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Processing uncertainty: Evolving beliefs, fallible theories, rationalizations and the origins of macroeconomic crises



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**PROCESSING UNCERTAINTY: EVOLVING BELIEFS,
FALLIBLE THEORIES, RATIONALIZATIONS
AND THE ORIGINS OF MACROECONOMIC CRISES**

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The macroeconomic crisis of the last decade reopened questions about how economic agents define plans and expectations. The crisis triggered widespread, yet ongoing revisions of the beliefs entertained by agents and economists. The decision errors that result in crises do not necessarily derive from behavioral biases: often, those choices were rationalized with reference to established conventional wisdom, backed by economic theories influential at the respective times. Thus, understanding such socially relevant events requires addressing concretely how people build decision scenarios in changing environments, and how those interact with the evolution of prevalent economic analysis. A revision of Keynes' work on uncertainty, especially his notion of "weight of evidence", can help in this respect. In this paper we analyze some central informational elements of macro crises, discuss weaknesses of the standard analyses which try to accommodate critical phenomena into the rational expectations framework, and comment on ways to move ahead.

JEL classification codes: A11, B31, D8, G01

Key words: uncertainty, weight of evidence, financial crises, rationalizations

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I. Introduction

In macroeconomic crises, agents face large-scale destructions in perceived wealth. The wide shifts in the prevailing evaluations of the sustainable levels and growth prospects of the economies in question point to the deep uncertainty surrounding historical, irreversible, system-wide processes such as those that determine the pace and configuration of economic development. Such episodes bring vividly to mind Keynes's arguments (1936, especially Chapter 12) on the highly fallible and potentially variable nature of economic forecasts. The analysis of crises must consider how agents deal in practice with the evolution of their environments in order to form their anticipations and plan their actions, and what makes these develop in a way that ends in a deeply undesirable state. An economist studying macro crises must act in some way as an "applied epistemologist" (or an historian of practical economic thought), who analyses the nature of the working models that agents use to carry out their economic activities, their implications for actual behaviors, and the evolution of beliefs as a response to the performance that the agents themselves generate collectively.

A segment of the macroeconomic literature has recognized the pertinence of modeling uncertainty and learning effects (see, for example, Sargent 1993, 2001, Evans and Honkapohja 2001, Hansen and Sargent 2001, Cho and Kasa 2015). But, even if it is an ambiguous concept (as discussed below), the Rational Expectations (RE) notion has continued to rule the field for several decades; in whatever guise, "it makes agents' expectations disappear as objects to be specified by the model builder or to be estimated by the econometrician". Instead, "they are equilibrium outcomes" (Sargent 2008). However, as an observed fact, macroeconomic crises trigger intense activities of searching for lessons to be drawn from the experience, both on the part of analysts and economic agents. Thus, in practice, those events challenge previously held views about the functioning of the economies. Macroeconomic crises and RE are incompatible, despite the effort that has been put in trying to reconcile them.

The analysis of phenomena that involve centrally the breakdown of economic promises requires dealing with the ways agents form in practice their plans about the future, and how these turn out to be frustrated. Keynes insisted strongly on the precarious nature of long-term expectations: "about these matters there is no scientific basis to form any calculable probability whatever. We simply do not know" (Keynes 1937: 214; see also 1936: Chapter 12, IV). Thus, the matter of analytical interest is not only how people evaluate the chances of different outcomes, but also how solid they perceive that evaluation to be. Actual decision-makers and analysts alike may be more

or less confident on the working models they use to make interpretations and forecasts. Keynes used the concept of “weight of evidence” to address this issue.

The weight of evidence as perceived by economic actors can depend on the views or pronouncements of agents recognized as experts. At this point, the perspectives of the economic analyst and the economic agent come into contact. The expectations that are disappointed in a crisis need not have been purely impulsive, or predicated on eccentric views of the world. It is often observed that anticipations of sustainability of the economic paths that eventually lead to a crisis have been supported, and rationalized, by influential, sober opinions, using arguments that do not contradict the professional common sense of the times. These arguments are likely to play a non-trivial role in the development of macroeconomic bubbles by promoting the presumption that the boom rests on solid fundamental bases: their emergence and demise do not simply count as a matter of record, but they form a relevant part of the actual economic processes that result in crises.

We propose in this paper to work on these ideas as tools to use in the analysis of economic crises, at certain points extending and developing themes that we addressed in Crespo et al. (2010 and 2013). The next section (II) presents a brief characterization of macroeconomic crises as phenomena intrinsically associated with income and wealth misperceptions. In the following section (III) we discuss issues of consistency of the RE assumption, and the way in which it is typically implemented in macroeconomics; in this connection, we point out in particular that “model-consistency” as commonly understood in the literature ignores the dynamics that modify over time the analytical constructs widely accepted as relevant, and their potential implications for expectations formation. Taking as a given the mutability of the economic arguments that influence actual decisions, section IV uses Keynes’ analysis of probability and the weight of evidence to discuss epistemic problems implicit in the concrete activities of economic agents forming a representation of their environments: On that basis, section V considers aspects of learning in macroeconomic contexts, with particular reference to the international crisis in the late 2000’s. Section VI concludes.

II. Macroeconomic crises: great expectations and hard times

A. A heterogeneous but recognizable set of events

There is a distinctive class of macroeconomic perturbations characterized by deep or prolonged falls in real activity, and by disturbances in credit markets such that

the repayment of large masses of debt obligations is put into question. The family includes a sizable list of past historical episodes and, in recent decades, instances like the Latin American crises of the early 1980's which led to the region's "lost decade" and to protracted processes of sovereign debt renegotiation, the disruptions of the late 1990's in previously fast-growing Asian economies, or the Great Recession of the 2000's originated in the North Atlantic world economic centers, showing that rich, sophisticated economies are not immune to such shocks and, in their own way, share the vulnerability with "emerging markets".

With such a diversity of times and places, the members of the set must understandably form a heterogeneous collection. In fact, the existence of highly similar crises would appear as a contradiction in terms, symptomatically manifested in the expression "this time is different" that Reinhart and Rogoff (2009) used as a motto in their study of a collection of cases (see also Stiglitz and Heymann 2014). At the same time, crises are typically identifiable as such by analysts and agents. There seems to be little difficulty in agreeing on the inclusion of the episodes listed above within a larger group of macroeconomic crises, and in finding interest, from theoretical and practical perspectives, in studying them, individually and as a class. The tension between focusing on the idiosyncrasies of each case or the commonalities among them often emerges for agents trying to understand their environment and project future conditions in order to determine behavior. It is also present in analytical work.

B. Rare, dramatic, memorable, occurrences

Macroeconomic crises involve processes with different chronological scales: they build up "stealthily" over several years (this point will be discussed later), erupt typically in dramatic circumstances, where the time-frames for economic perceptions and decisions contract sharply, and may have impacts with considerably persistent effects, directly and through the behavioral changes they may induce.

By their nature, crises are low-frequency events, which take place as economies evolve (in part, through the consequences of past crises themselves).¹ In those circumstances, how to use (and reciprocally, why ignore?) the experience gathered from the observation of a necessarily small number of past instances with which

¹ Cf. the recent argument by Kozlowski et al. (2016) that the evidence of the large movements in asset prices in the US financial crisis induced agents to re-evaluate risk perceptions, with lasting repercussions on market returns and macroeconomic performance.

one may draw approximate analogies with present conditions? The question poses in a concrete fashion the problem of how to represent and extrapolate the behavior of macroeconomic systems on the basis of inferences from a finite (and possibly not-too-large) mass of information whose relevance itself may be a matter of doubt (cf. for example Weitzman 2007). As a matter of real-world observation, crises retain a vivid presence in people's minds long time after their occurrence, as personal and collective life-changing phenomena, and their recollection may get "activated" when circumstances seem to indicate their pertinence.

C. General feature: wealth losses, widespread miscalculations

Crises do not appear to be particularly selective regarding the monetary or exchange rate regimes of the countries they hit: they have been observed in economies with no monetary policy, belonging to a currency union, in economies with a strict peg to a central money under a currency board, and also in countries with floating exchange rates, or implementing intermediate systems with variable degrees of official intervention. The characteristics of credit markets, in terms of size, institutional setup and types of instruments being held and traded certainly play a large role in the configuration of crises: financial disruptions with strong macroeconomic implications require the existence of a substantial mass of liabilities outstanding and well established mechanisms of propagation translating the presence of actual and expected shortfalls in debt services into falls in real activity. But this can be compatible, as seen in practice, with extremely large or relatively small banking sectors; stock market capitalizations tiny or huge; widespread or practically no use of foreign currencies as denominators; large circulations of securities with highly complicated (and potentially misleading) specifications of exposures to various contingencies, or else an ample majority of as-if unconditional claims.

Thus, the precise form and operation of the financial system does not seem to provide a general characterization of crisis economies. In looking for a common denominator of the various episodes, one may better refer directly to the commonsense meaning attributed to crises, as "times of disagreement, confusion, difficult decisions",² and focus as a defining feature on the large, "abnormal", volume of unfulfilled contracts and defaults on debts.

² From the definitions of the term in the Cambridge and Oxford dictionaries. See also Merriam-Webster on *crisis*: "an unstable or crucial state of affairs in which a decisive change is impending; a difficult or dangerous situation that needs serious attention."

A big mass of “broken promises” (Leijonhufvud 2004, Heymann 2007) indicates that both debtors and creditors find themselves in undesirable positions, poorer than they would have been by acting differently in the past; “innocent bystanders”, who abstained from participating in financial transactions, see their economic situations worsen through the secondary effects of the disruptions in credit markets. Large masses of agents are thus led to revise, perhaps drastically, their estimates of permanent incomes. The great social costs of crises derive precisely from the fact that many people (a number of whom may have never given a thought to the ups and downs in financial markets) are caught, unprepared, by a shock that destroys their businesses, wipes out part of their savings, or leaves them without a job. Crises imply sizable reductions in perceived wealth, and thus can hardly be reconciled with accurate forecasts on the part of most agents. This also applies to analysts as a whole.

Once they occur, macroeconomic crises may look easily foreseeable, as if everyone should have predicted that they had to happen (evoking the “black swan” image in Taleb 2010, as a seemingly impossible animal before it has been observed, and an unremarkable one after it has been shown to exist.). In retrospect, the mass of financial obligations created on the road towards financial collapses such as that of the huge US investment banks or the Greek public debt may be judged like an evident house of cards apt to be identified as such from the start. Certainly, in each specific instance, some economic actors may have anticipated the problems ahead, and taken advantage of that prediction. The asymmetry in beliefs and in knowledge about the prospects of economies does create opportunities for dishonest maneuvers: in the course of a big financial cycle, big-time swindles are likely to happen. But when the debts that eventually go sour are issued, market behaviors typically reflect substantial degrees of belief in normal repayment.

Also, it is likely that some economists and commentators sounded the alarm well in advance. But it is in the nature of the case that such warnings do not get general hearing. Indeed, the question famously posed by the Queen of England soon after the eruption of the 2008 financial troubles, “Why did no one see it coming?” seems representative of the usual evaluation of professional opinion in the aftermath of a crisis. Thus, an important task in the analysis of crises would be to explain this contrast between the *ex-post* appearance of necessity of the bursting bubble and the necessary opacity that allowed it to develop (cf. Crespo et al. 2013).

D. Not simply irrational exuberance

The road to a crisis and the following reversion can be marked by behaviors, especially in asset markets, which suggest the influence of altered states of mind (as in the “manias and panics” studied brilliantly by Kindleberger 1978, or the “irrational exuberance” highlighted among others by Shiller 2000). While these effects may be present, it does not seem the case that the macroeconomic ups and downs associated with crises are driven by the sheer impulse in one direction or another generated by unreflective, purely instinctive agents. Rather, positive readings of the economic prospects in the upward phase are typically supported by plausible arguments, based on then prevailing professional views. Booms ending in busts need not go against the grain of sober, informed opinions.

E. Searching for lessons

In principle, crises may result from “outside shocks” drawn from a universally known probability distribution. Likewise, debt defaults could implement well understood contingency clauses implicit in contracts. The resulting economic and financial disruption would then appear to all concerned as an unfortunate occurrence, but not as a source of regret: past decisions would still look optimal given the information available at the time when they were made, and the behavior in the future would remain as it was predetermined originally, taking into account the state of the world the shock has generated and the resulting tree of future possibilities, already evaluated accurately.

But this is far from the reactions observed: crises stimulate much investment in learning by agents, analysts and policymakers alike, and there is a strong demand, theoretical and practical, for conclusions to be drawn from the experience. Two effects seem to be in operation: people find themselves in novel situations, to which they must adapt, and they are disposed to reconsider previous modes of thought which have been disappointed by the crisis. As a piece of factual observation, these attitudes indicate that crises modify the “models of the world” which explicitly or implicitly guided behavior in the past. From the point of view of analysts, crises also motivate intense research activities trying to extract lessons from those events. It is quite ironic when much of this effort is conducted by building or using models which assume that agents have nothing significant to learn.

III. Troubles with Rational Expectations

A. An ambiguous notion

With no doubt, the Rational Expectations (RE) hypothesis has been for several decades at the center of much of the work done in Macroeconomics. However, it is not easy to find a precise, universally shared definition of such an influential general notion.

In a strict version (RE1, say), rational expectations is understood as a coincidence between the actual laws of motion of the variables of interest and the laws of motion universally perceived (allowing for the possibility of different information sets) by the agents in the system, which in turn condition the behaviors that drive the outcomes to be predicted; in other words, it refers to a fixed point of the mapping that transforms the subjective probability distributions of future conditions guiding (perhaps implicitly) the decisions of economic actors and the corresponding objective distributions that characterize the evolution of the system (see for example Lucas and Sargent 1981; Sargent 2008; the concept appears already in the seminal paper by Muth 1961). But, in another interpretation (RE2), rational expectations would equate the probabilistic expectations of agents with those generated by people sharing unanimously the beliefs of the economist who is conducting the analysis: “model consistency”.

Those two meanings are sometimes brought together as identical, as in Sargent (2008): “From a practical perspective, an important property of a rational expectations model is that it imposes a communism of models and expectations. If we define a model as a probability distribution over a sequence of outcomes, possibly indexed by a parameter vector, a rational expectations equilibrium asserts that the same model is shared by (1) all of the agents within the model, (2) the econometrician estimating the model, and (3) nature, also known as the data generating mechanism. Different agents might have different information, but they form forecasts by computing conditional expectations with respect to a common joint density, that is, a common model.”

However, the equivalence between both notions could only hold if one is prepared to assume that the analyst is truly in possession of the best of all possible models, and that no new knowledge about the system can ever be produced. But a working economist can hardly presume to possess the ultimate, definitive model without negating the very activity she plans to keep undertaking. If, as is clearly the case, the economist’s analytical constructions are dated objects (meant to make previous ones obsolete, and firmly expected to be superseded in the future by better products), the idea of a correspondence between expectations and models deserves to be

scrutinized closely in order to specify its content. The ambiguities in the definitions of rational expectations are not merely a matter of conceptual neatness, but have a bearing on the logic and the interpretation of actual research.

B. Concepts and practices: consistency matters

In common practice, macro models which embody in principle a rational expectations assumption implement neither the perceived-law of-motion equals actual-law-of-motion notion (RE1), nor the model-consistency notion (RE2), in the sense of a correspondence between the analytical scheme used by agents to form anticipations and the predictions of the “relevant economic theory”, understood as the professional standard (perhaps identified with the modeler’s preferred representation) at the moment the expectations are determined. The reason is that the usual procedures ignore the rather trivial, but undeniable and also pertinent fact that the construction of economic models for analytical (and advising) purposes is an ongoing process, still far from converging to an end of the history of research and discussion.

In a hypothetical RE1 world, that convergence would have occurred already long ago (since the beginning of time, in the limit), albeit in an “as if” fashion, in the determination of behaviors in the economy (for the sake of simplicity, in this discussion the hypothesis is supposed to encompass all agents, public sector included). As a direct corollary, the researcher with a strong belief in the validity of RE1 should take for granted that the decisions of economic actors incorporate all the knowledge potentially attainable about the system, which is far more than the analyst may presume to have achieved, now or (realistically) even in the future. The economist may assume that her models provide unbiased representations of the system, but she can hardly maintain that the uncertainty faced by agents is identical with that derived from the models without contradicting her full belief in RE1.

Representing the expectations and the behavior of agents who are as-knowledgeable as possible can raise thorny issues, and force the economist to speculate about the “ultimate” sources of randomness in the economy: if the analyst believes that the evolution of the economy is intrinsically deterministic (and, therefore, what appears as random represent the “measure of one’s ignorance”), RE1 agents should be modelled as if their anticipations were characterized by perfect foresight.³ Alternatively, the analyst might think that there is a deep, irreducible

³ Unless, perhaps, the system’s non-linearities induce chaotic dynamics and agents are assumed to have imperfect measurement devices, making their long-run forecasts imprecise.

unpredictability in the economy, even for RE1, and then, maybe, she considers the possibility that they could be aware of “tail risks” that she has still failed to identify. In any case, the probability distributions characterizing the actual behaviors of RE1 agents *should not* coincide with the distributions generated by the imperfect model built by the analyst.⁴

The logic of the RE1 assumption would in fact entail that, if the economist has access to some direct indicators of expectations (e.g., if she trusts surveys), then, given the presumption of superior knowledge of agents, the model should be adapted to correspond to those anticipations and provide a “rationalization” for them: the analyst should learn from the practical wisdom of market participants, rather than the other way around. In whatever form the RE1 hypothesis may be implemented, moreover, literal acceptance of the notion would imply that economic arguments and models, while they may have intellectual value as explorations of the workings of the system, only make explicit, and only partially, what the agents have already discovered for the purpose of their concrete activities. And, given the knowledge imputed to agents (which includes full confidence in that knowledge), there would be no room for them to reconsider beliefs or to regret past decisions if bad outcomes materialize. Crises in the sense described before are excluded *ex hypothesis*.

The notion of “agents as economists” (RE2) brings down the knowledge incorporated in expectations to the level of professional competence. But its application begs tricky questions about the “relevant economic theory” that agents would follow implicitly. Those questions get sidetracked in the usual models, which represent the expectations of agents, past, present and future, as derived from the *current* specification postulated by the analyst. Here, agents are depicted as if they had known the present model before the economist has produced it, while ignoring the potential for future changes in theories and models (which may, for instance, create an incentive to delay commitments in order to maintain flexibility to incorporate new learning); that is, in the past, they had superior knowledge compared with the analyst (who was working

⁴ In the context of the discussions motivated by the 2008 crisis, it has been argued that Real Business Cycle (or DSGE) models should not be unfairly criticized for not accounting for extreme events of that type, because “those models were designed to describe aggregate economic fluctuations during normal times when markets can bring borrowers and lenders together in orderly ways, not during financial crises and market breakdowns” (Sargent 2010). However, in that case, since the analyst must necessarily recognize that his model provides only a partial representation of the relevant probability distributions, he should also understand that, by construction, expectations based on the model are also inaccurate. Consequently, it would be hard to identify an internal logic of the common procedure of attributing to agents the expectations derived from the models, and in any case, those constructs cannot be said to embody the RE1 assumption.

with old vintage formulations and methods), but do not contemplate now that, if their expectation formation scheme gets frozen at its current version, it will become outmoded by the activity of the analyst (who, when the time comes, will assume that agents always based their anticipations on her more recent model).

C. Rationality in the field

Bounded rationality is a somewhat redundant expression. A reasonable, sober, thoughtful, informed person certainly has limitations in his understanding of things, and is aware of them, to the best of his knowledge. The same would apply to the rational analyst. The representations of the economic environment built by both classes of agents for their own purposes must be based on the learning, tacit or explicit according to the case, accumulated in the past. This implies that the schemes that people use to form anticipations evolve over time, perhaps influenced by the also changing (if only because of the arrival of new data) models elaborated by researchers. The behavioral dynamics induced by that evolution impacts on the performance of the system (cf. Sargent 1993, Evans and Honkapohja 2001).

In some conditions, these complications may be downplayed. However, in crises, the disappointment of expectations includes substantial segments of not particularly gullible, emotional, or naïve agents, economists particularly included. Behaviors that after the fact are interpreted straightforwardly as contributing to an unsustainable bubble may have found a motivation in opinions considered prevalent in academic or policy circles, and may have been reinforced by analytical rationalizations. One of the main tasks of a theory of crises is trying to account for those costly mistakes. Among its main criteria, the rational expectations literature tried to get rid of the conjectures and anticipations of economic agents as objects of investigation by themselves. However, in the context of crises, the actual determinants of beliefs and perceptions about the future, and their dynamics, are of primary importance, as intrinsic elements of the phenomena under study. The analyst dealing with crises must, explicitly or by default, address the problem of how people evaluate uncertainty, and manage with it.

IV. Anticipations in evolving economies

A. Regularities and novelties

Processes that lead to crises have often been viewed (Pigou 1927, Fisher 1933, Minsky 1975, Kindleberger 1978,) as triggered by “displacements” that lead many

agents to re-evaluate in an optimistic sense their prospects and opportunities. These changes may be of different nature (technological developments, institutional shifts or occasional events such as mineral discoveries), with the common feature that they appear to alter substantially, and favorably, the economic environment. In those circumstances, agents must find means to adapt their behavior to new, possibly unprecedented, conditions, using as the help available the knowledge that may have gathered from past experiences.

Economic systems are intrinsically evolving, and rapidly so when “displacements” happen. Thus, previous patterns of performance may or may not have lost relevance, and the observer can hardly expect with any certainty to have found the “true model” for forecasting purposes, with a pertinent data sample which can remain bounded at relatively small sizes. With the whole set of economic agents in the same predicament, the learning strategies of individuals will collectively feed into aggregate outcomes: the future “depends on our intentions and beliefs” and, therefore, “it is open” (Skidelsky 2011: 3).

In that setting, a possible analytical approach is to assume that, when confronted with deep fundamental uncertainties, decisions follow impulses which can hardly be subject to analysis or interpretation: when there are “no strong roots of conviction”, economic activity takes place under the incentive of spontaneous waves of optimism or urges to action rather than inaction (Keynes 1936: 154). In the limit, the argument would imply that, “[since] uncertainty is irreducible on ontological grounds, some probabilities are not just unknown, but non-existent” (Zappia 2012); decisions like those associated with long-run investments would then result from a spontaneous urge, far from the image of an “actuarial calculus” of gains and losses on the basis of numerical probabilities.

Taken to the extreme, this argument would lead, from an opposite angle, to something analogous to the strict rational expectations proposition which places the concrete procedures than agents use to determine their anticipations out of bounds for the analysis. Alternatively, it may be conjectured that, as a default option, agents rely on conventions, that is, on procedures established somehow over the course of the experience of the decision-maker, or through the imitation of others, which give practical guidance while providing some reassurance that a satisfactory performance in the past will be replicated in the present. Keynes (1936: 152) argues “we have tacitly agreed, as a rule, to fall back on what is, in truth, a convention. The essence of this convention –though it does not, of course, work out quite so simply– lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect change”. The conventional

method of day-to-day decision making would then rely on this implicit assumption of continuity of circumstances. Still: “although nature has her habits, due to the recurrence of causes, they are general, not invariable. Yet empirical calculation, although it is inexact, may be adequate in affairs of practice” (Keynes, 1921: 368). This tension between the incentive to “exploit regularities” that may appear in the information available and the ambiguous status of the knowledge that may be gained in that way is especially relevant in the processes leading to macroeconomic crises, and it applies both to agents and analysts, and to analysts talking about how agents behave.

Skidelsky (2011) lists several types of convention that may be at work behind typical investment/consumption and financial decisions: 1) induction (the future will be like the past); 2) “majority judgment” (follow the crowd); and 3) specific sets of values, motives, beliefs, expectations, psychological uncertainties and feelings. Such patterns of thought would condition the “state of confidence”, which Keynes (1936: 148) describes as “a matter to which practical men always pay the closest and most anxious attention (...) there is, however, not much to be said about the state of confidence *a priori*. Our conclusions must mainly depend upon the actual observation of market and business psychology”.

In any case, convention need not refer simply to simple-minded behavior, but can also encompass more sophisticated modes of reasoning, including arguments derived from analytical works that come to influence public opinion and become part of a widespread consensus about the situation and prospects of the economy. Influential propositions may get to be accepted, implicitly or explicitly, by large classes of agents as a matter of course when defining their behavior, in such a way that contrarian views get charged with a heavy burden of proof in order to be considered. Those “commonsense” assessments of the economy’s course may conclude pointing simply to a continuation of prevailing trends, not from an unmindful impulse, but following a pondered evaluation which takes into account the theories of the day.⁵ Thus, the evolution of economic analysis, and its practical impact, would belong intrinsically to the material to be considered when studying macro crises. A crisis would then represent a failure of those working models which, for practical

⁵ Cf. for example “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 easily this would continue” (Blanchard 2008). The medium term projections of institutions like the IMF for countries such as Greece or Spain just before the eruption of the European crises contemplated sustained growth as if the performance of the recent years would continue without interruption (see, for example, Guzmán and Heymann 2015).

purposes, may have shared features with those held by large groups of economists, as in the “long list of leading academics, investors, and the U.S policy makers” (Reinhart and Rogoff 2009: 208) who argued for the sustainability of the macroeconomic trajectory that preceded the crisis.

B. Probabilities and weight of evidence

The problems of decision-making in evolving and complicated environments have been present among the concerns of economic theory for a long time, and particularly in the work of authors such as Keynes, Knight, Shackle and Hayek. In his early *Treatise*, Keynes (1921) conceives probability as the logical relation between a proposition (H) and the corpus of knowledge (E) to which we relate it. The likelihood we assign to an event is subjective (the information used and the way in which it is processed generally differ between individuals), but not arbitrary: probability refers to “the degree of belief which it is *rational* to entertain in given conditions” (Keynes 1921: 4, italics in the original; see also Runde 1994, Feduzi 2010). When new evidence appears, the “degree of belief that is rational to entertain in a given proposition changes” (Lawson 1988: 42). Therefore, probabilities here are epistemic in nature, since they are conceived as a property of the way in which agents think about the world. Rational people do not freeze their probability assessments, but are prepared to update their beliefs about the chances of future events, and also about the strength of their knowledge about those chances.

Keynes accordingly distinguishes between probability and the weight of the argument for the probability. This later dimension depends on the amount and significance of the information available:

As the relevant evidence at our disposal increases, the magnitude of the probability of the argument may either decrease or increase, according as the new knowledge strengthens the unfavourable or the favourable evidence; but *something* seems to have increased in either case,—we have a more substantial basis upon which to rest our conclusion. I express this by saying that an accession of new evidence increases the weight of argument (Keynes 1921: 71).

Thus, the evaluation of future chances may be split into two elements which represent the likelihood attributed to the occurrence of a certain event and the confidence which the agent has on that presumed likelihood. This would lead to a “two-tier theory of belief”. Probability is at the first level, a measure of the belief in some conclusion relative to some specific body of evidence. Weight is at the second level, a measure of the *completeness* of the evidence on which that belief

is based (see Runde 1994: 133; Runde 1990). If K is the relevant knowledge and I is the relevant ignorance, the weight of evidence would express something like a comparison of K relatively to $K+I$. The weight depends negatively on the existence of missing information, which consists of relevant factors possibly omitted or inaccessible better information, “if it were known, she conceives it would be relevant for the decisional problem” (Feduzi 2010: 334). With the acquisition of new evidence (whether favorable or unfavorable to a certain conclusion), K increases thus leading to an increase in weight, other things equal.

That is, as part of their practical work, agents and analysts must evaluate the reliability and the scope of validity of their pertinent knowledge. That means dealing with “model uncertainty” (cf. Hansen and Sargent 2001 or, in Keynes’ terms, with the weight of evidence to be attached to beliefs about the likelihood of different future states). From the perspective of carrying out macroeconomic analysis, the relevant questions would be how agents determine in practice their views on the “amount of evidence supporting an expectation” (Skidelsky 2009: 87),⁶ and how those assessments operate on their willingness to commit resources in undertakings with outcomes contingent on the perceived accuracy of expectations. There are firmer probabilities than others, depending on the degree of objectivity of the ontological basis on which a number is assigned to the chances of an event (Humphreys 2000)

It is possible for people to learn new things which makes them feel more (rather than less) uncertain or ignorant compared with what they previously thought (relevant ignorance increases), a typical situation at the start of crises, when the performance of the economy presents serious challenges to previous beliefs.

V. Representing crises: learning the tough way

Along the path towards a crisis, agents tend to exaggerate their trust in prevailing, complacent views about the economy, and thus misjudge their future prospects. “Overconfidence” has been one of the effects considered in the literature in the context of macroeconomic fluctuations (see, for example, Hong, Scheinkman and Xiong 2005; also Minsky 1975). Some macroeconomically relevant effects may be associated with behavioral biases. “Irrational exuberance” and primary impulses certainly play

⁶ Confidence and weight are not the same things, but they can be linked as correlated concepts under this set of materials. Changes in the “weight of evidence” influence strongly the extent to which agents are willing to make economic commitments contingent on their existing beliefs.

a role in booms and busts (cf. Shiller 2000, Akerlof and Shiller 2009): as a general feature, the weight of emotional influences on decision-making seems theoretically and experimentally well determined (e.g., Damasio 2003), and it is probably stronger in circumstances like large economic ups and downs where the fate of individuals and organizations can change dramatically. Keynes argues that “a sufficient supply of individuals of sanguine temperament and constructive impulses who embark on business as a way of life, not really on a precise calculation of prospective profit...” may make the market “...subject to waves of optimistic and pessimistic sentiment... where no solid basis exists for a reasonable calculation” (Keynes 1936:154).

However, “there is always a very real basis [of real opportunities to invest lucratively] for the “new era” psychology before it runs away with all its victims” (Fisher 1933). Typically, the cheerful views during times of a boom are shared by well-informed, often powerful observers. This can be observed in historical episodes in economies of very different features.

Along the way to the recent crisis in the U.S., highly qualified opinions found solid grounds for the “great moderation” (Blanchard and Simon 2001, Bernanke 2004a): the fundamentals of a low-volatility, strong aggregate demand compatible with the absence of inflationary pressures.⁷ Should the central bank be concerned about asset prices and not only about inflation in goods prices (cf. Bernanke 2004b, Geithner 2006)? The “Greenspan doctrine” held that there were no strong reasons to lean against upswings which “could well be based on real economic improvements and, in any case, if the asset-price movement eventually proved exaggerated and was reversed, policies could intervene to prevent the propagation of the shock” (Crespo et al. 2013: 82). Financial deregulation (like the repeal of the Glass-Steagall Act) was supported by most of the mainstream analysts and practitioners (cf. Zappia 2012). Influential arguments dismissed the possibility of a real estate bubble as unlikely (Greenspan 2004), since home-price increases “largely reflect strong economic fundamentals” (Bernanke 2005b). Reinhart and Rogoff (2009) supported a non-interventionist policy: “the private sector can judge the equilibrium [housing] prices at least as well as any government bureaucrat.”

In turn, the high volume of spending in the US (associated with international borrowing) was perceived as a natural consequence of the strong propensity to lend in high-savings economies (a “global savings glut”), and the attractiveness of the US as a supplier of safe assets (cf. Cooper 2004, Clarida 2005, Backus et al. 2005,

⁷ Cf. Lucas (2003): “the central problem of depression-prevention has been solved”; Blanchard (2008): “The state of macro is good”.

Bernanke 2005a, Bernanke 2007). Alan Greenspan (2002) referred to a “productive miracle”, as the benefits of electronic technology propagated throughout the economy, creating a prosperity-enhancing structural break. The strong supply of funds, it was argued, “was matched on the demand side by good investment prospects, as institutional and structural features of the US economy, such as the flexibility of labor, capital and product markets, made it especially well-suited to capitalize on the opportunities afforded by the rapid technical change” (Crespo et al. 2013:83).

Then the economy was hit by the financial disruption, and “the entire intellectual edifice collapsed” (Greenspan 2008). The economic system was disturbed by shocks arising not from the outside but from its own core. While the crisis strongly contradicts the assumption of optimal use of information as in the Efficient Market Hypothesis in its different forms, the agents making decisions were not merely irrational: the judgments of “the expert” could provide sufficiently strong support for the belief that it was right to ignore the dangers of a buildup and subsequent burst of a bubble, with the macroeconomic result of building up excessive trust on the persistence of conditions which, after the fact, will be seen as unsustainable.

Mutatis mutandis, similar scenarios can be adapted to various crises in emerging economies (see Heymann 1984, 1994; Heymann et al., 2001, Galiani et al. 2003). Consider the following illustration: the government of a certain country implements policy reforms aligned with prevailing recommendations of mainstream academic analysis and international organizations. At first, while this “new-era economy” remains a fuzzy notion, economic actors will wait for more evidence to decide whether or not to execute investments predicated on the success promised by the authorities. But, since, the economic reforms are backed by influential analytical arguments and agree with established policy recommendations, positive developments can have amplified effects on expectations. The prospect of economic improvements thus generated may suffice to remove some credit restrictions and to induce acceleration in demand and production. A current account deficit might develop as a counterpart of the foreign financing of higher domestic consumption and investment. At this point, opinions can differ: according to one group, rising foreign liabilities indicate a reasonable response of reinforced confidence on the economy’s future growth, derived from the productivity gains that the reforms will induce over time; opposing views perceive those debts as a dangerous source of macroeconomic fragility that will manifest itself sooner or later.

The story can be retold, with variants, as that of a country (say, Greece), which joins a club of developed nations and where expectations of a convergence of income levels to those observed in the partners arises under the belief that, once institutions

are modified to correspond to those of rich neighbors, a transition converging to the conditions of those model economies would follow naturally. This perception can both strengthen the foreign willingness to lend as well as the incentives to borrow (cf. Machinea and Schiaffino 2011). In the end, the question will be whether the anticipated increases in the income-generating capacity of the economy will materialize, or else they will be disappointed, and a crisis will follow. The evolution of consensus opinions among experts, and the pronouncements of influential analysts have concrete macroeconomic implications to the extent they become incorporated as relevant evidence in the making of practical decisions.

Situations of substantial structural or institutional chance are associated with ambiguity: “a state where people face circumstances of decision-making in which information bearing upon these relevant facts (or states, events, propositions) is scanty, marked by gaps, obscure and vague, or on the contrary plentiful and precise but highly contradictory” (Ellsberg 2001: 1). Specifically, a group of observers and agents may favor the view that there are solid fundamentals, while others can suspect that a bubble has developed. If, plausibly, neither side is able to gather firm, convincing evidence definitely supporting their position, established patterns of argument and belief may play a large role in determining in which direction actual behaviors tend to lean, especially if agents use some type of categorical thinking (Mullainathan 2002), such that, presented with inconclusive information, they tend to choose the “more likely” alternative as the only (in the limit) scenario on which to focus their decisions. While some construction over decision making is based more or less on real perceived notions (“the probability, its merits”), there are some deep shadows where confidence (“the weight”) plays a determinant role. People will be more confident in their forecast as long as more evidential weight exists. Crucial to our argument, a probability assessment over an economy cannot be enough to inform of a decision, but the probability combined with the weight might be.

The crisis is likely to trigger widespread reconsiderations of the propositions that rationalized the previous boom as fundamentally sustainable: the weights of different arguments and the claims subject to the burden of proof will be shifted around; new commonsense views may replace those that the crisis appears to have made untenable, as Keynes claims in his 1937 *Quarterly Journal* article that “the practice of calmness and immobility, of certainty and security, suddenly breaks down. New fears and hopes will, without warning, take charge of human conduct. The forces of disillusion may suddenly impose a new conventional basis of valuation”. The changes in beliefs and perceptions may have repercussions on the economy’s performance years ahead.

A quick look at some specific historical instances thus illustrates how, as a general feature, crises reveal substantial gaps in the collective knowledge of agents and analysts, as manifested in their decisions, or evaluations of the economy's performance. Behaviors which after the fact can be interpreted as contributing to generate unsustainable macro imbalances are likely to have been consistent at some point with salient analytical views (which may have established their influence as result of previous hits, and whose perceived relevance may be recognized *ex post* to have been extrapolated beyond their range of validity). Professional views may be noticeably heterogeneous; the agent would then be confronted with multiple plausible forecasts, which she would take more or less into account according to the credibility she attributes to them. In terms of the discussion of the previous section, the availability of rationalizations can affect the chances of future occurrences that agents incorporate in their expectations, and also the "weight of evidence" presumed to back these probability assessments. In crises, eventually, such expectations are disturbed by pieces of actual information that arrive. Attitudes of confident, "fundamental" optimism morph into a watchful anxiety. The consequent prudential wait-and-see behaviors tend to contract the time horizon of decisions and reduce the demand for goods and financial assets. In severe crises, the eventual frustration of large sets of once prevalent expectations leads to widespread reconsideration of beliefs. Expert opinions that lent weight to the evidence in favor of the solidity of the boom are now challenged. Agents who followed the "predictions of the relevant economic theory", and behaved accordingly turned out to be wrong. Economic decisions happened to be inconsistent with one another, in a large scale: the dated-model consistency form of rationality failed to generate an equilibrium (cf. Streb 2017). Those times call for intensive learning.

VI. Conclusion

Crisis place in the open the deep uncertainties faced by economic agents even in seemingly tranquil states of the world. In their daily life, decision makers must, explicitly or implicitly, evaluate the likelihood of different future scenarios which may be relevant for their choices, but also contemplate the trust it may be reasonable to lend to these assessments. If a model can be identified as a probability distribution over a sequence (Hansen and Sargent 2001), then perceptions about model uncertainty, or the weight of evidence to be attached to a model, will condition behavior, especially in matters where the relevant outcomes depend strongly on future macroeconomic trends.

We have looked back to review traditional themes of economic epistemics, searching for elements to address practical issues in macroeconomic analysis. It is well known that social sciences, and economics specifically, have the particularity that the agents whose individual or collective behaviors are objects of research are also engaged in trying to understand and to predict the evolution of that very same system under observation (cf. Crespo et al. 2010: 180ff.). The agent-analyst correspondence has concrete implications. These become salient when studying phenomena like macroeconomic crises, which reveal in a highly costly way the fallibility both of the expectations of many economic actors and of the interpretations and predictions of influential bodies of economic analysis. The formation and dynamics of the beliefs of economic agents is intrinsically a subject of research, which cannot be addressed on the basis of methodological precepts of one type or another. When dealing squarely with the fundamental epistemic aspects of crises, the economics profession is apt to be confronted with the limitations of its knowledge as a matter of concrete relevance, and with the interactions between its own learning processes and those of actual decision-makers

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