Internet Appendix to "The Credit Ratings Game"*

In the first part of this appendix we provide proofs to LEMMA 1 and LEMMA 3, as well as PROPOSITION 1, PROPOSITION 2, and PROPOSITION 3 stated in the main text of *The Credit Ratings Game*. In the second part we analyze an extension of our basic model on rating senior tranches of asset-backed securities, and how issuers respond by structuring the 'conduit' or 'vehicle' so as to obtain the best possible rating.

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I. Proofs

LEMMA **1** : *Given the fee ϕ, the CRA's reporting strategy is as follows:*

1. *For $\phi > ep\rho$, the CRA inflates ratings (always reports G).*

2. *For $0 < \phi < ep\rho$, the CRA reports the truth, relaying its signal perfectly.*

Proof: Given that the issuer may not purchase after a given report, we will label the fee ϕ as two different fees: the fee collected after a "G" report, ϕ_G (which could be ϕ or zero), and the fee collected after a "B" report, ϕ_B (which could be ϕ or zero).

Conditional on receiving a good signal, the CRA may report "G,"in which case it earns

$$\pi(G \mid g) = \phi_G + \rho.$$

The CRA receives a fee ϕ_G for its report $m = G$ and subsequently earns its full future rent. If the CRA were to report $m = B$ conditional on receiving a good signal, it would earn

$$\pi(B \mid g) = \phi_B + \rho,$$

as there is no punishment for having said the investment was bad. Similarly, conditional on receiving a bad signal, the payoff of rating $m = B$ is

$$\pi(B \mid b) = \phi_B + \rho.$$

Reporting $m = G$ conditional on a bad signal $\theta = b$, however, yields

$$\pi(G \mid b) = \phi_G + (1 - ep)\rho,$$

since now with probability ep the investment defaults and the CRA is punished, while with the complementary probability there is no default and the CRA earns ρ.

Conditional on receiving the good signal, the incentive to report $m = G$ depends on the difference in payoffs:

$$\pi(G \mid g) - \pi(B \mid g) = \phi_G - \phi_B.$$

Conditional on receiving the bad signal, the payoff to reporting $m = B$ is:

$$\pi(B \mid b) - \pi(G \mid b) = \phi_B - \phi_G + ep\rho.$$

This yields three possible information regimes: if $\phi_G - \phi_B > ep\rho$, the CRA always reports G; if $0 < \phi_G - \phi_B < ep\rho$the CRA reports truthfully; and if $\phi_G - \phi_B < 0$, the CRA always reports B.

There is no informational regime in which a report of B increases the valuations of sophisticated investors above their ex-ante valuation of V^0. Moreover, by assumption, a report of B decreases the valuations of trusting investors below V^0. Therefore, there is no reason for an issuer to purchase a B report, making the CRA's return on a B report equal to $\phi_B = 0$. ■

PROPOSITION **1** : *The equilibrium of the fee setting game is:*

1. *If $\alpha 2V^G - V^0 > ep\rho$, the CRA inflates ratings, sets $\phi = \alpha 2V^G - V^0$ and has profits*

$$\alpha 2V^G - V^0 + (1 - \frac{ep}{2})\rho,$$

2. *If $\alpha 2V^G - V^0 < ep\rho$, the CRA reports truthfully, sets $\phi = \min[2V^G - \max[\alpha V^0, V^B], ep\rho]$, and has profits*

$$\frac{1}{2}\min[2V^G - \max[\alpha V^0, V^B], ep\rho] + \rho.$$

Proof: If the CRA always reports $m = G$, the issuer is willing to purchase this rating as long as the fee is not above

$$\alpha 2V^G - V^0,$$

the incremental profit obtained from trusting investors. There are many beliefs off the equilibrium path for sophisticated investors such that no deviation will occur. Always reporting $m = G$ is feasible when

$$\alpha 2V^G - V^0 > ep\rho$$

(from Lemma 1) and CRA profits are then

$$\alpha 2V^G - V^0 + (1 - \frac{ep}{2})\rho.$$

If the CRA reveals its signal truthfully, the $m = G$ report induces the highest valuations from both trusting and sophisticated investors buying two units, while the $m = B$ report induces the lowest valuations for sophisticated investors and the ex-ante valuation for trusting investors (because it is not disclosed). So the maximum fee is given by

$$\phi \leq 2V^G - \max[\alpha V^0, V^B].$$

In order to report truthfully, the CRA must respect the limitations given by Lemma 1 and ensure that the rating fee is not above $ep\rho$. Therefore,

$$\phi = \min[2V^G - \max[\alpha V^0, V^B], ep\rho].$$

Profits from reporting truthfully are thus given by

$$\frac{1}{2}\min[2V^G - \max[\alpha V^0, V^B], ep\rho] + \rho.$$

Lastly, notice that for $\alpha 2V^G - V^0 > ep\rho$, both always reporting $m = G$ and truthtelling are feasible but it is easy to check that the CRA's profits are higher by always reporting $m = G$, as the following expression always holds:

$$\alpha 2V^G - V^0 + (1 - \frac{ep}{2})\rho > (1 + \frac{ep}{2})\rho \geq \frac{1}{2}\min[2V^G - \max[\alpha V^0, V^B], ep\rho] + \rho.$$

■

PROPOSITION **2** : *The equilibrium of the fee-setting subgame (assuming Assumptions 5 to 7 hold) is as follows:*

1. *If* $\alpha 2(V^{GG} - V^G) > ep\rho^D$*, both CRAs always report* G*,* $\phi_k = \alpha 2(V^{GG} - V^G)$ *for* $k = 1, 2$*, and CRA profits are given by*

$$\alpha 2(V^{GG} - V^G) + (1 - \frac{ep}{2})\rho^D.$$

2. *If* $\alpha 2(V^{GG} - V^G) < ep\rho^D$*, both CRAs report truthfully,* $\phi_k = \min[2(V^{GG} - V^G), ep\rho^D]$ *for* $k = 1, 2$*, and CRA profits are given by*

$$\frac{1}{2}\min[2(V^{GG} - V^G), ep\rho^D] + \rho^D.$$

Proof: First, consider the case in which issuers have approached both CRAs and both CRAs always report G. If the issuer buys no reports, its profit is V^0.[1] If the issuer buys one report its profit is

$$\alpha 2V^G - \min[\phi_1, \phi_2].$$

If the issuer buys two reports, it gets

$$\alpha 2V^{GG} - (\phi_1 + \phi_2).$$

The issuer thus prefers two G reports to one when

$$\alpha 2(V^{GG} - V^{G}) \geq \phi_k, k = 1, 2.$$

If each CRA sets its fee ϕ_k equal to $\alpha 2(V^{GG} - V^{G})$, the issuer is willing to buy both reports as long as this is preferable to purchasing no reports, which is true if

$$\alpha 2V^{GG} - \alpha 4(V^{GG} - V^{G}) > V^{0}.$$

which can be rewritten as

$$\alpha 2V^{G} - V^{0} > \alpha 2(V^{GG} - V^{G}).$$

This condition is satisfied by Assumption 5. These fees yield profits

$$\alpha 2(V^{GG} - V^{G}) + (1 - \frac{ep}{2})\rho^{D}$$

for each CRA.

Note that there can't be an equilibrium in which both CRAs set higher fees of $\alpha 2V^{G} - V^{0}$ such that the issuer would only want to purchase a single G report. Indeed, since the reports are homogeneous goods, each CRA would profit by deviating and lowering its price as in Bertrand competition, eliminating this possible equilibrium. Also, note that a deviation from the equilibrium by firm k of $\phi_k = \alpha 2V^{G} - V^{0}$ isn't a profitable deviation from the equilibrium by Assumption 5, which guarantees that this deviation total fee is larger than $\alpha 2(V^{GG} - V^{G})$, so that the issuer simply wouldn't pay the high fee. Furthermore, a deviation by a CRA intending to tell the truth would not be profitable: if the fee for truthtelling is less than $\alpha 2(V^{GG} - V^{G})$, it is not profitable, and if the fee is more than $\alpha 2(V^{GG} - V^{G})$, since we know that ratings inflation is feasible ($\alpha 2(V^{GG} - V^{G}) > ep\rho^{D}$), the CRA who attempts to deviate will not tell the truth.

Now assume that both CRAs rate the investment truthfully. If the CRAs set their fees to sell their reports when two G reports are issued, the maximum ratings fee for each CRA is

$$\phi_k = \min[2(V^{GG} - V^G), ep\rho^D].$$

since $2(V^{GG} - V^G)$ is the maximum fee that makes the issuer prefer two reports rather than one, and since $ep\rho^D$ is the upper bound of the truthtelling constraint. When there are two G reports, Assumption 5 implies that the issuer prefers to purchase two reports to none.[2] When there is a G report and a B report, Assumption 5 also tells us that the issuer will purchase the G report.

When both CRAs are hired, a CRA may want to deviate by setting high fees $\phi_k = \alpha 2V^G - V^0$ and always reporting G to earn rents when the other CRA truthfully issues a B report. This deviation is ruled out by Assumption 6.

Finally, if $\alpha 2(V^{GG} - V^G) > ep\rho^D$, then deviating to a fee of $\alpha 2(V^{GG} - V^G)$ and always reporting G is profitable for a CRA. This sets a boundary on the parameters for which truthtelling can be an equilibrium.

There cannot be an equilibrium where CRA k reveals truthfully and CRA $-k$ always reports G. If this were an equilibrium, we would need $\phi_k < ep\rho^D$ and $\phi_{-k} > ep\rho^D$. However, CRA k has a profitable deviation to set $\phi_k = \phi_{-k} - \varepsilon$ and always report G. For the same reason, there can't be an equilibrium in which the issuer only purchases one report since any fee that CRA $-k$ would set would be undercut by a deviating CRA k. ■

PROPOSITION **3** : *Given Assumptions 1 to 7, a truthtelling monopoly strictly dominates a truthtelling duopoly.*

Proof: Total surplus with a truthtelling duopoly depends on how large the fraction of trusting investors is; that is, what interval α is in: $[\frac{V^0}{2V^G}, \frac{V^{BB}}{V^0}]$ or $[\frac{V^{BB}}{V^0}, 1]$.

In the first interval, total surplus W_{DT1} given by equation (4) in the paper is increasing in α:

$$\frac{d}{d\alpha} W_{DT1} = e(1-e)(2R - 2U + 2(1-p)R - 2u).$$

In the second interval, total surplus W_{DT2} given by equation (5) in the paper has a larger positive slope than in the first interval.

Total surplus in the first interval is larger than in the second for all α except at the top when $\alpha = 1$. Total surplus in the two intervals is equal to

$$V^0 + \frac{1}{2}(e^2 + (1-e)^2)V^{GG} + 2e(1-e)(V^0 + u - U)$$

at their maximum point of $\alpha = 1$.

In sum, the composite total surplus curve increases in the first interval and then jumps down and increases in the second interval.

Total surplus with a truthtelling monopoly also depends on what interval α is in: $[\frac{V^0}{2V^G}, \frac{V^B}{V^0}]$, or $[\frac{V^B}{V^0}, 1]$.

Over the first interval total surplus is independent of α (see equation (2) in the paper), while over the second interval it jumps down and is increasing (see equation (3) in the paper).

We first compare W_{MT1} and W_{DT1}. When $\alpha = 0$, the difference in total surpluses is

$$\begin{aligned}
W_{MT1}(\alpha &= 0) - W_{DT1}(\alpha = 0)\\
&= [V^0 + \frac{1}{2}[(e-(1-e))(R-U) + (1-e)2(V^0+u-U)]]\\
&\quad -[(e^2+(1-e)^2)V^0 + \frac{1}{2}(e^2-(1-e)^2)(R-U) + (1-e)^2(V^0+u-U)\\
&= 2e(1-e)V^0 + e(1-e)(V^0+u-U)\\
&= e(1-e)(3V^0+u-U).
\end{aligned}$$

This expression is positive since $2V^0 + u - U = V^G + V^B > 0$.

When $\alpha = 1$, the difference in total surpluses is

$$\begin{aligned}
W_{MT1}(\alpha &= 1) - W_{DT1}(\alpha = 1) \\
&= \frac{1}{2}V^G - [\frac{1}{2}(e^2 - (1-e)^2)(R-U) \\
&\quad +(2e(1-e) + (1-e)^2)(V^0 + u - U)] \\
&= \frac{1}{2}[(e-(1-e))(R-U) + (1-e)2(V^0 + u - U)] \\
&\quad -[\frac{1}{2}(e-(1-e))(R-U) + (1-e)(1+e)(V^0 + u - U)] \\
&= -e(1-e)(V^0 + u - U).
\end{aligned}$$

This expression is again positive as $V^0 + u - U < 0$ by A3.

As we have already shown,

$$W_{DT1}(\alpha = 1) = W_{DT2}(\alpha = 1)$$

and

$$W_{DT1}(\alpha = 0) > W_{DT2}(\alpha = 0).$$

Since both are linearly increasing in α, the argument above implies that $W_{MT1} > W_{DT2}$.

Next, we must examine whether W_{DT2} and W_{MT2} can cross. We know that

$$W_{DT2}(\alpha = 1) < W_{MT2}(\alpha = 1)$$

(since $W_{DT1}(\alpha = 1) = W_{DT2}(\alpha = 1)$ and also since $W_{MT1}(\alpha = 1) = W_{MT2}(\alpha = 1)$).

Furthermore, we can establish that $W_{DT2}(\alpha = 0) < W_{MT2}(\alpha = 0)$:

$$\begin{aligned} W_{MT2}(\alpha &= 0) - W_{DT2}(\alpha = 0) \\ &= \frac{1}{2}[e(2R - u - U) + (1 - e)(2(1 - p)R - u - U)] \\ &\quad -\frac{1}{2}[e^2(2R - u - U) + (1 - e)^2(2(1 - p)R - u - U)] \\ \\ &= e(1 - e)(2V^0 + u - U) > 0. \end{aligned}$$

Given that both W_{DT2} and W_{MT2} increase linearly in α, they cannot cross. This establishes the proof. ■

LEMMA **2** : *Total surplus for a truthtelling duopoly is larger than when there is a monopoly CRA who inflates ratings.*

Proof: The total surplus when two CRAs report truthfully given in equation (5) in the paper (W_{DT2}) is less than or equal to W_{DT1} for all α. We therefore compare this expression to the total surplus when one CRA always reports G, which is given by equation (1) in the paper.

First, total surplus when the two CRAs report truthfully and $\alpha = 0$ can be written as

$$W_{DT2}(\alpha = 0) = \frac{1}{2}[e^2(2R - 2U) + (1 - e)^2(2(1 - p)R - 2u) + (e^2 - (1 - e)^2)(U - u)] > 0,$$

while total surplus when both CRAs always report G and $\alpha = 0$ is equal to zero.

Both total surpluses are increasing linearly in α since

$$\begin{aligned} \frac{d}{d\alpha} W_{DT2} &= e(1 - e)(2R - 2U + 2(1 - p)R - 2u) \\ &\quad +\frac{1}{2}[(1 - e)^2(R - u) + e^2((1 - p)R - u)] \end{aligned}$$

and

$$\frac{d}{d\alpha}W_M^G = (R-U) + ((1-p)R - u)$$

are both positive.

Finally, when $\alpha = 1$, the difference between the total surpluses is:

$$\begin{aligned}
W_{DT2}(\alpha &= 1) - W_M^G(\alpha = 1) \\
&= [\frac{1}{2}(e^2 - (1-e)^2)(R-U) + (2e(1-e) + (1-e)^2)((1-\frac{p}{2})R - U)] \\
&\quad -[(1-\frac{p}{2})R - U] \\
&= \frac{1}{2}(e^2 - (1-e)^2)(R-U) - e^2((1-\frac{p}{2})R - U),
\end{aligned}$$

which is larger than zero by A3 and $e \geq \frac{1}{2}$. This completes the proof. ■

II. Rating Asset-Backed Securities and Structuring to the Rating

Our analysis so far does not capture an important aspect of the ratings process for structured finance products, namely, the back-and-forth negotiations between issuers and CRAs and the active structuring of asset-backed securities by issuers. As Fender and Mitchell (2005), Gorton (2008), Ashcraft, Goldsmith-Pinkham, and Vickery (2010) and Benmelech and Dlugosz (2009a, 2009b), among others, have highlighted, issuers of structured finance products could *design* the default risk of an asset-backed security both by manipulating the risk characteristics of the asset pool and by tranching the issue to obtain a higher rating for the senior tranche. We argue in this section that this *strategic structuring activity* by issuers of structured products is another important form of ratings shopping that can give rise to excessively rosy ratings in equilibrium.

A. Equilibrium Tranching and Credit Enhancement

To allow for the issuer's structuring activity, we extend the model by (i) introducing a new stage in the credit ratings game following the announcement by the rating agency of a bad rating and (ii) enriching the CRA rating technology. In the new stage, we give the issuer the choice to restructure the issue and solicit another rating. Define p^* as the default probability where an investor's valuation is the same when she has one unit of the investment and two units of the investment:

$$(1 - p^*)R = U. \tag{1}$$

We enrich the CRA rating technology by allowing it to detect whether investors prefer one unit (i.e., the probability of default is larger than p^*) or two units (i.e., the probability of default is smaller than p^*).[3] To keep the analysis of this more complex game as tractable as possible we also make some simplifications, which mainly reduce the number of cases we need to consider. We now assume that all investors are trusting ($\alpha = 1$) and that the CRA obtains a perfectly informative signal about the underlying risk of the issue ($e = 1$).

Consider first the monopoly case. The credit ratings game with restructuring that we consider here is a simple extension of our previous framework:

1. The CRA posts two fees, one for initial ratings ϕ^i and one for rating the product if it has been restructured ϕ^r.[4] The issuer follows by deciding whether to seek a rating on an issue.

2. If the issuer decides to seek a rating, the CRA obtains either signal g or b. We restrict attention to the truthtelling regime, formalized in assumption A8 below.[5] Therefore, if the truthfully announced rating is G, the issuer responds by purchasing it as long as the fee ϕ^i satisfies his participation constraint:

$$\phi^i \leq 2V^G - V^0.$$

3. If the rating is B for the unstructured issue, the issuer can now restructure the issue

so as to reduce the probability of default of the senior tranche sufficiently to get the CRA to issue a G rating on that tranche. More precisely, the issuer can propose to split the issue into a *senior tranche* and a *junior tranche*, where the probability that the senior tranche defaults is decreased to μp. The issuer then holds on to the junior tranche and enhances the credit quality of the senior tranche. This involves a unit loss for the issuer of

$$(1-\mu p)R-(1-p)R=(1-\mu)pR,$$

which is equal to the expected value of one unit of the senior tranche minus the expected value of the original investment. The probability μ is a choice variable for the issuer.

4. The CRA responds to a restructured issue by giving a good rating as long as $\mu p \leq p^*$, for then the benefit of selling a G rating exceeds the expected reputation cost.

The *equilibrium best response for the CRA* in this game is then to set an initial fee at $\phi^i = 2V^G - V^0$ for an initial G rating, and a restructuring fee $\phi^r = 2V^G - 2(p-p^*)R - V^0$ for a G rating on the senior tranche of the restructured issue. An *equilibrium best response of the issuer* is then to purchase the initial G rating at fee ϕ^i when it is offered, to restructure the issue after an initial B rating so that $\mu = \frac{p^*}{p}$ (the minimum level needed to get a G rating on the senior tranche), and to purchase the G rating for the senior tranche at ϕ^r.

We assume that the fee ϕ^r is positive (so that restructuring following a B rating for the unstructured issue will occur) in the following assumption:

ASSUMPTION 8 : $2V^G - 2(p-p^*)R - V^0 > 0$.

To ensure that the CRA does not gain from inflating its initial rating in the game with restructuring we must make sure that $p\rho > (\phi^i - \phi^r) = 2(p-p^*)R > 0$.

ASSUMPTION 9 : $p\rho > 2(p-p^*)R$.

Under these assumptions, the equilibrium outcome of the monopoly credit ratings game with restructuring is then as described in the proposition below.

PROPOSITION **4** : *Under Assumptions 1 to 4, 8, and 9, the equilibrium tranching and credit enhancement is such that:*

1. *Following an initial B rating, the issuer restructures the initial issue by splitting it into a* junior tranche *and a* senior tranche*, where the senior tranche gets a* credit enhancement μ *such that the probability of default of the senior tranche is reduced from p to $\mu p = p^*$.*

2. *The issuer retains the junior tranche, thereby incurring an expected loss of* $2(p - p^*)R$.

3. *The senior tranche obtains a rating G and is entirely sold to investors.*

Consider next the case of a CRA duopoly, where each CRA competes by offering fees (ϕ^i, ϕ^r) for ratings. It turns out that under our simplifications ($e = 1$ and $\alpha = 1$) this game has a straightforward solution and, except for the distribution of surplus, an equilibrium outcome that is basically the same as under a CRA monopoly. Indeed, with $e = 1$ both CRAs have the same information and the marginal value of a second rating is zero: $V^{GG} = V^G$. This implies that Bertrand competition in fees (ϕ^i, ϕ^r) between the two CRAs will drive the fees to zero, leaving the entire surplus to the issuer. It then follows from Proposition 2 that since the CRAs obtain no positive profits from selling ratings, they have a strict preference for truthfully disclosing their ratings.

The game proceeds as under the game with a monopoly CRA: i) the issuer approaches one of the two CRAs and gets a rating. If the rating is B, the issuer doesn't purchase it and decides to restructure, setting $\mu = \frac{p^*}{p}$. It then approaches one of the two CRAs for a new rating and receives a rating G, which is purchased by investors. While the split of the rents has changed from monopoly, the information revealed and product sold to investors has not changed at all.

B. The Welfare Costs of Credit Enhancement

Does the ability to restructure an issue and engage in credit enhancement improve efficiency? In this section we provide an unambiguous negative answer to this question. At best, in an efficient capital market where all the actors are rational, credit enhancement neither adds nor subtracts value. This observation simply follows from straightforward application of Modigliani-Miller neutrality logic to the asset-backed securities market. Moreover, as all debt issues benefit from the same favorable tax treatment of interest payments, there is no obvious tax benefit to be obtained from credit enhancement. In practice, as in our model, credit enhancement and tranching is driven by a preference for high ratings by some investors, over and above the preference for higher risk-adjusted returns. We model this preference for higher ratings as arising from a form of investor naivete. But, as we have argued, it can also arise from particular institutional arrangements, such as restrictions on permissible asset classes and compensation practices of pension fund managers.

We compare the total surplus of the game with and without restructuring. Without the possibility of restructuring an issue, the ex-ante surplus following a B rating is just

$$W^{NR} = (1-p)R - u.$$

In contrast, under restructuring following, a B rating the total ex-ante surplus is

$$W^{R} = [(1-p)R - u] + [(1-p)R - U].$$

The second term is negative given Assumption 4. We summarize this discussion in the proposition below.

PROPOSITION **5** : *Equilibrium tranching and credit enhancement results in a net efficiency loss of*

$$\frac{1}{2}[U - (1-p)R].$$

Notice that this result is the same for both monopoly and duopoly. The monopoly CRA strictly benefits from the restructuring since it gets paid ϕ^r and the issuer just breaks even. The issuer strictly benefits from the restructuring and the CRAs just break even in a duopoly. Either way, the entire efficiency loss is borne by trusting investors, who overpay after seeing the G rating and create wasteful excess demand for the investment. Credit enhancement here is a socially wasteful activity that only serves the purpose of deceiving trusting investors.

Notes

[1]As in the monopoly case, we restrict off-the-equilibrium path beliefs to be the ex-ante beliefs.

[2]Since no reports purchased is now on the equilibrium path, the issuer would get a return of $\max[\alpha V^0, V^{BB}]$ if it purchased no reports. Given that $\max[\alpha V^0, V^{BB}] < V^0$, it is easy to see that the statement holds.

[3]The initial investment is still either good or bad, with respective default probabilities of zero and p. The rating technology is thus consistent with our previous model. This further elaboration is important for understanding the situation in which restructuring may occur.

[4]In a previous version, we considered the case of just one fee that would be paid by the issuer each time it asks for a rating. Two fees is more general and yields the same results.

[5]There is no need for restructuring in the ratings inflation regime.

References

[1] Ashcraft, Adam, Goldsmith-Pinkham, Paul, and James Vickery, 2010, MBS ratings and the mortgage credit boom, Unpublished manuscript, Federal Reserve Bank of New York.

[2] Benmelech, Efraim, and Jennifer Dlugosz, 2009a, The Alchemy of CDO Credit Ratings, *Journal of Monetary Economics* 56, 617–634.

[3] Benmelech, Efraim, and Jennifer Dlugosz, 2009b, The Credit Rating Crisis, *NBER Macroeconomics Annual 2009*, 161-207.

[4] Fender, Ingo and Janet Mitchell, 2005, Structured Finance: Complexity, Risk and the Use of Ratings, *BIS Quarterly Review.*

[5] Gorton, Gary, 2008, The Panic of 2007, Unpublished manuscript, Yale University.