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Eduardo Pol
University of Wollongong, epol@uow.edu.au

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REGULATING FINANCIAL INNOVATIONS WITHOUT APOLOGY

Eduardo Pol
School of Economics

University of Wollongong
Wollongong, NSW 2522

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Eduardo Pol*
School of Economics
University of Wollongong
NSW, Australia 2522
e-mail: epol@uow.edu.au
Phone: +612 4221 4025

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Abstract

This paper views the housing and credit bubble 2001-2008 in a stylized manner, namely as a sequence starting with a financial innovation in 2001 followed by the superimposition of other financial innovations leading to the prevalence of uncertainty in Knight's sense and ending in the last quarter of 2008 with both market failure and regulation failure. This 'debt bubble sequence' is just a slice of a dynamic process of stupefying complexity involving ignorance in a fundamental way. Few analysts would deny that a financial innovation, namely the sub-prime mortgage, combined with market participants' ignorance about the size and location of the risk underlying complex financial products was a critical factor conducive to the financial meltdown 2007-2008. To the extent that financial innovation does bear the blame, the most obvious question is whether anything can be done to help reduce the degree of public's ignorance about financial innovations and to prevent destabilizing innovations from entering the market. The main claim of this paper is that society should be involved in exercising directive intelligence through an appropriate institutional arrangement over the intricacies and technicalities inherent to financial innovations. Specifically, the paper proposes a new institutional arrangement conceived with the aim of strengthening financial system reliability and breaking the 'government regulation-financial innovation' vicious circle.

Keywords: Toxic financial innovations, Knightian uncertainty, debt bubble 2001-2008, relevant regulation

JEL Classification: G14, G18, G21, G28

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1. Introduction

Uncertainty in economic life has long been recognized as a destabilizing factor. Ignorance –in the sense of lack of understanding of economic information– is generally considered as a less relevant factor in the context of economic stability. The reasons for neglecting the importance of ignorance are seldom explicit. The tacit presumption is that 'transparency' means that people have easy access to all the relevant economic information and this availability of information automatically implies an *understanding* of the possibilities and limitations of the economic issue in question. For lack of a better term, I will call this presumption *Postulate of Automatic Understanding (PAU)*.

The current global financial crisis that first struck in August 2007 suggests that the PAU is not universally valid. We live in a digital economy where our ability to trade esoteric financial products emerging from financial innovations vastly exceeds our ability to understand (and value) these financial instruments. The information about mortgages revolving around dodgy loans and on a pyramid of complicated debt products built on top of them was publicly available, but many individuals were unable (not unwilling) to understand the toxic nature of these financial assets and their explosive consequences on the real economy.

The present paper builds on an analysis of the recent past, but it is essentially about the future. The structural pillars of the argument developed in this paper are a guiding principle and a stylized version of the debt bubble 2001-2008. The guiding principle emerges from the following passage:

> Many of the greatest economic evils of our time are the fruits of risk, uncertainty, and ignorance. It is because particular individuals, fortunate in situation or in abilities, are able to take advantage of uncertainty and ignorance, and also because for the same reason big business is often a lottery, that great inequalities of wealth come about; and these same factors are also the cause of the unemployment of labour, or the disappointment of reasonable business expectations, and of the impairment of efficiency and production. Yet the cure lies outside the operations of individuals; it may even be to the interest of individuals to aggravate the disease. I believe that the cure for these things is partly to be sought in the deliberate control of the currency and of credit by a central institution, and partly in the collection and dissemination on a great scale of data relating to the business situation, including the full publicity, by law if necessary, of all business facts which is useful to know. These measures would involve society in exercising directive intelligence through some appropriate organ of action over many of the inner intricacies of private business, yet it would leave private initiative and enterprise unhindered. Even if these measures prove to be insufficient, nevertheless, they will

> furnish us with better knowledge than we have now for taking the next step.

One would be inclined to guess that the source of the preceding passage could well be the speech of one of the Group of 20 leaders who met in Washington in November 2008 to redesign the global financial system. The author is John Maynard Keynes. What is even more surprising is that the paper containing this long paragraph was first published in 1926, a few years *before* the Great Crash of October 1929.[1]

This paper views the housing and credit bubble 2001-2008 in a stylized manner, namely as a sequence starting with a financial innovation in 2001 followed by the superimposition of other financial innovations leading to the prevalence of uncertainty in Knight's sense and ending in the last quarter of 2008 with both market failure and regulation failure. This 'debt bubble sequence' is just a slice of a dynamic process of stupefying complexity involving ignorance in a fundamental way. [2]

With all probability, this global financial crisis will prompt a tide of regulation. How far should the balance between governments and markets shift? It is generally agreed that too many new regulations could backfire. What is needed is 'relevant' regulation. Some rebalancing is needed in financial regulation where financial innovation outpaced an old supervisory regime.

An agenda for financial market reform is already developing in America, Europe and Australia. For example, establishing clearing mechanisms for credit derivatives –especially, collateralized debt obligations and credit default swaps–, increased control on hedge funds and overhauling ratings agencies appear to be key global priorities. However, a change in the international regulatory regime will most likely induce profit-seeking innovators to devote their creative energies to develop new financial ideas and concepts to circumvent the new regulations.

Few analysts would deny that a financial innovation, namely the sub-prime mortgage, combined with market participants' ignorance about the size and location of the risk underlying complex financial products was a critical factor conducive to the financial meltdown 2007-2008. To the extent that financial innovation does bear the blame, the most obvious question is whether anything can be done to help reduce the degree of public's ignorance about financial innovations and to prevent destabilizing innovations from entering the market.

The main claim of this paper is that society should be involved in 'exercising directive intelligence' through an appropriate institutional arrangement over the intricacies and technicalities inherent to financial innovations. Specifically, the paper proposes a new institutional arrangement conceived with the aim of strengthening financial system reliability and breaking the 'government regulation-financial innovation' vicious circle. Even die-hard free marketeers should concede that there is a real opportunity for improving the effectiveness of the financial markets through regulatory institutions. One of the fundamental challenges for social scientists is to find these new arrangements.

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[1] The essay in question is "The End of Laissez-Faire," based on two lectures given by Keynes, one at Oxford in November 1924 and the other at the University of Berlin in June 1926. Keynes (1926).

[2] It seems premature to assert that the financial crisis is over. However, having an end point for the debt bubble sequence is useful to make the description more concrete.

To make the case for this proposal, I develop two arguments. First, I show that the issue of ignorance is assumed away in the established approaches to financial market efficiency. Second, I use the understandings won by economists who have studied financial innovation empirically to point out the existence of a peculiar innovative interaction between the government and the financial sector engendering a vicious circle.

The structure of the paper is as follows. In the next section, I indicate that the PAU is inextricably linked to the efficient markets hypothesis and the assumption of rational expectations. Section 3 consists of a very brief description of the 2001-2008 debt bubble as well as a glimpse of evidence casting doubt on the PAU in order to establish the first part of the background to my proposal. The second part is presented in Section 4 where a possible definition of 'toxic' financial innovation is introduced and the vicious circle nature of the innovative interaction between governments and financial markets is brought into sharp focus. Section 5 highlights the need for relevant regulation of financial markets in the light of the recent regulation failure. In Section 6, I outline a specific policy proposal to keep pace with financial innovations and strike a balance between financial innovation and economic stability. The paper concludes with a summary and some remarks.

2. The Postulate of Automatic Understanding (PAU)

The assertion that information availability *guarantees* understanding is counterintuitive. A substantial proportion of individuals do not seem to have either the resolving power or the time necessary for interpreting the meaning of the vast amount of economic data available to them. For example, if one wants to find information about the financial instrument introduced by Merrill Lynch in 1985 known as LYON (Liquid Yield Option Note) a good starting point is McConnell and Schwartz (1992). In this article we can find that the LYON innovation is a complex security consisting of the combination of four ideas: it is a zero coupon, convertible, callable, and puttable bond. Abundant additional information can be found in Google. Processing and understanding the existing information about LYON is not impossibly difficult but it is both intellectually demanding and time consuming.[3] Thus, an automatic grasping of the possibilities and limitations of this financial instrument does not necessarily follow from the availability of information. Some individuals would probably base their decision to use LYON on the broad name recognition of the issuer, not on their precise understanding of the product.

We do not have to dig deep to find additional examples showing that the presumption 'transparency implies understanding' is not true in general. In the field of financial innovations, we can easily name exotic instruments that are well-known for financial engineers but difficult to understand for the layperson: butterfly spreads, collateralized-mortgage bonds, portfolio insurance and synthetic cash are a few.

Furthermore, the tacit presumption 'information availability implies understanding' appears to overlook evidence emerging from information processing psychology and cognitive load research pioneered by the 1978 Nobel Prize winner Herbert Simon (1979, p. 507). A topic –any topic, economic or other– is difficult to

[3] Understanding LYON requires at least a working knowledge of elementary finance theory.

understand if it involves high element activity. For example, understanding practical economic issues may be difficult for many individuals because the learner has to process large amount of interactive elements (empirical data, principles of economics, conceptual frameworks, and so on). In some areas such as finance, where knowledge is cumulative, lack of automation of prior concepts may prevent understanding of subsequent concepts. To complicate things even further, individuals may have understood a new concept such as 'credit default swap' despite being unable to use it in a new context such as 'collateralized debt obligations.'[4]

It is true that the Internet has made it possible for virtually anyone to collect vast amounts of information. But it is true, too, that the data are spread around in many places. Sometimes one has to wander from site to site as if you were solving a jigsaw puzzle. In addition, multiple sources of information split attention and tend to retard the process of understanding.

A reliable inference from the foregoing is as follows: the existence of information is necessary but not sufficient to eliminate the ignorance factor, and therefore, the use of the tacit presumption or Postulate of Automatic Understanding (PAU) requires caution.

The PAU has its roots in the theory of efficient markets.[5] An efficient market is one in which all the available information is quickly understood by the economic agents and immediately incorporated into the market prices. Efficient prices are equilibrium prices subject to the information available when prices are established. This suggests that efficient markets and rational expectations are related to each other. Indeed, the assumption of rational expectations asserts that individuals take into account all the information available to them and they do not make systematic errors. For this assumption to be operative, it is necessary that individuals quickly understand the information available. Consequently, the efficient market hypothesis and the assumption of rational expectations share the PAU.

Beyond any doubt, the efficient market hypothesis and the assumption of rational expectations constitute enduring contributions to our stock of economic knowledge. They work exceedingly well when uncertainty about the future can be treated as risk, that is, in terms of a well and correctly specified probability distribution of possible future events.[6]

Regrettably, in a world plagued with uncertainty in the strict sense the applicability of these approaches vanishes. This point was recognized more than forty years ago by Robert E. Lucas, the intellectual leader of the rational expectations approach to macroeconomics and 1995 Nobel Prize winner. Lucas emphasized that

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[4] For a rigorous explanation of cognitive load theory see Sweller (1999).

[5] As Shiller (1978, p. 6) explained, the statistical theory of martingales was applied to economics by Paul A. Samuelson and Benot Mandelbrot, and this in turn, led to the efficient market approach about the behaviour of security prices.

[6] The terms 'risk' and 'uncertainty' are used throughout this paper in the Knight's sense. Frank Knight (1921, esp. pp. 19-20) made the distinction between two types of randomness: *risk* (calculable probability) and *uncertainty* (incalculable probability, in that it is 'unmeasurable'). The expressions 'Knight's uncertainty' and 'uncertainty in the strict sense' will be used interchangeably.

the rational expectations approach, which identifies subjective and true probabilities, is not applicable in situations of uncertainty in the strict sense. Specifically, Lucas suggested that his approach will most

> likely be useful in situations in which the probabilities of interest concern a fairly well recurrent event, situations of "risk" in Knight's terminology. In situations of risk, the hypothesis of rational behaviour on the part of agents will have usable content, so that behaviour may be explainable in terms of economic theory. In such situations, expectations are rational in Muth's sense. In cases of uncertainty, economic reasoning will be of no value.
> Lucas (1977, p. 15)

It is worth noting that bubbles are ruled out by the existence of rational expectations.[7] Therefore, the process conducive to the October 2008 bursting of the debt bubble must entail some sort of non-rational expectations. Surely that was a failure to understand all available information and surely that was the perpetration of systematic errors due to ignorance.

3. Validity of the PAU during the Debt Bubble

We are still in the middle of a global financial crisis that became acute in August 2007 when the money market interest rates rose drastically. What caused the financial crisis? There is no simple answer to this question. However, the argument I present in this paper suggests that any answer should involve a web of financial innovations conducive to pervasive uncertainty in Knight's sense. This is not to deny that the debt bubble had several concurrent causes including loose monetary policy (the US Federal Reserve kept interest rates too low for too long), the misconceived belief that rapid appreciation of homes and equities is a universal law of the global economy, and poor supervision. There were also other factors such as greed and big executive bonuses, but in hindsight they appear to be at a lesser level of importance.

Modern finance in combination with the Internet succeeded in creating an extraordinary complex dynamics revolving around sub-prime mortgages, securitization and other financial innovations. This dynamics generated a debt bubble that burst in the last quarter of 2008.

For analytical purposes, the debt bubble can be seen as a sequence starting in 2001 and culminating in 2008 with the collapse of the global financial system. In rough outline, there are four major components or terms of this sequence that can be described as follows. First, the US banks and non-bank lenders provided home loans to people who could not possibly pay them back. Second, these mortgages were all packed up and Wall Street sold them to different investors creating an immense amount of financial products. Third, neither the shareholders nor the top executives of investment banks had a clear understanding of what the risk takers were doing. There was no guarantee that yesterday's odds would be the same tomorrow. All in all, the

[7] Under rational expectations bubbles simply cannot occur. For the rigorous proof of this proposition, see Tirole (1982). He shows that in a fully dynamic rational expectations equilibrium, price bubbles do not exist.

economic agents traded financial products plagued with uncertainty in the strict sense, not risk. Fourth, after the realization that highly leveraged financial institutions were holding a substantial proportion of securitized American sub-prime mortgages the effectiveness of the financial sector was reduced dramatically and the world faced a major financial disruption: the interaction between global financial intermediaries and the real economy largely ceased, and the stock markets around the world crashed in October 2008.[8]

An obvious lesson emerging from this sequence of events is that financial institutions that work well in normal times may become counterproductive when toxic innovations are introduced in the financial system. But there is a less obvious message underlying the evolution of the debt bubble that can be deciphered as follows.

It is generally agreed that during the period 2001-2008 financial information was abundant. One basic question immediately suggests itself. If the relevant information was publicly available, why the market participants could not see the catastrophic end coming? There is a glimpse of evidence suggesting that many economic agents were unable (not unwilling) to understand the available financial information due to the technicalities involved in the chain of complex financial products.

It is no exaggeration to say that individuals are not superior financial engineers. The financial information was veiled in technical nomenclature (for example, 'mortgage-backed securities,' 'auction-rate securities' and 'three-month LIBOR/Overnight Swap spread') and acronyms (such as ARMs, Alt-A, MBSs, OIS spread, CDOs, CDSs, and SIVs) difficult to understand or decipher at first glance. This compelling point is forcibly made by Paul Kedrosky:

> There is an entire language required to understand this new generation of financial technologies, from credit default swaps to collateralized debt obligations to residential mortgage-backed securities, not to mention the corresponding three - and four-letter abbreviations. There's also data on current account deficits and yield spreads. Most people, faced with this tsunami of data, do only the rational thing: they give up.
> Kedrosky (2008, p. 21)

Apparently, the financial jargon was also unintelligible for some senior bank executives. For example, there is evidence suggesting that in addition to the Citigroup's deficient risk-management models, its top executives did not understand the relevant information available to them. According to Citigroup insiders, Charles Prince –former Citigroup chief executive– did not have a working knowledge of the CDOs:

> A former Citigroup executive said of the bank's big CDO push: "Chuck Prince going down to the corporate investment bank in late 2002 was the start of that process. Chuck was totally new

[8] More details on the debt bubble sequence can be found in the appendix to the present paper.

> to the job. He didn't know a CDO from a grocery list, so he looked for someone for advice and support. That person was Rubin. And Rubin had always been an advocate of being more aggressive in the capital markets. He would say, 'you have to take more risk if you want to earn more.'"
> Dash and Creswell (2008)

Moreover, Samuelson (2008) reports "after leaving government, Rubin landed at Citigroup as 'senior counsellor.' He failed to identify toxic mortgage securities as a big problem in the bank's own portfolio." These stories call into question the validity of the PAU during the debt bubble 2001-2008.

4. Financial Innovations and Regulatory Dialectics

Before going into the specific issue of this section –how government and financial innovators interact– a brief terminological digression is in order. The importance of finance and financial innovation is widely recognized. The essential function of finance is to channel funds from savers to individuals and firms with productive opportunities. Finance is a facilitator of most (if not all) production activities as well as of a significant proportion of consumption activities. As a result, innovations in the financial sector tend to have ramifications throughout the economy.

Any new idea applicable to the essential function of finance is termed a *financial innovation*. Examples of financial innovations abound: credit cards, automatic teller machines (ATMs), de novo Internet banks are a few. Financial innovation may be either product innovation, such as collateralized mortgages, or process innovation, such as telephone banking, or organizational innovation, e.g. research and development financing organizations (RDFOs).

In the business innovation literature it is customary to refer to either product innovation or process innovation as 'technological innovation' irrespective of the nature of the product or process. Viewed in this context, any product/process financial innovation is always a technological innovation but the converse is not necessarily true. For example, a new design for a car constitutes a technological innovation but it is clearly not a financial innovation.

If necessary, one could introduce the idea of 'manufacturing innovation' as follows. The set of all technological innovations, denoted by TI, includes the set of all product/process financial innovations, denoted by FI, as a proper set. It may be convenient to call the difference between TI and FI, the set of *manufacturing innovations* MI. With this convention, it follows at once: $TI = FI \cup MI$. Note, however, that $FI \cap MI$ is not empty as illustrated by the introduction of the ATMs many years ago which is both a financial innovation and a manufacturing innovation.

The distinguishing features commonly associated with the elements in FI are generally distinct from those in MI so that it may be methodologically improper to mix the two sets indiscriminately. This point is explicitly made by Josh Lerner (2005, p. 224) where he suggests "the need to examine financial innovation as a phenomenon in its own right."

Two aspects associated with the notion of financial innovation, namely economic benefits and asymmetric information, should be emphasized. First, not all the elements belonging to FI are economically desirable. This important point has recently been made by Mason (2008). He distinguishes 'real' from 'nominal' financial innovations. A financial innovation that provides economically valuable benefits constitutes a *real* financial innovation. *Nominal* financial innovations are financial instruments that increase compensation without providing lasting economic benefits.[9] Second, the empirical evidence supports the view that "Financial innovations inexorably create conditions of asymmetric information that can lead to financial crises and panics." Mason (2008, p. 8).

The foregoing suggests a possible definition of 'toxic" (or economically malignant) financial innovation that may be useful for analytical purposes. A *toxic* financial innovation is a nominal innovation which singly or jointly with other financial innovations provokes a financial crisis. The existence of toxic financial innovations presupposes not only loose monetary policy but also poor supervision. It is generally agreed that the sub-prime mortgage innovation in combination with securitization and CDOs led to the financial crisis 2007-2008, and therefore, the sub-prime mortgage is an example of toxic financial innovation.

What are the economic/environmental conditions that increase the number of elements in the set FI? It has long been recognized that regulatory and tax changes are inextricably linked to the production of financial innovations.[10] Financial innovation is regarded as a by-product of regulation because financial engineers try to circumvent regulatory constraints by introducing new elements in the set FI. For example, Van Horne (1985, esp. pp. 622-623) included within the group of key factors prompting financial innovations regulatory and tax changes. A similar point is emphatically made by Nobel Prize winner Merton H. Miller:[11]

> What process stimulated the new and energized the dormant innovations in finance over the past twenty years? I wish I could say that it was the flood of MBAs out of our business schools over this period. That was essentially part of the story, but not the decisive part. The major impulses to successful financial innovations over the past twenty years have come, I am saddened to have to say, from regulations and taxes. (…)
> (…) The government is virtually subsidizing the process of financial innovation just as it subsidizes the development of new seeds and fertilizers, but with the important difference that in financial innovation the government's contribution is typically inadvertent. There are cases,

[9] This is a slightly modified version of the original definition formulated by Mason (2008, p. 11): "Nominal innovations are vehicles that primarily increase Wall Street compensation with few real benefits."

[10] This is not to deny that regulations and taxes may induce innovative activity in the manufacturing sector as well. For example, in the approach to climate change known as 'emissions trading scheme' the ultimate government's purpose is to encourage manufacturing innovation. The point here is that financial innovation is *unintendedly* encouraged by the government.

[11] Miller received the 1990 Nobel Prize in economics jointly with Harry M. Markowitz and William F. Sharpe for their pioneer work in the theory of financial economics.

> particularly in the politically sensitive housing area, where the U.S. government has been the major pioneer of new financial instruments. For the most part, however, the role of government in producing the pearls of financial innovation over the past twenty years has been essentially that of the grain of sand in the oyster.
> M.H. Miller (1986, pp. 460-461).

Time after time financial innovators have found ways to work around regulation. For instance, the auction-rate security innovation introduced in the 1980s is virtually equivalent to a bank loan, but they are not regulated like banks. All in all, the transition from traditional banking (banks make loans and hold them on their books) to modern banking revolving around securitization (banks pool and sell repackaged assets from mortgages to student loans) may be regarded as the unintended outcome of the creation of financial innovation induced by government action.

Regulations designed to maintain financial stability (such as rules on banks' capital adequacy) abound. However, financial crises happen. Minsky (1977) and Kindleberger (1978) have argued for the inherent instability of the financial system, but in doing so have had to assume irrational behaviour. None of these authors have emphasized that the interaction between regulators and financial innovators may in fact be responsible for financial instability.

The notion of 'regulatory dialectic' goes back to the classic work of Edward J. Kane (1977) some thirty years ago. Regulation of the financial system is seen as an endless game of back and forth. Financial innovators short-circuit regulator intentions by finding and exploiting loopholes. Regulators find themselves trying to catch up with their regulatees because innovators enjoy 'first-mover advantage.' In fact, regulators are at a disadvantage because they become aware of the existence of the new financial instruments *after* the commercialization of the new ideas has taken place.

Or, to put it differently, the efforts of regulators to avoid financial excesses are superseded or nullified by profit-seeking innovators designing new financial products to overcome the constraints imposed by the government, and thereby, a 'Sisyphus Stone process' takes place. [12] New regulations emerge and generate incentives to innovate in order to maximize profits by finding novel mechanisms to circumvent the constraints (for example, the pooled asset-backed securities got around financial regulations such as rules on banks' capital adequacy). Within the new financial instruments created to overcome government regulations there are toxic innovations conducive –after a number of years and in combination with other factors– to a financial crisis. This, in turn, provokes a new wave of regulation.

Formalizing the (evolutionary) game first described by Kane (1977) does not appear to be an easy task. The mathematical formalization would involve a complex dynamics allowing both the convergence to some equilibrium in the absence of toxic

[12] Sisyphus was a legendary king of Corinth whose wickedness in life was punished in the lower world where he had to roll a huge rock up a hill which as soon as it had reached the top rolled down again.

financial innovations as well as dynamic discontinuities reflecting the bursting of financial bubbles. To the best of my knowledge, evolutionary game theory has not yet provided a model able to capture this esoteric dynamics originated by financial innovations. Catastrophe theory may provide one of the building blocks because this mathematical formalism involves a fast dynamics allowing either convergence to equilibrium or dynamic discontinuities (termed 'catastrophes') depending on the path followed by the system.[13]

5. Regulation Failure

Although it is not my purpose to explain how the current financial crisis resembles the one that happened in the period 1930-1933 (or how it does not), there are important elements in common that can be mentioned to put the proposal of this paper in perspective. Given this historical background, attention will be turned to the central issue of the paper.

The similarities between these financial crises include, but are not limited to, the introduction of critical business innovations, the brief recessions of 1920-1921 and 2000-2001, and the stock market crashes of October 1929 and October 2008. More specifically, two technological innovations (the automobile and the Internet) and two financial innovations (the investment trust and the sub-prime mortgage) provided important stimulus to investment and growth in the corresponding periods.

The *investment trust* was a company whose purpose was to speculate in other companies' shares using leverage to magnify returns.[14] The holding company with investment in and control of an operating company or another holding company was another important innovation. However, the line between an investment trust and a holding company was often a shadowy one.

It would not be difficult to find more commonalities, e.g. credit squeezes, a boom in real estate and the spread of speculative behaviour in widening circles, but for the purposes of this paper one additional and important analogy is as follows: before the above mentioned stock market crashes there was little support for *new* regulation of financial markets.

Two striking differences between the financial crises in question can be found in the chronological order of the stock market crashes and in the regulatory environments. While the stock market crash of 1929 preceded the financial crisis 1930-1933, the stock market crash of 2008 *followed* the financial crisis that first struck in 2007. As to the regulatory environments, the following points can be made. There was a regulatory void before and during the period 1930-1933. In contrast, regulations concerning the financial system were abundant during the period 2000-2008.[15]

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[13] Pol (1993) contains an evaluation of catastrophe theory from the economic viewpoint.

[14] The world's first investment trust was the Foreign & Colonial Investment Trust established in 1868. Investment trusts, were sarcastically described as 'new engines of financial progress' by John Kenneth Galbraith (1979, p. 52).

[15] It is true that the Bill Clinton administration helped loosen Depression-era banking regulations by, for example, allowing banks to expand beyond their conventional role as lenders and relaxing oversight

A tide of regulation came during the Great Depression of the 1930s.[16] Before March 1933 the US financial system was assumed to be self-regulating. The President Roosevelt's "bank holiday' marked the beginning of an extensive government intervention in all aspects of the financial structure. According to Ben Bernanke, March 1933 was a "watershed month" because it was the starting point of both economic recovery and substantial government intervention. Furthermore, he states

> It might be argued that the federally directed financial rehabilitation –which took strong measures against the problems of both creditors and debtors– was the only major New Deal program that successfully promoted economic recovery. In any case, the large government intervention is prima facie evidence that by this time the public had lost confidence in the *self-correcting* powers of the financial structure.
> Bernanke (1983, p.272) [*Italics added*]

The Great Depression that followed the stock market crash of October 1929 is the event that shaped many regulatory institutions in the US economy, including the Securities and Exchange Commission (SEC).[17] During the peak of the Great Depression the US Congress passed the Securities Act of 1933. This law, together with the Securities Exchange Act of 1934 (which created SEC) was designed to promote market stability and to protect investors. Nowadays, the SEC's functional responsibilities are organized into four Divisions and 19 Offices. The Division of Trading and Markets is responsible for "maintaining fair, orderly, and efficient markets."

One of the distinguishing features of the financial crisis 2007-2008 was regulation failure, not lack of regulation. The failure emerged from the inability of financial market regulations and supervisory systems in some developed countries to stop excessive risk taking and faulty management practices. For example, the failure of SEC can be easily verified by looking at the US Securities and Exchange Commission home page (What do we Do?)[18], where one can find the mission of the Office of Risk Assessment (ORA):

> The Office of Risk Assessment helps the SEC anticipate, identify, and manage risks, focusing on early identification of new or resurgent form of fraud and illegal or questionable activities. ORA focuses on risk issues across the corporate and financial sector, including issues relevant to corporate disclosure, market operation, sales practices, new product

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of esoteric financial products. But it is true, also, that the amount of regulations addressing the formal as opposed to the shadow, banking system was still substantial over 2001-2008.

[16] Economic historians emphasize that the Great Depression of the 1930s and the stock market crash of October 1929 are related to each other, but they are distinguishable phenomena. In fact, the US economy started tuning down before the stock market crash. Gordon (1974, Ch 2, esp. p. 45). In the formal economics literature, Bernanke (1983) provides the best explanation of the protracted depression of the 1930s extant.

[17] President Franklin Delano Roosevelt appointed Joseph P. Kennedy –President John F. Kennedy's father– to serve as First Chairman of the SEC.

[18] Search done on Google, 11 December, 2008

> innovation, and other activities of financial markets participants. ORA analyses information from a variety of sources, such as external experts, domestic and foreign agencies, industry and financial services, empirical data and other market data. The Office develops and maintains the overall process for risk assessment throughout the SEC and serves as a resource for divisions and other offices in their risk assessment efforts, working closely with them as they work to identify, prioritize and mitigate risks.

Wall Street's worst year in decades culminated with another regulation failure: the Madoff Affair. Christopher Cox, the SEC's chairman, recognized that SEC overlooked Mr Madoff financial innovation consisting of a pyramid strategy in which existing investors' returns were topped up with money from new investors. This Ponzi scheme fraud could be on the order of $US50 billion.[19]

In November 2008, the existence of regulation failure was explicitly recognized by the Group of Twenty (G-20):[20] "Policy-makers, regulators and supervisors, in some advanced countries, did not adequately appreciate and address the risks building up in financial markets, keep pace with financial innovation, or take into account the systemic ramifications of domestic regulatory actions."

What this crisis has highlighted is not the need for more regulation per se, but the need for more *relevant* regulation, that is, regulation conducive to more efficient global financial markets without stifling economic activity, in general, and financial innovation, in particular.

The institutional innovation presented in the next section is designed to "keep pace with financial innovation" and is premised on three ideas. First, even if the public had an enabling description of a financial innovation, automatic understanding of the new idea would not be guaranteed. Second, an independent evaluation of both direct and collateral effects of financial innovations would be extremely useful to avoid the disruptive impact of toxic financial instruments. Finally, to break the Stone of Sisyphus process, it is necessary to evaluate ex-ante (before commercialization) the consistency of the proposed financial innovation with the current regulatory system.

6. An Institutional Innovation

Bell and Quiggin (2006) developed the argument that no effective policy response to asset price bubbles is possible without at least partial reversal of deregulation. In relation to the desirability of financial innovation, they pointed out the existence of two antagonistic eras. During the postwar era there was a presumption against financial innovation and in the current era of deregulation there is a presumption in favour of financial innovation. Nowadays, any financial innovation is genuinely beneficial almost by definition: "In general, no process of regulatory

[19] For more details, see : "Dumb Money and Dull Diligence" and "Con of the Century," *The Economist*, 20 December, 2008, pp. 17-18 and pp. 119-121, respectively.
[20] The G-20 grew out the 1997 Asian financial crisis. It is a forum that promotes cooperation between advanced and developing countries on global economic stability. For example, the G-20 contributes to the strengthening of the international financial architecture.

approval is required before a new financial instrument is adopted." Bell and Quiggin (2006, p. 646).

Market fundamentalists have an absurd criterion for judging whether an innovation has increased social welfare: are people willing to pay their hard-earned money for it? During 2001-2008 many people were willing to buy financial products such as sub-prime mortgages but the bursting of the financial bubble in October 2008 could hardly be considered as a social welfare-enhancing event. Foreclosures, for example, entail extremely high social costs because (a) the homeowners are forced to move (some become homeless), and thereby, their children have to switch to new schools; (b) neighbourhoods suffered because vacant homes reduce the value of nearby properties; (c) lenders are harmed because by the time that the homes are sold a substantial proportion of the value of the loan is lost; and finally, (d) local governments are negatively affected because of the reduction of property tax revenue and cuts in local public services.

One of the finest problems for economists and politician is to draw the boundaries between government and markets, to determine what the government should take upon itself to improve economic performance, and what it should leave to the market. In particular, what government controls are necessary to help markets? Interventionists believe that unfettered capitalism may not be satisfactory in many respects and therefore government should and does have a role to play in the market economy. Specifically, their view is that government decisions should focus on those enabling activities which are undertaken by no one if the government does not undertake them.[21]

Let us start by stating the obvious. An innovation is a new idea and a new idea is not necessarily socially desirable. For example, the 'cigarette' was an innovation exhibiting devastating effects worldwide. Moreover, there is a widespread inability to anticipate the future impact of innovations.[22]

In particular, the law of unanticipated consequences often finds applications in the field of innovation. A new idea may trigger changes that go far beyond the intentions of the original innovators. For example, many innovations such as biological innovations or financial innovations affect complex systems with interconnected parts, and consequently, the law of unanticipated consequences may find important applications in these areas. It goes without saying that 'unanticipated consequences' should not be identified with 'consequences that are necessarily undesirable from the standpoint of society,' that is, unforeseen effects are not always undesirable effects.

If we were omniscient, that is, if all the implications of any new idea were intuitively obvious, the law of unanticipated consequences would be irrelevant. Short of such powers, we have to recognize that in some cases the impact of creativity (be it in biology, finance or anything else) may require some sort of independent scrutiny.

[21] This view goes back to Keynes (1926, esp. p. 291).
[22] This point is forcibly made by Nathan Rosenberg (1995).

Market fundamentalism postulates that the ultimate discipline and correction for business innovations must come from the market itself irrespective of the cost incurred by society. Scrutiny is neither necessary nor desirable. The current financial crisis suggests –correctly– that this axiom may entail unjustifiable social costs. The case for regulation is simple, yet fundamental: financiers make egregious mistakes and society has to pay for them.

For society to be the winner in the 'financial innovation game,' some sort of market-friendly regulatory institution should be introduced. Or, to put it differently, a new institutional arrangement is needed to stop the Sisyphus Stone process inherent to the financial system. To show how such a process might be stopped, I describe a specific policy proposal. Whatever the final judgement is on this particular proposal, the key point will be, I hope, clear. To promote efficiency and financial stability, it is not enough to believe in the PAU. We need new institutional arrangements to guarantee that the market participants are well informed and above all protected from financially irresponsible innovations.

The role of regulatory agencies as providers of information is to help avoid a welfare cost due to misinformation. The public's interest is particularly important when very little is known about the new products or processes to be placed in the market and when the consequences for society may be catastrophic. For example, it is entirely reasonable for society to impose its evaluation of risk on the producers of potentially toxic products or the builders of nuclear plants rather than rely on the assumption that innovators, in the profit interest, will be socially responsible.

The *Financial Innovation Administration* (FIA) would be an international regulatory agency responsible for protecting and promoting long-run global financial stability, hopefully free of political meddling. The key tenet underlying the FIA is that the mere production of a financial innovation should not automatically allow the commercialization of the new financial product or process. Any financial innovator (private or public) must apply for both registration and evaluation of the new financial idea.

Certainly, a case-by-case approach has at least the virtue of generating basic empirical knowledge which will ultimately prove decisive in promoting financial stability. One of the major obstacles to the study of financial innovations has been the scarcity of data. To overcome this data void, Josh Lerner had to develop a database of financial innovations by compiling all articles in the Wall Street Journal between 1990 and 2002 related to novel financial products. See Lerner (2006, especially Appendix, pp. 249-253).

This proposal has an obvious parallel with the Food and Drug Administration (FDA) and comparable organizations operating in almost every country. In a similar way as biological innovations are subject to clinical trials before they are allowed to enter the market, financial innovations should be subject to minimal logic scrutiny – and possibly to trial periods– before full commercialization is allowed. Needless to say, the FIA will have to develop rules regarding the tests that all financial innovation should pass before the commercialization of the corresponding financial products or process is allowed.

Financial innovations that spread risk in an intelligible way, reduce the cost of capital, allow more people access to credit and make the system more resilient to shocks are acceptable and welcome. Examples of financial innovations that should not be allowed to enter the financial system are not difficult to find. Three obvious schemes that constitute malignant innovations are as follows. First, financial innovations involving loans that can be repaid only under the assumption of continual increases in the price of the asset in question; second, financial innovations involving reckless banking (i.e. granting loans without regard to the borrowers' ability to repay); and third, financial innovations paying returns to investors out of the money contributed by subsequent investors rather than from revenues generated by genuine cash flow (Ponzi scheme).[23]

Furthermore, financial innovations that spread uncertainty in the strict sense (not risk), and thereby, render financial markets vulnerable to crashes should be rejected. Had the FIA been in place, the growth of uncertainty originated by dodgy securitized assets might have been checked before they could have wrought their damage.

Or, to add one more example which by no means exhausts the list of possibilities, consider the following hypothetical case imagined with the help of the information provided by The Earth's Leading Lunar Real Estate Agency that can be found in Google. The innovator, say a bank, has designed a new-fangled financial product to sell lots on the Moon (say, minimum lot size 1000 acres at $100 per acre) secured with real estate on the Earth and with repayments possibly starting in the year when humans return to the Moon. There are categories of property on the land (premium, standard, etc) in each of the following regions: Lunar Alps, Sea of Cold, Ocean Storms, Bay of Rainbow and Sea of Vapours. Specifically, the innovator offers the following deal to buyers of property on the Moon: (a) buy today and pay the first instalment when humans return to the Moon; (b) start paying your monthly repayments today and choose the year of return to the Moon; if you happen to select the correct year (meaning the year of actual return) you will automatically receive 50% reduction of the principal without any additional qualifications; and finally, (c) before the return of humans to the Moon, you have the option of moving from (a) to (b) or vice versa, but a fee applies. To enter this agreement you have to guarantee your repayments with real estate on the Earth. The bank plans to securitize the resulting mortgages, packing them on the basis of the above mentioned categories of property in the different geographical regions on the Moon. This financial innovation is surrounded by uncertainty (for example, the 1967 UN Outer Space Treaty states that space property "is not subject to national appropriation" but remains silent about the role of private and corporate owners) and has the potential for engendering a bubble, particularly when we approach the year of the return to the Moon.

When a new institutional arrangement is proposed, it is human nature to point out risks and shortcomings. There are at least three arguments that could be made

[23] The Ponzi scheme requires an ever increasing flow of money paid by later investors in order to keep the scheme going, and thereby, the strategy is destined to collapse. Ponzi schemes are illegal. What matters, however, is to detect the existence of Ponzi schemes ex-ante, *not* ex-post when the financial damage has been inflicted.

against the FIA. First, the standard criticism would be that the government role in the author's proposal would end up being far more intrusive than the author assumes. Commonsense leads one to believe that the degree of regulatory intervention of the FIA would be comparable to that of the FDA in the field of biological innovation and certainly less than the unprecedented intrusion of America's government in the recent past

> In two tumultuous weeks the Federal Reserve and the Treasury between them nationalise the country's two mortgage giants, Fannie Mae and Freddie Mac; took over AIG, the world's largest insurance company; in effect extended government deposit insurance to $3.4 trillion in money-market funds; temporarily banned short-selling in over 900 mostly financial stocks; and, most dramatic of all, pledged to take up to $700 billion of toxic mortgage-related assets on to its books. (…)
> *The Economist*, 11 October, 2008.[24]

Another extraordinary example of government intervention happened on 24 November, 2008. When Citigroup announced more than $US65 billion in losses, write-downs for troubled assets and charges to account for future losses, the US government took the unprecedented step of guaranteeing $US306 billion on troubled mortgage assets held by Citigroup to restore confidence and stop Citigroup following Wall Street rival Lehman Brothers into bankruptcy.

Few economists would deny that the pure teachings of the ultra-free market approach have been violated, for example, with the $US700 billion US bailout package. This rescue plan has really abrogated contracts and changed the rules after the fact.

Second, it might be argued that there are appropriability problems associated with the FIA. This argument can be disposed of easily. The predominant view nowadays is that business methods, in general and financial innovations, in particular, are patentable subject matter. The notion of the "business methods exception" established in a 1908 US court decision was explicitly rejected by the Court of Appeals for the Federal Circuit (the centralized appellate court for patent cases) in 1998. Financial innovations protected by trade secrets, copyrights or trademarks are surpassingly rare.

Finally, it could be argued that the FIA is unlikely to be internationally accepted, and therefore, the present proposal is of limited scope. There are at least two obvious reasons to believe that the FIA could gain general acceptance. First, a global agreement to evaluate financial innovations will be less difficult to achieve than an international agreement on greenhouse emissions or arms control because the cost of implementing the FIA are relatively small and the degree of government interference with the economy is negligible. Second, the FIA is entirely consistent with one of the medium-term actions established by the G-20 group of nations in Washington (15 November, 2008): "International standard setting bodies, working with a broad range

[24] This quotation comes from *Special Report on the World Economy*, entitled "When Fortune Frowned," included in the 11 October 2008 issue (p. 3).

of economies and other appropriate bodies should ensure that regulatory policy makers are aware and able to respond rapidly to evolution and innovation in financial markets and products."

7. Summary and Concluding Comments

It is true that the assumption of transparency implies that all the relevant data are well understood by the economic agents, but it is hard to see why this should be true. I call this implication Postulate of Automatic Understanding (PAU). This postulate is the tacit presumption of both the efficient market hypothesis and the assumption of rational expectations. There are compelling examples suggesting that the PAU was not applicable during the debt bubble 2001-2008.

Broader access to credit fuelled the US housing bubble. Securitization made it even easier to lend to less creditworthy borrowers. Securities were used to transmute one form of uncertainty (risk) into another (uncertainty in the strict sense). Specifically, the fast dynamics dramatically spread the ignorance zone about the scale of risks and who held them. A world dominated by uncertainty in Knight's sense bred illiquidity and offered little profitable scope for the time consuming nature of production. The global financial system collapsed in October 2008 and this made it difficult for borrowers to obtain funds for investment.

The view that government intervention in the economy is *always* pernicious is wrong both scientifically and morally. It is wrong scientifically because no one has ever proved –and probably never will– the following impossibility theorem: for any governmentless economy in which the necessary conditions for economic efficiency are not met, it is *impossible* to improve social welfare through government intervention. It is wrong morally because it means that economic freedom has no boundaries. For example, according to market fundamentalists predatory economic behaviour with devastating externalities such as expropriation of savings in pension funds should be allowed because markets are always right and governments always wrong to interfere. This political philosophy of unfettered capitalism does not accept that markets can transform risk into uncertainty and misallocate resources or that financial systems without relevant regulation are a recipe for economic disaster.

Conventional wisdom in economics teaches us that governments direct and interact with the economy. For example, standard economic textbooks recognize without apology that three of the major economic functions of the government are improving economic efficiency, stabilizing the economy and preventing commercialization of toxic products.

The housing and credit bubble 2001-2008 can be regarded as an historical period culminating with a double failure, market failure and regulation failure. This paper has proposed an institutional innovation, namely the Financial Innovation Administration (FIA) with the purpose of strengthening financial stability. Quite obviously, the FIA is in line with the regulatory vision proposed by the G-20 in November 2008. In particular, one of the decisions emerging from the G-20 states:

> "We will strengthen financial market transparency, including
> by enhancing required disclosure of complex financial products

and ensuring complete and accurate disclosure by firms of their financial conditions."

In essence, the tasks of the FIA would include evaluation and registration of financial innovations. It would not be the purpose of the FIA to establish the level of novelty involved in the new financial ideas. Van Horne (1985, p. 622) made the point that some financial innovations are bogus in the sense that they have "little or no substance when we peel away the veneer, other than to their promoters." However, it is the patent office task, not the FIA task, to establish whether these innovations are truly innovative. Quite obviously, no one should expect that the FIA is the 'open sesame' to the elimination of financial crises. What it can do is to reduce their risk and cost.

When a new regulation such as the FIA is proposed, there is a natural tendency to focus on its potential drawbacks. However, it is also important to recognize that, when there are enabling activities that private individuals cannot fulfil, such as judging whether financial innovations should be allowed because they are conducive to economic efficiency or should be abandoned because they have the potential for creating price bubbles or fraud, relevant government regulation is both necessary and desirable.

Finally, it should be emphasized that the proposal of the present paper is not one to be dealt exhaustively in a few pages and it would not be difficult to qualify the foregoing argument. For example, because financial innovation bears only part of part of the blame the introduction of the FIA will, at best, yield part of the relevant regulation and oversight necessary to avoid financial catastrophes. But I hope to have carried the analysis far enough to permit the following broad conclusion: financial innovations –like pharmaceutical drugs– can contribute to or detract from human welfare, and therefore, we need to "involve society in exercising directive intelligence through some appropriate organ of action over many of the inner intricacies of private business, yet it would leave private initiative and enterprise unhindered. Even if these measures prove to be insufficient, nevertheless, they will furnish us with better knowledge than we have now for taking the next step."

Appendix: Financial Innovation, Uncertainty and Collapse

This appendix highlights some aspects of the recent financial history and puts others in the background. A comprehensive explanation of the main events of the credit squeeze in 2007-2008 can be found in Brunnermeier (2008).[25] The process of discarding the inessentials and going straight for the essential elements involved in the debt bubble 2001-2008 is equivalent to constructing an historical sequence starting in 2001 and ending in the last quarter of 2008 where the terms of this sequence indicate the important aspects to be taken into account.

The first term of the debt bubble sequence is a financial innovation, namely the sub-prime mortgage, and the last term is the bursting of the bubble or the seizing up of the world's credit markets. The description of this sequence is of absolutely fundamental importance because it shows a case in which risky assets were metamorphosed into uncertain assets and the whole system collapsed. Let us start by the last term of the debt bubble sequence:

> Global financial intermediation is broken. That intricate and interdependent system directing the world's savings into productive capital investment was severely weakened in August 2007. The disclosure that highly leverage financial institutions were holding toxic securitized American subprime mortgages shocked market participants. For a year, banks struggled to respond to investors demands for larger capital cushions. But the effort fell short and in the wake of the Lehman Brothers default on September 15th 2008, the system cracked. Banks fearful of their own solvency, all but stopped lending. Issuance of corporate bonds, commercial paper and a wide variety of other financial products largely ceased. Credit-financed economic activity was brought to a virtual standstill. The world faced a major financial crisis.
> Greespan (2008, p. 122)

Each financial crisis is unique in terms of its causes and the types of assets that involves. The unique manifestation of the debt bubble 2001-2008 was the growing importance of interlinked securities, i.e. sub-prime mortgages, debt securitization and derivatives.

Providing mortgage finance to low income and minority households is a social goal in many rich countries. The main issue to be confronted in lending to this group is that the borrowers are riskier because of two issues: (a) insufficient funds (they do not have enough funds for the down payment on the house); and (b) credit issues (they have either no credit history or prior problems repaying debts). A financial innovation was necessary to answer the following daunting question: how can a mortgage loan be designed to make lending to riskier borrowers potentially profitable. 'Sub-prime mortgages' were a profit-seeking financial innovation aimed at answering

[25] This paper succeeds in illuminating the facets of the debt bubble sequence, including important elements omitted in the description provided here. For example, Brunnermeier (2008, esp. pp. 21-29) outlines four different amplification mechanisms of the losses in the mortgage market that are not mentioned in the following sketch of the debt bubble.

this question. The new idea associated with the sub-prime mortgage is as follows: the borrower and the lender can take advantage of the house *appreciation* over short horizons.

A representative sub-prime mortgage can be described in four steps. First, a subprime mortgage starts with a fixed interest rate ('teaser' rate, say 7% per year) and incorporates a variable interest rate ('reset' rate or 'step-up rate, say LIBOR plus 8%) after an initial period of time of two or three years. Second, the appreciation of the house is the basis for refinancing every two or three years. Third, the lender makes the choice to refinance or not at the end of the initial period and the borrower may be rolled into another sub-prime mortgage. Finally, another important feature of a subprime mortgage is the prevalence of prepayment penalties.

It is well-known that the sub-prime mortgage innovation engendered excesses. The extreme case was known as 'ninja' loans (no income, no job, no assets). An analysis of the America's housing market madness can be found in Michael Lewis (2008). In this book one can find the following example of 'financial alchemy': a couple bought a house for $1.16 million with no money down and they secured loans worth $1.5 million on that house; they then extracted $333,000 to spend on consumer products and lived in a nice home for three years before they walked away.[26]

The US housing boom period started in 2001 and ended in 2006: US housing prices reached a peak in 2006 exceeding replacement costs by as much as 100% and fell 50% from this peak in 2006-2007. The high housing prices of 2001-2006 were a short-run response to high demand. Expectations were not rational because individuals assumed that housing prices will keep on rising forever, while elementary economic logic predicts that housing prices will revert back to replacement costs.

The foregoing suggests that the US housing market bubble would fit nicely into the textbook case where the bubble is highly localized, e.g. confined to a domestic market. However, there were financial instruments and new technologies operating concurrently that engendered a *high-powered* bubble, that is, a bubble that propagates to other markets.

Sub-prime mortgages were financed via securitization. In essence, securitization means that banks and other lenders pool their loans into securities and sell them to investors in order to make new loans. During the development of the debt bubble lenders sold their riskiest mortgages to investment banks which in turn packed them into securities identified as *Collateralized Debt Obligations (CDOs)*. Three points should be made here. First, securitization is decades old. Second, CDOs are financial instruments used by investment banks to off-load risk. Third, CDOs not only package commercial and residential mortgages but also other forms of debt such as credit cards and car loans.

Securitization transferred ownership of mortgages from lenders who knew their borrowers (lenders had information about the probability of default of their borrowers) to investors who did not. In fact, investment banks turned risky assets into investments that would be suitable to investors who would know nothing about the

[26] See Roberts (2007).

risk characteristics of the underlying assets. CDOs were classified by degree of risk and allocated to categories referred to as 'tranches,' for example, senior (lower risk/lower yield), mezzanine (medium risk/medium yield) and junior (higher risk/higher yield).[27]

As the housing market around the US took flight, the CDO market grew immensely as more and more mortgages were pooled into new-fangle securities: lenders over-lent, builders over-built and buyers over-paid. Over time, the size and complexity of the 'financial repacking' increased. Investment banks manufactured 'synthetic' securities that made the underlying risks even more opaque. In fact, these banks sliced up CDOs and repackaged them into CDOs of CDOs known as CDOs squared or CDO^2s. There were cases of CDO^3s.

Four points should be stressed. First, firms issuing CDOs generated fees of 0.4 to 2.5 percent of the quantity sold; for example, Citigroup made up to $US500 million in fees from the CDO business in 2005 alone. Second, the investment banks sold the CDOs to institutional investors around the world. Third, the market for *Credit Default Swaps (CDSs)* enabled banks to insure against failure of the new-fangled credit products.[28] Finally, investment banks carried large positions of CDOs off balance sheet and developed *Structured Investment Vehicles (SIVs).* As the credibility of the CDOs came into question some investment banks were forced to bail out their SIVs.

CDOs were complex financial products and even professional investors and experts found it virtually impossible to estimate the risks involved in a particular CDO. The reason is not far to seek. CDOs involved many forms of bundled debts creating a black box that could not be penetrated by investors to determine the size and location of the risks. The average investor was unable (not unwilling) to understand whether a particular CDO represented value or was a toxic asset.

Having said this, it is an open secret that ratings agencies such as Standard & Poor's and Moody's claimed that they were able to evaluate the risks underlying CDOs *without* verifying the information provided in the original loan application. Using sophisticated econometric models under the assumption that historical patterns of default were a good predictor of risk they did the job on a regular basis. For example, they considered securitized pools of, say 2,000 sub-prime mortgages and using historical performance from 1970s onward they asked: what percentage of borrowers will pay their loan?

It is clear that the ratings agencies ignored the fact that the mortgage sector was morphing into a speculative bubble prompted by the sub-prime mortgage innovation. What may not be as obvious is the fact that the agencies were paid by those issuing the CDOs, and consequently, there was a conflict of interest. What mattered to issuers (Wall Street) was the rating –not the accuracy of the risk evaluation.[29]

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[27] The senior tranche offers low interest rate, but it is the first to be paid out of the cash flows of the portfolio. At the other extreme, (junior tranche, usually referred to as 'toxic waste') will be paid only after the senior and mezzanine tranches have been paid.

[28] The CDS innovation is due to Blythe Masters of J.P. Morgan. This method for insuring against loan defaults was introduced in 1995.

[29] For more details on the issue of conflict of interest and CDOs, see Lowenstein (2008).

There is evidence that some banks also undertook the task of evaluating CDOs risk. As an illustration, consider the case of the Citigroup, one of the world's largest banks with operations in more than 100 countries. In late 2002, the bank moved aggressively into CDOs. After five years (circa September 2007), the Citigroup ended up owning $US43 billion in mortgage-related assets. The bank's risk evaluation procedures were grotesque, to say the least. For example, Citigroup's risk models assumed *away* the possibility of a US housing downturn, on which millions of homeowners could default on their mortgages. As reported by the New York Times, the Citigroup's top executives were indulging in daydreams:

> Even as the first shock waves of the sub-prime mortgage crisis hit Bear Stearns in June 2007, Citigroup's top executives expressed few concerns about their bank's exposure to mortgage related securities.
> In fact, when examiners from the Securities and Exchange Commission began scrutinising Citigroup's sub-prime mortgage holdings after Bear Stearns' problem surfaced, the bank insisted the probability of those mortgages defaulting was so tiny that they excluded them from their risk analysis, says a person briefed on the discussion.
> Dash and Creswell (2008)

It is worth noting that there was a global chain reaction ending with the stock market crashes around the world in October 2008.[30] The Internet was used to disperse risk on a global basis and to create a 'shadow banking system' (or unregulated lending network) that, by 2007, was as large as the formal banking system. This shadow system is a nexus of CDOs, credit-default swaps, auction-rate securities, private-equity and hedge funds. In particular, there were financial instruments traded by instant message in trillion dollar markets.

Securitization and derivatives reduced the financial sector resilience and magnified the damaging effect of the crash. In October 2008, most of the world's largest banks were virtually insolvent and depending on continuing government aid. Furthermore, losses in one stock market provoked losses in others and international investors sold everywhere.

For all practical purposes the dynamic process involved a massive transformation of risk into uncertainty.[31] In a state of affairs chiefly characterized by a totally unpredictably future, individuals could not possibly follow any course of action because economic reasoning was worthless. Most financial firms were unable to raise capital and refused to lend. The predominance of uncertainty in Knight's sense created an 'economic black hole' that sucked in the real economy.

To sum up, the debt bubble sequence 2001-2008 can be condensed as follows:

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[30] It is estimated that $US30 trillion of global stock market value was wiped out in the year 2008. Greenspan (2008, p.121).

[31] It was like buying and selling lottery tickets among hard core gamblers where the probability of success was impossible to calculate and the traders did not even know if there was a prize.

- Toxic financial innovation →
- Loans are pooled, tranched and then sold via securitization →
- Uncertainty in Knight's sense →
- Collapse,

where the term 'Collapse' identifies the financial crisis 2007-2008 and the corresponding market failure due to the prevalence of Knightian uncertainty.

While some economists may focus on a single cause, and thus on a single remedy, the sheer number of causal factors that has been identified appears to suggest that there is a *bundle* of causes explaining the current financial crisis. In a recent paper, John B. Taylor has provided empirical evidence about the causes of the financial crisis 2007-2008 and concluded that this crisis was provoked, prolonged, and worsened by the US government actions and interventions. Taylor (2009, esp. p. 27). In his view, the use of sub-prime mortgages was a complicating factor and the complex securitization of these and other mortgages a significant amplification factor. One way of knowing whether the existence of a malignant innovation in combination with securitization was necessary for the financial crisis to occur would be to construct a model to see what would have happened in the counter-factual event where the sub-prime mortgage innovation did not exist.

As I mentioned in the introduction to the present paper, the debt bubble sequence is just a slice of an extraordinary complex dynamic process. It is generally agreed that there is a collection of causal factors of the financial crisis that began in 2007 and gathered intensity in 2008. Jackling (2009) has identified and tabulated 26 particular causal factors, not necessarily independent of each other. A glance at Table 1 in Jackling (2008) shows that the common thread connecting most (if not all) of these factors is a relatively small set of financial innovations.

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