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Substituting risk for uncertainty

Where are the limits and how to face them?

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Substituting risk for uncertainty
Where are the limits and how to face them?

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Résumé

Dans un monde confronté à des changements globaux, historiques et complexes, la gestion de l'incertitude est devenue une préoccupation majeure pour les acteurs politiques et scientifiques. La question qui guide cet article conceptuel est donc la suivante : pouvons-nous anticiper l'avenir, et si oui, comment ? Nous examinons ainsi les possibilités d'anticiper l'avenir en convertissant des incertitudes indéfinies en risques supposément gérables. Pour ce faire, nous distinguons deux niveaux d'analyse dans le traitement de l'incertitude : l'épistémique de l'ontologique. Nous soutenons de ce fait qu'il existe à la fois des limites épistémiques et ontologiques dans la transformation de l'incertitude en risque. Cet argument s'appuie en particulier sur la distinction établie par Frank H. Knight (1921) entre risque et *vraie incertitude*. Mais contrairement à Knight qui se fie au jugement des experts pour surmonter les limites épistémiques, nous considérons que l'avenir ne peut être pleinement anticipé par la production continue de nouvelles connaissances. Néanmoins, nous affirmons que nous sommes mieux armés pour faire face à un avenir incertain grâce une coproduction de connaissances par un plus grand nombre d'acteurs. Les incertitudes découlant de la crise écologique actuelle sont mobilisées tout au long de l'article pour illustrer ces différents arguments.

Mots-clefs : crise écologique, Frank H. Knight, incertitude, pluralisation des connaissances, risque

Abstract

Dealing with uncertainty has become a matter of great concern of policy makers and scientific research in a world facing global, epochal and complex changes. Such call for a comprehensive understanding of the implications of uncertainties lead to the broader question of: can we anticipate the future, and if so, how? This conceptual paper explores the ability to anticipate the future by converting undefined uncertainties into manageable risks. To do so, we distinguish between epistemic and ontological level of analysis, to argue that there are both epistemic and ontological limits in the substitution of risk for uncertainty. We build in particular on the distinction drawn by Frank H. Knight (1921) between risk and *true uncertainty* to put forward such limits. Yet, in contrast to Knight who relies on expert judgment to overcome the epistemic limits, we suggest that the future cannot be fully anticipated through the production of new knowledge. Notwithstanding, we contend that we are better armed to face an unknown future with a co-production of knowledge by a larger range of actors. We illustrate our argument with the uncertainties arising from the current global ecological crisis.

Keywords: ecological crisis, Frank H. Knight, pluralisation of knowledge, risk, uncertainty

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Contents

Introduction

Understanding, calculating or 'taming' uncertainty has become a matter of great concern of policy makers and scientific research in a world facing global, epochal and complex changes. Against this background, a large range of scholarship rely on the assumption that uncertainty can somehow be transformed to known quantitative units of analysis. This is particularly true for environmental governance, with its attempt to develop complex knowledge infrastructures that reduce uncertainty as much as possible, in order to "generate, share, and maintain specific knowledge about the human and natural worlds" (Edwards, 2013, p. 17). Such a dominant mode of dealing with the future builds upon a specific instrumental rationality which attempts to respond to the systemic feature of risk in contemporary society (Beck, 1992). Indeed, capitalism has evolved in recent decades in such a way that risk "is now economically 'systemic, enveloping everyone'; and this is perhaps nowhere more apparent than in relation to nature and the risks ascribed to environmental transformation" (Levy, 2005; Christophers, 2018, pp. 331–332). Such a bid for a comprehensive understanding of the implications of risk and uncertainty lead to the broader question of: can we anticipate the future, and if so, how?

This paper explores how different approaches of relations between the economy, nature and society, conceive the possibility to anticipate the future by substituting risk for uncertainty. Risks are situations that can be defined with numbers, and in which future outcomes have known probabilities. In contrast, probabilities stay unknown in situations of uncertainty, so that uncertainty cannot be turned into a quantitative set of instances. A number of studies in mainstream economics have examined the characteristics of risk and/or uncertainty and disapprove such interpretation. While varying in many respects, mainstream economics sees the future as subject to a well-defined set of instances (Haavelmo, 1944; Friedman et al., 1948; Arrow, 1963; Akerlof, 1970; Reddy, 1996, p. 230). In this regard, the concept of uncertainty is often overlooked by this strand of scholarship in favour of risk. Heterodox economists scholars such as Dequech (2011) or Hodgson (2011, p. 160) note that the decline in the use of the concept of uncertainty, or in the distinction between risk and uncertainty, is mostly "related to the increasing mathematical formalization of economics, the particular emphasis on mathematical models that yield predictions". In a similar vein, Reddy (1996, p. 246) points out that "a view of uncertainty as calculable and probabilisable, in short as 'risk', gained favour in this century, as a result of the influence of the scientistic promise of calculation and control". For their part, heterodox approaches such as heterodox economics, economic sociology or international political economy (IPE) have doubts regarding the ability to turn anything at hand into a risk liable to being accounted in market terms (Callon et al., 2008; MacKenzie et al., 2008; Fourcade, 2011; Dequech, 2011; Katzenstein et al., 2018). Yet, by looking critically at how the world is made "more certain, controllable, and governable" (Deuchars, 2004, p. 2), they still often find ways to anticipate the future by substituting risk for uncertainty. In contrast, we argue that there are limits in the substitution of risk for uncertainty.

In order to understand such limits, we distinguish between epistemic and ontological levels of analysis. Davidson (1996) and Dequech (2004, p. 375) have also shown the "the strong entwinement of ontology and epistemology in the debate about uncertainty". Yet, they focused on the characteristics of uncertainty and not on the limits of its reduction into risk. Orléan (1987, p. 157) defines 'epistemic uncertainty' as a lack of rationality that links the anticipation of the future with the subjectivity of actors. Epistemic level of analysis thus relates to the production of knowledge and specialised expertise required to anticipate the future. At the ontological level of analysis, we focus on whether any kind of uncertain phenomenon that could occur in

the future world can be assessed in such a way as to make it less 'truly uncertain'. As Dequech points out, uncertainty is not only a matter of knowledge, but can also be "caused by, or described as, some properties of reality" (2004, p. 368). In our view, an ontological limit of substituting risk for uncertainty would exist if a distinct class of objects are defined as unfit for quantifiable probabilities and expectations about the future. In this case, the inability to turn uncertainty into a well-defined set of instances (or risk) is inferred from the nature of such and such real phenomena, rather than from the development of the apposite knowledge. It would be for instance the characteristics of complex ecosystems as such rather than modelling techniques that would put limits on risk management exercises related to biodiversity. We will see that existing theories diverge at both the epistemic and ontological levels of analysis when it comes to the ponder the limits in the substitution of risk for uncertainty.

We draw our argument from the theoretical framework of Frank H. Knight, an American economist from the 'old institutionalism' stream who lived between 1885 and 1970. He is remembered for the publication of *Risk, Uncertainty and Profit* in 1921. This book systematically distinguishes between risk, uncertainty, and true uncertainty in any attempt to make profits. The first two – risk and uncertainty – are subject to being numerically measured and anticipated with objective data. True uncertainty, for its part, cannot be turned into a calculus of statistical or probability measurement and cannot be fully objectified. Knight therefore contends that our capacity to grasp the future quantitatively is limited. He sees, however, ways to objectify the future using the specialised skills of entrepreneurs and experts (Knight, 1971, p. 223). In contrast to such a way to overcome the epistemic limit thanks to expert judgment, we suggest that the knowledge brought into play for anticipating the future will fail if not co-produced by a larger range of actors. Indeed, narrowing down uncertainty requires what Graz and Hauert (2019) call a "pluralisation of knowledge".

Figure 1: Substitution of risk for uncertainty

	No ontological limits	**Ontological limits**
No epistemic limits	Mainstream economics	Frank Knight
Epistemic limits	Heterodox approaches	Pluralisation of knowledge

The first section of the paper explores the limits – or their absence – in any attempt to substitute risk for uncertainty. To this end, we review the existing scholarship by distinguishing their epistemic and/or ontological stance regarding the existence of such limits (see the table above). We thus discuss the literature in mainstream economics, heterodox approaches, as well as Knight's legacy on the distinction between risk, uncertainty and true uncertainty. The second section examines how to face the previously identified limits. We draw on Knight's toolbox to reduce true uncertainty and suggest that the knowledge brought into play for anticipating the future is doomed to fail in case of true uncertainty. Against this background, we underline the need of a co-production of knowledge by a larger range of actors.

Where is the limit?

Mainstream economics

Is there no limit in the substitution of risk for uncertainty? This is what mainstream economics suggests, so much that the future can theoretically be fully anticipated. Through an "extraordinary faith in quantitative techniques" (Morgan, 1991, p. 1), mainstream economics sees no limits regarding the ontology of the marginal utility function enacted in the behaviour of rational individuals facing an uncertain future. Similarly, mainstream economics sees no epistemic limits in the possibility of economic theory to appraise individual preferences in such context by combining probabilistic calculus to marginal utility functions.

Mainstream economics often builds on utility-based methods to anticipate the future. As Skidelsky (2019) recently pointed out, such methods give "economics a unique predictive power, especially as the utilities can all be expressed and manipulated quantitatively". Expected-utility theory is an account of how to choose rationally in situation of uncertainty. It is based on the following basic motto: "choose the act with the highest expected utility" (Briggs, 2017). Expected-utility theory considers that there is no limit in the substitution of risk for uncertainty, since it rejects the "association between uncertainty and the absence of measurable probabilities" (Dequech, 2011, p. 625). This is precisely what suggests Von Neumann and Morgenstern (1944), who argue that all uncertainties can be transformed into well-defined objective risks. Expected-utility theory thus treats uncertainty as objective and probabilistic risk. In contrast, Savage theorem (1972) does not assume the existence of probabilities, but derive them from preferences. It leads Friedman and Savage (1948, p. 279) to argue that "an important class of reactions of individuals to risk can be rationalised by a rather simple extension of orthodox utility analysis". According to Savage theorem, risk is not objective anymore, but subjective. Dequech (2011, p. 625) points out that from the view point of a subjectivist, "the idea of objective probability does not make sense and all probabilities are subjective, by definition". Yet, both of these perspectives – subjective or objective risk – tend to the same conclusion: all uncertainties can in fact be reduced into risks.

Let's now see how environmental economists – a subfield of neoclassical economics established in the 1970s – apply these tools for reducing nature's related uncertainty. It is important, however, to take note of the distinction between 'environmental' and 'ecological' economics. The former – also called 'weak sustainability' – builds on mainstream concepts and notions to argue that the pursuit of economic growth remains possible despite environmental constraints, since so-called 'natural capital' – an extension of the economic notion of capital to natural resources – can be replaced by other forms of capital, such as human, technological or financial capital. The latter – 'strong sustainability' – considers the economic system as an open subsystem of the ecosphere. Such assumption leads ecological economics to point out the limited substitutability of 'critical natural capital' and the importance of its the long-term maintenance (Norgaard et al., 1998). Subsequently, we shall see that ecological economics differs in this regard, as it builds on interdisciplinary scholarship, including economic sociology, to set epistemic limits to the substitution of risk for uncertainty.

Environmental economists recognise that "ecosystems are so complex that people have a hard time figuring out exactly what they are, let alone working out their economic value" (Heide et al., 2018, pp. 210–211). Yet, they always find ways to reduce such complexity by quantifying it. Indeed, the application of economic theory to nature is based on the attribution of a price, an economic value on nature according

to the following motto: "we don't protect what we don't value" (Myers et al., 1997). Against this background, and in the absence of proper market for so-called 'environmental goods and services', different valuation techniques have been developed. They can rely on market proxies based on observed market behaviour (revealed preference), such as the so-called 'travel cost method' or 'hedonic price method'. Yet, these cannot calculate the uncertain 'non-use value' of nature, i.e. the "value of the environmental resource to the public at large that does not actively make use of the resource" (Maas et al., 2017, p. 318). This is the case of contingent valuation methods (stated preference) based on survey, in which "individuals are directly asked about their preferences" (Heide et al., 2018, p. 220) for environmental goods or services. These two methods – stated and revealed preference – are both based on the utility-based models mentioned above. The marginal utility function is used to determine a subjective price on uncertainty and transform it into measurable risk. Such a transformation is made possible because "economists presume that consumers use the concept of utility to compare all possible things that they can experience with one another" (Heide et al., 2018, p. 247). Against this background, mainstream economists often claim that every kind of situation can be rationally analysed and solved.

These valuation calculus allow for instance to put a price tag on 'environmental externalities', what Coase (1960, p. 1) defined as "actions of business firms which have harmful effects on others". Environmental externalities are thus "impacts arising from the activities of an entity that are borne by others and do not feedback directly into short-term financial consequences for the entity" (Unerman et al., 2018, p. 498). Environmental externalities can be positive or negative depending of the benefits enjoyed or the costs suffered by a third-party as a result of economic activities (Hussen, 2000). Pigou (1920, p. 159) was the first to explain why and how "disservices to other persons" are not compensated "on behalf of the injured parties". He thus clearly introduced "the distinction between private and social marginal costs and benefits as well as the concept of external effects" (Sandelin et al., 2008, p. 56). While studies differ regarding the ability of the market as such to internalise externalities, Coase's method (1960, p. 40) is still the most influential among mainstream economists. Coase considers externality as a private issue, which concerns only those economic actors who are directly involved in the transaction. In this regard, Coase's method suggests that externalities are the result of a property rights failure so that the optimal level of pollution can be achieved by an arbitrary assignment of property rights to either the polluter or the pollute.

Dealing with environmental externalities supports economic actors to decide how much and more importantly when they have the greatest financial interest to reduce (or internalise) these environmental impacts, so that the investment is the most profitable or cost-effective. Against this background, environmental cost-benefit analysis implies present known costs for unknown future benefits. In the wake of Arrow (2013), this requires putting a present value on costs and benefits occurring in the future. This relates to the much-debated question of the discount rate, which has, as Groom and his colleagues (2005, p. 445) point out, "always occupied an important place in environmental politics and economics". At the microeconomic level, it reflects the degree to which we prefer present benefits (money today) over future benefits (money in the future), what is commonly known as 'revealed time preference'. Such a preference needs to be connected with the 'opportunity cost', i.e., "how much an investment pays relative to other uses of the same resources" (Roberts, 2012).

In quite the same way, putting a price tag on nature helps to compare future benefits (or costs) against any action that an organization may take in the present. This means that these future costs and benefits have to be converted into a net present value. Such particular feature of uncertainty reduction in environmental economics

has been popularised by William Nordhaus, laureate of the 2018 Nobel Memorial Prize in Economic Sciences. Nordhaus underlines that the key issue of environmental economics is "how to balance costs and benefits of global emissions reductions" (2007, p. 30). His calculations estimate how much the present generation should invest in limiting climate change. Many tools are available to economists to compare costs between different space and time. Every monetary assessment of nature makes such anticipations, but the discount rate can vary greatly, and, at the same time, the vision of the future in relation to the present. While life cycle assessment studies use a constant discount rate of 0% and thus value future generations equally to the present, environmental economists generally use a positive figure: they value the present more than the future[2]. This implicitly means that we should not reduce our environmental impacts too quickly, because the costs will be higher if we invest today than in the future (Hickel, 2018).

To sum up, mainstream economics – including its subfield of environmental economics – takes into account neither epistemic nor ontological limits when discussing the ability of economic actors to substitute risks for uncertainty. A variety of tools based on price mechanisms support the substitution of risk for uncertainty, which often leads mainstream economics scholars to just "use the terms risk and uncertainty interchangeably" (Reddy, 1996, p. 230). Now that we have seen how mainstream economics literature is approaching the questions of risk and uncertainty, we do the same for heterodox approaches.

Heterodox approaches

We now continue with scholarship in heterodox economics, IPE and economic sociology of risk and uncertainty. Such strand of scholarship assumes to work with the concept of uncertainty in mind (Dequech, 2011), and is critical of the lack of epistemic limits. However, we argue that it often recognises no ontological limit in the substitution of risk for uncertainty.

From an IPE perspective, the question of risk reflects a particular power relationship between political and economic spheres across borders. As Deuchars (2004, p. 2016) points out, "risk is deeply implicated in how power is manifested in the world". A good starting case is provided by Nelson and Katzenstein's analysis of the 2008 financial crisis (2014). In their view, finance lies in the world of uncertainty rather than risk, as economics, calculative practices and standards cannot foresee disasters. However, they argue that actors can still rely on social conventions to take their decisions, thus substituting risk for uncertainty. Katzenstein and Seybert (2018) rely on the concept of 'protean power' to respond to situations marked by uncertainty, which is not something that social actors possess, but rather something the emerges in a world of uncertainty and possibility. For his part, Kessler (2008, p. 4) draws on Luhmann to examine how institutions "not only reduce but also reproduce uncertainty", leading to open-ended futures that make a "plurality of possible worlds" possible (2008, p. 17). Aradau and van Munster (2012) explore uncertainty through the lens of potential catastrophic events. Since such events cannot always be prevented, actors create new modes of knowledge and styles of reasoning to reduce uncertainty. Putting a great emphasis on the role of imagination and aesthetic sensorial experience, they still consider that modes of knowledge and practices can "act on an event that cannot be known" (2012, p. 2).

[2] Costanza and his colleagues did the first global monetary assessment of nature's value, i.e., ecosystem services: "the benefits human populations derive, directly or indirectly, from ecosystem functions" (Costanza et al., 1997, p. 253). The choice to fix the discount rate at 5% in order to convert stock values into annual flows was crucial to reach the final figure of US$33 trillion/year. This is slightly more than Nordhaus' average 4.3% used in his modeling (Goulder et al., 2012, p. 13).

Scholars in both IPE and sociology often draw on Foucault to consider risk as a particular instrument of governmentality, therefore examining the performativity of discourses and the intrinsic dialectics between power and knowledge. With a particular focus on the role of insurance as securing so-called "liberal forms of life", Lobo-Guerrero emphasises the importance of the "strategisation of time", an abstraction process which "projects into a future the technological reality of the model fabricating the uncertainties of their own scheme" (2014, p. 366). From his point of view, knowledge on temporality allows pushing "the limits of insurability" (2014, p. 356) by elaboration of predictive models. In the same vein, Ericson and his colleagues view uncertainty as an object of governance insofar as "private insurance has come to constitute a vast behind-the-scenes system of informal governance" (2003, p. 226). Many other scholars have written about risks as a technology of power to improve crime prevention (O'Malley, 1992, 2003, 2008), as a way to settle down the welfare state (Ewald, 1986, 1996) or as an instrument to govern environmental risk (Gouldson et al., 2007). According to Foucauldian approaches, all risks are likely to be governed – and thus anticipated. By describing such technologies, they see no ontological limit, or at least do not specifically analyse the ontological limit of economic actors to substitute risk for uncertainty.

Similarly, a large amount of risk management studies focus on the ability to control all uncertainties, what Kaplan and Mikes (2012, p. 11) value as strategies for "managing the uncontrollable". While Power (2004, p. 767, 2015, p. 50) sees this as myth, as radical uncertainty is here to remain, he still explains how valuation practices can transform "an abstract 'matter of concern' to a matter of (organizational) fact" through three key moments: "counting, control, calculation". Similarly, studies in economic sociology and social studies of science and technology do not see any ontological limits in the ability of economic actors to substitute risk for uncertainty. They focus on how valuation arises from calculative practices such as commensuration (Espeland et al., 1998) ranking (Sauder et al., 2009) and classification (Stinchcombe, 2001). For instance, Espeland and Stevens have emphasised the importance of commensuration as a social process; the transformation of "qualities into quantities, difference into magnitude" (1998, p. 315); and the comparison with a "third thing, a metric" (1998, p. 317). In describing standards as "recipes for reality", Busch (2011, p. 189) shows the importance of standards in such commensuration methodologies to differentiate adequately – what he refers to as "standardised differentiation". In the field of international development, Bracking and her colleagues (2019, p. x) explore the calculative rationality underpinning these valuation and related risk management practices, especially how these instruments incorporate "evermore entities into socially articulated markets and spaces".

Regarding nature's valuation as such, Fourcade has examined in a prominent study on claims to compensation from damages resulting from large oil spills in the United States and in Europe not just how "something that stands normally outside market exchange comes to be attributed an economic (monetary) value" (1723); she also showed how such monetisation of nature significantly differed according to the distinct sociocultural environments on both sides of the Atlantic. In this view, it is not the economic valuation of nature as such which might face limits; it remains, however, heavily dependent on "evaluative frames and judgments [and] specific politico-institutional configurations and conflicts" (2011, p. 1769). Similarly, Maas and Svorenčík explored how the cost estimation of the Exxon Valdez oil spill created methodological struggles between consultants and experts. However, they still rely on quantitative valuation methods to describe such reality. This need to evaluate environmental values for which there is no proper market relates to what Dempsey describes as "liberal environmentalism". It aims at reducing environmental uncertainty by "enterprising nature", that is to deal with the conservation of

biodiversity in a way that is "entirely compatible with current, predominantly capitalist, global political-economic relations", i.e. through markets (2016, p. 3). Similarly, Chiapello provides a critical analysis of the financialisation of valuation as a specific form of calculation. Here again, she explains how such mechanism is made possible through "conventions used in order to pluralise the idea of economic quantification or monetary measurement" (2015, p. 14). Such analysis is based on the extensive work of Desrosières about the historical sociology of quantification. Desrosières points out that any quantification (and objectivisation) effort involves a (political) choice – an equivalence convention – since quantifying is to agree, then to measure (2008, p. 10).

German social theory has perhaps been the most forward-looking on the concept of risk. Beckert (2016) recently explored the impact of imagined futures on the dynamics of capitalism – what is called the 'sociology of expectations'. Luhmann's 'system theory' also includes significant developments on the construction of risks and threats (Luhmann, 1986). In this regard, social systems are viewed as having increasingly internalised complex external threats as risks to be dealt with systematically – this is what Luhmann calls the "security of expectation" (Luhmann, 2013, p. 78). However, complexity theory just as complexity reduction always produces another layer of uncertainty. For his part, Beck (1992) drew on Luhmann to develop his analysis of risk society. He argues that risk has become the defining feature of late modernity, since "modern society has become a risk society in the sense that it is increasingly occupied with debating, preventing and managing risks that it itself has produced" (2006, p. 332). His definition of risk emphasises the importance of time, reversing "the relationship of past, present and future" (Beck, 2000, p. 214). However, as Aradau and von Munster (2012, p. 21) point out, Beck confuses risk and uncertainty, leaving the latter aside, since "uncertainty is merely the residual of risk, the incalculable leftover of risk management"[3]. Such residual risk arising from the previous transformation means that Beck considers the existence of epistemic but also ontological limits. Beck's concept recognises that the transformation of uncertainty into risk is complete, but that new uncertainties are produced during the conversion: the creation of another layer of uncertainty. In contrast, we argue that such conversion is not complete, and that something is purely 'left out'.

Finally, scholarship in IPE and sociology thus provides a critical analysis of the ability of the economic actors to anticipate the future by substituting risk for uncertainty. While they provide a good appraisal of the epistemic limit of substituting risk for uncertainty, they fall short, however, on explaining the ontological limit, i.e. the conditions under which an uncertain phenomenon can or cannot be turned into an objectified set of instances. We consider that both epistemic and ontological limits in the substitution of risk for uncertainty should be more explicitly conceptualised. In order to appraise such ontological limit, we build on Frank H. Knight's study on *Risk, Uncertainty and Profit* (1921).[4]

The ontological limit of Frank H. Knight

Frank Hyneman Knight and John Maynard Keynes both published in 1921 a book exploring the links between calculability and knowledge production on the one hand, and risk and uncertainty on the other: *A Treatise on Probabilities* for Keynes; *Risk,*

[3] In the same vein, Ericson points out that "Beck should have called it the uncertain society because his focus is on potential and actual scientific and technological disasters that have proven unpredictable and entail immeasurable human suffering" (Ericson, 2005, p. 660).

[4] While Knight sees ontological limits in the substitution of risk for uncertainty, he does not fully consider the significance of epistemic limits.

Uncertainty and Profit for Knight. Both books have been identified as a landmark analysis in the distinction between risk and uncertainty. As pointed out by Shackle, another key figure in the conceptualisation of risk and uncertainty (1967, p. 6):"uncertainty was the new strand placed gleamingly in the skein of economic ideas in the 1930s". In a famous article in the *Quarterly Journal of Economics*, Keynes provided a simple definition of uncertainty: "a matter for which there is no scientific basis on which to form any calculable probability whatever. We simply do not know" (1937, pp. 213–214).[5] Best (2008, p. 364) underlines that both Knight and Keynes "saw economic decision making as based on conventional rather than perfectly rational thinking". Despite their similarities, Knight's radical distinction between risk and uncertainty allows us to better grasp and understand the ontological limit we are looking for. Indeed, Keynes' reasoning is not based on the importance of knowledge, but on the "intersubjective nature of economic activity" (Best, 2008, p. 364) through the role played by social conventions. In contrast, Knight develops a technical toolbox to find ways of managing part of the 'true uncertainty' in a non-quantified way. We build thus on Knight to further develop our argument regarding the pluralisation of knowledge. Overall, Knight gives us a detailed spectrum of the different forms of risk and uncertainty, which helps to situate the ontological limit of uncertainty reduction.

Knight explores how profit is generated in different situations of "partial knowledge" (1971, p. 199), developing various categories to secure "better knowledge of and control over the future" (1971, p. 260). These categories are represented in his well-known triptych: a priori probability, statistical probability and estimates of probability. However, Knight also raises the fuggy boundary between these three categories, especially between statistical probability and estimates of probability (uncertainty), for which the divergence "is a matter of degree only" (1971, p. 225). A priori probability is used in a situation of entire rationality close to laboratory conditions, in which alternatives are homogeneously classified. Knight gives the example of six faces dice and the results of potential throwing. As he points out, this kind of probability is the easiest to solve, but is also very rare (especially in business): "we hardly find in practice really homogeneous classifications (in the sense in which mathematical probability implies, as in the case of successive throws of a perfect die)" (1971, p. 246). A priori probability is thus useless for our analysis, as we explore how economic actors face an uncertain future. Statistical probability aims at objectifying a more uncertain situation, yet still considered by Knight to be a risk. It differs from a priori probability according to "the accuracy of classification of the instances grouped together" (1971, p. 217), i.e. heterogeneity versus homogeneity. Statistical probability can only be computed empirically (1971, p. 224), and not, as a priori probability, on general principles (1971, p. 224).[6] The next level of this triptych – estimates of probability – is an uncertainty, in which there is "no valid basis of any kind for classifying instances" (1971, p. 225). Yet, this situation can still be managed and transformed into statistical probabilities with the help of 'estimates' of probability. It requires estimating "the given factors in a situation and also estimate the probability that any particular consequence will follow from any of them if present in the degree assumed" (1971, p. 214).

[5] The whole quote is the following: "By 'uncertain' knowledge [...] I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; nor is the prospect of a Victory bond being drawn. Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which 1am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth-owners in the social system in 1970. About these matters, there is no scientific basis on which to form any calculable probability whatever. We simply do not know" (Keynes, 1937, pp. 213–214).

[6] According to Runde (1998, p. 540), statistical probability is an "empirical evaluation of the frequency of association between predicates, not analysable into varying combinations of equally probable alternatives".

However, the core the analysis driving towards an ontological limit lies in the difference between uncertainty and true uncertainty. While uncertainty can still be transformed into quantitative risk, this is no longer the case for true uncertainty that cannot be dealt quantitatively. Coming back to the initial aim of his book – the origin of profit – Knight underlines that business decisions "deal with situations which are far too unique, generally speaking, for any sort of statistical tabulation to have any value for guidance. The conception of an objectively measurable probability or chance is simply inapplicable" (1971, p. 231). The entrepreneur, or what Knight also calls the "adventurer" (1971, p. 237), often deals with situations of true uncertainty that distance themselves from quantitative reasoning and appeal to "judgment", "common sense", or "intuition" (1971, p. 211). Knight thus sets an ontological limit in the substitution of risk for uncertainty. Yet, he still recognises the ability of judgment to reduce part of it.

We now examine how to face the previously identified limits by drawing on Knight's toolbox to reduce true uncertainty. We then make the argument that the knowledge brought into play for anticipating the future is doomed to fail in case of true uncertainty. Against this background, we underline the need of a co-production of knowledge by a larger range of actors.

How to face the limit?

Dealing with Knightian true uncertainties

Knight's toolbox to deal with true uncertainty puts forward "the difference in individuals in relation to uncertainty [then leading] […] to a tendency to specialise the function of meeting it in the hands of certain individuals and classes" (1971, p. 244). Such core argument of Knight's book means that some individuals predict better than others (1971, p. 241). Each individual has different capacities by perception and inference to form future correct judgments; to judge means, discern, plan steps and adjust if necessary (1971, pp. 241–243). In this regard, Knight distinguishes between "objective probability" and "subjective probability", and considers that both can exist at the same time in spite of the limits to men's deliberations. Most decisions are made on the basis of an opinion of a probability, often resulting from both the subjective and objective type, "so that the degree of felt uncertainty is a product of two probability ratios" (1971, p. 237). He points out that capacities of prediction vary between their accuracy; their promptness – speed; time range (to which conduct is or may be adjusted) and space range, in other terms the capacity of action. All of the above has been stated to help us take into consideration that there is "differences in the men themselves or differences in their position in relation to the problem" (1971, p. 239).

We can now explore in more detail what we consider as a 'two-in-one method' to reduce true uncertainty, which is "based respectively upon reduction by grouping and upon selection of men to bear it, consolidation (i.e. grouping) and specialisation, respectively" (1971, p. 239). First, consolidation or grouping consists of classifying past events, which is made and born by experts. Even in complete absence of data, this can create more knowledge and reduce a part of uncertainty. Mostly used in insurance, it deals "with groups of cases instead of individual cases" (Knight, 1971, p. 245). The Knightian grouping, to our understanding, is dealt by experts mandated by the entrepreneur. However, the business man (who is outside the process) remains the one who takes decisions, since he has judgment, past experience knowledge or 'gut feeling'. The Knightian entrepreneur by borrowing money has to

deal with other investors' views and experiences, thus, creating more knowledge and obtaining better results than what he would have done otherwise. Nevertheless, through what Knight calls "diffusion" and the "law of big numbers", i.e. the result of a businessman's borrowing money, the entrepreneur "extends the scope of his exercise of judgment over a greater number of decisions or estimates". There is thus "a greater probability that bad guesses will be offset by good ones and that a degree of constancy and dependability in the total results will be achieved" (1971, p. 252). Second, the specialisation method relates to one's judgment capacity and through the action of speculation. One of the most fundamental effects is "its conversion into a measured risk or elimination by grouping which is implied in [specialisation]" (1971, p. 256). This is indeed a 'two-in-one method', since "specialisation implies concentration, and concentration involves consolidation [grouping]; and no matter how heterogeneous 'the cases' the gains and losses neutralise each other in the aggregate to an extent increasing as the number of cases thrown together" (1971, p. 256). The role of experts in the field and the ability of judgment of entrepreneurs (even though not equal in all beings) are thus fundamental in Knight's method.

To summarise, Knight considers that there is no limit in the ability to produce the knowledge required to substitute risk for uncertainty. However, such knowledge stays in the hands of few people, a form of elite able to anticipate the future thanks to good judgement. It remains now to discuss that reducing uncertainties is not limited to what Knight suggests in his two-in-one method. This is what we mean when arguing that we are better armed to face an unknown future thanks to pluralisation of knowledge.

Beyond Knightian expertise: Pluralisation of knowledge

To reduce true uncertainty non-quantitively, Knight puts forward the activity of "production and sale of information", which is close to the modern definition of expertise: "a codified knowledge produced by specialist, and that is generally assumed to require skills and experience not possessed by professional administrators" (Littoz-Monnet, 2017, p. 2). Littoz-Monnet points out that the objective of expertise is to put in place policies that are "evidence based", "rational" and "neutral", while Knight explains that expertise "consists essentially of the sale of guidance" (1971, p. 262). Although he is sceptical of the "rapid growth" of this industry, since these "experts and consultants" mandated by the entrepreneur "do not stop at diagnosis; in addition they prescribe" (1971, p. 262), he also acknowledges that they "do a useful work in forcing the intelligent, critical consideration of business problems instead of a blind following of tradition or the use of guesswork methods" (1971, p. 263).

International Relations (IR) and IPE scholarships have discussed at length the authority of science, expertise and knowledge in the contemporary world order. More than 25 years ago, Haas (1992) coined the concept of 'epistemic communities' to shed light on the transnational power of expertise in a particular domain. It is worth noting that, still today, Haas considers that the knowledge produced within the confines of a disciplinary field is the most likely to produce the expected outcome of an epistemic community: "panels with expertise based on disciplinary credentials proved more influential than those with more open-ended experts from civil society" (2017, p. 62). While the 'Delphi method'[7] also makes the assumption that "several heads are better than one in making subjective conjectures about the future", it still acknowledges the superior role of experts, who are able to "make conjectures based

[7] It is a method developed by the RAND corporation in the 1950s to "forecast the impact of technology on warfare" https://www.rand.org/topics/delphi-method.html

upon rational judgement rather than merely guessing" (Weaver, 1971, p. 268). Therefore, both the concept of epistemic communities and the Delphi method replicate the difficulties regarding Knight's true uncertainty confined to a specialisation within the hand of entrepreneurs, elites and experts.

A large range of tools are currently developed to reduce the uncertainty of the ecological crisis. Again, their aim is to exceed both the ontological and epistemic limits discussed above. One of these tools is 'natural capital accounting methodologies', which aim at assigning a book value to nature. It allows – as seen above – to undertake an environmental cost-benefit analysis, and to put an economic value on a future (environmental) situation. Yet, these methodologies developed among others by the Big Four accounting firms (Deloitte, Ernst & Young, KPMG and PricewaterhouseCoopers), The International Organization for Standardization or the Natural Capital Coalition, always build on the work of experts, consultants and entrepreneurs, sharing a "common vision of a world where business conserves and enhances natural capital" (Natural Capital Coalition, 2016, p. 12). The same is true for a large range of other arenas developing quantitative tools to reduce ecological uncertainties into manageable risks. Again, we have doubt regarding the ability of a small group of experts to anticipate the future by quantitively substituting risk for uncertainty.

In contrast, we build on Science and Technology Studies (STS) that point out the co-production of science and society, while acknowledging the power of science as a mean of control over the material world (Latour, 1993; Jasanoff, 2004; Pestre, 2013, p. 7). Such recognition of scientific knowledge as inevitably and deeply political has been taken on board by the "practice turn" in IR (Best et al., 2013; Bueger, 2013; Cornut, 2015). As Jasanoff suggests, scientific knowledge is embedded in "social practices, identities, norms, conventions, discourses, instruments and institutions" (2004, p. 3). Under the apparent technicality of the subject and the 'neutrality of science', decisions of experts escape democratic debate although they engage our common future. Latour (2008) has conceptualised such a gap between science and politics, asking "to bring the sciences into democracy". Callon and his co-authors (2011, p. 18) proposed the concept of "hybrid forums" to resolve situation of scientific controversies, i.e., "open spaces where groups can come together to discuss technical options involving the collective".

According to Graz and Hauert (2019, p. 178), pluralisation of knowledge reflects such a need "to reach out to a broader pool on an ad-hoc basis" in order to "look for cognitive resources on a much more heterogeneous basis". Yet, in contrast to Callon and his co-authors focused on regime of controversies, pluralisation of knowledge provides "insights for an in-depth understanding of the co-production of socio-technical knowledge" (Graz et al., 2019, p. 172). Our purpose is to suggest that pluralisation of knowledge can recognise both the epistemic and ontological limits discussed above, while helping to make better and more inclusive decisions in situation of uncertainty. Indeed, asking for the most heterogeneous basis of knowledge means that such a group of people will never be 'complete', so that an epistemic limit is inevitable. The ontological limit is also illustrated in a hybrid forum made up of people who do not share – as experts and especially economists – the powerful role of models and quantitative tools to anticipate the future. Therefore, a better anticipation of the future necessitates to be open to other forms of knowledge on the one hand, and to innovative and potentially non-quantitative methodological tools and policy options on the other.

A good case in point regarding such pluralisation was already discussed more than twenty years ago by Funtowicz and Ravetz. They studied the democratisation of knowledge for a proper understanding of songbirds' contribution to nature – what they call a "postnormal science" – that would be worthless without "an extension of

the peer community for quality assurance" (1994, p. 198). International initiatives, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[8], recently claims to include a larger range of actors for efficient biodiversity assessment and related valuation (Vadrot, 2014). Its reports especially recognise the diversity of nature's values on the one hand – including non-quantitative valuation – and the plurality of forms of knowledge on the other, including "governments, civil society organizations, and indigenous people and local communities" (IPBES, 2018, p. 30). The United Nations International Strategy for Disaster Reduction (UNISDR) was one of the first to recognise the importance of local knowledge in disaster reduction policy. This "world of natural disaster reduction" has emphasised the importance of "sensorial measures", described as "traditional secular knowledge" (Revet, 2018, p. 125). In one of their report of 2008, they underline that "indigenous knowledge contributes not only to the success of intervention, but more importantly to its sustainability in the longer term" (UNISDR, 2008, p. 3). Yet, a gap remains between the discourse (or even the will), and the practice regarding the inclusion of indigenous, local – or simply a more heterogenous – knowledge into 'mainstream science'. Literature shows that the IPBES failed "to find ways of dealing with contrasting rationalists, diverging ontologies and different criteria for knowledge validation" (Dunkley et al., 2018, p. 794). Many challenges therefore remain regarding a proper pluralisation of knowledge recognizing both the epistemic and ontological limit in any attempt to substitute risk for uncertainty.

Conclusion

This paper has examined the distinction between risk and uncertainty and rests on two interrelated arguments. First, we contend that the substitution of risk for uncertainty faces limits. To this end, we reviewed how different approaches of relations between the economy, nature and society, conceive such possibility to anticipate the future, by distinguishing between epistemic and ontological levels of analysis. While mainstream economics sees neither epistemic, nor ontological limits in substituting risk for uncertainty, heterodox approaches including IPE, heterodox economics and economic sociology question such lack of epistemic limit, while remaining often trapped in a 'no limit ontology'. We have drawn on Frank H. Knight's concept of *true uncertainty* to suggest that there are also ontological limits in the substitution of risk for uncertainty. Yet, this conceptual paper has not provided an analysis of concrete applications of such limits in the substitution of risk for uncertainty to the ecological crisis. Yet, we follow Heide and her colleague (2018, p. 212) who argue that by expressing nature in terms of one dimension, e.g., money, "it is virtually impossible to represent the complexity of natural processes, which often exhibit non-linear behaviour that is difficult to predict". A good case in point has been made by the environmentalist Norman Myers describing more than 25 years ago "unknown problems in the environmental field" as the "unknown unknowns" (1993, 1995, p. 358). Therefore, substituting ecological risk for uncertainty is about abstraction and reduction. In a similar vein, Innes (2019) points out that "in the real world the parameters of the global political economy are being changed every day by the accelerating ecological crisis. This is not a world of calculable risk in a closed system, but of radical uncertainty in an evolving system that depends wholly on the biosphere". From there, it may be interesting to empirically explore the status of what is 'left out' in the substitution of risk for uncertainty. Indeed, the valuation of

[8] The official aim of the IPBES is to "provide Governments, the private sector, and civil society with scientifically credible and independent up-to-date assessments of available knowledge to make informed decisions at the local, regional and international levels" (IPBES, 2018, p. 4).

nature and related uncertainty reduction inevitably leaves out some values while retaining other. The question would then be which values are lost in such substitution.

Second, we have shown various ways to face such limits. While Knight acknowledges the role of expert knowledge in the ability of entrepreneurs to reduce such uncertainty and, eventually, make profits, we have argued that we are better armed to face uncertainties such as the yet unknown impacts of the ecological crisis thanks to the co-production of knowledge by a larger range of actors. Again, this conceptual paper has not provided an analysis of concrete applications of a proper pluralisation of knowledge. This leads us to consider three other dimensions for future research. First, it is important to explore the power relations within these platforms or organisations such as the IPBES, conflicting actors and forms of knowledge put into play. Second, it may be interesting to provide further emphasis on the role of indigenous and traditional knowledge in uncertainty reduction. Third, the growing importance of 'citizens science', united under the slogan "Science for the People" can also extend the scope of the pluralisation of knowledge (Irwin, 1995).

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