi}^M_S$,
2. *fees satisfy participation constraint and truth telling conditions of the CRA, evaluated at e^*,*
3. *fees satisfy incentive compatibility constraint of the issuer if a signal precision higher than $\underline{e}$ increases the security issuance amount more than it increases the expected fees:*

$$\left(V^G(e^*) + \frac{1}{4}V^B(e^*)\right) - \left(V^G(\underline{e}) + \frac{1}{4}V^B(\underline{e})\right)$$

$$\geq \left[(1-p+e^*p)\ \psi^M_S(e^*) + e^*p\ \psi^M_F(e^*)\right] - \left[(1-p+\underline{e}p)\ \psi^M_S(\underline{e}) + \underline{e}p\ \psi^M_F(\underline{e})\right]$$

[19] With $\frac{1}{2}$ probability the CRA gets the good signal, and report G; with probability e the project is in fact good, and hence the CRA gets paid ψ^M_S. With probability $(1-e)$ the project is bad, but it succeeds with probability $(1-p)$, in which case the CRA again gets paid ψ^M_S. With probability $\frac{1}{2}$ probability the CRA gets the bad signal, and report B; with probability e the project is bad and it fails with probability p, in which case the CRA gets paid ψ_F. The CRA also maintain its reputation.

$$\frac{1}{2}\left[e\psi^M_S + (1-e)(1-p)\psi^M_S\right] + \frac{1}{2}\left[ep\psi^M_F\right] + \rho$$

Proof is in the Appendix. The proof shows that conditional on truth telling conditions being satisfied, the trust can push the CRA to exert effort by increasing ψ_F^M at the cost of ψ_S^M.

6.3. Two CRAs

Similar to the case with only one CRA, and for the exact same reasons, the equilibrium choice of effort in the original duopoly game is not to exert any effort. As in Section 6.2, in presence of a trust, outcome contingent fees will induce additional effort. Each CRA chooses the optimal precision level e_D^* such that:

$$e_D^* = \underline{e} + \frac{p}{2c}(\hat{\psi_S^D} + \hat{\psi_F^D}) \tag{11}$$

e_D^* may not be equal to e_M^*, as fees chosen in duopoly, $\{\psi_S^D, \psi_F^D\}$, differs from those chosen by the trust when facing a monopolistic CRA, $\{\psi_S^M, \psi_F^M\}$.

Since the optimal precision choice of one CRA does not depend on the other CRA, competition between CRAs does not appear to aid in increasing social welfare. However, the feature of outcome contingent fees of the trust can be further exploited to increase social welfare, by encouraging competition among CRAs to produce more accurate ratings. One such mechanism is a participation deposit paid into an escrow account.

The escrow mechanism

The trust can introduce an additional compensation to one CRA that correctly predicts an outcome when the other CRA fails to predict the outcome correctly. CRAs are asked to fund an escrow account as a requirement to participate in the game. Each CRA deposits a sum equal to X^D.

When the outcome is realized, the escrow account is liquidated by the trust in a manner proportional to the accuracy of the predictions made by the CRAs. With two CRAs and a binary outcome, one CRA will receive the entire escrow account, $2X^D$, if it makes a correct prediction that the other CRA misses.[20]

[20] In practice, the fee schedule would look like the one presented in Section 4.3. In that case, the concept of an escrow mechanism would still be meaningful. One possibility is that part of the upfront payment to the CRAs would be retained and deposited in an escrow account. At maturity of the security, the account balance would be used to make additional payments to the CRAs in proportion to their projections. For example, let us say that two CRAs disagree on a security and one rates it AA and the other BBB. The balance of the escrow account could be used to increase the success payments for the AA rating and the failure payments for the BBB rating.

The additional payment creates an incentive for each CRA to produce a rating that is more accurate than the rating produced by the other CRA. The more the two CRAs compete over effort, the more precise their signals become, thus making it more unlikely that one of the two will actually receive the payment. In equilibrium, the CRAs exert the same effort and therefore in expectation they both receive back the amount that was originally deposited in the escrow account. However, if one of the CRA shirks, it will lose escrow payments in expectation.

The truth-telling and participation conditions for the two CRAs are in Appendix F. The four inequalities define the space of feasible fees that the trust can set.[21]

We now consider the CRA choice of the optimal signal precision e_D^* as a function of the payoff and the cost of effort under a two CRA regime with an additional payment for different ratings:

$$e_D^* = \underset{(e>\underline{e})}{\arg\max} \left\{ \frac{1-p+ep}{2}\hat{\psi_S^D} + \frac{ep}{2}\hat{\psi_F^D} + (e-f)p\hat{X^D} + \rho^D - \frac{1}{2}c(e-\underline{e})^2 \right\},$$

where e and f represent the level of precision chosen by the two CRAs respectively.

Note that the payoff to the CRA is increasing in his own effort e with respect to $\hat{X^D}$, but decreasing in his opponent's effort f. This is because an increase in the precision of each CRA increases the probability that he receives the bonus payment $2X^D$ by generating the correct signal. Consequently, each CRA will have an incentive to produce an accurate signal at the expense of their opponent.

First order condition with respect to e yields:

$$e_D^* = \underline{e} + \frac{p(\hat{\psi_S^D} + \hat{\psi_F^D} + \hat{X_F^D})}{2c} \tag{12}$$

[21] As before, the issuer delegates the trust to pay the minimum expected fees that maximize the proceeds raised from issuing the security. Therefore, the choice of fees $\{\hat{\psi_S^D}, \hat{\psi_F^D}\}$, will satisfy the CRA participation constraint with an equality, where the superscript D indicates duopoly. As in Section 6.2, the issuer is willing to pay fees that maximize the CRA effort if a higher precision increases the amount raised by issuing the security

$$\frac{1}{2}[e^{*2} + (1-e^*)^2]2V^{GG}(e^*) + \frac{1}{2}[e^{*2} + (1-e^*)^2]\frac{1}{2}V^{BB}(e^*) + 2(e^* - e^{*2})V^0 -$$
$$- \left\{ \frac{1}{2}[\underline{e}^2 + (1-\underline{e})^2]2V^{GG}(\underline{e}) + \frac{1}{2}[\underline{e}^2 + (1-\underline{e})^2]\frac{1}{2}V^{BB}(\underline{e}) + 2(\underline{e} - \underline{e}^2)V^0 \right\}$$

more than it increases the expected fees

$$[(1-p+e^*p)\psi_S + e^*p\psi_F] - [(1-p+\underline{e}p)\psi_S + \underline{e}p\psi_F]$$

Since both CRAs are symmetric, the equilibrium effort is the same for both CRAs. Note that the solution to the individual effort problem e^* does not depend on the equilibrium effort of the opponent. This is partially the result of the prisoner's dilemma style setup for the liquidation of the escrow account. It is always optimal for one CRA to exert slightly more effort to increase the signal precision even though, in equilibrium, the choice will be cancelled out by the opponent's choice. An increase in precision decreases the probability that the two CRAs will disagree unconditionally since two more accurate CRAs are unconditionally less likely to disagree on their opinions of true type.

6.4. Optimal Effort Level for One vs. Two CRAs

To demonstrate that competition can have a positive effect on the equilibrium signal precision, we need to show that for some level of compensation X^D, the trust can induce a higher equilibrium precision in the presence of another CRA than in the one-CRA case. Comparing the solutions for optimal effort in a duopoly and a monopoly, we need to show that $e^*_D > e^*_M$.

From equations (10) and (12), the effort in a duopoly is higher than in a monopoly if the size of the escrow account is larger than the difference between the sum of fees in monopoly and the sum of fees in duopoly

$$2X^D > \left[(\psi_S^M + \psi_F^M) - (\psi_S^D + \psi_F^D)\right]$$

The CRA participation constraint guarantees that the monopoly fees will be higher than the duopoly fees. However, the difference in fees should be decreasing in the number of market participants, so that, for example, the size of the escrow account when going from three to four CRAs should be smaller than the size required to make two CRAs exert more effort than one. Eventually, competition should lead to many CRAs willing to participate in the market in exchange for a small escrow payment.

7. Conclusion

Much of the debate surrounding credit rating agencies and the recent financial crisis has centered around the conflict of interests existing in the current issuer-pays system. Many research papers and industry expertise depositions have attested to the inadequacy of the status quo.

To address existing problems in the credit ratings market, we analyze in detail a platform-pays market design, where an intermediary exists between issuers and rating agencies. The approach has several advantages over the various proposals that are currently being discussed. First, it offers a commitment mechanism that guarantees the enforcement of contracts that are currently not renegotiation proof and thus lead to ratings inflation (i.e., issuers strongly prefer to buy only good ratings). Second, by eliminating direct negotiation between issuers and CRAs, the intermediary eliminates the possibility that the issuer forces the CRAs into taking particular actions, by threatening to contract with a different CRA (i.e., ratings shopping). Third, because payments are structured as contingent upon outcomes, when a CRA can exert costly effort to increase the precision of signals, the trust can set fees that can lead a CRA to optimize signal precision. Moreover, the precision increase is larger in duopoly than in monopoly, when the trust is allowed to require the CRAs to fund an escrow account that will be liquidated when the investment is realized in a manner that is proportional to the accuracy of the ratings issued by competing CRAs. Finally, outcome contingent aggregate payments ensure precise calibration of fees against ratings quality and can be constructed so that some of the payment can be anticipated to the CRA upon issuance of the rating.

Two issues that we have not addressed in this work, and welcome future work on, are how should the contract change over the business cycle, and how CRAs should be incentivized to keep updating the rating after issuance. This is important, because Griffin and Tang (2012) show that CRAs made positive adjustments to ratings during the housing boom, and Bar-Isaac and Shapiro (2013) find that ratings quality is counter-cyclical. Dynamic updating of ratings through provision of incentives over the business cycle and over the life-cycle of a firm requires an asset-pricing framework with dynamic contracting features, and is beyond the scope of our paper. We believe that such a model will be an important contribution should researchers choose to pursue it in the future.

From a practical point of view, perhaps the most interesting feature of the trust alternative is that it requires minimal intervention on the part of any regulatory authority. Adversarial regulation often leads to unintended consequences as financial intermediaries try to hide from or subvert the interests of regulators. By creating a market oriented mechanism that increases incentive alignment for all parties, the solution described in this paper reduces frictions between regulators and markets and adds greater transparency to the ratings process.

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Figure 1
Game tree with one CRA

This figure presents the sequence of actions of the basic game in Bolton, Freixas, and Shapiro (2012) for the case where there is only one CRA. The sequence is as follows: nature draws a signal, θ, which is observed by the CRA. The CRA compiles a report M. The issuer decides to buy or not buy the report. Investors decides how much of the project they want to finance.

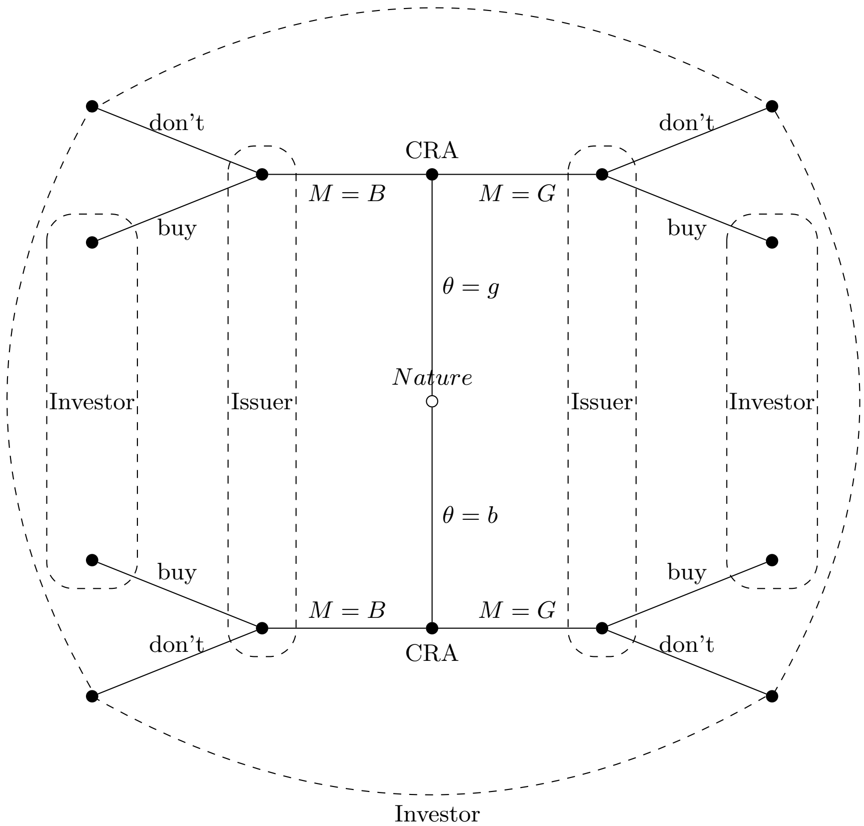


Figure 2
Inflation equilibrium with one CRA and an option to approach the trust

This figure presents the sequence of actions of the modified game with the inclusion of the trust for the case where there is only one CRA and the economy is in an inflation equilibrium. The sequence is as follows: nature draws a signal, θ, which is observed by the CRA. The CRA compiles a report M. The issuer decides to buy or not buy the report, or whether to approach the trust. If the issuer approaches the trust, a set of outcome contingent fees is set so to guarantee truth telling. All investors then fund the project for the maximum amount.

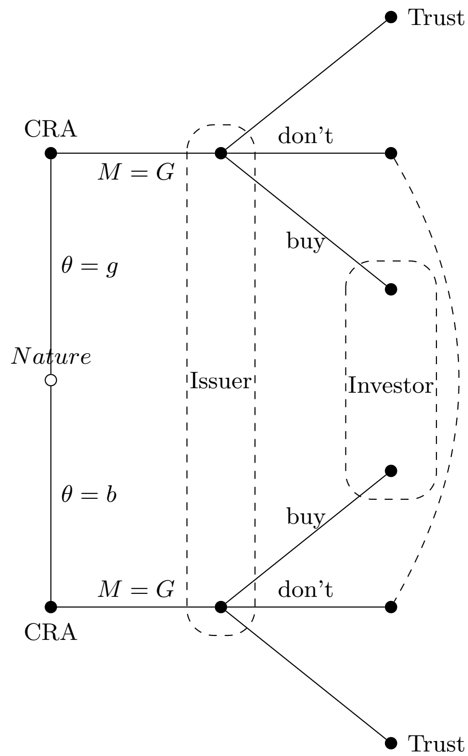
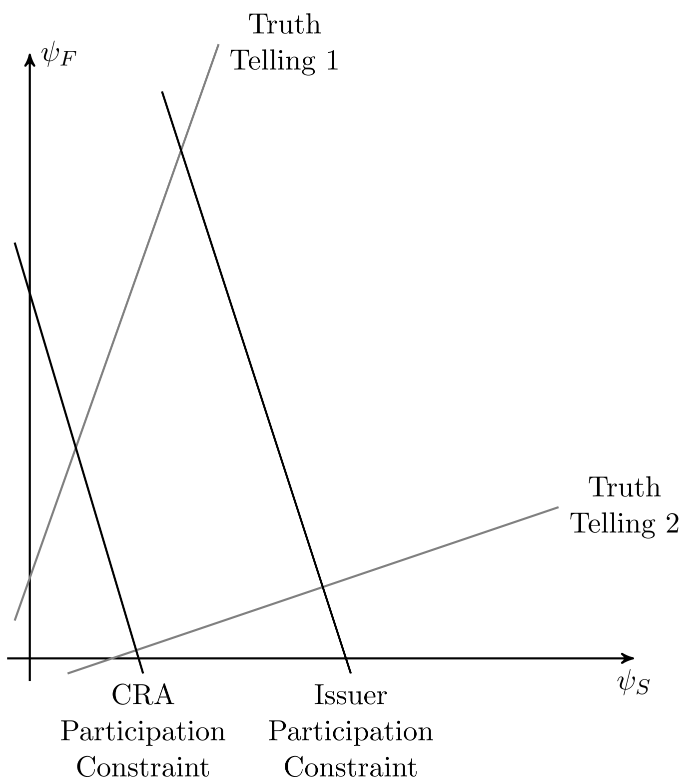


Figure 3
Feasible fees

This figure shows the space of feasible fees that the trust can pay to the CRA. The space of feasible fees is defined by the truth telling conditions that the trust want to guarantee and by the participation constraints. If the trust sets fees to the left of the truth telling condition number one, then the CRA will always report that the issue is going to fail. If the fees are to the right of the second truth telling condition, the CRA will always report that the issue will succeed. If the fees lie below the CRA participation constraint, the CRA will hold out and refuse to deal with the trust. If the fees lie above the issuer participation constraint, the issuer is better off dealing directly with the CRA and triggering the inflation equilibrium.



Internet Appendix

A. Proposition 2

Proposition 2. *(Participation Constraint) The following conditions must hold respectively for the issuers and CRA to choose to participate in the trust:*

$$\psi_F^M \leq \frac{1}{ep}\left(2V^G + \frac{1}{2}V^B - 2V^0\right) - \psi_S^M\left(1 + \frac{1-p}{ep}\right) \tag{3}$$

$$\psi_F^M \geq \frac{1}{ep}\left(4\alpha V^G - 2V^0 - 2ep\rho\right) - \psi_S^M\left(1 + \frac{1-p}{ep}\right) \tag{4}$$

Inequality (3) is derived from the issuer participation constraint. The issuer will participate in the trust if and only if the amount of project financed minus the transfer to the trust, which has to equal to the expected fees that are to be paid to the CRA, is larger than what the issuer gets if she approaches the CRA directly in the inflation equilibrium.

The amount that is financed if the issuer approaches the trust is $2V^G$ when the signal is good, as all investors invest two units in the project, and $\frac{1}{2}V^B$ when the signal is bad. Given that the probability that the CRA observes a good signal is equal to $\frac{1}{2}$ we obtain that the expected amount raised by the issuer when dealing with the trust is equal to $\frac{1}{2}(2V^G) + \frac{1}{2}(\frac{1}{2}V^B)$.

The issuer also has to make a transfer to the trust which has to be at least as large as the expected fee that the trust will have to pay to the CRA. If the CRA sends a message G, because it is truthfully reporting, it must have observed the good signal, $\theta = g$. Therefore with probability e the project is in fact good in which case the monopolistic CRA gets paid ψ_S^M. Also, with probability $(1-e)$ the project is bad, but succeeds with probability $(1-p)$, in which case again the CRA gets paid ψ_S^M. If the CRA sends a message B, then it must have observed the bad signal. With probability e the project is in fact bad and hence will fail with probability P, in which case the CRA gets paid ψ_F^M. Therefore the transfer from the issuer to the trust will equal to $\frac{1}{2}\left[\left(e\psi_S^M + (1-e)(1-p)\psi_S^M\right)\right] + \frac{1}{2}\left[ep\psi_F^M\right]$.

If the issuer approaches the CRA it raises $2\alpha V^G$ from the trusting investors and pays fees to the CRA equal to $2\alpha V^G - V^0$.

The issuer participation constraint therefore becomes:

$$\frac{1}{2}\left[2V^G - \left(e\psi_S^M + (1-e)(1-p)\psi_S^M\right)\right] + \frac{1}{2}\left[\frac{1}{2}V^B - ep\psi_F^M\right] \geq 2\alpha V^G - (2\alpha V^G - V^0)$$

Rearranging terms and solving for ψ_F^M we obtain (3).

Inequality (4) is derived from the CRA participation constraint. Although not strictly necessary, we impose that to obtain voluntary participation, the CRA revenues generated under the trust must be at least as large as those generated when the issuer approaches the CRA directly. Under the trust mechanism, the CRA is paid only when the rating matches the outcome of the project. With $\frac{1}{2}$ probability the CRA gets the good signal, and report G; with probability e the project is in fact good, and hence the CRA gets paid ψ_S^M. With probability $(1-e)$ the project is bad, but it succeeds with probability $(1-p)$, in which case the CRA again gets paid ψ_S^M. With probability $\frac{1}{2}$ probability the CRA gets the bad signal, and report B; with probability e the project is bad and it fails with probability p, in which case the CRA gets paid ψ_F. The CRA also maintain its reputation. The expected payoff to the CRA for dealing with the trust is then equal to:

$$\frac{1}{2}\left[e\psi_S^M + (1-e)(1-p)\psi_S^M\right] + \frac{1}{2}\left[ep\psi_F^M\right] + \rho$$

If the issuer approaches the CRA directly, then, in the inflation equilibrium, the CRA gets paid $2\alpha V^G - V^0$, whether it draws the good or the bad signal. The CRA maintains the reputation only if the project does not fail. We obtain

$$\frac{1}{2}\left[e\psi_S^M + (1-e)(1-p)\psi_S^M\right] + \frac{1}{2}\left[ep\psi_F^M\right] + \rho \geq 2\alpha V^G - V^0 + (1-ep)\rho$$

Rearranging terms and solving for ψ_F we obtain (4).

B. Proposition 3

Proposition 3. *(Participation Constraint in CRA Duopoly) The following conditions must hold respectively for the issuer and CRAs to choose to participate in the trust:*

$$\psi_F^D \leq -\psi_S^D\left(1 + \frac{1-p}{ep}\right) + \frac{1}{ep}\left(\left(\frac{1}{2} - e + e^2\right)\left(2V^{GG} + \frac{1}{2}V^{BB}\right) + 2(e-e^2)V^0 - \alpha(4V^G - 2V^{GG})\right) \quad (5)$$

$$\psi_F^D \geq -\psi_S^D\left(\frac{1-p+ep}{ep}\right) + \frac{1}{ep}\left(4\alpha(V^{GG} - V^G) - ep\rho^D\right) \quad (6)$$

Inequality (5) is derived from the issuer participation constraint. The issuer will participate in the trust if and only if the amount of project financed minus the fees that are paid to the CRAs is large under the trust than it is if the issuer approaches the CRAs directly in the inflation equilibrium.

Because there are two CRAs, three outcomes need to be considered: both CRAs draw a good signal; both CRA draw a bad signal; the signals are split. The probabilities of these three events are as follow:

$$\begin{aligned}
Prob(\theta_1 = g, \theta_2 = g) &= \frac{1}{2}[e^2 + (1-e)^2] \\
Prob(\theta_1 = g, \theta_2 = b) &= \frac{1}{2}[e(1-e) + (1-e)e] \\
Prob(\theta_1 = b, \theta_2 = g) &= \frac{1}{2}[(1-e)e + e(1-e)] \\
Prob(\theta_1 = b, \theta_2 = b) &= \frac{1}{2}[e^2 + (1-e)^2]
\end{aligned}$$

Therefore, if the both CRAs draw a good signal, they will report the good message. The investors fund two units of the project at a valuation of $2V^{GG}$. If both CRA draw the bad signal, they will post a bad report, and the investors only fund one half unit of the project at a valuation equal to V^{BB}. If the signals are split, so will the reports, and the investors only fund one unit of the project at a valuation equal to V^0. The amount funded therefore equals:

$$\frac{1}{2}\big[(1-e)^2 + e^2\big]2V^{GG} + \frac{1}{2}\big[(1-e)^2 + e^2\big]\frac{1}{2}V^B + 2(e - e^2)V^0$$

The issuer has to pay an upfront amount to the trust equal to expected fees that the trust will have to pay to the CRAs.

$$\frac{1}{2}\big[(1-e)^2 + e^2\big]\big[2\big(1 - \frac{(1-e)^2}{(1-e)^2 + e^2}p\big)\psi_S^D\big] + \frac{1}{2}\big[(1-e)^2 + e^2\big]\big[2\big(\frac{e^2}{(1-e)^2 + e^2}p\psi_S^D\big)\big] +$$

$$+2(e - e^2)\big[(1 - \frac{p}{2})\psi_S^D + \frac{p}{2}\psi_F^D\big]$$

If the issuer approaches the CRA it raises $2\alpha V^{GG}$ from the trusting investors and pays fees to both CRAs

$$2\alpha V^{GG} - 4\alpha(V^{GG} - V^G)$$

We obtain:

$$\frac{1}{2}\big[(1-e)^2 + e^2\big]\big[2V^{GG} - 2\big(1 - \frac{(1-e)^2}{(1-e)^2 + e^2}p\big)\psi_S^D\big] + \frac{1}{2}\big[(1-e)^2 + e^2\big]\big[\frac{1}{2}V^B - 2\big(\frac{e^2}{(1-e)^2 + e^2}p\psi_S^D\big)\big] +$$

$$+2(e - e^2)\big[V^0 - (1 - \frac{p}{2})\psi_S^D - \frac{p}{2}\psi_F^D\big] \geq 2\alpha V^{GG} - 4\alpha(V^{GG} - V^G)$$

Rearranging terms and solving for ψ_F^D we obtain (5).

Inequality (6) is derived from the CRAs participation constraint. Although not strictly necessary, we impose that to obtain voluntary participation, the CRAs revenues generated under the trust must be at least as large as those generated when the issuer approaches the CRAs directly. Under the trust mechanism, the CRAs are paid only when the rating matches the outcome of the project. With $\frac{1}{2}$ probability the CRA gets the good signal, and report G; with probability e the project is in fact good, and hence the CRA gets paid ψ_S^D. With probability $(1-e)$ the project is bad, but it succeeds with probability $(1-p)$, in which case the CRA again gets paid ψ_S^D. With probability $\frac{1}{2}$ probability the CRA gets the bad signal, and report B; with probability e the project is bad and it fails with probability p, in which case the CRA gets paid ψ_F^D.

$$\frac{1}{2}\left[e\psi_S^D + (1-e)(1-p)\psi_S^D\right] + \frac{1}{2}\left[ep\psi_F^D\right] + \rho^D$$

If the issuer approaches the CRAs directly, then, in the inflation equilibrium, the CRAs get paid $2\alpha(V^{GG} - V^G)$, whether it draws the good or the bad signal. We obtain:

$$\frac{1}{2}\left[e\psi_S^D + (1-e)(1-p)\psi_S^D\right] + \frac{1}{2}\left[ep\psi_F^D\right] + \rho^D \geq 2\alpha(V^{GG} - V^G) + (1-ep)\rho^D$$

Rearranging terms and solving for ψ_F^D we obtain (6).

C. Proposition 4

Proposition 4. *(Generalized truth telling conditions) The fee schedule,* $\{\psi_S(\hat{p}, \psi_F(\hat{p})\}$*, chosen by the trust, must be in the following space to satisfy the CRA's truth telling conditions:*

$$-\hat{p}\rho < (1-\hat{p})\frac{d\psi_S(\hat{p})}{d\hat{p}} + \hat{p}\frac{d\psi_F(\hat{p})}{d\hat{p}} < \hat{p}\rho \tag{8}$$

We specify here the truth-telling conditions under which the CRA prefers to report the expected conditional default probability (i.e., conditional on what is in the CRA information set), rather than deflating (i.e., reporting a rating that implies a higher default probability), or inflating (i.e., reporting a rating that implies a lower default probability).

No deflation condition

To ensure that the CRA prefers not to deflate, it must be the case that the expected conditional payoff from truthfully reporting must be higher than the payoff from deflating:

$$\pi(M = \hat{p}|\theta) > \pi(M = \hat{p} + \epsilon|\theta),$$

which yields:

$$(1-\hat{p})\psi_S(\hat{p}) + \hat{p}\psi_F(\hat{p}) + \rho > (1-\hat{p})\psi_S(\hat{p}+\epsilon) + \hat{p}\psi_F(\hat{p}+\epsilon) + (1-\hat{p}\epsilon)\rho.$$

After dividing both sides by $d\hat{p} = (\hat{p} + \epsilon - \hat{p})$ we obtain:

$$(1-\hat{p})\frac{[\psi_S(\hat{p}+\epsilon) - \psi_S(\hat{p})]}{\epsilon} + \hat{p}\frac{[\psi_F(\hat{p}+\epsilon) - \psi_F(\hat{p})]}{\epsilon} < \hat{p}\rho$$

In the limiting case $\epsilon \to 0$, we have:

$$(1-\hat{p})\frac{d\psi_S(\hat{p})}{d\hat{p}} + \hat{p}\frac{d\psi_F(\hat{p})}{d\hat{p}} < \hat{p}\rho \tag{13}$$

No inflation condition

Similarly, to ensure that CRA prefers not inflating, the payoff from truthfully reporting must be higher than the payoff from inflating:

$$\pi(M = \hat{p}|\theta) > \pi(M = \hat{p} - \epsilon|\theta)$$

which yields:

$$(1-\hat{p})\psi_S(\hat{p}) + \hat{p}\psi_F(\hat{p}) + \rho > (1-\hat{p})\psi_S(p-\epsilon) + \hat{p}\psi_F(p-\epsilon) + (1-\epsilon\hat{p})\rho$$

As $\epsilon \to 0$, we have the following condition:

$$(1-\hat{p})\frac{d\psi_S(\hat{p})}{d\hat{p}} + \hat{p}\frac{d\psi_F(\hat{p})}{d\hat{p}} > -\hat{p}\rho$$

The two conditions together provide a space in which fees satisfy truth telling conditions:

$$-\hat{p}\rho < (1-\hat{p})\frac{d\psi_S(\hat{p})}{d\hat{p}} + \hat{p}\frac{d\psi_F(\hat{p})}{d\hat{p}} < \hat{p}\rho \tag{8}$$

D. Truth-telling and participation conditions in monopoly with CRA effort choice

Exerting effort is only meaningful if the CRA reports truthfully. Otherwise, if the CRA is willing to inflate, i.e. $M = G$, then there is no benefit in expending costly effort to obtain a signal that will not be reported anyway. The CRA profits corresponding to a certain report and conditional on a signal are as follows:

$$\begin{aligned}
\pi(M = G|\theta = g) &= (1-p+ep)\psi_S^M + \rho - \frac{c}{2}(e-\underline{e})^2 \\
\pi(M = B|\theta = b) &= ep\psi_F^M + \rho - \frac{c}{2}(e-\underline{e})^2 \\
\pi(M = G|\theta = b) &= (1-\underline{e}p)\psi_S^M + (1-\underline{e}p)\rho \\
\pi(M = B|\theta = g) &= (p-\underline{e}p)\psi_F^M + (1-p+\underline{e}p)\rho
\end{aligned}$$

The truth telling conditions

$$\pi(M = G|\theta = g) - \pi(M = B|\theta = g) > 0$$

$$\pi(M = B|\theta = b) - \pi(M = G|\theta = b) > 0$$

imply that the expected fees generated by truthfully reporting the signal are higher than misreporting the signal. As before, this puts an upper and lower bound on the fee paid in failure relative to the fee paid in success:

$$\psi_F^M \leq \frac{1 - p + ep}{p - \underline{e}p}\psi_S^M + \left[\rho - \frac{c}{2(p - \underline{e}p)}(e - \underline{e})^2\right] \tag{14}$$

$$\psi_F^M \geq \frac{1 - \underline{e}p}{ep}\psi_S^M - \frac{1}{ep}\left[ep\rho - \frac{c}{2}(e - \underline{e})^2\right] \tag{15}$$

The cost of effort born by a CRA, and the distinction between e and $\underline{e}$ are the only differences between the above conditions and the truth telling conditions discussed in Proposition 1.[22]

The issuer participation constraint is not altered by the CRA effort choice as the payoffs to the issuer do not change.

$$\psi_F \leq \frac{1}{ep}\left(2V^G(\underline{e}) + \frac{1}{2}V^B(\underline{e}) - 2V^0\right) - \psi_S\left(1 + \frac{1-p}{ep}\right) \tag{16}$$

Effort exertion has to be instead taken into account when determining the CRA's payoff. We obtain:

$$\psi_F \geq \frac{1}{ep}\left(4\alpha V^G(\underline{e}) - 2V^0 - \underline{e}p\rho - \frac{c}{2}(e - \underline{e})^2\right) - \psi_S\left(1 + \frac{1-p}{ep}\right) \tag{17}$$

E. Proposition 5

Proposition 5. *(Fees chosen by the trust to induce optimal effort) The trust chooses fees, $\{\hat{\psi}_S^M, \hat{\psi}_F^M\}$, to induce the CRA to exert optimal effort e^* such that:*

1. *$\hat{\psi}_F^M > \hat{\psi}_S^M$,*
2. *the fees satisfy participation constraint and truth telling conditions of the CRA, evaluated at e^*,*
3. *the fees satisfy incentive compatibility constraint of the issuer if a signal precision higher than $\underline{e}$ increases the security issuance amount more than it increases the expected fees:*

$$\left(V^G(e^*) + \frac{1}{4}V^B(e^*)\right) - \left(V^G(\underline{e}) + \frac{1}{4}V^B(\underline{e})\right)$$

$$\geq \left[(1 - p + e^*p)\ \psi_S^M(e^*) + e^*p\ \psi_F^M(e^*)\right] - \left[(1 - p + \underline{e}p)\ \psi_S^M(\underline{e}) + \underline{e}p\ \psi_F^M(\underline{e})\right]$$

[22] If no effort is exerted, $e = \underline{e}$, and then inequalities (14) and (15) are exactly the same as inequalities (1) and (2).

The trust wants to pay fees on the CRA participation constraint. Not all choices are the same though. Since precision depends on the sum of the fees, moving towards the truth telling constraint defined by inequality (14) leads to higher levels of effort and hence precision. The economic intuition for increasing ψ_F as high as possible, while decreasing ψ_S, is that in our model, as in the real world, success of the issue is more likely than failure. The extent to which ψ_F can be increased is up to the point where the CRA is still incentivized to tell the truth. Therefore the optimal fees will be at the intersection of the CRA participation constraint and truth telling condition inequality (14).

We can apply implicit differentiation to the optimal precision level, and show that the implicit derivative of e^* relative to $\hat{\psi}_F^M$, given a decrease in $\hat{\psi}_S^M$ that keeps the CRA profit unchanged, is positive:

$$\frac{de^*(\hat{\psi}_S^M(\hat{\psi}_F^M),\hat{\psi}_F^M)}{d\hat{\psi}_F^M} = \frac{\partial e^*}{\partial \hat{\psi}_S^M}\frac{d\hat{\psi}_S^M}{d\hat{\psi}_F^M} + \frac{\partial e^*}{\partial \hat{\psi}_F^M} \tag{18}$$

We assume that the trust does not want to increase the expected transfer (the expected profit of the CRA $\pi(\psi_S^M, \psi_F^M)$), therefore fees are chosen so that the total derivative of the CRA's profit is zero:

$$d\pi(\hat{\psi}_S^M,\hat{\psi}_F^M) = \frac{\partial \pi}{\partial \hat{\psi}_S^M}d\hat{\psi}_S^M + \frac{\partial \pi}{\partial \hat{\psi}_F^M}d\hat{\psi}_F^M = 0 \tag{19}$$

Solving equation (19) for $\frac{d\hat{\psi}_S^M}{d\hat{\psi}_F^M}$ and substituting into equation (18), we obtain

$$\frac{de^*\left(\hat{\psi}_S^M(\hat{\psi}_F^M),\hat{\psi}_F^M\right)}{d\hat{\psi}_F^M} = \frac{\partial e^*}{\partial \hat{\psi}_S^M}\left(-\frac{\partial \pi}{\partial \hat{\psi}_F^M}\Big/\frac{\partial \pi}{\partial \hat{\psi}_S^M}\right) + \frac{\partial e^*}{\partial \hat{\psi}_F^M} = \frac{(1-p)p}{2\left(c(1-p(1-\underline{e})) + p^2(\hat{\psi}_F^M + \hat{\psi}_S^M)\right)}$$

which is always bigger than zero. Therefore, when possible (i.e., when it does not violate the truth telling conditions) the trust can push the CRA to exert the maximum effort, by increasing ψ_F^M at the cost of ψ_S^M.

F. Truth-telling conditions in duopoly with CRA effort choice and escrow account

We now derive truth telling conditions for two CRAs. In doing so we separate the level of precision achieved by one CRA, e, relative to the precision chosen by the other, f. We make the assumption that the CRA will exert effort only when truthfully reporting the observed signal. The CRA profits corresponding to a certain report and conditional on a signal are as follows:

$$\pi(M=G|\theta_1=g,\theta_2=g)=(1-\frac{(1-e)(1-f)}{(1-e)(1-f)+ef}p)\psi_S^D+\rho^D-\frac{c}{2}(e-\underline{e})^2$$
$$\pi(M=G|\theta_1=g,\theta_2=b)=(1-\frac{(1-e)f}{e(1-f)+f(1-e)}p)(\psi_S^D+2X^D)-X^D+\rho^D-\frac{c}{2}(e-\underline{e})^2$$
$$\pi(M=G|\theta_1=b,\theta_2=g)=(1-\frac{e(1-f)}{e(1-f)+f(1-e)}p)\psi_S^D+(1-\frac{e(1-f)}{e(1-f)+f(1-e)}p)\rho^D$$
$$\pi(M=G|\theta_1=b,\theta_2=b)=(1-\frac{ef}{(1-e)(1-f)+ef}p)(\psi_S^D+2X^D)-X^D+(1-\frac{ef}{(1-e)(1-f)+ef}p)\rho^D$$
$$\pi(M=B|\theta_1=b,\theta_2=b)=\frac{ef}{(1-e)(1-f)+ef}p\psi_F^D+\rho^D-\frac{c}{2}(e-\underline{e})^2$$
$$\pi(M=B|\theta_1=b,\theta_2=g)=\frac{e(1-f)}{e(1-f)+f(1-e)}p(\psi_F^D+2X^D)-X^D+\rho^D-\frac{c}{2}(e-\underline{e})^2$$
$$\pi(M=B|\theta_1=g,\theta_2=b)=\frac{(1-e)f}{e(1-f)+f(1-e)}p(\psi_F^D)+(1-\frac{(1-e)f}{e(1-f)+f(1-e)}p)\rho^D$$
$$\pi(M=B|\theta_1=g,\theta_2=g)=(\frac{(1-e)(1-f)}{(1-e)(1-f)+ef}p)(\psi_F^D+2X^D)-X^D+(1-\frac{(1-e)(1-f)}{(1-e)(1-f)+ef}p)\rho^D$$

We also need the following set of probabilities:

$$\begin{aligned}
Prob(\theta_1=g,\theta_2=g|\theta_1=g) &= ef+(1-e)(1-f)\\
Prob(\theta_1=g,\theta_2=b|\theta_1=g) &= e(1-f)+f(1-e)\\
Prob(\theta_1=b,\theta_2=g|\theta_1=b) &= e(1-f)+f(1-e)\\
Prob(\theta_1=b,\theta_2=b|\theta_1=b) &= ef+(1-e)(1-f)
\end{aligned}$$

From the above two set of equations we can obtain the profit of one CRA conditional on its own signal

$$\pi(M=G|\theta_1=g)=\pi(M=G|\theta_1=g,\theta_2=g)Prob(\theta_1=g,\theta_2=g|\theta_1=g)+$$

$$+\pi(M=G|\theta_1=g,\theta_2=b)Prob(\theta_1=g,\theta_2=b|\theta_1=g)$$

From this we obtain:

$$\pi(M=G|\theta_1=g)=(1-p+ep)\psi_S^D+(e+f-2ef-2fp+2efp)X^D+\rho^D-\frac{c}{2}(e-\underline{e})^2$$
$$\pi(M=G|\theta_1=b)=(1-ep)\psi_S^D+(1-e-f+2ef-2efp)X^D+(1-ep)\rho^D$$
$$\pi(M=B|\theta_1=b)=ep\psi_F^D-(e+f-2ef-2ep+2efp)X^D+\rho^D-\frac{c}{2}(e-\underline{e})^2$$
$$\pi(M=B|\theta_1=g)=(p-ep)\psi_F^D-(1-e-f+2ef-2p+2ep+2fp-2efp)X^D+(1-p+ep)\rho^D$$

Solving for the truth telling conditions

$$\pi(M = G|\theta = g) - \pi(M = B|\theta = g) > 0$$

$$\pi(M = B|\theta = b) - \pi(M = G|\theta = b) > 0$$

we obtain:

$$\psi_F^D \leq \frac{1 - p + ep}{p - ep}\psi_S^D + \frac{1 - 2p + 2ep}{p - ep}X^D + \rho - \frac{c}{2(p - ep)}(e - \underline{e})^2 \tag{20}$$

$$\psi_F^D \geq \frac{1 - ep}{ep}\psi_S^D + \frac{1 - 2ep}{ep}X^D - \rho + \frac{c}{2ep}(e - \underline{e})^2 \tag{21}$$

Similarly, the issuer and CRAs participation constraints are as follows

$$\psi_F^D \leq -\frac{(2 - 2p + ep + fp - 2)}{p(e + f)}\psi_S^D + \frac{\alpha(8V^G(\underline{e}) - 4V^{GG}(\underline{e}))}{p(e + f)} \tag{22}$$

$$\psi_F^D \geq -\frac{1 - p + ep}{ep}\psi_S^D + \frac{1}{ep}\left(4\alpha(V^{GG}(\underline{e}) - V^G(\underline{e})) + c(e - \underline{e})^2 - \underline{e}p\rho^D\right) \tag{23}$$

G. Alternative structures and mechanisms

In this section, we separately investigate the main features of the trust and show that they are individually insufficient to ensure participation by all agents and truth telling by CRAs. We also investigate whether ratings inflation and ratings shopping can be solved by an investor-pay model.

G.1. Committed issuer (without a third party)

A commitment from the issuer to take any rating from the CRA might be able to address ratings inflation. Two issues exist however with such an approach. First, given that there is no third party such as the trust to hold the issuer to the commitment, commitment by the issuer to the CRA to purchase the rating is not renegotiation proof. Once a CRA privately informs that the rating is B, then the issuer has the incentives to deviate from the commitment and not purchase the rating. The CRA may then relent, and also inflate the rating to ensure that the issuer purchases, defeating the purpose of the ex-ante commitment.

Second, even if the issuer is able to commit to any rating issued by a CRA, by means of a different mechanism than the trust, since the CRA extracts all the surplus and the fees of the CRA themselves depend on the rating, an inflation equilibrium still exists. In fact, Bolton, Freixas, and Shapiro (2012) make this point directly when they note that pre-commitment to take a bad rating would tighten certain constraints which make inflation more difficult, but it would not eliminate inflation altogether.

The first argument above also suggests a benefit of the trust mechanism which has not been underscored so far, the presence of the trust allows an issuer to enter an ex-ante contract with a CRA that is enforceable by a third party (i.e., the trust). This explicit mechanism solves the first problem directly, while the combination with contingent fees eliminates inflation as well.

G.2. Outcome contingent fees (without commitment)

If CRAs and issuers agree to outcome contingent fees, incentives to inflate may be reduced but will not be eliminated. The reduction in incentives to inflate may happen because the outcome contingent fees are more likely to be received if the rating aligns with the signal.

However, the lack of a commitment from the issuer, ensures that CRA only gets paid if the outcome predicted is good. This is because if the CRA gives a bad rating, then the issuer chooses not to purchase. Therefore, for a large set of model parameters (driven by fraction of trusting investors α and reputation ρ in particular), inflation equilibrium will still exist. In such a case, given that the fees paid by an issuer to a CRA, when the CRA predicts a successful outcome and is correct, is greater than the expected loss of reputation, the CRA will inflate.

Thus, ratings inflation remains in presence of outcome contingent fees as well.

G.3. Investor-pays model

Cornaggia and Cornaggia (2013) and Kashyap and Kovrijnykh (2016) find that ratings errors are larger when issuers order the ratings compared to when investors do. Yet, the problem persists with investor paid ratings as well. A symmetric problem in terms of ratings arises with investors preferring lower ratings and CRAs willing to oblige. The sophisticated investor, who pays for the ratings, always prefers a bad rating ($M = B$) over a good rating, since the issue will be priced at a lower level. Thus the problem of systematic rating inflation becomes a problem of systematic *deflation* in an investor-pays system. In contrast, a payment scheme that ensures truth-telling equilibrium, as suggested in our paper, addresses deflation as well.

The existence of a deflation equilibrium for the investor pays model has been widely recognized in academic circles, but has not been formally modeled. In the context of our model, the game remains effectively the same as in Figure 1, replacing the issuer information set with the investor's. However, in the deflation equilibrium, the game will be played on the left hand side of the game tree. The CRA always reports B, and to clear the market, the issuer will set the marginal price equal to that of the trusting investors, V_B. The CRA will then charge the issuer a fee equal to the total surplus, which in this case equals $V_0 - V_B$.

While formally modeling the rest of the game is outside of the scope of this paper, we note that this deflation equilibrium may persist for a wide range of assumptions. Hence, switching from issuer to investor-pay model might reduce the inefficiency of ratings but does not eliminate it.

G.4. Mandatory disclosure of contact

The June 2008 Cuomo plan, preliminary SEC proposals and also Sangiorgi and Spatt (2016) suggest mandatory disclosure of any contact between issuers and CRAs as an alternative commitment mechanism. However, the final rule adopted by SEC, rule 17g–7(a) effective June 15, 2015 in response to the Dodd-Frank Act, does not require mandatory disclosure of contact.

Our alternative, the trust, is a particular type of platform-pays model that is entirely driven by market forces, and relies on private voluntary strategic delegation. Because issuers and CRAs are given incentives to participate in the platform pays structure, they require minimum regulatory oversight.

G.5. Regulatory incentives

Opp, Opp, and Harris (2013) show that regulations requiring financial institutions to hold highly rated securities can cause higher investor's demand of such securities, thus leading CRAs to inflate ratings. Furthermore, the higher supply and demand creates a larger more liquid market that incentivizes CRAs to inflate even more.

The trust mechanism can generate truth telling by CRAs even under such regulatory incentives. However, in the presence of such incentives, the payments of the trust to CRAs will be higher when CRAs truthfully predict the security to fail, compared to payments when such incentives are not present.

H. Implementation of the trust

We discuss here several practical aspects concerning the implementation of the trust.

H.1. Transition from up-front to outcome contingent fees

The reader may be concerned about how we can transition from the current upfront payment system to a trust mechanism with outcome contingent payments. As described in Section 4, the fact that the fee structure is contingent upon outcome does not mean that the entire payment has to be deferred until resolution of uncertainty: a part, even substantial, of the rating fee can be paid up front.

Moreover, eventually, the number of securities that mature or are retired in every period will be approximately equal to the number of new securities that need to be rated thus securing that the CRAs receive a steady stream of contingent payments. For example, a tranche or cohort of bonds with maturity of five years issued in 2016 Q1 is rated by a CRA, and will be paid out for in 2021 Q1. In 2021 Q1, the CRA will receive payment for the bonds issued in 2016, and will be rating a new cohort of bonds that will be paid for five years later. Thus, in the long run, an equilibrium is established where CRAs get paid for past ratings, and rate new securities to be paid for later.

A thought-provoking alternative is that CRA could solve the problem by simply trading a derivative contract that allows them to swap a present payment, or sequence of payments, for a deferred lump sum payment from the trust in case the rated security goes in default. In particular, the CRAs could also sell the rights to the contingent payments to a third party that is sophisticated enough to find this investment attractive. The market price of such contracts will be based on the evaluation of the rating accuracy of the CRA. Such a contract will be similar in nature to CDS contracts that trade on the debt of underlying issuances.

H.2. Incentives of the trust

Another concern is that, just as CRAs and issuers interact to ultimately inflate the ratings, the trust may also be affected by perverse incentives. Both in the model and in what we believe could be a feasible practical implementation, the trust is a lightweight entity with a simple contract which key features are easy to both observe and verify in court. Keeping the trust separate and narrowly focused also has the added benefit of making fraud easier to detect. The contract of the issuer with the trust might contain the following stipulations:

(i) In exchange for a per issuance transaction fee, the issuer directs the trust to (a) Obtain a rating report through a public tender announcement, (b) Hold an initial payment from the issuer in escrow, and (c) Pay a fee from this escrow to the CRAs that rate the issue.

(ii) The payments to each CRA are based on the information obtained from a third-party (such as ISDA), which audits default events relating to *all* issues rated by the same CRA.

(iii) When multiple rating agencies agree to rate the issue, the trust should further require that, in order to be allowed to participate, each CRA make an up front deposit into an escrow account. Such an escrow account is liquidated at the end of each period in proportion to the accuracy of the ratings, with the most accurate CRAs possibly receiving a larger sum of money than what initially deposited.

The issuer prefers to choose a trust that provides the greatest expected surplus to the issuer in excess of the expected fee. To meet that preference of the issuer, the trust should choose a fee schedule that ensures participation and maximizes the effort of the CRA under the terms of the contract.

H.3. Enforcing the issuer commitment

The literature on strategic delegation started with the pioneering work by Schelling (1960). Over time, many practical applications of strategic delegation have been identified in games between parties where ex-ante commitment to a strategy is beneficial for the committing player. Some examples include Vickers (1985), Fershtman and Judd (1987), Sklivas (1987), Melumad and Mookherjee (1989), Bolton and Scharfstein (1990), and Katz (1991). In the context of this paper, strategic delegation means that the issuer (i.e., the principal) has the option to credibly and voluntarily commit to compensating the CRAs for any rating that they publish. Within the context of the game, and in reality an issuer can of course choose not to approach the trust and obtain a rating by approaching the CRA directly.

The presence of a platform makes a "sequential" strategic delegation practically implementable. In fact, the issuer's commitment is guaranteed by a few conditions: *before* the trust negotiates with the CRAs, the issuer funds an escrow account that is equal in amount to the expected outcome contingent fees; the trust makes a public request for tender to CRAs to obtain a rating, thus informing the investors that a rating will be published; by contract CRAs are required to publish the rating directly, without contacting the trust or the issuer. Once the trust is funded, the sequence of actions makes it impossible for the issuer to back out.

H.4. Preventing ratings side talk

An additional problem is the possibility of informal rating talks between CRAs and the issuer. We argue that in presence of a trust, a CRA cannot credibly convey the intention to give a good rating by means of a side/informal conversation with the issuer.

Our model does not assume there is no private disclosure of ratings information. An issuer could privately go to the CRA before committing to the trust and ask what rating the CRA intends to give. In our setup however, this behavior would simply add cheap talk to the game without impacting the equilibrium decision.

In case the signal is bad, the CRA could communicate to the issuer that a bad report is being released to the trust, offering a side deal under which the CRA issues a good report and is paid according to the original issuer pays model. However, the optimal fee schedule is such that the CRA earns more by truthfully reporting a bad rating under the trust. Therefore, upon observing a bad signal, the CRA will try to convince the issuer that the signal was good so that the issuer approaches the trust.

In case the signal is good, the CRA in fact earns more for a good report under the issuer pays model in the inflation equilibrium than for a rating that predicts success under the trust. However, upon hearing that the signal is good, the issuer prefers to deal with the trust. Therefore, the CRA could extract more money by communicating to the issuer that the signal is bad and offering a side deal under which the CRA promises a good report.

Consequently, the CRA always wants to convince the issuer that the signal is bad when it is in fact good and that the signal is good when it in fact is bad. Since there is no way for the issuer to infer the true signal from the CRA, and the CRA has no incentive to truthfully disclose the rating, any disclosure of information from the CRA through side conversation is not credible.

In sum, while the signal does have implications for the decisions of the participants once it is known, there is no credible mechanism to convey the signal. The issuer would always like to know the true signal, while the CRA would always like the issuer to believe the opposite. Any message about the potential rating will constitute cheap talk along the lines of Farrell and Rabin (1996), and no message exists that can be credibly committed to.

H.5. Preventing trust shopping

Since one of the primary goals of the trust mechanism is to prevent ratings shopping, we should naturally be concerned that the ratings shopping could simply occur at the organizational level of the trust as issuers shop for ratings output among multiple trusts.

In order to attract business, competing trusts might try to only solicit reports that predict success. However, CRAs would not be willing to issue a good report when they observe a bad signal, unless the trusts alters the outcome contingent fee schedule. In particular, the new fee schedule would be such that it violates one of the truth-telling conditions (i.e., condition (2)).

The sophisticated investors have access to the same information that the trust has, and therefore can infer when the truth-telling conditions have been violated. Upon learning that the trust is no longer enforcing truth-telling, they would abandon the market, thus reducing the surplus to the point where the CRA participation constraints can no longer be satisfied.

Therefore, competition among multiple trusts may reduce the transaction fees paid to the trusts, but does not allow for trusts to shop for good ratings with CRAs, as the contractual form of the outcome-contingent fees that are paid to the CRAs is public knowledge.

H.6. Franken Amendment

In 2010, the "Restore Integrity to Credit Rating Amendment" (S.A. 3991) was included in the final "Dodd-Frank Wall Street Reform and Consumer Protection Act" (Pub.L. 111-203, H.R. 4173. The amendment, known as the Franken Amendment, attempts to make sure that ratings shopping does not happen, by creating a board, overseen by the Securities and Exchange Commission, which will assign credit rating agencies to provide initial ratings. The Amendment suggests that this mechanism will eliminate inherent conflicts of interest. Unfortunately though, the Amendment appears to remove competition and incentives of CRAs regarding optimum due-diligence (See Staff of the Division of Trading and Markets, 2012). The act strengthens the position of incumbent CRAs by requiring that the board assigns an incumbent CRA to each issuance. CRAs have limited incentives to exert effort at all, beyond avoiding audits by the SEC.

Consequently, in February of 2015, the SEC finally responded to the policy requests laid forth by the Dodd Frank Act by adopting a set of rules (Staff of the Division of Trading and Markets, 2014) that revises the Rating Agency Act of 2006 and asks for a heightened level of disclosure, compliance and due-diligence within the framework of the "issuer-pays" model. The SEC therefore did not reference to the Franken Amendment in its rule making. It is presently not clear whether the creation of the supervisory board will be taking place.

Regardless, the trust alternative fosters competition and incentivizes CRAs to exert effort to improve accuracy of ratings.