Mortgage Credit Risk, Regulatory Standards and the Basel II Banking Supervision Reforms

by Hans-Joachim (Achim) Duebel

Modeling portfolio credit risk and its implications for the solvency risk of banks is one of the greatest challenges in finance. Despite this widely held belief, the Basel Committee has taken the route to depart from the current, largely risk insensitive capital requirements and move focus to bank-external (rating agency) and bank-internal credit risk models as a tool to determine regulatory capital. While work on "Basel II" is still not completed, this article undertakes to critically reflect the general strategy and methods proposed from the perspective of mortgage finance.

The first section of this article is devoted to the determinants of mortgage credit risk, a topic that has only recently become more intensively researched outside the United States. It subsequently reviews regulatory approaches for three different classes of specialized mortgage intermediaries: mortgage banks, mortgage insurers and secondary market institutions. It finally compares these with the current proposals.

Hans-Joachim (Achim) Duebel is an independent financial sector development expert, based in Berlin. Between 1998 and 2000 he was on staff of the financial sector development department of the World Bank, Washington, D.C. From 1991 to 1998 he was on staff at the economic think-tank empirica, based in Bonn and Berlin.

1. MORTGAGE CREDIT RISK

Standard Mortgage Credit Risk Models

In the most widely used class of credit risk models, expected credit losses are the product of expected probability of default (PD) and expected loss given default (LGD). Unexpected losses vary over time only unsystematically and the likelihood of them being large is assumed to be small. This model structure allows for the analysis of the impact of prudent underwriting practices, credit maturity and collateral on credit risk. Value-at-risk (VAR)[1] and other convenient concepts take the analysis further to determine credit enhancement levels for minimum-quality loan pools sold in the open market, or minimum capital requirements for bank loan portfolios.

The perhaps best known example developed along these lines, that has served as a basis for many analyses of mortgage default, is Robert Merton's (1976) option pricing model. Since Merton's work has been so instrumental in developing current market practices, Box 1 briefly summarizes its mechanics and main conclusions.

A broad empirical literature has supported these and other standard model predictions, such as the predictive power of borrower scoring, income and debt-service-to-income ratios. Empirical work with disaggregate loan datasets started in the 1960s with research undertaken at the U.S. Federal Housing Administration, a public loan insurer. Capone (2002) reviews credit risk research of the 1990s undertaken by mortgage market agencies and academics. Steinbach (1995), for example, demonstrates with private mortgage insurer data the strong predictive power of borrower scoring and debt service to income (DTI) ratios for default. In his dataset, loans with downpayments of 5% have double default rates compared to loans with 10% downpayments. The results are confirmed in other research with data from Freddie Mac.

A constraint for risk modeling outside the U.S. has been the very limited public avail-

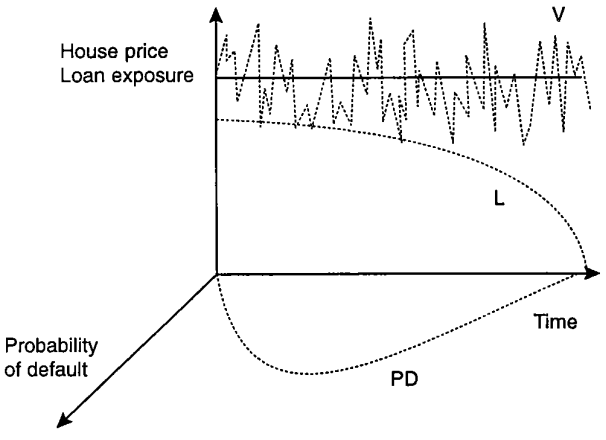
Box 1. An Option-Theoretic Model of Default

Consider a long-term loan funding the purchase of a house. Assume that house prices oscillate over time around the initial appraised value—as in Figure 1.[2] Merton interprets the lending situation as a bank "buying" a house on behalf of the borrower and selling him at the same time the option to sell the house in the future and cash out if his equity—in the diagram, V -L—becomes sufficiently large. On the other hand, if the equity becomes small or negative, the borrower may choose to "default," i.e., by conveying the house, or its equivalent cash value, to the bank.[3]

The model yields a number of powerful predictions:

- A high loan-to-value ratio (small distance between the L and V curves) will increase the likelihood of a negative equity position occurring in the future, and thus raise the expected PD. It will also increase expected LGD for the lender.
- An increase in house price risk adds both to expected PD and LGD.
- A loan with longer maturity will have a higher PD than a short-term loan. However, in standard mortgage finance contracts where L is amortized, equity is built up as the loan seasons. Prudently underwritten loans will have low initial LTVs, and hence low PD immediately after loan closing, too. As a result, PD can be expected to develop in an inverted hump-shaped profile over time.[4]

Figure 1. House Price Risk, Loan Exposure and Probability of Default



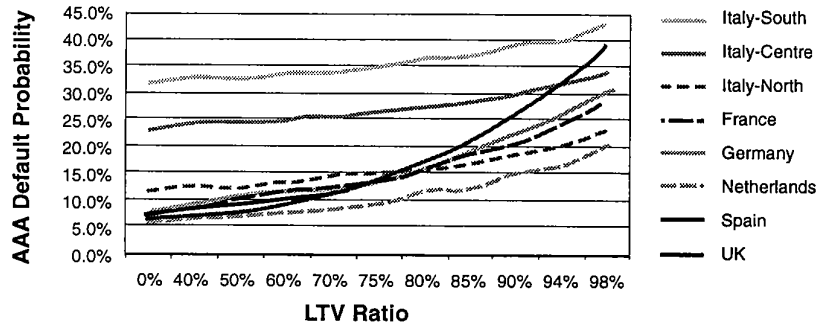
Source: Hans-Joachim (Achim) Duebel. Note: V: value of the house, L: loan exposure, PD: probability of default.

ability of disaggregate loan data in the context of credit losses, although limited academic work exists. This has changed in Europe since the mid-1990s with the upcoming residential mortgage-backed securities market that suddenly raised the transparency requirements for terms of disclosure, loan pool rating and surveillance. The rating agencies have started to condensate disaggregate loan pool data obtained in this way, macroeconomic and property market data as well as qualitative judgments into proprietary mortgage credit risk "models."

The rating agency Fitch-IBCA, for example, models PD as the product of indicators for a borrower's willingness-to-pay (LTV) and ability to pay (DTI or house-price-to-income ratio (HPI), unemployment rate, separation/divorce). An example for the resulting PD estimates for different European regions is displayed in Figure 2. These estimates are adjusted by variety of deal-specific factors: loan/pool seasoning, loan characteristics determining the speed of equity build-up and cash flow factors (fixed vs. flexible, amortization features), as well as the quality of origination and servicing.

Fitch's LGD model centers around assumptions about regional house price distributions, which are reflected in Figure 3 for different regions in the Netherlands. In order to obtain a AAA rating on a senior loan position, LGDs need to be low with the same likelihood across different regions. This implies that in a region with high price risk, e.g., Limburg, prices must be allowed to drop farther than in a region with low price risk, e.g., Groningen. To obtain the same rating, loans from Limburg must be more conservatively underwritten, or alternatively supported with higher levels of capital, than those from Groningen. The resulting capital requirement is adjusted by geographical diversification factors (on pool level), lien position, recovery timing, legal expenses and penalty interest rates.

Figure 2. Fitch-IBCA PD Assumptions for Several European Regions, by LTV



Source: Fitch-IBCA (2002 and 2000).

Figure 3. Fitch-IBCA House Price Risk Assumptions for Different Regions in the Netherlands

(Market Value Declines %)				
Region	*BBB*	*A*	*AA*	*AAA*
Drenthe	31.3	34.6	37.9	41.1
Flevoland	33.2	38.2	43.0	47.8
Friesland	34.2	38.6	42.8	47.1
Gelderland	37.4	42.5	47.4	52.4
Groningen	27.9	31.4	34.7	38.0
Limburg	36.5	41.7	46.7	51.6
N-Brabant	36.2	41.2	46.1	50.9
N-Holland	36.7	41.6	46.4	51.1
Overijssel	38.1	43.3	48.2	53.2
Utrecht	38.3	37.8	42.0	46.2
Zeeland	34.5	38.7	42.7	46.7
Z-Holland	32.2	36.5	40.5	44.6

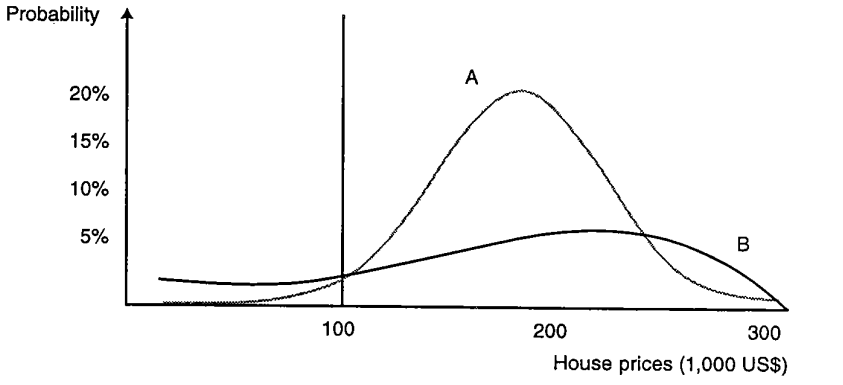
Cycles and Catastrophes

Figure 4 demonstrates how dependent the results of credit risk models described above are on the assumption of a specific form of the probability density distribution of underlying asset prices, and thus LGDs and credit losses. Distribution A, with a "thin" negative tail, is typical for the models discussed so far, including the Dutch example in Figure 3. Strong losses beyond a certain threshold level are considered as highly unlikely.

A growing body of literature suggests, in contrast, that asset prices and related credit losses have probability density functions with "heavy tails," as represented by distribution B. Especially in times of crisis very high LGD realizations may occur. Such situations are not rare exceptions, as distribution A would suggest, and perhaps would even require a model that is different from the one applicable in normal times. In fact, capital adequacy requirements computed on the basis of distribution A would carry a serious danger of understating economic risk capital.[5]

Is mortgage credit risk a candidate for these concerns? Clearly, as long-term financiers, mortgage lenders face a higher likelihood of an extreme loss situation materializing than a short-term lender. We look at two crisis situations: catastrophes and economic cycles.

Figure 4. Competing Assumptions for Price Risk Distributions



Source: Hans-Joachim (Achim) Duebel.

Examples for catastrophic risk relevant in mortgage finance are earthquakes, terrorism/war damages, or death of the mortgagee's household breadwinner. Where the potential losses incurred are of empirical significance, banks and their regulators have universally sought for property/casualty or life insurance solutions in order to protect solvency. Difficulties have arisen primarily where insurance markets are incomplete (e.g., property insurance for flood danger areas).

More problematic to deal with has been cyclical risk, notably local and national business and property cycles, i.e., events that occur usually with higher PDs than catastrophes but can have devastating LGD effects that result in catastrophic risk realizations. In these situations, a supportive role of the contingent capital provided by insurers has not been universally required.[6]

LGDs arising from property cycles are primarily potentially high because of uncertainty about the length of the cycle, and thus carryover costs for foreclosed properties. The length of a cycle, however, depends on a complex interaction between the property and financial market participants, influenced by the actions of financial regulators and monetary policy makers. In particular, there is danger that mortgage lenders react homogeneously to the same signals, e.g., by selling foreclosed properties simultaneously into a falling property market and realizing large LGDs, raising the likelihood of a systemic banking crisis.

An example is the U.S. commercial mortgage market of the late 1980s through the early 1990s. The Giliberto-Levy-Index, displayed in Figure 5, gives an impression of the magnitudes of commercial mortgage losses that lenders realized. Between 1974 and 1989, apparently losses were appropriately characterized by a "thin-tailed" loss distribution over time, with peaks in 1976 and 1989, but otherwise low loss levels. Between 1990 and 1995, suddenly losses exploded to catastrophic levels.

A closer look at property and financial market conditions of the time reveals that the swift transition to a catastrophic risk realization had its root in U.S. financial market conditions of the late 1980s. While the commercial property market had been going through a large, but in character, relatively well-behaved cycle, with office rents on decline already since 1986, the financial markets became increasingly characterized by a combination of excess liquidity and inflated asset prices.[7]

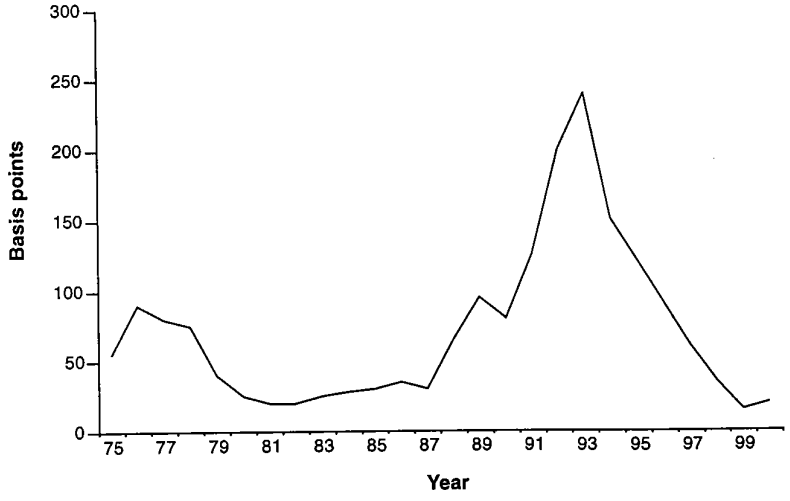
The price bubble was called as the gulf war recession hit the U.S. in the first quarter of 1990. Subsequently, a close interaction between rising yield requirements of investors, financiers and regulators that unwound real estate assets held by bankrupt financial institutions unfolded. The result was a negative property market shock of historical magnitudes, with recovery delayed for several years.[8]

The federally owned Resolution Trust Corporation (RTC), for example, which had assumed assets of bankrupt savings and loans, adopted mostly a fire-sale strategy, realizing LGDs between one-third and two-thirds of their exposures and depressing other institution's LGDs, e.g., those of traditionally prudent life insurers who realized historic LGDs (over 40%).[9] Few argue that it was the intrinsic character of property markets rather than the homogeneous behavior of financial market players that caused the heavy losses.

Models exist to capture cyclical property price risk and are widely used for analytical and empirical testing purposes.[10] Competing commercial mortgage credit risk models have been advanced by private firms that calibrate the behavioral component of financial markets with anecdotal empirical data.[11] In residential finance, U.S. mortgage insurers and agencies devote substantive resources to capturing cyclical risk in their models. Rating agencies apply simple correction factors[12] or traffic light models to indicate the position in the cycle.[13]

A key feature in models dealing with cyclical risk is that geographic and sectoral[14]

Figure 5. Credit Loss Realizations in the U.S. Commercial Mortgage Market (1974–2001)



Source: Giliberto-Levy-Index (http://www.jblevyco.com). Note: Rolling four-quarter losses as a percentage of asset book values, expressed in basis points (one hundredth of a percentage point). The index relies extensively on credit loss data provided by the American Council of Life Insurers.

diversification can significantly mitigate portfolio LGDs, even if individual market cycles create high individual LGDs. This reflects the fact that, even though financial markets become increasingly integrated, property markets are still segmented. As a result, large price swings may hit certain "hot spots" only, or cycles may be asynchronous between regions and sectors. U.S. mortgage market agencies stress the benefits of geographic diversification of residential portfolios.[15]

Geographic diversification is arguably even stronger in Europe, due to less homogeneous market practices and economic environments.[16] On the sectoral level, residential real estate markets bear less price correlation between each other than commercial real estate markets, and commercial price cycles often display significant phase differences between different sectors.

On the other hand, as the catastrophic risk example above demonstrates, true progress in developing mortgage credit risk models will ultimately depend on how correctly interaction during crisis in a given markets is assessed. Modeling this "endogeneous" risk, however, is beyond the scope of current financial markets models. A consequence has been an increased tendency by the industry to employ stress tests, calibrated with historical extreme values. This methodology clearly denies the validity of a "thin-tailed" distribution assumption for credit losses.

2. MORTGAGE INDUSTRY STRUCTURE AND REGULATORY REGIME

How have regulators historically dealt with mortgage credit risk?

Capital adequacy not only plays a relatively new role in mortgage finance—it does so in the entire finance industry—but is also put into stronger context by a tighter regulatory framework and a greater role of market control than in other parts of the industry. Many mortgage intermediaries are chartered as specialists subject to portfolio and asset-liability-management restrictions, and non-specialists often need to follow rules specific to mortgage lending (e.g., maximum LTVs). While the intensity of the supervisory review clearly varies, by jurisdiction and between specialists and universal examinees, most supervisors have mortgage finance specialists on staff or even concentrate expertise in specialized departments. Moreover, market discipline seems generally more advanced in an industry characterized by an early development of bond and credit risk transfer markets.

Before considering examples for specific regulatory practices, the impact a specific industry structure may have on bank solvency, given the same credit risk, should be noted. Mortgage banking institutions can be classified into one of two traditions: an Anglo-Saxon, with deposits as main funding instruments, and a Continental European based on the issuance of on-balance bank bonds dating back to the 18th century. Countries belonging to either have over time heavily borrowed from one another.[17] Some Anglo-Saxon countries, such as the UK and Australia, have only very recently adopted bond finance for mortgages. At the same time, Anglo-Saxon countries have been forerunners of the credit risk transfer market through external insurance.[18] The importance of bond finance and credit risk transfer for bank solvency risk can be demonstrated with two examples:

- U.S. and Danish residential mortgagees buy a universal prepayment option with their long-term, fixed-rate mortgage contract. This contract, in turn, strongly relies on the existence of an active callable bond market in which investors are willing to take the corresponding reinvestment risk for prepaid principal amounts. During recessions, interest rates tend to decline and trigger prepayments that function as a safety valve reducing debt service-to-income levels of homeowners. Credit risk for the intermediary is thus "spread" to those institutions holding the callable bonds, in the form of interest rate risk.[19]

- In the U.K., building societies active in high-LTV lending during the 1980s were required to have mortgage indemnity guaranty (MIG) for these loans. In the early 1990s, a combination of falling house prices, unemployment and rising defaults resulted in substantial claim levels for mortgage insurers. The Building Societies Commission, however, finds that it was only the continued decline in house prices until 1995 that "gave rise to losses to societies in some cases where the fall in value was sufficient to erode a society's normal LTV margin, even where the excess advance had been covered by MIG."[20] Banks were protected thus by insurers from catastrophic credit risk.

Regulatory approaches for mortgage intermediaries naturally develop within this specific context. We compare three cases, representing specialized banks, specialized insurers and secondary market institutions.[21]

Continental European Specialized Bank. In the case of German mortgage banks, the regulatory goal is the protection of Pfandbrief bondholders from credit risk.[22] Capital standards for mortgage banks follow the Basel I principles and consequently bear little sensitivity towards the risks described above.[23] However, the Mortgage Bank Act as a whole is designed to protect bondholders from cyclical and catastrophic risk, by three main construction elements:

- *Underwriting and operational constraints.* In order to match cyclical underwriting—obviously already a problem back in 1900—property valuation is subjected to strict requirements forcing the

BOX 2. CAPITAL STANDARDS FOR AUSTRALIAN MORTGAGE INSURERS

Although not explicitly required by regulators, as in other jurisdictions, mortgage insurers in Australia are de facto monolines.

- *Minimum capital* needs to be held on individual insured loans where the insured loan balance exceeds two-thirds of the property's value. The capital requirement equals 2% of that excess amount, which means that higher loan-to-value ratios require a higher effective reserve ratio.
- An *unearned premium reserve* must be established depending on the seasoning of the loan or pool and a model of probability of default over the residual term of the loan, up to ten years. In this way, the typical hump-shaped PD profile displayed in Figure 1 is explicitly taken into account and care is taken that excess cashflow generated during the first years characterized by low PD are put into loss reserves.
- A *claims equalization reserve* of 25% of *earned* premiums which must be retained for ten years, unless required sooner under stipulated high-loss conditions. This requirement is unusual for other property/casualty business lines. It builds up a catastrophic risk reserve and implicitly restricts market entry to only the best capitalized insurers. However, reserve levels vary across jurisdictions: in the U.S., for example, the corresponding contingency reserve is fixed at 50% of premiums.
- *Case basis and IBNR* reserves are finally required under general insurance regulations: case basis for arrears over 90 days, IBNR (incurred-but-not-reported) for known arrears that have not yet been reported as default by the lender.

bank to determine the "sustainable mortgageable" value of the property.[24] Inter alia, regulators have the discretion to ask mortgage banks to remove imprudently underwritten loans from the bond cover.

- *The senior-subordinate structure of the banks liabilities.* While total LTV of an individual loan is not capped, the position that is funded by Pfandbriefe is limited to the first 60% LTV. This implies the use of subordinate debt, usually interbank debt, for the remaining loan parts.
- *Direct access to mortgage collateral in case of bank bankruptcy,* in what can be seen as an early design to create bankruptcy-remoteness in mortgage finance.

In essence, the approach is to limit cyclical credit risk by restricting eligible assets only to those of the highest quality through intensive supervisory review of a special regulator. Once credit risk has materialized, however, mortgage bank solvency becomes quite credit risk sensitive. The main security valve in this case is the size of the subordinate debt position, in the case of residential mortgages up to 20% over the 60% Pfandbrief position, which effectively constitutes an external insurance layer for the Pfandbrief holder. In the past, mortgage banks in addition had certain latitude to run open interest rate positions that would tend to compensate for credit losses during recessions. However this option has been minimized through agreement with the regulator. Market discipline today constitutes a pivotal element of control—in practice, all Pfandbrief issues are rated.

Anglo-Saxon Specialized Insurer. We focus on measures taken to protect mortgage insurers' policy-holders, mostly banks.[25] Capital standards are directly geared towards dealing with the implications of cyclical and catastrophic risk arising from these liabilities. Mortgage insurers in most jurisdictions are subjected to a special chapter of the property/casualty (P/C) section of the insurance code. A distinct feature of P/C capital adequacy standards is that while the insurer has to hold minimum capital relative to the overall risk exposure, as banks do, several reserve requirements are added that are intended to restrict the outflow of cash needed to enable the insurer to inject immediate liquidity upon occurrence of a large loss. Box 2 reports the example of capital requirements in force for mortgage insurers in Australia.

In essence, insurers are required to hold reserves that are sufficiently large to "survive" the business cycle. In addition, they are subject to specialized supervision. Despite these – compared to banks - restrictive standards, market discipline exerted by investors and rating agencies plays a critical role; ratings determine whether an insured lender will receive capital relief, or not.

Secondary Market Institutions. The U.S. mortgage market agencies Fannie Mae and Freddie Mac can be interpreted as specialized European mortgage banks using a less restricted set of liabilities and asset-liability management options.[26] However, the regulatory goal and the approach taken differs from banking regulations in important aspects.[27]

First, due to the political mandates enshrined in their charters, both are regulated by a division of the federal housing department the Office of Federal Housing Enterprise Oversight (OFHEO) and not by

traditional U.S. financial regulators. OFHEO was only created in 1992, after Fannie Mae had existed already for 55 years.

Secondly, given the small number of examinees and high degree of operational flexibility, regulations are tailor-made to the business and risk profile of the institutions. Notably, they specifically address cyclical and catastrophic risk aspects.

Thirdly, combining both previous arguments, their review and capital standards follow state-of-the art data disclosure and modeling techniques:

1. The agencies are required to provide quarterly portfolio composition and performance information, and are in addition subject to the most intensive on-site examination program.

2. They need to hold the greater of minimum capital requirements[28] and risk-based capital requirements computed from a model developed in the regulator's office that mirrors the agencies portfolio composition and risk management activities. The model arrives at risk-based capital through a stress test of its exogeneous variables:

    - The credit risk stress test applies the worst regional loss experience for mortgages on a national basis.

    - The interest-rate risk test assumes both a severe and sustained increase as well as decrease in rates, capturing the risk of an asset and liability mismatch.

    - For management and operational risk, 30% additional capital needs to be held.

    - Capital derived from the test must suffice to endure ten years of prolonged, severe economic stress.

OFHEO regulatory standards go to the greatest length recorded from any regulator in the world to map mortgage intermediary solvency risk, while leaving the institution maximum flexibility in risk management. Whether the credit model's predictions are accurate is too early to say; the first data run has been completed by spring 2002.[29] In a striking contrast to the current Basel II discussion, the operational risk charge is flat and not modeled.

As with other specialist intermediaries, market discipline is a key element of control for the agencies. Given the perceived bias created in ratings through an implicit government guarantee that the agencies are understood to enjoy from the federal government, a recent code of conduct agreement stipulates the regulatory solicitation of stand-alone ratings.

While these different sets of regulations clearly represent not only different approaches, but also vintages, their common denominator is that—contrasting to general bank and insurance regulation—they identify and directly address the issue of cyclical risk. Supervision is highly specialized and supervisors have far-reaching competencies. An important additional layer of control is exercised in all three cases by bond investors and external rating agencies.

3. CONCLUSIONS FOR THE CURRENT BANKING SUPERVISION REFORM DEBATE

Basel I, by creating risk-insensitive minimum capital requirements, put specialized institutions that produced conservatively underwritten mortgages at a cost disadvantage. Insurers, public agencies and finance companies benefited from this situation and gained shares in the market for credit risk intermediation. New credit risk transfer markets developed that were at least partly driven by regulatory arbitrage considerations.

Basel II goes to great length in improving the allocation of regulatory capital to risk, with the explicit intention to curb the negative concomitants of Basel I and incentivize banks to improve both the pricing of risk and the allocation of financial capital to each risk source. It puts more emphasis on market discipline, by tightening transparency requirements, and provides minimum standards for supervisory review.

Basel II furthermore introduces credit risk models currently widely accepted by the finance industry for determining bank capital adequacy, both through the standardized approach dwelling on external ratings and the internal ratings-based approach. Credit risk mitigation and collateral are explicitly considered, although the specifics continue to be contested. In the advanced internal models approach, an attempt is made to define a specific set of minimum standards for credit risk modeling. The approach follows a VAR methodology; in other words, capital is designed to be held for expected and a portion of unexpected losses, and the loss distribution is assumed to follow a specific function form characterized by "thin" tails.

Capital charges for interest-rate risk in the banking book are not considered in the approach; regulators enjoy latitude under the supervisory review pillar to take measures in this area. Operational risk, on the other hand, is proposed to be explicitly modeled.

While many details of the second consultative package are still under review and some are not entirely clear, this set of proposals has received abundant comments by academics, banking, insurance and securitization industry as well as regulators.[30] In the opinion of the author, the evidence presented in this article can be wrapped up by recalling the main points of critique forwarded to the Committee by the LSE Financial Markets Group:[31]

- "The regulations fail to consider that risk is endogenous. Value-at-risk can destabilize an economy and induce crashes when they would otherwise not occur." Empirical evidence in mortgage finance supports the notion that cyclical and, to a great extent, catastrophic risk results from interaction of property and financial markets participants rather than exogenous factors. There is also evidence that, in particular, the latter are prone to harmonize their strategies under the impression of the predominant statistical models, with potentially disastrous consequences for property prices.

- "Statistical models used for forecasting risk have been proven to give inconsistent and biased forecasts, notably underestimating the joint downside risk of different assets." Section 1 has discussed the limits of applicability of a "thin" tailed distribution assumption for mortgage credit losses. Capital adequacy standards adopted by OFHEO in the U.S. draw the conclusion of relying on full portfolio models,[32] with external variables stressed with extreme values observed during full business cycles, or even historical extreme values.[33]

- "Heavy reliance on credit agencies for the standard approach to credit risk is misguided." Clearly, models employed by rating agencies in the residential MBS market are neither standardized nor regulated and include a multitude of factors derived from empirical casuism. On the other hand, the presence of external rating has certainly led to greater transparency and gradual improvements of regulations for specialized mortgage banks and insurers.

- "Operational risk modeling is not possible given current databases and technology." OFHEO operates with a lump-sum charge for operational risk, due to the practical difficulties.

"In so far as the purpose of financial regulation is to reduce the likelihood of systemic crisis, these proposals will actually tend to negate, not promote this useful purpose." Both proposed internal-rating based (IRB) modeling techniques and short-term data input are not able to capture the risk of cyclical or catastrophic crisis in mortgage markets. Combining IRB with long-term forecasting horizons and stress testing as a means to capture catastrophic risk appears as a sine-qua-non to avoid a potentially harmful procyclicity of capital holdings. The Committee seems to have accepted this most fundamental critique in its latest communication.[34]

This indicates that while Basel II makes important conceptual advances over Basel I, banking supervision reforms will remain a work in progress for the foreseeable future. In any circumstance, Basel II will provide helpful guidance in particular to those market participants most susceptible to bankruptcy risk by inducing them to adopt relatively easy-to-handle risk models. On the other hand, supervisors are well advised to look beyond the currently proposed framework and take the more advanced examples of mortgage banking and insurance regulations in their supervisory practice under Pillar II into consideration. Moreover, in the spirit of increasing market discipline under Pillar III, bank regulations should encourage, rather than discourage, mortgage-related bond and credit risk transfer markets. Adjustments in the current set of proposals can be made in that regard. After all, the great heterogeneity of the banking industry makes it likely that—even under the same set of rules—some institutions are significantly less able than others to intermediate mortgage-specific risks.

NOTES

[1] See Jorion (1995).

[2] More specifically, the model assumes that the capital gains are normally distributed around zero (i.e., they follow a Wiener process). For a technical presentation of the model, see Freixas and Rochet (1998).

[3] The model can be easily extended to include the costs of selling or disposing of the house, which occur in practice (e.g., costs of foreclosure, penalties).

[4] More precisely, PD in Figure 1 denotes the conditional probability of default, defined as the probability of default in the next period, given that the loan has stayed current until the current period.

[5] For an overview, see Danielson (2000), who argues that risk models commonly used by financial markets tend to break down in times of crisis as risk becomes endogenous to the interaction of market players. Empirical research has focused on stock, foreign exchange and derivative markets.

[6] Mortgage insurers take first loss positions of mortgage loans or pools and thus – if appropriately managed—provide very effective protection for senior debt position holders especially during property cycles.

[7] By the first quarter of 1990, office yields had dropped to 6%, from typical levels of between 7.5% and 9% in the early 1980s, implying continued build-up of capital gains expectations by office investors and their financiers despite increasing vacancies and falling rents.

[8] Office yields rose steadily from 6% in the first quarter of 1990 to 10% in the first quarter of 1995, i.e., risk premia required by investors increased over five years.

[9] See Snyderman (1991).

[10] For example, Pasquale & Wheaton's (1996) influential real estate market model.

[11] Such models have been developed inter alia by the Boston-based firms TortoWheatonResearch and PPR Research.

[12] For example, Fitch (2001) corrects for the distance of the current position in the property cycle from the long-term trend.

[13] Moody's has applied such a red-yellow-green indicator model to characterize the cycle position of U.S. commercial real estate markets.

[14] Residential for owner-occupied, residential rental, office, retail, hotel, etc.

[15] See Freddie Mac (2001).

[16] See PPR Research (2001).

[17] So is the German Bausparkasse modeled after the Anglo-Saxon savings and loans of the 1920s, and the U.S. agency system, here classified as a special type of mortgage bank, was an effort to pick up the European bank bond tradition in order to support a national long-term, fixed-rate mortgage market created in the early 1930s.

[18] Private mortgage insurance in the U.S., for example, dates back to the 1920s. It has remained an Anglo-Saxon product, as only in these countries do regulators actively require banks to seek external protection for high-LTV loan positions, or face higher capital charges.

[19] In some cases, intermediaries become themselves investors in prepayment risk, e.g., U.S. mortgage market agencies.

[20] Building Societies Commission (1998).

[21] Kupiec and Nickerson (2001) develop a comparison of the regulatory regime for U.S. universal banks, insurers and mortgage market agencies.

[22] It is worth noting that the Mortgage Bank Act, created to further this goal in 1900, predates general banking regulations in Germany by over two decades.

[23] Germany applies a 50% risk weight for both residential mortgages and the below 60% LTV-position held in commercial mortgages.

[24] Similar appraisal constraints are in place with other mortgage bank systems in Europe and provide a striking contrast to Anglo-Saxon open market valuation. Duebel (2002) demonstrates the effectiveness of these constraints for the extreme situation of the U.S. commercial mortgage market of the late 1980s/early 1990s.

[25] The discussion abstracts from insurers' capital requirements for credit risk of mortgage-related assets. See Kupiec and Nickerson (2001).

[26] As other Anglo-Saxon banks and savings and loans they protect themselves partly from the heightened cyclical and catastrophic credit risk of high-LTV loans through the purchase of mortgage insurance.

[27] Lea (1986) coined the term of "dueling guarantees" to describe the charter differences.

[28] Capital requirements are 2.5% of on-balance and 0.45% of off-balance sheet exposures. This is far below Basel I requirements, even if the additional capital held by mortgage insurers is considered (protecting roughly 20% of the agencies' portfolio).

[29] The first run yielded two striking results: i) risk-based capital for both institutions was lower than minimum capital, and ii) risk-based capital for Freddie Mac was only a third of that of Fannie Mae, apparently due to stricter internal risk management standards. Results can be downloaded from http://www.ofheo.gov.

[30] Available for download from: http://www.bis.org/bcbs/cacomments.htm#pgtop.

[31] See LSE Financial Markets Group (2001).

[32] In variation from the standards laid down under the advanced internal rating-based approach (IRBA), these models directly address interest-rate risk and acknowledge benefits from geographical diversification. OFHEO also imposes floor capital requirements – at the time of this writing, it was unclear whether there would be such floors under the advanced IRBA over and above the two-year transition period.

[33] The Basel committee has communicated by July 10, 2002, that "meaningfully conservative" stress tests should be a requirement under the IRB approaches, which introduced stricter supervisory review (Pillar II).

[34] Issued on July 10, 2002.

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WEB LINKS TO INFORMATION SOURCES

BIS Basel II Homepage http://www.bis.org/bcbs/index.htm

BIS Basel II Depositions by Stakeholders http://www.bis.org/bcbs/cacomments.htm#pgtop

Office of the Housing Enterprises Oversight http://www.ofheo.gov/

J.B.Levy & Co. (Commercial Mortgage Performance Index) http://www.jblevyco.com/

Local Initiatives Support Corporation (Housing Lobby Group) http://www.liscnet.org

Fitch-IBCA rating agency http://www.fitchibca.com/

Moody's rating agency http://www. moodys.com