SYSTEMIC RISK, A PROBLEM FOR THE WHOLE OF SOCIETY

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Abstract

In October 2008, the financial crisis generated unprecedented systemic risk on a global scale. Three years later, the crisis in private debt has become a crisis in sovereign debt, creating new systemic risk. The effects of this crisis, falsely described as financial, now extend well beyond the sphere of finance. They have generalised the risk society analysed in 1986 by U. Beck. According to Juvin (2008) "*The financial crisis is a crisis of risk, of belief in the abundance of assets without risk, of techniques of spreading and eliminating risk, of financial intermediation constructed as a negation of risk. It is a technical crisis of measuring instruments, of tools of calculation, but even more of the ideological conformity that claims to judge foundations by form*."
This crisis or these crises require the whole of society to question more than just the financial sector. Actors from the world of finance, referring to their own self-produced and self-legitimised standards, cannot, alone, analyse or understand them. Securitization was the instrument for the generalisation of risk spreading; it spread the risk so widely that a total crisis of trust destroyed the financial system. This is the analysis that we propose in this contribution. We study the evolution of risk in parallel with the development of more and more financialized economies; then we use a multidisciplinary perspective to analyse financial risk. Finally we analyze the role of methodological individualism in the current situation and ask whether a new approach to finance is possible. We deliberately position the present contribution outside any normative model in order to shed extra-financial light both on the financial crisis and on the social crisis that the world faces today. "*Borrowing too much increases the risk of crisis, and the costs of a crisis are not only borne by the lenders but by the whole of society*" (Stiglitz 2006).

Keywords: Systematic Risk, Corporate Governance, Financial Risk

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1. The notion of risk in finance today

Financial risk management has experienced remarkable growth over the last fifteen years. This success is partly linked to the globalisation of financial markets, to the arrival of a profusion of new financial products and to the increasing complexity of financial theories and institutions. However, the phenomenal development of financial risk management has also been punctuated by important crises (Savings and Loans, the Asian crisis, Long Term Capital Management, the dotcom bubble, the mortgage crisis, the liquidity crisis) and a succession of scandals (Barings, Sumitomo, Allied Irish Banks, Société Générale, UBS, Madoff etc).
During this period, risk management has evolved from being the simple practice of risk insurance into a complex discipline divided into two major parts: risk quantification and the managerial practice of risk management. Risk quantification has most often been dealt with scientifically, with academic research in disciplines as diverse as economics, finance, statistics, mathematics and operational research, or quasi academic deliberations within central banks and financial institutions. Managerial practice, on the other hand, has progressed thanks to the lessons of the scandals and crises.

To understand the current importance of financial risk management, we explore three dimensions. First, we analyse the historical evolution of the concept of financial risk. Then, we examine the influence of the development of economic theory over the last sixty years on the tools of financial risk management. Finally we trace the evolution of the concept of systemic risk.

1.1 The evolution of financial risk

The etymology of the term risk shows that it historically connected with maritime trade, which began to expand in the Middle Ages. Indeed, the term originates in the Latin resecare which means "to cut" and which is the root of resecum, a sharp rock or reef1.

Compared with traditional activities such as agriculture or industry in its infancy, maritime trade presents very particular problems that require a whole panoply of solutions: simple, material solutions (ships sailing in convoys with an armed escort) and complex, abstract ones (maritime insurance). Indeed, whilst a well-armed fleet can reduce the threat of piracy or rival merchants, it can do nothing against the uncertainties of sea travel.
This limitation stimulated the development of sophisticated insurance mechanisms. Insurance makes it possible to separate the management of the shipping company from the management of risk; but its development required, apart from just commercial need, an advance in thinking and the development of efficient mathematical tools.
The advance in thinking required was a leap into abstract thought, since an insurance policy is a mere legal contract, and thus an intangible good. Moreover, the contract is contingent and asymmetric: contingent since the payment is only made if the risk of bad weather materialises, asymmetric since the payment is much larger than the premium paid.

Calculating an insurance premium is therefore difficult and requires advanced conceptual and calculating tools. Ferguson (2009) summaries the six mathematical innovations of the seventeenth and eighteenth centuries that made this development possible: probability, life expectancy, certainty and the law of large numbers, normal distribution, utility and statistical inference.
After insurance the first mutual groups appeared to provide a pension for widows, and developed over the next two hundred years into health insurance funds, mutual funds and pension funds2. Actuarial science was born.

Through its use of probability, risk management is also related (and the link is possibly a cultural one) to betting and gambling. Indeed the first attempt to formalise probability was made by Girolamo Cardano, a 16th century Milanese doctor, mathematician and incorrigible gambler. Similarly, one of the first academic studies of probability by Blaise Pascal and Pierre Fermat was inspired by a question put by the Chevalier de Méré, an inveterate gambler. Etymologically, the French terms *aléatoire (random)* and *hasard (chance)* come respectively from the Latin and the Eastern Arabic terms for dice (*aleas* and *al-zahr*). The duality between risk and gambling is even more explicit in English, where *al-zahr* has evolved into the word *hazard*, meaning both uncertain and perilous, all of which brings us back to maritime trade in the British Empire.
The formalisation of insurance and mutualisation mechanisms in the 18th century took place at the same time as capitalism. Subsequently a modern financial system was developed, with insurance and reinsurance companies playing a key role. The link between commercial and financial risk became established. However, it was not until the development of economic theory in the 20th century that we began to speak of a genuine theory of financial risk management.

The first step in this direction was the definition of an economic notion of risk. This developed from the distinction made by the economist Frank Knight (1921) between risk and uncertainty, risk being described in terms of probability, but not uncertainty:

> "*It is a world of change in which we live, and a world of uncertainty. We live only by knowing something about the future; while the problems of life, or of conduct at least, arise from the fact that we know so little. This is as true of business as of other spheres of activity. The essence of the*

1 Cf. Bernstein (1998).
2 Scottish Widows was founded at this time.

> *situation is action according to opinion, of greater or less foundation and value, neither entire ignorance nor complete and perfect information, but partial knowledge. If we are to understand the workings of the economic system we must examine the meaning and significance of uncertainty; and to this end some inquiry into the nature and function of knowledge itself is necessary".*

Knight divided probability into three categories:
"A priori probability": probability that is objective and exact, because it originates in identical situations.
"Statistical probability": empirical probability.
"Estimates".

Concerning estimates, he writes:

> *"It is this third type of probability or uncertainty which has been neglected in economic theory, and which we propose to put in its rightful place. As we have repeatedly pointed out, an uncertainty which can by any method be reduced to an objective, quantitatively determinate probability, can be reduced to complete certainty by grouping cases. […] The present and more important task is to follow out the consequences of that higher form of uncertainty not susceptible to measurement and hence to elimination. It is this true uncertainty which by preventing the theoretically perfect outworking of the tendencies of competition gives the characteristic form of "enterprise" to economic organization as a whole and accounts for the peculiar income of the entrepreneur".*

1.2 An analytical view of an orthodox distinction

This Knightian distinction between objective risk, which can be analysed scientifically in terms of probability; and subjective uncertainty, which cannot be analysed and which represents the limits of our knowledge, is at the origin of the traditional view of financial risk management. This standard view divides financial risk into five major types[3]: market risk, credit risk, operational risk, liquidity risk and legal risk[4].

Market risk is the risk of a fall in the value of an asset resulting from fluctuations in stock prices, interest rates, exchange rates or commodity prices. This risk has been widely studied and analysed, and a long list of measurements is available for its calculation. Market risk is interesting for two main reasons: First of all, the theory of financial economics has, since Markowitz, Sharpe and Treynor, been built on the duality between systematic risk and market risk. Secondly, market risk can quite easily be analysed thanks to the existence of a large number of data sources.

Credit risk is the risk of a fall in the value of an asset resulting from a change in the ability of counterparty or a bond issuer to fulfil his financial commitments. It is linked to the probability that the counterparty will default, but also to the market value of the asset or of the transaction.

Operational risk is the risk of a loss resulting from inadequate or faulty internal processes, from problems related to people or with systems, or from external events. This risk includes operational problems, technical difficulties, failure in systems of governance, inadequate modelling and fraud.

There are two sides to liquidity risk. Firstly it is the risk of having insufficient liquidity to fulfil short-term financial commitments ("funding risk"). Secondly liquidity risk represents the risk of not being able to buy or sell an asset at current market prices ("trading-related liquidity risk"). These two dimensions are related by the fact that to create liquidity for the fulfilling of financial commitments we often sell existing

3 This classification has been adopted by numerous authors (Embrechts et Al. (2005), Jorion (2007), Marrison (2002)…), and by the Bank of International Settlement for the Basel Agreement. On this subject the reader may also refer to Lleo's Literature Review (2010).

4 This classification does not include geopolitical risk, which is often seen as an aggravating factor for sovereign risk, or credit risk. However, the concept of geopolitical risk is more than just a "micro" factor; it includes a "macro" dimension. The financial world's view of geopolitical risk is thus a self-centred analytical simplification serving the standard classification, and an attempt to widen this classification beyond finance in its strictest sense.

assets.

Legal risk is defined as the possibility of loss resulting from poor interpretation or application of current laws and regulations.

This partitioning into mutually exclusive types makes integrated risk management more difficult. Even if we could calculate the impact of each of these risks on the activities of a bank or a fund accurately, how could we bring these measurements all together into one global measure of risk? By making such a detailed analysis, we have made global analysis even more difficult.

This is even more true insofar as the different risks tend to interact, and thus to defy attempts to partition them. Let us imagine that that a company is looking for a counterparty for a financial transaction linked to the oil prices. Should the counterparty be an airline or an oil company? On one hand, the value of the transaction follows oil prices: there is a market risk. On the other hand, oil prices will have a financial impact on the financial health of the potential counterparty: a rise will weaken the airline whereas a fall will affect the oil company. This creates a credit risk. This relationship between market and credit risk is known as "Right Way Wrong Way Risk". Currently this is a significant problem in the financial sector[5].

This partitioned classification is a significant obstacle to the development of financial risk management. Apart from the Knightian distinction and our natural tendency to name and classify objects in an attempt to control them, one other reason explains the resilience of this partitioning. It originates in the links between financial risk management and modern financial economic theory.

Indeed, the new discipline of financial risk management has developed over the last thirty years on the fringes of the formalisation of financial economic theory, and more generally of orthodox economic theory. We can see this by simply noting that the basic measurements of market risk are standard deviation as proposed by Markowitz and Sharpe's Beta, or by recalling the predominant role of derivatives and hedging practices in financial risk management historically.

Economic thought, and incidentally financial economic theory, have developed in the wake of the publication of "The Methodology of Positive Economics" by Milton Friedman in 1953. Friedman's central idea is that economic theory must be an instrument for the analysis of the economy, and not a photographic reproduction of economic reality: it is "*an 'engine' to analyze it [the economy], not a photographic reproduction of it*" (Friedman 1953).

Donald MacKenzie (2006) quotes Friedman:

> *"'To be important, therefore, a hypothesis must be descriptively false in its assumptions'. The test of a theory was not whether its assumptions were 'descriptively realistic,' for they never are but… whether the theory works which means whether it yields sufficiently accurate predictions."*". To reinforce this point, the same author also quotes an interview with the celebrated economist Merton Miller: "*Around here, […] we just sort of take [Friedman's viewpoint] for granted. Of course you do not worry about assumptions"* and clarifies this by adding *"By 'here' Miller meant the University of Chicago, but he could have as easily been describing much of finance theory*".

This position concerning the hypotheses is neither unique nor isolated. Roll (2011) illustrates it in the following way:

> "*The following are four [elementary principles of finance and economic development][…]: The total value of all debt is zero, the total value of all derivative contracts is zero; financial markets are forward looking; a country's prosperity is positively related to the extent of economic liberalization"*. The conclusion of this article also demonstrates that orthodox economic theory runs the risk of appearing to have political or even proselytising objectives: "*If the diagnosis here is valid, a much better treatment protocol is available. The first step is to stop the current medicine because it is making the problem worse. Increased government spending and a decreased role for the private sector are simply going to prolong the malady; indeed, so long as that improper*

5 Cf. Cannabaro & Duffie (2003), Cesari & Al. (2010).

> *treatment continues, the patient will not improve. The global economy and the U.S. economy are destined for a long period of stagnation, akin to that experienced by the United Kingdom after World War II, until another physician like Margaret Thatcher comes along to try an alternative cure. In principle, the patient could recover much sooner and even very quickly, but only if the political seas have truly reversed themselves and we are now embarked on a divergent tack. There is a well- proven healthy regimen: a relatively smaller public sector and a larger private sector, lower public spending, and lower taxes. It has been shown time and again to bring a dramatic improvement in economic prosperity, an improvement that can happen quickly. Perhaps it is being excessively optimistic to hope that we have learned our collective lesson and that governments can be persuaded to shrink and, by doing so, create a more prosperous era*."

Despite the use of medical terminology such as "diagnosis", "cure" and "physician", this is far from being an objective, measured, scientific analysis: Roll's perspective is subjective and political. His message also echoes the violent opposition of Von Hayek and Friedman to all governmental intervention and regulation[6]. This ideology is moreover no longer exclusive to a few university circles, and has been widely adopted by the financial sector. As an example, during an interview published in the Financial Times, J. Dimon, CEO of JP Morgan, strongly urged the United States to withdraw from the Basel Committee, as the regulations it was proposing were "un-American".[7] This ideology spread through two channels: education in elite economic establishments and the deep links between the political and financial spheres. The "Chicago Boys" that Friedman trained at the Pontifical Catholic University of Chile are the iconic example of the first channel. The careers of R. Rubin, who worked at Goldman Sachs for twenty-six years before becoming Treasury Secretary in the Clinton administration and then joining the board of Citigroup; H. Paulson, CEO of Goldman Sachs before becoming Treasury Secretary in the Bush administration; T. Geithner, who spent part of his career at the Treasury Department before becoming President of the New York Fed and then Treasury Secretary in the Obama administration; and J. Corzyne, CEO of Goldman Sachs before becoming Senator for the State of New Jersey and then taking charge of MF Global[8], illustrate the extremely close links between the New York financial sector, politics and the Federal Reserve.

A difference in morality also separates the world of finance from that of government. During the United States Congress investigation into questionable practices in the banking sector during the Subprime crisis, several senior Goldman Sachs executives were questioned by congress, including the CEO Lloyd Blankfein, about CMO Abacus[9]. Senator John Tester concluded: "*it's like we're speaking a different language here*", thus highlighting a fundamental difference. Congress accuses Goldman Sachs of acting immorally, whilst Blankfein holds that Goldman Sachs operations are amoral, in other words are outside the sphere of morality.

Yet the power of Friedman's economic theory does not lie only in its political message[10], which was challenged early on by Samuelson[11], but also on its claims to the kind of scientific objectivity that is exclusive to physical sciences and mathematics. Friedman brought with him the idea that hypotheses must be formulated as required, in order to obtain a clear result. From this perspective, hypotheses are just a means to an end. The concern for the truthfulness of the hypotheses should no longer be an obstacle to the elaboration of a grand theory. In a tribute to Ross, Dybvig quotes him on this subject as saying: "*We make strong assumptions in order to get strong results*[12]." The clarity of the result in turn reinforces the clarity of the message, political or otherwise.

At this stage, it is important to distinguish between assumptions, axioms and hypotheses. The Oxford English Dictionary defines an assumption as "*a thing that is accepted as true or as certain to happen,*

6 Friedman, among others, argued in favour of insider dealing. For Friedman, prosecutions for insider dealing prevent the free circulation of information and are thus an obstacle to effective efficient markets.

7 http://www.ft.com/intl/cms/s/0/905aeb88-dc50-11e0-8654-0144feabdc0.html#axzz1cOeI2X9Y

8 MF Global filed for bankruptcy on 31 October 2011 and is also the subject of an investigation into the use of its clients' assets for its own operations.

9 See http://news.bbc.co.uk/2/hi/business/8645945.stm

10 Originally, economic theory was a branch of political science, itself a branch of philosophy.

11 MacKenzie

12 Plenary Presentation, Fifth World Congress of the Bachelier Society, London, 2008.

without proof." An axiom is "*a statement or proposition which is regarded as being established, accepted, or self-evidently true*" and in mathematics it is a "*statement or proposition on which an abstractly defined structure is based*." On the other hand, a hypothesis is "*a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation*" in logic and a "*proposition made as a basis for reasoning, without any assumption of its truth*" in philosophy. Friedman's orthodox economic theory blurs these distinctions, as demonstrated by Roll's "elementary principles". By concentrating on the result rather than on the verisimilitude of the assumptions, orthodox economic theory drifts towards a position where the end justifies the means. The end result of this approach may be a theory that may no longer achieves an understanding of how the economy performs its role, but derives results that justify a few basic hypotheses in order to frame them as axioms.

Where then do we situate financial risk management in relation to orthodox economic theory? In a world that satisfies the hypotheses of Modigliani and Miller or those of Sharpe's CAPM, there is no benefit in risk management since investors can always diversify away idiosyncratic risk and develop their portfolio to include the elements of risk and expected returns they require. Financial risk management is important only because the real world is different from the ideal world of orthodox theory. This is the first paradox of financial risk management: it is based on a theory with strict premises and assumptions, but a prey to the vicissitudes of the real world that constantly defies these hypotheses and premises. In financial theory, the aim of financial risk management is to manage the disconnection between the ideal and reality so as to create value for the owners and shareholders of the company. Here then is a second paradox in risk management which, according to economic theory, should create a safer "overall" economic environment but which uses the efforts of each company's leaders considered individually to create value for the owners and shareholders of this individual company. At the level of a specific individual company, the principal-agent problem comes into play, and this takes us even further from orthodox theory.

In Economics, when we accept dogma and implement uniform instruments in line with it, this can, instead of reinforcing a system, undermine it. This happens when the adoption of an orthodox theory leads to a radical weakening of the financial system. For example, Daníelson & Al. (2001) warned early on against procyclical banking regulations and the adoption of Value at Risk as the central measure of financial risk. The greatest danger, however, is not procyclicality, which is a temporary factor, but systemic risk developing within the huge network of interbank connections, directly influencing the economy and beyond it, society as a whole.

1.3 Systemic risk requires de-compartmentalisation to achieve a social perspective

The development of tools for financial risk management has occurred in parallel with a rapid increase in more and more complex financial instruments and at the same time a profound transformation of the regulatory framework. Investment banks, traditionally private companies managed by their partners, have become public limited companies: this was the case for Bear Stearn in 1985, Morgan Stanley in 1986, Lehman Brothers[13] in 1994 and Goldman Sachs in 1999. This first development is significant because it made it possible for merchant banks to increase in size more rapidly by obtaining outside equity, but also to separate the responsibility for risks, taken by senior executives, from their eventual negative consequences, which mainly impact investors. Senior management is now very well paid by the shareholders for their expertise in financial risk management, and these rewards are no longer related solely to profits[14]. Here again we are faced with the principal-agent problem: in industries with complex products, the salaried executives can exploit their privileged information to negotiate better advantages from their shareholders, which would not be possible for partners to do as they are themselves the owners. In 1999, the Gramm-Leach-Bliley Act cancelled the provisions of the Glass-Steagall Banking Act of 1933 which had imposed a strict separation between commercial and investment banks. In September 2008, the last two investment banks, Goldman Sachs and Morgan Stanley, changed their status to become "bank holding corporations", in other words full banking institutions. This event put the finishing touches to the dismantling of the Glass-Steagall Banking Act. The sale of Bear Stearns to JP Morgan and that of Merrill

13 Lehman Brothers had been acquired by American Express in 1984 before going public in 1994.

14 For example, in 2010, Goldman Sachs put aside $15.3bn, or 39% of its annual profits of $39.1bn, for bonuses and salaries. This was a reduction of 5% compared with 2009, but at a time when profits fell by 13%.

Lynch to Bank of America in the spring of 2008, confirmed that the age of the "too big to fail", which had begun some ten years earlier with the merger of JP Morgan and Chase Manhattan Bank and the creation of Citigroup, was well underway.

The 2008 financial crisis, whose origins are explained on several levels by Lewis (2010), Sorkin (2009), Reihnart & Rogoff (2009) and Mihm & Roubini (2010), also highlighted the importance of systemic risk and brought credit sovereign risk and liquidity risk to the forefront of concern. At a fundamental level, the crisis has reminded risk managers that there can be no analysis without synthesis. It also reminds them that financial risk cannot be managed at company level to maximise profits for the shareholders. Systemic risk goes well beyond the company and spreads throughout the financial sector, and beyond that throughout the economy and then society.

Rochet & Tirole (1996) give this definition of systemic risk:

> "*Systemic risk refers to the propagation of an agent's economic distress to other agents linked to that agent through financial transactions. Systemic risk is a serious concern in manufacturing, where trade credit links producers through a chain of obligations, and in the insurance industry through the institution of reinsurance*."

Before the middle of the 1990's, academic research into bank failure and the weaknesses of the banking system mainly focused on the phenomenon of bank runs, as witnessed by the article by Diamond & Dybvig (1983).

Systemic risk is a relatively recent concept: according to Dave Altyg and the Atlanta Federal Reserve Bank's economic team:[15]

> "*Systemic risk is a relatively new term that has its origin in policy discussions, not the professional economics and finance literature. A search of EconLit turned up the following: The first appearance of the term systemic risk in the title of a paper in professional economics and finance literature was in 1994. That appearance was in a review of a book written by a World Bank economist, not a journal article by an economist at a university. Given its origin in policy discussions, perhaps it is not so surprising that the term "systemic risk" often is used with no apparent precise definition in mind."*

It is supranational authorities (Financial Stability Board, International Monetary Funds, Bank of International Settlement) who produced a more recent working definition of systemic risk:

> "*The risk of disruption to the flow of financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy*[16]."

A comparison of the definition of Rochet & Tirole (1996) and that of the authorities reveals that systemic risk is a much wider field than financial risk in its traditional sense. Systemic risk is the risk of a propagation of distress, whatever the cause of this distress (adverse market movements, speculation, fraud) or the mechanism by which the distress is propagated (serial default, loss of confidence leading to a collapse of liquidity). The key difference between the two definitions is that the authorities stress the transfer of systemic risk from the financial system to the real economy. This change was doubtless caused by the painful lessons of the financial crisis.

A scholarly literature already existed before the crisis. The most important articles in this field are those of Rochet & Tirole (1996) and of Allen & Gale (1998). For modelling purposes, the tool currently favoured by economists and mathematicians is Network Theory: the interbank exchange system is seen as a directed network, where each node is an institution and each link represents a financial flow. The

15 Source: http://macroblog.typepad.com/macroblog/2009/11/what-is-systemic-risk-anyway.html
16 "Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations", Section II.7 Oct. 2009
(http://www.financialstabilityboard.org/publications/r_091107c.pdf)

seminal article is that of Eisenberg & Noe (2001). The theme of contagion was also explored by Davis & Lo (2001). More recently, Lehar (2005) as well as the Bank of England's researchers, encouraged by Nier & Al. (2008), have attempted to develop this approach. In particular, Nier & Al. base their model on an approach that is more oriented towards economic theory before developing a uniform hypothesis and simulations to analyse systemic risk. Cont, Moussa, Minca & Bastos (2009) and Cont (2010) consider the impact of Credit Default Swaps (CDS) on regulation systems modelled using networks. The approach based on Network Theory has had a strong influence on central banks and economists. However, the research work that it has led to focuses on systemic transfer within the financial system. The mechanisms of transfer to the real economy are either absent or are seen as an ultimate "sink node" of the graph or network. The working definition of systemic risk in academic research is thus even narrower than that proposed by Rochet & Tirole.

2. A Multidisciplinary analysis of risk in finance

2.1 A new kind of systemic risk in 2008

> "*The current crisis started with a burst housing bubble, which led to widespread mortgage defaults, and hence to large losses at many financial institutions. That initial shock was compounded by secondary effects, as lack of capital forced banks to pull back, leading to further declines in the prices of assets, leading to more losses, and so on - a vicious circle of "de-leveraging." Pervasive loss of trust in banks, including on the part of other banks, reinforced the vicious circle [...] We have a globalized financial system in which a crisis that began with a bubble in Florida condos and California McMansions has caused monetary catastrophe in Iceland*" (Krugman 2008).

We can use the notion of chaos developed by Poincaré to analyse how the subprime crisis, became a global crisis: was it not a butterfly flapping its wings in Brazil that caused a hurricane in Texas, an example of the butterfly effect made famous by Lorenz (1963)? The meteorologist uses the butterfly effect as a metaphor to explain the sensitive dependence on initial conditions developed by Poincaré (1908) who himself states that *"a tiny cause, that we are unaware of results in a considerable effect that we cannot fail to see, and so we say that this effect is a result of chance [...] It can happen that small differences in the initial conditions engender huge differences in the end results; a small error in the former would produce an enormous error in the latter."* The financial system is a complex one; the actors and markets are openly interdependent (Landau 2008); it demonstrated this complexity through nonlinearities (coupled with considerable financial leverage) and well-established discontinuities when interbank markets dried up in 2008 after the bankruptcy of Lehman Brothers and in 2011 during the Eurozone crisis. The characteristics of complex systems – nonlinearity, discontinuity, dependence of trajectory and dependence on initial conditions – apply to the financial system and show that it has become unpredictable and uncertain; the crisis is a crisis of models: "*most models have been built on the assumption that stable and predictable probability distributions could be used to describe the different states of the financial system and of the economy."* (Landau 2009). According to Galavielle (2003), *over and above the information shocks that were Brownian movements, the variety of financial products itself causes sensitivity to initial conditions. [...]This variety, regulated, but continually fed by the imagination of the actors, is also a cause of determinist chaos as it authorises reciprocal interactions between the different types of products: shares, bonds, derivatives etc."*

In October 2008 the intervention of central banks and then governments prevented the subprime crisis from resulting in systemic risk on a global scale hitherto unknown. However these interventions merely transformed private debt into public debt. Today we are experiencing another systemic crisis, without doubt greater than in 2008. Since the Greek crisis became apparent at the beginning of 2010, the last bastion has begun to fall. Governments managed to bail out the banking system by injecting enormous sums of money into the economy. But in the future, who will finance the public debts of countries in the West? And yet this whole crisis was just a counterparty crisis that originated in the United States: avarice has triumphed over prudence and is pushing the world into freefall[17] (Stiglitz 2010). The behaviour of some financiers did recall Lorenz's butterfly effect mentioned above, and this revealed the change of initial condition that Poincaré speaks of: the instrument that spread the crisis was securitization. But this

17 Freefall - America, Free Markets, and the Sinking of the World Economy – Stiglitz 2010.

technique was transformed to such an extent that we can liken the transformations of securitization to Latour's "technical folding" (2010): "*Technology is always 'fold upon fold', implication, complication, explanation. Technical folding will be evident every time we can demonstrate this second level transcendence which interrupts, twists or diverts other kinds of existence by cleverly introducing a different material or resistance, whatever type of material it is."* This concept is quite distinct from the famous domino effect, where the same effect is caused on similar interdependent elements: domino no. 37 is the same as domino no. 184 in the series. This mechanistic vision is reassuring but deceptive. It is in the nature of a system to be the result of interactions between diverse subsystems in environments that are themselves changing, since they are impacted by the variations produced by everything in the environment.

2.2 Securitization: the archetype of financial engineering

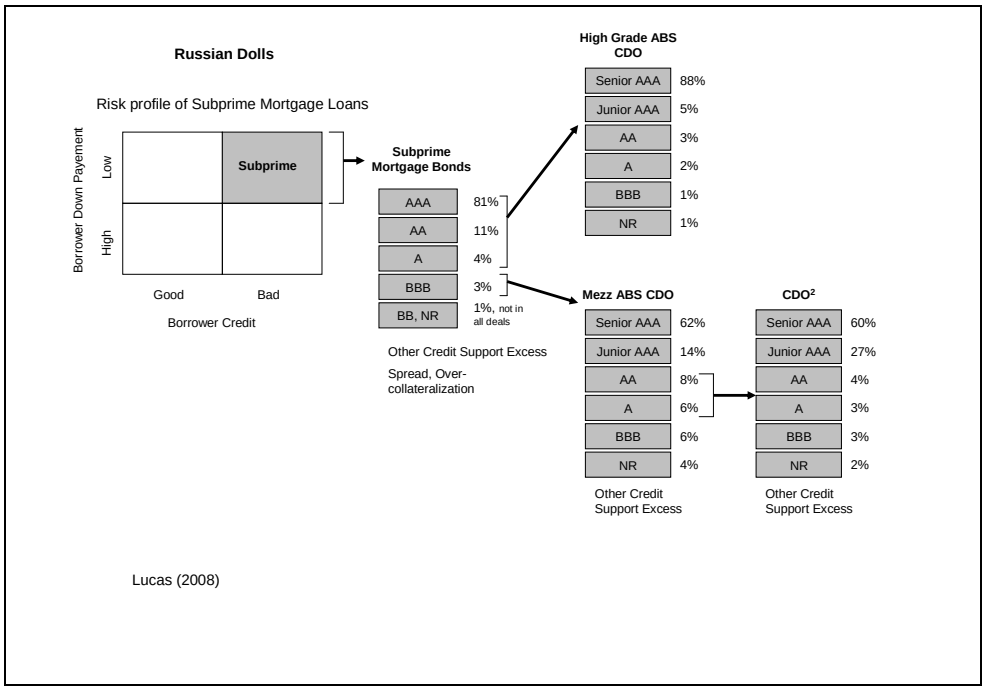
Synthetic securitization is without doubt the archetype of financial engineering. Primary securitization was initially used for very commendable purposes. The aim was to improve bank balance sheets and to fulfil the need for finance in economies facing limited bank capital, not to get round international regulation. However, in the name of the development of financial engineering, it became more and more complex and was diverted from its original purpose. Everything that could be converted into financial terms was now securitized: property loans, car purchase loans, credit card debt[18]. "The American Dream" was securitized (Walter & Pracontal 2009), but it was only gold-plated (Roubini & Mihm 2010) and the financial system was increasingly weakened[19]. The complexity of financial engineering is only equalled by the products it has engendered. After primary securitization came secondary and tertiary securitization. We now have CDO (Collateralised Debt Obligation), CDO^2 and CDS (Credit Default Swaps).

Lucas (2008) presents the structure of the various products as below and calls it "Russian Dolls".

18 "The first significant bank credit card sale came to market in 1986 with a private placement of $50 million of bank card outstandings. This transaction demonstrated to investors that, if the yields were high enough, loan pools could support asset sales with higher expected losses and administrative costs than was true within the mortgage market. Sales of this type — with no contractual obligation by the seller to provide recourse — allowed banks to receive sales treatment for accounting and regulatory purposes (easing balance sheet and capital constraints), while at the same time allowing them to retain origination and servicing fees. After the success of this initial transaction, investors grew to accept credit card receivables as collateral, and banks developed structures to normalize the cash flows". (Federal Reserve Bank of Chicago 1997)

19 "Securitization, for all the virtues in diversification, has introduced new asymmetries of information; forcing originators of mortgages to bear some of the risk would mitigate some of the resulting moral hazard" (Stiglitz 2009).

Figure 1. Russian Dolls



This diagram highlights the division and subdivision of credit and shows how difficult it is in the case of default to retrace the origin of the problem.
Securitization is the instrument through which finance has totally mutated. The banking system has mutated almost genetically:

> "*starting from the simple idea of transferring risk away from the banking sector in the strictest sense, we have gone much further by splitting the risk into smaller and smaller "wisps", into "grains" [...] and by transferring it further and further away from the entity that originally granted the loan. Using in particular synthetic credit derivatives and structured products we have spread the risk further and further away from banks and towards investment or speculative funds, insurance companies, financial institutions and mutual funds"* Bourguinat (2008).

Bastisdon et Al. (2010) repositioned securitization within Kindleberger's five phases (1978) leading to a crisis: during the first phase, expansion, innovations (securitization) perform well and confidence increases; the second phase is speculative frenzy: *"financial innovations made possible the hybridization of securitization with credit derivatives such as homogeneous and then "tranched" CLOs, repackaged but so complex or sophisticated that it is impossible to identify the origin and the correlation of defaults"*; the third phase is paroxysm and reversal: "*the enthusiasm explodes into a speculative boom fed by the excesses of securitization in an increasingly opaque situation where it is impossible to trace the securitized and repackaged credit and where the credit risk is relocated away from the regulated banking system"*. In the fourth phase comes the turnaround with pessimism and general mistrust: everyone follows the crowd, leading to a generalised overestimation of the risk (and a "flight to quality"), overreaction to the reduced liquidity of securitization ("overshooting") and then a search for liquidity at any price. Finally, the last phase is the deflation of debt and the restructuring of balance sheets, in other words the system is purged and there is above all the risk of insolvency among numerous stakeholders who are in no way responsible for the situation created: the real economy and individual investors.
This is almost the situation in which we find ourselves. However, we have not yet reached the purging phase. The banking system may have been purged of toxic assets (though only partially) but today sovereign debt weighs very heavily on the banks.
The banking system has not yet been totally purged.

2.3 The re-embedding of finance within society

"*The hypothesis that there will be a systemic crisis that will shake the whole world and will open the way to what we might call in negative terms post globalisation, is not a probability, it is a certainty. The crises we are witnessing are only the early indications of a great transformation"* (Coutau-Bégarie 2008). The author takes up the title of a work by Polanyi who, back in 1944, denounced the hegemony of the market which, by trying to manage everything, would one day destroy society: "*instead of the economy being embedded within social relations, it is social relations that are embedded within the economic system."* What Polanyi called commodification, where everything becomes a tradable commodity, has now become marketization, where a market is created for every commodity, with its notions of market self-regulation and embedding.

Beck (2001) states that *"in economics, agriculture, law and politics, the consequence of having totally interdependent modernisers in extremely specialised positions is the absence of individual causes and responsibilities that can be analysed in isolation: is it agriculture that pollutes the soil or are farmers just the weakest link in the global change of damage.*" In our opinion this can also be applied to securitization: Beck speaks of "*hyper-elaborate*" tasks that make up a complicit network and that take responsibility away from the initiators of certain operations (according to the author: *"each person is simultaneously cause and effect, and so nobody can be responsible for anything"*). Was there not a loss of sense of responsibility in American banks and brokers when they granted mortgages to at-risk families? These intermediaries knew that the risk would be transferred to other entities thanks to securitization.
But the financial system is part of the economic system; it is therefore a series of mutually related units as described by Bertalanffy (1948). So systemic risk is not confined to the financial system, which is itself interdependent with the economic system.

Moreover the crisis has shown that the markets are not capable of self-regulation. Consequently, the partitioning that Polanyi denounces must be revised. "*Sooner or later risk ends up by affecting those who produce it or profit from it [...] Risk has become more and more universal. It creates a direct, threatening link between widely differing fields, both in terms of contents and in terms of time and space. It gets between the mesh of overspecialisation. It is the gap between specialisations. To defeat risk, we have to take a step back, we need to work together and go beyond all the barriers that we build up and painstakingly maintain. Risk falls outside the distinction between theory and practice; it cannot be partitioned into fields and disciplines, into specialised skills and institutional powers, into value and fact"* (Beck 2001). The crisis has induced effects that go beyond the financial sector, and certain products, as Morrison (2002) observes, are harmful to collective well-being. They make the analysis of previous banking products more difficult, and increase moral uncertainty. Beck (2001) adds: "*with the multiplication of risk, economics becomes self-referential, independent from the context of the satisfaction of human need"*. And finance is even more self-referential than economics: as Orléan (1999) stipulates, the self-referential rationale of finance leads to *"a continual mimicking of opinions, leading to group unanimity*", the market legitimises itself as it organises itself, which reminds us of Keynes' (1936) notion of "*the beauty contest*".

> "The *techno-sciences of Marketization and securitization, serving the triumph of greed, have generated and continue to generate hitherto unknown risks through the sophistication of their technical folding and their widespread use. These risks dangerously impact our structures, our everyday way of life and the survival of Man in a world of finite resources."* (Karyotis, Fimbel 2011).

3. The current situation and the end of methodological individualism. Is regeneration possible?

"*There is no such thing as society. There are individual men and women."* In her famously succinct style, Margaret Thatcher expressed the basis of methodological individualism. This is not a defence of the legitimacy of individual rights within society, but is the negation of the very concept of society as a possible reference for any form of government. Methodological individualism sees social effects as an aggregation of individual actions. Friedrich Von Hayek (1899-1992) was the seminal writer on this theory, according to which everyone must use his own knowledge and talent to promote his own priorities; Hayek expresses his key idea as follows: *"social phenomena are the result of human actions*

but not of human intentions". The individual, called the "agent", must be absolutely (and this adverb is essential for a true understanding of Hayek) free in his decisions and his actions. This is the condition for obtaining optimum economic results from these actions. The market, which is essentially virtuous since it leads to healthy competition between agents, will both legitimise and arbiter them. The only possible social (in this context interpersonal) binder is therefore economic. Anything that hinders the application and universal fulfilment of these principles must be rejected, fought against, destroyed. Hayek considered the State to be the first of these "threats". This body of values and assumptions that makes up methodological individualism is an intellectual construction which, as such, is at least highly debatable; otherwise the thesis will become a self-referential ideology, or dogma.

Apart from the crucial right to challenge and debate, the current situation highlights one of the major limits of methodological individualism: the world is a finite planet; both its natural resources and its capacity to absorb the damage caused by Man's activities are limited. The clash between these limits and the absolute freedom of each individual, whether CEO or trader, to undertake what he considers to be in his own interest comes up against the barrier of acceptable physical and societal limits. In 2010, the scale and the violence of the shock between the dogma and its effects enabled Stiglitz to observe: *"Much has been written on the insane risks the financial sector has taken, on the ravages that the financial institutions have inflicted on the economy and on the resulting budget deficits: too little has been written on the implicit "moral deficit" that has become apparent – a deficit that is even bigger than the budget deficits and more difficult to correct. Although the tireless quest for profit and the glorification of personal interest have not created the anticipated prosperity, they have contributed to the creation of a moral deficit."* We are not talking here of a moral turnaround, where what was immoral in the past has become moral today, but of a world becoming ever more amoral.

For many of the actors in the finance, the sector operates in a social vacuum. It would be unthinkable to have to justify your actions to outside stakeholders. Clam (2004) even speaks of *"the autism of financial self-reference"*. The sector even managed to transform itself from being self-referential to supra-referential, in the sense that, for example, institutions stemming from the sector assess States and governments and dictate the "virtuous" route they have to follow. Based on their self-proclaimed, unquestionable competence, despite their recent failures, the credit rating agencies are symptomatic of this supra-referentiality. Although the "financial" crisis of 2008 was caused by practices and processes developed within the financial sphere, this absence of decency reveals almost a denial of reality; indeed its persistence feeds its loss of legitimacy in society. Here lie both a warning sign and a major risk for the financial world. Instead of being economically useful, financing the development of the real economy, financial operators could be considered as a poison in society and as being incompatible with democracy.

Society and the financial sector are both aware that it is in their common interest for the mechanisms of social governance to propose regulations that will explicitly redefine and limit their freedom of action. Governance, according to Stiglitz, is the authority that defines which stakeholder's interests are to be paramount when decisions are taken and arbitration given. Methodological individualism is the negation of society and thus social responsibility, and has proved itself incompatible with the meanness of the world and the intensity of the systemic interactions that operate within it. Without voluntarily repositioning itself within society, the financial sector runs the risk of being subjected, in the very near future, to social pressure such as its technical-intellectual self-referenced weaponry cannot even imagine.

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