World Development 173 (2024) 106426

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

Economics for an uncertain world

George DeMartino [a], Ilene Grabel [a], Ian Scoones [b,*]

[a] Josef Korbel School of International Studies, University of Denver, Denver, CO 80208, USA
[b] Institute of Development Studies, University of Sussex, Falmer, Brighton, BN1 9RE, UK

ARTICLE INFO

Keywords:
Economics
Uncertainty
Irreparable ignorance
Pastoralism
Global finance
Albert Hirschman

ABSTRACT

Uncertainty, where we do not know the likelihood of future events, dominates our world. This article examines how economics as a profession and discipline can address uncertainty. From Frank Knight to John Maynard Keynes to Friedrich von Hayek to George Shackle, economics has highlighted the importance of uncertain knowledge and distinguished this from calculable risk. In this article we show how such insights were lost through the rise of narrow neoclassical thinking and were excluded through the emergence of a dominant economics of control that rose to prominence during the twentieth century and especially in the neoliberal era. However, through a range of perspectives in economics that emphasise the importance of complexity, informality, positionality and narratives, uncertainty is once again being embraced within an increasingly heterodox economics. In many ways, this chimes with the work of Albert Hirschman who, starting from the mid-1960s, emphasised the importance of addressing uncertainty in development theory and practice. Through two examples on pastoral development and global financial governance, we highlight the continued relevance of Hirschman's thinking on the importance of adaptation, flexibility and learning-by-doing as responses to uncertainty and for the development of reliable, robust approaches to development policy and practice. In conclusion, we argue that economics theory, methodologies, professional practice and training need to change, recovering some of the insights from previous generations of economic thinkers and practitioners, in order to reinvent an economics appropriate for our uncertain world.

1. Introduction

Four moments; four challenges for economics. On 15 September 2008, bankers emerged from Lehman Brothers in New York City carrying boxes of their possessions; a massive financial crash was unfolding with impacts that reverberated across the world. In November 2019, a novel coronavirus was identified in Wuhan, China; soon a global pandemic was declared, which resulted in a huge number of deaths, widespread illness and massive economic damage globally. On 9 August 2021, the first report of the International Panel on Climate Change's sixth assessment was released; the UN Secretary General declared 'code red for humanity', as climate chaos wreaked havoc from droughts, floods, wildfires and more. On 24 February 2022, Russia invaded neighbouring Ukraine, confounding predictions from most pundits, with the war resulting in major shifts in the global economy and a devastating international food crisis.

What characterises each of these moments (and many more), and why is this a challenge for economics? The short answer is 'uncertainty'. Uncertainty arises whenever the future cannot be predicted owing to the ontological properties of the domain under consideration or when knowledge about such properties is lacking.[1] When the relevant domain—whether the social or natural world—is defined by complex, non-linear systems, the consequences of any intervention are indeterminate (Stirling, 2010; Scoones, 2019; Scoones & Stirling, 2020; Stirling & Scoones, 2020). While in some respects, all these events were foretold, the details of what would happen, where and to whom could not be predicted. As a result, they all unleashed a questioning of what can be forecast and managed and what cannot, highlighting the importance of

* Corresponding author. Address: University of Sussex, Falmer, Brighton, BN1 9RE, UK.
E-mail addresses: George.DeMartino@du.edu (G. DeMartino), Ilene.Grabel@du.edu (I. Grabel), i.scoones@ids.ac.uk (I. Scoones).

[1] Aleatory uncertainty refers to unpredictable variability in the system and is a fundamental property of the system. Epistemic uncertainty arises from a lack of knowledge of the system, meaning its properties cannot be predicted (Walker et al., 2003). Ontological uncertainty is where there is a fundamental lack of knowledge about what exists in the world, making modelling and statistical analysis impossible (Spiegelhalter, 2017). In practice all types of uncertainty co-exist and interact. In this article, we define uncertainty as the condition when there is lack of knowledge about the likelihood of outcomes, while ignorance is when we don't know the likelihoods nor the range of possible outcomes (Stirling, 2010).

https://doi.org/10.1016/j.worlddev.2023.106426
Accepted 1 October 2023
Available online 11 October 2023

taking uncertainty seriously.

Pushing back against the conventional wisdom of development economists of his day, Albert Hirschman recognised the problems (and opportunities) presented by ontological complexity and uncertainty. He warned his colleagues in both policymaking and academia that neither the economies of the Global North nor the Global South were simple systems that could ever be adequately represented by standard paradigmatic thinking (Hirschman, 2013 [1970]; see below). In arguing for a reappraisal of the importance of uncertainty in today's world, in this article we highlight the many important insights of Hirschman and, in turn, argue for a revived and recast economics for an uncertain world.

2. What is uncertainty and why is it important?

Following Frank Knight (1921), uncertainty is distinguished from risk, where the full range of possible outcomes are accessible and can be assigned known probabilities. Risk presumes that the social world is characterised by ergodic systems, such as at the casino where all possible outcomes are defined in advance, along with the odds. But what if, instead, Douglass North (1999:3) is correct in claiming that "the world we live in is not an ergodic world… For an enormous number of issues that are important to us, the world is one of novelty and change; it does not repeat itself." What if uncertainty and not risk is "written into the script of life" (Nowotny, 2015:1)? Epistemic insufficiency, where we cannot know all that will or even can happen, we argue, must be central to economic enquiry. As Brian Loasby (1991:1) puts it, "the foundation for useful economic theory must be incomplete knowledge, or partial ignorance."

Uncertainties take on different forms of what is termed 'irreparable ignorance' (DeMartino, 2022:77-8). In the future we might come to know some things we don't know now but only after the moment when the knowledge was needed to make a consequential decision. George Shackle (1972/1992: 86) put it this way, "[The] validity of knowledge of general principles is independent of the historical calendar," he writes, "but the question: What is the best action? Is wholly dependent on the unique historical situation; and any knowledge of that situation, which is lacking when it is needed, is effectively lacking forever and is forever too late." Alternatively, knowledge required to make the right decision can sometimes only be learned by making the decision, when it is too late to reverse course. The famished hiker asks, "are these berries food, or are they poison?" Only the act of eating will answer the question. Finally, there is the domain of the in-principal unknowable—the sort of ignorance that John Maynard Keynes referred to when he spoke of "the prospect of a European war … the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention …". As Keynes famously put it, "about these matters there is no scientific basis on which to form any calculable probability whatever. *We simply do not know* …" (1937: 213–14; emphasis added). Irreparable ignorance is to be distinguished from what US Defence Secretary Donald Rumsfeld referred to as the "unknown unknowns – the ones we don't know we don't know".[2] Awareness of the presence of unknown unknowns warrants intensified research to discover what is not yet known, on the presumption that it can in fact be discovered. But if ignorance is irreparable, then further research cannot solve the epistemic problem. Instead, the practice of searching for the unknowable can end up generating fake knowledge that can badly mislead.

Uncertainties of different kinds are a challenge for both theory and methodology in conventional economics, especially the mainstream neoclassical-Keynesian synthesis that has predominated in textbooks and policy advice for much of the twentieth century and since. Complicating matters further, uncertainties can also obscure our knowledge of the future, present and even the past, owing to irresolvable epistemological challenges in discerning causality./[3]

The standard approach of much economics however relies on assumptions about equilibrating mechanisms, stability, well-behaved probabilities, predictability, rational expectations and the achievability of control (Davidson, 1982; Colander, 2011; Kay & King, 2020). Given our daily experience of unexpected, even shocking, events in the world, such assumptions are surprising. But for over a century, the pursuit of mathematical tractability and the use of deterministic models relegated discussions of uncertainty to the periphery of the economics profession. Economists have too often presumed that risks are calculable, and that predictions about policy outcomes can be made. Uncertainty, where neither the range of potential future outcomes nor their likelihoods are known, has been repressed in much economic analysis (Kay & King, 2020).

This article therefore points to the necessity of recognising uncertainty in development economics theory and practice. Doing so, we suggest, requires reclaiming earlier strands of thinking that have become obscured by the predominant versions of economics over the past century, while highlighting contemporary conceptual and methodological innovations that break with the orthodoxy. In particular, we focus on the insights of Hirschman, who, perhaps more than any other twentieth century development economist, grappled with the limits to knowledge, and to expert control. As a journal length piece, all sections are necessarily short and much, much more could be said, but we hope that the article suffices to provoke, inspire and encourage a re-centring of uncertainty in development theory and practice, reviving some of the key insights from Hirschman and others.

3. The illusion of control

The emerging neoclassicals of the late nineteenth century discovered a general equilibrium framework, borrowing heavily from physics, that would guide standard economics throughout the next century (Mirowski, 1989). The architects of the approach were prepared to make whatever assumptions were required to sustain it. In Leon Walras' general equilibrium framework competition between rational actors with *full knowledge of all possibilities* conducted frictionless exchange and generated determinate prices and quantities for all goods (Walras, 2014 [1900]). Arthur Pigou later published *The Economics of Welfare* (2017 [1920]), which laid the foundations of a more quantitative, equilibrium-centred welfare economics that enabled policy assessment (Colander & Freedman, 2018). The 'moral geometry' that subsequently emerged in the New Welfare Economics of the 1930s took the form of unambiguous decision rules (DeMartino, 2022). Combined with the general equilibrium framework, the Kaldor-Hicks potential Pareto test, cost-benefit analysis and social welfare functions all generated definitive policy conclusions, where uncertainty was treated as nothing more than calculable risk (DeMartino, 2022). In the face of risk, policy aimed to maximise 'expected utility'—typically defined as the sum of all potential policy payoffs weighted by their respective *known* probabilities. Even in contemporary welfare economics this strategy continues to predominate (Adler, 2019).

Macroeconomics followed suit. The exploration of questions of industrial production, employment, income distribution and the like

[2] https://www.youtube.com/watch?v=REWeBzGuzCc.

[3] The 'fundamental problem of causal inference' (Holland 1986) arises from the fact that discerning causality would require the ability to run history twice—once with the event we probe for causal impact included in the flow of events, and a second time with that event excluded. But of course, history runs just once—and that fact requires researchers to simulate multiple runs of history through counterfactual analysis. Research methods seek to discover the right counterfactual, so as to be able to infer the right causal relation. But the certainty of causal claims is undermined by the inevitable fictional nature of all counterfactuals (see DeMartino, 2021).

employed computable general equilibrium and dynamic stochastic general equilibrium models. These "post-real" (Romer, 2016) approaches largely banished questions of uncertainty, yielding deeply inadequate predictions. Macroeconomics failed regarding the crisis of 2008 not because it did not predict the crisis, but because its most sophisticated models did not countenance even the possibility of a crisis (Krugman, 2009).

Twentieth-century economists went to extraordinary lengths to sustain the idea that they could make dependable predictions of policy effects. The required epistemic presumptions were heroic. By the 1950s Milton Friedman announced the emergence of a 'positive economics', which could be "an 'objective' science, in precisely the same sense as any of the physical sciences" (1953: 4), where generalisable laws could be elaborated through careful modelling and quantitative analysis of assumed 'subjective probabilities.' In *Price Theory*, Friedman explicitly dismissed as 'invalid' Knight's distinction between risk and uncertainty, claiming that "we may treat people *as if they assigned numerical probabilities to every conceivable event*" (Friedman, 2007, 282; quoted by Kay & King, 2020: 74; emphasis added; see also Friedman & Savage, 1948). By mid-century Kenneth Arrow had adapted the then standard competitive equilibrium model to account for the fact that individuals and companies do not know what the future holds. For a competitive equilibrium to exist he showed that everyone must prepare a list of all future states that might occur, and that everyone must hold the same beliefs about all future states (Arrow & Debreu, 1954). Domesticating uncertain knowledge that would otherwise disrupt modelling in the analysis of competitive equilibria therefore required making wildly unrealistic assumptions (Ormerod, 1994: 89-90).

For those entrenched in the predominant neoclassical-Keynesian synthesis, the fact that the models were laden with unrealistic assumptions was not seen as a deficiency, as long as the models appeared to provide convincing guides for policymaking (Friedman 1953/66). As Friedman's colleague at Chicago, Gary Becker (1976: 5), put it, "The combined assumptions of maximizing behavior, market equilibrium, and stable preferences, used relentlessly and unflinchingly, form the heart of the economic approach." Here there was no room for Knightian uncertainty. The result was a severely reductionist equilibrium thinking centred on an abstract version of the economy where stick-figure economic agents make decisions based on preferences that are predetermined, with no transaction costs or externalities (Coyle, 2021: 38), and with considerations of uncertainty excluded or domesticated (Hodgson, 2011).

This 'objective' science of economics that reduced uncertainty to calculable risk was advocated by the most influential economists from the UK (such as John Hicks (1939) and Nicholas Kaldor (1939))[4] and the US (such as Abba Lerner (1944)). Lerner in particular was instrumental in persuading economists that dependable policy assessment based on scientific rules derived from economic theory could guide policy (Colander, 2003: 201-2; Colander & Rothschild, 2010). Lerner's key book, *The Economics of Control,* set the tone for many decades, becoming entrenched for example in Paul Samuelson's influential textbook (Samuelson & Nordhaus, 1985). The title of Lerner's book was apt. The hunt for control was central to the economic project. Economists sought to create and sustain a theoretical architecture that could yield unambiguous policy assessment and clear direction to policymakers. If correctly applied, it was thought, the economy could be directed towards beneficial outcomes—static and dynamic productive efficiency, full employment and social betterment defined in terms of rising welfare.

The idea of a universal, unimpeachable science of economics that could inform policy, without worrying overly about uncertainties and complexities, was as important for economic practice and economists' influence in the Keynesian-planning era of the post-war years as it was throughout the subsequent neoliberal era, from the 1970s into the early 2000s. However, the control project was always threatened by a latent recognition of uncertainty. Control presumes epistemic adequacy—the economist could not control what the economist could not know. And therefore a fundamental choice had to be made—between representations of the economy as a site of irreparable ignorance and a representation that repressed uncertainty in order to facilitate tractability. For a profession craving policy influence, the choice was obvious. Knightian uncertainty was displaced by the presumption of calculable risk, allowing the profession to exploit the appearance of adequate knowledge to extend its influence over public affairs.

Nowhere was this strategy more apparent than in the field of development economics. From the post-war period through the neoliberal revolution, economists purported to have the authority to define 'development' in low-income countries and sufficient knowledge to ascertain which interventions to pursue to achieve it. As Robert Nelson (2001: xx) put it, "Correctly understood, [economic] messages [were] seen to be promises of the true path to a salvation in this world—to a new heaven on earth." At a speech at the World Bank-IMF annual meeting in 1991, Larry Summers, then Chief Economist at the World Bank, argued that "the laws of economics, it's often forgotten, are like the laws of engineering…. There's only one set of laws and they work everywhere." He continued, "One of the things I've learnt in my short time at the World Bank is that whenever anybody says, 'but economics works differently here,' they're about to say something dumb" (cited in Hardy, 2019: 18). This kind of hubris fueled the fervent closed-mindedness of the neoliberal reformers across the Global South and in the post-Soviet transition economies of the 1990s too (Murrell, 1993).

4. Dissenting voices—then and now

Many self-aware economists have of course wrestled with the epistemic problem and the challenge presented by uncertainty. For example, Herbert Simon (1990) offered the useful concept of 'bounded rationality,' which stems from a related recognition that the social world is inherently complex and only partly intelligible. Even some of the architects of the marginal revolution of the late 1800s recognised the challenge uncertainty presented to the emerging science. William Stanley Jevons wrote, "If we wished to have a complete solution of the [economic] problem in all its natural complexity, we should have to treat it as a problem of motion – a problem of dynamics." But Jevons recognised that that kind of knowledge was unavailable. To make analysis tractable, he opted for a "purely statical" approach to the analysis of the "action of exchange," rather than attempting a more difficult analysis of the economy as a complex system (quoted by Keen, 2021: 138).

Teasing out the distinction between uncertainty and risk, Chicago economist Knight emphasised in 1921 that "It is a world of change in which we live, and a world of uncertainty" (Knight [1921] 2014: 199). In his view, the economic actors about whom economists theorise face interminable and irresolvable epistemic constraints. They must rely on "images of a future state of affairs," "common sense," "intuition," "superstitions," "hunches," the "subconscious" and "convictions or opinions" ([1921] 2014, 201, 229– 30). Keynes agreed, while Shackle provided one of the most thorough analyses of the epistemic problem, arguing that economic agents confronting the future face "the *void of unknowledge*" (1992[1972]: xi). This insight led Shackle to advance the radical claim that economics must be understood not as the study of objective facts about the world, like prices and quantities, but of *ideas* about that world. "Economics is about thoughts," he wrote. "It is

[4] Like many leading economists of the period, Kaldor did not have a fixed view over time. In the period from the early 1930s until the later establishment of a narrow neoclassical-Keynesian consensus view there was much debate about the value and limits of equilibrium perspectives. For example, before moving to Cambridge, Kaldor was engaged in intensive debates between Hayek, Myrdal and Knight during the 1930s (Telles, 2023). He later reflected on the limits of an equilibrium perspective (Kaldor, 1972).

therefore a branch or application of epistemics, the theory of thoughts" (Shackle, 1972/1992: xx). Dani Rodrik (2017: 159, 163) emphasises the same point today: "Yet without ideas… the concept of self-interest is empty and useless… In truth, we don't have "interests." We have *ideas* about what our interests are" (cf. Knight, 2014[1921]: chapter 7). As Rodrik (2007, 2015) argues, there are many models from which to choose when confronting particular economic problems. Unfortunately, such is the influence of the mainstream view that side-lines considerations of uncertainty, the pursuit of optimality continues as if the world were adequately knowable - as if we can know which model to apply in any particular context.

However, countering such confidence, various leading economists have highlighted the epistemic challenges of economic science. Nearly a century ago, Lionel Robbins noted, "What precision economists can claim at this stage is largely a sham precision. In the present state of knowledge, the man who can claim for economic science much exactitude is a quack" (1927: 176). Almost fifty years later, Friedrich von Hayek remarked in his 1974 Nobel lecture, "I prefer true but imperfect knowledge, even if it leaves much indetermined and unpredictable, to a pretence of exact knowledge that is likely to be false" (Hayek, 1975: 438). As he explained in his famous article, '*The use of knowledge in society*', economists must recognise 'unorganised' knowledge, "the knowledge of the particular circumstances of time and place" (Hayek, 1945: 521; see also Hayek, 1978). In this context Hayek emphasised the importance of the tacit knowledge that individuals glean from and apply to their worlds. Tacit knowledge comprises know-how, craft, sensibilities and other forms of dispersed knowledge that are not easily articulated, conveyed and appropriated by central authorities. This form of knowledge cannot be codified in textbooks that convey abstract principles, but instead must be discovered through trial and error. The acquisition of tacit knowledge falls into the second category of irreparable ignorance: it can be gleaned only by taking decisions the effects of which depend on the missing knowledge, and then facing the consequences. It is knowledge that does not reveal itself easily; it must be hard-earned through practice that is fraught with uncertainties.[5] Decades later, the famous Cambridge economist, John Hicks argued that, "economic knowledge, though not negligible, is so extremely imperfect. There are very few economic facts we know with precision" (1980: 1).

Today control economics is in turmoil. The orthodoxy has been called into question by a new generation of micro- and macroeconomists who eschew the theory-laden axiomatic deductive models and 'blackboard proofs' of assumed realities that dominated economic thinking for many decades. Indeed, the profession has experienced a critically important empirical turn over the past few decades (Angrist et al., 2017). The new empiricism features 'big data'-driven research, 'natural experiments' that arise as a consequence of actual events in the world and 'randomised control trials' (RCTs), whereby researchers apply a treatment in the field to some groups but not to other similarly situated control groups (Banerjee & Duflo, 2011). In the same vein, in lab experiments behavioural economists test the assumptions and logic of economic propositions, while exploring how real human beings make actual economic decisions (Kahneman et al., 1982; Ariely & Jones, 2008). At its best, the new empiricism has unsettled received wisdom across policy domains by demonstrating just how wrong-headed are models of the economy and society that reduce all processes and outcomes to the simple workings of a small number of variables that can be captured adequately in theory (Resnick & Wolff, 1987; Rodrik, 2015).

In addition, the empirical turn has encouraged engagements with sociology, anthropology and psychology—fields that the mainstream in the profession had long ignored, and that emphasise the salience of factors that standard economics had frequently overlooked. Indeed, it is increasingly unclear just where the boundaries that distinguish economics from other fields now lie.

All this is to the good. But much of the new empirical work is aimed at discovering causal connections in the very same way that the axiomatic deductive methods did before. The mapping of assumed causal laws via empirical methods can be exploited by control-oriented economists and policymakers, reproducing the epistemic and policy errors of previous generations. For instance, behavioural economists often look to 'nudge' economic actors into making the 'right' decisions by taking advantage of predictable biases in decision-making (Thaler & Sunstein, 2019). Here, the economist is assumed to know best what kinds of outcomes individuals should value (DeMartino, 2022: chapter 2). The problem of course is that, if the world is itself complex and if inscrutable individuals hold distinct, evolving values as they negotiate unpredictable and changing worlds, then the new control methods are apt to generate substantial unintended and unforeseeable consequences, some of which may be deeply damaging to those whom economists purport to serve.

If we confront irreparable ignorance of the sort discussed above, then we cannot ever know the uniquely correct counterfactual that is required to ascertain the causal effect of any particular intervention (Donavan, 2018; van der Meulen Rodgers et al., 2020). RCTs warrant particular attention in this regard. RCTs are sometimes thought to demonstrate directly the causal effects of a policy intervention through careful stratification in the construction of the treatment and control groups. Provided one finds a statistically significant difference between the average outcome of a treatment and no treatment, the inference is drawn that the policy intervention caused the observed outcome. As Deaton and Cartwright (2018:2) put it,

> [RCTs] are taken to be largely exempt from the myriad problems that characterize observational studies, to require minimal substantive assumptions, little or no prior information, and to be largely independent of 'expert' knowledge that is often regarded as manipulable, politically biased, or otherwise suspect.

However, RCTs of course suffer the same challenges of inferring causality in complex and uncertain settings as other methods, where issues of both internal and external validity remain (Deaton, 2020). There should be no automatic hierarchy of preferred method, but diverse, complementary methods must be used when knowledges are always plural and conditional under conditions of uncertainty.

In terms of dissenting voices, many heterodox traditions in economics, especially those inspired by Knight, Keynes and Hayek, have taken far better account of uncertainty and irreparable ignorance. Those working broadly in the Austrian tradition have been amongst the most strident critics of the epistemological assumptions of mainstream

[5] These insights about complexities of knowledge and ignorance were informed the Austrian contributions to the socialist calculation debate of the 1920s through to the 1940s (Adaman & Devine, 1996). They were famously opposed by Oscar Lange, Abba Lerner, Maurice Dobb and other economists who sought to justify 'market socialism' and other forms of economic planning. Dobb, for example, argued against the 'atomistic' approach of neoclassical socialist economists as this would, he suggested, result in short-termism and fail to address uncertainties, which could only be accommodated through state-led planning and coordination to facilitate investment in the economy. This position however assumed that uncertainties could be objectively known and addressed through planning, something that the Austrian school rejected. Hayek instead focused on the relationships between knowledge and uncertainty, highlighting tacit economic knowledge in particular (Adaman & Devine, 1996). In emphasising the distinction between a 'taxis' and a 'cosmos', he noted how a taxis is a constructed order, "rationally designed to serve a particular purpose" (Burczak, 2006: 40) but, by contrast, a cosmos is a spontaneously emerging order; it arises "from regularities of the behavior of the elements which it comprises" (Hayek 1978:74). Hayek challenged control-minded economists – such as Dobb and others - to recognise that not all orders arose from or required rational design. Instead, efforts to impose a taxis threatened a naturally evolving cosmos, with damaging effects. His insights were discovered anew in the context of the failure of Soviet planning and came to inform late twentieth century efforts to transform planned economies into hyper-liberalised market economies in which, it was hoped, tacit knowledge would lead actors to pursue experiments that would promote economic development.

economics. For example, Deidre McCloskey (1990) advances the Hayekian point that economists cannot begin to know all that they presume to know. In place of genuine knowledge, they too often sell "snake oil." Hence, policymakers following economists' dictates cannot exert the kind of control over economic affairs that many economists have promoted. The 'post-Keynesian' tradition has been equally critical of the epistemic framing of mainstream economics. They have taken up Keynes' own insights and pushed back with particular intensity against any neoclassical-Keynesian synthesis, with its promise of guiding the economy along stable, predictable growth paths. They argue that the approach represses Keynes' chief epistemic insight: that we cannot know how private market actors will respond to stimuli. Some post-Keynesians infer that the state cannot eliminate cycles and crises under a liberal market order (Crotty, 2019) linked to long waves of often unpredictable Schumpeterian innovation (Perez, 2003), while others emphasise the sometimes epoch-shaping uncertainties that emerge in production processes (Chang & Andreoni, 2020).

Ecological economics takes a different approach to addressing uncertainty, highlighting how non-linear flows of resources, energy and waste must be conceptualised within complex systems subject to pressing local and planetary constraints (Common & Stagl, 2005; Raworth, 2017). The approach goes beyond the narrower extension of neoclassical presumptions in the field of environmental economics, which less ambitiously seeks to theorise and internalise externalities in economic calculus. Ecological economics, by contrast, challenges the way we think about the relationships between economy, ecology and human values, examining interactions between domains with complex causal relations where uncertainties emerge (Cartwright, 1980). Echoing ideas from 'post-normal science' (Funtowicz & Ravetz, 1993, 1994), when uncertainties prevail, values are plural, stakes are high and decisions are urgent, ecological economics offers an opportunity to engage with system complexity under uncertain conditions, where singular expert models are insufficient and deliberation among 'extended peer communities' is needed. An economics that accepts that there are plural values associated with different ethical positions must accept that such deliberation, enhanced by a range of methods such as disaggregated multi-criteria approaches, is essential (Spash, 2013). Ecological economics in this mode therefore offers a route to addressing the urgent questions concerning sustainability (Daly, 2007; Kallis, 2019), (de-) growth (Hickel & Kallis, 2020) and wider well-being (Brand-Correa et al., 2022) in ways that are attuned to system complexity and uncertainty.

The field of complexity economics (and more recently, quantum economics; see Orrell, 2018) presents a particularly stiff challenge to standard, deterministic economics. Instead, complexity economics offers insights into how non-linear systems operate. Here, instability is the norm; any apparent equilibria are illusory and unstable, and dynamic paths exhibit breaks, jumps and unpredictable behaviours (e.g., Ormerod, 1994; Beinhocker, 2006; Colander & Kupers, 2014; Gräbner & Kapeller, 2015; Arthur, 2015, 2021). For complexity economists, viable models of the economy must reckon with "black swans" (Taleb, 2007) of all sorts, recognising that the presence of unpredictable and even unimaginable events render useless attempts to predict economic futures or to control economic flows and outcomes. Indeed, the approach calls into question the very idea of economic causality, upon which standard models depend. In Brian Arthur's (2015: 1) words,

> Complexity economics thus sees the economy as in motion, perpetually "computing" itself—perpetually constructing itself anew. Where equilibrium economics emphasizes order, determinacy, deduction, and stasis, complexity economics emphasizes contingency, indeterminacy, sense-making, and openness to change.

Further, narrative economics recaptures the insights of Shackle on the epistemic nature of economics advanced decades before. From this perspective, economic models construct narratives, replete with metaphors and imaginaries, which provide the basis for making sense of complex, uncertain worlds (McCloskey, 1998; Bronk, 2009; Beckert, 2016; Akerlof & Snower, 2016). Narratives are essential as economic actors look to navigate the economy, and yet they are irreducibly fictitious. Competing narratives are conditioned by emotions, collective thinking, fads and fashions (Shiller, 2011; Tuckett, 2011), what Karin Knorr-Cetina (2007) refers to as 'epistemic cultures.' The narrative approach emphasises the tentative nature of economic modelling and the reflexivity of economic analysis (Sutton, 2002; Bronk, 2013; Beckert & Bronk, 2018). Recognition of the existence of epistemically insecure competing narratives undermines the hunt for one 'optimal' policy option, and instead provides the basis for making judgements about how to act responsibly in an inescapably uncertain world.

What might be called post-structuralist economists have perhaps gone furthest in highlighting that economic narratives are constitutive—shaping the worlds we inhabit—rather than merely explanatory (e.g., Resnick & Wolff, 1987; Ruccio & Amariglio, 2003). From this perspective, the misguided impulse to control can itself create unpredictable disruptions. Meanwhile, feminist economists have challenged the standard conception of '*homo economicus*' as the universally appropriate model of economic identity and behaviour (e.g., Kabeer, 1994; Nelson, 2004; Ghosh, 2012; Kuiper, 2022). Feminist perspectives emphasise how positionality and social difference affect how we understand economic actors, the world they act in, and the goals they do and should pursue. Like 'stratification economics' (Chelwa et al., 2022), feminist analysis seeks to reveal biases that inform economic theory, policy design, market interactions and economic outcomes and so problematises standard claims to certainty.

In the wake of the 2008 financial crisis – and in direct confrontation with unexpected empirical realities - some mainstream macroeconomists have come to accept the severe epistemic limits under which they work (e.g., Krugman, 2009). For instance, Kenneth Rogoff (2018) writes that, "As any academic macroeconomist will tell you, the global economy never ceases to be uncertain and unpredictable." In the same vein, Peter Orszag, Robert Rubin and Joseph Stiglitz (2022: 2) argue that, "In our collective experience, fiscal policy should… be informed by copious amounts of humility, particularly given the role of impossible to predict events (including pandemics, wars, and bubbles)." These and other macroeconomists are coming to recognise that deriving strong claims of causality from econometric models of the economy is highly problematic (Coyle, 2021: 100-1).

5. Uncertainties, development economics and the "Hirschmanian mindset"

By the late twentieth century, some influential economists had come to dismiss the "need for development economics because, in the new order, the laws of economics had universal validity without regard for structural or historical difference" (Polanyi Levitt, 2022: 15).

Among the prominent dissenters to this view was Hirschman. He worked across many disciplines and lived and conducted research in many national contexts, although he is perhaps best known as a development economist. His oeuvre provides a bridge between the array of epistemic dissent emerging across economics discussed in the previous section – with his work often preceding the blossoming of heterodox economics by decades - and the field of development economics and practice.[6]

While most development experts repressed uncertainty as they crafted ambitious development plans, Hirschman chose to embrace it. While his colleagues looked to infer policy strategy from blackboard proofs, Hirschman's mindset led him to celebrate the "possibilism" that arises when we just cannot know what strategies will and will not work (Hirschman, 2013 [1971]; see Lepenies, 2008). For Hirschman,

[6] Grabel (2017: chapter 2) develops the idea of a Hirschmanian mindset in greater detail than we can present here; see also Grabel (2019, 2022, 2023).

epistemic limits provided a "bias for hope," while his concept of the "Hiding Hand" emphasised the vital role of experimentation and pragmatic problem solving in response to unforeseen or underestimated challenges.[7] In his view, learning (imperfectly) from others—what Charles Lindblom (1959) referred to as "muddling through"—provided the right approach to development implementation (Hirschman and Lindblom (1971 [1962]).

For Hirschman, the development economist confronts an obscure world that cannot ever be 'known' via universal theories, let alone domesticated through social engineering. Hirschman embraced the virtues of theoretical messiness and complexity - what Grabel (2017) calls "productive incoherence" - over contrived coherence and parsimony. He urged development practitioners to look at the "development process in the small" and "immersion in the particular," seeking spaces for opportunistic interventions and innovation, and to push back against seductive visions of grand institutional change (Hirschman, 1969: ix, 1967: 2). Hirschman emphasised modest, mid-range theories and empirics, managing to combine intellectual boldness with humility. Against the "development experts" (Hirschman, 1965; 1967: chapter 1) who aspired to control, Hirschman embraced the autonomy and self-determination of the communities that development economists purported to serve. Hirschman (2013 [1970]: 144) even wondered whether expert meddling was "inspired primarily by compassion or by contempt" for the lot of poorer countries.

Hirschman accepted Hayek's view that much knowledge is tacit, partial and dispersed. He accepted equally Knight's, Keynes' and Hayek's views that the future is fundamentally uncertain (Hirschman, 2013 [1970]; see Alacevich, 2014, 2021). For Hirschman, the outcome of any intervention is unknowable in advance since it is always confounded by the "*balance* of the contending forces that are set in motion" and the totality of contextual circumstances at the time of the intervention, neither of which was accessible to the researcher (Hirschman, 2013 [1970]: 150). In Hirschman's view, the failure of development experts to appreciate the severe "limits to 'intelligibility' of our complex world" (Adelman, 2013: 238) led them to treat poorer countries as essentially simple, manipulable systems that invited expert control (Hirschman, 2013 [1970]: 144). This orientation led him to an appreciation of backward and forward linkages (associated with non-deterministic structuralism and the virtues of unbalanced growth) often tied to unpredictable side-effects that can induce new capabilities (Hirschman, 1969 [1958], 1967, 1973). In this and many other respects, Hirschman anticipated a paradigm shift, just now under way, towards understanding the economy as a 'complex adaptive system' that features constant evolution and abrupt shifts and, notably, the absence of sufficiently powerful equilibrating mechanisms (such as the Walrasian auctioneer) that can be relied on to bring an economy in a disequilibrium state back into equilibrium (Kirman, 2016).

The recognition of uncertainty is especially crucial in settings where informal, parallel, second, real, hustle or creole economies dominate (e.g., MacGaffey, 1991; Browne, 2002; Meagher, 2010; Jones, 2010; Thieme, 2018). This is the 'indigenous capitalism' of much of the world, where uncertainty reigns. Here the standard Western market models do not apply. Various attempts have been made to provide an alternative, 'Southern' perspective on economic thinking, including the Havana Charter and the UNCTAD approach to economic development (see, Reinert et al., 2016; Nissanke & Ocampo, 2019), as well as economics approaches emanating from Ghandian or Islamic traditions, for example (cf. Pani, 2001; El-Ashker & Wilson, 2006), or rooted in African contexts (Mkandawire, 2001; Nasong'o & Ikpe, 2022). Emerging from different settings, some of these have embraced uncertainty more centrally than the mainstream Western canon.

The notorious failure of Gross Domestic Product measures to reflect the reality of economic activity especially in such contexts, for example, is well known (Jerven, 2013); the result of inadequate and poorly framed economic statistics, often the inheritance of colonial era thinking and practice (Serra, 2014; Nyamunda, 2017). The Western gaze on so-called developing economies misses important dimensions, as noted long ago by Dudley Seers (1962) and Polly Hill (1986). Such framings miss the ingredients for economic success as crucial aspects remain hidden, as Deepak Nayyar found when revisiting the 1968 analysis by Gunnar Myrdal in *Asian Drama* in the light of the Asian growth story since (Nayyar, 2019; Myrdal, 1968).

As Hirschman argued, a more respectful approach that embraces the complexity of actually-existing economies—as opposed to simplistic model economies—is required, where uncertainty is always central. This requires a different starting point, one rooted in the always contradictory and transient economic practices and institutions – including the pragmatic getting by and making-do of '*debrouillardise*', a term used to describe economic behaviour in the Democratic Republic of Congo and elsewhere (Wild-Wood, 2007).

Immersed in these types of contexts, Hirschman's epistemic commitments and diverse experiences informed his distinct vision of development. He advocated a development approach that would "stress the unique rather than the general, the unexpected rather than expected, and the possible rather than the probable" (Hirschman, 1971: 28). In the words of his biographer Jeremy Adelman, Hirschman's work is marked by the view that "the study of social change, if it is to be helpful… should rethink the typical reliance on predictions according to laws of change and consider instead the analysis of possibilities and alternatives for social change" (Adelman, 2013: 137). With Lindblom he argued that "It is clearly impossible to specify in advance the optimal doses of… various policies under different circumstances. The art of promoting economic development… and constructive policymaking… consists, then, in acquiring a feeling for these doses" (Hirschman & Lindblom, 1971 [1962]: 83–84).

In 1994, Paul Krugman took stock of the state of development economics. He argued that the field had only recently been "rescued" from Hirschman and other like-minded thinkers. We argue the opposite: the need to reclaim such thinking for a world of uncertainty. As others are demonstrating across a range of heterodox and dissenting perspectives discussed briefly above, embracing uncertainty does not require abandoning economic methods, analysis and advice. It involves instead searching for strategies that prove to be robust in the face of highly variable, indeterminate, uncertain settings. In the spirit of Hirschman's influential work, this requires breaking with approaches that are overly prescriptive and deterministic – whether neoclassical models of individualised economic actors in idealised markets; mechanistic Keynesianism purporting to be able to map policy interventions onto determinant outcomes; narrow forms of causal experimentalism and paternalistic behaviourism, along with simplistic deterministic, structuralist perspectives on capitalist development. As we discuss further below, this shift has major implications for economics training, ethics and professional practice, perhaps especially in the context of the practice of 'development'. To get at this we explore briefly two very different empirical sketches – pastoral development and global financial governance – from our own empirical research that both feature strategies that reflect awareness of uncertainty, each drawing firmly on the Hirschman tradition.

6. Navigating uncertainties in the worlds of pastoralism and high finance

In the two sketches that follow, we focus on two very different sets of actors that would certainly not be categorised together in most social science research. The first are East African pastoralists, seeking reliability in highly variable dryland environments; the second are

[7] The capitalisation is Hirschman's *The Hiding Hand* has been the subject of lively debate (e.g., see the collection in *World Development*, 2018, volume 103; see also Alacevich, 2021: chapter 4); Grabel (2017: chapter 2) and Gasper, 1986.

policymakers from the Global South who look to protect themselves from global financial instability. Their worlds are of course wildly different. What they share is the fact that they face and must respond to challenges posed by the ineradicable uncertainties they confront in volatile, complex environments, where the stakes, though very different, are high. In both cases we find actors, who might be taken to have limited agency, utilising many of the principles and practices discussed by Hirschman. We therefore highlight the role of local knowledges, *ad hoc* experimentation and innovation, learning-by-doing and learning from others, along with pragmatic problem solving as a route to increasing resilience and exercising autonomy. Finally, both sketches highlight the initiatives of less powerful actors who entertain no illusions that they can control their worlds.

6.1. Pastoralists and drought in East Africa

Drought is a recurrent feature of dryland areas, and pastoralists – mobile livestock keepers who make use of extensive rangelands for their livelihoods – are frequently heavily affected. From mid-2022 into 2023, a drought across southern Ethiopia, northern Kenya and into Somalia resulted in the loss of huge numbers of livestock, with major impacts on food security for dryland populations.[8]

Over the years, many development programmes have invested in mechanisms for drought early warning and disaster response, including offering a range of social protection and insurance programmes to mitigate the effects of drought disasters. These solutions make use of sophisticated satellite-based monitoring systems linked to climate models to predict drought impacts, with early action responses based on a range of anticipatory models. Such risk management approaches assume that drought is a calculable risk that can be predicted and so managed, with disasters averted (Johnson, Mohamed, Scoones, & Taye, 2023). However, investments in risk-based early warning and humanitarian and disaster response have often been found wanting (Buchanan Smith & Davies, 1995; Caravani et al., 2021). Information derived from such predictions are frequently not followed, as such information systems are not embedded in people's day-to-day lives and practices (Buchanan-Smith et al., 1994; Mohamed & Scoones, 2023a).

As the experience in 2022–23 has shown – along with many other examples before – predicting drought is not straightforward; there are many uncertainties involved. The much-improved large-scale climate models may not 'down-scale' easily, making precise predictions for particular places impossible (Ericksen et al., 2012). Many disasters emerge through the compounded, cascading effects of multiple factors – locust attacks, inter-ethnic conflict, economic downturns and so on – and context-specific responses are required. In 2022-23, pastoralists in the Greater Horn of Africa had to deal with drought on the back of the major impacts of the COVID-19 pandemic (Simula et al., 2021). Pastoralists living in such settings are however well-practised in confronting droughts, as part of a suite of other uncertainties.

Such responses, aimed at increasing reliability, include the redistribution of animals through loans, splitting herds and flocks between different sites, changing the species composition, ensuring supplementary feeding and watering, negotiating access to fodder in farmland or protected areas, sales of certain animals and livelihood diversification to gain other income sources (Mohamed & Scoones, 2023b). This is not just a pattern of passive 'coping', but a deliberate, well-planned set of responses, all of which are central to 'living with uncertainty' in the drylands (Scoones, 1994). These strategies may not always be successful, as the terrible toll on livestock populations during 2022–23 showed, but disasters are frequently offset or at least ameliorated though a range of practices. Pastoralists must always live with and from variability, and so must continuously navigate uncertain conditions (Krätli & Schareika, 2010). Unexpected droughts – variable across time and space – are in this sense 'normal'.

Variability is the basis of pastoral production, involving mobile grazing across extensive landscapes, with careful herding (FAO, 2021; Scoones & Nori, 2023). Given the contingencies and uncertainties involved, even with sophisticated dynamic and stochastic approaches, it is impossible to model such practices effectively and precise prediction is futile. Agent-based and Bayesian approaches may offer some insights, focusing on how individual pastoralists respond to complex, fast-changing settings and uncovering how decisions are made sequentially in response to unfolding conditions (e.g., Yu, Evans, & Malleson, 2019; Lybbert et al. 2007). However, in the end, an economic understanding of pastoralism must embrace uncertainty and confront irreparable ignorance.

This means focusing not on predicting or anticipating actions but building on existing practices to improve reliability (Roe et al., 1998), very much in the Hirschman tradition. As with other 'critical infrastructures', this means reducing high input variation, so as to ensure a reliable, low-variability flow of system services – milk, meat, hides and so on, at the same time as assuring the viability of the asset (Roe, 2016, 2020). As 'high reliability professionals', pastoralists – working with others in wider networks – must actively manage uncertainties and avoid sources of ignorance where the real dangers lie (Scoones, 2023), deploying the strategies of experimentation, learning-by-doing and adaptive responses highlighted by Hirschman.

Pastoralists use movement to gain access to pasture and water (although some may move fodder and water to animals instead of moving the animals themselves). This requires timely knowledge about resource availability, prices of commodities, the flexible mobilisation of labour and transport, networking among different groups, scouting for information and real-time communication to allow responsive action (Maru et al., 2022). Flexible mobilities are not amenable to prescriptive plans or regulations and must rely on adaptive flexibility, responsive to highly variable conditions (Scoones & Nori, 2023). Unsurprisingly, these are features all central to the operation of development projects that Hirschman observed in the 1960s (Hirschman, 1967).

Central to pastoralists' responses are social networks – among pastoralists, across ethnic groups, with government officials, politicians and others. Mobilising knowledge requires investing in networks and relationships and building both formal and informal institutional capacities (Mohamed, 2023). For example, in response to uncertainties about animal disease, pastoralists in northern Kenya connect different knowledge networks, with brokers acting to mediate between them (Tasker & Scoones, 2022), and so echoing perspectives from institutional and complexity economics.

In facilitating mobility as a response to uncertainty, pastoralists must galvanise the group, learn the route, find out about conditions in other areas and be attuned to changing temporal and spatial patterns in key resources. Animals must be well-trained and skilled herding is essential (Krätli, 2008). This is above-all a social process, with particular gendered and age-specific roles. Movement is embedded in culture, associated with songs, poems and sayings and movement – so much a part of daily life – and is an emotional, affective experience, not simply a rational, scripted response (Maru, 2020).

In extensive, dryland pastures, making use of common resources is vital. Maybe combined with private sources of fodder, shared resources managed through communal institutions are essential (cf. Ostrom, 1990). In times of drought, 'key resources' – riverbanks, wetlands, forested hills – are especially important (Scoones, 1991), as they provide a level of redundancy in a complex landscape and are crucial when droughts strike. Yet such resources are easily encroached, subject to land or green 'grabs' that appropriate such 'unused' land, and so undermine the overall resilience of the system (White, Borras, Scoones, & Wolford, 2012).

[8] https://www.thenewhumanitarian.org/News/2022/31/05/A-country-by-country-guide-worsening-drought-in-the-Horn-of-Africa.

Pastoralists' responses to uncertain contexts are thus very different to rationalist, predictive risk management with anticipatory responses to a singular shock or event. Instead, firmly in the tradition of Hirschman and suggesting a different type of economic analysis, pastoralists must embrace uncertainty through much more emergent, adaptive responses, embedded in local networks, institutions and cultures, while providing flexibility and the possibility of exit through redundancy and the mobile use of common resources (Scoones, 2021).

6.2. Responding to financial crises in the global South

The financial crises of the 1990s and then 2008 presented a costly refutation to the idea that practices informed by economic theory had eliminated uncertainty and so provided dependable guidance for policy and institutional design. While in the first instance these crises solidified the International Monetary Fund's (IMF's) role in enforcing neoliberal responses (Grabel, 2017: chapter 3), they ultimately induced irreparable cracks in the neoliberal consensus. By the early 2000s, policymakers in the Global South had come to understand what economists had long repressed—that they operated in a world of epistemic insufficiency. That insight inaugurated a period of extraordinary institutional experimentation, centred on pragmatic problem solving (successful and not), innovation and learning-by-doing.

Two features of these dynamics are particularly notable and reflect Hirschmanian sensibilities. First, the wide-ranging institutional experiments were unscripted. They were not deduced from blackboard demonstrations of optimal institutional configurations; nor did they target economic efficiency. Instead, they represented pragmatic responses to pressing challenges that were not driven by a grand theoretical framework. Key actors looked to establish institutions and policies that would prove to be robust in the face of enduring uncertainty. Second, although some important early initiatives failed to take root, they laid the groundwork for later initiatives that succeeded in altering the landscape of global financial governance in ways that provide some measure of protection of Global South economies from global financial vicissitudes.

The range of new initiatives in financial governance that followed the crises of 1997–98 and 2008 is striking, especially in comparison with the institutional stagnation of the neoliberal period when rigid thinking dominated, rather than the sort of pragmatic innovation that Hirschman advocated. For Hirschman, the tendency to pronounce policy failure in advance of its application reflected a grievous error involving the prenarration of history that doomed what might otherwise be viable initiatives (Hirschman, 2013 [1970]). The crises flipped the script, inducing a new appreciation of uncertainty in financial affairs, which opened the floodgates to policy and institutional experimentation. The new pragmatism ultimately even influenced the thinking of the IMF. Most notably, perhaps, was a new-found appreciation of the utility of capital controls, which as recently as 1997 the IMF had sought to ban via a change in its Articles of Agreement. Countries of the Global South learned through experience how to employ capital controls to influence the disruptions associated both with rapid capital inflows and outflows. In the light of these experiences, the IMF switched its position, rebranding capital controls during the crisis of 2008 as prudential financial management, and began to consider them a "legitimate part of the policy toolkit" (Grabel, 2017: chapter 7).

Equally importantly, new institutions were created to ensure counter-cyclical crisis support and long-term project finance. Many of these institutions signed cooperation agreements with one another, establishing new networks that facilitated their capacity to adjust in the face of changing conditions. Some of these institutions comply with the established IMF model of surveillance and conditionality, but others deploy entirely different approaches to disbursement and surveillance, while also extending loans in local currencies (Grabel, 2017: chapter 6).[9]

Initial excursions by countries across the Global South into financial governance have not all been successful. But, as Hirschman would have expected, some initial failures provided opportunities for learning and adjustment (as per his concept of the Hiding Hand), bearing fruit in new forms and in new settings. For instance, as the East Asian financial crisis emerged in 1997, Japan proposed the formation of an Asian Monetary Fund. The Fund was to be independent of the IMF; its mission was to provide liquidity that protects policy autonomy in times of economic turbulence. The initiative was killed immediately on political grounds by the US, China and the IMF. But the initiative catalysed pragmatic thinking across the Global South about institutional innovation that has continued to this day (Grabel, 2017: chapter 3).

Another important site of innovation in financial governance is taking place among the BRICS countries— Brazil, Russia, India, China and South Africa, a grouping that has now significantly expanded. The BRICS have evolved from an acronym created by a financier (initially BRICs since South Africa was not an original member), to an informal group that met on the margins of a G-8 meeting in 2006 to a formal network with ministerial meetings. It is now an important network with an evolving institutional architecture that includes, for example, the New Development Bank, which is beginning to make loans to members in currencies other than the US dollar (so far only the RMB, with plans to disburse in other currencies). The BRICS also have a nascent liquidity support arrangement (the Contingent Reserve Arrangement) and China has established the Asian Infrastructure Investment Bank (AIIB) in 2015, along with a raft of other lending, investment and aid facilities.

These developments do not reflect a new coherent theoretical vision; instead, there are deep inconsistencies and unevenness in the emergence of disparate, overlapping and interconnected institutions that look to manage dangerous financial flows in the context of deep uncertainty. The initiatives are diversifying the financial governance landscape, dispersing power within it and inaugurating a more complex, decentralised, pluri-polar global financial and monetary system that is likely to be far more robust in the face of an unknowable and uncontrollable future.

Is the resulting 'disorder' disconcerting? For those of us trained in economics to seek guidance in parsimonious theory and institutional coherence, it surely is. But we propose instead that we follow Hirschman in not rushing to judgement, keeping in view the value of experimentation and continuous pragmatic adjustment. With Hirschman, we interpret the current incoherence as productive, allowing for the discovery of effective institutional arrangements and policy strategies that cannot be inferred from standard models, but which must arise from doing, failing and adjusting (Grabel, 2017).

While the worlds of pastoralism and finance are wildly different in almost all respects, we find striking similarities in the ways uncertainties have been confronted via adaptive, flexible responses. If the aim is to design robust, reliable practices to support development in highly uncertain settings—by which we mean practices that generate a reasonably stable stream of services (as with meat or milk from animals or financial flows that serve development objectives or quell liquidity crises)—then

[9] More recent initiatives include China's 2015 programme to develop a Cross Border International Payments System (CIPS) as an alternative to SWIFT (Society for Worldwide Interbank Financial Telecommunication), the West's dominant international financial messaging system used widely for cross-border payments. While CIPS remains extremely small relative to SWIFT, sanctions in Iran and now the war in Ukraine have provided Chinese and other policymakers with incentives to push it forward as a workaround to US financial power. Others, such as Russia, have sought to reduce dependence on the dollar and to provide some protection from the weaponisation of finance and trade relations by the US and other financial powers. Before the war, Russia was already developing an alternative to SWIFT, with the hope that it would connect to China's CIPS and that India would join the Russian alternative (Grabel 2022, 2023).

certain principles are central. Following Hirschman, these include unscripted pragmatic flexibility and adaptability, learning-by-doing, continuous monitoring, organisational redundancy, social networking, sharing of common resources and the preservation of exits from strategies that go wrong. All of these entail some loss of 'efficiency,' as economists define it, while pursuing such strategies requires rejecting once-and-for-all standard models that presume to tell us what will and won't work or what are the uniquely 'optimal' strategies to control the world through our interventions.

7. Confronting uncertainty with new methods

Some of these vital lessons from Hirschman are accepted by a new field – decision-making under deep uncertainty (DMDU) – where uncertainty is explicitly embraced (Marchau et al., 2019). DMDU foregrounds Knightian uncertainty and therefore rejects entirely the 'predict then act' model of policy analysis that has dominated economics and other fields for a century (Lempert et al., 2013). It rejects equally the pursuit of efficient policy design and outcomes on the grounds that the hunt for efficiency is far too dangerous in an unpredictable world; not least, because it runs the risk of imposing grave harms on affected communities, especially on the most vulnerable and those lacking political voice. In its place, the approach seeks 'robust' policy, by which is meant policy that stands to do *well enough* across a very large number of possible futures (Lempert, 2019). Such an approach is as relevant to questions of global finance as it is to issues faced by pastoralists in dryland Africa.

The DMDU approach starts from the assumption that social and natural systems are non-linear and interrelated. In this context no model can tell us what will happen next; none can dependably map policy interventions onto outcomes. Instead, DMDU generates thousands of possible futures, without weighting them by probabilities, and then empowers stakeholders—especially those who stand to be most seriously harmed, and those who are typically excluded from policy deliberation—to decide which risks to take in pursuit of which valued ends (Hallegatte et al., 2011). The approach recognises, in Hirschmanian fashion, that all policy interventions are experiments. But with Hirschman, and contrary to most RCT practitioners, here the experts experiment *with* rather than *on* those they seek to serve. The approach also dethrones the detached economist and arms-length policy analyst who lacks what Nassim Nicolas Taleb calls "skin in the game" (Taleb, 2018). Instead, what is required is meaningful, ongoing involvement of economists (and other experts) with stakeholders in decision-making processes, deliberation on the ambiguity of outcomes, assessment of uncertainties and negotiation around different versions of contested knowledges.

Building on the core principles of experimentation, improvisation, incremental learning and local level adaptation, the goal is to inform rational, responsible decision support, where those most directly and deeply affected by the consequences of policy decisions themselves play central roles in collaborative policy deliberation and policy choice.[10] This is inevitably a social process that embraces enduring collaborations with diverse participants to confront problems that have no end date. The transformation in economic practice is also ethical - away from a paternalistic vision in which the economist-knows-best to a vision in which the economist recognises the integrity and autonomy of those they hope to serve; something that Hirschman passionately argued for many decades ago.

8. Conclusion

The standard economic framing that represses uncertainty has generated dangerously over-confident assertions about what to do to promote 'development.' In contrast, self-awareness about the assumptions we make about complex processes, expected outcomes and future dynamics opens the door to more robust economic analysis. We emphasise that "uncertainty (of whatever kind) is by definition not a condition that is simply 'out there' in the world; uncertainty is a property of *relations* between what is known and who is doing the knowing" (Scoones & Stirling, 2020: 11). Both private economic actors and public decision-makers operate under epistemic insufficiency—there is simply no escaping the problem. As a consequence, and following Shackle, economics must study the construction and transmission of economic stories and beliefs rather than seek grounding in rational calculation of 'optimal' strategies as determined by 'objective' data. Navigating the future requires negotiating narratives, informed by different imaginaries (Bronk, 2009; Beckert, 2016). Edward Leamer (2009: 3) conveys much of what the new thinking alludes to when he writes in his influential textbook,

> You may want to substitute the more familiar scientific words "theory and evidence" for "patterns and stories." Do not do that… The words "theory and evidence" suggest an incessant march toward a level of scientific certitude that cannot be attained in the study of a complex, self-organizing human system that we call the economy. The words "patterns and stories" much more accurately convey our level of knowledge, now, and in the future as well. It is literature, not science.

What approaches might help recast an economics of control for make-believe model economies to one appropriate to the uncertain world we inhabit? Perhaps from a surprising provenance, given the long history of five-year plans, the Indian government has recently proposed an 'agile' approach to managing the economy, based on the experience of the COVID-19 pandemic. In the preface to the *2021–22 Economic Survey* – and quoting Hayek's views on the 'pretence of knowledge' – the ministry of finance argues, "This framework is based on feed-back loops, real-time monitoring of actual outcomes, flexible responses, safety-net buffers and so on. Planning matters in this framework but mostly for scenario analysis, identifying vulnerable sections, and understanding policy options rather than as a deterministic prediction of the flow of events……".[11] Following the central ideas of Hirschman and aligning with the ideas now being explored under the umbrella of DMDU, this is a major shift from the standard approach that defines a plan from prior analysis or model and then has a strict approach to implementation. The ministry argues that an alternative approach is now possible thanks to the availability of real-time data on all aspects of the economy and the ability to monitor, learn and react adaptively as circumstances change.

The common response to uncertainty by the economics profession and the decision-makers they serve is to demand more knowledge: if only we could parameterise each variable, then a risk model could be fitted, and we could predict what will happen and plan the future. More economic knowledge is expected to shrink the domain of our ignorance, yielding better predictions and a heightened ability to plan and control. RCTs, increasing computing power, 'big data' analysis, artificial intelligence, machine learning and geographic information systems certainly add to our knowledge, but gaining new knowledge can expand rather than contract the domain of uncertainty and ignorance. New knowledge brings new capacities to act, and those capacities necessarily make salient new areas of ignorance (DeMartino, 2022). The financial crisis of

[10] The DMDU approach draws inspiration from some strands of ecological economics that highlight 'strong' versions of sustainability and 'deep' versions of ecological economics (Spash 2013). These emphasise the importance of participatory deliberation around different options, informed by plural values and different ethical positions (Özkaynak et al. 2004), as well as a wider argument around 'economic democracy' requiring a challenge to mainstream approaches that ignore complexity and uncertainty (Akbulut and Adaman 2020).

[11] https://www.indiabudget.gov.in/economicsurvey.

2008 was the result of *more* (not less) information; *faster* (not slower) processing power and *newer* (not archaic) models that promised control in the face of hyper-liquid financial markets. For this reason, we are not surprised that enormous investments in predictive early warning systems supported by satellite imaging have not reduced uncertainty either in the pastoral drylands or in financial systems.

That said, we fully accept Des Gasper's (2018) argument that an emphasis on uncertainty can open the door to the disavowal of responsibility for harm by those whose behaviour harms others. Uncertainty does not provide moral cover for those making decisions with ruinous consequences on the grounds that they could not have known that things would go so badly. Recognition of uncertainty instead implies a duty to support decision-making processes that help stakeholders, including the most marginalised and vulnerable, to discover robust strategies as they confront so-called 'wicked problems' in an often dangerous, opaque world. The DMDU approach discussed above, for one, provides a way forward in contexts where more data and more knowledge cannot suffice to ensure good policy outcomes.

Recognition of uncertainty implies a change in economic training. Uncertainty-aware instructors present economic practice as imperfectible art rather than perfectible science, emphasising where the world will always overwhelm the cognitive capacity of the very best economists armed with the most sophisticated techniques. Policy and institutional innovations are therefore always experimental - the n always equals 1 - and all stakeholders must be incorporated as key actors in the policy-making enterprise since they and not the economist will bear the costs of the decisions taken.[12]

Uncertainty should not be seen solely or even principally as a constraint, but also as an opportunity: "Instead of inventing numbers to fill the gaps in our knowledge, we should adopt business, political and personal strategies that will be robust to alternative future and resilient to unpredictable events… uncertainty can be embraced, because it is the source of creativity, excitement – and success." (Kay & King, 2020: cover). Today there is an acute need to displace perilous prediction, assertive causality in the service of control and the narrow calculus of risk and expected utility. Following Hirschman, this means shifting to a stance of pragmatic practice in economic analysis and policy advice for development - and indeed in other fields - whereby 'productive incoherence' can be a positive feature of negotiating an uncertain world, in the context of what Zygmunt Bauman (2013) has termed our challenging, turbulent 'liquid modernity.'

Funding sources

For IS, the writing of the paper has been supported by the UK Economic and Social Research Council through the STEPS Centre (Grant number: ES/R008884/1), as well as the European Research Council through an Advanced Grant (PASTRES, www.pastres.org, Grant number: 74032).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

[12] New initiatives in economics training emphasise heterodox approaches, including the importance of uncertainty. See, for example, https://www.ineteconomics.org/research/programs/knightian-uncertainty-economics-kue; https://www.core-econ.org/about/; https://www.exploring-economics.org/en/orientation/#discover; https://www.paecon.net/PAEReview/, among others. Meanwhile, challenges to the dominance of narrow patterns of authorship and publishing gather pace (e.g., Chelwa 2021).

Data availability

No data was used for the research described in the article.

Acknowledgements

This article emerged out of conversations that started during 2019 as part of the ESRC STEPS Centre's 'uncertainty' year (www.steps-centre.org/uncertainty). We would like to thank participants at the symposium and seminar series for stimulating this writing project. The empirical work on pastoralism was carried out by IS and colleagues as part of the European Research Council PASTRES project (pastres.org), while the empirical case on global financial governance is based on the work of IG.

References

Adaman, F., & Devine, P. (1996). The economics calculation debate: Lessons for socialists. *Cambridge Journal of Economics, 20*(5), 523–537.
Adelman, J. (2013). *Worldly philosopher: The odyssey of Albert O.* Hirschman: Princeton University Press.
Adler, M. (2019). *Measuring social welfare: An introduction*. Oxford University Press.
Akerlof, G. A., & Snower, D. J. (2016). Bread and bullets. *Journal of Economic Behavior & Organization, 126*, 58–71.
Akbulut, B., & Adaman, F. (2020). The ecological economics of economic democracy. *Ecological Economics, 176*, Article 106750.
Alacevich, M. (2014). Visualizing uncertainties, or how Albert Hirschman and the World Bank disagreed on project appraisal and what this says about the end of "high development theory". *Journal of the History of Economic Thought, 36*(2), 137–168.
Alacevich, M. (2021). *Albert O. Hirschman: An intellectual biography*. Columbia University Press.
Angrist, J., Azoulay, P., Ellison, G., Hill, R., & Lu, S. F. (2017). Economic research evolves: Fields and styles. *American Economic Review, 107*(5), 293–297.
Ariely, D., & Jones, S. (2008). *Predictably irrational*. Harper Collins.
Arrow, K. J., & Debreu, G. (1954). Existence of an equilibrium for a competitive economy. *Econometrica: Journal of the Econometric Society, 22*(3), 265–290.
Arthur, W. B. (2015). *Complexity and the economy*. Oxford University Press.
Arthur, W. B. (2021). Foundations of complexity economics. *Nature Reviews Physics, 3*(2), 136–145.
Banerjee, A., & Duflo, E. (2011). Poor economics. *Public Affairs.*
Bauman, Z. (2013). *Liquid modernity*. John Wiley & Sons.
Becker, G. S. (1976). *The economic approach to human behavior*. University of Chicago Press.
Beckert, J. (2016). *Imagined futures: Fictional expectations and capitalist dynamics*. Harvard University Press.
Beckert, J., & Bronk, R. (2018). *Uncertain futures: Imaginaries, narratives, and calculation in the economy*. Oxford University Press.
Beinhocker, E. D. (2006). *The origin of wealth: Evolution, complexity, and the radical remaking of economics*. Harvard Business Press.
Brand-Correa, L., Brook, A., Büchs, M., Meier, P., Naik, Y., & O'Neill, D. W. (2022). Economics for people and planet—Moving beyond the neoclassical paradigm. *The Lancet Planetary Health, 6*(4), e371–e379.
Bronk, R. (2009). *The romantic economist: Imagination in economics*. Cambridge University Press.
Bronk, R. (2013). Reflexivity unpacked: Performativity, uncertainty and analytical monocultures. *Journal of Economic Methodology, 20*(4), 343–349.
Browne, K. (2002). Creole economics and the débrouillard: From slave-based adaptations to the informal economy in Martinique. *Ethnohistory, 49*(2), 373–403.
Buchanan Smith, M., & Davies, S. (1995). *Famine early warning and response: The missing link*. Intermediate Technology Publications.
Buchanan-Smith, M., Davies, S., & Petty, C. (1994). Food security: Let them eat information. *IDS Bulletin, 25*(2), 69–80.
Burczak, T. (2006). *Socialism after Hayek*. University of Michigan Press.
Caravani, M., Lind, J., Sabates-Wheeler, R., & Scoones, I. (2021). Providing social assistance and humanitarian relief: The case for embracing uncertainty. *Development Policy Review, 40*(5), e12613.
Cartwright, N. (1980). The truth doesn't explain much. *American Philosophical Quarterly, 17*(2), 159–163.
Chang, H.-J., & Andreoni, A. (2020). Industrial policy in the 21st century. *Development and Change, 51*(2), 324–351.
Chelwa, G. (2021). Does economics have an 'Africa problem'? *Economy and Society, 50*(1), 78–99.
Chelwa, G., Hamilton, D., & Stewart, J. (2022). Stratification economics: Core constructs and policy implications. *Journal of Economic Literature, 60*(2), 377–399.
Colander, D. (2003). Post Walrasian macro policy and the economics of muddling through. *International Journal of Political Economy, 33*(2), 17–35.
Colander, D. (2011). How economists got it wrong: A nuanced account. *Critical Review, 23*(1–2), 1–27.
Colander, D., & Freedman, C. (2018). *Where economics went wrong*. Princeton University Press.
Colander, D., & Kupers, R. (2014). *Complexity and the art of public policy*. Princeton University Press.

Colander, D., & Rothschild, C. (2010). Sins of the sons of Samuelson: Vision, pedagogy, and the zig-zag windings of complex dynamics. *Journal of Economic Behavior & Organization, 74*(3), 277–290.

Common, M., & Stagl, S. (2005). *Ecological economics: An introduction*. Cambridge University Press.

Coyle, D. (2021). *Cogs and monsters*. Princeton University Press.

Crotty, J. (2019). *Keynes against capitalism: His economic case for liberal socialism*. Routledge.

Daly, H. E. (2007). *Ecological economics and sustainable development*. Edward Elgar Publishing.

Davidson, P. (1982). Rational expectations: A fallacious foundation for studying crucial decision-making processes. *Journal of Post Keynesian Economics, 5*(2), 182–198.

Deaton, A. (2020). Randomization in the tropics revisited: A theme and eleven variations. *National Bureau of Economic Research Working Paper, 27600*. https://www.nber.org/system/files/working_papers/w27600/w27600.pdf.

Deaton, A., & Cartwright, N. (2018). Reflections on randomized control trials. *Social Science and Medicine, 210*, 86–90.

DeMartino, G. (2021). The specter of irreparable ignorance: Counterfactuals and causality in economics. *Review of Evolutionary Political Economy, 2*(2), 253–276.

DeMartino, G. F. (2022). *The tragic science: How economists cause harm (even as they aspire to do good)*. University of Chicago Press.

El-Ashker, A., & Wilson, R. (2006). *Islamic economics: A short history*. Brill.

Ericksen, P., de Leeuw, J., Thornton, P., Said, M., Herrero, M., & Notenbaert, A. (2012). Climate change in sub-Saharan Africa. In A. Catley, J. Lind, & I. Scoones (Eds.), *Pastoralism and development in Africa: Dynamic change at the margins*. Routledge.

FAO (2021). Pastoralism – Making variability work. *FAO Animal Production and Health Paper*, 185. UN Food and Agriculture Organisation.

Friedman, M. (1953). The methodology of positive economics. *Essays in positive economics*. University of Chicago Press.

Friedman, M. (1953/1966). *Essays in positive economics*. University of Chicago Press.

Friedman, M. (2007). *Price theory*. Transaction Publishers.

Friedman, M., & Savage, L. (1948). The utility of choices involving risk. *The Journal of Political Economy, 56*(4), 279–304.

Funtowicz, S., & Ravetz, J. (1993). Science for the post-normal age. *Futures, 25*(7), 739–755.

Funtowicz, S., & Ravetz, J. (1994). The worth of a songbird: Ecological economics as a post-normal science. *Ecological Economics, 10*(3), 197–207.

Gasper, D. (1986). Programme appraisal and evaluation: The Hiding Hand and other stories. *Public Administration and Development, 6*(4), 467–474.

Gasper, D. (2018). Insouciance, indifference and any inspiration in the face of emergent global crises? In B. Jessop, & K. Knio (Eds.), *The pedagogy of economic, political and social crises: Crisis dynamics, construals, and lessons*. Routledge.

Ghosh, J. (2012). Women, labor, and capital accumulation in Asia. *Monthly Review, 63*(8), 1–14.

Grabel, I. (2017). *When things don't fall apart: Global financial governance and developmental finance in an age of productive incoherence*. MIT Press.

Grabel, I. (2019). Continuity, discontinuity and incoherence in the Bretton Woods order: A Hirschmanian reading. *Development and Change, 50*(1), 46–71.

Grabel, I. (2022). Post-American moments in contemporary global financial governance. In P. Katzenstein, & J. Kirshner (Eds.), *The downfall of the American order? Liberalism's end?* Cornell University Press.

Grabel, I. (2023). The war in Ukraine and the American financial order? *Review of Radical Political Economics, 22*(1), 7–43.

Gräbner, C., & Kapeller, J. (2015). New perspectives on institutionalist pattern modeling: Systemism, complexity, and agent-based modelling. *Journal of Economic Issues, 49*(2), 433–440.

Hallegatte, S., Lecocq, F., & De Perthuis, C. (2011). Designing climate change adaptation policies: an economic framework. *World Bank Policy Research Working Paper*, 5568. World Bank.

Hardy, A. (2019). *The crossroads of globalization: A Latin American View*. World Scientific.

Hayek, F. von (1978). *New studies in philosophy, politics, economics, and the history of ideas*. University of Chicago Press.

Hayek, F. von (1945). The use of knowledge in society. *The American Economic Review, 35*(4), 519–530.

Hayek, F. von (1975). The pretence of knowledge. *The Swedish Journal of Economics, 77*(4), 433–442.

Hickel, J., & Kallis, G. (2020). Is green growth possible? *New Political Economy, 25*(4), 469–486.

Hicks, J. R. (1939). The foundations of welfare economics. *The Economic Journal, 49*(196), 696–712.

Hill, P. (1986). *Development economics on trial: The anthropological case for a prosecution*. Cambridge University Press.

Hirschman, A. O. (1967). *Development projects observed*. Brookings Institution Press.

Hirschman, A. O. (1969[1958]). *The strategy of economic development*. Yale University Press.

Hirschman, A. O. (1971). *A bias for hope*. Yale University Press.

Hirschman, A. O. (1973). *Journeys toward progress. Studies of economic policy-making in Latin America*. WW Norton.

Hirschman, A. O. (2013[1970]). The search for paradigms as a hindrance to understanding. In J. Adelman (Ed.), *The essential Hirschman*. Princeton University Press.

Hirschman, A. O. (2013[1971]). Political economics and possibilism. In J. Adelman (Ed.), *The essential Hirschman*. Princeton University Press.

Hirschman, A. O., & Lindblom, C. E. (1971). Economic development, R & D, and policy making. In A. O. Hirschman (Ed.), *A bias for hope: Essays on development and Latin America*. Yale University Press.

Hodgson, G. M. (2011). The eclipse of the uncertainty concept in mainstream economics. *Journal of Economic Issues, 45*(1), 159–176.

Holland, P. (1986). Statistics and causal inference. *Journal of the American Statistical Association, 81*(396), 945–960.

Jerven, M. (2013). *Poor numbers*. Cornell University Press.

Jones, J. L. (2010). 'Nothing is straight in Zimbabwe': The rise of the Kukiya-kiya economy 2000–2008. *Journal of Southern African Studies, 36*(2), 285–299.

Kabeer, N. (1994). *Reversed realities: Gender hierarchies in development thought*. Verso.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgment under uncertainty: Heuristics and biases*. Cambridge University Press.

Kaldor, N. (1939). Welfare propositions of economics and interpersonal comparisons of utility. *Economic Journal, 49*(195), 549–552.

Kaldor, N. (1972). The irrelevance of equilibrium economics. *Economic Journal, 82*(328), 1237–1255.

Kallis, G. (2019). *Limits*. Stanford University Press.

Kay, J., & King, M. (2020). *Radical uncertainty: Decision-making for an unknowable future*. The Bridge Street Press.

Keen, S. (2021). *The new economics: A manifesto*. John Wiley & Sons.

Keynes, J. M. (1937). The general theory of employment. *The Quarterly Journal of Economics, 51*(2), 209–223.

Kirman, A. (2016). Complexity and economic policy: A paradigm shift or a change in perspective? *Journal of Economic Literature, 54*(2), 534–572.

Knight, F. H. (1921). *Risk, uncertainty and profit*. Houghton Mifflin.

Knorr-Cetina, K. (2007). Culture in global knowledge societies: Knowledge cultures and epistemic cultures. *Interdisciplinary Science Reviews, 32*(4), 361–375.

Krätli, S. (2008). Cattle breeding, complexity and mobility in a structurally unpredictable environment: The WoDaaBe herders of Niger. *Nomadic Peoples, 12*(1), 11–41.

Krätli, S., & Schareika, N. (2010). Living off uncertainty: The intelligent animal production of dryland pastoralists. *The European Journal of Development Research, 22*(5), 605–622.

Krugman, P. (1994). The rise and fall of development economics. In L. Rodwin, & D. Schön (Eds.), *Rethinking the development experience: Essays provoked by the work of Albert O*. Hirschman. Brookings Institution.

Krugman, P. (2009). How did economists get it so wrong?. *New York Times Magazine*.

Kuiper, E. (2022). *A herstory of economics*. John Wiley & Sons.

Leamer, E. E. (2009). *Macroeconomic patterns and stories*. Springer-Verlag.

Lempert, R. J. (2019). Robust decision making (RDM). In V. A. Marchau, W. E. Walker, P. J. Bloemen, & S. W. Popper (Eds.), *Decision making under deep uncertainty*. Springer.

Lempert, R. J., Popper, S. W., Groves, D. G., Kalra, N., Fischbach, J. R., Bankes, S. C., & McInerney, D. J. (2013). *Making good decisions without predictions: Robust decision making for planning under deep uncertainty*. RAND Corporation.

Lepenies, P. H. (2008). Possibilism: An approach to problem-solving derived from the life and work of Albert O. *Hirschman. Development and Change, 39*(3), 437–459.

Lerner, A. P. (1944). *Economics of control: Principles of welfare economics*. Macmillan and Company Limited.

Lindblom, C. E. (1959). The science of muddling through. *Public Administration Review, 19*(2), 79–88.

Loasby, B. J. (1991). *Equilibrium and evolution: An exploration of connecting principles in economics*. Manchester University Press.

Lybbert, T. J., Barrett, C. B., McPeak, J. G., & Luseno, W. K. (2007). Bayesian herders: Updating of rainfall beliefs in response to external forecasts. *World Development, 35*(3), 480–497.

MacGaffey, J. (1991). *The real economy of Zaire*. University of Pennsylvania Press.

Marchau, V. A., Walker, W. E., Bloemen, P. J., & Popper, S. W. (2019). *Decision making under deep uncertainty: From theory to practice*. Springer Nature.

Maru, N. (2020). A relational view of pastoral (im)mobilities. *Nomadic Peoples, 24*(2), 209–227.

Maru, N., Nori, M., Scoones, I., Semplici, G., & Triandafyllidou, A. (2022). Embracing uncertainty: Rethinking migration policy through pastoralists' experiences. *Comparative Migration Studies, 10*(1), 1–18.

McCloskey, D. N. (1990). *If you're so smart: The narrative of economic expertise*. University of Chicago Press.

McCloskey, D. N. (1998). *The rhetoric of economics*. University of Wisconsin Press.

Meagher, K. (2010). *Identity economics: Social networks and the informal economy in Nigeria*. Boydell & Brewer.

Mirowski, P. (1989). The probabilistic counterrevolution, or how stochastic concepts came to neoclassical economic theory. *Oxford Economic Papers, 41*(1), 217–235.

Mkandawire, T. (2001). Thinking about developmental states in Africa. *Cambridge Journal of Economics, 25*(3), 289–314.

Mohamed, T. (2023). Responding to uncertainties in pastoral northern Kenya: The role of moral economies. In I. Scoones (Ed.), *Pastoralism, uncertainty and development*. Practical Action Publishing.

Johnson, L., Mohamed, T., Scoones, I. & Taye, M. (2023). Uncertainty in the drylands: Rethinking in/formal insurance from pastoral East Africa. Environment and Planning A: Economy and Space, online first, https://doi.org/10.1177/0308518X231168396.

Mohamed, T., & Scoones, I. (2023a). *Local knowledge is crucial for crisis preparedness*. https://www.theelephant.info/features/2023/04/14/local-knowledge-is-crucial-for-crisis-preparedness/.

Mohamed, T., & Scoones, I. (2023b). *Kenya drought: Pastoralists suffer despite millions of dollars used to protect them - what went wrong?* https://theconversation.com/kenya-drought-pastoralists-suffer-despite-millions-of-dollars-used-to-protect-them-what-went-wrong-200838.

Murrell, P. (1993). What is shock therapy? What did it do in Poland and Russia? *Post-Soviet Affairs, 9*(2), 111–140.

Myrdal, G. (1968). *Asian drama: An inquiry into the poverty of nations*. Pantheon.
Nasong'o, W., & Ikpe, E. (Eds.). (2022). *Beyond disciplines: African perspectives on theory and method*. CODESRIA.
Nayyar, D. (2019). *Asian transformations: An inquiry into the development of nations*. Oxford University Press.
Nelson, J. (2004). Clocks, creation and clarity: Insights on ethics and economics from a feminist perspective. *Ethical Theory and Moral Practice, 7*(4), 381–398.
Nelson, R. H. (2001). *Economics as religion*. Pennsylvania State University Press.
Nissanke, M., & Ocampo, J. A. (Eds.). (2019). *The Palgrave handbook of development economics*. Palgrave MacMillan.
North, D. C. (1999). Dealing with a non-ergodic world: Institutional economics, property rights, and the global environment. *Duke Environmental Law & Policy Forum, 10*, 1.
Nowotny, H. (2015). *The cunning of uncertainty*. John Wiley & Sons.
Nyamunda, T. (2017). British sterling imperialism, settler colonialism and the political economy of money and finance in Southern Rhodesia, 1945 to 1962. *African Economic History, 45*(1), 77–109.
Ormerod, P. (1994). *The death of economics*. Faber and Faber.
Orrell, D. (2018). *Quantum economics: The new science of money*. Icon Books.
Orszag, P. R., Rubin, R. E., & Stiglitz, J. E. (2022). Fiscal resiliency in a deeply uncertain world: The role of semiautonomous discretion. *Industrial and Corporate Change, 31*(2), 281–300.
Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.
Özkaynak, B., Devine, P., & Rigby, D. (2004). Operationalising strong sustainability: Definitions, methodologies and outcomes. *Environmental Values, 13*(3), 279–303.
Pani, N. (2001). *Inclusive economics: Gandhian method and contemporary policy*. Sage Publications India.
Perez, C. (2003). *Technological revolutions and financial capital*. Edward Elgar Publishing.
Pigou, A. C. (2017). *1920*. The economics of welfare: Forgotten Books.
Polanyi Levitt, K. (2022). Unraveling the canvas of history. In H. Veltmeyer, & P. Bowles (Eds.), *The essential guide to critical development studies*. Routledge.
Raworth, K. (2017). *Doughnut economics: Seven ways to think like a 21st-century economist*. Chelsea Green Publishing.
Reinert, E. S., Ghosh, J., & Kattel, R. (2016). *Handbook of alternative theories of economic development*. Edward Elgar Publishing.
Resnick, S., & Wolff, R. (1987). *Knowledge and class*. University of Chicago Press.
Robbins, L. (1927). Mr. Hawtrey on the scope of economics. *Economica, 20*, 172–178.
Rodrik, D. (2007). *One economics, many recipes: Globalization, institutions, and economic growth*. Princeton University Press.
Rodrik, D. (2015). *Economics rules: The rights and wrongs of the dismal science*. W. W. Norton.
Rodrik, D. (2017). *Straight talk on trade*. Princeton University Press.
Roe, E. (2016). Policy messes and their management. *Policy Sciences, 49*(4), 351–372.
Roe, E. (2020). A new policy narrative for pastoralism? Pastoralists as reliability professionals and pastoralist systems as infrastructure. *STEPS Working Paper*, 113. STEPS Centre.
Roe, E., Huntsinger, L., & Labnow, K. (1998). High reliability pastoralism. *Journal of Arid Environments, 39*(1), 39–55.
Rogoff, K. (2018). Crash time. *Project Syndicate,* September 7, 2018. https://www.project-syndicate.org/onpoint/crash-time-by-kenneth-rogoff-2018-09.
Romer, P. M.. *The trouble with macroeconomics*. https://paulromer.net/trouble-with-macroeconomics-update/WP-Trouble.pdf.
Ruccio, D. F., & Amariglio, J. (2003). *Postmodern moments in modern economics*. Princeton University Press.
Samuelson, P., & Nordhaus, W. (1985). *Economics*. McGraw-Hill.
Scoones, I. (1991). Wetlands in drylands: Key resources for agricultural and pastoral production in Africa. *Ambio, 20*(8), 366–371.
Scoones, I. (2019). What is uncertainty and why does it matter?. *STEPS Working Paper, 105*. STEPS Centre.
Scoones, I. (2021). Pastoralists and peasants: Perspectives on agrarian change. *The Journal of Peasant Studies, 48*(1), 1–47.
Scoones, I. (Ed.). (1994). *Living with uncertainty: New directions in pastoral development in Africa*. Intermediate Technology Publishing.
Scoones, I. (Ed.). (2023). *Pastoralism, uncertainty and development*. Practical Action Publishing.
Scoones, I., & Nori, M. (2023). Living with and from uncertainty: Lessons from pastoralists for development. In I. Scoones (Ed.), *Pastoralism, uncertainty and development*. Practical Action Publishing.
Scoones, I., & Stirling, A. (Eds.). (2020). *The politics of uncertainty: Challenges of transformation*. Routledge.
Seers, D. (1962). Why visiting economists fail. *Journal of Political Economy, 70*(4), 325–338.
Serra, G. (2014). An uneven statistical topography: The political economy of household budget surveys in late colonial Ghana, 1951–1957. *Canadian Journal of Development Studies / Revue Canadienne d'Études Du Développement, 35*(1), 9–27.
Shackle, G. L. S. (1972/1992). *Epistemics and economics: A critique of economic doctrines*. Transaction Publishers.
Shiller, R. J. (2011). *Narrative economics: How stories go viral and drive major economic events*. Princeton University Press.
Simon, H. A. (1990). Bounded rationality. In J. Eatwell, M. Milgate, & P. Newman (Eds.), *The New Palgrave book series: Utility and probability*. W. W. Norton.
Simula, G., Bum, T., Farinella, D., Maru, N., Mohamed, T. S., Taye, M., & Tsering, P. (2021). COVID-19 and pastoralism: Reflections from three continents. *The Journal of Peasant Studies, 48*(1), 48–72.
Spash, C. (2013). The shallow or the deep ecological economics movement? *Ecological Economics, 93*, 351–362.
Spiegelhalter, D. (2017). Risk and uncertainty communication. *Annual Review of Statistics and its Application, 4*, 31–60.
Stirling, A. (2010). Keep it complex. *Nature, 468*(7327), 1029–1031.
Stirling, A., & Scoones, I. (2020). COVID-19 and the futility of control in the modern world. *Issues in Science and Technology, 36*(4), 25–27.
Sutton, J. (2002). *Marshall's tendencies: What can economists know?* MIT Press.
Taleb, N. N. (2007). *The black swan: The impact of the highly improbable*. Random House.
Taleb, N. N. (2018). *Skin in the game: Hidden asymmetries in daily life*. Random House.
Tasker, A., & Scoones, I. (2022). High reliability knowledge networks: Responding to animal diseases in a pastoral area of northern Kenya. *Journal of Development Studies, 58*(5), 968–988.
Telles, K. (2023). From Austrian theory of capital to dissent: Nicholas Kaldor, Friedrich A. *Hayek and the way to disequilibrium. EconomiA*. https://www.emerald.com/insight/content/doi/10.1108/ECON-10-2022-0139/full/html.
Thaler, R. H., & Sunstein, C. R. (2019). *Nudge: Improving decisions about health, wealth, and happiness*. Penguin Books.
Thieme, T. A. (2018). The hustle economy: Informality, uncertainty and the geographies of getting by. *Progress in Human Geography, 42*(4), 529–548.
Tuckett, D. (2011). *Minding the markets: An emotional finance view of financial instability*. Springer.
van der Meulen Rodgers, Y., Bebbington, A., Boone, C., Dell'Angelo, J., Platteau, J.-P., & Agrawal, A. (2020). Experimental approaches in development and poverty alleviation. *World Development, 127*, Article 104807.
Walker, W. E., Harremoës, P., Rotmans, J., Van Der Sluijs, J. P., Van Asselt, M. B., Janssen, P., & Krayer von Krauss, M. P. (2003). Defining uncertainty: A conceptual basis for uncertainty management in model-based decision support. *Integrated Assessment, 4*(1), 5–17.
Walras, L. (2014 [1900]). Elements of theoretical economics (4th ed.). In Walker, D., van Daal, J, (Ed. and trans.). Cambridge University Press.
White, B., Borras, S., Jr., Hall, R., Scoones, I., & Wolford, W. (2012). The new enclosures: Critical perspectives on corporate land deals. The Journal of Peasant Studies, 39, 619–647.
Wild-Wood, E. (2007). *Se débrouiller* or the art of serendipity in historical research. *History in Africa, 34*, 367–381.
Yu, R., Evans, A. J., & Malleson, N. (2019). An agent-based model for assessing grazing strategies and institutional arrangements in Zeku, China. *Agricultural Systems, 171*, 135–142.