The First Great Recession of the 21st Century

Competing Explanations

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Ekaterina Svetlova and Matthias Fiedler

3.1 INTRODUCTION

The financial crisis of 2007–09 caused significant discontent about the current state of economic theory. In the manifesto 'The financial crisis and the systemic failure of academic economics', Colander et al. (2009, p. 2) wrote of 'a systemic failure of the economic profession'. They argued that:

> [T]he current academic agenda has largely crowded out research on the inherent causes of financial crises. There has also been little exploration of early indicators of system crisis and potential ways to prevent this malady from developing. In fact, if one browses through the academic macroeconomics and finance literature, 'systemic crisis' appears like an otherworldly event that is absent from economic models. Most models, by design, offer no immediate handle on how to think about or deal with this recurring phenomenon. (Ibid., p. 2)

In this paper, we draw on the ideas of a neglected line of economic research to discuss the causes and consequences of the recent crisis. Against the background of the failure of traditional economic tools to analyse the financial turmoil of the last years, we explore the concepts of Frank Knight, John Maynard Keynes and George L.S. Shackle to search for an alternative explanation.

These three economists belonged to one thematic school of economic thought. This school differs from the economic mainstream by its focus on knowledge about the future related to the understanding of risk and uncertainty. Those issues were considered to have been resolved by economists of both earlier and later schools. For example, Friedman (1976, p. 282) considered Knight's suggestion of distinguishing between risk and uncertainty as useless because, in his view, subjective probabilities can always be assigned; hence an economist can treat every situation with uncertain outcomes as a situation of risk. While the neoclassical tradition

was focused on risk measurement based on probability calculus, Knight, Keynes and Shackle argued that uncertainty, rather than mathematical probability, governs the economic world. They did not consider knowledge and expectation formation as unproblematic, but rather as issues at the very heart of economic theory. Due to this common ground, we consider this non-mainstream line of economic thought as a separate thematic school that deserves greater attention.

The rest of our paper is structured as follows. In the second section, we will discuss the views of Knight, Keynes and Shackle on probabilities and uncertainty in detail. The concepts outlined will then be applied analytically to the recent crisis in the third section. Consequently, the third section contains a discussion of the challenges that economic theory should master. In the fourth section, our conclusions can be found.

3.2 KNOWLEDGE AND UNCERTAINTY AS UNDERSTOOD BY KNIGHT, KEYNES AND SHACKLE

This section outlines the main arguments of Knight, Keynes and Shackle. We are aware that these three economists did not form a historical school of economic thought: Knight was a part of the Chicago School, Keynes established his own influential line of thought and Shackle's approach has never been classified. But we believe that these three scholars formed one thematic line of thought of which they were not the only representatives. There were also other thinkers in the first half and middle of the 20th century who seriously analysed knowledge and uncertainty, for example, Friedrich von Hayek and Joseph Schumpeter. However, we will concentrate on the relevant ideas of Knight, Keynes and Shackle and will emphasize the many commonalities in their arguments. We will present their thinking as a single line of thought that is pertinent to an analysis of today's financial crisis.

3.2.1 Incompleteness of our Knowledge about the Future

The only thing of which we can have certain knowledge is the past. Thus, the only way to anticipate the future is to evaluate and to interpret our knowledge of the past. The easiest way to do this is to assume the uniformity of the past and the future. Though this assumption is often made, it poses a philosophical problem: when it comes to inferring from past particulars to future generalizations there is an absence of deductive certainty. This is the famous problem of induction formulated by Hume

(1938). What we know at present is linked to the future through 'constant conjunction' (ibid., p. 11), which refers to similar causes creating similar effects. Hume argues that this sense of causation rests upon experience and that it would be circular reasoning to argue that the future will be like the past because the past futures have been like past pasts (ibid., p. 14).

In Hume's view, inductive methods are not necessarily false, but he showed that their validity cannot be proved (Keynes, 1921, p. 272). In Hume's own words: 'suppose the future conformable to the past . . . however easy this step may seem, reason would never, to all eternity, be able to make it' (cited in Meeks, 1991, p. 138). The fact that we regard the past to be like the future is our unjustified habit or custom (Hume, 1938, p. 16). Such a custom is reflected by the common assumption that regards current market prices as a correct guide to future prospects, for example.

The absence of deductive certainty about the future was the point of departure for the thinking of Knight, Keynes and Shackle. There is evidence that Hume's work significantly influenced Keynes (Meeks, 1991, p. 137f). In *Risk, Uncertainty and Profit*, Knight (1921), though he doesn't cite Hume, criticizes 'the assumption of practical omniscience on the part of every member of the competitive system'. He further emphasizes that many 'economic phenomena . . . are connected with the imperfection of knowledge' (ibid., p. 197), primarily with the imperfection of knowledge about the future.

It was crucial for those economists to understand the imperfect nature of knowledge. For them, as for Hume, this was not identical to the problem of imperfect or asymmetrical information. Hume's scepticism was not affected by the amount of information available. Hume, as one of the first modern philosophers, was sceptical about inductive reasoning itself, independent of the level of information (Hacking, 2001, p. 248). Knight, Keynes and Shackle were fascinated with the problem of uncertainty because they believed that there is something like 'inherent unknowability in the factors, not merely the fact of ignorance' (Knight, 1921, p. 219). Ignorance is based on incomplete information and can, theoretically, be abolished. It is the foundation of epistemological uncertainty. But Knight, Keynes and Shackle considered the possibility of ontological indeterminacy as a legitimate fact of economic life (for example, Knight, 1921, p. 197ff, esp. 219ff; Skidelsky, 2009, p. 88). A detailed discussion of these issues follows in the next sections.

3.2.2 Probability Concepts as Measures of Ignorance

If valid inductive inference is impossible, how can this problem be avoided? There are several approaches to the question of knowledge under conditions of uncertainty. The description of non-valid arguments or uncertain

consequences in terms of probability is a possible approach, and it falls roughly into three categories: theoretical probability, experimental probability and probability as a degree of belief. The first can be predicted using counting principles (by rolling dice for example), the second describes the frequency of an outcome given a repeated trial and the last expresses a judgment of the likelihood of an event. The degree of belief type probabilities can be distinguished further. There is a subjective and a logical probability. Subjective probability, also called personal probability, refers to a statement such as 'I am very confident that inflation pressure is going to increase'. It is subjective, but obeys the basic rules of probability such as normality, certainty and additivity. Normality holds that every probability is a fraction between zero and one. Certainty states that a certain hypothesis has a probability of one, and additivity requires that the probabilities of mutually exclusive hypotheses add up to unity (for example, Ramsey, 1926; de Finetti, 1980). In contrast to subjective probability, logical probability is always related to evidence. An advocate of logical probability would make the following argument: 'Given the evidence, it is reasonable to have a high degree of belief in mounting inflation'.

Probability concepts of different types were developed to avoid the induction problem, that is, the impossibility of inferring from the known (the past) to unknown (the future). They imply that probability is capable of reducing uncertainty about the future to a number or a fraction, that is, that uncertainty can be expressed and analysed in terms of probability.

This notion was contested by Knight, Keynes and Shackle. Knight and Keynes concentrated on criticizing the first two types of probabilities; Shackle doubted that probabilities in general can be useful to an analysis of economic reality. These three thinkers argued that probabilities do not always help to bridge the knowledge gap between the past and the future and searched for alternatives. Though they followed quite different lines of argument, some commonalities between them can be highlighted. This will be done in the following sub-sections.

3.2.3 Critiques of Probabilities and Alternative Concepts

Though the discussion about uncertainty is often reduced to the problem of the measurability of probabilities, the common starting point for Knight, Keynes and Shackle was to ask if probability calculus as such is sufficient to account for individual actions under uncertainty.

3.2.3.1 Knight: a distinction between risk and uncertainty

Knight's critique refers to the first two types of probabilities (theoretical and experimental), which he calls a priori and statistical probabilities

(Knight, 1921, p. 216). He considers the determination of probabilities to be based on a classification of the possible outcomes. For him, a priori and statistical probabilities differ from each other in the accuracy of such classifications. However, Knight suggests that those two categories do not exhaust all the possibilities for defining a probability situation. Knight (1921, p. 223) adds 'estimates': 'The distinction here is that there is no valid basis of any kind for classifying instances. This form of probability is involved in the greatest logical difficulties of all' (ibid., p. 225). Knight refers to this last situation as a situation of uncertainty, while he defines the first two situations as 'risk' (ibid., p. 233).

Knight argues that the classification of outcomes is sometimes impossible because circumstances are unique:

> The practical difference between the two categories, risk and uncertainty, is that in the former, the distribution of the outcome in a group of instances is known (either through calculation *a priori* or from statistics of past experience), while in the case of uncertainty this is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique. (Ibid.)

Here, Knight's argument coincides with Shackle's line of reasoning, which will be discussed later.

Furthermore, Knight argues that the uncertainty situation is typical in business. He describes a manufacturer who considers increasing the capacity of his enterprise: 'He "figures" more or less on the proposition, taking account as well as possible of the various factors more or less susceptible of measurement, but the final result is an "estimate" of the probable outcome of any proposed course of action' (ibid., p. 226). Due to insufficient knowledge, the manufacturer cannot classify possible events, but he can make 'a judgment of probability' (ibid.), or 'an estimate of an estimate' (ibid., p. 227):

> The business man himself not merely forms the best estimate he can of the outcome of his action, but he is likely also to estimate the probability that his estimate is correct. The 'degree' of certainty or of confidence felt in the conclusion after it is reached cannot be ignored, for it is of the greatest practical significance. (Ibid., p. 226f)

Here we can see some intersections with Keynes's idea of 'the state of confidence', discussed later.

Knight's 'estimate of an estimate' is associated with subjective probability (ibid., p. 233). Subjective probabilities can always be formed under conditions of uncertainty; however, objective probabilities (mathematical and statistical) cannot be calculated under such conditions. Here lies the crucial distinction between risk and uncertainty: risk is the situation where probabilities are measurable; under uncertainty they are not, though they take the form of 'a ratio, expressed by a proper fraction' (ibid., p. 231). Thus:

> a measurable uncertainty, or 'risk' proper . . ., is so far different from an immeasurable one that it is not in effect an uncertainty at all. We shall accordingly restrict the term 'uncertainty' to cases of non-quantitative type. It is . . . 'true' uncertainty, and not risk. (Ibid., p. 20)

To sum up, Knight pleads for a sharp distinction between risk and uncertainty. He argues that people in business situations that are unique face 'true' uncertainty. Thus, they lack any valid basis to calculate probabilities and have to rely on subjective judgment, or 'an estimate of an estimate'.

3.2.3.2 Keynes: an immeasurable relationship

Now we will discuss how Keynes's notion of probability allows for a definition of uncertainty. Following Lawson (1985), Keynes's uncertainty is defined as the absence of a probability relation. This assertion will be discussed in more detail.

Keynes begins his analysis in his book *Treatise on Probability* (1921) with considerations about the nature of knowledge. He distinguishes between direct and indirect knowledge. These are obtained directly or by argument, respectively. Keynes associates the latter with the realm of probability and regards probability as a non-subjective logical relationship between a premise and a conclusion. The premise consists of a proposition h and the conclusion of a proposition a. If knowledge of h allows a rational belief in a, there is a probability relation of degree α (ibid., p. 4). Keynes defines the cases where such a probability relation exists as 'secondary propositions' (ibid., p. 10).

Besides the logical relation, another concept supplements the probability description. It is called the 'weight of the argument'. It refers to the size of the evidence supporting the probability relation and it increases with evidence available, but could decrease the probability of an argument (ibid., p. 71). Probability refers to a relation between a and h, whereas weight is concerned with the 'magnitude' of the evidence of h. Weight is positively correlated with evidence, that is, low weight implies less relevant information and an increase in h entails an increase in weight, but not necessarily probability. O'Donnell (1990, p. 256) understands weight as an indicator of 'confidence'. An increase in evidence of h implies a broader base for the argument.

To sum up, both measures are used to make an inference. Probability establishes the degree of rational belief in the conclusion and the weight expresses confidence about the probability. According to Lawson (1985) and Runde (1990), those two main dimensions of Keynes's probability concept define Keynes's notion of uncertainty. It is related to the absence of a secondary proposition. The absence of a secondary proposition does not allow for calculating a numerical value for the probability relation between premise and conclusion (Keynes, 1921, p. 34f; Lawson, 1985, p. 913). This notion is crucial to Keynes's thought. Lawson concludes that the absence of a secondary proposition, or the lack of a probability relationship, constitutes uncertainty. The evidence for the proposition is not measurable numerically and not comparable. In Keynes's words: 'It is not possible to say of every pair of conclusions, about which we have some knowledge, that the degree of our rational belief in one bears any numerical relation to our degree of rational belief in the other' (1921, p. 37). He goes on to argue that it is not 'always possible to say that the degree of our rational belief in one conclusion is either equal to, greater than, or less than the degree of our belief in another' (ibid.).

Lawson (1985, p. 914) summarizes: 'Thus uncertainty is not merely a situation in which the probability relation is known and the primary proposition, *a* say, relative to the evidence, gives rise to a numerical probability that is less than unity'. Rather, it refers to an immeasurable relationship between premise and conclusion in the absence of a secondary proposition.

In the absence of a secondary proposition, no comparison between magnitudes of probabilities of different contingent outcomes is possible, and uncertainty prevails. In this case, Keynes argues in unison with Knight that we lack a valid basis to form probabilities. Keynes suggests that such uncertainty exists, for example, in the case of predicting the price of copper or the interest rate 20 years hence: 'About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know' (Keynes, 1937, p. 113). Lack of knowledge is related to the insufficient scientific basis, or as Keynes terms it, the insufficient rational basis. There are cases, he writes (1921, p. 30), 'in which no rational basis has been discovered for numerical comparison. It is not the case here that the method of calculation, prescribed by theory, is beyond our powers or too laborious for actual application. No method of calculation, however impracticable, has been suggested'. This situation implies more than epistemological uncertainty, which we can remove by becoming more skilful in calculation or by collecting more information. It refers to ontological uncertainty which we cannot cope with by means of probability.

Nevertheless, as Keynes suggested, 'the necessity to action and for decision compels us as practical men to do our best to overlook this awkward fact and to behave exactly as we should if we had behind us a good Benthamite calculation' (1937, p. 114), that is, to assign probabilities. Those probabilities lack any scientific basis, however, which is the same point that was raised by Knight. The assignment of probabilities and the building of expectations on this ground has become one of the many conventions that people use to cope with uncertainty in business situations: we are 'calculating where we can, but often falling back for our motive on whim or sentiment or chance' (Keynes, 1936, p. 163), or 'animal spirits' (ibid., p. 162), that is, the non-calculative motivation to act. Those conventions are the basis of the expectations that guide action.

Keynes's discussion of long-term investment expectations in Chapter 12 of *The General Theory of Employment, Interest, and Money* (1936) seems to be especially relevant to understanding the recent crisis. Keynes describes two components of expectations, namely the most probable forecast and the state of confidence. Referring to Keynes's concepts of probability and weight of the argument, Gerrard (1994, p. 331ff) explains: 'The most probable forecast is the agent's best estimate of the likely future outcome. The state of confidence reflects the likelihood of the most probable forecast turning out to be wrong'. This similarity to Knight's 'estimate' and 'estimate of the estimate' is striking.

Long-term expectations are formed in a situation of uncertainty. The knowledge base is insufficient to be certain of the future. As mentioned above, according to Keynes, the most probable forecast is based on a convention:

> The essence of this convention . . . lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change. This does not mean that we really believe that the existing state of affairs will continue indefinitely. . .. Nevertheless the above conventional method of calculation will be compatible with a considerable measure of continuity and stability in our affairs, *so long as we can rely on the maintenance of the convention*. (Keynes, 1936, p. 152, original emphasis)

This statement is related to Hume's concept of 'custom', which he showed to be groundless. People make estimations about the future, but as they know that those estimations are imprecise, they make subjective judgments of these estimations. The formation of this judgment is crucial for understanding behaviour under uncertainty; however, this topic is notoriously under-researched in economics. One of the reasons is that:

> [b]y its very nature the state of confidence is not amenable to formal technical analysis. But, given its crucial importance in determining actual behavior,

> Keynes argues that the state of confidence needs to be the subject of careful analysis by economists. Any model of investment which excludes the state of confidence is likely to be seriously misspecified. (Gerrard, 1994, p. 332)

To sum up, Keynes contested the idea of a calculable future and developed the concept of probability as a logical relation. He showed that this relation is undetermined in situations of uncertainty, so that probabilities are not calculable or comparable. In this situation, people form expectations based on probabilities without any scientific basic. They fall back on conventions, or 'animal spirits'. As in Knight's understanding, the estimate of the most probable forecast ('the state of the confidence') plays a crucial role.

Keynes's work was a significant departure from previous traditional approaches to probability and expectations. G.L.S. Shackle shared most of Keynes's objections to probability, though he doubted that Keynes's concept of probability was the solution. Shackle's two main arguments are outlined in the next sub-section.

3.2.3.3 Shackle: a non-probabilistic alternative

In his early writings, Shackle (for example, 1949) objected primarily to frequency probability. Frequency probability refers to the relative outcome of an event in a large number of trials under equal conditions. Shackle's first line of argument stems from the distinction between different courses of action, rendering frequency probability meaningless. Shackle's second line of argument extends from the critique of frequency probability and questions the usefulness of all probability concepts, including subjective probability.

Shackle begins by classifying decision situations, or experiments. The throw of a die can be repeated indefinitely and its results can be added up. The latter constitutes a divisible experiment because it consists of a series of trials (Shackle, 1955, p. 23). The underlying reasoning is similar to Knight's grouping of cases with respect to rolling a die, or a priori probability (Knight, 1921, p. 224). According to Shackle, most economic decisions cannot be repeated indefinitely and do not rest upon various single trials that can be grouped together. A non-divisible experiment consists of just one trial. However, certain individual non-divisible experiments can be turned into divisible experiments in the aggregate. Such experiments are called 'seriable' (Shackle, 1955, p. 24). Fire insurance is an example of a seriable experiment. Although there is no probability that an individual house will burn down, if there are enough pooled results, a (statistical) probability will emerge.

Furthermore, Shackle (1949, p. 6) argues that most economic decisions

are unique (this is in line with Knight's argument). A unique experiment is non-divisible and non-seriable. For example, an investment decision is made just once or a career is chosen only once in a lifetime. Shackle goes on to argue that frequency ratios are irrelevant in such cases and that frequency probability is only admissible if it provides some certain knowledge of the relevant outcome. In Shackle's words (1955, p. 28f):

> Suppose, for example, that a probability of 1/6 is assigned ex ante to some hypothesis concerning the outcome of a non-divisible non-seriable experiment. Then if the hypothesis proves false, the decision-maker was plainly wrong not to assign it a probability of zero instead of 1/6 while if it proves true, he was plainly wrong not to assign it a probability of unity.

In other words, frequency ratios are irrelevant in unique cases. In such cases, it is impossible to set up a Bernoulli trial in order to attain long-term objective stability. There are also cases when frequency ratios are not just irrelevant, but also cannot be determined; these are called crucial experiments. The crucial experiment inevitably alters the conditions under which it was performed. A chess move reflects such a crucial experiment because it will subsequently be impossible to perform a similar experiment again (ibid., p. 25). Economic decisions are crucial because they destroy the very conditions under which they were performed. This makes a repeated trial impossible. Frequency probability cannot account for crucial experiments because they preclude a repeated trial, which is necessary to establish objective stability. However, crucial experiments do not exclude subjective interpretations of probability, as they do not rely on repeated trials. Now, we will outline Shackle's second objection to the use of numerical probability.

This objection refers to the absence of an exhaustive list of possible consequences. Traditional probability calculus assumes that the list of consequences over which it is distributed is an exhaustive list of hypotheses. However, if there is a residual hypothesis, that is, the list of possible consequences is incomplete, the numerical probability model runs into trouble. By adding a hypothesis to the list of possible hypotheses, each corresponding probability of the previously known hypotheses has to be revised downwards (ibid., p. 27). If five possible hypotheses are considered and a sixth hypothesis is added and additivity and normality are assumed, the probability of each of the initial five hypotheses is subsequently lower. This objection applies to both approaches, namely frequency probability and belief-type probability, because neither can incorporate a residual hypothesis.

How, then, can an economic agent make an inconclusive argument conclusive if the probabilities approach is not applicable? Shackle, like Keynes, asserted that an individual is guided by expectations. Although

the concept of expectations formulated by Keynes (1921, 1936) and Shackle's idea of expectations are not the same, both concepts arguably have a common starting point, that is, the aforementioned insufficiency of probability calculus to account for uncertainty. Shackle (1979) differs substantially from Keynes as he emphasizes the rational degree of belief less than imagination or 'originative audacity' (p. 75), whereas in the absence of knowledge Keynes refers to conventional expectations rather than a creative act.

Shackle's (1949, p. 1) definition of expectations makes this difference obvious:

> By expectation I mean the act of creating imaginary situations, of associating them with named future dates and of assigning to each of the hypotheses thus formed a place on a scale measuring the degree of our belief that a specified course of action on our own part will make this hypothesis come true. Such a hypothesis I call an expectation.

The crucial prerequisite to understanding Shackle's non-probabilistic approach is to distinguish between the certainty of a hypothesis being true and the absence of disbelief of that hypothesis (Shackle, 1955, p. 30). The latter refers to a state of mind that makes an individual decision-maker unsurprised to see a particular hypothesis come true.

Shackle (ibid., p. 31) introduces the concept of disbelief to meet some of the shortfalls implied by numerical probability because expressing perfect confidence in one mutually exclusive hypothesis would imply a belief in the falsity of all its rivals.

The absence of disbelief is not certainty. If an individual learns that a hypothesis is true that she had assigned an absence of disbelief to, the individual will not be surprised or experience any kind of shock. Shackle (ibid.) refers to disbelief as 'potential surprise'. The absence of disbelief can accordingly be regarded as zero potential surprise.

Potential surprise resolves the previously outlined dilemma by expressing a perfect possibility without implying perfect certainty by assigning zero potential surprise to a hypothesis. Furthermore, the potential surprise assigned is independent of the number of other hypotheses considered and the list of non-excludable hypotheses can be extended without affecting the second independent variable of a rival hypothesis. In addition, potential surprise is a measure that does not contain a faulty judgment, unlike the frequency ratio, which is proven wrong unless it is zero or one. If a hypothesis that had a potential surprise larger than zero is proved to be true, the degree of misjudgment is reflected by the degree of potential surprise. Finally, potential surprise allows for considering a hypothesis and its contradiction to be equally plausible.

Shackle argues that uncertainty is necessarily linked with surprise. It is reflected by 'potential surprise', which, unlike probability, does not focus on the truth of a hypothesis, but rather whether it would surprise the decision-maker. Therefore, a true hypothesis does not imply zero potential surprise. An exhaustive list of rival hypotheses is the precondition for additivity. Such an exhaustive list does preclude any surprise.

The existence of a residual hypothesis among its set of rival hypotheses allows an individual to expect to be surprised. Anything not capable of surprising him would have occurred to him (Shackle, 1955, p. 60).

To sum up, Shackle proposed an independent measure for uncertainty that does not rely on numerical probability. Furthermore, he took into account that the list of possible hypotheses is not exhaustive, that is, that a decision-maker never knows all the possible outcomes. By introducing a non-additive measure such as potential surprise, he allowed for the addition of hypotheses without affecting each single hypothesis. In addition, potential surprise allows for the existence of a residual hypothesis. Shackle was very much aware that this proposal is far from orthodox decision theory. He states that 'those accustomed to think in terms of the actuarial calculation of the result will find this hard to appreciate' (ibid., p. 42f). However, the proposal does address some of the aforementioned objections.

3.3 UNDERSTANDING FINANCIAL CRISIS

Now let us consider what implications the uncertainty concepts of Knight, Keynes and Shackle have for understanding the recent financial and economic turmoil.

Risk seems to be the key concept in mainstream economic theory's understanding of the recent crisis. The German Ifo Institute states in its *Report on the European Economy* in 2009 that excessive risk-taking by financial institutions was one of the main features of the crash (EEAG, 2009, p. 59). In the words of Alan Greenspan, 'the underpricing of risk worldwide' played a major role in the origins of the crisis (as cited in Skidelsky, 2009, p. 3).

In this context, uncontrollable risk-taking refers to new financial instruments like ABS (asset-backed securities), CDO (collateral debt obligations) and CDS (credit default swaps). Those products were the result of the mortgage securitization, which developed rapidly as US house prices rose 124 per cent between 1997 and 2006 (ibid., p. 5). Mortgage volume, including subprime mortgages, increased significantly in this time period. As those loans became securitized, uncontrollable risk-taking commenced.

The underlying securitization scheme works as follows:

> By issuing a mortgage loan to a household or a firm, a bank or financial intermediary is the originator of an asset that generates a cash flow paid regularly over time (the monthly installments). Securitization occurs when the originator sells this cash flow to a special purpose vehicle SPV . . ., administered by a financial institution called the administrator or the sponsor of the program. Because mortgage holders may default on their loans, however, the (nominal) face value of the cash flow is not sure. To deal with default risk, the SPV . . . purchases a well-diversified portfolio of mortgages, pooling together the cash flows from many borrowers. . .. The trick consists of slicing the cash flow from a well-diversified pool of mortgages into tranches of increasing risk/return profiles. (EEAG, 2009, p. 63f)

There are low-risk (senior) tranches, medium- and high-risk tranches. Those risk levels are related to the possibility of future default. Though the future is uncertain, financial institutions, as well as rating agencies, treated this issue as 'risk' in the sense used by Knight and Keynes. Existing risk models are based on the assumption that risk can be calculated as future events and that their effects are known and can be assigned probabilities. However, in the recent crisis, such models notoriously underestimated risk. How could this have happened?

Generally, to assess risks related to new products, banks and rating agencies had to assess the corresponding default risks. The Moody's/KMV credit risk company defines this kind of risk as follows:

> Default risk is the uncertainty surrounding a firm's ability to service its debts and obligations. Prior to default, there is no way to discriminate unambiguously between firms that will default and those that won't. At best we can only make probabilistic assessments of the likelihood of default. (Crosbie and Bohn, 2003, p. 5)

In this definition, the confusion of risk with uncertainty is quite clear; like most market participants, rating agencies were not concerned with the crucial distinction made by Knight and Keynes. The terms 'risk' and 'uncertainty' are used interchangeably. However, the confession that 'there is no way to discriminate unambiguously between firms that will default and that won't' does call to mind the Keynesian statement that 'we simply do not know'. Unlike Keynes, however, who suggested that probabilities cannot be calculated under such conditions, the credit risk company states that probability assignment is the only way to deal with the situation. Hence, we should ask if the situation faced by economic participants in 2007–09 was a situation of risk or uncertainty and if probability calculus was applicable. Perhaps this distinction will allow for a more profound understanding of the causes of the crisis.

Because financial institutions and economic agencies used models of risk that are based on the calculation of default probability, they saw themselves operating under conditions of risk as Knight and Keynes understood the term. For example, Moody's approach to rating CDOs was based on the evaluation of expected loss. In the first stage, the probability distribution for each level of loss of the underlying assets was determined; then the correlation between tranches was taken into account; and eventually the total expected loss of the CDO note was calculated using a complicated correlated binomial method (Witt and Xie, 2005). Standard and Poor's and Fitch Ratings based their assessments of credit risk entirely on default probabilities.

All of these default calculations were grounded in an assessment of the future development of the security issuer based on historical data, that is, statistics about the company and industry. This means that risk models relied on statistical probabilities.

The other model used to assess the risk of loss, Value at Risk, should also be mentioned. Value at Risk is:

> defined as the worst loss possible under *normal market conditions* for a given time horizon. For example, an investment position that loses a maximum of $100 million for the next year, no more than 1 percent of the time, will be viewed by some managers as having a value at risk of $100 million for the next year. (Hillier et al., 2008, p. 794, original emphasis)

Thus, Value at Risk is also based on a known probability distribution, given normal market conditions. The probability distribution is usually assumed to be normal, or to follow the Gaussian bell curve.

Why did rating agencies' models and Value at Risk models underestimate risk during the crisis? First, many of their calculations were simply wrong. Many reasons for this have been discussed in the academia and in the press. Adverse incentives were created as agencies were paid by product issuers. This induced agencies to produce the ratings required by clients, that is, to assign high ratings to papers that were in fact high risk. Agencies were able to easily manipulate ratings because their models were non-linear and very sensitive to input. They often used unreliable, that is, unaudited, information to estimate risks. But do the problems not lie deeper?

We believe that it is wrong to define the situation of the credit crisis as a situation of risk. Economic participants faced a situation of uncertainty that could not be reduced to risk. Thus, it was misleading to assume that the future is calculable and to analyse the situation in terms of probabilities.

The economic conditions that have prevailed since 2007 have been

entirely unique, though they resembled other crashes. This is exactly Shackle's point, the argument that business situations are crucial, non-seriable and non-divisible experiments. Ongoing risk assessments changed the very conditions under which they were initially performed. The underestimation of risk led to increased demand for risky assets; subsequently, more risky assets were issued and bought. The volume of structured financial instruments that were traded around the globe increased dramatically, creating a unique situation.

According to the theories of Knight, Keynes and Shackle, in such a situation, frequency probabilities cannot be used, but this is exactly what banks and rating agencies did. Their risk models were based on historical data that did not apply to the new unique situation. The actual problem was that the financial instruments that were assessed by the risk models didn't have a price history (Croft, 2009, p. 21). There was no scientific basis on which to estimate and to model their parameters. For example, one such uncertain parameter was the correlation between assets included in CDOs. Calculations of those correlations rested upon the assumption that such correlations are stable and, thus, 'made no allowance for unpredictability' (Salmon, 2009).

The other example refers to the Value at Risk formula. As structured products had a short and unique history, their liquidity became an uncertain parameter. According to Jane Croft (2009, p. 21):

> VAR [Value at Risk] was not designed for illiquid products as it assumed the sale of products within 24 hours and the 10-day holding period is a necessary extra buffer. . .. Putting really illiquid products into VAR, where you are looking at short-term moves in prices, is not appropriate because you will be locked in for a longer period and potentially suffer larger price moves. VAR will understate risk.

In other words, the underpricing of risk occurred because there was no way to estimate liquidity except to assume it to be high and stable, as it was in the past.

In general, a lack of knowledge prevailed in the system, implying that economic agents acted under conditions of uncertainty. Oliver Blanchard, the chief economist at the International Monetary Fund, described the situation in his Munich lecture. He stated that banks did not just hold mortgages on their books, but:

> these mortgages were basically securitized and re-securitized and re-securitized which made some sense from the point of view of risk allocation. It allowed to provide securities that are more tailored to the people who wanted a lot of risk or little risk but that made the assets extremely opaque in the sense of understanding the value of the assets became nearly impossible because the asset was claim on a claim on a claim and basically nobody, even in the business, really understood what these assets were worth with the implication that as soon as there were uncertainties about the ultimate value of the assets at the beginning (subprime mortgage or prime mortgage), then basically there was enormous uncertainty as to exposure you had by holding these derived assets, securitized assets. (Blanchard, 2008)

According to Knight, Keynes and Shackle, it was inappropriate to use probabilities to assess such a situation because there is no valid scientific basis to do so. In addition, no exhaustive list of possible future events was available. Economic agents simply didn't know what they and their counterparts had on their books. They faced uncertainty but continued to treat the situation as one of risk. Their decisions were based on the assumption of a high degree of predictability. Exactly as Keynes described, economic agents behaved as if they were able to make 'a good Benthamite calculation' based on the assignment of probabilities, but few realized at the time that this calculation was empty. Importantly, as Shackle demonstrated, this argument applies to probabilities of any kind when facing a crucial experiment. Thus, the point of Friedman and Savage that the assignment of subjective probabilities would be a solution is not valid. We think that an understanding of this fact could add a lot to our understanding of the crisis.

Knight, Keynes and Shackle further argued that if measurable probabilities cannot be assigned, market participants use judgments or build expectations to bridge the gap of uncertainty between the past and future. Now, let us analyse how the ideas of Knight, Keynes and Shackle could help us to understand expectations and their contribution to the recent financial turmoil in more detail.

We will continue to tell the story of the crisis from the point where we left off: economic agents faced enormous uncertainty concerning the value of assets on their books and the books of their counterparts. This uncertainty prevailed in the summer and autumn of 2007, when first banks like Northern Rock and IKB suffered from the liquidity squeeze and from deteriorating asset quality. This happened because financial institutions started to doubt whether the securities on their books were as risk-free as their ratings suggested.

In terms of Keynes's theory, investors' most likely forecast that high ratings corresponded to high security quality was based on the convention of believing in the judgments of rating agencies. In general, it can be easily demonstrated that during the crisis investors relied heavily on the assumption of the uniformity of the past and the future, which, according to Hume, cannot be proved valid. However, people fell back on this

'custom' and built their estimations upon it. Blanchard described the real events as follows:

> And the question is why is it that we were basically fooled as a system, as a collection of individuals and institutions, into producing of these assets and thinking that they were riskless. And I think here is basically the inability, with support in human nature really, the inability to think about risk when you haven't seen it for a while. In the US, housing prices have gone up every year since World War II; even in the recession of 2001 we hadn't seen them come down. So when you were told 'Look, basically you can buy risk because housing prices were not to go down', you looked at history, you looked at the last recession and you could convince yourself fairly easily that this would continue. (Blanchard, 2008)

However, as Keynes argued, this could not continue forever, but only until investors saw 'specific reasons to expect a change' (Keynes, 1936, p. 152). As the discrepancy between the past and the future became clear, market participants changed their 'state of confidence' or the Knightian 'estimate of an estimate'. They knew that the quality of structural products backed by mortgages was generally estimated to be high, but their estimate of this estimate reflected the expectation that the quality of such products might not, in fact, be sound. This change led to a situation whereby financial institutions stopped extending credit to each other and liquidity dried up. The 'confidence' factor became crucial.

Similarly, when, at the beginning of 2008, the discussion evolved round whether a 'hard' or 'soft' landing was the most likely scenario, the factor of 'confidence' also played a significant role for further developments. Markets believed in the likelihood of a soft landing because they were confident that the problems that had already occurred in the money markets were manageable. There was a conviction that 'central banks would make up for the lack of liquidity in the interbank markets' and that they 'would intervene on a case-by-case basis to support banks under threat of failure' (EEAG, 2009, p. 82). However, 'the state of confidence' changed dramatically during the summer of 2008, when markets were surprised by the Lehman Brothers bankruptcy. Expectations based on the convention that the US Central Bank had always functioned as a lender of last resort in the past, and therefore would continue to do so, no longer held. Capturing this change properly would have been a far more accurate predictor of the hard landing than risk probability models.

Shackle's related concepts of disbelief and non-numerical expectations could help to provide a more detailed understanding of the situation in 2008. As we see ex post facto, there were not just two hypotheses (that is, 'soft' and 'hard' landing). There was also a residual hypothesis of 'very hard landing'. The list of possible scenarios was not complete (which is an additional argument for why probability calculus could not work under such circumstances). However, market participants discussed only two scenarios, both of which appeared to be possible. They discussed arguments for and against soft landing that expressed their degree of disbelief. They assigned zero potential surprise to both scenarios. At the beginning of the crisis, a hard landing was a counter-expected event with a high degree of disbelief. The occurrence 'very hard landing' was an entirely unexpected event. It was not imagined at all by the majority. This is the answer to Queen Elizabeth's question at the London School of Economics briefing in 2008, 'Why did nobody see it coming?'

One might ask what we gain if we structure the decision situation this way. We think that it allows for a more precise description of the set of alternatives under conditions of uncertainty. In the absence of reliable knowledge people do not exclude any hypothesis completely, but consider all hypotheses as possible, assigning different degrees of disbelief to each of them. The use of imagination, a concept emphasized by Shackle, seems to have been low, with financial players limiting their hypotheses to those shaped by historical experience. For example, as people saw central banks helping financial institutions in trouble in 2007 and in the first half of 2008, they didn't imagine and didn't discuss the possibility that central banks might cease to function as lenders of last resort and would let a big bank go bankrupt. People do not imagine beforehand the unexpected events that surprise them, even though such unexpected events continue to occur.

This leads us to the last issue, namely expectation and surprise, which should be briefly discussed in light of Knight's, Keynes's and Shackle's ideas. We learn from them that expectations and surprises are inseparable. This fact has been widely neglected by standard economic theory. Surprises are not only events to which nobody can assign a probability, but they are events that no one can imagine. Surprises are unexpected events that play a crucial role in economic life because they destroy conventions and force people to change their expectations. Their role should be recognized and explored further. This is one of the important theoretical lessons we learn from the representatives of the line of economic thought that focuses on knowledge and uncertainty.

3.4 OUTLOOK

To conclude, we can draw some important lessons from the discussion above. Above all, we are concerned with lessons for economic theory, which was heavily criticized as the crisis evolved. Criticisms varied from

the argument that standard theory was unable to analyse and predict the crisis to the allegation that theory itself caused the turmoil. To provide an example of the last accusation, we turn to Akerlof and Shiller's (2009, p. 1) statement:

> What had people been thinking? Why did they not notice until real events – the collapse of banks, the loss of jobs, mortgage foreclosures – were already upon us? There is a simple answer. The public, the government, and most economists had been reassured by an economic theory that said that we were safe. It was all OK. Nothing dangerous could happen. But that theory was deficient.

Against the backdrop of such criticisms, the ideas of Knight, Keynes and Shackle experience a true revival. In their book *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*, the two star economists Akerlof and Shiller seized on Keynes's concept of confidence and non-rational motivation for action, suggesting that economics should open itself to psychology. They envision behavioural economics as the root of future developments in economic theory.

Though a detailed analysis of people's motives and beliefs is important, we would prefer not to relegate the ideas of Knight, Keynes and Shackle solely to the realm of psychology. The most important lesson from the above discussion should be that economics has to seriously confront the problem of imperfect knowledge (not imperfect information) and uncertainty. The financial crisis demonstrated clearly that standard economic theory could not meet high scientific standards in such a difficult situation because it neglected those important issues. Standard economic theory treats every economic situation as a situation of risk, and this has dire consequences, such as the facilitation of unjustifiable risk-taking and the failure to predict the crisis.

The line of economic thought represented by Knight, Keynes and Shackle draws attention to the genuine nature of every economic situation. Its major features – insufficient knowledge, true uncertainty, uniqueness and exposure to surprise – have to become the focus of mainstream economic theory. This line of thought provides us with new perspectives on the crucial topic of risk. Are the situations faced by markets daily truly 'risk'? If these situations are not risk, as Knight and Keynes suggest, then models that are based on numerical probabilities do not make sense. The obsession of modern science with risk measurement should be called into question and the role of financial models should be revised.

Undoubtedly, there is a tendency to pay more attention to these issues in light of the recent crisis. There is an evolving discussion about those issues; however, it obviously still takes place on the periphery, not in the heart of economic science. There is still no consistent research programme

that addresses these issues. From this perspective, the history of economic thought could be an important source of ideas on how to address the crucial questions that have still not been resolved by economic science.

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4. Financial crisis and risk measurement: the historical perspective and a new methodology

Gumersindo Ruiz and Ramón Trías

The revolutionary idea that defines the boundary between modern times and the past is the mastery of risk: the notion that the future is more than a whim of the gods and that men and women are not passive before nature. Until human beings discovered a way across that boundary, the future was a mirror of the past or the murky domain of oracles and soothsayers who held a monopoly over knowledge of anticipated events.
Peter L. Bernstein (1996, p. 1)

Slowly it began to dawn on me that what we faced was not so much risk as uncertainty.
Emanuel Derman (2004, p. 259)

4.1 RISK CONTROL IN FINANCE: A RECENT HISTORY

In his book: *Against the Gods: A Remarkable Story of Risk*, Peter L. Bernstein (1996) makes a thorough historical analysis of the concept of risk. He starts from the development of the laws of probability and the pretension of having statistical rules that permit the decision-making process, and arrives at the 20th century to make a distinction between risk and uncertainty, the former being valuable and measurable while the latter is not.

In economics, the concept of risk management as a practical technique, together with the use of statistical methods under certain theoretical assumptions, was introduced by Kenneth Arrow (1951, 1971) who was aware of the impossibility of predicting the future and its associated contingencies. Therefore, he developed a whole theory of diversification and insurance. The relevance of his thoughts lies in the fact that he considers the differences between the quantifiable and the non-quantifiable. That is why we regard him as a reference for global risk management