Financial innovation and a *new economics* of banking: Lessons from the financial crisis

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> Derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal to the financial system. — Warren Buffet, *Financial Times*

> If risk is properly dispersed, shocks to the overall economic system will be better absorbed and less likely to . . . threaten financial stability.
> — Alan Greenspan, "International financial risk management"

> Not everything that counts can be counted, and not everything that can be counted counts. — Albert Einstein (1936)

Introduction

The financial crisis that erupted in the middle of 2007, which has intensified to alarming proportions since then, is the most serious since at least the Great Depression of the 1930s, and it brings with it a serious recession in the world economy. The sequence of the crisis has been put well by Berk (2008: 4): "International markets are currently in a state of turmoil. What started out as a potential problem in a particular segment of a particular market in a particular country, by now has spread to large parts of the world adversely affecting not only financial but real outcomes."

The crisis is different from the many others that have occurred over the past 20 years: it is global in nature rather than being located in a single country; it focuses on a wide range of financial instruments (notably credit risk-shifting instruments) that have become a new feature in the world of banking; a wide range of different markets and asset classes has been affected; it has caused major disruption to wholesale financing markets in general and interbank markets in particular; and it has already transformed the financial landscape (e.g. the demise of the independent investment bank model that had become a defining feature of Wall Street). Furthermore, it has been systemic in nature and not confined to a particular type of institution, though inevitably, the centrepiece has been the position of banks. In the process, household names have disappeared from the landscape and the crisis has forced a rethink of several banking models that had become a feature of the twenty-first century of finance.

In addition, the crisis has forced an unprecedented degree of intervention by central banks and governments, both with respect to individual banks and systemically: in some countries banks have been taken into public ownership; assets have been insured by governments; banks around the world, notably in the United States (US) and United Kingdom (UK), have

been forced to re-capitalise; and in some cases banks have been partly nationalised, with governments injecting public capital, and governments have intervened to guarantee a wide range of bank deposits and debts. Around the world governments and central banks have intervened drastically by buying a wide range of financial assets (including commercial paper and asset-backed securities) to inject liquidity and ease the liquidity problems faced by banks. In addition, central banks have radically changed the way they intervene in money markets to inject liquidity by extending the range of counterparties; the asset classes they will accept as collateral; the amounts of intervention; and the maturity of the assets accepted as collateral. Overall, taxpayers have come to absorb bank credit risk with credit risk in effect being socialised. In the face of weakening banking systems, in some countries (notably the UK) the taxpayer has effectively been forced to absorb credit risk generated by banks. State ownership stakes in banks represent a socialisation of credit risk as do asset purchases, guarantees and public insurance arrangements.

A major ingredient of public intervention has been the forced recapitalisation of banks. In the UK banks have been required to inject £50 billion of new capital, of which £37 billion has been provided by the government in the absence of private market capital raising. Two of the largest banks (Royal Bank of Scotland and the Lloyds Banking Group) have received large injections of capital from the government, which now has a substantial ownership stake in both. The forced recapitalisation can be regarded as a public good in two respects: (1) it obviates the need for asset sales by banks at sometimes fire-wall prices and (2) it enables banks to continue lending to support the economy.

A wide range of policy measures has been adopted in many countries, largely because of a systemic market failure that, because of capital impairment and uncertainty, means that banks have ceased to perform their basic financial intermediation role in the economy. In the UK, for instance, official measures have been designed to maintain the flow of bank lending in the face of the serious financial fragility of the banking system.

This paper presents a holistic approach to the causes of the financial crisis by emphasising the multidimensional nature of the causes. Because financial innovation is a central part of the crisis (and what will be termed its '*ultimate* cause'), the analysis considers the nature of financial innovation, with special reference to the emergence of instruments and business models that purport to shift credit risk in an important way. It is argued that this has changed the traditional economics of banking in an important way and that a key element in the crisis has been the new business models that have evolved as a result of financial innovation. In the process banks stopped behaving like banks. The holistic approach also focuses on the incentive structures faced by various agents such as banks, shareholders and managers, and bank supervisors and central banks.

Antecedents

Crises never emerge in a vacuum and the antecedents need to be considered. Seven structural changes in the global financial system set the background to the current financial crisis: (1) a defining feature of recent financial history has been the sharp rise in the pace of financial innovation; (2) an increasing 'financialisation' of economies (sharp growth in the volume of financial assets and liabilities relative to gross domestic product (GDP)); (3) a more market-centric structure of financial systems (an increase in the role of financial markets relative to institutions in the financial intermediation process); (4) a sharp rise in the use of derivative instruments and markets; (5) so-called (and largely unregulated) shadow banks (such as hedge funds and structured investment vehicles (SIVs)) emerged as major new players in the financial intermediation process (Tett, 2008); (6) an increased globalisation of finance and financial markets and systems; and (7) a sharp rise in gearing both by banks (including intra-financial-sector gearing) and households in many countries.

It is also relevant to consider the ideological context since, for a long time, the dominant ideology in the industrialised world (most especially related to the world of finance) has been one of deregulation of banking, and a general belief in rational expectations and the efficient markets hypothesis. This dominant ideology came to overwhelm both the regulatory ethos and strategies in financial markets.

The impact of globalisation has been particularly powerful in the propagation of the current financial crisis: in particular, and as noted at the outset, what started as a local mortgage problem in parts of the US has been generalised to a wide range of asset classes, the interbank market, a wide range of countries, and to several different and varied types of financial institution.

A central theme is that, as with many previous financial crises, a major ingredient in the current crisis has been the role of financial innovation. The new dimension has been the emergence of instruments (e.g. securitisation, collateralised debt obligations (CDOs) and credit default swaps (CDSs)) and new vehicles; all of which purport to shift credit risk from loan originators (mainly banks) to other counterparties, including investors in SIVs.

The unique feature of the most recent period of financial innovation has been the emergence of credit risk-shifting instruments (for a fuller discussion of these instruments, see Llewellyn, 2009). Such instruments have several important properties with respect to bank business models, the distribution of credit risks, the generation of credit, the structure of financial intermediation in the financial system, a more market-centric financial system, and *adverse selection* and *moral hazard* problems. In particular,

instruments that have been designed to shift credit risk have produced new banking models (e.g. *originate and distribute*) that change the underlying economics of banking in a fundamental way and in a way that, under some circumstances, makes the system more crisis-prone. I argue that such business models have been central to the origin of the current financial crisis. It is also evident that the implications of new models have not been fully understood by originators, users or supervisors.

Paradigm of causality

The causes of the financial crisis are multidimensional and came together in the middle of 2007. An analysis of the causes is considered at six levels (summarised in Table 1) and considered in detail in later sections after the economics of financial innovation have been outlined:

- *Proximate* causes: The proximate causes were defaults on US sub-prime mortgages, and weak risk analysis and management systems within banks.
- *Ultimate* causes: The ultimate underlying causes are identified as financial innovation, which purported to shift credit risk away from the originators of loans; the new business models of banks that resulted from this and which exposed banks to low-probability-high-impact (LPHI) risks; failures of corporate governance; weakening lending standards; and a resultant systemic under-pricing of risk. These factors operated in a context where, around the world, banks became more focused on shareholder value business strategies in an environment where competitive pressures in traditional banking business had become more intense.
- *Environmental* factors operated in a structure of large global financial imbalances; a global savings glut; asset price bubbles; massive growth of global liquidity; low and less-volatile inflation; and low and stable interest rates and bond yields. Strong and more stable world economic growth, in turn, induced sharp growth rates in bank lending and excess leverage, and pressure to maintain returns in a low interest rate environment.
- *Incentive structures* of key agents in the system (e.g. bank managers, shareholders, rating agencies and supervisors) also became dysfunctional. Some of the new financial instruments and the new business models developed by banks brought with them *adverse selection* and *moral hazard* problems. Furthermore, banks' internal remuneration structures created a bias towards excess risk-taking and herd behaviour (see Llewellyn, 2009b)
- *Supervisory failures*: These are the failure of supervisors to act on identified concerns and to act against excessive risk-taking by banks. While several central banks and international agencies had been

warning for some time about hazardous trends (e.g. under-pricing of risk and asset price bubbles), little action was taken to address their concerns.

- *Prevailing ideology*: The dominant ideology of deregulation and financial liberalisation, rational expectations and the dominance of variants of the efficient markets hypothesis set a powerful intellectual climate that influenced bankers, market participants and supervisors. This was a view often expressed by the former Chairman of the US Federal Reserve System (the Fed), Alan Greenspan, and in the UK it manifested itself in, *inter alia*, the concept of 'light touch' regulation by the Financial Services Authority (FSA).

In each case, the specific factors identified within each 'layer of causation' can be categorised as internal to banks or external or systemic (see Table 1).

Table 1: Crisis matrix

Cause	Internal	External/Systemic
Proximate cause	• Risk analysis and management systems	• Sub-prime defaults
Ultimate cause	• Business models • Corporate governance • Weak lending standards • Under-pricing of risk	• Financial innovation • Wholesale funding markets
Environment	• Pressure for returns • Credit growth and excess leverage • Optimism and collective euphoria • Excess 'financialisation' of economies • Shadow banks	• Asset price bubbles • Global liquidity expansion • Interest rates: Levels and stability • Low bond yields • Global financial imbalances • Excess savings in emerging-market economies • Inflation: Levels and stability • World economy: Growth and stability • Perceptions of low risks • Financial liberalisation
Incentive structures	• Remuneration systems • Low-probability-high-impact risk • Business models – Adverse selection – Moral hazard	• Competition

The central theme is that, while many factors played their part (and that it is the combination of pressures that proved to be decisive in the

emergence of the crisis), none would have had the impact that it had, had it not been for financial innovation, the new business models that this made possible and, in particular, the emergence of credit risk-shifting instruments. For instance, many factors contributed to the sharp rise in bank lending and an under-pricing of risk. However, their impact would have been limited had banks been forced to hold assets on the balance sheet, absorb the associated credit risk and hold expensive capital against this risk. In other words, had banks not deviated so far from the traditional model of banking.

I The role of financial innovation

Given the central importance of financial innovation in the crisis scenario and, as argued in this paper, being the 'ultimate' cause of the crisis, the nature and role of financial innovation are reviewed before considering their special role in the current crisis. In many respects, financial innovation (in particular the development of structured instruments and credit derivatives) became a defining characteristic of national financial systems over the past decade or so. A central theme is that some aspects of financial innovation (notably those that purport to shift credit risk from loan originators) changed the underlying economics of banking and the financial system, and led to the emergence of new banking models. In particular, I consider the economics of financial innovation in general and its implications particularly with respect to four key issues: (1) how it might contribute to enhancing the efficiency of the financial system, (2) its implications for risk management, (3) how it changed the underlying economics of banking and (4) its implications for financial stability. A key issue is the impact that financial innovation has on two key aspects in the financial system: (1) its *efficiency* and (2) *stability*. As indicated in the quotations at the outset of this paper, opinion is divided on these central issues.

The main focus is on credit risk-shifting instruments, which enable credit risk to be shifted, traded, insured and taken by institutions without the need for them to make loans directly to borrowers. This, in turn, changes in an important way the underlying economics and traditional model of banking.

In the following sections, I apply a *functional* approach to financial innovation with a focus on the underlying functions of the financial system. In adopting such an approach, financial innovation and instruments may be classified according to their contribution to the basic functions of the financial system: risk transference; pricing of risk; liquidity enhancement; credit generation and financial intermediation; insurance; asset and liability management; an efficient allocation of financial resources; and the funding of financial institutions.

A central feature of financial innovation is the unbundling of characteristics of different instruments and either keeping them separate or combining them in different ways (Llewellyn, 1992). This enables investors or borrowers to maintain those characteristics of an asset they particularly want, but give up those features that are not desired. This illustrates three central features of financial innovation: (1) it increases the range, number and variety of financial instruments; (2) it combines characteristics in a more varied way and widens the combination of characteristics; and (3) it has the effect of eroding some of the differences between the various forms of intermediation. As part of this process, financial innovation often enables different risks to be unbundled so that each can be priced separately and redistributed to those who are most able and willing to absorb them.

Financial innovation and efficiency

A key dimension of financial innovation is the extent to which it contributes to *efficiency* and *stability* in the financial system. When a *functional approach* to financial innovation is applied, many new instruments and techniques have the potential to enhance the efficiency of the financial system in the performance of its basic functions (e.g. financial intermediation and risk shifting). In principle, financial innovation, and credit risk-shifting instruments in particular, has the potential to shift risk optimally to those who are most able and willing to absorb it. However, the stability implications of these instruments are ambiguous in that, while innovation may enhance the stability characteristics of financial systems in the face of small and uncorrelated shocks, it also has the effect of reducing stability in the face of large and correlated shocks.

Although I argue that financial innovation, and credit risk-shifting instruments in particular, has been a central factor in the emergence of the financial crisis, this is not to lose sight of its potential efficiency benefits. Greenspan (2004: 3) has argued that "[c]redit derivatives and other complex financial instruments have contributed to the development of a far more flexible, efficient and hence resilient financial system." The Bank for International Settlements (BIS) (2003: 172) has argued that

> the development of credit risk transfer [CRT] has a potentially important impact on the functioning of the financial system. It provides opportunity for more effective risk management, promises the relaxation of some constraints on credit availability, and allows more efficient allocation of risk to a wider range of entities. The pricing information provided by new CRT markets is also leading to enhanced transparency and liquidity in credit markets.

The efficiency dimension to financial innovation can be summarised by considering, in general terms, the benefits of financial innovation to the financial system.

Costs of financial intermediation: The costs of financial intermediation can be reduced in two ways: (1) by giving borrowers access to a wider range of markets and facilities, and (2) in some cases by allowing different institutions to exploit their comparative advantages in the lending value chain. Thus, a bank might have a comparative advantage in originating loans, while an insurance company might have a comparative advantage in taking the associated credit risk.

Wider access to credit: These arguments can equally apply to the issue of access to credit. For instance, by enabling banks to shift credit risk to others, their lending capacity is enhanced because it eases capital and risk constraints on further lending. Indirectly, the lending capacity of risk absorbers is also enhanced as, through credit derivatives, they are able to acquire credit risk without the necessity of making loans directly.

Matching portfolio preferences and enabling optimal portfolio selection: By the same argument, innovation is presumed to increase efficiency as the wider range of facilities and instruments increases the probability that different portfolio preferences can be met. New instruments facilitate a greater ability to unbundle transactions so that various parties are able to construct the risk-return structure most appropriate to them (Italian Bankers' Association, 2008). Equally, to the extent that new instruments are created to reflect changes in portfolio preferences, the financial system becomes more responsive to consumer requirements and those of the suppliers of financial services.

Pricing of risk and efficient allocation of resources: Some instruments allow risks to be priced more accurately which, in turn, enables the financial system to contribute to greater resource efficiency in an economy. To the extent that innovations (and especially derivative instruments) enable component risks to be identified, separated and priced accurately, funds are allocated more efficiently in the economy.

Unbundling of risks: Many instruments allow various risks to be unbundled, separately priced and 'sold', allowing different risks within a given instrument to be separated, priced and held separately. It also enables agents to choose the particular combination of risks that suits their requirements and to change the combination of risks to which they are subject. The ability to unbundle transactions means that various parties are able to acquire risk-return structures that are most appropriate to them (Masala, 2007).

Arbitrage potential: New instruments facilitate arbitrage between markets which, in principle, erodes pricing anomalies and reduces market imperfections through greater integration of markets. A later section also suggests that, through the use of credit derivatives, anomalies in the pricing

of credit risk may be eroded. If an investor judges, for instance, that a particular credit risk is overvalued, (s)he can earn premium income as a protection seller in the CDS market.

Risk transfer and management: Financial innovation widens the range of instruments available for risk management, and enables various types of risk to be managed and shifted optimally to those who have a greater ability and/or willingness to absorb risk. The wider range of financial instruments now available has become an integral part of risk management, both for the suppliers of financial services and their customers.

Risk more dispersed: One of the properties of some new financial instruments is that risks can be dispersed optimally throughout the financial system, which reduces the concentration of, for example, credit risk on a particular type of financial institution. This could have the effect of enhancing the stability of the financial system. By the same token, some instruments enable a bank to maintain a customer relationship without incurring an excessive credit risk exposure. Credit derivatives offer an attractive mechanism for managing exposure concentrations.

Liquidity in credit risk: The traditional bank model is that loans are non-marketable and hence the lender is effectively locked in to the borrower for the maturity of the loan. This limits the ability of a bank to change the composition of its loan portfolio if it is constrained in expanding its overall balance sheet. Many instruments (e.g. securitisation and CDOs) remove this constraint and effectively create liquidity for loans that have traditionally been illiquid. Some instruments create a market in credit risk.

Information efficiency: Some financial instruments have the potential to increase informational efficiency through the market prices of derivative contracts and instruments, including indexes.

Portfolio management: In addition to their risk management potential, to the extent that innovations create secondary markets, they facilitate the management and adjustment of portfolios. Furthermore, in many ways and for some investors the cost of creating a CDO can be less than the cost of assembling a portfolio of loans and/or bonds to achieve the same risk-return objectives.

Clearly, there are potential efficiency benefits to be derived from financial innovation in terms of enhancing the underlying functions of the financial system. However, a decidedly more sceptical note is sounded by the Chairperson of the FSA in the UK (Turner, 2009):

> Not all innovation is equally useful . . . If the instructions for creating a CDO squared have now been mislaid, we will I think get along quite well without it. And in the years running up to 2007, too much of the developed world's intellectual talent was devoted to ever more complex financial innovations,

whose maximum possible benefit in terms of allocative efficiency was at best marginal, and which in their complexity and opacity created large financial stability risks.

Whatever the welfare and efficiency benefits of financial innovation, they will not accrue under all circumstances and the potential efficiency advantages may be compromised if, for any reason, they threaten financial stability. This leads to a consideration of the systemic stability implications of financial innovation, and credit risk-shifting instruments in particular.

Financial innovation and stability

The previous section considered the characteristics of financial innovation in terms of their potential contribution to the efficiency of the financial system in performing its core functions. The main, though not only, potential benefits were found to derive from the risk-shifting characteristics of financial instruments. Conversely, the impact of financial innovation on stability is more ambiguous.

Until 2007 financial innovation, particularly with respect to credit risk, developed in a largely stable and benign economic environment of strong and reasonable growth in the world economy, strong profitability of banks, and low and reasonably stable rates of inflation. This benign combination meant that credit risks *appeared* to be low, which required low pay-outs on credit instruments and credit insurance. In essence, the new credit risk-shifting instruments had not been tested in a more demanding market environment. The decade before the onset of the crisis was one of historically high stability in many dimensions: the macroeconomy, inflation, interest rates and so on. In formal terms, the distribution curve of risks became taller and narrower with small tail risks. It was also during this period that data were taken for the purposes of stress tests within banks and this necessarily produced skewed results as the sample period was atypical. In other words, stress tests were being undertaken on the basis of data taken from an exceptionally low-risk environment.

However, circumstances changed with the financial market turmoil that began in the middle of 2007 when banks around the world began to report substantial losses (and the need for re-capitalisation) on some of their derivative instruments and credit exposures.

Two contrasting views have surfaced regarding the stability characteristics of financial innovation, and credit risk-shifting instruments in particular. One school argues that because they have the potential for risks to be shifted optimally, they enhance the stability of the financial system. Against this, others argue that they have the potential to undermine financial stability, not the least because they facilitate substantial leveraging of risk. A possible resolution of this apparent conflict focuses on the nature

of shocks, in that the increased use of derivative instruments (notably with respect to credit risk) may enhance the stability characteristics of the financial system in the face of small and low-correlated risks, while they may make the system more vulnerable to large systemic shocks, such as the drying up of liquidity in international markets as in 2007 and 2008. In this regard, Rajan (2005: 40) offers the following perspective: "Have these undoubted benefits [of financial innovation] come at a cost? Have we unwittingly accepted a Faustian bargain, trading greater welfare most of the time for a small probability of a catastrophic meltdown?"

There are several routes through which financial innovation might enhance the stability characteristics of the financial system, and through which structured finance may make financial systems more resilient to shocks:

- To the extent that financial instruments spread risks more widely within the system (and to those who are more willing and able to absorb them), stability is likely to be enhanced.
- In many ways, such credit risk-shifting instruments enable banks to respond more easily to certain types of shocks. Several years before the onset of the crisis, the former Chairman of the Fed (Greenspan, 2002: 3), proposed that

  > [these episodes] suggest a marked increase over the two or three decades in the ability of modern economies to absorb unanticipated shocks . . . this has doubtless been materially assisted by the recent financial innovations that have afforded lenders the opportunity to become considerably more diversified and borrowers to become far less dependent on specific institutions or markets for funds.

- A further perspective has been offered by the BIS (Knight, 2004: 6): "The ability to switch smoothly between balance-sheet financing and market-based financing contributes to the robustness of a financial system and improves its ability to deal with strain."

The overall assessment of the former Chairman of the Fed (Greenspan, 2002: 4) is that "these increasingly complex financial instruments have especially contributed to the development of a far more flexible, efficient, and resilient financial system than existed just a quarter-century ago".

By contrast, there may be a degree to which the instruments that enhance efficiency might, under some circumstances, threaten financial stability. Borio (2008) suggests that three particular characteristics of these instruments may have contributed to the current financial turmoil: (1) their payoffs may be highly non-linear (Fender et al., 2008) in that they tend to produce a steady stream of returns in calm times, but in bad times can produce disproportionately heavy losses; (2) the risk profile of structured

products can be very different from that of traditional bonds in that they can be subject to high "tail risks" (i.e., higher probability of large losses); and (3) as noted by Fender and Kiff (2004), modelling the future default and risk profile of some structured instruments is subject to considerable uncertainty, not least because of the limitations of current valuation models, which often underestimate the correlation of risks within the instrument.

Credit derivative instruments may either increase or decrease financial stability, depending on the different types of shock that may occur. The negative stability characteristics of financial innovation may be summarised as follows:

- The introduction of multiple layers between borrowers and lenders may increase the channels for the transmission of shocks within financial markets.
- To the extent that financial innovation has accentuated the market-centric nature of financial systems, shocks in one market may spread to a wider range of markets than was the case before. The experience of the middle months of 2007 and in 2008 illustrates how this can occur. Globalisation, coupled with financial innovation, means that markets have become more closely linked and shocks can be spread more widely.
- The enhanced leverage potential of credit derivatives may increase the vulnerability of the financial system to certain types of shock.
- The use of credit derivatives tends to be inherently procyclical through accentuating credit growth in the upswing of an economic cycle, but equally accentuating the opposite trend in the downswing.
- Financial innovation has a general effect of enhancing competition in the financial system as all suppliers of financial facilities face competition from a wider range of channels. While this is generally a beneficial outcome, competition can sometimes have the effect of inducing financial institutions into hazardous and risky behaviour as they strive to maintain market share and rates of return on equity.
- The experience of the financial turbulence since mid-2007 has been that, in practice, credit risk is not always shifted as much as might be thought through the use of securitisation and credit derivatives. This in itself can introduce a higher element of instability in the system to the extent that, in the event that risk has not been shifted, banks may need to take back on to their balance sheets credit risks they thought had been shifted. This, in turn, may induce funding and capital problems for banks.

These considerations suggest a tentative conclusion regarding the stability implications of financial innovation. It seems that financial instruments that enable risks to be shifted, and that enhance the market-centric nature

of financial systems make the financial system less vulnerable to small shocks and enable such small shocks to be handled more easily. In this sense, the stability characteristics of the financial system are enhanced. However, it may make the system more prone to large, highly correlated and systemic shocks, and make it more difficult for them to be handled. One such event would be the type of systemic liquidity shock experienced in financial markets during 2007. Rajan (2005: 28), for instance, concludes that "[while] the financial system is more stable most of the time, we may also have the possibility of excessive instability in really bad times (as well as higher probability of such tail events)". He argues further that "the linkages between markets, and between markets and institutions, are now more pronounced. While this allows the system to diversify across small shocks, it also exposes the system to large systemic shocks – large shift in asset prices or changes in aggregate liquidity (p. 4)" A further dimension is that in some complex credit derivative instruments, correlations that are zero (or even negative) in normal times can turn out to be positively correlated in abnormal times (see Chan et al., 2005).

The Financial Services Authority in the UK (FSA, 2008: 47) has argued that

> [s]tructured finance and the way in which firms have used associated finance vehicles, such as SIVs and conduits, are central to the instability that affected financial markets and financial institutions in the second half of 2007 . . . Liquidity more or less disappeared from the asset-backed commercial paper market after several years of unprecedented growth . . . The lack of liquidity caused significant problems for many products, most notable SIVs, ABCP conduits, CDOs and CLOs.

In effect, all credit derivative markets were badly affected by the crisis to an extent that led some commentators to doubt their long-run viability. Gorton (2008) argues that interlinked and nested unique security designs necessary to make sub-prime mortgages function resulted in a loss of information to investors, especially regarding the location of risks. They were also based on the assumption (requirement) that house prices would continue to rise so that maturing mortgage loans could be rolled over.

What is new in recent financial innovation: Credit risk shifting

Instruments for the shifting of credit risk are a recent development and raise particular issues, both of analysis and practicality. There is a clear difference between a bank protecting itself against price rather than credit risk as the former is systemic in that the risk associated with a price movement is not influenced by the behaviour of the protection buyer: the probability is exogenous to the bank. Issues of asymmetric information, *adverse selection* and *moral hazard* therefore do not arise. The probability of these

risks emerging is determined independently of the behaviour of the protection buyer. Thus, the probability of a currency depreciation or a rise in interest rates is not in any way determined by the fact that a bank might have protected itself against these risks by, for instance, conducting forward transactions or buying option contracts.

Credit risk and its protection, conversely, raise different issues. The relationship between a credit-risk protection buyer and seller is fundamentally different from that between two counterparties in a swap or forward transaction. One of the features of credit risk is an asymmetric information dimension in that the lender has more information about the quality of loans than does a protection seller or a purchaser of a bank's asset-backed securities. The traditional theory of banking is that this asymmetric information, and the potential for *adverse selection* and *moral hazard*, acts as a bar to credit insurance or the shifting of credit risk. As with standard insurance theory, there is a potential for banks deliberately to select high-risk loans to be insured (*adverse selection*) and deliberately to make high-risk loans or to fail to monitor borrowers (*moral hazard*) because the risk is passed to others.

However, the emergence of securitisation and, more recently, credit derivatives challenges this traditional paradigm. Notwithstanding the problems outlined above, it is now possible for a bank to shift credit risk either through asset sales of one sort or another, or through an insurance contract such as a CDS. These recent innovations mean that credit risks can be shifted, traded and insured. Furthermore, they can be used by a bank or other financial institution to acquire a credit risk without making a loan by, for instance, being a credit-risk protection seller. The main characteristics of the different credit risk-shifting mechanisms and instruments are summarised in Table 2.

Table 2: Credit risk-shifting instructions

	Credit guarantee	Credit insurance	Loan trading	Syndication	Securitisation (ABS)	Conventional CDO	Synthetic CDO	Single name CDS	Portfolio CDS
Funded			√	√	√	√			
Unfunded	√	√		?			√	√	√
Asset transfer			√		√	√	√		
Insurance		√						√	√
Tradeable			√		√	√	√	√	√
Risk transfer	√	√	√	?	√	√	√	√	√
Single name	√	√	√	√				√	
Portfolio					√	√	√		√
Counterparty	√	√						√	√

There are several advantages to banks in securitising some of their loans: credit risk is shifted; the need for regulatory capital is lowered; banks are able to exploit their comparative advantages in initiating loans, even if they have no such advantage in funding loans or holding loans and credit risk on the balance sheet; the cost of funding is lowered as investors are attracted by the particular assets being securitised rather than the bank itself; and it enables customer relationships to be maintained, even if their loans cannot be held on the bank's balance sheet. Overall, it is an instrument of balance sheet and capital management for banks.

A key dimension is the extent to which credit derivatives achieve a genuine transfer of credit risk. In this regard, the issue arises as to whether this risk shifting simply replaces credit risk with counterparty risk: the risk that a counterparty becomes unable to honour its obligations in a credit derivative transaction.

The Financial Stability Forum report (BIS, 2005) identifies three issues with respect to the stability characteristics of credit derivatives: (1) whether they create a clean and total risk transfer; (2) whether all participants understand the full nature of the risks involved in derivative transactions; and (3) whether they produce a concentration of risks, either inside or outside the banking system. A key dimension therefore is the extent to which credit derivatives achieve a genuine transfer of credit risk.

A further issue is the extent to which complex instruments are fully understood by the transactors. New complex products might have consequences that are not fully understood by the initiators, users or supervisors (Masala, 2007). The full risk implications of some instruments are sometimes determined by the application of complex mathematical models, and these models have to be appreciated as much by the users and supervisors as by the institutions making use of them. The FSA (2002, 2008) has argued that complexity and the lack of transparency of many credit derivative instruments (and notably CDOs) make it difficult for investors to determine precisely how exposed they are to particular risks. In particular, losses may be determined by the correlations of the risks within the portfolio and these are difficult to calibrate in practice. Furthermore, banks have also become less transparent in that it is difficult to know the extent to which credit risks have been shifted through, for instance, credit default swaps.

A major issue with credit derivatives is that they tend to be opaque. Santomero (2007: 22) has raised doubts about some aspects of the use of financial derivatives, most especially with regard to transparency:

> Perhaps recent events . . . suggest that, while we have made assets more tradable, we have not necessarily made their value more transparent. Indeed,

> the added complexity associated with current asset portfolios drawn from various types of credit and credit derivatives cries out for better transparency and better reporting. This ought to be the agenda for the next decade.

In essence, there has been a proliferation of opaque and complex financial derivative and structured instruments, which are traded by opaque off-balance-sheet vehicles such as SIVs.

The true extent to which risks are shifted through various instruments may also be brought into question, most especially at times of systemic crisis as in the second half of 2007 and in 2008. In practice, what appears to be a risk-shifting instrument may have limitations. Thus, in the turbulence of 2007 many banks found that, in practice, credit risks had not been shifted because, for instance, they had committed lines of credits to their special-purpose vehicles (SPVs) and conduits which, because of funding difficulties, were subsequently called upon. Furthermore, because of funding problems, several banks were induced either to take back securitised assets onto their balance sheet or were unable to securitise loans they had made in anticipation of securitisation.

Difficult valuation problems also arise with some instruments. Because they may not always be traded in secondary markets, it becomes difficult for accurate market valuations to emerge. The alternative that is commonly used is for valuations to be made by investors on the basis of complex mathematical formulae which, as noted in Ayadi and Behr (2009), may not always account for the true risk and which may apply over-simplistic methods to assess the risk profile (see also BIS, 2003). In particular, as noted in Masala (2007), there is uncertainty about how new products, instruments and markets might interact in the face of extreme stress and shocks. The familiar 'tail problem' (low-probability-high-impact risks) has, from time to time, caused severe difficulties for some institutions trading in complex derivative instruments.

The alleged 'normal distribution' of risks (upon which many business and risk management strategies are based) is misleading in that empirical evidence suggests that extreme events (fat tail risks) tend to occur more frequently than is implicit in the normal distribution curve. This means, for instance, that if decisions are based on 99 per cent probabilities, risks are ignored that, in practice, are more common than implied by a normal distribution and that can impose substantial losses. The problem is that it is not feasible to model extreme events as was found in the current crisis. Problems arise when key risks turn out to be highly correlated (as they often are in a crisis) because when crises occur, the correlations of risks tend to be greater than was assumed. It may also be the case that the widespread use of derivative contracts (which have the effect of optimally spreading risks in 'normal' times) accentuates risks in 'abnormal' times. This is a difficult trade-off for both banks and their supervisors to manage.

In some respects, and as a result of the development of complex instruments, the financial system has become more opaque. The lack of transparency of some credit risk-shifting instruments came to the surface during the current financial turmoil. In particular, some markets, such as the CDO and securitisation markets, have virtually closed altogether, while conditions in some others (e.g. the interbank market in London) weakened considerably, largely because of the difficulty of transactors in assessing counterparty risk exposure to mortgage-backed securities and CDOs. Banks began to report substantial losses in these instruments and it became difficult for market participants to assess with any degree of accuracy who was holding what risks. The failure of Northern Rock demonstrates that excessive reliance on some credit risk-shifting instruments may cause a bank to become exposed to a particular funding risk: the bank became dependent on securitisation and financing through short-term securities (Llewellyn, 2008).

Credit risk shifting can also be undermined by a seller of credit risk protection itself becoming insolvent or in any other way being unable to honour its obligations. This is particularly the case with unfunded risk transfer instruments (see Llewellyn, 2009). In this sense, while a bank may be able to shift a credit risk, it becomes exposed to a different counterparty risk. In this event, the original credit risk reverts to the protection buyer. This arose in 2007 with respect to bond monoline insurers in the US that had been guaranteeing structured bonds backed by mortgages, which subsequently lost value.

Asymmetric information risks

There are several asymmetric information risks attached to the change in the banking model implied by credit risk-shifting instruments. The standard problems of *adverse selection* and *moral hazard* may arise. The underlying basis is that the initial lender is likely to have more information about borrowers and a greater capacity to conduct post-loan monitoring. Several problems in particular may arise:

- The initiating bank may have an incentive to shift the risk on its existing low-quality loans (De Marzo and Duffee, 1999; Pennacchi, 1988).
- A potential *moral hazard* arises to the extent that, as a bank is able to shift credit risk, it has less incentive to assess credit risk accurately. This problem surfaced in the US sub-prime mortgage market during 2007. There is subsequently also less incentive to monitor the borrower (Gorton and Penacchi, 1995; Morrison, 2005), and it is unlikely that a seller of credit risk protection (or buyer of CDOs) is able to monitor borrowers because he or she does not have the information or relationship advantages possessed by the initiating bank. This amounts to a new banking model which, to some extent, abrogates

two of the fundamental roles of a bank: (1) assessment of risk and (2) *ex post* monitoring. There is some empirical evidence for this in that Mian and Sufi (2008) find that default rates tend to be higher on securitised mortgages than those that are held on the initiating bank's balance sheet. Keys et al. (2008) also find that securitisation tends to weaken the screening of borrowers before loans are made.

- A lemons problem can emerge in some credit risk transfer arrangements in that a lender buys protection on low-quality assets, which may drive up the cost of protection on high-quality assets (Duffee and Zhou, 2001). The standard lemons problem (Akerlof, 1970) is that, in the presence of asymmetric information, a market may eventually break down as only low-quality assets are offered for protection.
- In some cases, either the borrower or the credit risk protection buyer (banks that have made loans) may be able to influence the probability of a relevant 'credit event' as the buyer of protection may have the power to determine when a default has occurred. Under some circumstances there is an incentive for a buyer of credit protection through a credit derivative to trigger a default prematurely by, for instance, refusing to make further loans that it might otherwise have done had it not been for the terms of the CDS contract.
- If contracts are incomplete (in that they do not specify the rights and obligations of all parties in all circumstances), there may be scope for one of the parties (often the risk protection buyer) to act opportunistically against the interests of the risk absorber.
- The risk shedder may retain a relationship with the borrower after the credit risk has been shifted as an agent of the risk taker. As noted in BIS (2003), this gives rise to a potential principal–agent problem. In whose interest is the bank working?

In some cases financial innovation contributes to alleviating standard problems associated with asymmetric information and, by adding further instruments to the armoury of risk management, may enable transactors to protect against the associated risks. However, in several ways, recent financial innovation (more specifically the emergence of credit risk-shifting instruments) has accentuated problems of asymmetric information and the associated problems of *adverse selection* and *moral hazard.* Mizen (2008) identifies several hazardous incentives structures within the 'originate and distribute' banking model and, in particular, the payment of upfront fees for originating banks and brokers; moral hazard; a bias towards writing business; and the incentives of rating agencies, which may be subject to conflicts of interest as they often advise on how to structure instruments in order to receive a favourable rating.

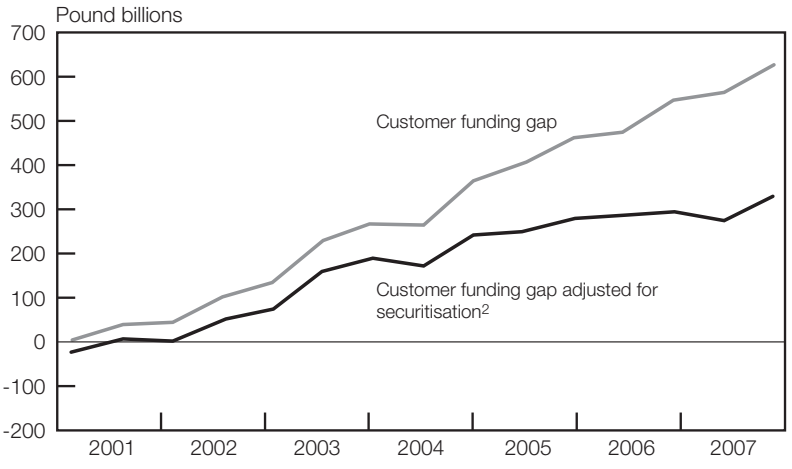
Risk analysis: Shifting versus changing

In practice, the financial crisis has revealed two major implications of credit risk-shifting instruments: (1) in many cases such risk was not shifted as much as banks thought would be the case, and (2) even when credit risk was shifted, this was sometimes at the cost of increasing market, liquidity, funding and ultimately solvency risk. In effect, credit risk that is initially shifted may involuntarily come back on to the balance sheet of the originating bank. There are several possible reasons for this, including a bank's SIV being unable to continue issuing asset-backed commercial paper; loans that were planned to be securitised may prove to be "non-securitisable" because of funding constraints; the originating bank may be called upon to honour agreed lines of credit to SIVs; and a bank may be induced to take back securitised assets in order to alleviate a potential reputation risk. In the case of Northern Rock, for instance, but other banks as well, an initial shifting of *credit risk* through securitisation exposed the bank to a *liquidity risk* as it (or its securitising SPV) could not "roll-over" in the wholesale markets its maturing short-term borrowings that were used to fund the acquisition of long-term mortgages. This liquidity risk, in turn, was quickly transformed into a structural *funding* risk (as alternative sources of funding were unavailable), which was ultimately transformed into a *solvency* risk.

In the case of Northern Rock (but again with several other banks too) the use of credit risk-shifting instruments exposed the bank to a low-probability-high-impact risk in that the reliance on short-term wholesale market funding to finance long-term mortgages meant that the bank became structurally dependent on a limited number of wholesale markets for its funding. It was always judged that the simultaneous drying up of all these markets would be extremely unlikely in that it had seldom, if ever, happened before. Equally, however, it would be very serious if this were to occur. In any event, this is precisely what happened. Banks ignored the low-probability-high-impact risk of liquidity drying up. Such risks equally applied to institutions and investors who would issue short-term commercial paper in order to acquire asset-backed securities of various kinds. The extensive use of some new instruments may, therefore, expose banks to low-probability-high-impact risks. The growing importance of non-retail funding for British banks is shown in Figure 1.

In essence, therefore, financial innovation (more specifically credit risk-shifting instruments) has both *risk-shifting and risk-changing* properties, and the specific outcome is not always predictable.

Figure 1: Major United Kingdom banks' customer funding gap[1]



1 Data exclude Nationwide
2 Customer funding gap less securitised debt. Where not available, stocks of securitisations are estimated from issuance data

Source: Dealogic, published accounts and Bank of England calculations

Problems are compounded in the case of many derivative instruments by the fact that they can become difficult to price, not the least because the risk characteristics are opaque and complex. When secondary markets dried up in these instruments after mid-2007, prices became unavailable. This forced holders (banks) to attempt to value their holdings of derivative instruments on the basis of models that were found to be fundamentally flawed in two respects: (1) they were based on an insufficiently long observation period from which to calculate probabilities, and (2) they did not take into sufficient account the tail-risk that the risks attached to many of the assets within CDOs were themselves highly correlated. Thus, what were thought to be diversified instruments turned out to be highly concentrated.

II The global financial crisis

Profile of the crisis

This is not the place to offer a detailed scenario of the global financial crisis (for a description of the sequence of events: see Brunnermeier, 2008). Nevertheless, the key features are summarised: (1) intense market *uncertainty* with respect to counterparty risks, and the value of securities based on derivatives and banks' own liquidity requirements given potential funding problems with their own SIVs; (2) increased concern over the

quality of structured instruments and their long-term viability; (3) eroding confidence in banks; (4) weak liquidity in major markets; (5) the effective closure of some interbank markets due to a hoarding of liquidity; (6) a sharp tiering of interest rates in the interbank market; (7) enhanced risk aversion across the broad spectrum of financial and banking markets; (8) funding problems for both banks and their SIVs, and a "reintermediation" of credit flows; (9) serious impairment of bank capital due to large losses and writedowns, most notably on complex structured securities and instruments; and (10) the need to deleverage following several years of exceptionally rapid balance-sheet growth.

In many countries banks have reported substantial losses on their exposures to credit derivatives and securities. This, in turn, has produced a massive decline in the market capitalisation of banks as summarised for a sample of banks in Table 3.

Table 3: Market capitalisation of selected banks (US$ billions)

	June 2007	January 2009
Citigroup	255	19
HSBC	215	97
JPMorgan	165	85
Royal Bank of Scotland	120	5
UBS	116	35
Bank Santander	116	64
BNP Paribas	108	33
Goldman Sachs	100	35
Unicredit	93	26
Barclays	91	7
Société Générale	80	26
Deutsche Bank	76	10
Credit Suisse	75	27

A particular feature of the current financial crisis has been the intermittent closure of the interbank market (notably in the UK) as banks have been reluctant to lend to one another because of lack of confidence (or information) about counterparties. This, in turn, is due largely to the opaqueness of some of the credit risk-shifting instruments, which means it is difficult to know who is exposed to what and how much risk. This has resulted in a hoarding of liquidity by banks. Different banks in the interbank market have always had different risk characteristics and this has been reflected in different risk premiums paid in the market. When uncertainty dominates risk, however, lending ceases altogether.

A particular feature of financial markets in recent months has been the hoarding of cash by banks. There are three main reasons for this: (1) they have become uncertain about the credit standing of potential counterparty banks; (2) banks increased their precautionary demand for cash lest they be called upon either to honour previously agreed lines of credit to securitisation vehicles or required to take back on to their balance-sheets loans that had previously been securitised; and (3) in addition, many banks have become concerned about their own ability to obtain funding in the interbank markets. The liquidity problem became serious because securitisation vehicles, such as conduits and SIVs, were funding the acquisition of long-term mortgages (and other loans) through issuing short-term debt instruments such as asset-backed commercial paper. As liquidity dried up, banks could not finance their off-balance-sheet vehicles and were forced to take assets back on to the balance sheet or hold on to assets they were planning to securitise. This effectively amounts to a process of reintermediation.

Furthermore, the losses that several banks have experienced on their sub-prime mortgage loans, and their exposure to conduits and other securitisation vehicles and instruments (notably CDOs), have weakened capital positions seriously. This has forced some major international banks to seek injections of capital from, for instance, Sovereign Wealth Funds in the Far East and elsewhere. In the UK, the government has required major banks to inject £50 billion of new capital with a large proportion being from the government itself. The same trends have also raised the cost of capital to banks. The willingness to lend has also been affected by the less certain value of collateral that is offered by borrowers against their bank borrowing.

Since the middle of 2007, both the primary and secondary markets in mortgage-backed securities have been effectively closed and concern developed over the exposure of banks in the market. There has been uncertainty, for instance, about which banks were holding mortgage-backed securities (MBSs) and CDOs. The Governor of the Bank of England (BoE) likened the drying up of wholesale funding opportunities to the equivalent of a run on banks.

All this created considerable market uncertainty, which led to a sharp fall in the prices of many asset classes; considerable uncertainty as to the risk exposure of banks, particularly in the interbank markets; credit markets dried up and most notably those focused on asset-backed securities; and liquidity dried up in the markets for MBSs and CDOs. Overall, there has been considerable uncertainty regarding the true value of credit instruments (partly because the market had virtually ceased to function effectively) and the risk exposure of banks. As a result, a loss of confidence developed in the value of all asset-backed securities on a global basis.

Causes of the crisis: *Proximate*

Having set the background, and especially the role of financial innovation, I turn to the underlying cause of the crisis, and the multi-dimensional paradigm established in an earlier section. At the outset six "layers of causality" were suggested. The *proximate* cause of the crisis (the trigger that started it) was a sharp rise in defaults on sub-prime mortgages in the US (associated, in part, with a tightening of monetary policy after 2004, following several years of ultra-low interest rates), the sudden and widespread loss of confidence in the securitisation model, and a sharp fall in property prices following sharp rises in both house prices and sub-prime mortgages over the previous few years (Jaffee, 2008). There had, in particular, been strong demand for sub-prime mortgages by Freddie Mac and Fannie Mae. The fall in house prices created refinancing problems for borrowers (given the way that sub-prime mortgage contracts had been structured) and increased both the probability of default and the loss-given-default. As noted by Mizen (2008), for several years mortgage originators had been maintaining the volume of new mortgages for securitisation by expanding lending activity into previously untapped areas. The first stage occurred in the early months of 2007 when defaults on sub-prime mortgages emerged on a significant scale. This was followed by a Moody's review of its ratings of MBSs.

These triggers, focused on sub-prime mortgages and securitisation of mortgage assets, were aggravated by evidently weak risk analysis, management and pricing systems within banks. Risks on sub-prime mortgages were clearly under-priced by mortgage originators which may, as argued below, be due in part to the moral hazard inherent in the securitisation process whereby originators adopting an "originate and distribute" model do not take the ultimate credit risk.

Causes of the crisis: *Environment*

Financial crises do not emerge in a vacuum, but surface in the context of the market environment that preceded it. It is usually the case that the seeds of a crisis are sown in an earlier period of euphoria and excessive optimism. For several years prior to the onset of the current crisis, the external economic and financial environment had been highly conducive to the financial sector and banks in particular (see Table 1). Financial liberalisation in many countries created conditions for a sharp rise in lending and balance-sheet expansion. For several years the world economy was particularly buoyant, in that growth was high and reasonably stable, inflation was similarly low and stable compared with previous decades which, in turn, brought with it a period of comparatively low and stable interest rates and bond yields around the world: real yields declined from around 4,4 per cent in 1990 to 1,5 per cent in 2007.

Some analysts have argued that the solution adopted to deal with one crisis sows the seeds of the next, and in this regard argue that the sharp cut in interest rates engineered by the Fed contributed to the subsequent euphoria (Boeri and Guiso, 2007). These conditions combined to create an environment of optimism and collective euphoria, and a perception that risks in the world economy generally, and bank lending in particular, were low. A perception of low risk (both in terms of the perceived probability of default and the loss-given-default), in turn, induced four hazardous trends: (1) an under-pricing of risk, (2) higher gearing by banks, (3) lower liquidity holdings by banks and (4) an accelerated growth in bank lending.

The emergence of substantial global financial imbalances created a glut of world savings, most especially in emerging-market economies such as China, India and countries of South East Asia, but also Germany and oil-exporting countries. The substantial accumulation of external financial assets by these countries needed to be invested and a significant proportion was invested in US government bonds. This, in turn, produced a sharp fall in US (and global) long-term bond yields.

Two more general trends emerged within financial systems. First, in many countries the financial sector expanded sharply and relative to GDP (a process of what might be termed a 'financialisation' of the economy) as indicated, for instance, by the sharp rise in the volume of a wide range of financial assets and liabilities relative to GDP. Second, within the financial sector, there was a shift towards a more market-centric system with a sharp rise in the role of financial markets in the intermediation process.

At the same time, and partly because of these trends and the responses made by banks and other lenders, there was a sharp rise in asset prices and most especially property prices in many countries: what turned out to be a substantial asset price bubble both in the stock market and housing market. This created conditions conducive to excessive lending by banks and excessive borrowing by households, most especially in the US and the UK. In the US, the savings ratio declined from 6 per cent in the early 1990s to close to zero by 2008, and the UK household savings ratio declined steadily from 11 per cent to close to zero by 2008.

Combined, these trends produced a period of several years of excessive optimism and euphoria during which conventional rules of banking were weakened or abandoned. What might be termed a 'collective euphoria' (or perhaps 'collective delusion and disaster myopia') militates against independent judgement by those who are required to monitor the behaviour and risk-taking of banks. The environmental conditions, in turn, induced internal fault lines within banks (see Table 1). In particular, they led to an excessive rise in bank lending and expansion of bank balance sheets. As lending rose at a faster rate than the supply of retail deposits,

the resulting "funding gap" was filled increasingly by wholesale funding, securitisation and the use of various credit derivatives. Within this total there was a substantial rise in the acquisition of mortgage assets, either directly or through investment in MBSs. Overall, such lending created excess leverage, both within banks and their borrowing customers. The low interest rate and yield environment created a "dash for returns" as banks and investors sought higher returns by moving up the risk-reward curve into higher-risk assets, even though their true risk characteristics were either not appreciated or ignored at the time.

This sharp rise in the size of bank balance sheets was compounded by a persistent under-pricing of risk, which became generalised within financial systems. Several supervisory agencies and others, including the BoE (2006 and 2007), the International Monetary Fund (IMF) and the BIS, gave frequent warnings that risks were being systematically under-priced. Always and everywhere, if risk is persistently either under-estimated and/or under-priced, problems will eventually emerge.

My thesis is that the financial crisis was preceded by a period of several years during which the external environment induced excessive optimism and encouraged banks to follow potentially hazardous strategies which, in some cases, were both predictable and predicted.

Causes of the crisis: Financial innovation

The theme of this paper is that the emergence of new banking models was a major factor in the emergence of the current crisis. The new models had two particular dimensions: (1) an increased emphasis given to rates of return on equity (ROE) as the bottom-line objective (Llewellyn, 2007, 2008) and (2) particular business models that followed from this. It can, for instance, be argued that the drive by banks towards securitisation and the use of credit derivatives was as much a product of a desire to raise revenue and the ROE as to shift credit risk.

Several trends in particular are identified: (1) bank assets expanded at a substantially faster rate than that of retail deposits; (2) the rise in bank loans substantially exceeded the rise in banks' risk-weighted assets; (3) banks reduced their holdings of liquid assets as they developed greater access to wholesale funding markets; (4) there was a sharp rise in the proportion of investment and trading activity in banks' balance sheets relative to loans; (5) there was an increased dependency on money-market funding and funding through securitisation models; and (6) a powerful trend emerged towards using credit derivatives as a means of supposedly shifting credit risk. With respect to the last-mentioned, the key issue is that securitisation and the use of credit risk-shifting instruments came to be strategic within banks rather than marginal: their use

became excessive and an integral part of banks' business models. As noted by Borio (2008: 20): "[T]he two most salient idiosyncratic aspects of the current turmoil are the role of structured credit products and that of the O&D [originate and distribute] business model". The BoE (2008) also notes that banks expanded into higher-risk assets for which the underlying value, quality and liquidity were unknown.

An overwhelming trend had been the substantial "financialisation" of economies as seen in the rise in assets of the banking system relative to GDP; the increased share of banks in aggregate corporate profits; a substantial rise in intrafinancial-sector leverage (perhaps symptomatic of increased "churning" whose real economic value might be questioned); and a sharp rise in the capital market value of banks relative to aggregate stock market valuation (Van Wensveen, 2007).

As a point of perspective, and with respect to the top ten US banks, total assets doubled in the period mid-2004 to mid-2007 while the sum of risk-weighted assets (against which capital needed to be held) rose by only 20 per cent. Furthermore, the loan-to-assets ratio of these banks declined from 52 per cent in 1997 to less than 40 per cent recently, while the investment-to-asset ratio rose from 32 per cent in 1998 to 54 per cent by 2008. At the same time and with respect to (5) above, the deposit-to-asset ratio declined from 45 per cent in 1998 to 36 per cent in 2008.

There are several routes through which financial innovation (most especially credit risk-shifting instruments) had the effect of increasing the pace of bank lending and raising the capacity of the financial system to generate credit: removing capital constraints as assets and/or risks are shifted off the balance sheet of lenders, thereby increasing the lending capacity of a given capital stock; lowering the risk profile of the balance sheet; through non-bank financial institutions being able to absorb credit risk without directly making loans themselves; raising the liquidity of bank loans and the possibility of trading credit risk, and the creation of SIVs which, to date, are not required to have capital. This largely unregulated 'shadow banking system' generated and facilitated a substantial volume of new credit. Shadow banks can be viewed as new entrants into banking markets, albeit outside the orbit of normal bank regulation.

I can also point to the substantial rise in the leverage of banks in recent years. In its Global *Financial Stability Report*, the IMF (2008: 27) noted "a collective failure to appreciate the extent of the leverage taken on by a wide range of institutions and the associated risks of a disorderly unwinding". In addition to all of this, there was an increasing volume of trading in credit risks in a situation where it had become evident that the risks in such trading were not always understood clearly.

A central theme is that, in some important respects, financial innovation (and most especially the emergence of credit derivatives) has changed the underlying economics of banking and the financial system. Earlier sections have outlined how new financial instruments have the potential to enhance the efficiency of the financial system in the performance of its core functions. I now consider how the economics of banking has also been changing, in part due to financial innovation. For illustrative purposes, a distinction is made in Table 4 between the *traditional model* of the bank (originate and hold), the *securitisation variant* (originate and sell), and the use of CDSs (originate, hold and externally insure).

It is instructive to begin with a stylised review of the traditional model of the banking firm (see Llewellyn, 1999 for a fuller discussion). Banks traditionally have information, risk analysis, and monitoring advantages, which enable them to solve asymmetric information problems and hence mitigate *adverse selection* and *moral hazard*. Banks accept deposits and utilise their comparative advantages to transform deposits into loans. In this model, the bank accepts the credit (default) risk, holds the asset on its own balance sheet, monitors its borrowing customers and holds appropriate levels of capital to cover unexpected risk. It also effectively 'insures' its loans internally through the risk premium incorporated into the rate of interest on loans. This is described in the *traditional* model in Table 4. In this process, the bank offers an integrated service, in that it performs all the core functions in the financial intermediation process.

Table 4: Alternative bank models

Model	Traditional	Securitisation	CDS
(1) Accept deposits	√	(√)	√
(2) Originate loans	√	√	√
(3) Utilise comparative advantage			
• Information	√	√	√
• Risk analysis	√	√	√
• Monitoring	√		
(4) Transform into loans	√	√	√
(5) Accept risk	√		
(6) Hold on balance sheet	√		√
(7) Capital backing	√		
(8) Insurance	Internal	Shift	Insure

Traditional: Originate and hold
Securitisation: Originate and sell
CDS: Originate and insure

Alternative bank models

Furthermore, in this traditional model the bank is not able to shift credit risk to other agents because of its asymmetric information advantages: a potential buyer or insurer of a loan from a bank might judge that, because of the bank's information advantage, there is an *adverse selection* and *moral hazard* problem, in that the bank might select low-quality loans to pass on and, if it knew that it could pass on risk, it might be less careful in assessing the risk of new loans and would conduct less intensive monitoring of borrowers after loans have been made. For the same reason, the traditional view of the bank is that it is unable to insure its credit risks externally and, instead, applies a risk (insurance) premium on loans and holds capital as an internal insurance fund. The reason for this is that, given the uncertainties outlined above, an external insurer would reflect this uncertainty in the insurance premiums charged to the bank. In this traditional view of the bank therefore credit risk cannot be shifted or insured, there is no liquidity to bank loans and banks are locked into their loan portfolios.

However, as noted in earlier sections, many aspects of this traditional model are now questioned. In the securitisation model in Table 4, the process of securitisation (including via CDOs) means that the bank is able to sell loans (which the traditional model denies) and hence the bank does not hold the loan asset on its own balance sheet, does not absorb the credit risk and does not need to hold capital against the credit risk. However, this depends on precisely how the securitisation is conducted and whether the SPV is truly bankruptcy-remote from the bank and *vice versa*.

The CDS model is similar to the securitisation model, except that, while the credit risk is passed to the protection seller, the asset remains on the balance sheet of the originating bank. In this model there is explicit external insurance of bank loans.

The two simple examples of financial innovation in Table 4 related to credit risk illustrate that the traditional model of the banking firm came to be modified. In particular, the examples of financial innovation considered in this paper (and many others that have not) mean that the bank is no longer required to perform all the functions in the bank intermediation business. Furthermore, banks are also able to outsource some of their other activities, such as loan administration and credit assessment through credit-scoring models of other banks. This further challenges the traditional view of the integrated bank. Banking is therefore no longer a totally integrated process whereby banks conduct all the functions in the loan process. Credit risk transfer facilities and instruments change the relationship between borrowers and lenders, and create incentive structures that are different from those contained in the traditional model of the

banking firm. In particular, the shifting of credit risk may create *adverse selection* and *moral hazard*, in that banks may have less incentive to monitor borrowers.

As a result of all of this, banks stopped behaving as banks in the traditional way and, in effect, came to act as brokers between ultimate borrowers and those who either purchased asset-backed securities or who offered CDS insurance.

Causes of the crisis: Incentive structures

The fourth identified 'layer of causality' identified at the outset focuses on incentive structures. Earlier sections discussed the incentive structures inherent in the originate-and-distribute bank models. Kashyap et al. (2008) place particular emphasis on the potentially perverse incentive structures in securitisation models.

There are several other dimensions to bank incentive structures in the current crisis: the extent to which reward structures have been based on the volume of business undertaken; the extent to which the risk characteristics of decisions are incorporated into management reward structures; the nature of internal control systems within banks; internal monitoring of the decision-making of loan officers; the nature of profit-sharing schemes; the extent to which decision-makers also share in losses and so on. Reward systems based on short-term profits can be hazardous as they may induce managers to pay less attention to the longer-term risk characteristics of their decisions. High staff turnover and the speed with which officers are moved within the bank may also create incentives for excessive risk-taking. A similar effect can arise through the herd behaviour that is common in banking. The incentive structures favouring 'short-termism' is epitomised by the now infamous statement of the Chairperson of Citi, Chuck Prince: "As long as the music is playing, you've got to get up and dance. We're still dancing."

Linked to such short-termism is the concept of 'disaster myopia' where low-probability-high-impact risks tend to be ignored most notably if competitors are adopting such myopia (the herd instinct). Internal reward structures within banks often make it difficult for managers to stand aside from the herd.

Buiter (2008: 14) suggests that "one of the key drivers of the excesses of the most recent (and earlier) financial booms has been the myopic and asymmetric reward structure in many financial institutions". The new business models of banks have created dysfunctional incentive structures. The President of the European Central Bank (ECB) (Trichet, 2008) has argued that there are lessons to be drawn from the crisis, as follows:

> [there are] lessons to be drawn in terms of the structure of incentives in all stages of the securitisation process and the 'originate to distribute' model. All the relevant players – including originators of loans, arrangers of securitised products, rating agencies, conduits and SIVs, and final investors – should have the right incentives to undertake a proper assessment and monitoring of risks.

Overall, there is evidence that reward structures within banks (which have often focused on short-term profitability) have produced a bias towards excessive risk-taking. In particular, UBS (2008) has identified systemic deficiencies in its own compensation policy as a contributory factor in the substantial writedowns it has suffered. It emerged that at UBS, triple A-rated MBSs were charged a very low internal cost of capital. Traders holding such securities were allowed to count any spread in excess of this low hurdle rate as income which, in turn, determined their bonuses. If the internal cost of capital is under-priced, and bonuses are paid on any excess return over this low cost of capital, there is an inevitable tendency for traders to take excessive risk.

The perversity of some incentive structures within banks was revealed in the current financial crisis. Governor Mervyn King, in oral evidence to the House of Commons Treasury Committee in April 2008, argued that "banks themselves have come to realise, in the recent crisis, that they are paying the price themselves for having designed compensation packages which provide incentives that are not, in the long run, in the interests of the banks themselves". The hazardous incentive structures implicit in new banking models have been put well by Bath et al. (2006: 104) who argue that "exploitive risk-taking took place at every stage in the financial engineering process". They cite several examples, such as lenders collecting up-front fees, passing the risks on to others, slicing and dicing cash flows without requiring appropriate documentation or performing due diligence, and the use by rating agencies of poorly tested statistical models.

Causes of the crisis: Supervision

Failures of supervision certainly contributed to the financial crisis. My thesis is that it has been a failure of supervision rather than regulation that has been a central issue. There may be a role for a review of regulation. However, the thesis here is that it is not so much that more or new rules are needed (though there are areas where this is appropriate and will likely be forthcoming), but more effective supervision of banks' behaviour.

Several areas in particular can be counted as supervisory failures: (1) the risk characteristics of new business models (and the use of credit derivatives generally) were not fully understood by supervisory agencies; (2) insufficient focus on banks' liquidity; (3) banks' business models were not subject to sufficiently rigorous supervisory stress tests; (4) insufficient

attention was given to monitoring and testing banks' risk analysis and management systems; (5) in some cases the *adverse incentive* structures associated with banks' internal remuneration systems were not considered to be an issue; and (6) while some agencies (i.e., central banks, the IMF and the BIS) had been warning of the triple dangers of the sharp rise in bank lending, asset price excesses and the persistent under-pricing of risk, no action was taken. Supervisory authorities were also slow to recognise that regulated banks were engaged in regulatory arbitrage by using securitisation and SIVs to circumvent regulation that restricted their ability to expand leveraged risk-taking.

In practice, however, and most especially in the supervisory context of the time, it is sometimes difficult for supervisors to intervene even when they have concerns. As already noted, the seeds of a financial crisis are usually sown in a prior period of optimism, high profitability for banks, strong asset growth, and benevolent business and market conditions. It is often difficult for a supervisory agency to intervene (even assuming it has the authority and power to do so) ahead of risks being revealed and when profitability is high. Only weeks before the failure of Northern Rock, the bank had reported record-high profits, the Financial Services Agency had lowered its target risk assets ratio and the banks' stock market price had also reached a record high.

There is also a more fundamental problem of what might be termed 'collective euphoria', which applies not only to supervisors, but also to other market monitors such as rating agencies and shareholders. The role of these stakeholder monitors (see Llewellyn, 2000 and 2004) is to apply an independent check on the strategies and decision-makers in banks. Yet in practice they may be subject to the same euphoria as the banks are themselves and may be part of a collective myopia based on the excessive optimism of the time. In this sense, their role is undermined by not being sufficiently independent of the climate of the time.

The ideological framework and policy

The sixth layer in the causality paradigm outlined at the outset relates to the prevailing ideology of the time based on deregulation, the liberal market economic model, and rational expectations and efficient markets hypotheses. The general ideological climate favoured free-market solutions and strategies, and tended to downplay the role of intrusive regulation. This general, and over-arching, ethos had the effect of militating against regulatory and supervisory intervention.

As part of this, in the US several policy initiatives were taken at various times in the years before the onset of the crisis: measures to help low-income families to obtain mortgages such as through zero-equity

lending; the deductibility of mortgage interest for tax purposes and the exemption (after 1997) of capital gains tax on residential homes; general pressure to lend to low-income families and pressure on Freddie Mac and Fannie Mae to increase lending under the Community Reinvestment Act of 1997; the draft Basel II Capital Accord opened up arbitrage opportunities for banks to accelerate off-balance-sheet activity; and the abolition of the Glass Steagall restrictions in 1999.

What is old and what is new

While there are new characteristics in the current financial crisis (largely centred on new banking models) there are also elements that are common to virtually all crises. As in some past crises, the idea that "it is different this time" because of financial innovation has proven to be seriously misguided. Some of the lessons to be learnt therefore are not only new and related to the specific circumstances of the current crisis, but are common to all past crises.

Several common themes emerge which, in varying degrees, feature in most financial crises:

- The benefits of financial innovation and the extent to which new instruments mitigate risk are frequently over-stated in two respects: (1) an exaggerated view about the extent to which they mitigate particular risks, and (2) a failure to appreciate that, even when particular risks are shifted, they may do so at the expense of creating different risks.
- Crises have often followed periods of deregulation and increased competitive pressures in the financial system.
- Incentive structures within banks can be perverse and create a bias towards excessive risk-taking. It has often been the case that financial innovation leads to increased leverage.
- Periods of collective euphoria tend to induce herd behaviour. Demirguc-Kunt and Detragiache (2005) find that the likelihood of crises increases with the strength and duration of economic booms. Weak internal risk analysis and management systems tend to emerge in periods of collective euphoria.
- Such periods of euphoria also tend to undermine independent monitoring of banks, because stakeholder monitors such as rating agencies and even supervisors tend to be subject to the same euphoric mentality.
- Short-termist behaviour of banks (with a focus on short-term profitability) is often hazardous.
- Periods of rapid and substantial credit expansion tend to produce an

over-expansion of banks' balance sheets, and in such periods risk analysis and management systems are often weak.

- Similarly, asset price bubbles (often associated with the property market) frequently lead to an overshooting of sustainable values, leading to a subsequent (and sometimes large) correction. Movements of asset prices often overshoot in both directions in that, just as the rise in prices goes too far in the euphoria so, in the short run at least, do the subsequent and necessary corrections.
- A common feature of banking crises is that risks (and especially credit risks) are under-priced in two respects: risks are underestimated and, even on this basis, are often under-priced. Furthermore, losses-given-default tend to be under-estimated.
- Low-probability-high-impact risks are ignored.

While the mix of these characteristics varies from one crisis to another, they represent common features. The seeds of the problem are sown in the previous period of optimism which generate sharp asset growth by banks, an under-pricing of risks, excessive optimism about the risk-shifting properties of financial innovation and weak supervision where supervisors find it difficult to interfere when the collective climate of opinion is optimistic.

III Assessment

The financial crisis has impacted on banks across the world, albeit in different degrees of intensity. It is, however, significant that banks in Spain, Canada and South Africa have been considerably less (if at all) affected than those in many other countries (notably the US and UK). This might offer some tenuous support for the hypothesis of this paper that financial innovation, and new business models of banks, have been major contributory factors in the crisis. In Spain, for instance, there has been a heavy regulatory cost on creating SIVs. In Canada banks have adopted a conservative business strategy, with a heavy reliance on retail deposits rather than wholesale funding. In South Africa exchange control has limited the ability of banks to acquire international assets and the banks have also stuck to the traditional model of banking. It is also the case that in the UK (one of the countries most affected by the crisis) mutual building societies have been largely immune from the problems experienced by their bank competitors. These institutions also retained the traditional model of banking, because of the regulation that applied to them and which limited their ability to seek funding though wholesale markets and because their mutual status militated against such wholesale market funding (Llewellyn, 2009b). It is interesting to note that not only has no building society in the UK been forced to seek capital injections from the government, but the

two banks that have been taken into state ownership (i.e., Northern Rock, and Bradford and Bingley) were both former building societies that converted to bank status and made most use of the new banking models.

The global banking crisis is likely to be transformational in many dimensions. The banking landscape in the US has already changed radically with the demise of leading independent, stand-alone investment banks. It is likely that the traditional model of banking will become more dominant with less reliance on wholesale funding and many of the complex credit risk-shifting instruments discussed in earlier sections of this paper. More attention is likely to be given, both by banks and their supervisors, to how to manage low-probability-high-impact risks. There is also likely to be less reliance on rating agencies.

There is also no doubt that changes will be made to regulatory and supervisory regimes. The regulatory implications of financial innovation have been assessed succinctly by the Financial Stability Forum as follows (BIS, 2003: 87):

> Credit risk transfer has the potential significantly to change institutions' risk profiles and their role in the financial system. From a financial stability perspective, it is important that these changes be addressed in regulation and disclosure standards, as well as in the behaviour of individual firms. Banks may in the future have less credit but more legal and operational risk. Liquidity risk might also become more important, created either by contingent liabilities within securitisation structures or by increased dependence on these transactions as a funding device. These risks are more difficult to measure than credit and market risk, and it may be more difficult to deal with them in quantitative capital rules and disclosure standards. A more qualitative approach, focussing on risk management, may be needed.

The way that supervision is conducted is likely to change in many respects: more active and proactive supervision, supervisory attention to banks' business models, greater focus on banks' liquidity requirements, and enhanced transparency and information disclosure with respect to both banks' balance-sheet position and the structure and characteristics of financial instruments. There is also likely to be a re-engineering of banks' regulatory capital requirements, with particular attention being given to addressing their procyclicality characteristics. It is also likely that incentive structures, and internal reward structures and their risk implications will become supervisory issues.

Over the past decade, banks enhanced their risk analysis and management systems, and financial innovation contributed to this in a significant way. For a decade or more, such innovation developed in a scenario of strong growth in the world economy, a fairly stable economic and monetary environment, low credit risks, and stable and low interest rates. This created a *disaster myopia* mindset.

However, the experience of the current financial crisis indicates that techniques and instruments that purport to shift credit risk in a stable environment may become problematic when the market environment becomes more volatile and uncertain, and when there are systemic shocks, more specifically when they involve low-probability-high-impact risks. In this sense, some risk-shifting innovations are 'fair weather' friends.

The financial crisis followed a period of several years when, throughout the world, banks had experienced exceptionally benign market conditions, which had the effect of generating rapid and substantial growth of business, enabling banks to diversify their business structures, generating new business models and ushering a period of exceptionally high profitability. The period 2000 to 2007 was, in many countries, the most profitable period for banks in particular and the financial sector in general. However, the fall-out from the most serious financial crisis since the Great Depression is likely to reverse many of these trends and force a rethink of business models. The traditional textbook model of a bank whereby it makes loans, keeps the asset on the balance sheet, holds capital against the risk and is unable to insure its credit risk externally seemed to evaporate with the experience of the early years of this century. Banks managed to do what the traditional textbook model said was not possible.

Since, to some extent, the crisis is a product of banks not behaving like banks, perhaps the traditional textbook model was right after all. Conversely, given the potential efficiency benefits of financial innovation, a sense of proportion is needed. While there will undoubtedly be regulatory responses to the crisis, and these are likely to limit the use of some instruments as banks revert to the more traditional model, there would clearly be a welfare loss if the potential efficiency benefits were to be lost. As always, a balance needs to be struck between the interests of efficiency and stability.

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