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Credit Ratings Failures and Policy Options

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Abstract

This paper examines the role of credit rating agencies in the subprime crisis that triggered the 2007-08 financial turmoil. We focus on two aspects of ratings that contributed to the boom and bust of the market for structured debt: rating inflation and coarse information disclosure. The paper discusses how regulation can be designed to mitigate these problems in the future. Our preferred policy is to require rating agencies to be paid by investors rather than by issuers and to grant open and free access to data about the loans or securities underlying structured debt products. A more modest (but less effective) approach would be to retain the "issuer pays" model but require issuers to pay an upfront fee irrespective of the rating, ban "credit shopping", and prescribe a more complete format for the information that rating agencies must disseminate.

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1. Introduction

Since the 2007-2008 financial turmoil originated in the market for subprime structured debt securities, much attention has been recently directed at the role played by flaws of the securitization process and particularly by failures of the credit rating agencies (CRAs).[1] Two issues fare prominently in this respect.

First, since 2007 even very highly-rated structured debt products have performed very poorly: the value of AAA-rated residential mortgage-backed securities (RMBS), as measured by the corresponding credit default swaps prices, fell by 70 percent between January 2007 and December 2008. Moreover, massive and severe rating downgrades occurred in 2007 and 2008. This suggests that the initial ratings of structured debt securities greatly understated their risk. Such "ratings inflation" played a key role in the crisis: insofar as many naively based their investment in these securities mainly or solely on inflated credit ratings, these led to a massive mispricing of risk, whose correction later detonated the crisis.[2]

Second, in the process of securitization and rating much detailed information about the risk characteristics of the underlying assets was lost: ratings provide very coarse and limited information about these characteristics. This information loss is particularly serious in view of the heterogeneity of the collateral and the great complexity of structured debt securities. Once a scenario of widespread default materialized, this detailed information would have been essential to identify the "toxic assets" in the maze of existing structured debt securities, and to price them correctly. Absent such information, structured debt securities found no buyers, and their market froze. So the information loss involved in the process of securitization and rating is largely at the source of the illiquidity that plagued securities markets since the crisis broke out.

In this paper, we draw on existing research to assess the likely causes for these two failures of rating agencies in the securitization process – ratings inflation and opacity – and review the policies that may be adopted to correct or mitigate them in the future.

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[1] See for instance the Financial Stability Forum Report (2008) and International Monetary Fund (2008).

[2] Both rating inflation and naïve investors' excessive reliance on ratings are well captured by Lloyd Blankfein, CEO of Goldman Sachs, who wrote that before the crisis "too many financial institutions and investors simply outsourced their risk management. Rather than undertake their own analysis, they relied on the rating agencies to do the essential work of risk analysis for them. … This over-dependence on credit ratings coincided with the dilution of the coveted triple A rating. In January 2008, there were 12 triple A-rated companies in the world. At the same time, there were 64,000 structured finance instruments, such as collateralised debt obligations, rated triple A." (Blankfein, 2009, p. 7).

The common source of both of these failures of credit ratings is an incentive problem: CRAs are paid by issuers, so that their interest is more aligned with that of securities' issuers than with that of investors. In this respect, CRAs are not unique: a similar conflict of interest also exists for other "financial gatekeepers", such as auditing companies, but as we shall see regulation has been much more lenient with CRAs. Moreover, in the case of ratings the problem is exacerbated by the possibility for issuers to engage in "rating shopping", by soliciting only the most favourable rating among those potentially available from competing agencies.

Why can these conflicts of interest account both for the pre-crisis ratings inflation and for the coarseness of ratings, which contributed to the opacity of the securitization process?

Issuers benefit from rating inflation if at least some investors are naïve, i.e. do not realize that ratings are excessively optimistic. In this situation, rating inflation leads to underpricing of risk. A similar situation occurs even if all investors are rational, but regulation forces them to buy highly rated securities (for instance, only AAA-rated ones) and these are in scarce supply. A third possibility is that these investors are rational portfolio managers who have an excessive incentive to take risk, even when it is mispriced.

The reason why issuers may benefit from opacity in the issuance of structured debt securities is less obvious, since one would expect the disclosure of detailed information to increase the liquidity of the secondary market for these securities, and therefore their issue price. This argument suggests that issuers should ask CRAs to provide the most detailed assessment of the risk characteristics of their issues, or else should complement their ratings with any additional data necessary for such assessment. But this argument breaks down if some investors are unsophisticated, in the sense that they have limited information-processing ability (even if they are not naïve in the sense of making systematic mistakes). When such investors are prevalent, opacity can actually benefit issuers, as it makes their securities palatable to unsophisticated investors, and therefore expands their primary market. When little information is available, unsophisticated investors can buy their securities without losing money to sophisticated ones. To the extent that CRAs respond to issuers' desires, they have the incentive to keep their ratings rather uninformative, so as to facilitate the marketing of structured debt to a clientele that includes relatively unsophisticated investors. However, the crisis shows that the implied information loss can have dire consequences for market liquidity further down the road, if and when the neglected information becomes price relevant.

Ratings' inflation and low informativeness may also reinforce each other. To the extent that investors are rational, they will see through CRAs' incentives to inflate ratings and therefore will consider them as relatively uninformative. Conversely, the coarseness of ratings may reinforce the tendency to inflate them, as it expands the room for collusion between issuer and rating agency, and therefore the conflict of interest with investors. For instance, if ratings are set on a discrete scale, friendly rating agencies can suggest to issuers how to structure their securities or tranches so as to just attain a given rating. So in each rating class a disproportionate number of issues or tranches will have a risk corresponding to the low end of that class. This enhances ratings inflation compared to a situation where ratings are set on a finer grid.

What can policy makers do to improve things for the future? We argue that the best policy requires a drastic change in regulation – not just in specific rules but in their guiding principles as well. First, since both of the problems discussed above arise from the conflict of interest between CRAs and investors, it is of essence to eliminate (or at least reduce) this conflict by addressing the issue of "who pays". If rating agencies are tempted to please issuers by inflating their credit ratings and/or by choosing excessively coarse ratings, the most appropriate solution is to have investors – not issuers – pay for their services, as indeed was the case before the 1970s. But switching from the "issuer pays" to the "investors pay" model may be difficult to implement in practice, because free-riding or information leakage could erode CRAs' revenues and thus their incentives to produce informative ratings. This would in turn require regulators to reduce (or eliminate) the reliance of banking and security regulations on ratings. Moreover, to reap the benefits from the "issuer pays" model one must prevent indirect payments by issuers to CRAs in the form of the purchase of consulting or pre-rating services.

Second, in order to increase transparency, issuers should disclose the complete data about the pool of loans (or bonds) underlying their structured finance products, so that buy-side investors may feed them into their own models to assess their risk characteristics. Clearly, many buy-side investors would not have the technical skills to do this, and would stay away from securitized products. This will constrain issuance of these securities, at least until new specialized information processors enter the fray to supply financial advice to investors, in competition with CRAs.

Such sweeping changes will meet not only the likely opposition of CRAs, but also that of regulators, due to their considerable transitional costs. Therefore, policy makers may also want to consider a second-best policy, which tries to address the above-discussed problems without

overhauling the current setup. Specifically, they may retain the "issuer pays" model but constrain the way in which agencies contract with issuers and are paid by them: issuers should pay an upfront fee irrespective of the rating issued (the so-called "Cuomo plan," named after NY Attorney General Andrew Cuomo), and credit shopping should be banned. Similarly, regulators could enhance transparency not by forcing issuers to grant open and free access to all relevant data, but simply by prescribing a more complete and detailed format for the information that CRAs must disseminate.

These more limited reforms may still be consistent with the current regulatory delegation of vast powers to a select group of rating agencies. But their effectiveness in addressing the failures of CRAs exposed by the current crisis is likely to be limited. First, even if issuers must pay an upfront fee and cannot engage in explicit rating shopping, implicit collusion may still be sustainable: issuers may systematically patronize the agency that offers them the best ratings, which they can identify by comparing the models that agencies use to rate securities.

Second, prescribing which pieces of information and statistics CRAs should disseminate would shift the burden of identifying such information on the regulator, which can be complex in the presence of very diverse financial products. It may also expose such detailed regulation to the danger of becoming rapidly outdated in the presence of innovations in the design of structured debt securities, some of which may even be induced by regulation itself.

In contrast, an open-access, non-prescriptive approach by regulators would shift on issuers and investors the burden of determining the pieces of information that are most relevant to evaluate the risk of each security, and would not run the risk of obsolescence. It would also reduce, instead of further increasing, the tangle of regulations in this area. This is an instance in which less regulation might also be safer and better regulation, in contrast to what is currently suggested by many.

2. Securitization process and rating agencies

Asset-backed securities have been around for decades. However, between 2001 and 2006 there was a spectacular growth in the issuance of two new types of structured debt products: subprime Mortgage Backed Securities (MBS), and Collateralized Debt Obligations (CDO). Subprime MBS are backed by pools of mortgage loans that do not conform to the standards set by Fannie Mae and Freddie Mac because of low FICO score, poor credit history or limited documentation.

CDOs are backed by pools of corporate bonds and other fixed income assets, or by portfolios of tranches of MBS and other CDOs. As shown in Table 1, between 2001 and 2006 the combined issuance of subprime MBS and CDOs grew ten times, from $100 billion to more than $1 trillion.

[Insert Table 1]

This remarkable growth in the market for asset-backed securities would have been impossible without the help of CRAs. The reason is simple: for this market to succeed, it needed to attract the large pool of institutional investors that are subject to rating-based constraints. In other words, the market for subprime MBS and CDOs needed be a "rated" market, in which the risk of tranches was assessed by CRAs using the same scale as bonds. In that way, the rating provided access to a pool of potential buyers, who would have otherwise perceived these securities as very complex and would have possibly shied away from them. Interestingly, rating agencies were very explicit in reassuring investors that the rating of structured securities was directly comparable with the rating of bonds. "Our ratings represent a uniform measure of credit quality globally and across all types of debt instruments. In other words, an 'AAA' rated corporate bond should exhibit the same degree of credit quality as an 'AAA' rated securitized issue" (S&P 2007, p. 4).

This led to a massive repackaging of risks into a vast quantity of newly issued AAA-rated securities: according to Fitch (2007), 60 percent of all global structured products were AAA-rated, in contrast to less than 1 percent of the corporate issues. Rating agencies benefited a lot from the growth of structured products. By 2006, 44 percent of Moody's reported revenue came from rating structured finance products, with respect to 32 percent of revenues from the traditional business of rating of corporate bonds (Coval et al., 2008). In this way the issuers of structured products and the rating agencies became very much dependent on each other, until the collapse in the late 2007.

The extent of the crisis in the market for asset-backed securities can be best appreciated by looking at the dynamics of the ABX price indexes reported in Figure 1. ABX indexes provide an indicative measure of the value of MBS, as they are based on the price of credit default swaps offering protection against the default of baskets of subprime MBS of different ratings. In other words, a decline in the ABX index indicates an increase in the cost of insuring a basket of mortgages of a certain rating against default. It is clear from the graph that the crisis was first felt in March 2007 by the BBB-rated MBS. A few months later, in June 2007, all tranches (even the AAA-rated securities) experienced a substantial drop in value, as UBS shut down its internal

hedge fund, Dillon Read, after suffering about $125 million of subprime-related losses. As the crisis worsened, the indexes kept declining across all ratings. The loss to the holders of structured debt securities was compounded by the massive and severe downgrades of their ratings by CRAs in 2007 and 2008 (Benmelech and Dlugosz, 2009b).

[Insert Figure 1]

The extent to which the performance of CRAs came to depend on the securitization process in recent years can be exemplified by comparing the profits of Moody's – one of the three largest agencies – with those of Reuters – a leading financial publisher and data provider – over the past 6 years. The choice of Reuters as a benchmark is justified by the fact that CRAs define themselves as "financial publishers", and as such are treated by the law, even though their activity arguably goes beyond the simple publication of financial "opinions".[3] The top chart in Figure 2 shows that Moody's earnings before interest and taxes (EBIT) grew threefold from $541 million at the beginning of 2003 to $1439 million in the third quarter of 2007, and then reverted to $683 million by the third quarter of 2009, in perfect synchrony with the crisis. In contrast, Reuters profits took only a modest dip at the start the crisis, and kept growing thereafter. The time pattern of the two companies' return on assets (ROA) in the second chart paints a similar picture, although the level of Moody's profitability greatly exceeds that of Reuters throughout the period (even at its lowest value in the third quarter of 2009, it stands at 40 percent against Reuters' 6 percent). Perhaps most tellingly, the ratio between the two companies' market capitalization, shown in the bottom chart of Figure 2, peaked at approximately 80 percent between the late 2005 and early 2006, and dropped continuously thereafter, down to the current level around 20 percent.

[Insert Figure 2]

To understand how securitization works, which information is made available to investors and how CRAs contribute to it, it is best to illustrate it with reference to a real subprime MBS. The special-purpose vehicle shown in Table 2 is called GSAMP-Trust 2006-NC2 and owns 3,949 subprime loans for an aggregate principal of $881 million. The originator of the underlying loans is New Capital Financial, at the time the second largest subprime lender in the US: it originated $51.6 billion in mortgage loans in 2006, and filed for bankruptcy in April 2007. The arranger of the deal is Goldman Sachs, who bought the portfolio from the originator and

sold it to a SPV named GSAMP-Trust 2006-NC2. The SPV funded the purchase of this loan through the issue of asset-backed securities (listed in Table 2). These securities entitle their holders to the cash flow generated by the loan portfolio, according to the seniority structure of their tranches (a "waterfall" scheme): holders of junior tranches can be paid only after senior tranches have been paid in full. Therefore, in case of default the "junior" tranche is the first to absorb losses from the underlying collateral loans, and when it becomes worthless the "mezzanine tranche" starts absorbing further losses, with the senior tranche (typically AAA-rated) being the most protected against default risk.

[Insert Table 2]

If sold to the public, these securities – or their tranches, if any – must be rated by a CRA and must be described in a public prospectus. In our example, there were 17 tranches: 5 AAA-rated senior tranches, 9 mezzanine tranches with ratings ranging from AA+ to BBB-, 2 B tranches with ratings BB+ to BB, and an equity tranche X with no rating. It is worth noticing that the first 5 tranches representing almost 80 percent of the total were AAA-rated. Tranche X (the riskiest one), being unrated, was not sold to the public. The prospectus of this MBS is a document of 555 pages deposited at the Securities and Exchange Commission (SEC) on 31 March 2006.

Prospectuses contain several summary statistics on the underlying pool of loans. From the prospectus of GSAMP-Trust 2006-NC2, we learn that 88.2 percent of the loans have adjustable rate (the remaining have a fixed rate); 98.7 percent are first-lien (that is, the first mortgage on the property); 90.7 percent are for first homes; 73.4 percent of the mortgaged properties are single-family homes; 38 and 10.5 percent are secured by residences in California and Florida, respectively, the two dominant states in this securitization. The average borrower in the pool has a FICO score of 626: out of 100 loans, 31.4 have a FICO score below 600, 51.9 between 600 and 660, and 16.7 above 660. The average mortgage loan in the pool has a loan-to-value ratio (LTV) of 80.34 percent: out of 100 loans, 62.1 have a LTV of 80 percent or lower, 28.6 between 80 and 90 percent, and 9.3 between 90 and 100 percent. The ratio of total debt service of the borrower to gross income is 41.78 percent. However, this information is not available for all loans, as only 52 percent of them have full documentation, that is, provide information about income and assets of the applicants.

[3] The legal status of "publishers" confers considerable legal privileges to CRAs, as we shall see below. However, if CRAs were standard financial publishers, it would be hard to justify the large discrepancy between Moody's profitability (or market valuation per employee) and that of Reuters or Dow Jones, as noted by Partnoy (2006).

The above information is contained in 20 pages. The rest of the document describes the originator (New Capital Financial), the arranger (Goldman Sachs), the servicer (Ocweb), the securities administrator (Wells Fargo), the underwriting guidelines, and contains a list of disclaimers and warranties (e.g., the absence of any delinquencies or defaults in the pool).

At this point, it is worth making three remarks on the quality of the information available to investors. First, the data provided in the prospectus are not enough to price the RMBS, being entirely made of summary statistics: these contain information about the average claim but not on the individual loans in the portfolio, which may be critical to assess the risk of default of the portfolio and its tranches. Valuing these risks was of limited importance when house prices were rising and defaults were few. But as house prices stopped rising and the number of defaults started increasing, information about the underlying securities became very important. Yet, it was not available in the prospectus and in the yearly reports produced by the SVPs.

Second, detailed information on the pool of underlying securities is available through data providers like Loan Performance and McDash Analytics. Loan Performance's securities databases are the industry's largest and most comprehensive: they include loan-level data on more than 90 percent of the market for MBS securities. As stated on the website of McDash Analytics, these companies "collect loan level data directly from servicers into an anonymous database, distribute the cleansed data, and provide them to clients who want to perform prepayment and default benchmarking analysis on their mortgage asset holdings." The catch is that the subscription to these datasets is very expensive, the data are provided only with a delay after the issue of a RMBS, and considerable skills are required to analyze them. Hence, most investors did not bother to use them to assess the risks of their investment decisions (and check the quality of the credit ratings) until the crisis hit them. After all, why should they spend their money to replicate what rating agencies were (supposed to be) doing for free?

Third, no information is available on the stake retained by originators and arrangers and on their subsequent trades. This information might have been very important to help investors to assess the value of MBS securities because securitization of subprime loans generates a clear moral hazard problem. If so, holdings and trades of originators and arrangers would signal the quality of the underlying pool of loans, and thus provide very valuable information for investors. In tranched securitizations, even the precise retention mechanism – whether for instance the originator retains a fraction of the equity tranche or of all tranches – may convey different signals to investors (see Fender and Mitchell, 2009a, 2009b).

3. Conflict of interest, rating inflation and coarseness

As noted by Partnoy (2006), among all "financial gatekeepers" CRAs are those who face the most serious conflicts of interest. This is due to a combination of factors.

First, differently from analysts (but not from auditors), since the 1970s they are paid by the issuers whose instruments they rate. This change in practice came at the same time as the approval of a body of U.S. regulations that depend exclusively on credit ratings issued by Nationally Recognized Statistical Rating Organizations (NRSROs), a status until recently awarded only to Moody's, Standard & Poor's, and Fitch.[4] Being paid by the issuers creates an obvious incentive for rating agencies to distort ratings so as to please their clients, and win further business from them.

Second, unlike other gatekeepers, CRAs are allowed to sell ancillary services to their clients, in particular pre-rating assessments and corporate consulting. For instance, an issuer can ask a rating agency how it would rate a financial instrument with certain characteristics, and even ask how these should be modified to (just) obtain a certain rating. This type of activity facilitates rating shopping, that is, it allows an issuer to identify the rating agency that would provide the most favourable rating to its financial instruments.

Thirdly, CRAs are largely immune to civil and criminal liability for malfeasance, because according to several U.S. court decisions they are to be considered as "journalists" and their ratings as opinions protected by the First Amendment (freedom of speech). In contrast, after the Sarbanes-Oxley Act auditors and corporate boards face new rules regarding conflicts of interest, and financial analysts at investment banks are subject to restrictions on their activity and compensation. Therefore, for CRAs regulators have made much less of an effort to mitigate the conflict of interest than for other financial gatekeepers.

3.1 Rating inflation

By now, there is a considerable amount of evidence that CRAs engaged in rating inflation before the crisis: this is not only witnessed by the sharp drop in AAA-rated issues during the crisis shown in Figure 1 and by the massive downgrades by CRAs in 2007-08 (Benmelech and

[4] Since 2003, the number of the NSSRO has risen to ten: between 2003 and 2005, the SEC designated two new NSSRO, and pursuant to the passage of the Credit Rating Agency Reform Act in 2006 by the U.S. Congress it designated five more – two Japanese ones and three small U.S. ones.

Dlugosz, 2009b), but also by evidence that the actual ratings reported by CRAs for CDOs were inflated relative to those predicted by their models. Griffin and Tang (2009) report that, by such "adjustment" in their ratings, CRAs increased the size of AAA rated tranches on average by 12.1%, and CDOs with larger "adjustments" experienced worse subsequent performance. They conclude that, had the CRA followed its model, "the AAA tranches would have been rated BBB on average" (p.5), resulting in a 20.1% lower valuation.

Such rating inflation may have resulted from collusion between CRAs and issuers at the expense of investors, as highlighted by Bolton, Freixas and Shapiro (2009) and Mathis, McAndrews and Rochet (2009). In particular, Bolton et al. (2009) show that such collusion is facilitated when issuers can engage in "rating shopping", that is, solicit ratings from several CRAs and only reveal to investors the most favourable one (see Box 1).

Box 1. Competition and reputation in the rating industry

Bolton et al. (2009) show that in the presence of rating shopping the conflict of interest is exacerbated under duopoly compared to monopoly. In their model, CRAs have noisy information about the quality of a security and can provide reports communicating that information. Issuers can purchase and publicize a report or shop around by having certain reports not disclosed to investors. Some investors are naïve, namely believe the CRAs' stated ratings; other investors are rational, in the sense that they understand that these reports are biased. Issuers will never buy a bad rating, so that CRAs have an incentive to overstate the quality of any given issuance if the reputation costs (i.e. future forgone profits) are low enough or is the share of naïve investors is large enough. Bolton et al. (2009) show that an increase in the number of CRAs, i.e. more aggressive competition, actually makes investors worse off, as it gives issuers more opportunity to shop around for a good rating. That competition has undesirable effects in this situation is also confirmed by the evidence in Becker and Milbourn (2008), who show that the entry by Fitch has been associated with greater ratings inflation.

Rating inflation is reduced by reputational concerns: the more a CRA inflates its ratings, the lower is its future credibility, hence its future profits. Indeed a standard defence that CRAs invoke when accused of colluding with issuers is that such collusion is not in their own best interest, as it would damage their reputation. However, Mathis, McAndrews and Rochet (2009) show that this argument is flawed if CRAs earn a sufficiently large fraction of their revenue from rating complex securities. If this is the case, the temptation to inflate ratings and cash in on pre-existing reputation exceeds the value of maintaining its reputation. Interestingly, the model by Mathis et al. (2009) generates endogenous reputation cycles. When a new complex security is introduced, investors are not very trustful, and the CRA has the incentive to behave well so as to build up its reputation. With time, the increase in investors' trust raises issuance and thereby the CRAs' revenues from rating the security, up to the moment when the temptation to inflate becomes irresistible. This leads to a default, a loss of confidence in the CRA and a collapse in issuance, after which the cycle will start again.

Clearly, rating inflation benefits issuers only if at least some investors fail to take it into account in their investment decisions, either because they are naïve or because their portfolio decisions are dictated by regulations prescribing investment in highly rated securities.

Indeed some market participants appeared to behave credulously in the pre-crisis period: "certain investors assumed the risk characteristics for structured finance products, particularly highly rated instruments, were the same as for other types of similarly rated instruments", and "some investors may not have performed internal risk analysis on structured finance products before purchasing them" (*Federal Register*, Vol. 73, No. 123 page 36235, June 25, 2008). Precisely on this basis the SEC later recognized the need for differentiated ratings for structured products and corporate bonds. Also the Committee on the Global Financial System (2005) indicated that several investors interviewed by their Working Committee "claim to rely almost exclusively on the rating agencies' pre-sale reports and rating opinions for information on deal specifics and performance" (p. 23).[5]

Why did the spectacular failure of ratings occur in conjunction with structured debt securities, and not until CRAs confined themselves to rating corporate bonds? Probably because the shift from corporate debt to structured debt securities increased tremendously the complexity of the instrument being rated and therefore the number of investors who can be considered as "naïve" in pricing them. Moreover, such complexity may have increased the genuine rating errors made by CRAs, thereby generating a more dispersed distribution of ratings from which issuers could shop (Skreta and Veldkamp, 2009). Thus, there is a direct link between the complexity of structured debt securities and the scope and incentive to shop for rating.

The complexity of structured debt securities arises from the fact that, as illustrated in Section 2, these are portfolios of many assets, often with very diverse risk characteristics. The extent to which the risk of these assets is correlated is very important to determine the sensitivity of structured debt securities to aggregate risk, as underlined by Coval, Jurek and Stafford (2008). In addition, for MBS securities the risk of the underlying mortgage loans stems from two quite different sources: prepayment risk, which materializes when borrowers find early repayment worthwhile because of improved refinancing conditions; and default risk, which instead occurs when interest costs escalate, housing prices decline, or there are adverse shocks to the

[5] Consistently with this, Firla-Cuchra (2005) documents that ratings explain between 70 and 80 percent of launch spreads on structured bonds in Europe. Indeed he interprets this as evidence that "some investors might base their pricing decisions almost exclusively on ratings".

borrowers' employment or income. The socio-economic and geographic composition of the underlying loan portfolio determines the exposure of the MBS to each of these risks. Complexity is further increased by "tranching": for instance, an AAA tranche has different exposure to default risk depending on whether it is protected by a thick layer of mezzanine tranches or not. So its value depends greatly on the size and number of the junior tranches.

Another likely reason for the emergence of rating inflation has been the growing regulation-driven demand for highly rated securities, which may have increased financial intermediaries' reliance on ratings in their investment policies. Pension funds, banks, investment funds and insurance companies are all subject to rating-based regulations, whose scope has greatly expanded over time. For instance, since 1989 U.S. pension funds are allowed to invest in highly rated asset-backed and mortgage-backed securities. Moreover, in November 2001 the Federal Deposit Insurance Corporation (FDIC) reduced from 8 to 1.6 percent the capital requirement of banks on their investments in MBSs and in most CDOs issued by non-governmental entities and rated AA or better (to be compared to the 4 percent capital requirement applying to mortgages and lower rated mortgage securities), creating a huge inducement for banks both to securitize their loans and to invest in highly rated asset-backed and mortgage-backed securities.

3.2 Rating coarseness

Credit ratings are coarse in more than one sense. First, they are discrete, rather than continuous, with classes defined by letters (such as AAA, AA, A, BBB, etc.). Second, they tend to capture only some dimensions of credit risk: the ratings issued by S&P and Fitch just reflect their estimate of default probabilities; instead, Moody's ratings reflect its assessment of the expected default loss, that is, the product of the probability of default and the loss given default. But even this is not a comprehensive measure of credit risk, as it disregards the security's exposure to systematic risk, i.e. the covariance between default losses and the marginal utility of consumption, as pointed out by Brennan et al. (2009).[6]

Knowing the exposure to systematic risk is particularly important for structured debt securities, since portfolio diversification eliminates most of the idiosyncratic risk of the underlying securities, as pointed out by Coval, Jurek and Stafford (2008). Moreover, the distribution of risk across tranches is very sensitive to the assumed correlation of defaults in the

[6] Before the crisis, the Committee on the Global Financial System (2005) already warned that "the one-dimensional nature of credit ratings based on expected loss or probability of default is not an adequate metric to fully gauge the riskiness of these instruments. This needs to be understood by market participants" (p. 3). Clearly it was not!

underlying portfolio, which happens to be one of the weakest spots of the methodology commonly used by CRAs: for instance, S&P simply assumes corporate bonds to have a 15 percent correlation if they are in the same sector, and a 5 percent correlation if they are from different sectors (Benmelech and Dlugosz, 2009a, p. 629), irrespective of the aggregate state of the economy. But default correlations are much higher in downturns than in expansions, which may help account for the massive failure of structured debt ratings in the current recession.

At another level, the coarseness of ratings reflects the limited amount of detailed loan-level data used by CRAs to evaluate the risk of the underlying portfolio. As late as 2007, Moody's reported that it was about to request more detailed loan-level data from issuers for the first time since 2002, and the newly requested data included items that Moody's itself considered to be "primary", such as a borrower's debt-to-income (DTI) level, the appraisal type and the identity of the lender that originated the loan. As noted by Mason and Rosner (2007), it is surprising that these data would not have been collected by Moody's earlier, considering that "traditionally the loan to value ratio (LTV), FICO score and the borrowers' DTI are the three most significant measures of credit risk on a mortgage" (p. 24). The same can be said about neglecting the identity of the loan originator, which turns out to be an important predictor of subsequent rating downgrades, as documented by Johnson, Faltin-Traeger and Mayer (2009) for S&P ratings.

To effectively convey all this information about the risk of MBSs, CDOs and their tranches, CRAs would have had to produce multidimensional ratings, and report statistics on the sensitivity of their ratings to the most crucial assumptions of their models, such as those about the correlation between the defaults of the assets in the underlying portfolio. This, however, would have made their ratings much harder to understand and interpret for many investors, thus limiting the issuance of structured debt and contradicting the role that rating agencies saw for themselves in the development of this market. Indeed, as wittily pointed out by Partnoy (2006), "with respect to these new instruments, the agencies have become more like 'gateopeners' than gatekeepers; in particular, their rating methodologies for collateralized debt obligations (CDOs) have created and sustained that multi-trillion-dollar market" (p. 60).

This idea is captured by the model of Pagano and Volpin (2008), who show that issuers may wish to release only simple information, because most market participants would be unable to grasp the pricing implications of complex information: if such information were released, unsophisticated investors would lose out in trading with more sophisticated ones, and would require a compensating price discount to buy into structured debt securities (see Box 2).

Box 2. Private and public choice of transparency in the market for structured debt

In the model by Pagano and Volpin (2009), issuers of structured debt securities choose how much information they wish to release to investors via a CRA. Beside the security's probability of default and the loss given default, they may disclose the precise composition of the underlying portfolio, which determines the security's exposure to systematic risk. The key assumption is that the pricing implications of the latter piece of information are hard to process for many potential market participants: these unsophisticated investors know how to price a typical structured debt security, but not how to adapt its pricing in light of the specific risk characteristics of each security. Instead, sophisticated investors have no such problem.

As a result, releasing such information would expose unsophisticated investors to a "winner's curse" in the primary market: when the security has high systematic risk, sophisticated investors would refrain from buying it and leave the entire issue to the unsophisticated; in contrast, when the security has low risk, sophisticated investors would compete for it. To compensate the resulting losses, unsophisticated investors would buy the security only at a discount. To avoid such underpricing, issuers might choose not to provide precise information about the composition (and therefore the systematic risk) of the underlying portfolio.

However, suppressing price relevant information may backfire: while it avoids underpricing in the primary market, it may reduce liquidity in the secondary market or even cause it to freeze. This is because the information undisclosed at the issue stage may still be uncovered by sophisticated investors later on, especially if it confers them the ability to earn large rents in secondary market trading. So limiting transparency at the issue stage shifts the adverse selection problem onto the secondary market. In choosing the degree of rating transparency, issuers effectively face a trade-off between primary and secondary market liquidity. The key parameters in this trade-off are the value that investors place on secondary market liquidity and the severity of the adverse selection problem in the primary market. If investors care little for secondary market liquidity and/or adverse selection in the primary market would induce severe initial underpricing, then issuers will go for opacity, that is, will prefer ratings to be coarse and uninformative.

Importantly, the degree of ratings transparency chosen by issuers may fall short of the socially optimal one: a freeze of the market for structured debt is more costly for society at large than for individual investors whenever it triggers a cumulative process of defaults and/or liquidation of assets in the economy, for instance due to "fire sale externalities" or to the knock-on effect arising from banks' interlocking debt and credit positions. Fire-sale externalities can arise if holders of structured debt securities, being unable to sell them, cut back on their lending or liquidate other assets, thereby triggering drops in the value of other institutions holding them, as in Acharya and Yorulmazer (2008) and Wagner (2006, 2008). Alternatively, the market freeze may force holders of structured debt securities to default on their debts, damaging institutions exposed to them, and thus triggering a chain reaction of defaults, as in Allen and Gale (2000) or Freixas, Parigi and Rochet (2000).

These externalities create a rationale for regulation mandating a degree transparency above the level that issuers of structured debt securities would spontaneously choose (as well as for liquidity injections targeted at distressed holders of these securities in case of a market freeze).

The point that disclosing detailed information about securitized assets may hinder their liquidity is also made intuitively by Woodward (2003) and Holmstrom (2008). The latter draws a parallel with the sale of wholesale diamonds, which de Beers sells in pre-arranged packets at non-negotiable prices, and argues that this selling method is aimed at eliminating the adverse selection costs that would arise if buyers were allowed to negotiate a price contingent on the packets' content. Similarly, Kavajecz and Keim (2005) show that asset managers are able to achieve a 48 percent reduction in trading costs via "blind auctions" of stocks, whereby they auction a set of trades as a package to potential liquidity providers, without revealing the identities of the securities in the package to the bidders.

3.3. Interaction between coarseness and rating inflation

The coarseness of ratings may further exacerbate rating inflation. To see why, consider that the discrete nature of ratings implies that each rating class corresponds to a range of possible values of credit risk, which confers some discretion to the CRA and thus allows it to grant an overly generous rating to its clients. For instance, the CRA may provide a pre-rating assessment to the issuer, explaining which rating the security would obtain depending on different potential structures of the underlying portfolio of assets. This allows the issuer to choose the portfolio structure that enables the MBS or the CDO to be, for instance, *just* AAA-rated. Therefore, AAA-rated structured debt issues will end up having not the rating corresponding to the *average* AAA-rated corporate bond but rather to the *marginal* one, implying that they are correspondingly riskier. The same "trick" could be applied to the rating of tranches, in which case the issuer can adjust not only the composition of the underlying portfolio but also the details of the "waterfall" scheme of seniority between tranches. If ratings were continuous, rating agencies could obviously not play this trick, as each rating class would be infinitesimal.

This may go a long way towards understanding the true meaning of the very large "credit enhancement" achieved by structured debt issuers relative to the credit risk of the underlying portfolio. Indeed, Benmelech and Dlugosz (2009a) find, using data on 3,912 tranches of CDOs, that "while the credit rating of the majority of the tranches is AAA, the average credit rating of the collateral is B+" and observe that the CDOs were structured according to a very uniform pattern – not only in their tranche structure but also in the composition of the underlying portfolio. They suggest that this uniformity may be explained by CRAs helping issuers to structure their CDOs so as to just fit their requirements to achieve an AAA rating. In support of

this interpretation, they note: “Anecdotal evidence suggests that the S&P rating model was known to CDO issuers and was provided to them by the rating agency” (p. 632). For instance, by making its CDO Evaluator software available via its web site, S&P allowed issuers to simulate different scenarios of expected default given the characteristics of the collateral they had chosen: “The CDO Evaluator software enabled issuers to structure their CDOs to achieve the highest possible credit rating at the lowest possible cost.” This is reflected even in the wording that S&P uses to define excess collateral: “what percentage of assets notional needs to be eliminated (added) in order for the transaction to provide *just enough* … support at a given rating level” (p. 633).

It is worth noticing that, just as the coarseness of ratings may encourage their inflation, the latter decreases their informativeness: if rational investors perceive ratings as inflated, they will consider them as unreliable, and in the limit as totally uninformative. Hence, even though we have discussed them separately for convenience, the issues of rating inflation and of their informative content are mutually related.

4. Possible policy interventions

In the previous discussion, we have identified rating inflation and coarse ratings as the main targets for policy interventions. The obvious solution to address them is to change the incentives of rating agencies. But, what are the specific policy reforms to implement? In what follows we outline two possible courses of action.

The first, which we regard as the *preferred policy*, is quite drastic, in that it requires not just an adjustment of existing rules but a complete reorientation of regulation according to two new guiding principles: (i) ratings should be paid by investors, and (ii) investors and rating agencies should be given free and complete access to all information about the portfolios underlying structured debt securities, as well as about the design of their tranches.

The second policy, which we regard as a *second-best* one, imposes milder changes to the current market model, but is likely to be less effective in addressing the problems illustrated in this paper. Furthermore, it requires a considerable increase in an already hypertrophic regulation, in contrast with the preferred policy, as underlined also by Richardson and White (2009).

4.1 Preferred policy

(1) Credit rating companies should be paid by investors and not by issuers.

Since both rating inflation and the tendency to issue coarse ratings arise from the conflict of interest between CRAs and investors, it is crucial to eliminate (or at least reduce as far as possible) this conflict by addressing the issue of "who pays". If CRAs tend to please issuers by inflating their ratings and/or by making them excessively coarse, then the most appropriate solution is to have investors – not issuers – pay them for their services, as indeed was the case before the 1970s. How would such a system work? Not too differently from the market for other forms of financial information, spanning from the sale of price and transaction data by trading platforms and newspapers to the sale of advice by financial analysts and of economic forecasts by econometric consultancies. Financial analysts are perhaps the most fitting comparison: their analysis and recommendations are either sold to investors on a standalone basis or are packaged together with financial services by large banks or securities companies.[7]

It should be recognized that even this arrangement is not completely free from incentive problems. First, agency problems in asset management can dull institutional investors' search for high-quality ratings. But competition in the asset management industry should weed out institutional investors that systematically patronize low-quality CRAs.[8] Second, if some investors are large enough (or manage to set up cooperative arrangements to purchase ratings), they may try to induce CRAs to avoid or delay rating downgrades for securities in which they have invested heavily. But it is hard to imagine that such large investors may wield sufficient power as to distort the ratings of *all* the competing agencies, and presumably other investors will try to patronize CRAs that show no such tendency to shade their ratings so as to please their large customers.

More importantly, switching from the "issuer pays" to the "investors pay" model may be difficult to implement in practice because of free-riding or information leakage within the pool of investors: after buying a rating, an investor could re-sell or leak the information to other investors, who could in turn resell or leak it to others. The end result would be that ratings would yield negligible revenues. Hence, CRAs would have little incentive to produce them, or at least to invest effort in producing valuable ratings. The problem is akin to that arising in the

[7] While in most cases analysts are paid by investors ("sell-side analysts"), companies can also hire a fee-based research firm to prepare one or many reports ("paid-for analysts"). Interestingly, Kirk (2008) documents that paid-for analysts issue relatively less accurate forecasts and more optimistic recommendations than sell-side analysts, which is consistent with the idea that the former are more exposed to a conflict of interest than the latter.

[8] In contrast, Calomiris and Mason (2009) argue that the pervasiveness of agency problems in asset management is such as to make the buy side at least as collusive with low-quality CRAs as the sell side. On this basis, they reject the "issuer pays" model as a possible solution to the conflict of interest between CRAs and final investors.

markets for music CDs or software, where the ability of consumers to reproduce and disseminate music and software at low cost via the web makes life difficult for their producers.

In principle, this hurdle can be overcome by appropriate public intervention: in particular, institutional investors who are required to buy only investment-grade asset-backed securities can be required to buy a rating at a pre-set fee. If there is enough competition between CRAs, institutional investors will tend to patronize the best CRAs, so that the market will ensure quality control. Of course, the regulator will have to set the rating fee at the right level, so as to ensure the viability of CRAs but avoid leaving excessive rents to them. A variant of this approach is the "platform pays" model proposed by Mathis et al. (2009): when an issuer wants to apply for a credit rating by a CRA, it is required to contact a platform (an exchange, a clearing house or a central depository), which would charge a fee to the issuer and choose a CRA to get the rating done. The platform's interposition would thus prevent direct contracting between issuers and CRAs, and its concern to retain trading activity by investors would presumably induce it to select the most reliable CRA.

Even if the "investors pay" model is accepted and successfully implemented, a remaining problem arises from the danger of implicit collusion between issuers and CRAs, in a situation where delegation by banking and securities regulations has conferred a tremendous power to a select group of CRAs over issuers. To prevent implicit collusion, it is essential to prohibit indirect payments by issuers to CRAs in the form of the purchase of consulting or pre-rating services. A more direct (and consequential) way to deal with the problem would be to eliminate the many regulations that delegate powers to CRAs: once the rents that these regulations confer to these agencies are gone, issuers will have less of an incentive to circumvent the "investors pay" principle. However, it must be recognized that this poses the problem of finding a substitute for ratings in the banking and securities regulation.

(2) Arrangers and servicers should disclose the complete data on the individual loans (or bonds) underlying the structured finance products.

To face the problems discussed in the previous sections, the disclosure of nothing less than the entire set of data available to the arrangers and servicers should be required. It should be clear from the discussion in Section 2 that currently prospectuses do not contain enough information to allow investors to assess the risk of default of a specific product and the change in risk characteristics over time. The information on individual loans currently available (for many but not for all securities) through expensive data providers like Loan Performance should

become available for free to all investors. With these data, buy-side investors may be able to form their own assessment of the risk characteristics of the product.

It is important to notice that this form of disclosure reduces both the risk of secondary market freezes (as all available information is given to all investors) and the possibility of collusion between issuer and rating agency. In fact, when the information becomes available on the market, specialized information processors will enter and provide financial advice to investors, thereby providing healthy competition to CRAs. This will weaken the unhealthy bond that now exists between issuers and CRAs.

It is also worth highlighting that imposing disclosure requirements on the issuers is far better than imposing them on the CRAs themselves, as proposed by the Securities Exchange Commission, in July. SEC (2008) indicates that CRAs should disclose *all information* used to determine ratings for structured products. Although this policy would make CRAs more accountable to the public, it would also reduce their incentives to improve their risk models. Moreover, transparency about rating models could lead to greater collusion with issuers: as seen above, S&P was so transparent about its CDO Evaluator Manual that issuers could predict perfectly the rating they would get, and thus structure deals so as to just get an AAA rating!

As already highlighted in the Section 3, the policy being proposed here should be expected to reduce the price at which securitized assets can be sold at the issue stage and therefore the size of the market for structured debt securities, in comparison with the pre-crisis period. But at least the market would be placed on safer foundations than it was at that time.

4.2 Second-best policy

This alternative policy retains the current principle that CRAs are paid by issuers, but tries to restrain the conflict of interest with investors by limiting the way in which agencies contract with issuers and are paid by them, and tries to remedy the coarseness of ratings by prescribing a minimal informational detail to issuers and CRAs.

(1) Rating agencies should be paid an upfront fee irrespective of the rating issued and credit shopping (and paid advice to issuers) should be banned.

The requirement of an upfront fee is the so-called “Cuomo plan,” named after NY Attorney General Andrew Cuomo. As noted by Bolton et al. (2008), this requirement needs to be

supplemented with the ban of rating shopping for it to be effective. Even so, implicit collusion may still be sustainable: issuers may systematically patronize the CRAs that offer them the best ratings, for instance because they know the models that each agency is going to use to evaluate their securities. As a result, the conflict of interest may persist.

Therefore, to be effective this policy needs to be complemented by active monitoring by a supervisory body such as the SEC to deter implicit collusion. One way to reduce the danger of implicit collusion is to assign CRAs randomly to each issuer, or – more modestly – to require that for a certain fraction of randomly drawn issues a second rating be issued by another CRA independently designed by the regulator.[9] Of course, such random designation may have limited bite in a context with few competing CRAs and repeated interactions between issuers and CRAs, but it may still limit the scope for collusion.

(2) Transparency should be enhanced, by determining the information that issuers and rating agencies must disseminate to the investing public.

This rule would require mandating a more complete format for the information to be disseminated by CRAs. This is the policy suggested by the Committee on the Global Financial System (2008), which recommends that CRAs present their ratings so as to facilitate comparison within and across classes of different structured finance products; provide clearer information on the frequency of their updates, and better documentation about their models and the sensitivity of ratings to the assumptions made in their models, and especially reduce the coarseness of their ratings by producing multidimensional measures of the risk properties of structured finance products. In the same spirit, the Financial Economists Roundtable (2008) suggests that ratings should be complemented by an estimate of their margin of error.

One may add yet three further suggestions. First, the statistics to be provided by agencies should include measures of the systematic risk of the loan pool and of individual tranches, not just estimates of the probability of default and of loss given default. Second, to further reduce their coarseness, one may require ratings be defined continuously on a common scale (say, between 0 and 10), instead of being defined over a discrete grid chosen by each agency: this would reduce the scope for discretion by CRAs and thus for collusion with issuers. Thirdly, issuers should disclose the magnitude of the tranche that they retain in each issue and in each of

[9] One such proposal has been advanced by Charles Schumer, a senior member of the U.S. Senate Banking Committee, who has suggested that every tenth rating issued by a NRSRO be complemented by a second rating from another agency independently designated by the SEC.

its tranches, as well as the fee paid to the CRA who rated the issue, since these pieces of information may help investors to better gauge the quality of the issue and of its tranches.

However, this prescriptive approach places considerable burdens and risks on the shoulders of regulators. It requires them to identify the statistics that CRAs should provide, which can be difficult in the presence of very diverse financial products. It also exposes regulation to the risk of failing to keep pace with financial innovation, for instance with new ways of designing structured debt securities, possibly spurred by regulation itself. Finally, this approach may induce investors to forgo once more an independent evaluation of the risk characteristics of these securities (for instance by tapping additional data sources or other information processors), trusting that the CRA already provided all the information required by regulators.

5. Conclusion

What has been the role of CRAs in the subprime crisis? This paper focuses on two aspects that contributed to the boom and bust of the market for asset-backed securities: rating inflation and coarse information disclosure.

Rating inflation, coupled with naïve investment decisions, contributed to the massive mispricing of risk before the crisis. The likely motive for the inflation of credit ratings is an incentive problem: CRAs are paid by the issuers of the securities being rated, and therefore their interest is more aligned with the issuers than with the investing public. Several features of the ratings business, for instance the possibility of issuers to solicit preliminary ratings and therefore "shop" for the most favourable rating, expand the scope for collusion between CRAs and issuers at the expense of investors, and therefore are likely to have spurred ratings inflation.

The coarseness of ratings is one of the main reasons for the illiquidity that plagued securities markets as soon as the crisis broke out. After house prices stopped rising and defaults started on subprime mortgages started to increase, market participants realized that the detailed information required to identify "toxic assets" in the maze of structured debt securities had simply been lost in the process of securitization, and that ratings provided an insufficient guidance to identify them. We argue that the reason why coarse (and uninformative) ratings had been produced was to expand the primary market of these securities, by making them palatable also to investors who could not easily process more complex information than coarse ratings.

It is also possible that the coarseness of ratings itself contributed to their inflation, and that in turn rating inflation reduces their informativeness, so that these two problems may have interacted and fed upon each other in the pre-crisis period.

What can be done to avoid or mitigate these failures in the future? Our preferred policy option is to move towards a system where credit ratings are paid by investors, and where arrangers and servicers disclose for free the complete data on the individual loans underlying the structured finance products, so that buy-side investors may feed them into their own models so as to assess their (changing) risk characteristics. Admittedly, such reforms are not without implementation problems, and are likely to reduce the liquidity and size of the primary market for structured finance securities in comparison with the pre-crisis period. Yet, they will restore investors' confidence in the securitization process, which can still prove a valuable tool to enlarge financial markets and transfer risk from lenders to investors. These reforms will also create opportunities for specialized information processors providing healthy competition to CRAs, and sharpen the investors' awareness that they must not place blind faith in ratings alone.

There are encouraging signs that some elements of the above reforms are already being discussed seriously in the policy arena. On 17 September 2009, the SEC voted at a public meeting to propose rules to bar companies from "shopping" for favourable ratings of their securities, by requiring companies to disclose whether they have received preliminary ratings from other agencies – in other words, whether "rating shopping" has occurred. Even though this does not amount to a ban on credit shopping, at least it informs investors whether any shopping went on, and allows them to take this into account in pricing the corresponding securities.

Regarding disclosure, in July 2009 the American Securitization Forum (ASF) has advanced a drastic proposal – essentially our preferred policy outlined in Section 4.1 (item 2). The ASF has developed very detailed and standardized templates for loan-level information reporting by issuers of Residential MBS (RMBS). This information includes both data at the time of the origination of the loan and monthly updates to monitor its performance and the economic conditions of the borrower. Similar proposals have been put forward in Europe, though with less detailed disclosure requirements. If these proposals are implemented, the amount of standardized loan-level information that will be available to purchasers of RMBS will be as good as that of the issuers and servicers themselves.

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Table 1. Issuance of Mortgage Backed Securities and CDOs over time

	Total Mortgage Origination	Subprime Origination		Subprime MBS		CDO Issuance
	($bn)	($bn)	(% of total mortgages)	($bn)	(% of subprime mortgages)	($bn)
2001	2,215	190	8.6%	95	50.0%	6
2002	2,885	231	8.0%	121	52.4%	36
2003	3,945	335	8.5%	202	60.3%	30
2004	2,920	540	18.5%	401	74.3%	157
2005	3,120	625	20.0%	507	81.1%	272
2006	2,980	600	20.1%	483	80.5%	552
2007Q1	680	93	13.7%	52	55.9%	186
2007Q2	730	56	7.7%	30	53.6%	176
2007Q3	570	28	4.9%	16	57.1%	93

Source: Gorton (2008), Inside Mortgage Finance, Securities Industry and Financial Markets Association, and Creditflux.

Table 2. Example of REMBS: GSAMP-Trust 2006-NC2

Tranche description		Width	Credit Rating		Coupon rate
Class	Notional	% of total	S&P	Moody's	1-month LIBOR +
A-1	$239,618,000	27.2	AAA	Aaa	0.15%
A-2A	$214,090,000	24.3	AAA	Aaa	0.07%
A-2B	$102,864,000	11.7	AAA	Aaa	0.09%
A-2C	$99,900,000	11.3	AAA	Aaa	0.15%
A-2D	$42,998,000	4.9	AAA	Aaa	0.24%
M-1	$35,700,000	4.0	AA+	Aa1	0.30%
M-2	$28,649,000	3.2	AA	Aa2	0.31%
M-3	$16,748,000	1.9	AA-	Aa3	0.32%
M-4	$14,986,000	1.7	A+	A1	0.35%
M-5	$14,545,000	1.7	A	A2	0.37%
M-6	$13,663,000	1.6	A-	A3	0.46%
M-7	$12,341,000	1.4	BBB+	Baa1	0.90%
M-8	$11,019,000	1.2	BBB	Baa2	1.00%
M-9	$7,052,000	0.8	BBB-	Baa3	2.05%
B-1	$6,170,000	0.7	BB+	Ba1	2.50%
B-2	$8,815,000	1.0	BB	Ba2	2.50%
X	$12,340,995	1.4	NR	NR	.

Source: Ashcraft and Schuermann (2008), SEC-filed prospectus for GSAMP 2006-NC2.

Figure 1. Value of MBS securities as implied by the ABX indexes

Each ABX index is based on a basket of 20 credit default swaps, which offer protection against the default of asset-backed securities containing subprime mortgages of different ratings. The index is set at 100 on 1 January 2007 for all ratings. Source: Brunnermeier (2009).

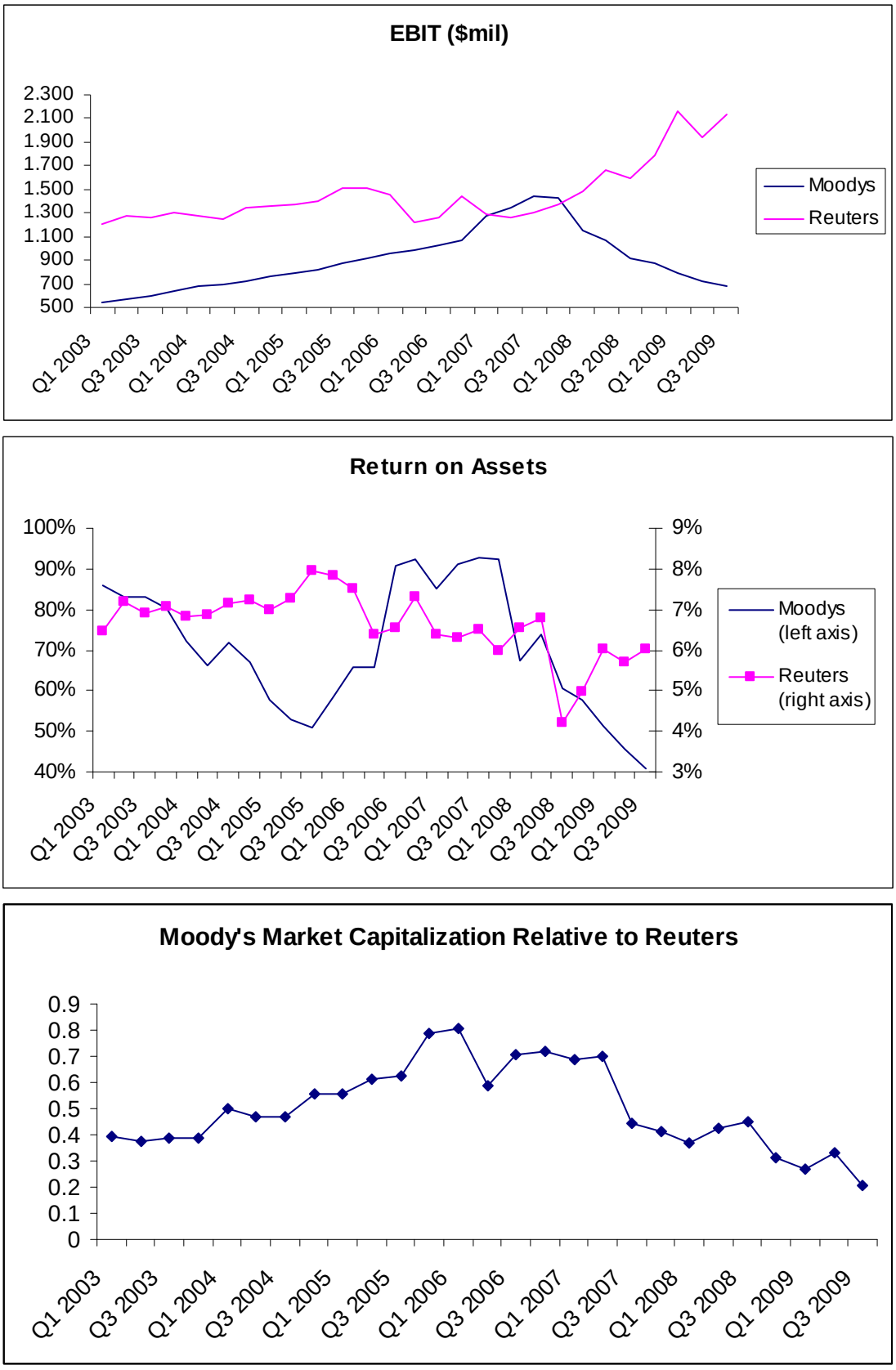

Figure 2. Moody's *vs.* Reuters
The top chart shows earnings before income and taxes (EBIT), and the second the return on assets (ROA) of the two companies. The bottom chart displays the stock market capitalization of Moody's relative to that of Reuters. Source: Worldscope.