The financial crisis and the credit rating agencies: the failure of reputation

Miele, Maria Grazia

Bank of Italy

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Maria Grazia Miele

Bank of Italy

Abstract: This paper presents a theoretical framework to describe the behaviour of the credit rating agencies (CRAs) during the crisis, surveying some reputational game models. CRAs have been blamed of inflating ratings of the new credit risk transfer products (CRTs) and of acting in favour of issuers instead of investors. This paper addresses three key elements to explain CRAs conduct: misaligned incentives – also favoured by the increasing reliance on ratings - the oligopolistic structure of the ratings' industry and the inadequacy of the credit risk models used by CRAs to evaluate CRTs.
Some policy initiatives are finally suggested to restore market confidence in ratings and reduce the analyzed biases.

Key words: credit rating agencies, regulation, reputation, reputational games.
JEL: D22, G01, G11, G24,

Introduction

The decade before the financial crisis was characterized by the development of a secondary market for loans, through the spread of complex Credit Risk Transfer products (CRTs): securities backed by mortgages and loans, repackaged and sold to investors. Securitized assets issuance grew exponentially during the last decade and until the financial crisis[1] in several industrial countries. Securitisation in general registered an estimated outstanding of $10.24 trillion in the United States and $2.25 trillion in Europe as of the 2nd quarter of 2008[2]. These securities could satisfy investors with different risk appetite and were sold to several kinds of financial firms that found them very attractive for the high returns or that had to invest in highly rated securities. CRT products appeared almost riskless, as most of them were rated as investment grade[3] but, as soon as subprime mortgage defaults began increasing in 2007, it became clear that they were substantially overpriced, overrated and much riskier than imagined. When credit rating agencies (CRAs) severely downgraded them[4], a generalized loss of confidence in CRAs emerged. This work concentrates on CRAs behaviour and the conflicts and misalignments which led to distortions.

Rating agency's role consists in collecting and processing information about an issuing firm to provide an assessment of the quality of the bonds, therefore reducing the asymmetric information between a firm issuing a bond and the investors. The firm can have private information about its ability to repay its bonds and investors may be unwilling to buy or they will ask for a high risk premium.

To understand credit rating agencies' role in the development of the CRT's market, it is worth briefly describing how rating agencies have been used by banks to provide new assets to foreign and domestic investors[5]. The banks were responsible of either originating or purchasing the assets (such as residential mortgages, credit card receivables, loans and corporate bonds or synthetic assets like Credit default swaps (CDS)) and of moving them to special purpose vehicles (SPEs), legal entities where loans were separated from the other obligations of the bank. Liabilities were tranched and the portfolio of assets typically divided into three tranches (senior, mezzanine and junior). The more subordinated a tranche is the more likely the losses: the equity/first or "toxic waste" tranche absorbed initial losses (their owner were paid only after all other tranches had been), followed by the mezzanine tranche which took up some additional losses, followed by the senior tranches.

Credit rating agencies usually provided AAA rating to the so called super senior tranche, characterized by lower return than the others but the first to be paid by the cash flow coming from the underlying assets. The junior tranche was usually unrated. To provide a high rating, credit rating agencies often required banks to grant high level credit enhancement; essentially represented by the amount of principal or total interest of the assets pool in excess of the tranche securities issued.

In the end, CRTs industry could create rated assets from a pool of unrated loans: this was the main reason for CRAs involvement in the CRT production and evaluation process. Nevertheless, it is also worth underlining that during last years authorities and financial intermediates reliance on CRAs had been increasing over time: financial regulation trusted on ratings for the definition of banks' capital requirements, investment company limits and for the portfolio choices of mutual funds; financial intermediaries were often required by internal rules to invest in highly rated securities.

The reason of the reliance on ratings lies on the reputation of high quality products that CRAs had built up over time: CRAs had a long history of producing good ratings and had therefore developed a reputational asset which let them to command a higher price. It was commonly believed that the value of this reputational asset could provide an incentive for the CRAs to continue to produce high quality ratings[6]. Nevertheless it was already known that a potential source of conflicts of interest could arise (not only for CRT products but for every kind of financial product) from CRAs' payment scheme. As ratings are generally paid by issuers rather than investors, CRAs interests could be more aligned with that of securities' issuers than with that of investors and this could result in more favourable ratings or fewer downgrades than otherwise should be[7].

The severe downgrades of CRTs from the very beginning of the crisis has nourished the suspicion that for CRTs the conflict of interests has played a more important role than for other kinds of securities (like bonds) because the share of profits coming from these securities was considerably high. Apart from the conflict of interest, the international debate following the crisis has point out other two main factors to explain CRAs conducts: the oligopolistic structure of the market for ratings, characterized by the main role of three agencies and the inadequacy of the credit risk models in use by the CRAs to evaluate CRTs products.

In order to describe these aspects, this paper reviews same existing literature about reputational games models. It is organized as follow: after a short description of the development of CRAs' role in financial regulation (part 1), part 2 illustrates some game theoretic models which formalize reputation-building ideas and the risks of relying too much on the same advisor; the synthetic nature of rating is also explained; part 3 focuses on the ratings' market structure and its consequences in terms of rating content and welfare; part 4 highlights the shortfalls in rating methodologies. Finally, part 5 is devoted to the policy initiatives to correct CRAs incentive and restore the confidence in the rating industry.

1. The role of CRAs in financial regulation and the new regulatory framework for CRAs

In the United States the term "Nationally recognized statistical rating organizations" – NRSRO, introduced by the Security and Exchange commission (SEC) in the 1975, identifies those CRAs that are registered with the SEC. Their rating could be used in order to comply to the Net Capital rule according to which broker-dealers or companies that trade securities for customers as well as on their own accounts had to refer to CRAs agencies valuation to define market risk and liquidity and apply a haircut, considered as a reserve against losses due to a subsequent decline in the market value of the securities. A lower haircut could be applied to securities rated investment grade by a credit rating agency of national repute, because those securities were considered more liquid and less volatile in price.

Several other U.S. rules relied on CRAs evaluations until the crisis. Among the others, according to the U.S. Investment Company Act, securitized products could be sold to the general public, only if rated in one of the four highest ratings categories; money market funds were essentially required by law or by internal regulations to invest only in highly rated securities.

The second of the Basel Accords[8] on banks' capital adequacy, from 2008 effective in Europe and in several other Countries, greatly relies on ratings to define riskiness and capital absorption of banks' assets in general and CRT products in particular. The Accord introduces a new category of CRA: the External credit assessment institutions (ECAIs) whose ratings can be used by banks to compute risk weighted total assets in the so called standardised approach. Supervisors are responsible for the recognition of CRAs as ECAIs and for assigning eligible ECAIs' assessments to the risk weights, i.e. deciding which assessment categories correspond to which risk weights (the so called *mapping*). Alternatively banks can choose the Internal Rating Based (IRB foundation or advanced) methodology for calculating their capital requirements for credit risk; this approach is subject to the explicit approval of the bank's supervisor.

It is important to underline that the role of CRAs in Basel II is overemphasized in the securitisation framework, as it differs from the general credit risk rules in the way that both the standardised and the IRB approach use authorised external credit ratings, as the use of internally generated ratings is difficult given the lack of statistical data for securitised products.

Despite the increasing reliance on ratings by regulators and investors, CRAs were essentially unregulated since prevailed the opinion that the maintenance of a high level of reputation was an adequate incentive to prevent the potential conflict of interest. Until the crisis, the CRAs had just to respect the self regulation issued by the IOSCOs[9]. Moreover, in order to safeguard the independence of ratings and the freedom of speech of CRAs, nor the Basel II Accord nor the U.S. legislation (the Credit Rating Reform Act issued in 2006) allows authorities to regulate and interfere in CRAs procedures and methodologies. The recognition process of CRAs as ECAII or as NRSRO essentially concentrates on the adequacy of internal governance and organizational requirements[10].

After the crisis, several initiatives have been undertaken to strengthen the regulatory framework for CRAs and others are under scrutiny. They aim at increasing oversight powers for authorities and enhance competition, transparency and internal governance of the CRAs without limiting their independence and freedom of speech:

- in the U.S., the Dodd-Frank Wall Street Reform and Consumer Protection Act, approved on 21 July 2010, enhances the SEC's enforcement mechanisms and adds a number of requirements on NRSROs that are immediately effective (i.e. do not depend on SEC rulemaking)[11];
- in 2009, the European Parliament approved a new regulation for the rating agencies, as, according to Members States, credit rating agencies failed to detect the worsening of the financial market conditions and to adapt their ratings in time. The regulation tries to increase transparency, independence and good governance of credit rating agencies, thus improving the quality and reliability of credit ratings and consumer's trust. According to the new regulatory regime, each CRA has to be registered by ESMA (the European Securities and Market Authority) that receive applications for registration and inform competent authorities in all Member States.

CRAs contrast the new regulatory initiatives and defend themselves asserting that ratings are just opinions about the credit quality of individual obligations or of an issuer's general creditworthiness; that they are ordinal measures of credit risk and are not predictive of a specific frequency of default or loss[12]. This defence cannot be entirely agreed with if confronted with the effects that a rating downgrade causes on the financial markets; these downgrades generates uncertainty in markets, leading to abrupt changes in assets' prices and affecting the firms' ability to fund themselves (Kiff J. et al., 2012).

2. The theoretical framework

The theoretical framework to analyze CRAs behaviour relies on part of the economic theory literature that describes the relationship between an advisor and an agent[13]. These models are very useful to illustrate several situations in which an agent has to rely on another advice to make a decision, like a policymaker relying on an economist advisor, a car-driver on its mechanics, a patient on its physician, a costumer on its financial advisor, and, finally, investors on a rating agency. In all these situations the agent has to decide about the consumption of an *experience good***,** i.e. a product or service whose features such as quality or price are difficult to observe in advance, but can be understood after consumption. Reputation of the advisor plays an important role: the more the agent trusts on it, the more likely he/she will take this decision according to its advising. If the advising reveals true, credibility increases otherwise the agent can decide not to trust on the same advisor anymore[14].

2.1 Building up a reputation: the risk of the conflict of interests

I will try to describe the mechanism of CRA's reputation building through Sobel's (1985) model. He considers a situation in which there are two subjects, a sender (that I will call as CRA to indicate the rating agency) and a receiver (INV, the investor) who have to play a game a finite number of times. At each stage of the game both players learn the value of a parameter Z measuring the importance of that period's play of the game (that is, the value of making a correct decision), that can be seen as the CRA's payoff.

CRA observes the state of nature, a binary random variable Ω_t, which is independent, identically distributed, and equally likely to be equal to -1 or 1. CRA then sends a signal M ϵ [-1,1] to INV, that can be seen as the speculative or investment grade rating. INV then makes a decision *A* that affects the welfare of both players. After both players learn the consequences of INV's decision, the process repeats. At each stage INV must decide what action to take. In order to do so he must assess the credibility of CRA. The difficulty arises because INV is uncertain about CRA's preferences when the game starts.

To model the possible conflict of interest between CRA and INV, this model assumes that with positive probability ρ, CRA has identical preferences to INV (CRA is honest - H) and with positive probability (1-ρ) CRA has completely opposed preferences to INV (CRA is opportunistic - O). More specifically, the utility function depends on the distance between the action A the receiver takes and the random variable Ω_t. The solution to the problem:

$$MaxU_{CRA}\left(A - M, Z\right) \tag{1}$$

is $A = M$ if CRA = H

and $A = -M$ if CRA = O.

So the honest CRA and the opportunistic CRA have opposite preferences.

The possibility that CRA is honest increases credibility to what he says, but this credibility may also be exploited by an opportunistic O. At each stage, providing accurate information enhances the opportunistic CRA's reputation, but only at the expense of losing an opportunity for immediate gain by cheating INV. CRA typically conveys accurate information for the first several periods, according to a signalling rule $\delta(Z,\rho)$, which represents the probability that it tells the truth. INV raises the probability he places on CRA being honest after receiving accurate information if he believes that an opportunistic CRA would have lied to him with positive probability. The more important the information, the more likely an opportunistic CRA will attempt to deceive INV. An opportunistic CRA will eventually take advantage of INV by misleading him. When this happens, it is assumed that CRA loses all opportunities for deception in the future.

In the one shot game, Nash equilibrium is reached only if CRA is sufficiently reliable (that is to say $\rho \succ \frac{1}{2}$), otherwise, if INV chooses to ignore CRA signal (and the babbling equilibrium arises), then it is a best response for CRA not to make informative signals.

In the multistage game INV updates CRA's reputation according to Bayes rule:

$$\rho_t = \frac{\rho_{t-1}}{[\rho_{t-1} + (1-\rho_{t-1})\delta(Z,\rho)]} \tag{2}$$

where the denominator is the probability of an honest signal, i.e the probability that:

- CRA is honest: ρ_{t-1}

or

- CRA is opportunistic: $(1-\rho_{t-1})$, but provided an honest signal in the previous period: $\delta(Z,\rho)$.

The model shows that CRA typically tries to increase its reputation conveying accurate information for the first several periods. So INV raises the probability he places on CRA being honest after receiving accurate information if he believes that an opportunistic CRA would have lied to him with positive probability. If CRA is opportunistic, he will most probably attempt to deceive INV when the information is more important (*Z* is higher). When this happens, it is assumed that the CRA's reputation drops to zero. It is also shown that INV prefers to deal with a single sender for T periods rather than T senders separately, as because repeated plays allow him to better evaluate the usefulness of CRA's information.

The model suggests that CRAs can have incentive to increase their reputation and supply accurate ratings as long as their payoff (the parameter *Z*) is low enough. When revenue coming from ratings is sufficiently high – like it seems to have been until the crisis for the new financial products - the temptation to burst their reputation becomes stronger and rating agencies are induced to provide good ratings for bad bonds. Finally, as the receiver (the investor) prefers to deal with the same sender (the rating agency) to better evaluate its credibility, the model also helps in explaining the oligopolistic structure of the market for ratings, where three of them account for most of ratings (see infra).

Nevertheless, the model is based on the assumption that the opportunistic CRA has no opportunity to regain its reputation once discovered. This assumption appears unrealistic for rating agencies as their reputation has already been damaged in various occasions, without significantly reducing their role.

2.2 Discovering an opportunistic CRA can take time

A different perspective is offered by Benabou at al.(1992), who generalize Sobel's model to a sender with noisy information. In this case reputation fluctuates up and down, rather than increasing until the first opportunistic move brings it down to zero forever like in Sobel's model. They focus on market manipulation and credibility, considering insiders who trade without being detected, but influence the price through public announcements or forecasts[15]. Rating agencies typically do not trade in assets, nevertheless this model can be used to explain their behaviour when facing the conflict of interest and when they are interested in providing a rating partly or entirely different from the signal they collect.

More specifically, in the model there is a continuum of agents, indexed by a parameter a in [0, 1] that trade a financial asset whose return is contingent upon the state of nature Ω. The asset pays S=1 if Ω = +1 and zero if Ω = -1. Each of these outcomes has probability one half, and only becomes publicly observable at the end of the period. At the beginning of the period the sender privately observes a noisy signal Ω' that predicts the state of nature with probability:

$$p \succ \frac{1}{2}.$$

This information structure is common knowledge. Then the informed individual sends the message M to "the public," i.e., to agents a in (0, 1]; he reports his signal truthfully (M = Ω') or untruthfully (M = - Ω') using a symmetric mixed strategy, i.e. according to the probability:

δ = prob [M = ω | Ω'= ω] for all ω in {-1,1}.

Thus, the message space M is {-1, +1} itself and δ is the probability that the report is truthful; the honest sender always plays δ = 1.

The public is uncertain about the CRA's "honesty" and has prior probability ρ that he always truthfully reports M = Ω' and (1 – ρ) that he opportunistically maximizes his expected utility gains from trade, manipulating information to his advantage.

To take into account the credibility and the relative importance of the sender's messages among the public and therefore its ability to affect their decisions, it is assumed that the public comprises both well-informed, rational speculators, a in (O, α] and traders with noisy information, a' in (α, 1]. "Noise" traders are agents who do not correctly receive or take into account the CRA's message and act instead according to a common belief B, drawn from a common knowledge distribution with support in [1 – b, b]; the smaller a, the less the sender can predict how the market will react to his announcements.

The parameter a in this case represents the degree of reliance of investors on ratings, both for regulatory purposes or for investment decisions. The higher a the wider are the effects of CRA's announcements on asset's prices. As seen before, several financial institutions worldwide are required to invest in investment grade instruments or define their capital requirements according to ratings. The downgrading of assets induces such firms to abruptly modify their portfolio choices and, as a consequence, can have a significant impact on market stability and asset prices.

Rational agents use their prior on the sender's type, their knowledge of each type's strategy, and Bayes's rule to infer the credibility of its prediction, i.e., the probability that it will be realized:

$$\pi = \rho p + (1 - \rho)[p\delta + (1 - p)(1 - \delta)] \qquad (3)$$

If the CRA announces M = 1, they update their belief about the asset's price S, from ½ to a common belief S = π. If it announces M = -1, the posterior belief is S =(1- π).

CRA uses its message to affect the public's belief about the asset's value, but its ability to do so is subject to how credible they judge it. It is assumed that CRA always trades after his announcement; its interests are diametrically opposite to those of the receiver INV: if *Ω'* =1 CRA has incentive to announce *M=-1* to depress asset price and then expect large profits when it is liquidated; if it observes *Ω'=-1*, he can gain more if it announce *M=1* and let the asset price increase to liquidate at a higher price.

It is shown that there is a unique price that clears the market. The one period game has a unique equilibrium. If the sender's credibility ρ is no greater than ½, then there is no information transmission; if the initial reputation $\rho_t \succ ½$ then $\pi(\rho_t) \succ ½$ even though the opportunistic sender always lies, but having privileged information is not enough to manipulate the market; the public must also have sufficient confidence in the sender's honesty: this allows the opportunistic type to "hide" behind the honest one and manipulate public beliefs.

In the infinite horizon game the sender maximizes the discounted expected sum of his instantaneous utilities. The probability of a correct forecast is $\pi(\rho_t)$ by definition, and the probability that the CRA is honest and makes a correct forecast is $(\rho_t p)$. For an incorrect forecast the corresponding probabilities are $1-\pi(\rho_t)$ and $\rho_t(1-p)$, so the updated reputation is:

$$\rho_{t+1}{}^{+} = \frac{\rho_t p}{\pi(\rho_t)} \quad \text{after a correct forecast} \tag{4}$$

and

$$\rho_{t+1}{}^{-} = \frac{\rho_t(1-p)}{[1-\pi(\rho_t)]} \quad \text{after an incorrect forecast.} \tag{5}$$

Since ρ_t embodies all the information available to the public at the beginning of period t, it follows from their subjective point of view, a martingale:

$$E(\rho_{t+1}) = \pi(\rho_t)\rho_{t+1}{}^{+} + (1-\pi(\rho_t))\rho_{t+1}{}^{-} = \rho_t \tag{6}$$

So even after an incorrect forecast, the reputation of the CRA decreases but does not go to zero. The opportunistic CRA decides its action optimally weighting its profit incentive to lie against its reputational incentive to be truthful. If its discounted expected sum of his instantaneous utilities when it lies (tells the truth) is higher than when it tells the truth (lies), it lies (tells the truth) systematically, otherwise it randomizes with probability δ. Benabou et al. show that the equilibrium that arises is unique; in equilibrium the CRA's messages always have some credibility (i.e. $\pi(\rho_t) \succ ½$).

Nevertheless, the reputation converges to 0 (respectively to 1) as *t* goes to infinity if the sender is opportunistic (respectively, honest). What enables the public to distinguish the two types (asymptotically) is that the opportunistic one periodically lies, so that his forecasts are inaccurate more often than for the honest type. It is worth noting that the model underlines two different profiles: the risks related to giving too much credit to CRAs' assessments and the possibility that reputation is only partly damaged when an opportunistic behaviour is discovered. The overreliance on rating until the crisis can have contributed to exacerbate the conflict of interest; moreover CRA's interest in increasing returns from rating new financial products can have induced them to issue optimistic ratings and contributed to the increase in prices. This behaviour has partly but not entirely damaged their reputation as shown in the model just described.

2.3 The rating industry during the crisis: the impact of high revenues on incentives

Another interesting model to explain rating agencies conduct during the crisis is represented by Mathis et al. (2009). It adapts Benabou et. al. to the rating industry by considering a financial market where, at discrete dates, new firms want to issue a security for financing some investment project with a cost normalized to unity. The project quality is a priori unknown (even to issuers). It is ‘‘good’’ with probability θ, or ‘‘bad’’ with probability $(1-\theta)$. They assume that good firms should be financed but that without prior knowledge on the quality of the project, no financing should take place. A monopoly CRA observes the project quality and communicates a rating to the market. No issue takes place if rating is bad or denied. The CRA can be of two types: either it is fully committed to always tell the truth or it is opportunistic (i.e., chooses the rating that maximizes the expected present value of its profits). The reputation of the CRA is measured by the probability ρ that investors assess to the CRA being committed.

The strategy of an opportunistic CRA is described by the probability $\delta(\rho)$ that a CRA of reputation ρ will be too lax (i.e. will give a good rating to a bad security). This influences the accuracy $a(\rho)$ of ratings (i.e., the probability that investors believe a good rating to mean a good project, given the reputation of the CRA). They show that, when the fraction of the CRA income that comes from other sources than rating complex products and/or the proportion of successful projects are large enough, there is a unique Markov perfect equilibrium (MPE)[16] where an opportunistic CRA always tells the truth. In this case, reputation is a good disciplining device for CRAs. By contrast when the fraction of the CRA income that comes from rating complex products and/or the proportion of unsuccessful projects becomes large, they show that there is a unique MPE where the CRA is always too lax with some probability and lies with probability one when its reputation is good enough.

The model is an illustration of the folk theorem for repeated games, which states that imitating the behaviour of the truthful type is an equilibrium strategy for a patient player. This implies the possibility of what the authors call as “confidence cycles”: starting from a situation where investors are not very trustful, issuing volumes are low, and credit spreads are high, the CRA tries to increase its reputation by being very strict; investors become more optimistic, the reputation of the CRA increases, spreads decrease, and issuing volume raises. But then CRAs become more lax, the following default provokes a crisis of confidence: the opportunistic CRA is detected, its reputation brutally falls down, spreads become high again and issuing volumes decrease dramatically. Like in the previous model it is shown that it may take a long time to detect an opportunistic CRA, but also that the conflict of interest is not solved by reputation concerns; instead, reputation building strategies by CRAs generate inefficient confidence cycles.

2.4 Why ratings are represented by synthetic messages

Ratings are divided in two categories of speculative and investment grade and some sub categories identified by letters (AA, AAA, etc), slightly different among rating agencies. “A” rating indicates investment grade bonds, that is to say bonds with a relatively low risk of default. Generally those are bonds that are judged by the rating agency as likely enough to meet payment obligations. Credit ratings for bonds below these designations ('BB', 'B', 'CCC', etc.) are considered low credit quality and are commonly referred to as "junk bonds" or speculative grade bonds.

The threshold between investment and speculative grade has important market implications as ratings play a critical role in determining how much companies and other entities that issue debt, including sovereign governments, have to pay to access credit markets, i.e. the amount of interest they pay on their issued debt. Firms issuing speculative grade bonds, in fact, will have to pay a risk premium in terms of higher interest rates to induce investors to buy their bonds.

To understand why rating agencies make recourse to synthetic messages I will refer to a set of models that afforded this topic for equity analysts and investors. It is shown that synthetic ratings are a consequence of the possible conflict of interest between CRAs and investors; more specifically they are a consequence of the uncertainty about CRA’s incentives. Giving a synthetic information about a bond represents the sender’s optimal compromise between including enough information in the signal to induce the receiver to respond to it and holding back enough so that his response is as favourable as possible.

In Crawford and Sobel's model (1982), CRA observes the state of nature, represented again by the value of a random variable, Ω, whose differentiable probability distribution function, $F(\Omega)$, with density $f(\Omega)$, is supported on $[0,1]$. CRA has a twice continuously differentiable von Neumann-Morgenstern utility function $U_{CRA}(A,\Omega,b)$,where A, a real number, is the action taken by INV after receiving CRA's signal M and b is a scalar parameter used to measure how nearly agents' interests coincide. INV's twice continuously differentiable von Neumann-Morgenstern utility function is denoted $U_{INV}(A, \Omega)$. All aspects of the game except Ω are common knowledge.

CRA observes his "type", Ω, and then sends the signal M to INV; the signal may be random, and can be viewed as a noisy estimate of Ω; then INV processes the information in CRA's signal and chooses an action, which determines players' payoffs. If players interests are different $(b \neq 0)$. It is shown that in the Bayesian Nash equilibrium[17] that arises the actions induced in equilibrium are countable and finite[18] and that the equilibrium whose partition has the greatest number of elements is Pareto-superior to all other equilibria and that if agents coordinate on this equilibrium, INV's equilibrium expected utility rises when agents' preferences become more similar.

The same topic can be found in Morgan and Stocken (2003); they extend Crawford and Sobel's model to the case where there is uncertainty about the degree of divergence in preferences between the sender and the receiver. In this model, when receivers (or investors) are uncertain of the sender's (or CRA's) incentives, they find a class of equilibria that is partitioned and a class of equilibria where CRAs with aligned incentives can credibly convey unfavourable information about a firm's value, but can never credibly convey favourable information.

They study a financial market setting containing a firm, many investors, and an equity analyst who follows the firm. The market participants have identical uniform prior beliefs about the firm's value S lying in some bounded interval, which is normalized to be $[0, 1]$. The analyst is employed in the brokerage division of a securities firm that offers brokerage and investment banking services, but the model can be easily adapted to rating agencies. The analyst (or the CRA) is privately informed about the nature of the incentives that he/it faces when preparing his stock report.

Investors value the firm upon observing this report. The analyst's payoffs depend on the firm's stock price, its underlying value, and the presence of investment banking opportunities or personal stockholdings in the firm. The analyst's payoff consists of two components: a benefit associated with inflating the stock price S above its true value ω, and a cost associated with poor performance. Specifically, the analyst's objective function is:

$$U(S,\omega,\beta) = 2\beta S - (\omega - S)^2 \tag{7}$$

The analyst's incentive parameter β is the amount above the firm's true value that an analyst wishes to inflate the stock price. They assume that β is distributed as follows:

- 0 with probability g,
- b with probability $1 - g$,

where $b, g \in (0, 1)$.

Thus, when $\beta = 0$, the analyst has purely performance-based concerns. That is, the analyst's payoffs are maximized by inducing a stock price that is equal to the firm's value: $S = \omega$. In contrast, when $\beta = b$, the analyst's payoffs are maximized by inducing a stock price that is above the firm's value, that is, $S = (\omega + b)$. With respect to the Crawford and Sobel's model the type space consists now of two components $\omega, \beta \in (0, 1)$.

The analyst privately observes the realization of the firm's value ω and issues a stock report M, which can be vague or even misleading. All aspects of the game are common knowledge except the analyst's privately observed incentive parameter and signal of the firm's value.

Investors observe the report M and revise their beliefs about the firm's value, which are given by the cumulative distribution function $P(\omega / M)$; they then value the firm. The firm's stock price, S, equals the firm's expected value given all publicly available information, including any information contained in the analyst's stock report M; hence:

$$S(M) = \int_0^1 \omega \, d \, P(\omega / M) \tag{8}$$

Morgen and Stocken define the stock price S as:

- fully responsive if, for some realization of β, it is continuous and strictly increasing almost everywhere;
- semiresponsive if, for some realization of β and in some nondegenerate interval of ω it is continuous and strictly increasing.

Morgan and Stocken show that when incentives are uncertain, a fully responsive stock price is impossible. Suppose to the contrary that the stock price is fully responsive. Fix a firm value $\omega' > b$. Let M' be the stock report inducing price $S = \omega'$. When $\beta = 0$, an analyst who learns that the firm's value is ω' will prefer to induce the stock price $S = \omega'$ over all other prices and report M'. Likewise, when $\beta = b$, an analyst who learns that the firm's value is $\omega'' = (\omega' - b)$ also will prefer to induce the price $S = \omega'$ and report M'. Thus, investor beliefs when hearing the message M' yield an expected firm value of:

$$E(\omega \mid m') = g\,\omega' + (1 - g)(\omega' - b) < \omega' \tag{9}$$

fixing a lower price than the report. But this is a contradiction, since $[A(M') = E(\omega \mid M') < \omega']$.

Therefore it is impossible for an analyst to convey good news about a firm $(\omega' > b)$ when there is uncertainty about incentives. In this case the institutional practice of severely restricting the message space of the analyst/rating agency to a small number of reporting categories allows reaching an equilibrium even in the presence of uncertainty.

Like in Crawford and Sobel model in such an equilibrium there are only a finite and countable number of equilibrium stock prices.

In fact, the concavity of the analyst's objective function ensures that there exists a firm value ω ^ such that an analyst with incentives β is indifferent between S_i and S_{i+1} for firm value ω^. Thus:

$$U(S_i, \omega^\wedge, \beta) = U(S_{i+1}, \omega^\wedge, \beta) \tag{10}$$

For a given pair of stock prices S_i and S_{i+1}, an analyst with incentives $\beta = 0$ is indifferent for some firm value $\omega = \omega^\wedge$, then an analyst with incentives $\beta = b$ will be indifferent for a firm value that is lower by exactly b: $\omega = (\omega^\wedge - b)$. Suppose that there are a countable but infinite number of equilibrium stock prices; i.e., prices are "close" to one another. Then, an analyst with aligned incentives will release a report M_i that induces price $S_i = S(M_i)$ only when the firm's value is arbitrarily close to S_i. Further, since investors are unable to infer an analyst's incentives from the report, for an analyst with misaligned incentives, A_i is induced only when the firm's value is arbitrarily close to $(S_i - b)$. Thus, investors, upon hearing report mi, infer that the firm's expected value is arbitrarily close to $[S_i - (1 - g)b]$. The only way to avoid this contradiction is if equilibrium stock prices are sufficiently far apart. Hence, there are only a finite number of equilibrium stock prices.

The finite number, N, of equilibrium stock prices $\{S_i\}$i=1,N can be arranged in ascending order in i. In such an equilibrium, an analyst will strictly prefer to induce the stock price S_i over all other prices for any ω that lies in some interval $(\omega_i\hat{}, \omega_{i-1}\hat{})$. These intervals partition the space of firm values. In summary, Crawford and Sobel show that categorical ranking (like ratings of investment and speculative grades, with some subcategories) represents a useful way to overcome investors' scepticism about the motives of analysts. The uncertainty about the analyst's incentives leads to a situation where an analyst's information about firm value is not reflected in stock price even if most analysts have aligned incentives.

They also argue that in equilibrium all analysts tend to issue more favourable reports with greater frequency than less favourable reports; analysts whose incentives are misaligned tend to issue favourable reports even more frequently to inflate stock prices. However, analysts with aligned incentives are able to effectively communicate unfavourable information about a firm's value, but not favourable information. This happens because reports of favourable information are imitated by analysts with misaligned incentives, whereas unfavourable reports are not. Thus, it is only for unfavourable reports that all relevant information is reflected in stock prices.

3. Market structure and the importance of competition in the rating industry

The market for ratings has an oligopolistic structure as it is dominated by the three main agencies: Standard and Poor's, Moody's and Fitch that offer their services in many countries (but several minor agencies play a significant role at local level). According to the SEC (2009) in 2008 the three main CRAs issued approximately 97% of all outstanding ratings in the U.S. across the categories of financial institutions, insurance companies, corporate issuers, backed securities, government municipal e sovereign securities.

Lizzeri's model (1999) can be very useful to describe the downfalls related to the market structure of the rating industry. He shows that a monopolist certification intermediary, like a monopolist CRA, can appropriate all the surplus in the market without releasing any information. This can happen when investors are not willing to buy bonds not certified by an independent and external institution, like it essentially happened until the crisis. While in the Akerlof's lemon market, the guarantee allows to separate lemons from good cars, in this model ratings allow "good" bond to be identified and sold even if the rating agency doesn't provide any additional information about their true value. The situation greatly changes if there are more identical CRA's competing for issuing the rating to the bond; in this case, like in Bertrand oligopoly, a competitive price and full disclosure of the bond's price will arise.

In the model there are four agents: one informed seller, two uninformed buyers, and one certification intermediary (the CRA). The seller owns an object that is worth S to buyers; he knows the value of the object S, and buyers and the intermediary have a prior on S represented by the distribution $f(S)$, which is assumed to be strictly increasing with continuous density on the closed interval $[a, b]$, where: $b \succ a \geq 0$. The intermediary has the technology to test the seller at no cost. If the test is made, the intermediary discovers S. This structure is common knowledge to all the participants in the market.

First of all the intermediary sets a fee F and credibly commits to a disclosure rule δ to maximize expected profits. The fee F can be any nonnegative real number. Then the nature chooses the type S of seller according to the distribution $f(S)$. Having observed F, δ, and S, the seller decides whether to go to the intermediary, i.e., whether to pay the fee and have the product tested. If so buyers observe the disclosure rule, the fee, whether the product was tested and what the intermediary disclosed and bid independently and simultaneously for the product.

Lizzeri shows that, if the intermediary (or CRA) is a monopolist, there is an equilibrium in which it sets:

$$F = E(S) - a \,, \tag{11}$$

δ = *no disclosure*

and all types go to the CRA; furthermore under the condition that

$$E(S/S \succ x) - E(S/S \le x) \ge (E(S) - a) \tag{12}$$

this is the unique equilibrium outcome; the CRA reveals nothing with probability one and captures the entire informational surplus in the market: all types go to the CRA and pay a price:

$$F = (E(S) - a).$$

In fact, suppose all seller types are expected to go to the CRA that releases a certificate that says "the seller is certified by this CRA" and nothing else. If the seller did not go to the CRA, buyers' beliefs coincide with the prior *f(.)*, the buyers believe that he is the worst type (type *a*). This implies that the highest types will definitely want to go to the CRA. But if only these were to go, then lower types would want to go as well, because going to the CRA would be viewed as a good signal (since the highest types are not revealed with probability one). This means that any equilibrium has a cut-off feature, with types below x not going to the CRA and types above x going.

The CRA has no incentive to deviate from no disclosure strategy, set ($x=a$) and price equal $F = (E(S) - a)$, as it makes the highest possible profit: its profits are $\Pi = (E(t) - a)$, buyers are making no profits, and the seller is making the minimum possible profit (*a*). In this equilibrium the CRA appropriates all the informational surplus in the market, no seller type gets any payment above the minimum and no information is revealed.

The condition (15) ensures that the difference between the expectation of quality conditional on going to the CRA and the expectation of quality conditional on not going to the CRA is always greater than the price to be paid to be certified. Thus, all seller types are willing to pay the price of certification. This guarantees that the equilibrium unravels downward and all types get certified. Thus, the only outcome consistent with optimality for the CRA is the one where the CRA reveals nothing and charges a price of exactly $(E(t) - a)$; all of the CRA's power to extract rents comes from its ability to manipulate information rather than from selling something that the seller values.

Lizzeri also shows that welfare greatly increases when the market for rating is more competitive that is to say when CRAs can compete in a Bertrand oligopoly, reaching the competitive equilibrium with zero fee (or price equal to marginal cost) and full disclosure of information. Suppose in fact that there are N intermediaries. A strategy for the seller is now a function that maps an N-tuple of fees and disclosure rules into $\{O, 1, ..., N\}$, i.e., a decision of which CRA to go to and whether to go to any one at all. A strategy for a buyer now maps observables into bids. The observables are the fees and disclosure rules set by the N intermediaries, which CRA the seller went to if any, and all the information revealed by the CRA, i.e., the realization of the disclosure rule. Suppose CRA 1 sets a fee of zero and full disclosure, then all types go to CRA 1 as in this case beliefs coincide with the type. No seller type will want to go to any CRA that charges a positive fee as he would have to pay a fee of F_i and, by construction, receive offers that are strictly less than $(S + F_i)$, but he can guarantee himself a payoff of S by going to CRA 1, which is clearly higher. This shows that any subgame in which the seller has the option of at least one CRA with full disclosure and zero fee has an equilibrium in which all intermediaries make zero profits. This implies that it is a best response for other intermediaries to also set a policy of full disclosure and zero fee.

4. Model risk or moral hazard?

So far I have emphasized the possibility that the high ratings for CRT products were a consequence of CRAs'moral hazard; nevertheless it cannot be ignored that a significant role in underestimating risk can have been played by credit risk models in use by the agencies. Some early warning about the pitfalls of these models came before the crisis by the BIS[19], when it noticed that CRAs were directly involved in designing the structural specific of these securities, not only as providers of third-party opinions about the riskiness of these instruments. BIS also warned against this source of mistakes: the so called "model risk", that is to say potential errors made in evaluating and pricing the exposures arising from financial transactions.

Model risk is not only relative to CRTs but it can have played a significant role in this ratings sector because of the complexity of these products with respect to other kinds of securities. Model risk is related to both the main inputs of the loss distribution of the underlying portfolio and the methodology used by CRAs.

As highlighted by the BIS, the three main inputs into CRAs' models for CRT products are:

- the probabilities of default (PDs) of the individual obligors in the pool of loans and how these can change along the life of the transaction;
- the recovery rates or losses-given-default (LGD), ie measures of recovery risk or of the magnitude of likely loss on the exposure (generally expressed as a%age of the exposure);
- the default correlations within the pool, i.e. the tendency of multiple defaults to occur within a given period of time.

CRAs use to define credit risk of CRT products by the concepts of probability of default or expected loss (the product of probability of default times loss given default times the exposure at the time of default). A different notion of credit risk is related to unexpected loss, which reflects the volatility and other higher moments of the portfolio loss distribution and reflects the idea that an investment will tend to be riskier if its loss distribution is more dispersed, even if the expected loss is constant.

A key issue affecting loss distribution in a portfolio is default correlation: when correlation is close to zero, the pool's credit loss distribution is well approximated by the binomial or normal distribution. At higher correlation levels, the loss distribution changes and the tails becomes thicker as both extreme and zero loss events are more likely.

Credit risk models for CRT securities combine assumptions about individual assets in the pool with default correlation of the pool of assets and recovery rates. If the actual default correlation is higher than estimated, rating agencies approach is likely to underestimate expected losses/probability of defaults and overestimate ratings[20]. In effects, it has been noticed that the high numbers of downgrades of CRTs tranches can be seen at least partially as the result of under-modeling of both default and recovery rates and, hence, a manifestation of model risk[21].

BIS underlines the differences between a corporate credit rating and a CRTs rating: the first one relies on the CRAs' assessment of the likelihood that a firm will default during a period of full employment[22]. If the risk of defaulting increases because of an adverse cyclical period, a firm can modify its investment strategy or inject more capital; on the contrary the pool of loans of CRT products is typically fixed, and investors do not expect an issuer to support a weakly performing deal.

The static nature of the underlying pool leaves the performance of structured securities highly vulnerable to the business cycle. In other term, corporate ratings are largely based on firm-specific risk characteristics, and reflect idiosyncratic risk, while CRTs are typically secured by a portfolio large enough that much of the idiosyncratic risk is diversified away, leaving largely exposure to systematic risk factors. CRTs products are much more exposed to systemic risk than to idiosyncratic risk as their portfolios usually consists of large, well diversified, homogeneous pools of assets (like residential mortgages or credit card receivables), while individual exposures relative to overall pool size are not significant. The higher the correlation among loans, the higher the sensitivity of the pool to systematic or systemic risk, as the PDs is much more sensitive to common factors and, therefore, to individual obligors' exposure to business cycle risks.

CRAs (as well as banks) made wide recourse to the Gaussian copula model to provide ratings (and prices) for credit derivatives and CDOs[23]. This method represents a useful way to model the joint behaviour of the underlying loans and bonds without referring to their joint marginal distribution; it is based on the normal distribution and has several advantages: it is easy to understand and compute and it requires the estimation of only one parameter, the pair wise correlation of assets. The main drawback is that it fails to adequately model the occurrence of extreme events like the contemporary defaults of the underlying portfolio of assets that, as seen, represented the factor affecting credit risk evaluation more than the others.

Some factors have instead been underlined to defend CRAs operate and methodologies:

- the BIS[24] again emphasized that rating agencies evaluations were also influenced by the lack of historical data about defaults in subprime losses: available data was "largely confined to a relatively benign economic environment, with very little data on periods of significant declines in house prices";

- SEC, instead, underlined that originating banks can have induced misjudgement of credit risk by CRAs. According to SEC(2008), the July 2007 subprime RMBS downgrades were concentrated in the issues of four firms, suggesting that there were important unobserved differences in underwriting standards across originators. It suggests that "some weakly capitalised originators may have taken advantage of transparent rating agency criteria, enabling borrowers to misrepresent occupancy, income, down payment source and/or property appraisals".

4.1 Model risk: when the rating agency does not invest in the screening technology

A very useful model to understand the relationship between model risk and competition in the rating industry is offered by Mariano (2009). She studies the behaviour of two different types of rating agencies, talented and less talented, and shows that:

- reputational concerns are not enough to prevent deviations of the less talented CRAs from the private signal and these concerns might end up being the driving force behind these deviations. This result depends on the assumption that project without a rating are not implemented; therefore it is shown that less talented rating agencies can have incentive to issue more bad ratings to avoid their type being revealed;
- reputational concerns combined with competition may induce less talented CRAs to issue too much good ratings, as issuing a bad rating can worsen the agency's reputation because a bad rating cannot be verified, so investors believe that the rating agency is likely to be mistaken or is hiding its type.

More in detail, Mariano considers two different situations: a monopolistic market with one rating agency and a more competitive setting with two agencies acting as Bertrand duopolists. The economy lasts two periods and in each period it consists of an entrepreneur asking for a rating about its project and a large group of homogeneous investors. At each time period, agency's reputation – that is to say the subjective probability that the agency is talented – is updated according to rating correctness. A crucial assumption in the model is that rating is mandatory: if the firm gets a good rating, it can raise the financing from the project by the investors, otherwise the project is not undertaken.

The project is good with an exogenous probability $\theta \in (0,1)$, which summarizes the public information about the project's type.

The monopolistic rating agency is hired by the entrepreneur who pays a fee, and then the agency collects a private signal (ω_G for a good project or ω_B for a bad one) about the project and issue a good or bad rating. If the agency is talented, it correctly identifies the project's type, otherwise it can make small mistakes. In other words the probability that a talented agency correctly identify the project quality (G good or B bad) is one:

$$P(\omega_G/G) = P(\omega_B/B) = 1 \tag{13}$$

While for a not talented agency these probability are given by:

$$P(\omega_G/G) = P(\omega_B/B) = p \tag{14}$$

$$P(\omega_G/B) = P(\omega_B/G) = 1- p \tag{15}$$

While collecting the private signal, the agency discovers its type (talented or not). Both public and private information are used to issue the rating, but the agency can also issue a rating different from the private signal, in this case it incurs a given and fixed cost C.

The model is solved by backward induction starting from period two: in this period the agency has no reputational incentives, so it will issue a rating correspondent to the private signal not to incur in the fixed cost C.

In the first period it will issue the rating that allows maximizing future profits. Fee at time two depends upon the rating issued at time one: if the rating is correct and the project turns out to be good, the agency reputation grows up and it will be able to ask a higher fee in period two; otherwise, if the rating is good but the project is not, it will receive a lower fee. Therefore, while a talented CRA will always issue the private signal as a rating, a less talented CRA can decide to contradict this signal to improve its reputation.

When investors expect a project to be very good or very bad (that is when θ is close to 1 or close to 0), and the CRA signal indicates instead a different quality of the project (that the project is bad or good respectively), the agency can prefer to follow the public information and issue a corresponding rating, as it knows that, had it been a talented agency, it would have been more likely to have collected an equivalent private signal (this behaviour is named *conformism* this model).

On the contrary, when the public information about the project is good but not strong enough (θ is greater of ½ but close to this value) the agency can decide to contradict this information and issue a bad rating in the attempt to minimize reputational costs (*conservatorism*). Doing so the project is not undertaken and therefore the agency type not revealed. In this way, its reputation remains unchanged as well as the fee.

The results of the model modify in the competitive setting as competition forces rating agencies to be more aggressive to make sure that they continue being hired and are not replaced by the competitor because only the agency with the highest reputational level will be hired at time period two. In this setting there are two identical rating agencies with the same initial reputational level. Like in the Bertrand model, the fee at time one just covers marginal costs (the cost of collecting the private signal).

Like in the monopolistic case a talented CRA issue the private signal in every period and both types of rating agencies issue the private signal as rating in period two not to incur in the fixed cost C. In period one a less talented CRA can issue more good rating than in the monopolistic case. When issuing the rating in period one the agency has to consider the trade off between the following situation: if the outcome of the project reveals different from the (good) rating, the reputational level of the agency goes to zero and it is not hired again in period two; in the mean time, issuing a bad rating can worsen the agency's reputation because a bad rating cannot be verified, so investors believe that the CRA is likely to be mistaken or is hiding its type.

Especially if investors believe that the project is good, the agency can be induced to issue a good rating to persuade them that it is talented. When the public information about the project is bad there is no reputational cost in issuing a bad rating but even if the agency collects a bad private signal, it can decide to issue a good rating to be hired in the second period. More in detail, in the first period it plays in mixed strategy according to the following signalling rule:

- for $\theta \in [\theta-, \theta+]$ with $1- p < \theta- < \theta+<1/2$ it issues the private signal as a rating;
- for $\theta\in [\theta+, 1]$ it issues a good rating whenever it collects a good private signal, a good rating with probability δ and a bad rating with probability $(1- \delta)$ whenever it collects a bad signal;
- for $\theta \in [1-p, \theta-]$ it issues a bad rating whenever it collects a bad private signal, a bad rating with probability δ and a good rating with probability $1- \delta$ whenever it collects a good signal.

Hence, reputational concerns combined with competition originate boldness as rating agencies issue too many good rating ignoring private and even public information that indicates that the project is bad. According to Mariano, competition might not solve the incentive problems faced by rating agencies unless it is combined with better models of risk assessment, which would improve the quality of rating agencies assessments, more transparency in that rating's procedures, and measures to improve monitoring and accountability in the ratings industry.

The two types of CRAs can also be seen as the same agency dealing with different rating sectors (corporate, banking, insurance, sovereign, etc.). Having invested more in the screening technology in the past, CRAs have been able to provide reliable ratings in the traditional sectors; their involvement in rating the new structured products, for which the screening technology - as seen - was not sufficiently developed, can have induced them to issue too many good ratings, following the common belief that these products were riskless.

4.2 The issuing firms' moral hazard

The theme of the moral hazard of the issuing firm (underlined by SEC) and investments in screening technology can be explained by Chemmanur et al's model (1994). They describe the moral hazard of entrepreneurs that approach an external institution (CRA, investment bank, etc.) even if their project is bad, since there is a positive probability that a good evaluation is assigned to a bad project for the withfalls in the screening technology.

They consider an economy that has two dates (time 0 and time 1). There are three kinds of agents, who are all risk neutral: entrepreneurs, investment banks (or CRAs in our case), and ordinary investors. At time 0, entrepreneurs take their private firms public by selling their equity in these firms to outsiders in an initial public offering (IPO). Each entrepreneur chooses to market equity either directly to investors or using the services of an investment bank (the investment bank can also be seen as a rating agency providing the rating before selling). At time 1, a new round of entrepreneurs enters the equity market; then the events at time 0 are repeated. This concludes the game. Each entrepreneur of firm has a single project, which can be of two types, *"good" (ω = G)* or *"bad" (ω = B);* the expectation of future cash flows from firms with good projects is 1, and those with bad projects is 0. The market for new issues is characterized by asymmetric information. While entrepreneurs know the type of their own firms, ordinary investors don't. The proportion of good firms is the same at each date, and is denoted by θ, which is common knowledge. Investment banks conduct an evaluation of each firm approaching them. These evaluations have only two possible outcomes, denoted by M: "good" (M = G) or "bad" (M = B).

The investment bank can set a different evaluation standard at each date; depending on how strict its evaluation standard is, it may also assign (incorrectly) a good evaluation to a bad firm with a probability *r:*

$$r = prob(M = G / \omega = B) \tag{16}$$

where $r \in [p, 1]$, $p > 0$

A higher r corresponds to a less-stringent evaluation procedure (since r is the probability of making an incorrect evaluation). If the investment bank sets ($r = 1$), it gives a good evaluation to all firms approaching it. The other extreme, (r = p), corresponds to the most stringent evaluation procedure available; since ($p \succ 0$), mistakes are possible even in this case.

An entrepreneur can refuse to make use of an investment bank after learning the evaluation that the investment bank will report; each entrepreneur's firm is evaluated by only one investment bank. If this investment bank does not agree to market the equity or the entrepreneur chooses not to use the investment bank, he has no choice but to market the equity directly to investors.

Investment banks/CRAs are of two types, indexed by $I=[H,N]$: while most have to incur a cost $C(r)$ to evaluate firms ("high-cost" investment banks, $I = H$), there is a small proportion that can evaluate firms costlessly ("no-cost" investment banks, $I = N$).

At time 0, entrepreneurs and investors have a prior probability assessment $\rho \in (0, 1)$, of each investment bank being of the no-cost type. The evaluation cost of the high-cost investment bank $C(r)$ depends upon the stringency of its evaluation standard. Further, the higher the probability of making an incorrect evaluation (r), the lower the expected value of the evaluation cost incurred at each date (i.e. ($C(r) \prec 0$), while ($C(1) = 0$) i.e. the evaluation cost is zero if the investment bank does not produce any information and instead gives a good evaluation to all). The investment bank's evaluation cost is unobservable, so the high-cost type is subject to moral hazard as it has an incentive to lower its evaluation standard in order to reduce the evaluation cost. The no-cost type, however, has no such incentive, since it can evaluate firms costless.

Investment banks obtain a fee F only from firms whose equity they market; the fee is a fraction $k \in (0, 1)$, of the "surplus value" generated for the firm, represented by the difference between the value of equity when the investment bank markets equity and the value when the entrepreneur approaches the equity market directly.

At time 1, investors know the true type of firms marketed by investment banks at time 0, and update the investment bank's reputation using Bayes' rule. If investors conjecture that the no-cost type sets stricter evaluation standards than the high-cost type in equilibrium, the investment bank's reputation goes down if it is revealed that the equity marketed by it at time 0 was that of a bad firm and goes up if the equity was that of a good firm.

It is shown that in equilibrium, the no cost type investment bank always sets the strictest possible evaluation standards at each date ($r = p$), since it can evaluate firms costless. The high cost type minimizes the evaluation cost by setting ($r = 1$) at time 1 (i.e. giving good evaluation to all firms). However, at time 0, the high-cost type faces a tradeoff; setting a lower evaluation standard reduces evaluation costs, but increases the probability of marketing a bad firm with a good evaluation, thereby damaging reputation and lowering time 1 profit.

Since the two types of investment banks behave differently in equilibrium, the revelation of firm type at time 1 conveys to investors information that they use to update their probability assessment of the investment bank type. If the firm taken public by an investment bank at time 0 is revealed as a bad, the investment bank's reputation decreases; if it turns out to be a good firm, its reputation increases. In equilibrium, investment banks market equity only in firms that obtain good evaluations. Further, since a good firm is guaranteed a good evaluation, it is always in the interest of entrepreneurs with good firms to use investment banks to reduce the extent of their pooling with bad firms. Given this incentive, investors infer that any firm whose equity is marketed directly by the entrepreneur is a bad firm and therefore price the equity of such firms at the true value of a bad firm; i.e. ($S_B = 0$). This, in turn, implies that even an entrepreneur with a bad firm will approach an investment bank in equilibrium to undergo evaluation, since there is a positive probability that the investment bank will incorrectly assign its firm a good evaluation and market its equity. Thus, only entrepreneurs whose firms receive bad evaluations market equity directly.

In conclusion, investing in the screening technology is necessary not only to avoid wrong evaluations but also the issuing firms' moral hazard. As seen, firms can be induced to ask for a rating even for bad projects, if they are aware that the technology is not totally reliable and that there is some probability that their project can be valued as good. Even if there is not direct evidence of this aspect, it could have played a role in the recent crisis as some originating banks can have taken advantage of downfalls in rating methodologies obtaining a good rating for CRT securities even if the underlying pool of assets was not of a high quality.

5. Correcting the incentives

5.1 The need for a real separation between sale and advice

More recently, after the crisis, a number of papers have been published affording the theme of financial assets mis-selling by financial intermediaries, i.e. selling products unsuitable to consumers' preferences, financial situation or needs. As described in the introduction, CRAs were directly involved in the production process of CRT securities not only as providers of third opinions there fore these models appear suitable to partly describe their behaviour as well.

The two models in the following describe intermediaries involved both in evaluating and in selling financial products with no distinction between the two different roles, showing the consequences for customers in terms of loss of surplus. They demonstrate that only high reputational costs can induce a "honest" behaviour from the advisor; they also show the importance of competition and, finally, make evident the need of a real separation of advice (rating in our case) from sale.

In Bolton et al. (2009) a fraction q of costumers belongs to type Ω_A, i.e. prefers A financial products to type B, getting utility of U from A and utility $u<U$ from B, while a lower fraction $(1-q) \prec q$ belongs to Ω_B, getting U from B product and $u<U$ from A. Costumers do not know their type; they just know the value of q (that is to say they believe that most probably they belong to type Ω_A).

The model also assumes that financial intermediaries suffer a reputation loss ξ for any misselling and that they can discover the clients' type investing in an information technology at a fixed cost C.

So the question is: should a bank specialized in selling just one of the two products tell a client that another bank offers a product that better suit her needs or should it try to sell its own product (eventually suffering a cost of ξ)? In our case the "bank" identifies both the CRA and the originators involved in creating and selling CRT securities altogether.

In the model, the outcome of the game depends on the value of ξ as, when defining their strategy, banks will face a trade off between increase selling even to other type costumers and pay a penalty. In fact, profits for banks are given by:

$$\Pi = S\Omega_A q + (S\Omega_A - \xi)(1-q) \tag{17}$$

for type Ω_A banks;

$$\Pi = S\Omega_B(1-q) + (S\Omega_B - \xi)q \tag{18}$$

for type Ω_B banks, where *S* is the price of both products *A* and *B*.

The model analyzes three different market structures:

1. monopoly specialized banking. In this case there exists just one bank specialized in product *A* or *B*. If the bank belongs to type Ω_A, then it sells its product to everyone at a price given by the average utility they get from the product Ω_A. If it belongs to type Ω_B, it sells its product to everyone at a price given by the average utility they get from the product Ω_B when ξ is sufficiently low, or sells at a lower price S', revealing type information if ξ is high. Ω_B bank, in fact, incurs a higher expected reputational cost of lying and realizes a smaller financial return since the proportion *q* of costumers that are well matched with product Ω_A is higher;
2. "one stop" monopoly bank: it is represented by a monopoly bank that can sell both products, therefore it could also set the price at $S=U$ for both products, segmenting the market and extracting all the rent to consumers;
3. competition between two specialized banks: in this case the two banks compete in a Bertrand oligopoly. In the absence of any additional information, one stop bank Ω_A would set the price low enough to attract all the clients forcing bank Ω_B to zero profits. But then bank Ω_B would have incentives to invest in an information technology to truthfully reveal the customer's type. This is due to the fact that Ω_B bank would be able to raise its price up to ξ, credibly convey information to its well-matched customers and make higher profits. Therefore there will be information disclosure under competition between specialized banks.

In summary, for intermediate values of the reputational cost ξ, bank Ω_A has a dominant strategy not to provide information since, if Ω_B doesn't provide information, Ω_A can still enjoy its advantage. Once the reputational cost gets larger, Ω_A can possibly provide information credibly, because it receives a high enough rent to justify its provision. As ξ approaches to zero, all Ω_B's rent disappears in every scenario: the lack of reputation cost eliminates the ability to reveal information.

Finally, in the additional case of competition between a one stop bank and a specialized one the one stop bank Ω_A can discipline Ω_B by setting its price for product *B* sufficiently low to eliminate Ω_B's incentive to grab the whole market.

In conclusion, for very small reputation costs no information is provided when specialized banks compete, as incentive for misselling are too strong. However when the market is dominated by a one stop bank, advice can be credibly provided even if the bank extracts most of the costumers value of information. For higher reputation costs this comparative advantage of one stop bank is eroded as specialized banks are also able to give advice credibly. Finally, separating advice from sales could allow banks to extract higher margins from costumers.

Regarding banks and CRAs behaviour in the recent crisis, the model provides two policy suggestions:

- the reputational cost of the conflict of interest should be high. This could mean, for example, significantly reduce the reliance on ratings of regulatory and financial intermediaries' internal rules;
- supervision by authorities about the real separation between advice (provided by CRAs) and selling (provided by banks) in the future for new financial products should be strict and rigorous.

5.2 More transparency about CRAs' compensation

Another paper by Inderst et al. (2009) affords the theme of *misselling* financial products when the financial firm hires the same agent to both prospect for new costumers and provide product advice. This two task delegation gives rise to a conflict of interest as the incentives necessary to induce search effort subsequently tempt the agent to advice purchase indiscriminately. As before the agent can represent CRA's as well as the other subjects (originators, servicers, etc) involved in advising and selling structured products.

Like in the previous model, consumers belong to two different types Ω_A, Ω_B: a costumer of type Ω_A gains the major utility from purchasing the product A (that is $U_A \succ U_B$). The prior probability of being of type Ω_A is q, but the agent just observes a noisy signal $\omega' \in [0,1]$ about the costumer type, where ω' is realized according to the type dependent distribution $F(\Omega_A)$ or $F(\Omega_B)$.

If the product is missold to a type Ω_A purchaser, it can compliant with probability ψ: in this case the firm pays a penalty ξ. Finally, the agent compensation scheme consists of:

- a wage of w if no sale is made and an additional commission for sale b if a sale is made and non negative post sale signal is sent;
- zero if the sale is contested.

Setting $\omega'=0$ (that is to say trying to sell the product to everyone) can reduce the agent payoff under w because of the increase in complaints, while setting $\omega'=1$ (selling just to Ω_B type costumers) results in receiving both w and b. Therefore there exists a ω^* at which the agent is indifferent between making a sale or not.

When deciding for w and b the firm must take into account that a higher commission b pushes ω^* down because it induces the agent to advise more costumers to purchase the product while a higher w pushes ω^* up because the agent is sure to get the salary when advising a customer to purchase but risks losing it otherwise.

Taking the ratio b/w constant, the firm gets the desired level of ω^* that allows it to maximize profits and minimize the penalty cost.

In equilibrium a certain misselling will arise as ω^* is a noisy signal so there is no guarantee that only Ω_B type costumers will purchase the product. It is also shown that a higher monitoring ψ or a higher penalty ξ let the desired standard ω^* to increase thus reducing misselling.

The firm can change its own organization of sales process letting one agent responsible for prospecting to consumers and another one for advising them; in this case it can be shown that a strictly higher ω^* will arise as the conflict of interest between the agent's double task doesn't arise anymore.

Alternatively the firm can credibly disclose the agent compensation scheme. When observing that the firm offers less steep incentives to the agent, customers are reassured that the suitability of the product has increased; hence they are willing to pay more, to the benefit of the firm. But, as individual customers may lack incentives or legal means of monitoring the firm's remuneration policy and the firm may find ways to provide the agent with less observable incentives to sell, a policy intervention can be necessary to guarantee transparency.

Regarding the CRAs industry, the model – apart from a lower involvement of rating agencies in the production process of CRT securities – provide a simple suggestion: CRAs' compensation scheme (i.e. the percentage of principal required for rating each issuing) should be made public. This would allow the investors to understand the CRA's incentives to issue a certain rating and would contribute to improve their investment choices.

5.3 An investor paid model

As seen, several factors can contribute to explain CRAs behaviour, but the conflict of interest seems one of the most relevant. It is therefore necessary to understand how and if it is possible to restore the correct incentives in the rating industry to get high quality ratings, not affected by the temptation to please issuers.

One way to eliminate or reduce the conflict of interest is to require investors and not issuers to pay for ratings, coming back to the model in use before seventies (when CRAs were paid by investors). A return to the investor-pay model would solve the conflict of interest problem but it would introduce the issue of free riding as some investors would obtain ratings freely from sources other than CRAs. This is likely to result in insufficient revenues for the rating agencies. For this reason in the early 1970s CRAs changed their business model, as the rise of photocopying made protecting the ratings increasingly impractical.

One way to circumvent this problem is proposed by Pragyan D. et al. (2009). They study a model where investors using credit rating for their investment decisions can choose to be subscribers or free riders. If they choose to be free riders, they do not have to pay the rating agencies subscription fee *F*. However free riding involves a delay and they assume that the opportunity cost of free riding for the investor is ξ. There exists a continuum of investors with ξ lying between *a* and *b*. Each investor decides whether to free ride or subscribe depending on ξ: if $\xi > F$, then the investor is better off subscribing to the rating agency, as the opportunity cost of free riding is too high; if $\xi < F$, the investor prefers to free ride and wait for the information to arrive with a lag. The fraction of investors subscribing to the rating agency is given by:

$$\alpha = \frac{b - F}{b - a} \tag{19}$$

which depends on the subscription fee F. The profit function for CRAs is given by:

$$\Pi = F\alpha - C \tag{20}$$

where C represents the cost of rating.

The problem arises when the fee charged is relatively modest and/or the fraction of investors willing to pay *a* is small. In this case the investor-pay system may not generate enough revenues for the rating agencies, i.e. $\Pi < 0$. In such a situation, the rating agencies will not survive or will be forced to cut costs and compromise on the quality of ratings. To avoid this scenario, it might be necessary to introduce a subsidy to the CRAs as a supplementary source of revenue.

The amount of subsidy necessary to guarantee that the rating costs are covered is given by:

$$\Pi = F\alpha - C + F\alpha\tau = 0 \tag{21}$$

and the optimal subsidy is:

$$\tau^* = \frac{C}{\alpha F} - 1 \tag{22}$$

To define this optimal level the regulator needs detailed and accurate information on the rating agency's costs as well as demand, supply and optimal pricing of the ratings. On the opposite, CRAs know their cost structures and can define the level of subsidy that ensures the break even in equilibrium. The authors propose an auction mechanism to determine the optimal subsidy rate for the rating agencies: each rating agency determines the minimum level of subsidy it requires to break even as:

$$\tau_i^* = \frac{C_i}{\alpha_i F_i} - 1 \tag{23}$$

If the auction process is properly designed[25], then the most efficient rating agencies (i.e. the ones that are confident of getting higher subscription revenues from the investors and have lower costs) will win the auction: the auction winners would be entitled to a portion of the tax pool which is paid in arrears and linked to the share of the investor-pay market that they manage to achieve.

Finally, to fund the government subsidy, the authors propose that a small tax would be levied on issuers or at the point of issue.

Conclusions

This paper presents a theoretical framework to discuss the role of CRAs until and during the recent financial crisis. After the subprime crisis it became evident that CRAs did not just use to provide an independent evaluation of CRTs but were involved in their production process, as one of the main purposes of the CRTs industry was to create rated securities from a pool of unrated assets: there was not an effective separation between advice (provided by CRAs) and sale (by banks) for these products. Furthermore, during the years proceedings the crisis, the importance of rating in the banking and financial regulation as well as for the investment choices of financial intermediates had been steadily increasing. Despite that, CRAs were essentially unregulated as it was commonly believed that reputational concerns were sufficient to avoid any conflict of interest.

The paper addresses three key elements to explain CRAs conduct: misaligned incentives – also favoured by the increasing reliance on ratings -, the oligopolistic structure of the ratings' industry and the inadequacy of the credit risk models used by CRAs to evaluate CRTs. In order to describe CRAs behaviour, I have surveyed some reputation games models. It is shown that:

- a CRA dealing with the conflict of interests typically tries to improve its reputation producing honest ratings as long as its payoff is low enough; when the payoff is relevant then it can decide to issue a higher rating to favour the issuing firm and increase its gains;
- the more the reliance and the confidence on ratings, the higher the effects of CRAs announcements on assets' prices; moreover discovering an opportunistic CRA can take a long time as it can have incentives to randomize between telling the truth and lying in order to optimally weighting profit and reputational incentives;

Regarding the structure of the market for rating, characterized by the main role of three agencies, it is shown that, paradoxically, if rating is mandatory - like it essentially was for some securities until the crisis - a monopolistic CRA can appropriate all the surplus in the market without releasing any information, as the investors need an evaluation from the CRA (independently from the information content) to invest in a certain asset. This situation greatly changes when more CRAs compete in a Bertrand oligopoly, as fees tend to diminish and the rating content tends to improve.

Finally, it cannot be ignored that a significant role in the shortfalls in rating CRT securities has been played by the credit risk models in use by the agencies. It is shown that competition is a necessary but not sufficient condition to guarantee good quality ratings if it is not accompanied by the improvement of screening technology: if rating is mandatory to undertake a project, in a competitive setting CRAs tend to be more aggressive, issuing too many good ratings, as a bad rating could be seen as a signal of poor talent (a bad CRA can give a bad rating to avoid that the project is undertaken and its type revealed).

Investing in the screening technology is also necessary to avoid the issuing firms' moral hazard, as firms will ask for a rating even for bad projects if they are aware that the technology is not totally reliable and that there is some probability that their project can be valued as good. This aspect can also have played a role in the recent crisis as, according to SEC (2008), the July 2007 CRTs downgrades were concentrated in the issues of four firms, suggesting that there were important unobserved differences in underwriting standards across originators.

In the end, the analysis enlightens that reputation has not represented an adequate incentive to guarantee good quality ratings and underlines the need to intervene in the rating industry to increase competition and improve internal governance and screening technologies. Several initiatives have been proposed[26] and a new regulatory framework has been introduced both in USA and Europe to respond to the failures in ratings; CRAs have responded to the shortfalls improving their rating methodologies for CRT products.

As shown in the paper, a model where investors (not issuers) pay for ratings would be attractive because it would align incentives of CRAs with that of investors; nevertheless it would be subject to the free rider problem, as many investors could prefer not to pay for ratings and get them from freely from other sources. Another argument against the investor pay model is that it could be subject to conflict of interest too, as CRAs might be induced to please investors with strong preferences for product ratings[27]. Finally, investor paid (or unsolicited) ratings are generally considered less accurate than issuer paid model as they are generally based on publicly available information (like firms' balance sheets) without any direct involvement of the issuing firm.

Nevertheless, some investors paid CRAs already exist and they show that this model is practicable both in Europe and in USA[28]; so far, these CRAs have dealt with the free rider problem by generally communicating their ratings only to subscribers and rated firms. A wider development of this type of CRAs would certainly reduce the problem of the conflict of interest and help to increase competition in the rating industry.

Regarding regulation, both in Europe and in USA the new rules, recently implemented, aim at requiring CRAs to guarantee more transparency and better governance, in order to improve market discipline. In this field, regulation faces a trade off as it must not interfere with CRAs' methodologies to guarantee the independence of their evaluations while ensuring that CRAs behave correctly and make recourse to adequate rating procedures.

A wider disclosure of ratings' models, methodologies and key assumptions, as required by the new regulatory framework, would allow investors to correctly evaluate reliability of ratings, providing users with a better understanding of the content of the rating, and would contribute to reduce the over reliance on ratings. Also the disclosure of remuneration would reveal where potential conflicts might arise. In the meantime, CRAs should improve the quality of ratings not only by modifying their methodologies for complex products but also by strengthening internal governance processes in order to manage the conflicts of interests and guarantee analysts independence.

Finally, regulators have committed themselves to reduce the reliance on ratings in "standard, laws and regulations" and in markets in general[29]. They acknowledge that this would take some time as no direct substitutes of ratings have been identified so far, even if several alternative approaches that remove references to ratings entirely have been considered in the debate (like CDS premia). Banks, central banks and investment managers and institutional investors should carry out due diligence on their investments commensurate with the complexity and materiality of the exposure. Banks should develop their internal risk assessment methodologies and even less sophisticated banks, that may not have the resources to conduct internal credit assessments for all their investments, should carry out 'risk assessment commensurate with the complexity of the investment product and the materiality of the holding'.

In the end, issuers' paid ratings should become one of the elements to evaluate credit risks, in competition with investors' paid ratings, internal risk models and market information.

The described initiatives, altogether, should contribute to restore market confidence in ratings and reduce the biases so far analyzed.

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[1] According to the Securities Industry and Financial Markets Association (SIFMA) global CDO issuance rose from 78 billions of dollars in 2001 to 520 in 2006, abruptly declining to a bit more then 4 billions in 2009 (see SIFMA web site). CDOs (collateralized debt obligations) were probably the most complex type of CRT instruments; a kind of security backed by other types of CRTs securities, by CDSs (Credit default swaps) or other CDOs (so called CDO square).

[2] "ESF Securitisation Data Report Q2:2008" (2008), European Securitisation Forum, London, Securities Industry and Financial Markets Association (SIFMA).

[3] Rating Agencies use to design ratings by letter such as AAA, B, CC. "A" rating indicates investment grade bonds, that is to say bonds with a relatively low risk of default. Generally those are bonds that are judged by the rating agency as likely enough to meet payment obligations. Credit ratings for bonds below these designations ('BB', 'B', 'CCC', etc.) are considered low credit quality and are commonly referred to as "junk bonds" or speculative grade bonds.

[4] Benmelech et al. (2009) estimate that more than half of the CRTs securities rated by Moody's were AAA, but most of these tranches were downgraded during 2007 and 2008, the average downgrade was 4,7 and 5,6 notches.

[5] CGFS (2005) and SEC (2008).

[6] SEC (2009). Apart from reputation, another important factor cited by SEC are the economies of scale which are seen as favouring the larger long established rating agencies, as they can allocate the costs of analytical software, administrative, legal, compliance, marketing and support staff, among other costs, across a wider range of ratings. In addition, these rating agencies have large sunk costs in the form of developed ratings, methodologies, procedures and outstanding ratings.

[7] CGFS (2008).

[8] It is available in the Bank for International Settlement web site.

[9] See Iosco (International Organization of Securities Commissions) Code of Conduct Fundamentals for Credit Rating Agencies, October 2004. This code of conduct - that was revised in 2008 in response to the subprime crisis - consists of a Statement of Principles regarding the activities of credit rating agencies and a Code of Conduct fundamental for credit rating agencies that

comprises three parts: Quality and integrity of the rating process, Independence and the avoidance of conflicts of interests and Responsibilities to the investing public and issuers.

[10] To be recognized as ECAI a CRA must satisfy six criteria:

- objectivity: the methodology for assigning credit assessments must be rigorous, systematic, and subject to some form of validation based on historical experience;
- independence: an ECAI should be independent and should not be subject to political or economic pressures that may influence the rating;
- international access/transparency: the individual assessments should be available to both domestic and foreign institutions with legitimate interests and at equivalent terms. In addition, the general methodology used by the ECAI should be publicly available;
- disclosure: an ECAI should disclose the following information: its assessment methodologies, including the definition of default, the time horizon, and the meaning of each rating; the actual default rates experienced in each assessment category; and the transitions of the assessments, e.g. the likelihood of AA ratings becoming A over time;
- resources: an ECAI should have sufficient resources to carry out high quality credit assessments;
- credibility: to some extent, credibility is derived from the criteria above. In addition, the reliance on an ECAI's external credit assessments by independent parties (investors, insurers, trading partners) is evidence of the credibility of the assessments of an ECAI. See Part II.II of the revised framework of the Accord available on the BIS web site.

[11] The Dodd-Frank Act also requires the Commission to adopt a number of new rules concerning annual reports on internal controls, conflicts of interest with respect to sales and marketing practices, "look-backs" when credit analysts leave the NRSRO, fines and penalties, disclosure of performance statistics, data and credit rating methodologies.

[12] According to Fitch official web site: "Fitch Ratings' credit ratings provide an opinion on the relative ability of an entity to meet financial commitments, such as interest, preferred dividends, repayment of principal, insurance claims or counterparty obligations. Credit ratings are used by investors as indications of the likelihood of receiving the money owed to them in accordance with the terms on which they invested.

[13] These models began to be developed during the eighties after the publication of Kreps D. and Wilson R.'s work (1982) in which agents exploit uncertainty and take short term losses in order to build a reputation and make long-term gains.

[14] These models are often referred to as "cheap talk games" as the advisor actions do not directly affect any player payoff, but influence payoffs only indirectly via impact on the belief of the decision maker, so its action has no cost. There can also be situations in which the cheap talk is ignored. If players observing cheap talk do not infer any meaning in the messages, then there is no incentive for those sending the messages to fill them. Thus if the advisor, independent of whether it is good or bad and independent of the signal it has observed, simply randomizes its announcing, the decision maker will learn nothing from the message and will continue to believe that each state is equally likely. Given this anticipated response by the decision maker, the advisor has no incentive to deviate from its uninformative random announcements. Such equilibria, in which cheap talk is ignored, are known in the game theory literature as "babbling equilibria."

[15] They refer to a journalist who writes a financial column, and can trade directly or through namesakes, or a "guru" who issues forecasts or newsletters but is also in the business of trading for his own account, or some investment firms, or a corporate executive who owns or trades stock in his company, and by the very nature of his job periodically makes prospective reports to stockholders and financial analysts.

[16] A Markov perfect equilibrium (MPE) is a pair of functions $(\delta;a)$ that are simultaneously rational from the respective view points of CRAs and investors.

[17] It consists of a family of signalling rules for CRA, denoted by $\delta(n \mid \Omega, M)$, and an action rule for INV, denoted $A(M)$, such that CRA's signalling rule yields an expected-utility maximizing action for each of his information "types," taking INV's action rule as given; INV responds optimally to each possible signal, using Bayes' rule to update his prior, taking into account CRA's signalling strategy and the signal he receives.

[18] This comes from the concavity and continuity assumption about the utility function and the additional assumption that the partial derivative Ui M,A>0 which is a sorting condition that ensures that the best value of the decision A for a fully informed agent's standpoint is a strictly increasing function of the true value of M.

[19] Committee on the Global Financial System (2005).

[20] Committee on the Global Financial System (2008).

[21] Fender I. et al. (2005).

[22] Committee on the Global Financial System (2008).

[23] Donnelly C. et al. (2010) .

[24] Committee on the Global Financial System (2008).

[25] They propose an Anglo-Dutch auction, where the price rises until all but two bidders quit and the last two bidders then make a sealed bid. The surviving bidders would then be committed to bid at or below this level of subsidy in a sealed-bid auction in which the four lowest bidders are awarded a licence.

[26] For an overview of these proposals see Fennell D. et al. (2011).

[27] As an example, banks that make recourse to the Basel II – standardised model may require higher ratings for the assets in their portfolio to reduce capital requirements.

[28] Among the others, in the USA, Egan-Jones Ratings Company, also known as EJR, founded in 1995, actively rates the credit worthiness of approximately 2000 U.S. corporate debt issuers; it is entirely investor supported. In Europe, the Bank of France is a recognized CRAs for regulatory purposes (it is an ECAI, External Credit Assessment Institution), in Italy, CRIF has recently been registered as an unsolicited CRA by the ESMA.

[29] See Financial Stability Board (2010), "Principles For Reducing Reliance On CRA Ratings".