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Econ 101 – In need of a sustainability transition

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Abstract
Ecological economics was one of the first of a number of scientific communities to develop transdisciplinary understandings of the sustainability challenges faced by society. As a field with economics in its name, ecological economics differs from the other communities and should face the particular task of contributing to the development of a new economics. For economics to promote sustainability transitions, it is not enough to call for more pluralism. A new basic structure of economic knowledge should be developed in order to provide the foundation for a sustainability transition to Econ 101. This paper argues that the performativity of economics needs to change and proposes a way of structuring Econ 101.

Keywords
Sustainability transition; Econ 101; new economics; pluralism; heterodox economics; performativity; Boulding Award

Highlights
- A new economics is needed to promote sustainability transitions
- It is not enough to call for pluralism in economics: a new structure of knowledge is needed
- Ecological economics should provide a new economics with a biophysical foundation
- A new economics should be based on key ideas from heterodox economics
- The performativity of economics needs to change

1. Introduction
With the combination of climate change, biodiversity loss, extreme inequality and many other serious problems, humanity faces unprecedented and interconnected global crises. Therefore, it is important to be equipped with theoretical understandings that support effective actions and interventions. While the natural sciences are key to identifying the trends in the development of the Earth system, more transdisciplinary approaches are needed to understand why and how societies exert pressure on the Earth system and to find ways of changing the course in a socially just manner. Ecological economics emerged as one of the core responses to this call along with related fields such as common property studies, industrial ecology and political ecology. These scientific communities share many concerns and research areas, but as a field with economics in its name, ecological economics faces the specific challenge of being involved in the debate about mainstream economics: Are the core ideas and approaches of mainstream economics appropriate for bringing about socially just sustainability transitions? Do they constitute a barrier? Or are they something in-between? The role and tasks of ecological economics depend on the answers to these questions. If the theoretical foundations of mainstream economics are considered appropriate, ecological economics may be considered a supplement or a subfield, among many others, that emphasizes the biophysical perspective and deals with environmental governance issues. However, if the foundations of mainstream economics are considered a serious barrier to sustainability transitions, ecological economics faces the much more challenging task of contributing to the development of a new economics. In this paper, I first argue that this is precisely the task that we, as ecological economists, must take on. I then deal with the contours of such a new economics: What should be included in a new Econ 101 that supports socially just sustainability transitions?

The next section provides a brief historical introduction to the call for pluralism and the different call for a new economics, while section 3 discusses the present motivation for a new economics in more detail. Section 4 starts the discussion on how to formulate a new economics and questions the usefulness of simple oppositions in relation to mainstream economics. Instead, the challenge is to structure knowledge in a different way in order to develop a new Econ 101. Section 5, which constitutes the main body of the paper, outlines a suggestion for such a knowledge structure, while section 6 concludes.

2. The history of calls for pluralism and a new economics

Economics includes a large number of subfields related to sectors, policy areas, the application of particular methods, etc. However, all the fields that are considered to be part of mainstream economics build on a core set of ideas that students of economics are taught during their first year of study. Key concepts include self-regulating markets, firms and households, supply and demand, price formation, the allocation of resources, equilibrium, efficiency and optimality. These basic ideas go back to the 1870s when social science began to diversify into economics, sociology and other disciplines. The early practitioners of this emerging economics did not apply a specific label to themselves, but later, the set of ideas was named neoclassical economics. From the beginning, the development of neoclassical economics has been accompanied by various critical streams such as institutional economics, which continued to combine economic and sociological aspects. In the US, institutionalism remained strong into the interwar period, but then lost ground to neoclassical economics because it tended to neglect matters of theory (Hodgson 1988: 20ff). The main challenge to neoclassical economics came from Keynes' theories during the 1930s, but these ideas were distorted when they were partly integrated into the mainstream neoclassical framework after WWII. When the postwar growth period came to an end in the 1970s, the Keynesian elements were gradually purged from mainstream economic theory, which subsequently reemerged in a purer neoclassical form, although it is still often referred to as the Neoclassical-Keynesian synthesis.

An increasing number of theoretical approaches that are critical of mainstream economics have emerged and developed. From the 1990s, these approaches began to be characterized as different streams of heterodox economics, i.e. in opposition to the orthodoxy of mainstream economic (Lee 2009). Often, heterodox economists have a hard time surviving in economics departments and, therefore, many make their living in other institutions and departments. An obvious consequence of this is the tendency of heterodox economists to call for more pluralism in economics: As a suppressed minority, the way forward seems to be a call for more equal opportunities. This call is sometimes supplemented by reflections on how the position of heterodox economics could be strengthened by the formulation of a common platform, just as mainstream economics shares a core set of ideas across the many individual research areas (Lavoie 2006). As Fullbrook (2013, 2014) has argued, one of the reasons that the alternative to the mainstream is weak is that the various communities of heterodox economics tend to define themselves on the basis of their particular difference with the orthodoxy: for instance, ecological economics dealing with the biophysical foundation, feminist economics with gender, institutional economics with structures as opposed to methodological individualism, Post-Keynesian economics with the importance of money and uncertainty. Fullbrook finds that heterodox economists actually agree on a number of substantial points, including the basic ideas of ecological economics, which could form the basis of what he calls a New Paradigm Economics. Similarly, Stilwell (2016) argues that more unity is needed, both analytically and organizationally, to challenge the orthodoxy in a situation of conflict. He suggests that a stronger alternative to the mainstream could be formed around the label "political economy", again including ideas from ecological economics.

Within ecological economics, the call to develop a new economics as an alternative to mainstream economics has mainly been voiced by socio-economists, who combine biophysical perspectives with

institutional, evolutionary, political economy and other social approaches (Jacobs 1996, Spash 2011). As an early programmatic statement put it:

> "A new movement is growing within – and beyond – the field of ecological economics. This claims that economics must be more than ecological. It must be socio-ecological. That is, not only must the biophysical bases of economic activity be understood, but so must the sociological and political" (Jacobs 1996: 14).

The statement emphasizes the need to consider social structures and processes as well as ecological conditions and biophysical flows as being endogenous to the economic system and economic study: social structures and institutions, economic activities and environmental change co-evolve (also emphasized by (Norgaard 1994)). Furthermore, the incommensurability of values is stressed, which implies that economics must always be value-based and political in prescription. Ten years later, Gowdy and Erickson (2005: 207) argued that ecological economics should play a leading role:

> "As the only heterodox school of economics focusing on the human economy both as a social system and as one imbedded in the biophysical universe, …, ecological economics is poised to play a leading role in recasting the scope and method of economic science".

While this leading role may be overstating the claim, the fact that ecological economics ideas are increasingly spreading into other heterodox schools of thought, as illustrated by the contributions of Fullbrook and Stillwell, is an achievement. The increasing cooperation between ecological and post-Keynesian economists further underlines this point (Holt et al. 2009). This can be seen as significant progress compared to the past when environmental issues received very little attention from most heterodox communities (Røpke 2005: 270).

Societal conditions seemed to become much more conducive to the promotion of a new economics in the aftermath of the financial and economic crisis of 2007. Mainstream economists were discredited for believing in the Great Moderation and for not foreseeing the crisis (Colander et al. 2009). Furthermore, social unrest in the wake of the crisis increased general awareness that deepening inequalities could challenge social stability, which questions the mainstream economics idea that distribution is best served by "free" markets. Adding the increasingly obvious threat of climate change, which economists had tended to underestimate for years, the time was ripe for competing ideas. For years, economics students and academics had been asking for a broadening of the curriculum to include various heterodox theories, but with limited success. However, this demand gained momentum in the wake of the 2007 crisis, and the Rethinking Economics movement gradually began to form.[1] This time the call for change has been more successful as some economics departments have felt the need to respond to the challenges and make a few concessions. However, the changes are still surprisingly limited. Part of the explanation is the institutional stronghold that is mainstream economics – neoclassical economists are in charge of editorial boards, funding schemes, citation practices, promotion procedures, etc., and they exclude dissenting voices (Glötzl & Aigner 2017, Glötzl & Aigner 2018, Fourcade et al. 2015). Actually, conditions have become more difficult for heterodox economists within the last decade (Lavoie 2015). The hegemony of mainstream economics also implies that orthodox economists can be seen to respond to the call for pluralism by including more of the diversity that has developed *within* mainstream economics, for instance, in relation to game theory, new behavioural economics, experimental economics, and new institutional economics, while continuing to dismiss more radical heterodoxy (Davis 2008, Lavoie 2015).

[1] http://www.rethinkeconomics.org/about/our-story/

While entrenched power structures in academia undoubtedly play a decisive role in the repression of heterodox perspectives, the lack of a more unified alternative may also represent part of the explanation, as Fullbrook and Stilwell argue. Consider how effectively monetarism took over in the wake of the economic crisis of the 1970s: Perhaps this could partly be explained by the theoretical and organizational preparations carried out by, not least, the Mont Pelerin Society (Mirowski & Plehwe 2009). As Milton Friedman (2002: xiv) argued:

> "Only a crisis - actual or perceived - produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around. That, I believe, is our basic function: to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes the politically inevitable."

Such a strong heterodox alternative was not waiting in the wings when the Great Recession hit or when awareness of the climate challenge intensified. Significantly, the present social interests who are in need of a theoretical alternative are not as powerful as the economic and political interests who wanted to cancel the postwar social compromise in the 1970s and who were able to fund think tanks to promote their perspective (Sayer 2015).

Therefore, the focus is still mainly on the need for pluralism, as reflected in the introduction to pluralist economics, which is published by Rethinking Economics and includes chapters on nine different fields, but no shared platform (Fischer et al. 2018). This form of pluralism represents an extension of the basic foundation of economics, but does not really challenge it.

3. Motivations for a new economics

A shared platform may be useful for strengthening the position of heterodox perspectives in relation to the internal competition for acknowledgement, positions and funding within academia. However, beyond their interest in academic survival, most heterodox economists are motivated by a desire to contribute to the achievement of important societal aims, sometimes combined with a wish to further the interests of specific, often less privileged, social groups (the poor, women, workers, future generations, etc.). Why are heterodox economists dissatisfied with neoclassical economics as a basis for their contribution? Actually, some mainstream economists wish to contribute to similar goals and attempt to do so from the neoclassical platform. As Hodgson (2017: 3) argues, "many prominent theories can serve multiple policy outcomes, and particular policy outcomes can be defended from multiple, contrasting theoretical positions. The relationship between theory and policy is many-to-one and one-to-many". So why not stick with the mainstream? One of the core arguments of heterodox economists is that neoclassical economics cannot provide a relevant basis for policy formulation because the theory overlooks key aspects of reality and is based on deductive reasoning and models that are far too abstract. In contrast, heterodox approaches provide deeper insights into economic processes and an improved basis for formulating policies by including broader empirical analyses of social structures and actors and their evolution over time.

Related to this argument is the critique of the excessive and inappropriate use of mathematics, described by Georgescu-Roegen (1979: 323) as "arithmomania", which cannot capture qualitative change and replaces economic reasoning with "empty exercises with symbols" (p. 318). Lawson (2004, 2006) even considers the critique of mathematical formalism to be a distinguishing feature of heterodox economics, but this goes too far, partly because the critique is shared by several prominent mainstream economists (Hodgson 2017), and partly because some heterodox economists welcome the use of mathematics, arguing that it does not make models inherently unrealistic (Keen 2016). In Fullbrook's (2013) formulation, heterodox economists choose the (sometimes more complicated) mathematics that fits the problem, rather than shape the problem to fit the traditional mathematics.

In addition to the critique of neoclassical economics for misrepresenting the complexities of social life and for inappropriate use of mathematics, many also criticize the ideological role of economics – a role that may, in fact, be served by abstracting from reality. Although mainstream economists tend to argue that their approach is value-free, heterodox economists emphasize that a conceptual framework always has a normative dimension when it is applied to real-world situations (Fullbrook 2013). In spite of Hodgson's point that there is no one-to-one relationship between theories and values, it is obvious that mainstream economics, in practice, is often used to sustain free market policies. As Marglin (2012: 166) puts it: "the apparatus of economics exists to further a normative agenda, not because of its usefulness in describing the world", and later on the same page: "What is the normative agenda? In a word, to convince us that markets are good for people." Thus, the need for a new economics may also be motivated by ideological considerations.

A related, but broader perspective suggests that economics should not only be seen as an ideological weapon, but also as an integral part of shaping the institutional details of economic processes. The relationships between theories, policies and business practices are studied within the research programme on the performativity of economics, which emerged from science studies in the late 1990s. In an early contribution, Callon (1998a: 2) writes: "economics…performs, shapes and formats the economy, rather than observing how it functions". Economics is, thus, not about studying and representing a material world external to itself, but about operating within this sociotechnical world (Mitchell 2007: 244). Similarly, the economy is not seen as a pre-existing reality to be observed, but rather as something that particular economic theories and their related calculative devices are involved in bringing into existence (Callon 1998b, MacKenzie et al. 2007). An example of such a process is highlighted in MacKenzie's (2006) study, which has the illustrative title "An Engine, Not a Camera. How Financial Models Shape Markets", of how modern theories of finance affected financial markets. Another example is Mitchell's (2007) study of how De Soto's approach to ownership played a role in the dispossession of poor people in developing countries. From this perspective, narrow theories may be successful in transforming the world in accordance with particular interests: economics provides:

> "a set of instruments of calculation and other technical devices, whose strength lies not in their representation of an external reality, but in their usefulness for organizing sociotechnical practices, such as markets. The narrowness of neoclassical economics then serves a purpose" (Mitchell 2007: 244).

Therefore, critique may be motivated by disagreement with a particular purpose, while a call for a different theoretical approach may be motivated by a desire to serve another purpose. This perspective also emphasizes that no one can claim to have a theory that is simply a "realist" reflection of reality. Ideas and calculative devices are integral parts of shaping the outcome of social processes, but their success depends on many conditions and forces, including big socioeconomic and political interests (MacKenzie et al. 2007).

Studies of the performativity of economics are often concerned with relatively limited issues such as the integration of particular economic theories and calculative devices into specific socio-technical practices, for instance, in relation to the construction of specific markets. However, I suggest that a similar approach can be applied in relation to economics more generally. The need for a new economics is, first and foremost, motivated by the view that the performativity of the core reasoning of mainstream economics tends to be counterproductive in relation to just sustainability transitions. The central thought patterns, concepts and ways of reasoning have serious consequences and, therefore, they should be replaced by a perspective that results in fundamentally different outcomes. Some economists are genuinely interested in achieving just sustainability transitions and argue that they can be promoted through arguments from mainstream economics, but this approach may inadvertently strengthen counterproductive reasoning by

sticking to thought patterns that should be replaced. The relevance of this point is reinforced by the research that demonstrates how the study of mainstream theory affects behaviour by making people behave more like *Homo economicus* (Frank et al. 1993, Kirchgässner 2005).

In the following, some implications of the simple circular flow model are outlined to illustrate the performativity of the core of mainstream economics across a broader set of issues that are relevant to sustainability transitions:

- As emphasized by ecological economics, the model suggests that the economy is a perpetual motion machine, which is not embedded in nature. This calls for maximizing the flow (increasing GDP) and overlooks the embeddedness of humans in nature and the basic dependence on high-quality energy. Energy is understood as a production factor comparable to any other resource, which implies a lack of understanding of the industrial revolution as a new phase of social metabolism. Therefore, the present challenges facing humanity have been completely underestimated, and trust in technological solutions is far too optimistic.
- The model is also involved in performing distribution processes. In the model, production factors are paid in accordance with their contribution to production. Furthermore, it is assumed that all production factors are ultimately owned by individuals, which makes other forms of ownership invisible. Therefore, everybody gets what they deserve, which justifies inequality. The payment of interest on capital is also justified, without any distinction being made between real and financial investment. As the impact of distribution on the functioning of the economy is not considered, whether it is desirable to change the distribution or not is considered an exclusively political question, which is outside the scope of economics.
- A third area relates to the focus on markets as a mechanism of allocation and distribution. Markets are treated as mechanisms that can function “freely” in the sense that they are free from government intervention. In the case of externalities and other deviations, markets are considered to need slight modifications through regulation, but the perspective is blind to all the governance that is actually needed to make markets work. Markets are, thus, considered to produce politically neutral results and competition is expected to ensure efficiency and optimality, which implies a call for privatization and commodification. Prices are seen as direct information on value that can be applied as relevant input to societal decision-making.

The performativity of the core of mainstream economics is evident in the daily media coverage of economic issues. Since journalists are among the groups that only learn the basics of economics, they tend to apply the truisms of Econ 101 when they conduct interviews and put daily events into perspective. Similarly, many politicians and policy makers apply basic economic reasoning without question. In this way, several problematic messages are widely assumed to be true, such as:

- Growth in GDP is good
- Markets and competition are useful and ensure efficiency
- It is best to leave identifying the best technological solutions to sustainability problems to the market
- Private property rights are necessary
- The national budget should break even
- Taxes are inefficient
- Activities in the private sector finance the activities of the public sector
- Investments in renewable energy and other sustainability measures are limited by the availability of money (not resources)
- If a country has fossil fuel resources, they should be extracted to finance sustainability transitions
- Economists can calculate whether investments in renewable energy are worthwhile for society
- A shrinking population is a bad thing because it reduces economic growth.

The urgency of the call for a new economics first and foremost stems from the problematic performativity of mainstream economics in relation to the public's understanding of the present challenges and the approaches to tackle them. It is a call for the formulation of a different fundamental theoretical platform rather than a call for more pluralism in economics. While a shared platform may be useful for the promotion of various strands of heterodox economics, the principal goal is to establish a new fundamental structure of economic reasoning with a profoundly different performativity in relation to sustainability transitions.

It is essential that the core of a new economics is formulated as an independent and self-contained perspective that does not rely on a previous introduction of mainstream economics. Only then can it become a real challenge to mainstream thinking and policy. The need for such an alternative Econ 101 probably seems particularly pressing for teachers like me, who have taught economics and ecological economics to non-economists (in my case, to engineering students) for many years. Teaching both mainstream and alternative economic approaches within a limited period is an ambitious task. It can be frustrating and unsatisfactory if important insights can only be presented as an opposition to the mainstream, which has to be introduced first (for a basic introduction to ecological economics with little reference to neoclassical economics, see (Røpke et al. 2017)). Other heterodox economists are in a different situation when they try to communicate with mainstream economists or with students who have passed through the mainstream brainwashing machinery. In this case, there is a strong need for unlearning and "debunking economics" (Keen 2011). In the struggle for just sustainability transitions, applying mainstream thinking to counter the traditional promotion of markets may also be useful, for instance, by arguing that goods such as information and other non-rival resources should be removed from the market to avoid underuse (Farley & Kubiszewski 2015). However, when heterodox economists have the chance to communicate with the uninitiated, they should provide an altogether different platform – an alternative Econ 101 that does not rely on an initial introduction to the core theory of mainstream economics. Eventually, this theory can be presented later as this strange reasoning that has had such an important influence on society. But let us start by asking the question: How would we teach economics if neoclassical economics had never been invented?

4. Developing a shared platform and going beyond oppositions

In order to teach economics as if neoclassical economics had never been invented, we need to develop a shared platform for heterodox economics that can serve as an alternative to neoclassical economics. Preferably, the platform should be formulated without any reference to neoclassical economics, but the development process often takes the form of listing what heterodox communities agree on and how this differs from the mainstream. An example is Fullbrook's (2013) comparison of old paradigm economics and new paradigm economics, which he summarizes in ten key oppositions. For instance, while the old paradigm assumes that markets converge toward equilibrium, the new one recognizes the importance of markets that do not converge toward equilibrium and do not frame theories around the equilibrium concept. While such oppositions can be useful for discussing the shared ground for heterodox communities and organizing "unlearning" for mainstream economists, they do not provide a structure for an alternative approach, and they continue to promulgate the idea that in order to explain the alternative, one must first present the mainstream.

Working with oppositions also has the disadvantage that it calls for discussions on how and where to draw the lines: Which scientific communities should be considered heterodox, and which belong to the mainstream? As the different positions of such prominent heterodox economists as Tony Lawson (2004, 2006) and Fred Lee (2008, 2009) illustrate, this is not uncontroversial (survey in (Hodgson 2017)). Furthermore, this discussion is becoming ever more complicated as different strands of mainstream economics are integrating positions that were traditionally considered heterodox. For instance, it has been

argued that mainstream economics is being increasingly influenced by developments in behavioural and experimental economics, game theory and information theory, while feedback mechanisms are now taken into account in new mainstream theories of finance, and empirical studies are playing an increasingly prominent role (Colander et al. 2004, Davis 2008, Coyle 2010). In relation to environmental economics, the influence of ecological economics is also becoming increasingly visible. While such trends are certainly encouraging, the extent of the changes has been questioned (Thornton 2015), and they have as yet had little effect on the introduction to economics or the basic structure of knowledge in the field. Rather than getting involved in a discussion about whether or not, and to what extent, mainstream economics is integrating various heterodox positions, it is more important to consider the basic structure of knowledge and to attempt to do so without applying oppositions. Jo et al. (2018: 10f) assert that this is already underway as heterodox economics "has evolved from an initial quite strong predilection to concentrate around critiquing mainstream economics to a stage of developing its own coherent and logical theories and policies".

Important steps in this direction have been taken by O'Hara (2007) and Gerber and Steppacher (2012). Although both publications discuss differences in relation to mainstream economics, their main focus is on formulating alternatives. O'Hara selects seven sub-groups of heterodox political economy as the basis for identifying convergence around a set of principles of institutional-evolutionary political economy. In addition to classical institutionalists, he selects institutionalists related to, for instance, Marxist theory, Post Keynesianism and feminist economics. The principles are referred to as ""substantive principles" associated with the historically specific working and evolution of institutions" (p. 5). Instead of being transhistorical and independent of time, the principles are rather part of and linked to the institutional and temporal processes of the economy (p. 9). O'Hara suggests a large number of principles, which range from the more general, such as the principles of agency and structure, historical specificity, heterogenous agents and circular and cumulative causation, to the more specific, such as creative destruction, dialectic of innovation and competition and endogenous money and credit. Many of his observations are inspiring, but it is not easy to see how to build a knowledge structure on the basis of such a list. The lack of a coherent structure is reflected by the fact that the biophysical basis ("the principle of entropy") appears very late in the article.

Gerber and Steppacher (2012) give much higher priority to the biophysical basis of economic activities, while they apply a similar approach in other respects. They argue that "it is time to work towards establishing an alternative paradigm in economics" (p. 5-6) and that this can be accomplished by integrating ideas from the different schools of heterodox economics. Gerber and Steppacher choose to start with the integration of ecological and critical institutional economics, including evolutionary and social economics. This integration can then provide "a theoretical basis on which to articulate, in a pluralistic way, the contributions of the other schools of heterodox thought" (p. 6). After describing some key characteristics of ecological economics and critical institutional economics, they draw on inspiration from Kapp in their discussion of how to integrate the fields. First, they identify the open, living systems approach as a common denominator, based on thermodynamics and an evolutionary perspective. After some elaboration, Gerber and Steppacher proceed to suggest a series of more specific integrative concepts that are intended as building blocks for the new economic paradigm. Examples of such concepts are social metabolism, value pluralism, property/possession, funds/services and stocks/flows, and evolution. The list is more focused and limited than O'Hara's collection of principles, but as an edited collection of papers by various authors, it also falls short of providing a structure for an alternative Econ 101.

With a focus on the development of research programmes, this issue of structure may not seem so important. However, if the ambition is to suggest a basic structure of economic concepts that can form Econ 101, structure clearly comes to the fore. The structure does not have to be as abstract and axiomatic as neoclassical economics, but it should also be based on a core set of ideas that are reflected in more specific applications. Based on such a structure of knowledge, it might even be possible to incorporate and

subsume some useful insights from mainstream economics into a new framework – just as the mainstream incorporates some heterodox ideas. Raworth's book on "Doughnut Economics" (2017) is an impressive attempt to integrate ideas from various heterodox schools and formulate a perspective that can challenge the basic teaching of economics. Her work, as well as ideas from both substantive principles and integrative concepts, inspire the following in which *economics* with the absence of a qualifying adjective means *new economics*.

5. The delimitation of economics

It seems prudent to start by delimiting the field of economics. To this end, economics may be said to deal with substantive issues related to provisioning: how do humans make a living, and how does provisioning and distribution influence the quality of human lives? This can be studied in every human society and includes questions such as: what is the biophysical basis for living? How and what is provided? Who can appropriate what and how? And how should these processes be assessed from a political and ethical perspective? The focus is on provisioning and appropriation by various social groups, thereby relegating market exchange to a specific feature of certain societies. Furthermore, economics involves the dynamics of stability and change over time in relation to provisioning. Therefore, the field encompasses specific subject matter and it cannot be characterized by a generally applicable approach. Placing social provisioning centre stage is sometimes considered to be the defining characteristic of heterodox economics: "heterodox economics may well be defined as the study of the social provisioning process" (Jo & Todorova 2018: 37), with provisioning covering "a vast range of activities, including both market and non-market, paid and unpaid activities" (p. 35). As most heterodox economists deal with capitalism, the focus is sometimes specified as "the historical process of social provisioning within the context of a capitalist economy" (Lee 2009: 8). Yet from an ecological economics point of view, a longer historical perspective is important.

The subject matter of economics cannot be delimited in any ontological sense: there is no economic sphere, but rather an economic perspective that can be applied to the study of a biophysical and social whole. In ontological terms, it is common to distinguish between the different levels of inorganic matter, living organisms, and human society (e.g. (Kapp 1961: 61) cited in (Spash 2012: 37); (Køppe 1990)). They are called levels because it is possible to have inorganic matter that is not part of living organisms, whereas living organisms cannot exist without inorganic matter. Furthermore, not all living organisms are human, while all humans are living organisms. Simultaneously, one level cannot be reduced to another. Although human activities rely on physical and biological processes, they also add something more than that. When it comes to dynamics, causalities go in both directions. This is not only reflected in the ever more obvious human impacts on nature. For instance, it has recently been demonstrated that early forms of life played a role in the creation of the inorganic geological formations found in Greenland (Allwood et al. 2018). Similarly, it is becoming increasingly clear that biological processes are central to ongoing climate change. Therefore, classical clear-cut distinctions between physics, biology and the social sciences tend to fade as the subjects unavoidably merge.

Economics as the study of human provisioning cuts across all classical disciplinary distinctions. For instance, the field involves an understanding of traditional natural science issues related to energy, ecosystems and humans as a species, traditional humanities related to human psychology and ethics, and traditional social science issues related to social groups, institutions, power, and governance. In my opinion, attempting to capture this broad range of aspects through the idea of embeddedness, whereby the economy is pictured as a specific sphere that is embedded in society, which is then embedded in the biosphere, is problematic. This illustration suggests that the economy can be delimited in an ontological sense and that the biosphere and society are surroundings or frameworks. Instead, the idea of embeddedness could be replaced by the idea of economics as a specific perspective on the totality of human life with the purpose of highlighting provisioning. In this way, it is emphasized that economic issues are always essentially biophysical, technical

and social. At the same time, this view emphasizes the need for openness to insights that are achieved through other perspectives on the totality because they are often relevant for the practices of provisioning. Consilience with many scientific fields is, thus, inherent to the perspective. Although the perspective does not consider the economy as a sphere in ontological terms, it is certainly relevant to acknowledge the modern idea of the economy as a particular object of study and to explore how this idea came into being (Mitchell 2005).

5.1 Fundamental thought patterns

A scientific field applies concepts and explanatory models to uncover the substantive processes that are the object of enquiry. If a field is relatively coherent (which is not always the case, (Whitley 2000)), the explanatory models tend to reflect some fundamental thought patterns or ways of reasoning that can be applied to different topics. In teaching, the explanatory models can either be presented directly in abstract terms early on, or they can be learned more indirectly as a sort of hidden message behind the specific theories, as is often the case in the teaching of mainstream economics. Methodological individualism is seldom announced at the beginning. To increase the students' awareness of these fundamental thought patterns, I suggest bringing them to the fore. Where to draw the line between general thought patterns and substantive theories is not always clear, but the following are often considered to be examples of the first.

Economics as the study of provisioning and distribution includes the analysis of processes that change through time, both in the long and short run. According to current scientific knowledge, some physical and biological conditions of provisioning do not change over the time span relevant for humans. For instance, the laws of thermodynamics and the process of photosynthesis can be taken as given, but many other aspects of provisioning do change and have to be treated in their historical context. Therefore, a fundamental idea is to focus on qualitative change over time and to focus more on historical specificity than on general and abstract models.

Although the scope for generalization is limited, it is possible to propose some general concepts and causal relationships that are repeated over time. As a starting point, it seems useful to introduce the issue of structure-actor interplay, which has been the focus of much social science controversy since the split between economics and sociology in the late 19th century. This involves introducing the concept of institutions as central to the meaning of structures, both in themselves and as embodied in both humans and the human-made materiality of infrastructure and other objects. A model for the introduction of various positions on the structure-actor interplay can be found in Vatn's books (Vatn 2005, 2015), which emphasize institutions as both enabling and constraining and related to power. Vatn's own position follows in the footsteps of Giddens and others who intend to bridge the traditional dichotomy between structures and actors. The bridging of the structure-actor interplay also involves the idea of humans as social animals, who are highly dependent on belonging to a social group, not solitary individuals. Human characteristics have evolved through thousands of years living in small groups as hunter-gatherers, where cooperation at the group level represented an evolutionary advantage. Pro-sociality is, thus, a key characteristic. However, according to various sociobiological theories of multilevel selection, it also means that there is potential for conflict between groups (Wilson & Wilson 2007).

Since economics deals with qualitative change over time, ideas about dynamics are important. Institutions are often considered to provide stability, but as they often frame conflicts and contradictions involving power, they may just as easily drive change, including change to the institutions themselves (Vatn 2015). Explanatory models concerning dynamics are also heavily influenced by evolutionary thinking. This calls for an exploration of the creation of variation, for instance, the ways in which new institutions and technologies emerge, and the functioning of selection environments that influence the fate of the

innovations. This family of concepts also includes co-evolution, cumulative causation, path dependency and lock-in as well as the idea that the future is open and radically uncertain.

A related family of concepts stems from systems thinking. The idea that a set of elements can be connected in a way that has a function or serves a purpose (Meadows 2008), and that the whole is, thus, more than the sum of its parts, has much in common with the idea of structures. Yet it also goes further by arguing that it is fruitful to analyse structures as various separate, but more or less interconnected, systems. This perspective introduces concepts such as feedback effects, emergence, self-organisation, tipping points, resilience, and complexity.

When these ideas and concepts are applied in economic analysis, they call for endogenizing, for instance, agents' character and behaviours, the patterns of interplay, and the character of technological change. This makes predictions based on the past difficult. The large measure of indeterminism is further emphasized by the fact that the understandings of the development by agents, including researchers, are an integral part of the development and, thus, can change its course (see (O'Hara 1993: 56) on Boulding's epistemological paradox and the generalised Heisenberg principle). Performativity theorists add an extra layer to this point when they highlight how understandings may not be about trying to achieve knowledge about the world, but rather about influencing it.

These fundamental thought patterns make another set of ideas irrelevant: there are no rational agents with full information, no exogenous preferences, no transparency, no equilibrium, no optimality, no potential GDP. Maybe a useful rule for teaching economics (similar to the limiting rules of Dogme film) could be: never draw an intersection between two curves. In the section below on governance, I add that the efficiency concept may also be problematic.

5.2 The biophysical basis

Turning to the substantive issues of economics, we should start with some insights from physics, biology, anthropology and related fields (long-term history). Here the textbook by Common and Stagl (2005) serves as a good knowledge resource. Chapter 2 introduces the systems of planet Earth, the basics of thermodynamics, some simple ecology and the theory of evolution, while chapter 3 discusses humans as a species and the three main phases in the energy history of modern humans. A key point concerns the role of fossil fuels in relation to the industrial revolution, which was not primarily about great ideas and human ingenuity, but rather the combination of fossil fuels and ideas about how to use them. In the words of Grinevald, it is a thermo-industrial revolution. A basic understanding of the role of exergy in increasing labour productivity belongs here as well (Ayres et al. 2013).

This basic framework facilitates the addition of more knowledge and allows old understandings to be revised according to new insights and theories. For instance, since the publication of Common and Stagl's book, Earth system science has popularized concepts related to planetary boundaries, the Holocene, Anthropocene and the Great Acceleration. Also, new knowledge about various human species and their geographical spread is developing rapidly, as well as new contributions to the ongoing controversies concerning the impact of human activities on the biosphere during the hunter-gatherer phase: Were the extinctions of megafauna species during the last glacial period mainly caused by climate change, or did humans play more than a marginal role (Harari 2014, Cooper et al. 2015)?

With the establishment of agriculture during the Holocene, humans took a decisive step toward dominating the planet. Recent research suggests that the agricultural revolution should be studied as a transition to ultrasociality, when humans, over a relatively short period, developed societies that are similar to the superorganisms that social insects such as ants have established during a long evolutionary process (Gowdy & Krall 2013, 2016). These societies are very complex with an elaborate division of labour and they can

directly produce their own food and manage the inputs to food production. This advantage is reflected in intensive resource exploitation, population growth and territorial expansion with the resulting impact on ecosystems being dramatic. When the exploitation of fossil fuels is added to the agricultural practices during the thermo-industrial revolution, the impact is now so great that we are currently witnessing the sixth mass extinction of life on Earth.

Long-term historical perspectives are important to understanding the human species as an integral part of nature and to understanding the severity of the present challenges. We need to enter into a fourth phase of human energy history at a time when the human population is very large and is still growing and when the pressure on ecosystems is already extreme. For a closer analysis of the more recent past and the present situation, the idea of the economy as a metabolic organism within the biosphere should be introduced. This involves an introduction to related research programmes that focus on measuring the biophysical size of the metabolism such as energy accounting, material flow accounting, human appropriation of net primary production, ecological footprint, water footprint, and the composition of world terrestrial vertebrate biomass (shares of wild animals, domesticated animals and humans). When economic activities demand the appropriation of more energy and materials from the biosphere, the metabolic organism can expand and take up more space – eventually undermining its own living conditions. These measures can be applied at the global level, and some are also useful at other geographical levels, e.g. to highlight unequal exchange between nations or the metabolism of cities and other areas.

5.3 Social organization of provisioning

As emphasized in the section on fundamental thought patterns, economics should deal with specific, continually evolving, structures and processes. Many concepts are specific to a particular context in time and space, such as patents, collective labour agreements and castes with specific tasks. However, it may be useful to start by introducing some general economic issues as a basis to explore questions that call for historically specific answers. Asking such general questions in relation to modern societies is similar to the approach applied by anthropologists in studies of pre-modern societies, which are foreign to the anthropologists. The purpose of applying this approach to the study of one's own society is to challenge the idea that the organization of society is "natural" and given, just as Brecht tried to do with his techniques of *Verfremdung* in his stage plays. Responding to such general questions can both reveal features that were hidden from view and highlight the fact that much could be organized differently.

For humans to survive and prosper, we need ecosystems to provide the fundamental conditions for human life (composition of the atmosphere, primary production, etc.) and resources for human provisioning activities, which transform the resources into products and human provided services in the form of, for instance, food, shelter and care. Therefore, a general topic for economic analysis must be the processes of provisioning: what natural resources are used? How are they transformed? And which products and services are provided? I intentionally use the concept of provisioning instead of production because it is more generally applicable and calls for a broader perspective, including activities from hunting and gathering to childcare and car production. In contrast, the concept of production tends to have a narrower connotation that excludes the provision of care. Similarly, a product (or good) is a more neutral concept than a commodity.

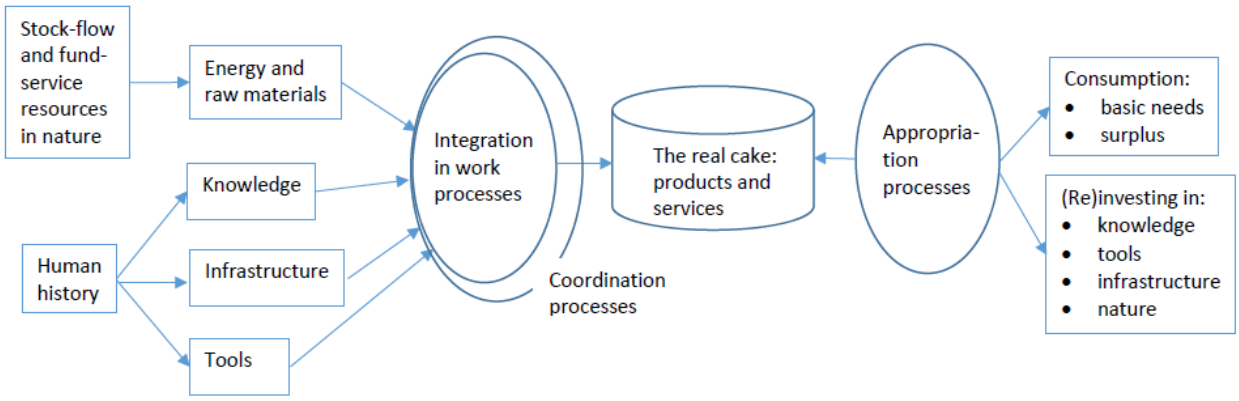

Figure 1. Provisioning and appropriation.

Figure 1 illustrates some general concepts related to provisioning and appropriation. In practice, many economic activities involve aspects of both provisioning and appropriation, but it is decisive to distinguish analytically between the two in order to facilitate a discussion about who the makers and takers are (Mazzucato 2018). Provisioning is seen as a human activity – work processes – which result in products and human provided services, here called the real cake. By using this concept, I avoid talking about value as, for instance, Mazzucato (2018) would do: here the cake is a "pile" of products and services provided during a year, which is called "real" to emphasize that it is not measured in money or any other unit of value (more on this below). The work processes consist of applying energy and transforming raw materials from nature through the application of knowledge and tools within the framework of a physical infrastructure, given at the time. Along with the material transformations, the work also involves processes of sense-making. Energy and raw materials can take the form of flows from stocks or services from funds (Georgescu-Roegen 1971, Daly & Farley 2004: 70ff), while knowledge, infrastructure and tools are inherited from a long human history and are continuously transformed. Placing work centre stage in this way is similar to the perspective of classical political economy, in particular Marx, but it also resonates with a practice theory approach, where humans are seen as practitioners, who combine knowledge, skills, tools, materials and meaning in the performance of practices, in this case work practices (Schatzki et al. 2001). The provisioning activities can be carried out within the framework of many different social units (in modern societies, for instance, households, civil society, non-governmental organizations, various branches of the public sector, cooperatives, utility companies, private businesses, etc. all contribute). The perspective stresses that ownership is not a productive force, but as emphasized in the next section, property relations are key to the appropriation of the cake. Depending on the form and degree of the division of labour, the activities need to be coordinated both within and between the economic units through institutionalized processes of negotiations, traditions, planning, markets, etc., also involving work. Similarly, the appropriation of the cake occurs through institutionalized processes, while the use of the cake can take place in various economic units. Part of the cake is consumed and part of it is invested in future provisioning. Investments include both reinvestment and surplus investment in increased future capacity. Similarly, a part of individual and collective consumption covers basic needs, while another part is surplus. As illustrated by Lotka's concepts of endo and exosomatic energy use, humans can consume much more than they need to survive and participate in provisioning activities.

More elaborate questions related to the study of provisioning and appropriation in a specific society include: into what social units are provisioning activities organized? What is the division of labour within and between units? How is it decided in which way the activities within a unit should be carried out? How do people become members of the units? Is there a need for coordination between the units, and if so,

how is it organized? Who gets access to what and how? Are there large differences in access to goods? Are the processes of provisioning and appropriation related, and if so, how? More directly normative questions involve the influence of provisioning and distribution on the quality of human lives. The size, composition and distribution of the real cake is central to human wellbeing, but wellbeing is heavily dependent on additional conditions. As the concept of the real cake only includes the products and services that result from human provisioning activities, it is important to consider also the impacts of provisioning on natural systems and the ensuing impacts on present and future wellbeing. Similarly, provisioning activities influence wellbeing through the related working environment and the opportunities for participation in well-functioning communities. As emphasized in the section on governance below, the political and ethical assessment of social conditions should include a broad spectrum of issues. However, including all issues in the concept of the cake is not considered feasible.

The size of the cake and the share that can be seen as a surplus can increase with the increased appropriation of energy and materials, better knowledge and tools, improved infrastructure and more effective organization of the provisioning and coordination processes. Nevertheless, development that expands the cake can be combined with increasing social complexity, which may imply a decreasing surplus if a larger share of the cake is needed to keep the provisioning system going (Tainter 1988), or if bureaucratic activities evolve (Graeber 2018). A related issue concerns the distinction between the work that contributes to the cake and the activities that are concerned with appropriation. Mazzucato (2018) discusses how economists have made the distinction between makers and takers in different ways over time and how the issue has disappeared from the agenda. She argues that it is important to reignite the discussion because the present silence makes it all too easy for the takers to present their activities as productive. For instance, finance was made "productive" through changes in the way GDP is calculated (Christophers 2011).

Neither the size nor the value of the real cake can be measured in any meaningful way as it represents a collection of disparate goods and services that have no relevant common biophysical or social quality. The biophysical measures that can be applied to assess the appropriation of energy and materials from the biosphere as inputs to human provisioning activities are not relevant from an output perspective, and there is no other alternative. Therefore, the concept of the real cake is used here as an abstract idea of a quantity that cannot be measured. In the section on distribution below, I explain why prices are unsuitable for adding the components of the cake. Although the cake cannot be measured in a meaningful way, it is obvious that it can be unevenly distributed among individuals. In most societies, some people live more comfortable and luxurious lives than others. As the present mechanisms of distribution are based on a long history of conflicts and power relations, they need to be introduced in relation to an account of the emergence and further development of the historically specific institutions of capitalism.

5.4 Capitalist institutions

As a basis for dealing with current challenges, a brief outline of the history of capitalism is a necessary component of Econ 101 because modern institutions have to be understood in a historical context in order to highlight the fact that they are the result of an evolutionary process and are susceptible to change. Since it is not possible to provide such a summary, the following is just a list of key issues to be included in such an account. It is inspired by the textbook "Business and Society. A Critical Introduction" by Birch et al. (2017), who provide an interesting and elaborate account of how the institutions of capitalism emerged. The historical account should integrate the following key messages:

Property relations are decisive for distribution. When individuals or social groups possess the necessary means for provisioning – land, materials, tools, knowledge – they can provide for themselves. This is a strength in the distribution process, but it may be challenged if other groups have the tools to appropriate the produce. When people do not have access to the means of provisioning, they are in a weak position

and can only make a living by working for somebody else. Processes of enclosure and the dismantling of the commons have contributed to the creation of such groups and still do today. At the same time, other groups accumulate wealth in the form of ownership of land and other resources (accumulation by dispossession, as Harvey (2003) calls it), which constitutes the basis for unearned income, rent – which is income that has no relation to any effort on the part of the owner of the resource. In addition to property relations, other conditions influence the relative strength of social groups. For instance, recent research has highlighted the importance of energy technologies for the power balance between capital owners and workers, and for the changing conditions for political democracy (Malm 2016, Mitchell 2011).

In relatively self-sufficient village communities, markets and money play a very minor role (Graeber 2011). However, with industrialization, urbanization and an increased division of labour, markets come to play an increasing role in the coordination of economic activity. As Polanyi (1944) has demonstrated, the power of the state forms the basis of the institutions upon which markets rely. For instance, only government can secure and police private property, legal contracts, money and credit. Markets are always based on a large number of rules and regulations, for instance, specifying what can and cannot be traded, who is allowed to trade, and what the conditions of trade are. As Chang (2011: 9) writes, "the history of capitalism has been a constant struggle over the boundaries of the market". Regulation is also established to "restrict the freedom of individual firms so that they do not destroy the common pool of resources, which all of them need such as natural resources or the labour force" (Chang 2011: 190). Paradoxically, the struggles of the oppressed groups can help to save the capitalists from themselves in this respect. The political construction of markets is an ongoing process in which business plays an active role along with various organizations (Birch et al. 2017: Ch. 6, Zingales 2017). From the perspective of large firms, markets are not just outside selection environments for their products and innovations, but are also subject to active interventions and path creation (Garud & Karnøe 2001).

The market participants also undergo considerable change. Birch et al. (2017) describe the long and complex story of joint-stock companies, which emerged prior to capitalism, and the changing organization, regulations and understandings of corporations over time. The account emphasizes how a significant proportion of economic activity now takes place within business organizations rather than within markets: "it is an organizational entity and not the market mechanism that shapes our world" (Birch et al. 2017: 5). Similarly, Chang (Chang 2011: 208) asserts that "more and more areas of the economy have become dominated by large corporations". Such large firms should not be considered as single rational actors. Rather than being threatened by competition in the market, a firm may collapse from inside (Galbraith 2014: 158ff).

Capitalism is a very dynamic system. It is important to emphasize the point already mentioned that the large increase in the amount of material goods is only possible because of the use of fossil fuels (Ayres et al. 2013), but the social drivers also play a key role. Due to the unequal power relations related to the concentration of the ownership of the means of production, the owners can accumulate ever more wealth (cumulative causation). In pre-capitalist societies, accumulated wealth tended to be transformed into symbols and consumption in the form of pyramids, palaces, luxuries, and armies to ensure the wealth, while capitalism is characterized by reinvestment in more production as well as technical change of processes and products (Kallis 2018). Just how this change came about is controversial (Birch et al. 2017: Ch. 1), but the fact that some began to adhere to the practice of reinvestment, competition forced others to follow. Competition, thus, drives innovation, accumulation and Schumpeter's "creative destruction" (a dynamic that is, by the way, very far from creating efficiency). In some periods, the dynamism is supported by the financial system. The institution of money creation by banks makes it possible to mobilize real resources and initiate projects without having to borrow from rich people, who must then abstain from their activities. However, in some periods, finance tends to become parasitic.

The economic relations of capitalism are inherently unstable. When the majority rely on paid work to make a living because they do not have the means to procure all the necessities themselves, employment becomes important for social stability. However, two conditions have to be fulfilled for employers to hire workers: employers must expect to be able to sell the products and to do so at a profit. This raises the issue of the double character of wages as both costs and the basis for effective demand: Nothing ensures that it is profitable for employers to pay wages that provide an effective demand corresponding to full employment. At the same time, the interplay between investments and productivity increases adds to the fundamental uncertainty that may give rise to crises. Furthermore, the financial system is prone to crises, for instance, when lending is provided to speculation in existing assets and creates bubbles, and when unpayable debt accumulates (Bezemer & Hudson 2016). How the economic institutions and related processes of capitalism play out changes considerably over time and differs widely between nations (Hein et al. 2015).

From the beginning, capitalism was a worldwide transformation. The European conquest of other parts of the world through war, slavery and colonialism formed the background for the emergence of capitalism in Europe and the ensuing interdependent development (Birch et al. 2017: Ch. 2). Interdependence through trade, investment and transnational companies is obvious, but geopolitics and military power also still play a key role in economic processes (Schor 2005, Galbraith 2014).

5.5 Social organization of distribution

The global distribution mechanisms are based on the long history of global capitalism. The most decisive factor in terms of an individual's access to goods and services is where they were born or, possibly, where they live. Branko Milanovic (2016) calls it 'citizenship rent' – an individual's living standards depend more on where they are than what they do. Chang (2011: 24ff) illustrates a similar point by comparing the competences and efforts of bus drivers in New Delhi and Sweden, and argues that the difference in wages between rich and poor countries is first and foremost determined by immigration control.

In addition, within a country there is little connection between individuals' efforts to provide the cake and their access to appropriate parts of it. In modern society, the distribution mechanisms can be divided into two broad groups depending on whether they are linked to markets or not. In markets, access to goods is determined by whether you have purchasing power in the form of money, while access in other contexts is provided in other ways. For example, the distribution mechanisms within a household are usually based on conventions about who is entitled to what, to which there is a major element of care attached. With regards to the public sector, the distribution of goods is often based on rights. These may be rights to the transfer of purchasing power in the form of, for example, pensions or support for education, or they could be in the form of access to use goods, such as medical assistance or education, which are made available by the public sector. Appropriation through criminal activities can both be linked to markets and to simple use of force.

As many goods and services in modern society are available through markets, the acquisition of purchasing power is crucial. It can be obtained in the form of salaries or by virtue of ownership of assets such as land, buildings, machinery, patents, trademarks and other rights. As mentioned above, ownership as such does not contribute anything to the cake, but various institutions give owners the right to collect a rent. While the unfairness of the land rent accruing to owners of relatively fertile land was highlighted by David Ricardo and elaborated by Henry George, we now need to extend this idea and question the justification of a wider set of rent extraction from all sorts of assets (Sayer 2015, Stratford Forthcoming). It is being increasingly argued that patents deter innovation (Farley & Kubiszewski 2015, Mazzucato 2018), but even when patents actually incentivize real contributions to enlarge the cake, it does not justify very large and inheritable remunerations that are unrelated to personal efforts. For many assets, rents occur in the form of capital gains that emerge because of societal changes such as urbanization. As the financial sector has

demonstrated, gains can also be obtained through the creation of fanciful financial constructions. In such cases, part of the rent can take the form of exorbitant salaries (Stratford Forthcoming). This broad concept of rent as a term for unearned income beyond any socially acceptable remuneration for work or effort also includes, for instance, compound interest and inheritance.

With rent included in prices, it is illustrated that prices serve as distributional mechanisms rather than relevant measures of value. As Martinez-Alier (1987: x) states as the main point of his book on the early contributions to ecological economics: "Economists are left without a theory of value". There is no relevant way to establish economic commensurability between different goods as they have no mutual biophysical quality, and consensus on the worth of the goods from a human perspective is impossible to achieve. Market prices should not be considered relevant measures of value as they emerge as historical constructions that are influenced by both past and present inequalities. The current interplay between supply and demand reflects many different factors: uneven income and wealth distribution nationally and globally, physical and social structures that are based on decades when the environmental impacts of production have not been priced, power structures and cultural ideas that influence the relative wages for different types of work, etc. (Røpke 1999). It does not make sense to assign to this construction the ability of expressing relative values, and this is why a meaningful measure for the size of the real cake cannot be constructed. However, the formation of prices is an important part of distribution as the process allocates purchasing power among market participants. Through this power, the holder can influence the actual composition of the real cake.

The real cake can grow based on increasing biophysical inputs and socio-technical innovation. When we can only rely on the latter, growth can be expected to be relatively limited, but this does not necessarily limit growth in purchasing power, which can be constructed without any relation to increases in the real cake. For instance, compound interest and capital gains combined with money creation allow for this. In this way, monetary demands on the cake can increase more than the cake, which can make it even more difficult for holders of little money to gain access. Diverging trends in the real cake and the monetary claims can emerge in relation to debt and have historically been managed by debt jubilees (Daly 1980, Graeber 2011). In the calculation of GDP, which is based on the circular flow model and the application of prices as a device for adding goods and services, this divergence is handled by statistical conventions, for instance, in relation to the treatment of capital gains and the financial sector (Christophers 2011, Coyle 2014).

As mentioned, property relations are decisive for distribution. They influence the extent to which the cake is distributed according to conventions related to care, rights or purchasing power, and they influence the amount of purchasing power that various social groups and individuals get access to. Therefore, it is an important component of economics to consider new developments in property relations and new mechanisms of appropriation in relation to, for instance, information and communication technology and the related infrastructure (Elder-Vass 2016). Furthermore, the ongoing processes of enclosure as well as the struggle to recover and create new commons are key issues.

5.6 Governance for sustainability

The purpose of elaborating an economic perspective on societal development is to improve the conditions for governance. However, no actor is in a position to govern from outside. Governance, which can be performed by various actors, is about navigation within complexity on the basis of how the actors perceive their interests and the interplay. When the concept of governance is applied, it suggests that this navigation takes place in some sort of civilized world where outright violence is not among the available means. With a view of sustainability transitions as processes that involve both keeping within planetary boundaries and ensuring the fulfillment of basic needs for all humans (Raworth 2017, Gough 2017), this idea of governance may seem naive. When resources are scarce, and the rich have to give up privileges to improve the conditions of the poor, it may not be easy to manage "by design, not disaster" (Victor 2008).

As, for instance, the mapping of environmental justice conflicts (Temper et al. 2015) has demonstrated, many environmental conflicts are permeated by violence. It is important to convey an understanding of these conditions in Econ 101, but also to elaborate on the more civilized aspects of governance.

As a starting point for governance, I suggest following Dewey (1939) in discouraging a rigid means-end rationality. Summing up Dewey's reasoning in a simplified way, it does not make sense to distinguish between means and ends because ends are always means to something else. Since there is no final end, it is necessary to consider different combinations of means and ends and to realize that an end may have to be revised in the light of the means (p. 26-28). This is all the more so as desire and interest are not ready-made from the outset, but emerge in a context of cultural conditions and institutions (p. 54f, 64). Based on this reasoning, the efficiency concept belongs to the group of problematic terms. Simple rationalities (technical efficiencies) can be brought into the discussion – for instance, the concept of EROI, Energy Return On (energy) Input, is useful to reflect on the relevance of biofuels (Hall et al. 2009) – but even they should be combined with other considerations. Something that is particularly problematic from an ethical perspective is the use of allocative efficiency in neoclassical economics (Farley et al. 2015, Pirgmaier 2017). Basically, both the goals and the means are up for discussion.

As a basis for governance, it is necessary to make the world understandable and governable through various devices. In relation to sustainability governance, various biophysical measures are needed to describe the environmental conditions and various social measures to describe inequality, health and other issues. However, monetary measures should be applied with caution as an input to decision-making. Since prices are historical constructions that are not informative regarding real social and environmental costs, they should rather be the output of the deliberations: How should prices be changed through taxes, minimum and maximum wages, environmental regulations and many other measures in order to promote sustainability goals? This perspective implies a critical view on cost-benefit analysis, whereas deliberative methods can be useful ways of providing inputs to political decision-making. The concept of VAI, value articulating institutions, is important to introduce here (Vatn 2005, 2015), including an open discussion on the problems related to the use of deliberative methods.

Regarding the actual strategies and measures that can be applied to promote sustainability transitions, it is useful to draw on a variety of theoretical approaches. It is not an option to "leave it to the market" to find the way forward, and although the standard recommendation of a tax on carbon emissions can be useful, it cannot stand alone. Markets have to be constructed in other ways as well and sometimes replaced or supplemented by other mechanisms. For instance, as price rationing may be unfair and may reduce the adoption of green technologies, non-price rationing may be a better option (Farley et al. 2015). As mentioned, governance may be performed by various actors and should be framed as navigation in complex processes of change rather than choices between given alternatives. An elaboration of this perspective can draw on a rich literature on sustainability transitions (Foxon 2011), the dynamics of innovation, the role of government in technological transformation (Mazzucato 2011, 2018), the different roles of consumer-citizens (Walker & Cass 2007), etc.

Sustainability transitions also involve macroeconomic policies. These policies should be informed by post-Keynesian and Minskyian perspectives combined with biophysical understandings (Galbraith 2014). This means that the dynamics of the system is based on monetary phenomena (money is not just a veil), but at the same time, the limits to government policies are to be found in real resources, not in money. In a state with its own currency, there is never a lack of money, but there may certainly be a lack of real resources. Influencing how these resources are used and by whom is decisive. Furthermore, the balance of payments is a relevant constraint.

6. Conclusion

The main point of this paper is that Econ 101 needs to undergo a sustainability transition in order for economics to be better suited to a call for just sustainability transitions in society. Ecological economics should contribute to such a new economics by providing the biophysical foundations and developing a new basic structure of economic reasoning through integration with other heterodox strands of thought. The new economics should be formulated as an independent and self-contained structure of knowledge that does not rely on a previous introduction to mainstream economics. Based on such a structure, it might be possible to incorporate and subsume useful insights from mainstream economics. Obviously, this proposal is more radical than a call for pluralism, which usually implies that the teaching of economics starts with mainstream thinking and then adds various heterodox perspectives as critical or supplementary comments. What is needed is a re-structuring of knowledge that involves a real turn-around, which is similar to, but even more radical than, the one made with Odum's textbook on ecology in the 1950s (Odum 1953, Røpke 2004: 298).

The proposed knowledge structure involves a delimitation of economics with a focus on provisioning: how do humans make a living? This provides a specific cut through the totality, which is always both biophysical and social. The fundamental thought patterns of the approach include the bridging of the structure-actor interplay and related concepts of institutions and power, conceptualization of dynamics based on evolutionary thinking and systems thinking, and the idea that agents' own reflexive understanding are an integral part of development. Turning to the substantive issues of economics, the introductory topics include thermodynamics, ecology, the energy history of humans, basic ideas from earth system science, and the idea of social metabolism. Provisioning is introduced as a broad concept that captures all sorts of contributions of goods and services to the real cake that is available for consumption and investment. Provisioning is seen as a human activity where the practitioners provide the result, while ownership of the tools involved is not considered a productive force. Due to the condition of incommensurability, the size of the real cake cannot be measured in any meaningful way. As the present distribution of the cake is based on a long history, it is necessary to give a brief outline of the emergence and development of capitalist institutions. This should include the importance of property relations for distribution, the emergence of markets and their dependence on government, the changing character of market participants, the dynamics and instability of capitalism, as well as the global reach of capitalism. Turning to distribution, it is important to emphasize the lack of connection between the individuals' efforts to provide the cake and their access to appropriate parts of it. Access is achieved through conventions related to care, through rights and purchasing power, which is acquired as salaries and, even more, in the form of rent related to property institutions. Prices serve as a distributional mechanism, but cannot be considered relevant measures of value. Finally, the introduction to governance challenges rigid means-ends rationality, but acknowledges the need for making the world understandable and governable through various devices. Biophysical and social measures are preferable to monetary assessments, and deliberative methods are promoted as means to provide inputs to political decision-making. Regarding actual strategies, the need for conscious construction of markets is emphasized as well as a navigational approach to sustainability transitions.

This knowledge structure can be used as a framework and basis for adding insights from both heterodox and mainstream economic thinking, but it replaces the mainstream focus on market exchange as the key topic of economics and it dismisses, for instance, the concepts of equilibrium, optimality, efficiency, choice between given alternatives, and money as a measure of value. Such concepts and the related neoclassical framework can be introduced at a relatively late stage as a way in which various actors perceive the world. For instance, it can be illustrated how this understanding often plays a key performative role in legitimizing current institutions and power relations in connection with various battlefields. Both Vatn (2005, 2015) and Birch et al. (2017) demonstrate how neoclassical approaches can be presented without endorsing them. This approach differs from the one applied in the well-known textbooks on ecological economics by

Common and Stagl (2005) and Daly and Farley (2004). Their approach is understandable because the first steps to get ecological economic ideas into the mainstream curriculum went through the teaching of mainstream environmental economics. However, I think we are in a different situation today and we should try to avoid endorsing the basic thought patterns of neoclassical economics, even though it may be difficult for economics teachers, even heterodox economists, to give up teaching something that they struggled to learn as students.

The purpose of restructuring economic knowledge and developing a new Econ 101 is to promote a different performativity of economics – one that implies a strong call for just sustainability transitions and empowers environmental justice movements. Some examples of performative messages are:

- The challenges related to the environment and justice are very serious and include the need to enter a new phase in human energy history.
- Biophysical measures should inform policy-making.
- The present distributional institutions are not legitimate and need to be changed. Rent should be socialized to make sustainability transitions socially acceptable and possible.
- Active governance is necessary. For instance, markets have to be consciously constructed to serve sustainability purposes and influence the direction of technical change.
- Common property should play a greater role.
- As prices are not good measures of value, inputs to decision-making need to be provided through deliberative processes.
- Government deficits and public money creation may be useful to ensure investments in sustainability and more equal access to health and education.

Arguing that it is an important task for ecological economics to contribute to the development of this new economics does not imply that this is the only task for the field. Ecological economists should continue to pursue the diverse, more specific research programmes that have emerged within the field in relation to, for instance, the details of environmental conflicts and governance, the development of an ecological macroeconomics and the challenges related to sustainability transitions within different provisioning systems. However, compared to related transdisciplinary fields working with sustainability issues, we should remember our particular responsibility to promote a new economics.

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