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Risk management, the Subprime crisis and finance-dominated capitalism: what went wrong?

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Abstract

Over time the financial sector has gained greater relevance in the economy, a phenomenon that some call financialisation or finance-dominated capitalism. Contrary to the mainstream view, financialisation literature emphasises that risk management by financial corporations will not be socially efficient in a context of deregulated markets and will ultimately lead to an increase of aggregate risk and crises. To assess the validity of such claim, in this paper we review the literature on risk management during the Subprime crisis. These failures fall into three categories: technique and methodology, corporate governance and strategy, and regulation and external factors. **We conclude that** these failures can be interpreted in the light of the financialisation perspective, which is therefore a valuable approach when addressing regulatory changes in the financial system.

Keywords: risk management, financial crisis, financialisation, financial institutions, financial regulation

JEL classifications: G01, G18, G21, G28.

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Risk management, the Subprime crisis and finance-dominated capitalism: what went wrong?

1. Introduction

In most developed countries, the financial sector has seen a growth in employment, value added, visibility and power. Some authors call this phenomenon financialisation (Epstein, 2005) or financed-dominated capitalist, which is characterised by features such as (i) a large development of financial markets, (ii) de-regulation of the financial system and of the economy in general, (iii) the emergence of new financial institutions and markets, (iv) and the appearance of a culture oriented to the individual, the market and rationalism.

Some authors see the growth of finance and financial deregulation as essentially beneficial given that the financial sector stimulates economic growth and financial markets guide the efficient allocation of resources (e.g. IMF, 2006:51). For example, securitisation allows risk to be spread to institutions that are better equipped to deal with it.

In contrast, the literature on financialisation highlights the negative consequences of that phenomenon, such as: firms aim to maximise their short-run financial value at the cost of sustainable productive investments; economic and social public policies are pushed into accepting market mechanisms in all areas of life, sometimes with deleterious consequences for efficiency and equity; and growing areas of economic and social life are exposed to the volatility and crises that often characterise financial markets.

This paper is concerned with the implications of both visions of finance for risk management. The mainstream view argues that as finance grows, risk management becomes more efficient and therefore ensures the diversification and control of risk. When divided and packaged into securities, risk is diversified and reduced. The expansion of financial markets and products increases the states of nature covered, allowing better risk handling (Arrow and Debreu, 1954). This occurs in a context where management acts to maximize profits in the name of shareholders without any agency problems (Jensen and Meckling, 1976).

In contrast, the financialisation approach is sceptical about the financial sector's capacity to manage risk effectively. As finance expands and new financial institutions and markets emerge in financial deregulation context, the pressure for short-run profit and growth leads to more risk and ultimately to crises. Firms tend to ignore their long-run survival and other social values.

We review the literature to assess the role of risk management in the Subprime crisis in order to conclude which of the two aforementioned visions prevails. It should be noted that the simple fact a crisis has occurred does not mean necessarily that the mainstream view is wrong. Even if risk management is perfectly executed, great losses may be incurred due to bad luck or to unforeseeable risks.

The financial literature provides no single definition of risk management. In one of the broadest definitions, risk management is defined as the identification and management of a corporation's exposure to financial risk (Kaen, 2005).

In general efficient risk management is key for financial organizations to survive crises, and this was particularly true during the subprime crisis. The literature has described many of the factors that contributed to that crisis. First and foremost, at the top is usually found the badly designed incentives of the players in the Collateralised Debt Obligations (CDO) market (Rötheli, 2010; Kashyap, 2010), including bank managers (Nelson and Katzenstein, 2011) and credit rating agencies (Lang and Jangtiani, 2010; Gupta *et al.* 2010)¹. The production of excessively complex and opaque CDO was facilitated by the bubble in the real estate market (Voinea and Anton, 2009; Nelson and Katzenstein, 2011). Other factors commonly mentioned include the excessive leverage of households and banks (Hellwig, 2008), the US monetary policy (Foo, 2008; Rötheli, 2010), deregulation, international imbalances related with a high US current account deficit, and the large amount of funds seeking high returns (with these funds linked ultimately to a functional income distribution that does not favours labour).

The excessive credit given to households was linked to the financialisation of the mortgage market and it progressively facilitated global financial investments (Aalbers, 2008). Banks increased leverage excessively to boost shareholders' returns (Palley, 2007) by using short term funds to finance long term investments, thereby raising systemic risk (Hellwig, 2008). This risk was also heightened by the procyclicality

¹ CDOs are part of the wider Asset-Backed Securities (ABS) market, which includes also residential and commercial Mortgage-Backed Securities (MBS).

introduced in the system by credit ratings, margin calls, and Credit Default Swap (CDS) spreads (Turner, 2009).

Whereas hedging strategies based on CDS made individual investors safer, they were riskier for the financial system (Crotty, 2009). Derivatives in general and CDS in particular take the separation between asset ownership and direct ownership of a tangible or intangible asset to an unprecedented extreme, and simultaneously give the wrong impression that risk can be controlled scientifically (Wigan, 2009).

Increased income inequality created the conditions that allowed the financial crisis, working through both the supply side and mostly the demand side of financial assets (Lysandrou, 2009). The supply of CDO depended on subprime mortgages to poor households. These households had difficulty in meeting their obligations towards banks due to lower wages and higher living costs, but this was also true of relatively wealthy households in periods of increasing interest rates and falling asset prices (Langley, 2008).

The remainder of the paper is organised as follows. Section 2 addresses the main risk management failures during the crisis, and Section 3 sets out the lessons and recommendations that can be drawn from the analysis of these failures. Section 4 concludes with a **systematic literature review**.

2. Risk Management failures

Haubrich (2001), Jorion (2009) and Stulz (2008) note that even when risk management is flawlessly executed, it does not guarantee that big losses do not occur. There can be an unlucky one-in-a-hundred event or an overly risky business decision. Haubrich (2001) adds that risk management may break down when optimal private levels of risk are not socially optimal. The question that we would like to address is whether there was a failure of risk management during the subprime crisis or if it was simply a case of bad luck or bad business decisions, which risk was correctly identified *a priori*.

Stulz (2008) states that the risk management process involves five stages: identification, measurement, communication, monitoring and management of risks. **As we shall see**, problems have arisen in each one of these stages. We have organised the weaknesses of risk management identified in the subprime crisis literature into three

categories: methodology and technique, governance and strategy, and regulation and external factors (Table 1).

Table 1 – Major risk management failures identified in the literature

Methodology and technique
<ul style="list-style-type: none"> • Ill-suited risk-metrics, namely VaR measures • Overconfidence in quantitative models and lack of qualitative analysis • Neglected risks (e.g. liquidity, reputational and concentration risks, contagion) • Quick evolution of financial products, characterised by high complexity and low transparency
Governance and the strategy
<ul style="list-style-type: none"> • Disaggregated vision of risk • Lack of a capital allocation strategy • Little importance given to risk management • Failures in internal communication, risk control and auditing • Flaws in the design of compensation arrangements • Cultural weaknesses
Regulation and external factors
<ul style="list-style-type: none"> • Excessive reliance on external ratings wrongly performed • Poor regulatory framework, namely capital regulation • Gaps in accounting standards and regulatory requirements • “Too big to fail” policy • Monetary policy prevented the market to re-assess the importance of risk

Methodology and technique

To begin with, the first type of failure results from using inappropriate risk metrics. During the subprime crisis, banks, credit rating agencies and international regulators employed sophisticated risk management metrics, and VaR (Value-at-Risk) was the most widely adopted model (Stulz, 2008; Nelson and Katzenstein, 2011). Since VaR models are not meant to reveal the distribution of the losses that exceed the VaR

limit, they are of little use if risk managers want to understand potentially catastrophic losses with a low probability of occurring (Stulz, 2008).

Crotty (2009) and Nelson and Katzenstein (2011) argue that VaR systematically underestimates low-probability events because it is based on the Gaussian distribution, which under-represents these high-cost events in distribution tails. Extreme and unlikely events with serious consequences or “black swans” make the distribution more skewed (Taleb, 2007).

Stulz (2008) notes that top risk management should not focus primarily on daily VaR but on long-run indicators of risk. Moreover, daily VaR implicitly assumes that assets can be sold quickly or hedged and, therefore, a corporation can essentially limit its losses within a day. But this may not occur at a time of low liquidity like the subprime crisis.

Nelson and Katzenstein (2011) advocate that the failures of the VaR methodology were determinant in creating and exacerbating the subprime collapse. Firstly, VaR was calculated on the basis of very short time series data (often less than 12 months), which did not include any serious crises. The reason for this procedure is that the structured debt products were new and it was believed that old ABS data were not relevant given the changes in the mortgage market in the previous two decades. Given the lack of historical data to assess risk, firms had to use proxies (e.g. corporate bonds rated Aaa), which proved wrong. Therefore, there was an under-valuation of risk, and VaR models did not capture well the behaviour of new structured debt products when severe shocks hit markets and liquidity decreased (SSG, 2008).

The risk of structured subprime products (CDO and MBS) was assessed assuming that house prices would grow forever, clearly underestimating risk (SSG, 2008). Indeed, based on the available historical data, it was difficult for risk managers to estimate the losses arising from a wide housing market collapse as this had only occurred in the 1930s (Crotty, 2009; Nelson and Katzenstein, 2011). This is a good illustration of the fact that statistical techniques of risk management are useful tools when there is a lot of data and when it is reasonable to expect future returns to have the same distribution of past returns (Stulz, 2008).

Nelson and Katzenstein (2011) also claim that the wide adoption of VaR models amplified the crisis by inducing “similar and simultaneous behaviour by numerous players”. Risk measured by VaR models rises at times of increased volatility and, in an attempt to reduce risk, investors start selling, thus amplifying the crisis (The Economist, 2008).

In fact, VaR has difficulty in capturing systemic risk since it assumes that each firm's actions do not affect the market outcome (Stiglitz 2009; Turner, 2009). However, in a situation where all firms behave in a similar way, the risk will be much higher than the model predicts. It is equally disturbing that the VaR assessment of risk may be lowest precisely when systemic risk is at its highest level, as in the spring of 2007.

Hellwig (2008), Crotty (2009) and Jackson (2010) also criticise the VaR hypothesis that future asset price correlations will be similar to those of the past. Crotty (2009) and Jackson (2010) add that securities kept off the balance sheet were not included in VaR estimations, ignoring the possibility that the risk from these securities may come back onto the balance sheet.

Lang and Jagtiani (2010) and Beyhaghi and Hawley (2013) agree that the use of sophisticated but untested models of risk management was a key element of the crisis and led to many corporations underestimating risks and engaging in excessive risk taking. Ashby (2010) demonstrates that many financial institutions showed an excessive reliance on quantitative tools and failed to adopt adequate stress and scenario testing. Banks that made stress tests used very weak assumptions; they never considered a full freezing of the money market (Larosière, 2009) and overestimated the advantages of diversification in a crisis (SSG, 2008).

Several reasons are advanced for the overconfidence in quantitative risk models and under-utilisation of qualitative approaches. Firstly, a culture had emerged that focused on market mechanisms and quantification. Another factor was the need to use rules of thumb in the presence of uncertainty (Nelson and Katzenstein, 2011). Finally, Lapavitsas (2011) shows that as banks increased credit to households, they started to use sophisticated statistical techniques of credit scoring to assess households' risks due to the large number of households and the relative small size of each transaction.

A side effect of quantitative risk models is that they give the impression that organisations are protected against risk, ultimately leading to professionals being overconfident (Hellwig, 2008; Nelson and Katzenstein, 2011). Additionally, Nelson and Katzenstein (2011) argue that uncertainty is irreducible and unquantifiable, and the mathematical treatment of risk does not make sense.

A crisis like the subprime crisis required a more qualitative approach to risk (Voinea and Anton, 2009; Nelson and Katzenstein, 2011). Sophisticated statistical models could not substitute qualitative judgments on the nature of the housing market boom, the presence of irrational exuberance and the problems of moral hazard and adverse selection in the subprime credit market and securitisation process (Lang and

Jagtiani, 2010). These judgements should have taken into account that the economy becomes unstable at times of economic growth due to the excess of optimism (Lakonishok *et al.*, 1994) and the emergence of speculators (Minsky, 1994). Traditional tools of credit risk management like industry analysis were also absent from the CDO market study (SSG, 2008).

Another important failure in the subprime crisis was that some risks were overlooked. Jorion (2009) notes that the crisis exposed serious flaws in risk models, namely in the risk categories “known unknowns” i.e. risks identified but measured inaccurately (model risk and liquidity risk), as well as in the category “unknown unknowns” that are risks outside most analysis, as for example structural and regulatory changes in capital markets and contagion. Regarding the category of model risk, this author notes that the failure of risk management derived from ignoring some important known risk factors, i.e. basis risk between cash bonds and CDS (see also SSG, 2008), and from errors in the mapping process which consists in replacing positions with exposures on the risk factors.

In relation to liquidity risk, Jorion (2009) argues that management does not usually account for this due to its complexity and the difficulty of reducing it to simple quantitative rules. Consequently, financial corporations generally did not anticipate the liquidity constraints occurred during the subprime crisis (Voinea and Anton, 2009), or that credit risk problems could turn into liquidity problems (Larosière, 2009).

Reputational risk was also underestimated. During the financial turmoil, banks felt obliged to supply liquidity to conduits and SIVs in order to maintain their reputation (SSG, 2008). Conduits and SIVs proved to be a source of systemic risk that was largely ignored due to their lack of transparency (Hellwig, 2008).

Similarly, Jorion (2009) claims that it is difficult to account fully for counterparty risk, and consequently most scenarios failed to consider it. He stresses that we need to know not only our counterparties, but also our counterparty’s counterparties. This risk became increasingly important due to the use of derivatives to invest and hedge positions.

Concentration risk was also largely disregarded with financial corporations taking extremely concentrated positions in the mortgage market despite the basic principle of diversification. The reasons for such behaviour can be found in principal-agent problems internal to firms that were not addressed by the corporate governance structure (Lang and Jagtiani, 2010) and the lack of an integrated capital allocation strategy (Sabato, 2009), issues that we will turn to below.

A more fundamental problem with risk management is that it rested on unrealistic theoretical assumptions, like the efficient market hypothesis (Beyhaghi and Hawley, 2013; Williams, 2011). The generalized use of these assumptions led to feedback loops and deceived practitioners, which paradoxically made risk management contribute to the increase of risk. González-Páramo (2011) stresses that banks were overconfident about the efficiency of markets and the ability of financial innovations to spread risk. Crotty (2009) notes that, in some cases, risks were transferred to clients who were not able to understand them fully, thereby increasing systemic risk in financial markets.

An interesting aspect is that the evolution of financial products outpaced the evolution of risk management (Voinea and Anton, 2009) and the regulators' capacity to adapt (González-Páramo, 2011). Structured financial products were extremely complex, with several layers of MBS making risk evaluation difficult (Larosière, 2009), and thus firms were not able to anticipate that losses could affect even the super-senior tranches of CDO (SSG, 2008).

This complexity contributed to the lack of transparency of the MBS and CDO markets (Crotty, 2009) that was amplified by the securitisation process (Stiglitz, 2009). Moreover, the unclear situation of certain financial institutions raised doubts about the dimension and location of credit risk and undermined confidence in the system (Larosière, 2009).

Governance and the strategy

The subprime crisis is also explained by failures in corporate governance that did not safeguard excessive risk taking. Some authors emphasize that the lack of implementation of Enterprise Risk Management (ERM) made it difficult to prevent risks (Kirkpatrick, 2009). In the ERM approach, all risks are assembled in a strategic and coordinated framework and a specific entity has an overview of the company's risk. Three main weaknesses in the insufficient implementation of such a strategy have been reported. Firstly, the disaggregated vision of risk was a key problem (Sabato, 2010; Lang and Jagtiani, 2010). By trying to create an independent risk management function, organisations isolated it from the overall investment process and thus limited its ability to influence the main decisions (Flaherty *et al.*, 2013). Moreover, financial innovation associated with the subprime market was developed by isolated departments and they were not integrated in the general business model, which implied that firms had no

perception of their aggregate risk (The Economist, 2008). The disaggregated vision of risk also resulted from an inadequate and fragmented infrastructure that made effective risk identification and measurement difficult (SSG, 2009). In some cases, this problem was clearly associated with the poor integration of data that had resulted from corporations' multiple mergers and acquisitions.

Secondly, Kirkpatrick (2009), SSG (2009) and Sabato (2010) say that the failure of risk management in most banks was in part due to the lack of a capital allocation strategy by the board, with the delineation and imposition of a level of acceptable risk and suitable risk metrics.

Thirdly and finally, the figure of Chief Risk Officer (CRO) was not sufficiently important at board level (Lang and Jagtiani, 2010), and risk management was considered a support function (KPMG, 2009).

Failures in reporting risk and communication between risk management staff and senior management were also common in financial institutions and information was not provided with sufficient regularity (Ashby, 2010; Lang and Jagtiani, 2010). Nevertheless, KPMG (2009)'s survey reports that communication across units of the organisation did not play a major role in the crisis.

This meant that the board and senior management did not know the overall exposure of companies to risk, which was also aggravated by the fact that they did not fully understand the new structured products (Larosière, 2009; Turner, 2009). The board also failed to have proper control over business line managers due to inadequate internal risk control and auditing (Larosière, 2009; SSG, 2009; Lang and Jagtiani, 2010), namely there were delays in the identification, limitation and treatment of losses and frauds (Jawadi, 2010).

The reasons for excessive risk taking by traders can be found in the inadequate supervision by regulators, in arrangements that favoured risk takers at the expense of control personnel (SSG, 2009), and complicity between managers and traders that can represent fraud (Jawadi, 2010). The complicity between managers and traders to take excessive risk has to be understood in the context of an irrationally exuberant market.

It should also be noted that compensation arrangements were not associated with the strategy, risk appetite and long-term interests of corporations (Kirkpatrick, 2009; KPMG, 2009). They were skewed to maximize same year results, disconnected from risk, as they did not take into account the true economic profits with the deduction of all appropriate costs (SSG, 2009). Remuneration schemes favoured high risk/high return investments (Acharya and Richardson, 2009; Crotty, 2009; Kashyap, 2010). Lang and

Jagtiani (2010) focus on the fact that managers were given incentives to increase the profitability of their business lines rather than consider the corporation's overall risk position.

According to the SSG (2009), another main problem associated with compensation practices was that they were driven by the need to attract and retain talent and often did not integrated with the corporation's risk control. Hellwig (2008) adds that employees were concerned with their careers and peer pressure as well as remuneration. Anyone that doubted a new and profitable business like the MBO would not be well regarded by colleagues.

Freeman (2010) defends that the huge monetary rewards given to high-level managers in financial institutions, instead of leading them to improve products offered, made them redistribute rents from consumers to firms, make high-risk investments and misreport financial returns. **In particular**, the top management of commercial banks was interested in increasing assets and profits, which meant they had to increase credit. Since good borrowers already had credit, the only alternative was to increase credit to less creditworthy clients: the subprime segment (Adrian and Shin, 2010).

Finally, Ashby (2010)'s survey stresses human and cultural weaknesses such as ego, greed, and "disaster myopia". It can be concluded from KPMG (2009)'s survey that risk culture was one of the elements of risk management that most contributed to the crisis.

Regulation and external factors

External conditions also made risk management more difficult and created incentives for excessive risk taking. The assignment of incorrect ratings by rating agencies led banks towards excessive risk. More generally, the incentives of all agents in the securitisation chain were misaligned. Banks also did not perform appropriate due diligences and relied excessively on external ratings (González-Páramo, 2011).

Hellwig (2008) and Ashby (2010) found that competitive pressures prevented financial institutions from staying out of the most profitable risky activities.

Sabato (2009) points out that the poor regulatory framework based on the belief that banks could be trusted to regulate themselves was one of the main flaws of the subprime crisis. Freeman (2010) claims that governments experimented laissez-faire

capitalism by deregulating financial markets. The lack of regulation can also be explained by the capture of regulators by the financial sector.

Indeed, Basel II trusted in banks' own models to assess some important risks like market and credit risks. Ashby (2010)'s interviewees (risk managers from a range of financial institutions) indicate the presence of significant regulatory failures in design (for instance, Basel II and its focus on capital requirements) and implementation (namely, supervisors' capacity to make effective judgements). One of the main criticisms of Basel II was the incentive to use credit securitisation and shadow banking organisations to reduce regulatory capital, as the regulatory framework was lax and almost non-existent in the shadow banking system (Crotty, 2009). Hellwig (2008) highlights other perverse effect of capital regulation. Banks were able to use quantitative risk management models to economize regulatory capital, thus exacerbating the insufficiency of capital that amplified the crisis. Since regulators were trusting in capital regulation, they had not efficiently monitored risk management functions and did not prevent highly concentrated risk.

Anyway, monitoring was hampered by gaps in accounting standards and regulatory requirements, e.g. the absence of commonly accepted accounting principles for risky products that would ensure a clear and comparable disclosure in annual reports (Kirkpatrick, 2009). Better accounting standards, greater transparency about risks and products would have facilitated the working of market discipline, which did not play a major role in limiting risk taking by banks (Turner, 2009).

Best (2010) is sceptical that other financial crises will be avoided by providing the market with better and more information about financial instruments because the true risk of some instruments is impossible to calculate and it is unclear whether the market has the ability or interest in making appropriate use of that information.

Dowd (2009) and Lang and Jagtiani (2010) emphasise that large financial corporations were not given appropriate incentives to worry about "tail-risk" due to the government's "too big to fail" policy. The largest banks were financed at lower rates than their true risk justified and this allowed them to expand risky activities even further (Moss, 2009). Panageas (2010) develops a model where the possibility of bail out by outside stakeholders allows firms to choose high volatility investments while net worth is high.

Finally, monetary policy also played a role by mitigating the fall in asset prices, especially after the burst of the internet bubble, which prevented the market re-assessing the importance of risk (González-Páramo, 2011).

3. Risk Management Recommendations

Many lessons can be learnt and recommendations made by identifying the faults in risk management. Once again we group these into three broad areas: methodology and technique; governance and strategy; and regulation and external factors (Table 2).

Methodology and technique

One main lesson from the crisis is that some types of risks cannot be overlooked and others must be taken particularly seriously. Even though liquidity, counterparty and regulatory risks are difficult to measure, banks should be aware of them; capital buffers should exist to prevent them, and they should not be so big that they lead to bankruptcy (Jorion, 2009)². Nevertheless, since banks cannot have enough capital to service a systemic collapse of the financial system, the role of risk manager of last resort rests on the regulator (Jorion, 2009).

Table 2 – Major risk management’s recommendations of improvement identified in the literature

Methodology and technique
<ul style="list-style-type: none">• More attention to certain risks in a dynamic and systematic way and adoption of capital buffers to account for them• Complement quantitative models with qualitative approaches• Improve technical aspects of quantitative analysis
Governance and the strategy
<ul style="list-style-type: none">• Adoption of ERM approach: involvement of all employees and limits on risk-taking in accordance with organization culture

² Regulatory risk is the risk deriving from changes in government intervention.

<ul style="list-style-type: none"> • Increase the importance of risk-related matters, namely the introduction of an independent CRO • Improve the effectiveness of risk control frameworks and internal communication • Long-term investment in high-quality professionals and technology to have in-house capabilities of credit analysis • Remuneration system linked to long-term return and risk
<p>Regulation and external factors</p>
<ul style="list-style-type: none"> • Rethink capital regulation • Greater transparency and better regulation of off-balance sheet securities • Greater harmonization and coordination of national liquidity regimes and supervision practices • Monetary policy more aware of bubbles and financial stability • Change in the treatment of large banks • Reform of credit agencies • Improvement of the structure of markets of complex financial products

In particularly, Golub and Crum (2010) stresses the increasing importance of policy or regulatory risk, as changes in policy often result in a structural break in the covariance of economic variables. In many markets policy risk surpasses the risk arising from economic fundamentals.

Concentration risk also warrants a watchful eye, mainly where there are new financial products like the subprime securities that were largely untested (CRMPG, 2008; Foo, 2008; Jackson, 2010).

Golub and Crum (2010) argue that corporations should acknowledge that market risk can change dramatically and they should be very vigilant about investments that require continuity in risk appetite or the ability to foresee risk appetite and volatilities. Foo (2008) claims that investors should take into account that excessive demand for financial products may lead prices to move away from fundamentals. Another important message of the crisis is that risk cannot be seen in a static environment (The Economist, 2008). In the presence of a systemic event, things hitherto taken for granted disappear when all investors start selling and panic sets in.

A comprehensive view of all risks must be adopted to capture the interaction between different types of risks leading to compounding effects (González-Páramo,

2011). For example, liquidity risk during the crisis interacted with market risk and both reinforced each other.

The use of a less quantitative approach to risk is also commonly recommended. Risk management is a task for experienced professionals and not machines (Jorion, 2009) and risk models should support and not drive decision making (KPMG, 2009). Golub and Crum (2010) stress that investors in securitized products should look beyond data in order to develop a deeper and direct understanding of the underlying assets; this includes the behaviour, incentives and practices of all players involved in the securitisation process.

Other tools of risk analysis are suggested **in complement of** quantitative models. Stulz (2008) concludes that the probabilities of large losses cannot be measured very precisely and corporations should therefore rely less on these estimates and pay more attention to the implications of such losses on their profitability and survival. Instead of depending on traditional measures of risk, based on stable returns and correlations, they should construct forward-looking scenarios that make more use of expert views (SSG, 2008; Jorion, 2009) and stress tests (Ashby, 2010; Jackson, 2010), especially to assess situations of contagion (CRMPG, 2008) and policy risk (Golub and Crum, 2010). Institutions are required to consider new types of risk **that emerge**; notably, risk plans should lead and not lag behind business development (Accenture, 2013). A more critical and deeper approach that goes beyond the available technology is also necessary when analysing risk (CRMPG, 2008).

The very nature of extreme events or “black swans” mean they cannot be predicted, but their impact can be minimized if, for example, potential areas in which extreme events may occur or where failure is highly costly are identified (Taleb, 2007). The most important lesson of the subprime crisis is that financial crises are more common than previously thought, and they may be different from past crises (González-Páramo, 2011).

Improvements should be made to some technical aspects of quantitative analysis used by banks and regulators that failed during the crisis (Stiglitz, 2009). For example: risk models should be flexible enough to adapt to changes in market conditions, use **other distributions more appropriated than the normal**, be aware that correlations may change in crises, use longer samples that include serious crises (or use qualitative analysis when this is not possible), include off-balance-sheet securities in the models’ estimates of risk, and not over-rely on untested models.

In short, we can conclude that although quantitative models are an important tool for banks and regulators to assess risk, their application needs to be improved and they should be complemented with qualitative tools, analyses and expert views. González-Páramo (2011) indicates that the problem is not the risk measures and models used *per se*, but the lack of understanding of their limitations. Unlike natural sciences which have fundamental laws, economics and finance study a system composed of human interactions.

Banks that did well in the 2008 crisis avoided many of the above mentioned mistakes (SSG, 2008). Resilient banks had a firm-wide risk perspective, a cooperative organisational structure of risk management, shared information across departments, and developed in-house expertise. This leads us to the importance of governance issues.

Governance and strategy

The technical and methodological issues in risk management are undoubtedly important, but even the best techniques will be misused in the absence of the right governance and incentives. KPMG (2009) and Ashby (2010) suggests the need to improve risk governance and create a risk culture through the widespread adoption of the ERM approach to ensure that all employees understand and are involved proactively in the risk management process. The board of directors needs to set realistic limits on risks that fit the institution's culture and risk aversion and that are the foundation of the system of controls within the organisation (see also SSG, 2008). Ashby (2010) recommends the creation of a culture of prudence and security.

Risk governance also implies the need to increase the importance organisations give to risk-related matters. Managers should become more risk aware, give careful consideration to the risks associated with their strategic decisions, manage risk for longer horizons, take a comprehensive view of all risks, and be prepared to react rapidly and determinedly when they believe firms are exposed to excessive risk (Stulz, 2008; Ashby, 2010). Thus, risk managers should build contingency hedging plans that can be implemented quickly if the corporation wants to reduce its risk in a short period.

It is necessary to build stronger relations between all levels of the organisation, including the business lines, audit committee, internal audit and board of directors (KPMG, 2009). Reliable quantitative and qualitative information should move between them in a timely manner.

Walker (2009) and Jackson (2010) defend the introduction of a board of risk separate from the board of directors and independent from the audit committee; its role would be to oversee and guide the directors on current and future risk exposures. The Walker Report also recommends having a CRO that participate in risk management and control with a firm-wide perspective and independence from business units. In this regard, Aebi *et al.* (2012) conclude that banks with the best performance during the subprime crisis were those where the CRO reported directly to the board of directors and not to the CEO.

According to the Accenture (2013) survey of 446 financial and non-financial organisations around the world, some progress has already been made as nearly all surveyed organisations have a CRO (though some may not have a formal title); it also reports that nowadays risk management plays a much bigger role in business decisions.

Even though several authors propose that financial firms should adopt an ERM of risk, this approach is not free of criticism. Power (2009) suggests that ERM uses a control-based approach and cannot appreciate the risk of the organisation's interconnectedness with the economy. Power (2009) argues in favour of Business Continuity Management (BCM), which is a hybrid approach to risk management, developed in recent years, and includes IT and emergency management professionals among others. It uses non-accounting knowledge to shed light on the interconnected characteristic of economic life.

Risk can only become more relevant in an organisation if the effectiveness of risk control frameworks is improved, namely through more accurate and timely risk reports (Ashby, 2010) and greater independence between traders and risk controllers (Jawadi, 2010). Risk limits are especially important in new lines of business, where the measurement of risk is more imprecise (The Economist, 2008). In support of this recommendation, Ellul and Yerramilli (2013) show that more effective risk controls reduced the risk of US bank holding companies during the subprime crisis.

The improvement in risk management is also fundamentally related to a stronger long-term investment in high-quality professionals and technology (Golub and Crum, 2010; Accenture, 2013). Each corporation should ensure it has a team of professional risk managers with substantial subject matter expertise, practical experience and strong communication skills, as well as the appropriate technology and infrastructures to develop suitable risk metrics. KPMG (2009) adds that banks need to improve risk expertise at senior levels, because this is crucial for more robust and informed business decisions.

Regarding in-house knowledge on credit risk, Golub and Crum (2010) add that corporations should recognize that financial certification is useless during systemic shocks. Instead, they must rely more upon their own credit analysis, surveillance and due diligence capabilities to understand investments, or avoid investing in certain classes of risky assets (González-Páramo, 2011).

Given that good professionals can make bad risk decisions when faced with the wrong incentives, changes in the remuneration system are often recommended. Crotty and Epstein (2009) indicate that the elimination of the widespread bad incentive structures and moral hazard in the financial system is key to **avoid** a future crisis. In particular, the top management of bailed out institutions should also be strongly penalized. Incentives should be based on long-term shareholder interests (Crotty and Epstein, 2009; KPMG, 2009; Walker, 2009; Ashby, 2010; Jackson, 2010), without asymmetries in the treatment of gains and losses (Stiglitz, 2009). Walker (2009) and Rötheli (2010) suggest that compensations should take into account the risk assumed, with salaries and bonuses linked to risk measures and not only to profitability.

Regulation and external factors

A change in regulation is also essential to promote a safer financial system. Gualandri *et al.* (2009) note that it is necessary to rethink the Basel Accord in order to take the relation between solvency and liquidity into account. They agree that good liquidity risk management helps lower the probability of insolvency and that a bank's capacity to obtain liquidity in severe market conditions depends directly on the adequacy of its capital. These authors, SSG (2008) and González-Páramo (2011) propose the development of more robust, standardized and rigorous stress testing and contingency funding plans to minimize the losses when financial strains occur.

The maximum leverage ratios of investment banks should also be reduced to make them less vulnerable to changes in market risk. More generally, in booms regulators should be aware of the risk of rising leverage in the financial system (Stiglitz, 2009). The creation of counter-cyclical capital requirements to restrict the growth of financial assets in good times has been proposed by Crotty and Epstein (2009). These proposals have already been addressed in Basel III. In Canada, a strong regulatory control of capital implied that Canadian banks were better capitalized than US counterparts before and during the subprime crisis, thus contributing to a better performance of banks in Canada during this crisis (Seccareccia, 2013).

The shadow banking system and investment banks must also be adequately regulated, and off-balance-sheet vehicles should be subject to adequate capital requirements that eliminate regulatory arbitrage (Crotty and Epstein, 2009). Similarly, increases in the capital required for some securitized assets should be placed on the agenda and reputational risk (associated with conduits and SIVs) should be addressed (SSG, 2008).

In addition, Rötheli (2010) defends more transparency and greater regulation of off-balance-sheet products. The accounting and disclosure of off-balance-sheet vehicles and products should be clearer; during the recent financial crisis, knowing which banks had the so called “toxic products” was a major problem (SSG, 2008; Kirkpatrick, 2009). Shareholders and risk managers must also collaborate to improve the functioning of financial markets by producing better information (Rötheli, 2010).

However, Stiglitz (2009) and Ashby (2010) stresses that capital rules naturally lead to regulatory arbitrage in banks, and therefore these rules cannot replace close supervision of bank practices. Ashby (2010) recalls that capital regulation may have negative effects on the quality of risk management and financial innovation, and that regulators should find a balance between hard rules and flexible practices.

Gualandri *et al.* (2009) also recommend greater harmonisation and coordination of national liquidity regimes and supervision practices, especially for the large banks and financial conglomerates. The global financial infrastructure and policy response should be changed to better address counterparty risk, avoid contagion effects (González-Páramo, 2011) and maintain public trust in banks by reacting **timely** to crises (Foo, 2008). The rescue of problematic banks by authorities is defensible to avoid public panic and social turmoil.

Stiglitz (2009) and Rötheli (2010) add that central banks should be more concerned with financial market stability (including asset bubbles) and its impact on growth and employment, and make use of other tools to guarantee it. The formation of a Financial Markets Stability Authority to monitor the stability of the entire financial system is crucial (Stiglitz, 2009).

Changing the treatment of large banks is another topic on the reform agenda not only because bailouts normally prove too expensive for the tax payer (Rötheli, 2010) but also due to the moral hazard caused by the existence of “too big to fail” banks (González-Páramo, 2011). Rötheli (2010) proposes introducing limits on the size of individual banks or the practice of special supervision for large banks. **In our view, the former option has to take into account that, up to a certain limit, large banks play a**

significant role in innovation and cost reduction. But Stiglitz (2009) supports the break-up of large banks due to both the “too big to fail” issue and competition problems. Such proposals have to take into consideration that more competition may imply banks have greater incentives to undertake risky activities. Canada’s case study shows that low competition between banks may promote more financial stability (Seccareccia, 2013).

Any future bailouts of banks should be funded by financial institutions (Crotty and Epstein, 2009). A structure similar to the insurance deposit scheme for commercial banks should be created for the other financial institutions.

Rötheli (2010) also recommends a reform of credit rating agencies in order to eliminate the tendency towards the underestimation of risks due to conflicts of interests. Measuring the accuracy of ratings would be a good solution. Stiglitz (2009) argues that rating agencies should be carefully regulated and that the government should create a rating agency.

Crotty and Epstein (2009) defend that any financial product that is too complex to be sold in an exchange should be prohibited. Confining financial products to exchanges would increase transparency and efficiency of the economy, reduce counterparty risk, and limit the size of the market of these products (Stiglitz, 2009). Regulatory agencies should also monitor the creation of new financial products closely and apply a “regulatory precautionary principle” to assess whether a new product should be allowed in the market in light of its systemic impact (Crotty and Epstein, 2009).

Jackson (2010) advocates that the lack of standardized structures or documentation in mortgage securitisation made search costs very high, which increased the reliance on ratings. At the same time, the standards of due diligence declined over time. According to Crotty and Epstein (2009), banks that create complex structured products should be required to undertake due diligence to evaluate the risk of each underlying mortgage; the ultimate ownership of the mortgage should be clear and it should be impossible for this to be done externally by rating agencies. This would clarify the risk of complex products and make their production less profitable. Moreover, the bank originating the mortgage should retain at least a 20% equity share (Stiglitz, 2009).

Price setting in the MBS market should also be made clearer (Voinea and Anton, 2009). Accordingly, the ECB and market participants already promoted an initiative to disclose information on each loan on the European ABS market (González-Páramo, 2011). At the bottom of the chain, predatory credit and usury practices should also be banned by regulation and supervision. Variable rates in mortgages, where the interest

rate can increase substantially after an initial period of low interest, should also be prohibited especially for low-income individuals (Stiglitz, 2009).

4. Concluding remarks

This paper discusses the role of risk management in the context of the subprime financial crisis. There is no doubt that several macroeconomic factors have to be taken into account in order to understand the crisis; these include the increase in house prices, the high demand of financial products from international investors, the Fed's low interest rate policy, and regulation errors. However, the behaviour of financial corporations was at the core of the crisis; not only were they too optimistic and took excessive risk without making a correct appraisal of risk across the subprime securitisation chain, but they also created complex financial products with little transparency and used CDS that made the financial system riskier.

The reasons for financial institutions' failure to manage risk appropriately are intriguing, because this is one of their main roles in the economy. We organized the explanations for this failure into three main groups: technique and methodology, corporate governance and strategy, and regulation and external factors. At the technical level, risk models showed several limitations; when dealing with new and complex products in particular, qualitative judgments were largely ignored and several important risks were overlooked (namely liquidity, counterparty, and systemic risks). Another major shortcoming was the inappropriate risk governance structure that gave little importance to risk matters and was characterized by a fragmented vision of risk, poor monitoring and auditing, wrongly designed incentives, and cultural weaknesses. Regulators and external forces also failed to fulfil their role correctly due to a lack of efficient monitoring by regulators, the incorrect design of Basel II on some key aspects, the “too big to fail” protection, poor accounting standards, and insufficient market discipline.

Given the shortcomings identified, the literature proposes recommendations to improve risk management. From the methodological and technical perspective, it is important to pay more attention to certain risks. Qualitative models, scenarios analysis and stress tests should complement quantitative analysis; and quantitative analysis needs to be improved. Regarding governance, institutions should have a strategic approach to risk, be concerned with their long-term survival and align their remunerations schemes accordingly; the risk governance structure should be

strengthened. Finally, regulation must be changed to avoid a future crisis. The Basel Agreement and prudential regulation must be reassessed, reforms made to credit rating agencies; the transparency and regulation of off-balance-sheet products and vehicles must be increased, the “too big to fail” effect addressed and improvements must also be made to the structure of markets, and monetary policy awareness of asset price bubbles must be raised.

Even though much still needs to be done, many of the aforementioned recommendations have already been undertaken by regulators around the world. Basel III is probably the most relevant step towards stronger regulation, with the reinforcement of capital requirements, and the introduction of new liquidity requirements. The Basel Committee on Banking Supervision also issued new regulations in 2013 on risk data aggregation and risk reporting that were applicable to systemically important banks at the global and domestic levels. Measures have also been taken to increase the trade of derivatives in organized and transparent markets. Furthermore, the EU started debating a proposal to limit bankers’ bonus in 2012 (Leão and Leão, 2012). Other important measures are the introduction of a resolution framework for international financial firms, and procedures to deal with banks of systemic importance (Giustiniani and Thornton, 2011).

Our discussion supports the financialisation perspective of risk management in the crisis. Large non-financial firms, previously a major source of profit for banks, have started to raise funds directly on the markets (Lapavitsas, 2011). As a result, and in a context of deregulation of the financial system, the banking system has gone through a deep restructuring process with the growth of the shadow banking system, the move from traditional banking to fee-generating banking grounded on the originate-and-distribute model, and the increase of lending to households rather than to firms (Stockhammer, 2010).

One of the conduits of financialisation is the alignment between corporate interests and financial markets interests (Palley, 2007). This is done by making managers’ remunerations dependent on corporations’ stock price evolution, and through the encouragement of debt. This has negative implications for risk management since managers focus on the short run behaviour of the share price and take excessive leverage. More generally, the rise of short-termism is related with the growth of institutional investors, changes in governance control, and the prominence of finance in the economy (Orhangazi, 2008: 74).

The increase in the share of profits in income (with the reverse decrease of the wages' share) led to the arrival of a growing volume of capital on financial markets in search of high returns. Faced with this pressure and abundant capital, banks paid less attention to risk and were more concerned about obtaining high returns.

The need to increase profits in the short run led to the creation of complex mortgage backed securities, without proper risk assessment, which ultimately gave rise to the crisis. The fact that regulators trusted in the self-regulation and market discipline of financial institutions also proved to be misguided as neither of the mechanisms were sufficient to foster a sustainable approach to risk. Simultaneously, risk taking by financial institutions increased systemic risk and volatility in the economy. Cultural aspects associated with ego, greed and over-confidence in both markets and quantitative tools also play a part in explaining the crisis.

We can therefore conclude that the shortcomings in risk management identified during the subprime crisis should be interpreted by using the broad concept of financialisation as this will foster the design of more effective regulations that prevent further crises.

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