Rien Ne Va Plus -
The 2007/2008 Credit Crunch
And What Gambling Bankers Had to Do With It

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Abstract

The paper argues that the incidence of moral hazard played a significant role in the 2007/2008 credit crunch. In particular, bank traders subjected to asymmetric compensation structures have an incentive to take excessive risks even when the bank's shareholders would prefer prudent investment. Traders' incentives are shown to be unaffected by capital regulations, with the associated financial burden falling upon the taxpayer through deposit insurance or government bail-outs. Selected case studies further indicate that the phenomenon of "gambling traders" was widespread during the credit crunch, when high bonuses tempted bank employees to invest in risky subprime-backed securities. The intransparency of structured products and the inaccuracy of credit ratings contributed to the employees' ability to conceal the underlying risk from the banks' shareholders. The analysis points to an urgent need to reform compensation practices in the financial sector.

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List of Abbreviations

ABS – Asset-Backed Security

AMPS – Asset-Backed Commercial Paper

ARM – Adjustable Rate Mortgage

CDO – Collateralised Debt Obligation

CDS – Credit Default Swap

CEO – Chief Executive Officer

CMO – Collateralised Mortgage Obligation

EPS – Earnings per Share

IB – Investment Bank

MBS – Mortgage-Backed Security

P&I – Principal and Interest

ROE – Return on Equity

SIV – Structured Investment Vehicle

1 Introduction

“Increased subprime lending has been associated with higher levels of delinquency, foreclosure and, in some cases, abusive lending practices.”[1] This statement by Edward M. Gramlich, a Federal Reserve official, sounds very commonplace in a time where global financial markets are shaken with the turmoil of the 2007/2008 credit crunch that became known as the “subprime crisis”. But Mr. Gramlich made this statement in May 2004.

The subprime crisis started to unfold in mid-2007, featuring rising default rates on mortgages, falling prices of highly-rated and previously extremely popular securities, the eventual drying up of funding markets for many banks and investment vehicles, and the subsequent failure of many affected institutions. Everyone seemed surprised. Listening to companies' statements, the sizable losses they suffered in 2007 came completely unanticipated. After all, the highly profitable structured debt instruments which had bolstered their returns on equity to record levels over the past years carried an AAA credit rating – that is, they were labelled “safe except for a small tail risk” by major rating agencies.

With hindsight, it is acknowledged that the securities' high returns essentially reflected the high risk premia of the underlying collateral, which often involved subprime loans of poor quality. But is it plausible to assume that market insiders like mortgage lenders, originators of subprime-backed securities and expert security traders in large banks did not know this in advance? Could they have been so ignorant of the deteriorating conditions in the subprime market that they had to rely exclusively on credit ratings as an indicator of asset quality? Considering their expertise as well as early warnings like those of Mr.Gramlich, it does not seem likely.

Presuming that the considerable risk underlying the structured debt boom was to some extent predictable, why were agents so eager to participate in it? An obvious possibility would be that the people who were in charge of the decision to lend to shaky subprime borrowers, or to invest in subprime-backed securities, profited from their decision without bearing the full risk of their action. Such an incentive structure is commonly known as moral hazard.

This paper aims to analyse and illustrate how the incidence of moral hazard might have been conducive to the structures leading up to the credit crunch of 2007/2008. It focuses on the particular type of moral hazard which occurs when bank employees are subject to asymmetric compensation systems, which give them an incentive to make risky investment

1 Edward Gramlich, cited from Krugman (2007).

decisions ("gamble") for their company, reaping high short-term bonuses and walking away with the profits when the "gamble" (and their company) fails. The analysis will be conducted against the backdrop of capital regulations (such as Basel II) and deposit insurance, taking into account a possible cost to taxpayers.

Furthermore, an attempt to "untangle" the subprime mess will shed light on banks' incentive to originate high-risk securities and, via securitisation, pass on credit risk to investors and off-balance sheet conduits, earning large fees in the process.

Chapter 2 outlines the developments which led to the credit crunch, introducing the reader to the concept of securitisation and its connection to deteriorating subprime lending standards. Chapter 3 develops a theoretical approach to moral hazard structures for traders by first reviewing the canonical model of moral hazard in banking, and subsequently allowing for a trader in the model. The empirical plausibility of such structures is discussed through case studies in chapter 4. Chapter 5 concludes.

2 The Credit Crunch in a Nutshell

It has now become common knowledge that the remarkable performance of the United States' residential housing sector for more than a decade was a mere bubble: In the ten years prior to 2005, U.S. house prices increased by an annual 5.4 percent on average (68.9 percent over the whole period), even throughout periods when overall economic performance was weak.[2] By fall 2004, the U.S. price-rent ratio had increased to 18 percent above its long-run average.[3] The bubble burst in early 2006, and by June 2006 sales of new homes had fallen by 15 percent compared to the previous year.[4]

The housing bubble was accompanied by a "housing finance" bubble, which turned out to continue for an entire year after the housing bubble had burst. During the boom, a long period of increasing real estate prices had encouraged borrowers to take up mortgages on existing or newly bought properties, relying on the prices to climb up further so that they could refinance their mortgage on better terms in the future - using the higher value of their collateral. In turn, mortgage lenders readily provided cheap credit to all classes of borrowers. Of the total outstanding mortgages made, 14 percent were dubbed "subprime".[5] This term refers to loans made to borrowers with poor credit ratings, who do not qualify for market interest rates because of risk factors like insufficient income, lack of employment, or poor credit history. Alone in 2005, new subprime mortgages worth $625 billion were written, followed by another $600 billion in 2006 – a total of almost 10 percent of the United States GDP.[6] Many of those mortgages featured low interest rates ("teaser rates") in the beginning, adjusting upwards substantially after two or three years. Not surprisingly, when housing prices started to decline in mid-2006, in particular the weakest of borrowers found themselves in growing financial distress, being unable to refinance their mortgage and thus facing foreclosure. In February 2007, a significant rise in delinquency rates on mortgages was first noted, causing the popular adjustable rate mortgages (ARM) to reset their rates upward, which further increased pressure on borrowers, boosting foreclosures in a vicious circle. RealtyTrac, the provider of the largest U.S. foreclosure database, reported almost 1.3 million of properties subject to foreclosure during 2007 – an increase of 75 percent from 2006.[7]

2 Cf. e.g. FRBSF (2004), p. 1.
3 The price-rent ratio is the ratio of the average house price and the annual rent for a comparable house. If the fundamental value of a house is taken to be the discounted value of the future rent that could be earned on it, large upward movements in the price-rent ratio can be interpreted as a sign of a possible bubble.
4 Cf. Lahart (2007), p. C1.
5 Cf. Bernanke (2007).
6 Cf. Lahart (2007), p. C1.
7 Cf. RealtyTrac (2008).

2.1 Securitisation and the Boom in Cheap Credit

The key to understanding why institutions lent so much money to people with low income or a poor credit history in the first place is to look at the concept of securitisation (see also figure 1). Securitisation refers to the increasingly popular bank practice of pooling and repackaging loans and other cash-flow producing assets. The newly originated structured products are tradeable securities, which effectively allow the bank to pass on credit risk to third-party investors. The most common terminology for these securities are collateralised debt obligations (CDOs). To originate a CDO, the bank forms a portfolio of various types of assets like credit card receivables, corporate bonds, or mortgages. A central feature of most securities is that they are sliced into different "tranches" before they are sold to investors. "Tranches" of different seniority levels refer to securities with different risk classes, albeit with the same underlying portfolio: The "super senior tranche" is the safest, offering a low interest to investors, but also enjoying the highest priority of repayment.[8] Therefore they are classical debt capital, usually with an AAA credit rating. The most junior tranche, in contrast, only gets paid after all investors of other tranches have been paid, but is rewarded with a substantial share of the profits (it is either unrated or B). Since investors in the junior tranches are the first to bear losses incurred by the portfolio, the junior tranches are comparable to equity capital. Depending on the security, there can be arbitrary numbers of mezzanine tranches in between junior and senior. Note also that the return on junior tranche investment is often highly leveraged: The bigger the proportion of senior tranche capital to junior tranche capital, the higher the proportional loss (gain) for junior tranche investors for a given negative (positive) portfolio return.

The concept of pooling and tranching is common to a wide class of tradeable instruments. The underlying portfolio can exclusively consist of mortgages (so-called collateralised mortgage obligations, CMOs, see figure 1), corporate bonds, a mixture of assets, or even a portfolio of CDOs. In all cases, securitisation allows banks to attract different investor groups with different degrees of risk aversion.

With their newly gained ability to pass on credit risk, banks no longer kept loans on their own books – they simply earned a commission on them and sold them on, usually after repackaging them as described.

8 Cf. e.g. Brunnermeier (2008), pp. 2 for an introduction to securitisation.

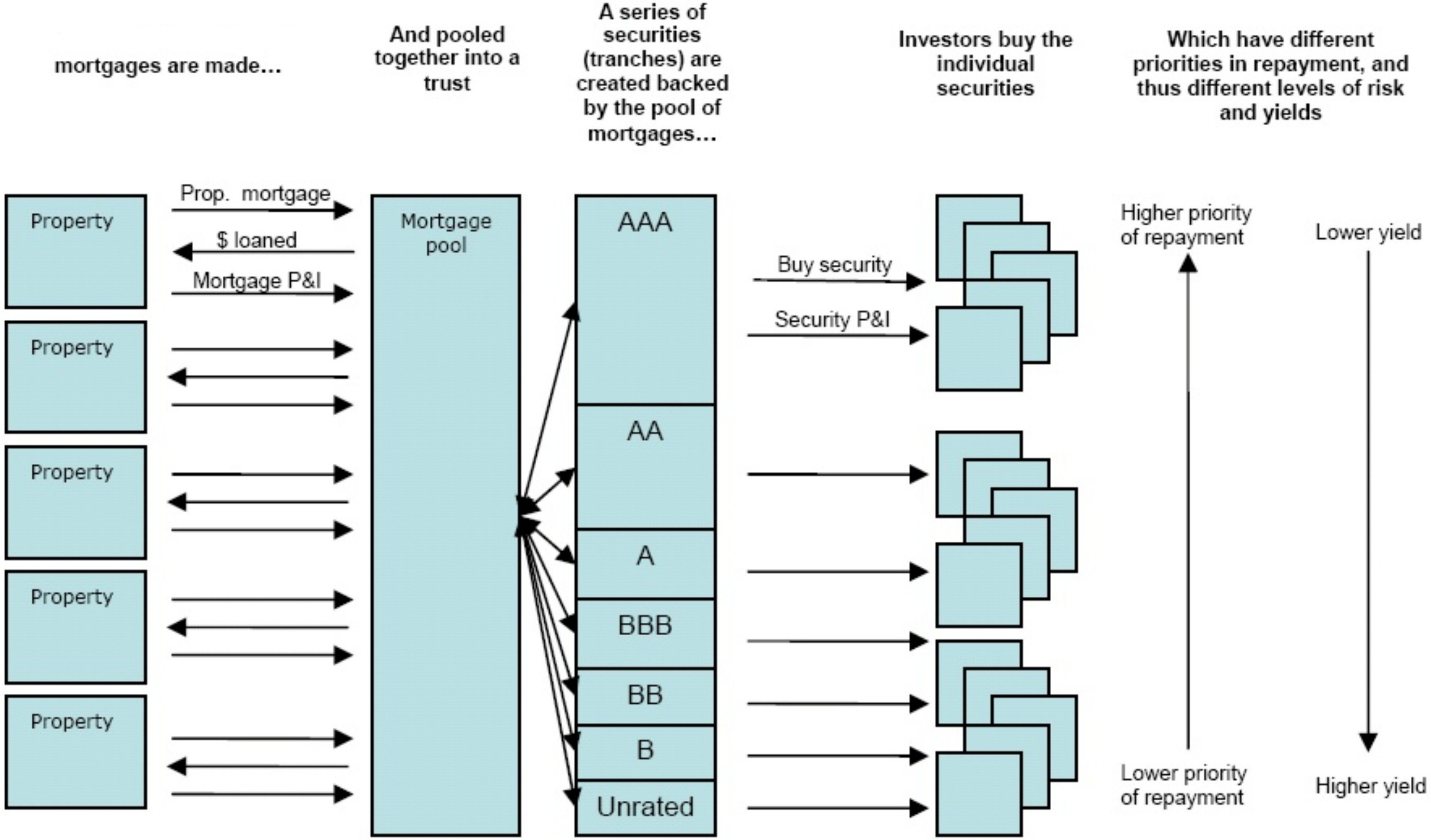

Figure 1: Securitisation of a CMO
Source: Modified from CMSA (2007).

With the diversification of credit risk and the distribution over many investors, credit markets became extremely efficient, making credit historically cheap.[9] On the downside, however, banks no longer had an incentive to closely monitor the financial health of those they were lending to – since the time the bank was exposed to the credit risk was mostly limited to the one to four months the bank needed for the origination of securities.

Why was the boom in subprime mortgages instead of some other type of loan? For one thing, risk premia that could be charged on subprime mortgages were substantially higher than those for prime mortgages or other types of loans. Second, demand for mortgages in general was high because of the seemingly never-ending rise of real estate prices. Finally, the subprime business was so profitable everyone wanted to take part in it, boosting competition for clients, in consequence making lenders more aggressive in their marketing and lending terms, and less concerned regarding the quality of their customers – Why should they be picky if they are not the ones bearing the risk? The result were deteriorating lending standards and excessive lending, including low- or no-documentation mortgages and so-called "NINJA loans" (No income, no job or assets).[10] Empirical evidence confirms the adverse link between securitisation and lending standards.[11] Apart from the subprime sector, there seems to have been another bubble in the corporate debt sector, displaying characteristics largely similar to the subprime bubble, and again featuring excessive and reckless lending.[12]

When in the spring of 2006 it became clear that the housing bubble was over, a normal market reaction would have been to tighten lending standards and to restrict credit to "worthy" borrowers. But that is not what happened at first – according to senior loan officer surveys conducted by the Fed, most banks kept their lending standards for mortgage loans to private households at the previous lax level throughout the second half of 2006,[13] arguing that competition got stronger due to weaker demand for mortgages. It may seem paradoxical that the boom in securities which financed the real estate boom peaked well after house prices had started to decline: Throughout 2006 and early 2007, institutions kept issuing CDOs, which often carried subprime positions in their portfolio. New CDO issuance in 2006 went up to

9 Cf. Brunnermeier (2008), pp. 7. Further, the efficiency of risk diversification is clearly related to cheap credit: Assuming a concave utility function of the investor, and looking at a single loan, the sum of paying a small risk premium to each investor for taking a small risk will be less than the one big premium that would have to be paid to a single investor for taking all of the risk.

10 For a slightly humorous but insightful article giving a basic overview of "predatory" mortgage products, see Pearlstein (2007), p. D1. Apparently the risks of these lending practices were neither new nor unrecognised, see Krugman (2007).

11 Cf. the results of Keys et al. (2008).

12 Cf. Berman (2007), p. C1.

13 Cf. e.g. Federal Reserve (2006), Table 1, Question 19 and Federal Reserve (2007), Table 1, Question 11.

$187bn, a 72 percent increase from the previous year, and peaked in March 2007 at $38bn in one month.[14]

The biggest question remains: Why were CDOs and other structured products so popular with hedge funds, structured investment vehicles (SIVs), and other banks? The simple reason is that the new instruments promised higher returns than traditional fixed-income assets (like treasury bonds) even though they enjoyed the same credit rating. It is important to understand that the *senior* tranches of a portfolio can easily receive an AAA rating, even though the underlying assets are single-A rated. Further, even AAA does not imply a default risk of zero – it just means the tail risk of default does not *exceed* a certain well-defined probability. For structured products, however, the different tranches were always cut off *precisely* at the maximum risk level allowed for whatever rating was desired by the issuer. In consequence, AAA-rated super senior tranches were riskier on average than traditional AAA-rated *un*structured bonds (since some bonds could have zero default probability), and thus super seniors could offer higher interest rates.

On top of that, Brunnermeier (2008) mentions several reasons why credit rating agencies may also have been overly optimistic in their ratings:[15] First, their statistical model was based on historical data of low delinquency rates, but also tighter lending standards. Second, housing busts had so far been regional, making regionally diversified portfolios look fairly safe. Third, as credit rating agencies were paid by the institutions whose securities they were rating, issues of moral hazard might have played a role. Altogether, ratings were so favourable that investors were led to believe the risk of their securities was negligible. A final reason for the popularity of structured products was that investors did not have to shoulder what they perceived as a tail risk if they did not want to: They could insure themselves ("hedge") against default by either buying a credit default swap (CDS, which works just like an insurance), or by purchasing insurance from a monoline insurer. Note that neither option eliminates risk, but both replace the credit risk of the borrower with the insolvency risk of the insurer.

2.2 Profiting from a Maturity Mismatch: SIVs and Conduits

A last topic we will briefly introduce here is the role of structured investment vehicles (SIVs) and similar off-balance sheet entities. SIVs, SIV-lites, or conduits (summarised as SIVs) are mostly bank-run programmes which make profits by investing in high-interest long-term illiquid assets and refinancing by issuing short-term asset-backed commercial paper (ABCP),

14 Data from Dealogic, cited from Lahart (2007), p. C1.
15 Cf. Brunnermeier (2008), p. 6.

using the illiquid assets as collateral. Put differently, SIVs profit from a maturity mismatch in their balance sheet.[16] The bonds that an SIV typically invests in are complex, mostly AAA-rated, credit market instruments like asset-backed securities (ABS, not to be confused with the short-term ABCP), mortgage-backed securities (MBS), or CDOs (for our purposes, ABS, MBS and CDOs are very similar). On the liability side, the ABCP which an SIV issues (usually at a rate close to the interbank reference rate LIBOR) has an average maturity of 90 days. Since this is substantially shorter than the maturity of its assets, an SIV needs to refinance frequently by selling new ABCP to pay back the expiring one. This exposes the vehicle to funding liquidity risk: The SIV quickly turns illiquid if it can no longer sell its ABCP (e.g. because markets dry up). To ensure sufficient funding, the bank which initiated the SIV (the "sponsoring bank") usually grants a contractual credit line, a liquidity backstop. This has the important effect of ensuring an AAA credit rating for the SIV (given a highly rated sponsoring bank). An SIV is generally intransparent and opaque – i.e. investors in its ABCP can generally not see through to the structure of the SIV's balance sheet and the underlying assets. The more important is a most favourable credit rating. The number and the asset volume of SIVs have grown substantially over the past years, before playing a key role in the current crisis.[17] The incentives for banks to initiate SIVs are based on the legal independence of SIVs (which allows them to stay off banks' balance sheets) and range from regulatory arbitrage to cheap funding (see section 4.3).

2.3 Timetable of Events

This section will briefly outline the developments in global financial markets from July 2007 onwards, while selected cases will be analysed in more detail in chapter 4.

When mortgage defaults notably started to rise in early 2007,[18] the first to suffer were mortgage lenders which had kept mortgage loans on their books, furthermore third-party investors (individual or institutional) who had bought MBS, CDOs or ABS with subprime exposure (as a security declines in value if one of the loans in the portfolio defaults). Because of the complexity of structured products and the intransparency of banks' balance sheets, it was far from obvious for investors and market observers exactly *who* was holding *what* risks. The result was a vicious circle where rating agencies downgraded the credit rating of many subprime-related securities and the prices of these securities subsequently fell. With higher

16 See Brunnermeier (2008), p. 4 for more details.
17 Also see Tett et al. (2008) for a discussion of the role of SIVs in the credit crunch.
18 See Bernanke (2007) for details on subprime developments.

mortgage default rates and lower demand for securities, ARM interest rates increased and mortgage conditions in general worsened, putting additional pressure on borrowers. Defaults increased further, with subprime ARMs accounting for 6.8 percent of all mortgage loans but 43 percent of all foreclosures (data from 2007Q3).[19] The consequence were further downgrades and price decreases of structured products. By June 2007, the interest rates on corporate credit were increasing as well, signifying higher risk premia – even though corporations were generally well-capitalised and in no immediate danger. This spillover effect may have resulted from the fact that investors were becoming insecure about how to value structured products in general (including corporate credit products), and that confidence in credit ratings' accuracy had been shattered.[20]

Investor's uncertainty about exactly what assets SIVs and conduits had on their balance sheet, and how damaged those assets were, continuously increased. A fundamental turmoil was caused when the markets for ABCP (which funded many SIVs and conduits) dried up in late July: Numerous "silent bank-runs" occurred when investors refused to "roll over" their ABCP assets, forcing the issuing institutions to disburse their ABCP upon reaching maturity. SIVs, conduits, hedge funds and banks which had relied on ABCP short-term funding were unable to find new buyers, resulting in a severe liquidity crisis for many of them.[21] Without opportunities to refinance, they had no other option but to sell their long-term assets into a depressed market, leading to bankruptcy for some of them. Big banks which sponsored SIVs involuntarily got involved in the ABCP mess as SIVs (often for the first time in their history) had to draw on the credit lines which they had been granted to ensure high ratings (also see section 4.3).

With the wide and untraceable dispersion of credit risk, the unreliability of credit ratings, and the incalculable market risk of asset holdings, interbank markets froze up in August 2007. Not only were banks unable to assess counterparty risk (e.g. because of possible links to off-balance sheet vehicles) when lending to other banks, but also did they fail to anticipate what liquidity shortages they themselves might face. The result was a significant increase of the so-called TED spread, which is often used as an indicator of the depth of the credit crunch in interbank markets (see figure 2). The TED spread is the difference between the LIBOR (the average interbank lending rate) and the U.S. treasury rate. It indicates banks' unwillingness to lend to one another instead of buying the essentially riskless treasury bond.

19 Cf. MBA (2007).
20 Cf. Brunnermeier (2008), p. 11.
21 Cf. Tett et al. (2008).

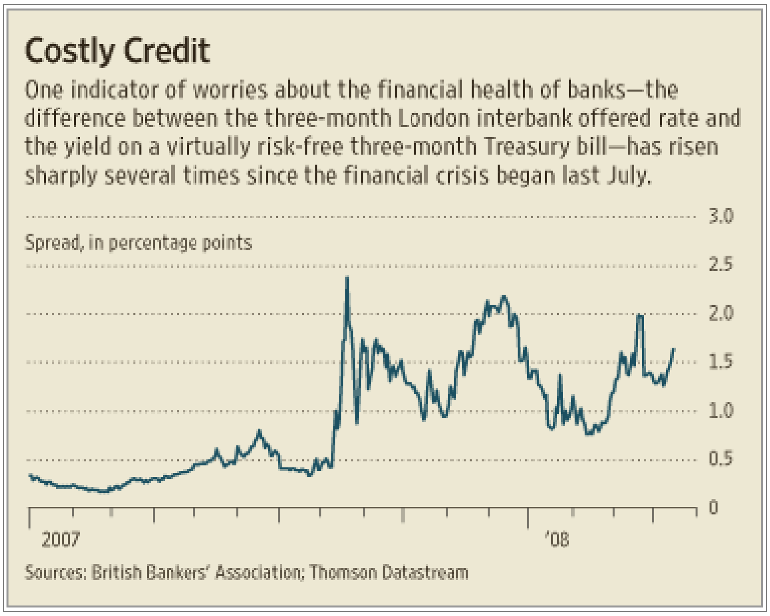

Figure 2: The TED Spread and the Three Waves of Illiquidity
Source: Mollenkamp (2008).

The "waves" of illiquidity in the figure were due to new market information (like loss evaluations). A recent study further suggests that the true TED spread may have been higher as banks may likely have understated their true borrowing costs for reputational reasons.[22]

From July 2007 onwards, numerous big banks took widespread write-downs on asset holdings, others could not bear their liquidity commitments towards ABCP conduits or hedge funds and had to be bailed out or even failed.[23] Several bank runs occurred, not sparing a leading U.S. investment bank. Chapter 4 examines the case of UBS, whose write-downs ($38bn) rank among the largest, and the case of IndyMac, the largest bank failure the credit crunch has produced – so far.

The chapter closes with a warning: Today's global financial architecture and modern banking system has reached a level of complexity that renders almost any description of what precisely led to the credit crunch necessarily incomplete. This brief introduction is therefore confined to give a very basic understanding of the mechanisms between borrowers, lenders and investors and serves as a foundation for the paper's subsequent focus on the influence of moral hazard during the credit crunch.

22 Cf. Mollenkamp (2008).
23 Cf. Buiter/Sibert (2007), Bartz/Atzler (2007), and Brunnermeier (2008), pp. 17.

3 A Theory of Gambling Traders

3.1 Motivation

Many questions remain unanswered: Why did a market as small as the subprime market cause such extensive losses, and why did the crisis involve subprime-unrelated assets? Why did lenders, investors, and rating agencies not recognise the dangers involved in subprime lending? And *if* they recognised the financial trouble that was about to come up, why did they not *act* on their suspicion, but went along with everyone else?

The amplification and spillover effects of the crisis are addressed by Adrian and Shin (2008), who show that banks and other investors effectively manage their portfolio risk by ensuring that their leverage ratio is high in booms and low in busts (i.e. leverage is pro-cyclical). In other words, they buy assets when their price rises (and take on new debt), and sell assets when their price falls (and pay back debt with the proceeds).[24] This behaviour tends to be synchronised by *many* financial agents, triggering feedback effects from asset sales to further price drops, resulting in a liquidity spiral.[25] This approach provides a sound answer as to how initial price declines of mortgage products (due to increased delinquency rates) could trigger large-scale asset sales, substantial write-downs and the drying up of funding markets.

Nevertheless, all of these reactions would likely not have been triggered, had banks (and other investors) chosen to invest prudently in the first place, and abstained from risky subprime products promising high returns. It can be argued that the risk associated with subprime products was underestimated, diluted in securitisation, and concealed by AAA credit ratings. But the erosion of mortgage lending standards was a highly visible phenomenon, the existence of a U.S. housing bubble was long conjectured, and at least expert investors in big banks and SIVs can be assumed to have had some idea about the risk that they were taking. Considering the existence of deposit insurance and the repeated occurrence of government bail-outs during the crisis, the issue of moral hazard arises: Did banks have an incentive to gamble because they could rely on not having to bear the consequences if the gamble failed? How were these incentives influenced by the capital requirements which the Basel regulations imposed? And what role has been played by the internal decision procedures within a bank? The following sections will develop a theoretical approach to a particular kind of moral hazard: The type of moral hazard which arises when investment bank traders are compensated for generating high returns, but are not punished for generating losses, the consequence of

24 Cf. Adrian/Shin (2008).
25 See "loss spirals" and "margin spirals" in Brunnermeier (2008), pp. 23.

which are overly risky investments and socially inefficient outcomes. Before investment decisions are thus analysed on a micro-level in section 3.3, the next section will outline a general model of moral hazard in banking which will serve as a basis for further considerations.

3.2 The HMS Framework

The model proposed by Hellmann, Murdock and Stiglitz (HMS 2000) provides useful insights on how the deposit insurance frequently granted by governments to prevent bank runs endangers prudent bank behaviour, and how capital requirements (as imposed by Basel I and II) and deposit rate controls can help to preserve asset quality.[26]

Consider a bank that pays its depositors a gross interest rate r in exchange for funds, which the bank can invest in either a prudent or a gambling asset. The prudent asset yields a return α with certainty, while the gambling asset yields γ with probability θ and β with probability 1-θ. While $\gamma > \alpha$, the prudent asset has a higher *expected* return, $\alpha > \theta\gamma + (1-\theta)\beta$, i.e. the gambling asset is socially inefficient. For every unit of deposits mobilised, the bank invests k units of its own capital (deposits are normalised to 1 so total assets invested are 1+k). Equity capital bears an opportunity cost of $\rho > \alpha$ (note that all rates are gross: $\alpha, \gamma, \rho, r > 1$). Finally, deposits are insured, which implies that the amount of assets which an individual bank can mobilise depends only on the degree of competition with other banks and on the interest rate offered by the banks.

For simplicity, assume $\beta = 0$. For the bank, the one-period profit from investing in the safe asset is then $\pi_P = (\alpha(1+k) - r - \rho k)$, while the *expected* one-period profit from gambling is $\pi_G = \theta(\gamma(1+k) - r) - \rho k$, reflecting the fact that the bank does not have to pay back the deposits if the gamble fails. However, gambling and failing would result in the closure of the bank by the government, and so the bank would lose future profits. A bank will thus choose to invest prudently if and only if the discounted value of its future profits (in the following: its franchise value) from prudent investment are higher than those from gambling. The franchise value of a prudent bank is $V_P = \sum_{t=0}^{\infty} \delta^t \pi_P = \frac{\pi_p}{(1-\delta)}$ for an infinite time horizon and a discount rate of δ. What is the franchise value of a gambling bank which risks to be closed every period? It receives the expected return π_G in the current period. With probability θ of winning this period, the bank lives for another period, with expected return $\delta\pi_G$. With

26 See Hellmann et al. (2000), pp. 151 for the original model.

probability θ^2 it lives to the third period and receives $\delta^2 \pi_G$, and so on. Its franchise value thus sums to

$$V_G = \pi_G + \theta \delta \pi_G + \theta^2 \delta^2 \pi_G + \ldots \quad = \quad \sum_{t=0}^{\infty} (\delta \theta)^t \pi_G \quad = \quad \frac{\pi_G}{(1-\delta \theta)} \quad .$$

The "No Gambling Condition" (NGC) $V_P \geq V_G$ becomes $\frac{\pi_p}{(1-\delta)} \geq \frac{\pi_G}{(1-\delta \theta)}$, which can be rearranged to $\pi_G - \pi_P \leq (1-\theta) \delta V_P$ for stationary values of the parameters. The interpretation is immediate: A bank will not gamble if the one-period return from gambling is less than the lost franchise value from prudent investment which the banks gives up with probability $1-\theta$. Further rearranging yields a threshold interest rate below which no gambling will occur:

$$r^{NG} \leq \frac{[(1-\delta)(1+k)(\alpha - \theta \gamma)]}{(1-\theta)} + \delta(\alpha(1+k) - \rho k) \quad .$$

If we now look at the case where banking regulation is absent and the market is characterised by perfect competition, the only feasible equilibrium is one where all banks gamble: Profits are zero in equilibrium, so no franchise values can be created which could keep banks from gambling. In contrast, the high profits a bank makes from a winning gamble enable it to offer higher interest rates to depositors: $\pi_P = \pi_G = 0$ imply $r_G = \gamma(1+k) - \frac{\rho}{\theta} k$, whereas the maximum rate offered by a prudent bank is $r_P = \alpha(1+k) - \rho k$, where typically $r_G > r_P$ is valid for small k (see figure 3). Note that neither bank will voluntarily hold any capital, as the assumption $\rho > \alpha > \theta \gamma$ implies that the return on capital is always below its opportunity cost (also note that $\frac{dr_G}{dk} < 0$). In consequence, a symmetric situation of prudent banks would entail strong deviation incentives to steal the market. In equilibrium, competition for deposits will force all banks to gamble, at $k=0$ and $r_G = \gamma$.

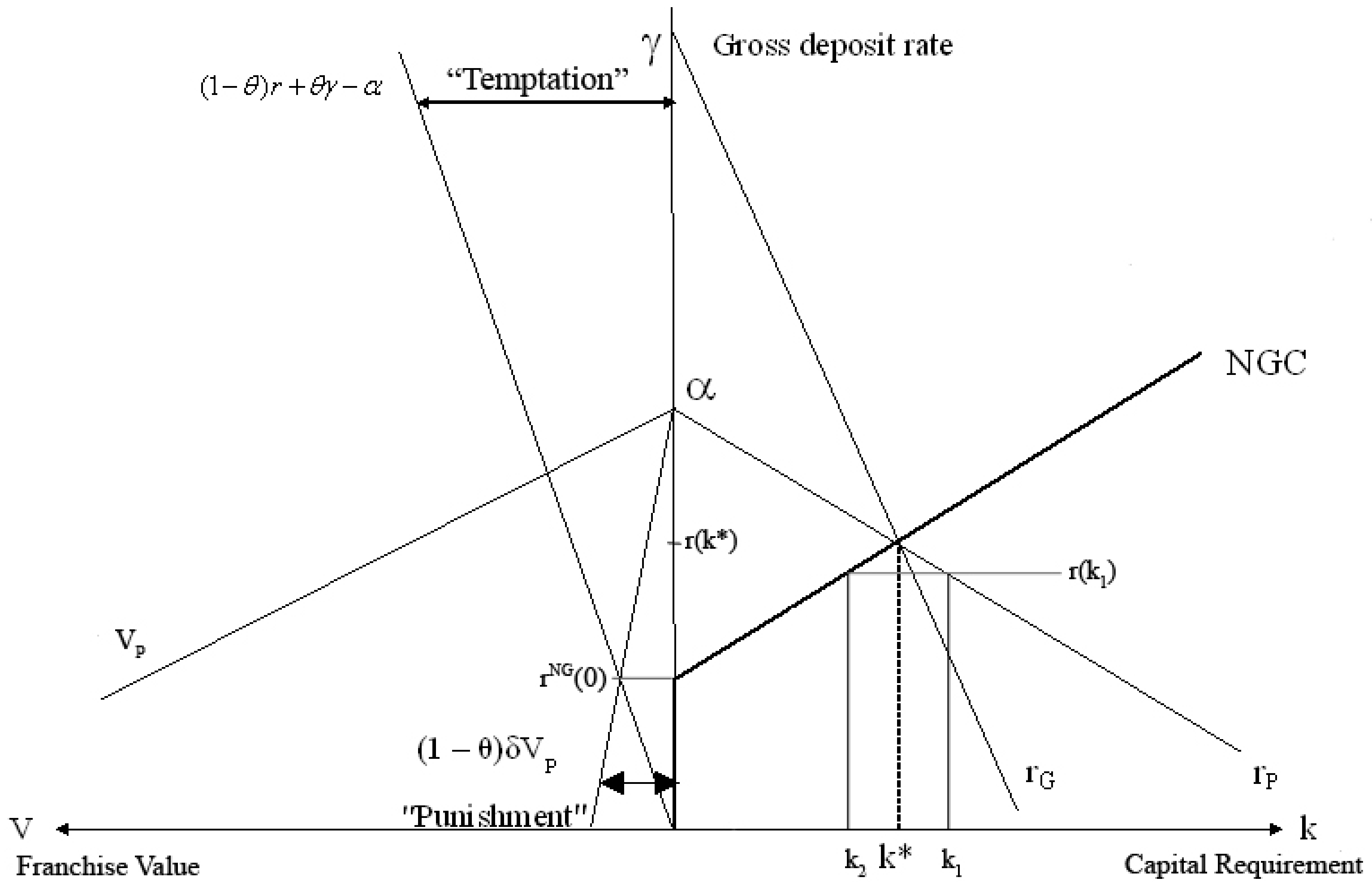

Figure 3: Minimum Capital Requirements and Deposit Rate Ceilings in the HMS Model
Source: Modified from Miller (2008).

One way out of this inefficient equilibrium (where the burden of deposit insurance is paid by the taxpayer) is to impose minimum capital requirements. Investing own capital forces banks to bear some of the downside risk of gambling, and it reduces the deposit rate which banks can pay at maximum. Because $\frac{dr_G}{dk}=\frac{(\theta\gamma-\rho)}{\theta} < \frac{dr_P}{dk}=\alpha-\rho < 0$, r_G decreases more steeply in k than r_P does. Once k is so high that the maximum interest rate affordable for a gambling bank is also affordable through prudent investment, it can be assumed that banks will invest prudently in equilibrium. The minimum capital requirement consistent with prudent investment in perfect competition is obtained by equating the two interest rates:

$$r_P=r_G$$
$$\Leftrightarrow r=\gamma(1+k)-\frac{\rho}{\theta}k=\alpha(1+k)-\rho k$$
$$\Leftrightarrow \mathrm{k}^* =\frac{(\gamma-\alpha)}{(\rho\frac{(1-\theta)}{\theta}-(\gamma-\alpha))}$$

As can be seen from figure 3, the two interest rates cross exactly on the NGC line (which increases in k for sufficiently myopic banks), implying that returns from both investments are equal in this situation (note that profits are still zero in equilibrium).

In the original paper, Hellmann et al. show that the capital requirement needs to be *strictly* greater than k*: While banks at k* have no incentive to gamble at the asset allocation stage, at the deposit mobilisation stage the marginal profit from attracting one more depositor is higher for gambling than for prudent banks.[27] Setting an even higher $\mathrm{k}_1>\mathrm{k}^*$ implies $r_P(\mathrm{k}_1)>r_G(\mathrm{k}_1)$ so all banks will invest prudently. However, this situation is pareto-inferior: The interest rate $r_P(\mathrm{k}_1)$ could equivalently be obtained with a capital requirement of k_2 complemented by a deposit rate ceiling of $r_P(\mathrm{k}_1)$, so that depositors' profits are the same while banks' profits are higher (note that binding interest ceilings always entail positive franchise values for banks). Would deposit rate ceilings alone be sufficient? Without a capital requirement, the ceiling would need to be set at $r^{NG}(0)$, the y-intercept of the NGC line: At $k=0$ and any $r>r^{NG}(0)$, banks' "temptation" to gamble, $\pi_G-\pi_P=\theta\gamma-\alpha+(1-\theta)r$,[28] exceeds the "punishment", $(1-\theta)\delta V_P=(1-\theta)\delta\frac{(\alpha-r)}{(1-\delta)}$. Which of these options is best? If

27 See Hellmann et al. (2000), p. 163 for a proof.

28 The temptation increases in r as higher interest payments increase the incentive to default on depositors. Note that temptation is graphed for the special case of $\theta\gamma = \alpha$, so the line starts at the origin.

banks' profits, consumers' interest and government's burden are taken into account, *any* point on the NGC line is pareto-optimal and, for $r \leq r(k^*)$, can be achieved with a capital requirement of k and an interest ceiling of $r^{NG}(k)$. The common objective to achieve the highest deposit rate consistent with prudent investment is obtained by implementing the original minimum capital requirement of k*, complemented by a deposit rate ceiling of $r(k^*)$.

3.3 Including a Trader in the HMS Framework

The model proposed by Hellmann, Murdock and Stiglitz (2000) provides a theoretical foundation for moral hazard in banking, treating the banks as unanimous deciders which maximise shareholders' value. The model developed in this section will relax this assumption: In a modern banking system with investment banks, hedge funds, and SIVs, shareholders often do not have an immediate influence on a bank's investment decisions. Investment decisions are commonly made by traders employed solely for this purpose, and traders' interests may conflict with shareholders' interests depending on their compensation structure.

A recent model which has received considerable attention in the media is Foster's and Young's (2008) “Hedge Fund Game”[29]. The model is directed primarily towards hedge funds, SIVs, and other types of conduits, and describes how an unskilled trader can “game” the system, earning large fees while adding no value to the investment process.

Consider a hedge fund of $100 million, set up by a manager who promises investors to generate returns well above a benchmark return (e.g. treasury bonds) while not taking more risks. For these supposedly special abilities, he charges investors an annual management fee of 2 percent of funds under management, and a 20 percent incentive fee of the return above the benchmark. He then writes covered options on an event that will occur with a chosen probability, say, the Dow Jones ends the year with an x percent gain, where x is chosen to occur with a 10 percent probability. If each option pays $1 million and buyers are risk-neutral, he can sell 100 options at $100,000 each, yielding $10 million.[30] These proceeds allow for 10 more options, yielding another $1 million. The manager puts the $111 million he has mobilised into treasury bonds yielding 4 percent. After one year, he has a 90 percent chance that the options are worthless, leaving him with $115.4 million gross. Investors will be delighted: Their return net of fees will be $15.4-2-0.2(15.4-4) \approx$ 11.1 percent per year,

29 Cf. Foster/Young (2008).

30 Options are “covered” by the equity capital of the fund. More options could be sold if the fund was leveraged, but then margin requirements would have to be considered.

while the manager makes \$4.28 million. With a chance of 10 percent, however, the options are exercised, paying the holders a total \$110 million. Of the remaining \$5.4 million in the fund, the manager gets his \$2 million management fee, leaving investors with a loss of 97 percent. However, the manager has a 59 percent chance that the fund runs for five years at an annual 11.1 percent net return without crashing, making him seem like an exceptionally skilled manager when all he does is gambling. While this so-called “piggy-back strategy” is unrealistically transparent, Foster and Young claim that more sophisticated (and thus harder to detect) versions of this strategy are likely to be popular in the hedge fund market.[31]

Clearly, hedge funds are very different from the commercial banks for which the HMS framework was designed. Most importantly, hedge funds are largely unregulated, and there is no such thing as deposit insurance or capital requirements. Nevertheless, similarities may exist in the compensation structure of hedge fund managers and bank traders. This makes it worthwhile to look at the consequences of inserting a “Foster-and-Young trader” into the HMS model. The empirical plausibility of this combination will be discussed in chapter 4.

Consider the original HMS model as described in section 3.2. Now suppose that shareholders lack knowledge about the available assets and their quality. In consequence, they delegate the investment decision to a trader, who is assumed to be more knowledgeable about the most attractive assets in the market. This also implies that shareholders will not be able to tell whether the trader invests in a risky or in a safe asset – they only see the returns at the end of the year. Shareholders influence the trader's decision by choosing his payment structure: As in the Foster and Young model, the trader receives 2 percent of the funds under management as a basis annual salary, plus a 20 percent bonus on all returns above a benchmark. Since the trader has no influence on funding or leverage decisions but simply invests whatever funds are raised, his payment is calculated on the basis of total funds 1+k (where deposits are again normalised to 1 and shareholders choose capital k). We will further assume that the trader employed by the bank does not genuinely have the skills to recognise assets which are so undervalued that they promise a higher return than a safe benchmark asset while not bearing more risk. The trader is thus left with two options: He can either invest in the safe benchmark asset, yielding a (gross) return of α, or he can choose to game the system, which in our model is represented by the risky asset of section 3.2, yielding γ with probability θ and zero otherwise. Note that the trader is assumed to be aware of the true risk he is taking, while the shareholders are led to believe the high-return asset is as safe as the benchmark asset. Once

31 Cf. Foster/Young (2008), p. 7.

the gamble fails, however, shareholders realise what the trader was doing, and he gets fired. What is the best investment choice for an unskilled trader? The one-period return which the trader gains from the safe asset is simply his management fee, $\pi_P^T = 0{,}02(1+k)$. His alternative is to gamble, at an expected return of $\pi_G^T = [0{,}2\,\theta(\gamma-\alpha)+0{,}02](1+k)$. The trader will choose to invest prudently if the present discounted value of his future earnings from prudent investment exceeds the one from gambling. There is an important assumption involved here: Just like we assumed that a bank will be closed and no further profits made after a lost gamble, we will assume that a trader will not be able to find a new job once his scam has become public. The present discounted value for a gambling trader therefore takes into account that all future income is lost once he loses a gamble.[32] Formally, given $PDV_P = \frac{\pi_P^T}{(1-\delta)}$ and $PDV_G = \frac{\pi_G^T}{(1-\delta\theta)}$, $PDV_P \geq PDV_G$ implies that $\frac{\pi_p^T}{(1-\delta)} \geq \frac{\pi_G^T}{(1-\delta\theta)}$ or equivalently $\pi_G^T - \pi_P^T \leq (1-\theta)\,\delta\, PDV_P$.

The condition becomes $0{,}2\,\theta(\gamma-\alpha)(1+k) \leq \delta(1-\theta)\frac{0{,}02\cdot(1+k)}{(1-\delta)}$ and finally

$$\delta \geq \frac{(0{,}2\theta(\gamma-\alpha))}{(0{,}2\theta(\gamma-\alpha)+0{,}02(1-\theta))} \quad .$$

A trader will be able to resist gambling if his discount rate is high enough, i.e. if he cares enough about his future income which he puts at risk when gambling. Note that the condition is independent of the amount of assets under management or the level of equity capital invested. To get an impression of the size of the necessary δ, consider the hedge fund case above with gross returns $\alpha = 1{,}04$, $\gamma = 1{,}15$ and a winning probability of $\theta = 0{,}9$. To invest prudently, the trader's discount rate needs to be $\delta \geq 0{,}91$.

In the following, let us look at the perspective of the bank which employs the trader. How do the bank's interests change compared to a situation where shareholders decide themselves about investments? The net gain which they hope a *skilled* trader will generate for them is

$$\pi_{Skilled}^B = \gamma(1+k) - r - 0{,}2(\gamma-\alpha)(1+k) - \rho k - 0{,}02(1+k) \quad \text{or}$$

$$\pi_{Skilled}^B = (0{,}8\gamma + 0{,}2\alpha)(1+k) - r - (\rho + 0{,}02)k - 0{,}02 \quad .$$

For most (plausible) parameter values, this return will be higher than the return the bank can gain by investing prudently itself (otherwise the compensation structure "2 and 20" would be

32 Thinking of current court cases like those against Société Générale's Jérôme Kerviel or Bear Stearns' Ralph Cioffi and Matthew Tannin, this may not seem so unrealistic.

chosen differently). This, however, presumes that the trader is able to generate excess returns without additional risk. Unfortunately, it is not possible for the bank to distinguish between a skilled and an unskilled trader. What does this imply for its profits? Would it still be in the bank's own interest if an *unskilled* trader decided to gamble? If a trader is unskilled but invests prudently, the bank's one-period return is $\pi_P^B=\alpha(1+k)-r-(\rho+0{,}02)k-0{,}02$ or

$$\pi_P^B=(\alpha-0{,}02)(1+k)-r-\rho k\,.$$

For an unskilled trader who gambles, the bank's expected one-period return is

$$\pi_G^B=\theta[\gamma(1+k)-r-0{,}2(\gamma-\alpha)(1+k)]-\rho k-0{,}02(1+k) \quad \text{or}$$
$$\pi_G^B=\theta[(0{,}8\gamma+0{,}2\alpha)(1+k)-r]-(\rho+0{,}02)k-0{,}02 \quad \cdot$$

Whether it is in the bank's interest that an unskilled trader gambles depends mostly on the regulation imposed on the bank (note that we consider the alternative "unskilled trader invests prudently", not "not employing a trader"). Adjusting the "No Gambling Condition" for the costs of the trader, the equation $\pi_G^B-\pi_P^B\leq(1-\theta)\delta V_P$ yields a critical deposit rate of

$$r^{NG}\leq\frac{((1-\delta)(1+k)[\alpha-\theta(0{,}8\gamma+0{,}2\alpha)])}{(1-\theta)}+\delta[(\alpha-0{,}02)(1+k)-\rho k]$$

below which the bank prefers the trader not to gamble as their returns from prudent investment are higher. How does the resulting NGC condition compare to the one from the original HMS model without the trader? Including the costs of a trader for the bank results in a reduction of the return of the gambling asset, which makes the NGC less stringent, i.e. r^{NG} rises. In addition, the return to both assets is reduced due to the management fee, which decreases affordable deposit rates in general and thus r^{NG} declines. The effect of the trader on the slope and intercept of the NGC curve is thus ambiguous and depends on the specific values of α, γ and θ. What deposit rate will be paid? The interest rate which a bank will pay its depositors depends on the level of competition in the market. Assuming perfect competition between banks, deposit rates in equilibrium *should* be $r_P=(\alpha-0{,}02)(1+k)-\rho k$ for banks with prudent portfolios and $r_G=(0{,}8\gamma+0{,}2\alpha)(1+k)-\frac{(\rho+0{,}02)}{\theta}k-\frac{0{,}02}{\theta}$ for banks with risky portfolios. Setting these two interest rates equal, the resulting minimum capital requirement is

$$k^* = \frac{[0{,}8(\gamma-\alpha)-0{,}02\frac{(1-\theta)}{\theta}]}{[\rho\frac{(1-\theta)}{\theta}-0{,}8(\gamma-\alpha)+0{,}02\frac{(1-\theta)}{\theta}]} \quad .$$

Assuming that banking regulation imposes a capital requirement of k* (strictly speaking, it needs to be either k* with a complementing deposit ceiling, or $k^*+\epsilon$), it can be concluded that the bank is better off with a trader who invests prudently.

Yet, considering the bank's ignorance of the trader's strategy, the entire equilibrium concept is problematic. If the bank presumes the trader will produce a risk-free return γ, i.e. it incorrectly believes that $\theta=1$, it is likely to offer depositors a higher interest rate of up to $r_{Skilled}=(0{,}8\gamma+0{,}2\alpha)(1+k)-(\rho+0{,}02)k-0{,}02$. This cannot be an equilibrium interest rate, as the bank can only maintain this interest as long as the trader's gamble does not fail. On the other hand, an equilibrium where the bank *knows* the trader is gambling and pays its depositors the risk-adjusted r^G is not plausible either, *presuming* the bank can choose to not employ a trader at all: No matter whether the bank wants to gamble or invest prudently, it can do both on its own, without hiring an expensive but unskilled trader.

Thinking back to the trader's incentives, is it a plausible assumption that his discount rate will keep him from gambling? No, for three reasons. First, traders empirically tend to focus on short-term objectives. Unlike owners of a bank who are likely to be concerned about the bank's long-run profits and reputation, traders often focus on the next couple of years, as they do not know how the market will change, or for how long they are going to stay with their current employer anyway. Hence, they may either have a low discount rate, or alternatively their decision-making may be subject to a "present bias",[33] which sharply increases the discount rate needed for prudent investment. Secondly, a bank hires a trader to consistently deliver returns above a benchmark. If a trader would actually stick to the benchmark asset for several years, the shareholders of the bank will figure that he is not skilled. In this case they can save on his substantial management fee by just investing in the benchmark asset themselves, or alternatively they can hire another trader who promises higher (but safe) returns. The competitive pressure in the labour market may thus cause an unskilled trader to gamble even if his discount rate is high, simply because he would lose his job otherwise. Thirdly, the hedge fund case illustrates that the derivatives market often allows the trader to "tailor" assets and their risk to his needs. If, say, he has a discount rate of $\delta=0{,}92$ so the risky asset above is not attractive to him, he can probably find (or create!) another risky asset

33 See the literature on quasi-hyperbolic discounting, e.g. Laibson (1997).

which is: Take a second risky asset with a return $\tau = 1{,}12$ and $\theta_\tau = 0{,}95$, yielding a critical $\delta \geq 0{,}94$ for prudent investment. The trader will then prefer the safe asset over asset γ but also prefer asset τ over the safe asset. The second and third argument tie in together: Competitive pressure is likely to force even traders with a high discount rate to search or create risky assets which are suitable given their preference structure.

Taking this into consideration, what is likely to happen? The trader will gamble and is likely to get by with it for a while, causing the bank to pay $r^{Skilled}$ (depending on competitive pressure) to depositors. As this is an opportunity to quickly earn substantial profits, mediocre traders and outright “con artists” are likely to be attracted into the market. Once gambles start to fail, some banks will default on their depositors, and the market will learn about the frequency of unskilled traders. With banks' inability to distinguish skilled and unskilled traders, a market failure due to adverse selection is possible:[34] Banks will adjust traders' compensation for the risk involved in attracting an unskilled trader. This might drive genuinely skilled traders out of the market, which in turn increases the proportion of unskilled traders until eventually no skilled traders are left, the market collapses, and no traders are employed.

But for now, let us abstract from such equilibrium considerations. One question which has not been addressed so far is how banking regulation (such as capital requirements and interest ceilings) and deposit insurance granted by the government interact with the motives and the decision making of the trader. The answer is as simple as it is shocking: They don't.

Given a compensation structure as discussed, and assuming that the trader was hired to generate excess returns, the trader will not be concerned whether he is losing the depositors' money, or whether it is the bank's own money that he is losing. While high capital requirements might thus suffice to make sure it is not in *shareholders*' interest to gamble, the ratio of equity capital in the bank's balance sheet will be of no relevance to the incentives of the trader. The case is similar for deposit insurance: If his gamble fails, the trader knows he will be fired anyway – it does not matter to him whether the bank goes insolvent, and whether depositors get their money back or not.

In conclusion, the result of inserting a Foster and Young trader into the HMS model of moral hazard was that the two models only weakly interact with each other, and run separately for the most part. While at very first sight this may seem like an uninteresting result, the

34 See the original literature on adverse selection using the classical example of automobile “lemon markets” in Akerlof (1970). Also see Foster/Young (2008), p. 22.

consequences of finding corresponding structures in reality would be disastrous: In Foster's and Young's hedge fund case, losses are borne by wealthy, large-scale institutional and private investors – a small fraction of the population. If, however, it were true that traders with the incentive structure described were entrusted with investing money stemming from insured bank deposits, then it would be the government, and lastly the average taxpayer, who pays for the losses generated by the ruthless gambling of a few bank employees.[35]

Summing up, the theoretical considerations of this chapter give rise to the conjecture that asymmetric bonus systems for bank employees can lead to excessive risk-taking, which in conjunction with deposit insurance leads to a financial burden for the taxpayer when the bank goes bankrupt. This behaviour can be prevented neither with capital requirements nor with deposit rate ceilings. When researching the empirical plausibility of this notion, it is important to note that this mechanism does not necessarily require deposit insurance: The financial burden is comparable when banks are "bailed out" by the government (or the central bank), i.e. banks receive emergency financial support to prevent bankruptcy – usually financed by the taxpayer either directly or indirectly via the inflation tax.[36] Further, the applicability of the model does not hinge upon the employee being a *trader* of securities – any employee who influences the investment process and who is paid based on company performance (as managers usually are) has the same incentive structure. The remaining question is: Were there incidents during the credit crunch which, in their structure, bear resemblance to the model discussed? The next chapter will attempt to provide an answer by discussing selected case studies.

35 To calculate the exact loss for the deposit insurance corporation (and thus indirectly the taxpayer), the interest rate granted to depositors by the banks has to be multiplied by the volume of debt capital invested. As discussed, the bank is likely to offer $r^{Skilled}$ instead of r^G to depositors – with the result that the cost of deposit insurance is even higher than if the bank was gambling itself.

36 See the literature on the controversial topic of the "lender of last resort", modelled e.g. in Goodhart/Huang (1999).

4 Moral Hazard in the Credit Crunch

The institutions most immediately affected by the credit crunch were mortgage lenders and traders of CDOs and other securitised assets, such as investment banks, hedge funds, and SIVs. Most of these institutions do not have an immediate connection to deposit insurance, as they do not rely on customer deposits for funding. However, the idea of flawed compensation systems for bankers has received considerable attention in the recent media,[37] including several cases of individual traders causing huge losses to their companies.[38] The following two case studies represent incidents of moral hazard via gambling bankers and discuss a possible connection to deposit insurance. The last section of the chapter provides an overview of other possible sources of moral hazard which have led to, or have exacerbated, the turmoil associated with the current financial crisis.

4.1 UBS

Few "victims" of the credit crunch caused as much surprise among investors as the Swiss bank UBS, which reported net losses of $37.7bn related to the U.S. subprime and Alt-A real estate market for the year 2007 ($18.7bn) and 2008Q1 ($19bn).[39] With an asset volume of $2.2 trillion (CHF 2.4 trillion) and an annual profit of $11.2bn (CHF 12.3bn) in 2006, UBS is the second-largest bank in Europe, with a major presence in the United States.[40] With a return on equity (ROE) as high as 28.2 percent in 2006 and 39.7 percent in 2005,[41] it was also one of the most profitable banks in the world – *before* the subprime meltdown.

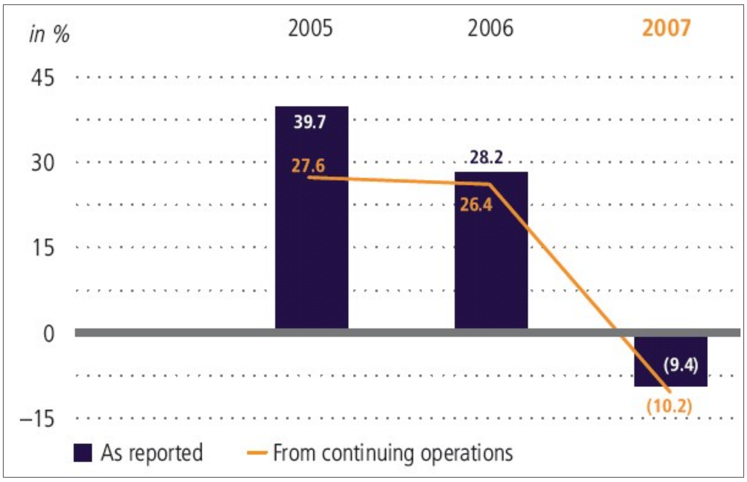

Figure 4: UBS Return on Equity 2005-2007
Source: UBS (2008b), p. 33.

37 Cf. e.g. Rajan (2008) or Robinson/Moghadassi (2008).
38 Cf. e.g. Chung/Mishkin (2008) and Guerrera/White (2008).
39 Cf. UBS (2008a), p. 4, 7.
40 Cf. UBS (2007), pp. 82.
41 Cf. UBS (2007), p. 18.

The ongoing subprime crisis suggests that these returns were too good to be sustainable: ROE crashed to -9.4 percent in 2007. Given that the UBS group is comprised of four individual businesses – Global Wealth Management, Asset Management, Investment Banking, and retail banking in Switzerland – it seems remarkable that 84 percent of UBS's 2007 losses were incurred by the investment bank (IB), while only 16 percent are accounted for by Dillon Read Capital Management, a much-blamed internal UBS hedge fund.[42]

Within the IB, 66 percent of total UBS's 2007 losses were contributed by the CDO desk within the Fixed Income business – a desk that at its peak comprised 35-40 out of UBS's total 83,500 employees. The CDO desk had created CDOs from subprime collateral, keeping in particular the super senior tranches. The main reason of the losses, according to a UBS report on the 2007 write-downs, was the IB's emphasis on fast growth: After the Fixed Income Business in 2005 was identified as its "biggest competitive gap", major *revenue* growth opportunities were seen in ABS, MBS and ARMs, each with underlying assets of subprime nature.[43] The effect was the fast boosting of revenue at the expense of risk.

Even within the CDO desk, a further concentration of losses existed: After UBS had acquired assets from a collateral manager, but *before* these assets were structured into CDOs, tranched and sold on to third party investors, assets were held in a "CDO warehouse" for a time lag of 1-4 months. For this period of time, risky subprime assets were held on UBS's books with full exposure to market risk. UBS risk control systems did not impose a limit on the business as to what asset volume could be held in the warehouse at a time. By end 2007, losses from CDO warehouse positions contributed16 percent of UBS's total losses (25 percent of CDO losses) .

The largest part of the CDO losses, however, is due to the insufficient hedging of retained super senior positions: The CDO desk not only kept most super senior tranches of the CDOs it had structured on UBS's own books, but it also purchased additional super seniors from third parties. Super senior positions held by the IB were either fully hedged (so-called "NegBasis trades"), partially hedged ("Amplified Mortgage Portfolio Super Seniors" or AMPS), or unhedged. Risk emanated primarily from a substantial number of AMPS trades: Presuming the accuracy of the AAA ratings of most super seniors, statistical analysis indicated that insuring against a loss of at most 2-4 percent on the *total* position of the relevant super seniors would fully protect UBS from exposure to their credit risk. With rising delinquency rates and falling CDO prices, losses from UBS's $50bn super senior inventory amounted to 50 percent

42 Cf. UBS (2008a), p. 7.
43 Cf. UBS (2008a), p. 11.

of the total losses (75 percent of CDO losses). Remarkably, 31 percent of total UBS group losses resulted exclusively from AMPS trades.[44]

The unsustainable growth strategy of the CDO desk was facilitated by an insufficiently robust risk control framework: No limits existed on subprime-related holdings. The reliance on AAA ratings led to AMPS and NegBasis trades being "netted out" in risk assessment (i.e. they were neutral in "Value-at-Risk" and Stress Loss testing) as they were considered fully hedged – and thus could be bought indefinitely. CDO structuring transactions required ad hoc prior approval, which many times was requested at a stage when the underlying assets were already purchased, and when declining the deal would have been very costly. Finally, Market Risk Control (MRC) agreed to grant the CDO desk "a favourable treatment" in the risk assessment of the CDO warehouse. More generally, "risk systems and infrastructure were not improved because of a willingness by the risk function to support growth".[45]

With $12bn losses (for 2007) caused by less than 0.05 percent of UBS's workforce, it seems indicated to look at the particular incentives that employees within the CDO desk had. Unfortunately, their precise compensation and bonus structures are not known to the author, making an application of the theoretical structures discussed in chapter 3 difficult. However, UBS generally claims to determine bonus payments on an individual basis according to employee performance. The UBS report further confirms that CDO traders were, like many other UBS employees, rewarded asymmetrically: While they were likely to receive high bonuses for furthering revenue growth of their respective business, they were not penalised for underperformance.[46] Although this structure is common to many UBS employees, CDO traders might have enjoyed particularly good opportunities to simulate "genuine investment skill" in the Foster and Young sense (see section 3.3) without being detected. Job pressure in the Fixed Income business to catch up with competitors is likely to have enforced incentives to gamble. With the intransparency of CDOs and the failure of UBS risk control systems to "look through" to the quality of the underlying assets, it may have been easy for CDO traders to convince senior management or risk control units that CDOs with subprime collateral were a genuine opportunity to make what appeared to be easy, fast and practically riskless profits. They could support their argumentation with AAA ratings of super seniors, which non-experts in their field were likely to rely on.[47] Even if CDO traders themselves knew better about the quality of the underlying assets they had purchased, they had strong incentives to

44 Cf. UBS (2008a), pp. 13.
45 UBS (2008a), p. 40.
46 Cf. UBS (2008a), p. 42.
47 Note that this argument ties in strongly with the inaccuracy of credit ratings due to the housing boom.

invest in “Mezzanine CDOs” (not to confuse with mezzanine tranches), which are CDOs made of lower quality MBS. Mezzanine CDOs generated fees three to four times as high as high-quality CDOs, but still had AAA rated super senior tranches. This made them a tempting opportunity for CDO traders to generate high short-term profits, appear “skilled” to their employers and yield high bonuses. Similarly, they could boost profits of their business by saving on hedging cost: Hedging via AMPS trades cost 5-6 bp, while NegBasis trades cost 11bp.[48] With both being neutral from a risk metrics perspective, CDO traders clearly preferred AMPS trades – regardless of whether they knew that AMPS super seniors were likely to incur more than just a 2-4 percent loss. It could be argued that CDO traders themselves did not know how much risk they were taking. However, this does not seem plausible: In March 2007, the CDO desk gave a relatively pessimistic assessment of the subprime market to the (by then concerned) group senior management. At the same time, they proposed risk limit *increases* for the CDO warehouse. Although limit increases were rejected, warehouse activity continued, and the subprime CDO business kept growing significantly in 2007Q2.[49]

Is there a connection to deposit insurance? Possibly. The UBS IB was not legally independent, but a part of the UBS group's “integrated business model, with a 'one firm approach' designed to facilitate [...] the exchange of products and distribution services between businesses”.[50] Another part of this “integrated business” was UBS Retail Banking, holding both customer deposits insured by Swiss deposit insurance and deposits insured by the Federal Deposit Insurance Corporation (FDIC) within its U.S. branch. In the deposit insurance context, the “universal bank approach” generally has two advantages: First, interest rates on insured deposits tend to be relatively low because there is no risk premium involved. This may have contributed to the ample availability of cheap internal funding which UBS businesses enjoyed. A second “advantage” is that deposits would have been covered by the insurer in case of a UBS bankruptcy. However, savings and deposit accounts made up “only” $66bn (CHF 72.3bn) of UBS's 2007 balance sheet.[51] Since UBS also did not go bankrupt, it can be concluded that taxpayers were most likely spared from the losses generated by a gambling CDO desk. Losses were mostly borne by shareholders. The small volume of insured deposits further makes it implausible that deposit insurance created incentives for the bank as a whole (represented by shareholders) to gamble (note that *traders*' incentives are not influenced by deposit insurance anyway, see section 3.3).

48 Cf. UBS (2008a), p. 30.
49 Cf. UBS (2008a), p. 37, 40.
50 Cf. UBS (2008a), p. 8, 25.
51 Cf. UBS (2008c).

Although taxpayers may not have suffered from gambling UBS employees, structures present at UBS might be representative for other large banks: The “universal bank approach” became increasingly popular after the Gramm-Leach-Bliley Act in 1999 allowed commercial and investment banks to consolidate. This, in principle, allows investment banks to receive significant parts of their funding from insured customer deposits. With the prevalent bonus systems for bankers and the current legal framework, cases of large failing banks due to gambling employees at the expense of deposit insurance thus do not seem hard to imagine.

While the application of our model in the UBS case was complicated by complex corporate structures, the next section presents a case of a significantly more transparent bank where the connection between subprime losses and deposit insurance is immediate.

4.2 IndyMac

On Friday July 11, 2008, the California based bank IndyMac was closed down and seized by federal regulators, representing the biggest bank failure during the credit crunch (as of August 2008), and the third-largest bank ever to fail in the United States. The savings and loans association was the seventh-largest U.S. mortgage originator as of 2006, with a total asset volume of $32bn.[52]

IndyMac was a specialist in Alt-A mortgages, a type of loan offered to customers who do not qualify for a prime loan (e.g. because they are unable to fully document their assets or income), but who have better credit quality than subprime borrowers. Accordingly, Alt-A interest rates are typically between prime and subprime rates. With a market share of 17.5 percent of the U.S. Alt-A market and an origination volume of $70bn in Alt-A loans in 2006, IndyMac was the biggest Alt-A lender in the nation.[53] However, as most other mortgage originators, IndyMac did not keep the majority of their loans, but sold them on to investment banks and other financial institutions, where they were securitised (i.e. pooled and repackaged) into the popular MBS.

IndyMac's performance during the mortgage boom was remarkable: According to IndyMac's quarterly reports to the Securities and Exchange Commission (SEC), its loan production tripled between 2003 and 2006 (see table 1), leading to a fourfold increase in its mortgage market share.

52 Cf. Chung/Scholtes (2008) and Paletta/Enrich (2008).
53 Cf. CRL (2008), p. 6.

	Total annual loan production in billion U.S. dollars	Mortgage industry market share (%)	Return on average equity (%)
2003	29	0.8	17
2004	38	1.4	17.4
2005	61	2.0	21.2
2006	90	3.3	19.1
2007	77	3.3	-31.1

Table 1: IndyMac's Performance during the Mortgage Boom
Source: Data from www.secinfo.com, compiled in CRL (2008).

IndyMac's performance reversed in the beginning of 2007, when mortgage delinquencies increased dramatically. Again, IndyMac's filings at SEC show that the volume of so-called "non-performing assets" went up from 0.51 percent of total assets in 2006Q3 to 6.51 percent in 2008Q1[54] – an almost 13-fold increase within a period of 18 months. This reduced the firm's ability to sell loans to the secondary market, forcing them to hold more loans on their own books. IndyMac was further required to repurchase a substantial number of deficient loans it had previously sold to investors (so-called "kick-backs"). During 2007 and 2008Q1, the company incurred a total loss of $799m, a sum bigger than its combined profits in 2005 and 2006 ($636m). When the firm could no longer conceal its unsound condition from the public, a bank run in July 2008 caused IndyMac to collapse.[55]

The story of the bank provides a primary example of gambling: Long before the collapse of the bank, IndyMac was sued in numerous instances for misleading and defrauding mortgage costumers to reach their loan origination targets. A class action lawsuit of IndyMac's shareholders, supported by a considerable body of evidence, was filed in 2007. While it cannot be the purpose of this paper to verify allegations of a current court case, the following discussion will hypothesise all evidence contained in the legal complaint to be true and rely in particular on the testimonies of witnesses. In the official legal complaint, eight former IndyMac employees testify that senior management instructed all mortgage underwriters "to abandon approval guidelines and push all loans through for approval which came in the door".[56] In case of loan denials, applications are said to have gone to upper management who frequently overturned underwriters' decisions. Upper management was further responsible for setting loan origination targets. As a former vice president of the company testified, IndyMac's approval policies and internal risk assessment models could not easily be changed:

54 Cf. SEC Info (2006), p. 4 and SEC Info (2008), p. 6.
55 Cf. Paletta/Enrich (2008).
56 Cf. Tripp vs. IndyMac (2008), p. 11.

They were those of an Alt-A, not a subprime lender. Thus, “pushing through” loans of inferior credit quality frequently meant falsifying borrower's loan applications by inflating their stated income – with the result that risk assessment models provided loan approvals based on false information.[57] The aggressive marketing of “stated income loans”, i.e. loans which do not require income documentation, facilitated this practice and allowed IndyMac to charge higher interest than for “full-doc” loans. Loans with deficient documentation became known as “Disneyland loans” - in honour of a loan issued to a Disneyland *cashier* claiming to have an annual income of $90,000. A similar documented case is that of an 80-year-old retiree from Georgia who received a mortgage based on his application stating an income of $3,825 a month from *Social Security* – without the borrower himself knowing about this figure.[58]

The profits of IndyMac's gambling strategy were substantial: Apart from quadrupling the firm's mortgage market share within 3 years, its margin on every loan issued was boosted by the company's efforts to sell highly complicated ARMs to uneducated borrowers, featuring “teaser rates” of 1.25 percent and “reset rates” as high as 9.95 percent a couple of months into the loan. Margins increased further when borrowers could be put into mortgages with higher interest rates or fees than they qualified for.[59]

Further evidence indicates that IndyMac's senior management chose to hedge inadequately against credit risk to preserve its high margins, representing an inconsistency with its reassurances toward its shareholders and the general public, claiming to be fully hedged.[60]

What makes the IndyMac case worthwhile to look at? First, taking testimonies to be true and presuming an “anything goes” lending policy as well as a reluctance to hedge, the term “gambling” seems well-deserved. Second, and most importantly, IndyMac incorporates all features of the bank discussed in the HMS model: Unlike most other mortgage lenders or investment banks who rely on issuing commercial paper for funding, IndyMac receives 60 percent ($18.9bn in 2008Q1) of its funding from federally-insured customer deposits. Another 33 percent ($10.4bn) are borrowings from the privately capitalised Federal Home Loan Bank system (FHLB).[61] The privilege of deposit insurance comes with a price: IndyMac was subject to regulations by the FDIC as well as the Office of Thrift Supervision (OTS), requiring the bank to maintain a risk-adjusted capital ratio of at least 10 percent in order to be considered

57 Cf. CRL (2008), p. 8. The CRL study contains a good summary of the class action complaint.
58 Cf. Tripp vs. IndyMac (2008), p. 16 and CRL (2008), p. 2.
59 See other documented lawsuits discussed in CRL(2008), e.g. CRL(2008), p. 10.
60 Cf. Tripp vs. IndyMac (2008), pp. 28.
61 Cf. SEC Info (2008), p. 6.

“well-capitalised”.[62] Neither OTS nor FDIC, however, monitored the soundness of IndyMac's portfolio – just like portfolio composition was up to the bank in the HMS model. The collapse of IndyMac causes an estimated loss of $4bn-$8bn to the FDIC, potentially depleting more than 10 percent of its $53bn deposit insurance fund.[63]

How does the IndyMac story compare to the two models of moral hazard discussed in chapter 3? The first question that arises asks if the company *itself*, represented by the shareholders, had an incentive to gamble (i.e. the case of the original HMS model). With shareholders' equity declining from $2.06bn in 2007Q1 to $0.95bn in 2008Q1[64] and IndyMac's stock price falling from $48 per share in April 2006 to $0.31 on July 10, 2008, this question can be answered with a clear No – it is highly unlikely that shareholders would have wanted the bank to take on this much risk (note that the volume of equity at risk was determined mostly by the capital requirement).

As for the second model of gambling traders, it has to be noted that IndyMac, by virtue of being a mortgage *originator*, did not employ “traders” of securities. Nonetheless, IndyMac employees in various other positions were incentivised to “gamble”, i.e. support lending to borrowers of poor creditworthiness, via employee compensation structures:

- Underwriters received bonuses if loan origination targets were reached, completely regardless of credit quality or whether the loans ultimately ended in default. These loan origination targets were set by senior management.[65]
- IndyMac's own Fraud Investigation Department had no incentive to detect fraud (such as inflated income in loan applications). Instead, “auditor bonuses were based on the number of loans reviewed, not the number of fraudulent findings found”.[66] Auditors were thus encouraged to review large numbers of loans as quickly as possible and without much in-depth attention.

Yet, if the evidence from the class action lawsuit is at least partially true, underwriters and auditors were little more than small cogs in a big wheel, steered by the senior management of the company – first and foremost, by IndyMac CEO Michael Perry.

Being the principal defendant of the class action lawsuit, testimonies claim that

62 Cf. SEC Info (2008), p. 32 for a differentiation between “well-capitalised”, “adequately capitalised” and “undercapitalised” and the associated regulatory responses.
63 Cf. Paletta/Enrich (2008).
64 Cf. SEC Info (2008), p. 6.
65 Cf. Tripp vs. IndyMac (2008), p. 14.
66 Cf. Tripp vs. IndyMac (2008), p. 20.

"Defendant Michael W. Perry recognized that in order for IndyMac to continue to grow at difficult times (which he thought 2006 would be), the Company would have to loosen underwriting standards and quickly dispose of risky mortgage loans before borrowers defaulted, by selling them outright or securitizing them and selling them. [...]Perry had manipulated the Company's underwriting controls, and the exposure it faced from its obligations to buy back bad loans. Perry's plan, for a time, worked [...].

and further that

"Perry sought to make his short term goals for the Company "at all costs". To this end, Perry put immense pressure on subordinates to "push loans through", even if it meant consistently making "exceptions" to the Company's guidelines and policies (at the expense of the company's future).[67]

Finally, Perry himself admitted that "we don't hedge as we talk many times", further disclosing that "the Company had intentionally allowed hedges on $1.5bn worth of liabilities to expire", while at the same time "touting IndyMac's successful hedging techniques".[68]

It does not come as a surprise that CEO Michael Perry had financial incentives to adopt a risky strategy and mislead investors about the company's situation. According to IndyMac's "Short-Term Cash Incentive Plan", Perry in 2006 received an entirely performance based "cash incentive" rewarding short-term growth, the amount of which depended on the achieved values of IndyMac's earnings per share (EPS) and its return on equity (ROE). SEC filings indicate that Perry would have received a $1m award for generating an EPS growth of 15 percent towards 2005 and a ROE exceeding 19 percent. With the actual EPS values of $4.82 (8.8 percent more than 2005), and a ROE of 19.1 percent, he still received a payout of $791,300. In addition to this "performance bonus", Perry received a base salary of $1m.[69]

With a few simplifications, the incentive structure of Michael Perry can now be reconstructed using our model from section 3.3. First, Mr. Perry was not a trader, but his power to decide if the company was investing in a risky or a prudent strategy make him comparable to one. Second, while it is impracticable to derive returns α and γ of a safe and a risky asset in reality, Perry's base salary will be considered as the one-period gain he would have from prudent investment, i.e. $\pi_P = 1$, with one unit being $1m. Third, it will be assumed that Perry's

67 Tripp vs. IndyMac (2008), p. 3.
68 Tripp vs. IndyMac (2008), p. 6.
69 Cf. SEC Info (2007), pp. 38.

2006 bonus of roughly \$800,000 represents his one-period gain from gambling *if the gamble wins (* in a losing period he still receives his base salary). Therefore, $\pi_G = 0.8\theta + 1$. He can either gamble or invest safely – there is no such thing as "a little gambling". Given that a failing gamble means that he loses his job, faces criminal charges and will not find a job again, the prudent *future* income he loses with probability $1-\theta$ is $\sum_{t=1}^{\infty} \delta^t \pi_P = \delta \frac{\pi_P}{(1-\delta)}$. Using the formula from section 3.3, it is profitable for him to gamble if

$$\pi_G - \pi_P \geq (1-\theta)\delta \frac{\pi_P}{(1-\delta)}$$

$$\Leftrightarrow 0{,}8\theta \geq \delta(1-\theta)\frac{1}{(1-\delta)}$$

$$\delta \leq \frac{4 \cdot \theta}{(5-\theta)}$$

Assuming a winning probability of $\theta = 0.8$, it was rational for Michael Perry to gamble if his discount rate was below $\delta *_{0.8} = 0.76$. Given a probability of $\theta = 0.9$, a discount rate below $\delta *_{0.9} = 0.88$ would have been sufficient.

The implication of the model is unambiguous: If Michael Perry is assumed to carry the responsibility for IndyMac's risky business strategy, then his personal discount rate (or from an institutional perspective, IndyMac's compensation scheme) is currently costing the taxpayer a sum of \$4bn-\$8bn.

4.3 Other Types of Moral Hazard

This paper has so far focused exclusively on the case of "gambling bankers" as an example of moral hazard which is likely to have played a costly role in the credit crunch. Nevertheless, had bankers been the only agents subject to flawed incentives during this crisis, the crisis might not have started in the first place, or at least have been of substantially weaker magnitude than experienced. Although a comprehensive discussion of all relevant types of moral hazard is beyond the scope of this paper, a few major channels are outlined in this section.

With increasingly competitive markets, mortgage lending institutions no longer distribute the majority of their products themselves, but instead use mortgage brokers as an intermediary.

These brokers are typically paid on a commission basis for the loans they sell (or recommend) to customers. Evidence from the subprime crisis indicates that incentives of mortgage brokers were often insufficiently aligned with the interest of (the owners of) the bank they worked for.

In the typical example of the mortgage bank Countrywide, brokers were rewarded with a 0.5 percent commission of the loan's value for a subprime loan, while the commission for the next higher category, an Alt-A loan, was a mere 0.2 percent of the loan.[70] In addition, brokers were incentivised to sell ARMs with “teaser rates”, with commissions increasing in the level of the reset rate to which interest would jump after a short period. More generally, brokers could make substantial profits in the booming subprime market by selling high-cost loans to people with little income and poor credit – and in many cases could not be held liable if customers defaulted early into the loan.[71] Evidently, the moral hazard issue involved here is closely interconnected with the personal incentive of bank managers to pursue high-risk company policies and incentivise brokers accordingly (at the expense of the company's future).

Secondly, the role of credit rating agencies in the credit crunch is undoubtedly crucial. With accurate credit ratings, many banks' risky investment strategy simply would have been prevented by internal risk control mechanisms. Even compensation structures which tempt traders to gamble could not have done as much harm, had the risk of super seniors with subprime collateral been openly visible to investors. Yet, the question *why* rating agencies failed to rate securities accurately is controversial. An inability to understand the complex and innovative instruments they were rating is one view on the topic. The claim that agencies were biased because they were paid by the issuers whose securities they were rating is another.[72]

As indicated in section 2.2, a third related issue of moral hazard is that of regulatory arbitrage via unregulated off-balance sheet vehicles like SIVs and ABCP conduits. The HMS framework from section 3.2 has argued that capital requirements discourage banks from gambling. Specifically, the Basel I accord forces banks to put at least 8 percent of their own capital at risk, while Basel II is substantially more complex in its requirements (both apply whether or not the bank holds insured deposits[73]). However, banks could evade these regulations by selling their risky assets to legally independent SIVs or conduits, which they set up for this purpose. Since banks received significant commissions on the assets they sold,

70 From a class action complaint against Countrywide, see White vs. Countrywide (2007), p. 8.
71 Cf. e.g. Brunnermeier (2008), p. 8.
72 See e.g. Economist (2007) for a discussion.
73 Banks with insured deposits are generally subject to further regulations by the insurer.

SIVs allowed them to reap the benefits from gambling while not having to keep risky assets on their own balance sheet. The liquidity backstops they granted to SIVs (see section 2.2) carried little or no capital charge. Exercised credit lines for the bank thus implied a balance sheet expansion financed by more borrowing. As a result, banks' *expected* capital ratio was lower than required by regulators – without banks' creditors being aware of this. As shown in section 3.2, a low capital ratio makes it profitable for banks to gamble, at the expense of their creditors.[74]

The above may provide a rationale of the crisis at Deutsche Industriebank (IKB), a German specialist in corporate lending which had to be rescued in August 2007 by the state-owned bank KfW and the German government, using roughly €11bn ($16bn) of taxpayers' money.[75] The difficulties emerged when Rhineland Funding, an IKB off-balance sheet conduit, had to draw on its €8.1bn ($12bn) credit line from the bank. This triggered a severe liquidity crisis at IKB, which subsequently had to be bailed out to prevent bankruptcy. Rhineland had used short-term ABCP funding to invest in structured products, part of which were subprime-related. When investors became suspicious about Rhineland's exposure to the U.S. subprime market, they refused to roll over its ABCP in July 2007, amidst the general drying up of the ABCP market (see section 2.3). The IKB case illustrates how a lender with the reputation of a conservative "widows' and orphans' stock", which invested in small and medium German businesses, successfully evaded capital regulations by setting up a conduit with a €12.7bn ($18.6bn) asset volume in risky structured products at negligible $500 of equity capital.[76]

The three types of moral hazard described above are likely to have played a significant role in the developments of the 2007/2008 financial crisis. While further research should be directed at their structure and influence on the crisis, combinations of the individual types (like gambling managers using regulatory arbitrage) are very plausible as well and should be given careful attention.

74 In terms of the HMS model, invested assets would increase to (1+x+k), with 1+x being debt, at unchanged k. Note that the argument here does *not* require deposit insurance: Without deposit insurance, competition for depositors is likely to force banks to voluntarily hold sufficient capital to signal they are investing prudently. However, if depositors are not *aware* that banks' *effective* balance sheet is larger than reported, and their capital ratio lower, they will not recognise the banks' incentive to gamble.

75 Total cost until August 2008, see Atzler/Haake (2008).

76 Cf. Wilson (2008), FAZ (2007) and Bartz/Atzler (2007).

5 Conclusion and Outlook

The present paper has examined the 2007/2008 credit crunch, aiming to clarify in what ways issues of moral hazard have facilitated and contributed to the emergence of the crisis. It has been suggested that while market turbulences were *amplified* by feedback effects from leverage-based risk-management, several types of moral hazard have been conducive to the establishment of the dysfunctional financial market structures which caused the turmoil in the first place. The core part of the paper focused on the type of moral hazard which is created through asymmetric compensation systems for bank traders making investment decisions.

The paper has argued that asymmetric compensation structures of bank employees can severely bias a bank's asset portfolio towards short-term revenue at the expense of high risk exposure. Empirical evidence from the credit crunch indicates the widespread nature of this phenomenon: It not only applies to security traders, but to a wide class of employees who are a) paid based on company performance and b) have some say in the riskiness of the bank's business strategy – i.e. in particular to traders as well as the management of banks and lending institutions in general. Note that the form of the institution – investment bank, commercial bank or specialised mortgage lender - is completely irrelevant for the incentives of the trader.

Conversely, the *consequences* of a gambling banker much depend on the form of his employer. Considering that the original HMS model was designed for classical deposit-holding banks with deposit insurance, the question emerges whether the implication of the trader's model for the taxpayer burden applies to the modern investment banks which dominated the credit crunch media, or whether the presented case studies are isolated examples. What is the difference between investment banks and deposit-holding banks? Since 1999, there is no *legal* separation. Accordingly, capital regulations like Basel II apply to both kinds of banks. Their major difference lies in the business model: An IB receives its funding from capital markets (like ABCP). Therefore, differences in regulation are mostly due to the extended requirements and the increased supervision imposed on banks with deposit insurance. Regarding the financial burden of gambling bankers, the following can be summarised (assuming the affected bank goes bankrupt):

a) Deposit insurance pays for bankers' gambling in cases of savings and loan institutions, commercial banks, and in cases of “universal banks” like UBS.

b) In classical investment banks without deposit insurance (like Bear Stearns), the taxpayer pays for the gambling if the bank is bailed out on government cost (i.e.

because of a “too-big-too-fail policy”).

c) With neither deposit insurance nor bail-outs, the institution's creditors suffer the losses from gambling. Note that if the bank can hide its risk exposure from its creditors (like in the case of off-balance sheet vehicles), the creditors will not even charge a risk premium.

The extent of the losses stresses the urgency of the need to reform compensation practices in the financial sector. So far, reform proposals aimed at aligning the interests of bank employees and shareholders are controversial and range from penalties for underperformance (discourages skilled workers), over mandatory possession of equity stakes (they could hedge against their own exposure)[77] to a simple reduction of the bonuses relative to base salaries (effectiveness only partial), all of which are difficult to implement on an industry-wide basis since no bank would want to start given competitive pressures.[78] On that account, it appears that further research needs to be conducted before a sustainable solution can be implemented.

In light of intense ongoing debates about the adequacy of banking regulation, it seems alarming that supervision frameworks which are based on capital requirements (like Basel II) will do nothing to prevent a bank from gambling, as long as its employees receive asymmetric bonuses. The core inadequacy in this context is the regulation's failure to take into account that a bank is not a single, unanimous decision maker – but that the incentives of individual traders are of vital importance. As long as the incentives of those who actually make investment decisions are not aligned with the interests of shareholders, regulations like Basel II will remain ineffective.

77 Cf. Foster/Young (2008), pp. 17.
78 Cf. Heller (2008).

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