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The neoclassical Trojan horse of steady-state economics

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A B S T R A C T

The vision of a steady-state economy elaborated by Herman Daly describes an economy that uses materials and energy within the regenerative and assimilative limits of the planet's ecosystems. Sustainable scale, just distribution, and efficient allocation are its constitutive theoretical goals. This paper is a critique of the theoretical foundations of steady-state economics. It argues that steady-state economics consists in an attempt to squeeze neoclassical economics into a biophysical and ethical corset. As a result, many fundamental flaws and criticisms of neoclassical economics remain. As a consequence, steady-state economics does not lead to a radical departure from, or improvement upon, neoclassical theory but rather to fundamental internal inconsistencies between the 'old' economics paradigm and 'new' progressive ecological economic thinking. Contradictions appear at various levels ranging from ontology and methodology to theory and values. As Daly has pioneered the foundations of ecological economics with his thinking, these ambiguities are not only problematic for steady-state economics but ecological economics as a field more generally. The paper concludes that ecological economics has to let go of neoclassical foundations as they contradict its core values and ambitions. A new and consistent theory of political economy of the environment along heterodox lines is needed.

Keywords (max 6): allocative efficiency, steady-state economics, neoclassical economics, pre-analytic vision, methodology, ontology

Highlights:

- Steady-state economics internalises neoclassical economic theory and reasoning
- This leads to fundamental theoretical inconsistencies within steady-state theory
- It also contradicts core values and ambitions of ecological economics
- New theory is needed to understand and act upon social ecological crises

1. Introduction

Steady-state economics is one of the most influential theories in ecological economics for considering the interrelated nature of ecological and economic systems. The vision elaborated by Herman Daly describes an ecologically sustainable economy that uses materials and energy within the regenerative and assimilative limits of the planet's ecosystems. It is defined in physical terms, by a constant stock of human population, domesticated animals (i.e. livestock) and built capital – such as buildings, infrastructure, or durable consumer goods – that are maintained by a low rate of matter-energy throughput (Daly, 1974a; 1991a: 475; O'Neill, 2015). Daly argues that a physically non-growing or steady-state economy is the only long-run alternative for economies to die of old age in the distant future rather than of the cancer of 'growthmania' (Daly, 1996; 2010b).

The analytical starting point for the steady-state goal is a new preanalytic vision (Schumpeter, 2006 [1954]) that overcomes the shortcomings of traditional economic ontology. Daly attacks the isolated circular flow model of exchange value of 'orthodox economics' for ignoring biophysical reality and absolute resource limits. Instead, he proposes a view of the economy as a subsystem of a finite ecosystem that is totally dependent on it, both as a source of low-entropy matter-energy and as a sink for high-entropy matter-energy (Georgescu-Roegen, 1971). This worldview infers that modern societies have moved from an 'empty world', where the scale of the economy was relatively small compared to its surrounding ecosystems, into a 'full world', where it increasingly presses against planetary boundaries (Steffen et al., 2015).

The full-world perspective begs the question: how big can the economy get in relation to its surrounding ecosystems? This is the matter of sustainable scale which is Daly's most important concept and subject matter for a new 'Environmental Macroeconomics' that is meant to focus on *"the volume of exchanges that cross the boundary between system and subsystem"* (Daly, 1991b: 256; 1996: 48). Scale is defined as the material-throughput that can be tolerated without eroding the carrying capacity and resilience of natural systems[1]. As we approach or overshoot sustainable scale, or planetary boundaries in modern parlance, the aim can no longer be quantitative growth but qualitative development, leading to *"an economics of better, not bigger"* (Daly, 1996: 167).

The implementation of the steady-state economy is envisaged as a hierarchy of three consecutive goals: sustainable scale, just distribution, and efficient allocation (Daly, 1991a, 1992; 2010b). A 'good' scale is at least sustainable. Once the overall cake is no longer growing, distribution becomes an issue in its own right that has to be tackled as a separate economic goal. Distribution means deciding how to divide the resource flow amongst people, and a 'good' distribution is one that is just or fair, based on ethical principles and keeping levels of inequality below reasonable levels. Only after a resource limit and the level of distribution have been set does efficient allocation

[1] The preanalytic vision and Daly's concept of sustainable scale were instrumental in establishing a research programme within ecological economics that deals with the operationalisation of biophysical scale, leading to concepts and methodologies such as MFA, HANPP, energy accounting, footprint and rucksack calculations etc. (Røpke, 2005).

become the mechanism to determine the destination of scarce resources. A 'good' allocation is efficient if it:

> *"allocates resources among product end-uses in conformity with individual preferences as weighted by the ability of the individual to pay. The policy instrument that brings about an efficient allocation is relative prices determined by supply and demand in competitive markets"* (Daly, 1992: 186).

Daly leaves little doubt that allocative efficiency is the kind of efficiency he means (Daly, 1991a: 82; 1992; Daly and Cobb, 1989: 59; Daly and Farley, 2011: 457).

This framework is supposed to be substantially different from the standard environmental economics solution of 'getting the prices right'. Externality theory, Daly argues, subsumes the scale problem under allocation by assuming that once all prices are internalised, there will be no scale problem as prices reflect true scarcity. However, if scale it set first, then there is nothing wrong with using the market mechanism for what it is good at: determining prices that reflect relative resource scarcity. Faith in the market mechanism to yield Pareto efficient outcomes is reflected not only in steady-state theory but has also become a foundation for several influential ecological economic textbooks (Common and Stagl, 2005; Costanza et al., 2015; Daly and Farley, 2011).

Any theory needs to be logically consistent, as one criterion among others, to serve as a good compass and guideline for effective action, especially so if the aim is to convince politicians, policy makers and academics to advocate and implement steady-state proposals. Daly himself says in the Preface of *Steady-State Economics* that

> *"we should be concerned with whether [...] arguments are valid or invalid, and whether underlying values are good or evil" (Daly, 1991a: xvi) and "to refute an argument one must find either a factual error in the premises or a logical error in the reasoning" (Daly, 1991a: xi/xii).*

Despite Daly's appeal for theories based on logical reasoning and ethical considerations, there has been very little critique of steady-state economics. Mainstream economists tend to ignore it, do not know about it or dismiss it as naïve, and much of the ecological economics community embraces it as a useful and pragmatic vision of a sustainable society.

The purpose of this paper is to offer a critique of steady-state theory with a view to stimulating dialogue and establishing a constructive research agenda. Thinking through the steady-state edifice step by step reveals that it relies on the neoclassical understanding of the economy. If neoclassical theory is dropped (and several reasons will be provided why this is necessary), steady-state economics remains a rather shallow normative framework stipulating that the economy 'should' stay within the limits of the ecosystem and that resulting redistribution issues 'should' be tackled in a relatively just way. Steady-state economics does not explain how growth dynamics emerge, why steady-state proposals face extreme implementation barriers, how wealth is distributed, why society changes, etc. In other words, it does not have a social or economic theory of its own that explains social ecological dynamics.

The paper primarily draws on Daly's works, for several reasons: he established steady-state economics and has written most extensively about it; his contributions still influence major advances of steady-state economics, lately sometimes under the name

of ecological macroeconomics (Rezai and Stagl, 2016); and his works are most insightful in revealing the theoretical essences of the steady-state approach[2].

The structure of the argument is as follows. Section 1 introduces the foundations of steady-state theory. Section 2 deconstructs these foundations by highlighting that steady-state economics relies on the neoclassical theory of demand, supply, and general equilibrium theory, which leads to theoretical inconsistencies, contradictions and unresolved issues. This section also includes some presentation of alternatives on the issues covered. Section 3 demonstrates that steady-state economics not only relies on neoclassical theory but also neoclassical thinking, which is problematic for similar reasons. Section 4 discusses why this analysis matters. Section 5 summarises and concludes that ecological economics requires sound theories that explain the emergence and dynamics of social ecological phenomena.

2. The ambiguous nature of steady-state theory

The steady-state approach seems reasonable at first. The idea is to limit the use of natural resources, distribute them fairly amongst people and do this in an efficient manner. Market efficiency is proposed as the third goal of steady-state economics to solve 'the allocation problem'. However, what does this really mean? What is 'the allocation problem'? What is efficient? For whom? And how is it to be achieved? This section reveals that allocative efficiency is not a neutral concept in neoclassical economics but integrated in its very core. Accepting allocative efficiency in the way Daly suggests implies accepting the neoclassical understanding of capitalist dynamics – the theory of demand, the theory of supply, and general equilibrium theory. This move is highly problematic, as these theories are flawed in at least two ways: they are internally incoherent, and thus fail on their own terms; and they are unrealistic, and thus do not capture essential dynamics of real-world economies that are key for explaining and addressing social ecological problems.

2.1 Allocation and perfect markets: the adoption of neoclassical microeconomics

Allocative efficiency is endorsed in steady-state economics based on the claim that markets solve the allocation problem and deliver Pareto optimal societal outcomes.

> *"Yes, the market should certainly be the main mechanism for solving the problem of efficient allocation of resources […] We must use the market to solve the allocation question, but we cannot expect it to solve the scale and distribution questions" (Daly, 1996: 13). "The invisible hand [is] wonderful for allocation" (Daly, 1996: 59). "The best we can hope for from a perfect market is a Pareto-optimal allocation of resources" (Daly, 1996: 32).*

[2] Especially Daly's older works explicitly refer to economic theory (e.g. Daly, 1974b, 1991, 1996). In more recent texts the focus shifts towards specific policy proposals, without addressing their theoretical underpinnings (e.g. Daly, 2010b). This is problematic, as implicit theories are more difficult to detect. However, from my reading there is little indication that Daly has changed the tendency to embrace neoclassical economic theory and methodology ever since he developed steady-state economics.

Lawn, a supporter of steady-state economics, confirms that *"Daly's vision of steady-state-capitalism embraces the efficiency-facilitating role of markets"* (Lawn, 2010: 7). These statements illustrate the acceptance of the narrative and prospect of neoclassical microeconomic theory, which centres, at its heart, on yielding allocative efficient outcomes.

The 'allocation problem' concerns decisions about what to produce, how and how much (Pindyck and Rubinfeld, 2015). Whether, which, how and how many bicycles, shoes or teapots are produced in an economy depends on various factors, such as available means of production (machines, factories, technology, resource inputs), consumer preferences, their income and willingness to spend, and broader political economy considerations such as industrial relations, the legal architecture and cultural, historical and geographical contexts (Vatn, 2005, 2015). The neoclassical approach of tackling allocation assumes initial endowments, consumer tastes and technology as given (exogenous), and abstracts from political and time-space concerns (Fine, 2016b). What remains endogenous is the determination of equilibrium prices and quantities. This means the 'allocation problem' boils down to a pure exchange problem, the solution to which is provided by 'the invisible hand' of the market.

Perfect markets are considered efficient by consolidating production functions and utility functions in the equilibrium, i.e. the point where welfare is maximised as the marginal benefits of consumption equal the marginal costs of production (Pindyck and Rubinfeld, 2015). The strict conditions for markets to yield efficient outcomes are well known – they include perfect competition, perfect information and rationality of individual actors, the existence of markets for all goods and services produced, the inexistence of externalities and public goods, and fully assigned private property rights for all resources and commodities (Perman et al., 2003: 18). These conditions are notoriously unmet in real markets, and yet *"it is no exaggeration to say that the entire modern microeconomic theory of government policy intervention in the economy […] is predicated on this idea"* (Lockwood cited in Gowdy and Erickson, 2005: 209).

Overall, efficiency is a vexed term in economics and subject to many interpretations, for instance regarding the exact relationship between allocative efficiency and Pareto efficiency. Daly uses both terms interchangeably, and so do many economists. What remains clear, however, is that this type of efficiency often relates to the claim of perfectly competitive markets yielding optimal societal outcomes. Daly maintains that *„it would be a foolish waste of effort and an intolerable imposition of microcontrol to refuse to use the market"* (Daly, 1991a: 89). However, it is one thing to accept a certain role of markets as coordinating production, distribution and exchange decisions, but another to accept neoclassical economic theory as a sufficiently good explanation of how market economies and markets function. It is not.

2.2 Unrealistic, flawed and inconsistent theoretical underpinnings

The problem with endorsing allocative efficiency lies in the implicit acceptance of the neoclassical conception of the economic system and its pillars – the theory of demand, the theory of supply, and general equilibrium theory. These theories establish the building blocks for achieving a Pareto efficient allocation of resources – a downward sloping market demand curve, an upward sloping market supply curve, and the idealised equilibrium position where both intersect. The purpose of this section is to show that all

three theories are internally flawed and detrimental to ecological economic ambitions.

The neoclassical theory of demand, to begin with, conceptualises consumers narrowly as self-interested hedonists aiming to maximise their utility and concludes that this is good as it benefits society at large. The theory rests on a set of well-known preference axioms: preferences are presumed to be complete (consumers can compare and rank all possible commodity baskets and thus always choose what is good for them); transitive (if A is preferred to B, and B to C, then A to C); rational (consumers always choose what maximises their utility); and non-satiable (more consumption is always better) (Pindyck and Rubinfeld, 2015). Moreover, preferences are taken as given and considered to be stable, i.e. neoclassical economists ignore where consumer tastes come from and assume that they do not change.

Daly questions consumption theory for its lack of realism, narrow scope, and neglect of ethical concerns. For instance, he criticises the preference satisfaction approach for being purely subjective, and thus not allowing comparisons between people: as he highlights *"there is no distinction between what people of the present age of advertising think will make them whole and happy and what would in fact make them so"* (Daly, 1991a: 3). However, market efficiency rests on assumptions of non-satiability and a subjective theory of value[3] that contradict the viewpoint he presents here (satiability and objective values). As high levels of GDP and income no longer make most people in high-consumption nations any better off, neither in terms of happiness (Easterlin et al., 2010), nor quality of life (Max-Neef, 1995), whilst increasingly destroying life-support systems, sufficiency thinking matters and questioning preferences becomes an ethical responsibility (Kallis et al., 2012). This reasoning forms part and parcel of the steady-state vision to sketch a sufficiency economy that should level-off once destructive overconsumption sets in (Daly, 2008). However, theoretical inconsistencies remain unconsidered, not even when confronted with this criticism by Okun, who declared that

> *"this concept of efficiency implies that more is better […] It is appropriate to ask sceptically whether people are made better off (and thus whether society really becomes more efficient) through the production of more whiskey, more cigarettes, and more big cars" (Okun, 1975: 2).*

Daly, however, disagrees with this argument.

> *"The first of several problems with this view is that the maxim "more is better" does not follow from the definition of efficiency. We could give an equivalent definition "efficiency means getting the same output with less input", and then argue that efficiency implied that "less is better" (Daly, 1991a: 121).*

He claims Okun confuses the definition of efficiency with consumer sovereignty and concludes that an alternative definition of efficiency is needed that does not *"lead to the anomalies and confusions of the 'more is better' school"* (Daly, 1991a: 122). However, Daly confuses a technical understanding of efficiency with allocative efficiency in his response to Okun. Allocative efficiency is about whether it is possible to make someone better off without making someone else worse off. Technical efficiency is about using minimum inputs for a given output. Technical efficiency plays into allocative efficiency as part of production decisions (increasing energy or labour productivity) but it does not

[3] The neoclassical subjective theory of value implies that the worth of things only depends on what people are willing to pay for them at the margin of consumption (Fine, 2016b).

replace it. Daly endorses both understandings of efficiency, as is standard in microeconomics.

> *„It is well known in economic theory that the price system, in pure competition, will attain an efficient allocation of resources in the sense of a Pareto optimum" (Daly, 1991a: 202).*

This quote and others provided in the introduction clearly demonstrate that Daly endorses the allocative understanding of efficiency in the steady-state framework.

Daly's suggestion to overcome the problems of the '*more is better' school*, as he says above, is an alternative 'comprehensive efficiency identity' that measures the ratio between man-made capital services gained to natural capital services sacrificed. It is essentially a service-throughput, or benefit-cost ratio, expressing how much ecosystem services are used to produce goods and services for the satisfaction of people's needs and wants[4] (Daly and Farley, 2011: 475). The introduction of an alternative efficiency identity is a move towards measuring technical efficiency differently. This is admirable, and not inconsistent with ecological economics and the rest of the steady-state framework, but it does not overcome Daly's reliance of allocative efficiency and the problem of an unrealistic and reductionist theory of consumption and the economy more generally.

Let's turn to the neoclassical theory of the firm, which is equally unrealistic. Supply theory says that firms maximise profits at optimal levels of output. The heart of the argument is an assumption of rising per-unit production costs with rising output, both in the short and the long term[5]. The short run explanation centres on rising labour costs; the long run argument on diseconomies of scale, mainly due to capacity constraints. Both assumptions lead to an upward-slowing supply curve of a firm: a higher price has to be offered to motivate firms to produce more (Pindyck and Rubinfeld, 2015). Both arguments have been refuted by Sraffa already in the 1920s (Sraffa, 1926). Sraffa showed that diseconomies of scale do not exist as firms produce up to a level of minimum efficient scale before they open the next factory. This means that, in reality, the law of diminishing marginal returns does not apply to an industrial economy in general. There is no production optimum as most firms operate under conditions of constant or increasing returns to scale[6]. As a consequence, profit can be made from every extra unit sold. Firms will try and sell as much as they can. Limits on how much they can sell depends on their ability at persuasion – convincing consumers to spend and banks to invest (Keen, 2001). The result of constant or falling production costs for most manufactured goods is flat or downward-sloping supply curves.

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[4] There are various ways how this type of efficiency can be improved, e.g. by distributing natural resources to those people first that profit most from them, increasing product lifetime, maximising sustainable yield, or giving up those ecosystems first that yield the least services for people (Daly and Farley, 2011).

[5] Short run means that some production inputs are variable and others fixed, whereas in the long run all factors are variable.

[6] Modern microeconomics textbooks acknowledge the possibility or even likelihood of constant or increasing returns in certain sectors too (esp. manufacturing), but not as part of their core analysis and argument, and without drawing explicit conclusions for the demand-and-supply analysis overall (e.g. Mankiw, 2004: 283ff; Nicholson and Snyder, 2014: 204ff; Perloff, 2015: 166ff; or Pindyck and Rubinfeld, 2015: 237ff).

> *"This causes manufacturers no difficulties, but it makes life impossible for economists, since most of economic theory depends on supply curves sloping upwards" (Keen, 2001: 55).*

This is no mere technical detail. It matters as Daly derives misleading conclusions about the functioning of the economy. He suggests utilising the micro-economic concept of 'optimal scale' for thinking about the macro-economy (Daly, 1991a: 83; 1996: 51, 60).

> *"All of microeconomics is nothing other than defining the optimal scale of some activity, be it production of shoes, consumption of ice cream, hours worked per week […] But, surprisingly, when economists switch from micro-to macro-economics we hear no more about optimal scale […] each micro activity has an optimal scale, but the aggregate of all micro activities, the macro-economy, is supposed to grow forever and never exceed an optimal scale! How can this be?" (Daly, 1989: 145)*

The answer is that the neoclassical theory of the firm is unsound. However, steady-state economics suggests to employ the empirically unsupported 'when to stop rule' to think about the macro-level, for instance, by suggesting caps on natural resource use. Daly's metaphor[7] of a macro 'optimum' of matter-energy use is portrayed as the point where marginal benefits of additional built capital for human needs satisfaction equal the marginal costs of depleting natural capital (Daly, 1996: 51). In other words: the macroeconomic perspective of steady-state economics becomes a biophysical marginal cost-benefit-analysis for the economy as a whole, based on neoclassical microeconomic reasoning. Regardless of whether it was meant as a metaphor or not, this is severely misleading, not least because it neglects systemic growth dynamics. In reality, economies need to grow or enter into crises. It is crucial to understand these dynamics and the inherent role of (over)using matter-energy. Introducing a hypothetical 'when to stop' rule on the macro level – as if growth could be assumed away – distracts from facing economic realities.

Constructive alternatives to the theory of the firm can be found in classical political economy. These theories are more committed to an objective theory of value (in which costs of production are independent of demand); allow for economies of scale – both within firms (think of Adam Smith's pin factory) and between firms (as in Marx' analysis of the social division of labour); offer insights into how production processes are actually organised (as opposed to a pure exchange perspective on production); and explain how and why growth dynamics emerge (Fine, 2016b).

General equilibrium theory is a third case in point for internal inconsistency and unrealism. It is the neoclassical theory of the system as a whole and theoretical description of Adam Smith's invisible hand, attempting to prove that the aggregation of individual utility and production functions results in an overall equilibrium of the macro economy. *"Yet those who follow the news about microeconomic theory have known for some time that general equilibrium is not exactly alive and well any more"* (Ackerman, 2002: 120). General equilibrium theory was mathematically proven to be unstable 40 years ago. This means there is no unique existence of a stable Pareto efficient

[7] I learnt from Inge Røpke and Dan O'Neill that Daly's discussion of 'optimal scale' should be understood in a metaphorical way. Daly would argue that the biophysical sustainable scale of the economy can only be discussed in natural science terms (such as planetary boundaries) rather than as an outcome of valuation exercises.

equilibrium (Kirman, 1989; Rizvi, 1994; Saari, 1995). The neoclassical micro-foundations project for macroeconomics failed as it crudely sidesteps aggregation problems (Brown and Spencer, 2014). Individualistic marginal theory is unable to grasp macroeconomic aggregates, as well as non-individual domains, such as power, class, conflict or institutions (Weeks, 2014). That emergent macro phenomena cannot be explained by aggregating individual states is obvious from a system theoretical perspective and well rooted in ecological economics (think of rebound effects or positional goods). Daly also repeatedly emphasises that 'the whole is more than its parts' (Daly, 1991: 3). However, again, without general equilibrium theory there is no Pareto efficient outcome for concluding that competitive markets are efficient and lead to maximal welfare.

2.3 The narrow confines of neoclassical economics

This section makes the case that the scope of neoclassical economics is too narrow for and conflicting with steady-state ambitions. As economic historian Mirowski put it recently *"Allocation as a special phenomenon […] captures the essence of economics"* (Lash and Dragos, 2016). This is prominently reflected in the definition of neoclassical economics as the allocation of scarce resources between competing ends (Robbins, 1932: 15). The standard economics definition that Daly adopts on page three of his influential textbook (Daly and Farley, 2011) seems to suit well at first, as the subject matter is about scarce resources. This is a fallacy, however, as the focus is on allocating *given* resources in a setting of *given* production conditions and *given* ends (Pindyck, 2015). Recall: on the production function side of allocation, technology is given, factor inputs such as natural resources are given and input prices as well due to the assumption of perfect competition; on the utility function side, preferences are given. The latter reflects a deliberate choice to abstract from any ethical content in the enterprise of 'positive economics'[8]. Ultimately, this led to an extreme reductionism in the substantive content of neoclassical economics: optimising the behaviour of individuals under very restricted conditions (Brown and Spencer, 2012).

The focus and ambition of steady-state economics is admirably different: Daly is not content with an economics that abstracts from the finiteness of 'means' – the question of absolute resource limits – and raises the need for tackling desirable societal 'ends' – such as fairer distribution and long-term sustainability. However, the way he suggests to implement this vision is problematic. He only proposes to extend the scope of neoclassical economics. The way in which this is done is to wrap 'the allocation problem' of neoclassical economics into a biophysical and ethical corset by adding sustainable scale and just distribution as additional goals (and to introduce a new measure of ultimate efficiency that captures the broader scope). However, adding an ethical and ecological taste to wormy theory does not transform it into 'new' economics – it remains 'old' economics with add-ons.

An associated issue arising from the narrow scope of neoclassical economics relates to

[8] Robbins' aim was to establish economics as a science that clearly departed from ethical judgements, reflecting the positivist philosophical understanding of the time that economists should refrain from meaningless metaphysical statements. A demarcation between objective facts and normative statements, i.e. means and ends, was introduced, leaving it to the social sciences (psychology, sociology or political sciences) to deal with the latter (Bromley, 1990; Brown and Spencer, 2012; Milonakis and Fine, 2009).

efficiency as a goal. Why exactly does efficiency need to be a goal in its own right? It is clearly an objective in neoclassical economics. In fact, Bromley concludes that efficiency as a goal lies at the heart of the ideology of economics (Bromley, 1990). However, Daly repeatedly criticises 'growth economics' and runaway GDP for becoming ends in themselves. If steady-state economics is to move beyond a perspective of the economy as an end in itself (which Daly advocates) towards one in which the economy is a means to serve society at large, then efficiency too, is a means to achieve scale and distribution, which are clearly more important. The lesson learnt from the problematic but widespread three-pillar approach of sustainable development is that economic considerations often overrule broader societal long-run targets Establishing a goal hierarchy where scale comes first, distribution second and efficiency third, is insufficient to address this issue. I argue that scale and distribution are goals, whereas efficiency can be a better or worse means to achieve them, but should not be a goal in itself.

The alternative for effectively addressing scale issues and related ethical concerns, the two central issues in steady-state economics, is to see that the 'emperor has no clothes' (Keen, 2001). Recognising the reductionist, ahistorical, asocial, apolitical character of the neoclassical approach removed from time and space leads to the conclusion that it cannot explain its own subject matter – the economy – from its core principles and concepts (Fine, 2016b). It cannot explain how and why goods are produced, nor the social relations under which allocative efficiency is generated. This means it is – in its entirety – of no help for a progressive ecological economic enterprise. Promising alternatives can for instance be found in Marxist theory and classical institutionalism (Marx, 2011 [1867]; Veblen, 1898, 1904). Marx's analysis of capitalism is still unparalleled as an excellent account of how capital and capitalist economies function and evolve (Harvey, 2010). The classical institutionalists, on the other hand, offer key insights into how the economic and political landscape within capitalist societies unfolds and how social change emerges (Vatn, 2015). Both schools of thought consider the system as a whole, take a long-term perspective and do not contradict a biophysical perspective of the economy.

2.4 The neglect of interdependencies, dynamics and change

Another problematic consequence of the steady-state approach is the perpetuation of analytical separations. Scale, distribution and allocation are presented as analytically separate entities that can be implemented by separate institutions[9]. In practice, it is impossible to uphold this distinction. Allocation and distribution are connected as one cannot know the value of production independent of the distribution of income (Bromley, 1990). Scale and distribution are connected as imposing any kind of limits-to-growth means bringing distribution back in its own right. Allocation and scale are

[9] In earlier works, Daly suggested three separate institutions that deal with limiting population, resource use, and inequalities. This approach has been broadened by Daly (e.g. Daly, 2010) and others (e.g. Dietz and O'Neill, 2013) over the years, leading to a longer list of policy recommendations and associated institutions (ranging from cap-auction-trade systems, to reforming national accounts, limiting the range of inequalities, stabilising population, and others). However, the central issues and problems persist: the questions how these policies and institutions are interlinked (which is absolutely crucial from a systems-perspective) and why they are not being implemented on a large scale remain widely unaddressed.

connected as the amount of available resources, or a resource cap, would influence what is being produced. Daly acknowledges interdependencies and possible conflicts between the three goals (Daly, 1996: 51, 55), but not to a great extent. The neglect of strong interconnectedness and trade-offs has been discussed (Lawn, 2004; Malghan, 2010; Prakash, 1994; Stewen, 1998a; Stewen, 1998b). What I would like to add from a theoretical perspective is that the analytical separation of concepts becomes problematic when they change the focus of attention in a direction that misguides the analysis. If trade-offs between the goals are massive, which is the case in reality[10], then a theoretical framework is needed that focuses on a comprehensive understanding of interdependencies (Klitgaard and Krall, 2012; Krall and Klitgaard, 2011). Above all, we need to systematically understand how the dynamics of capital accumulation relate to scale and distribution. For instance, we need to ask why, how and under what circumstances labour and resource efficiency improvements drive the expansion of the economy as a whole. Otherwise, we might be deprived of the chances to effectively think through implementation challenges.

There are alternatives beyond analytical separation. Krall and Klitgaard (2011, 2012) prominently mention the Social Structure of Accumulation (SSA) school as one alternative approach to reconnect allocation, distribution, and accumulation dynamics. I would like to provide the social provisioning approach in heterodox economics[11] as another example. Social provisioning means explaining the social process of how goods and services are provisioned in a capitalist system embedded in a social context (culture, technology, history etc.) (Lee, 2009). The approach recognises that allocation, distribution and scale cannot be treated separately from each other (drawing on Smith, Marx, Veblen, Keynes and others) and thus offers an integrated framework to address the problem comprehensively; above all, social provisioning focuses on process and includes elements of dynamics and change which is particularly relevant as explaining the resource flow is no longer sufficient in a resource constrained world – it's about changing it; moreover, it recognises that provisioning rests on a material basis of the natural environment; it highlights production as being more important than consumption because production decisions are made upon the expectation of profits whereas consumption is dependent on these decisions; and it is not limited to market activities as it accepts that economic processes rest on both market and non-market institutions (Bayliss, 2015; Boffo, forthcoming; Jo, 2011; Lee, 2009). The social provisioning approach thus seems to offer a true alternative to the core neoclassical framing of 'the allocation problem' that is solved by the market.

[10] This fact gave rise to a recent critique of steady-state economics, which centres on the question whether a biophysically non-growing economy is compatible with capitalist accumulation dynamics (Burkett, 2009; Hahnel, 2012; Lawn, 2011; Smith, 2010).

[11] Heterodox economics is defined as spanning *"a variety of approaches including 'old' institutional economics, post-Keynesian economics, feminist economics, Austrian economics, and Marxian economics. These diverse and sometimes conflicting perspectives have for many years offered an approach to economics that situates the economy in a broader social, historical, and political context. They have by their nature and often by their design sought to develop links with other human and social sciences and to push economics in a more interdisciplinary direction"* (Spencer, 2013: 5).

3. The logic of steady-state economics

If we agree with Audre Lorde that *"the master's tools will never dismantle the master's house"* (Lorde, 2007 [1984]: 110), novel ways of reasoning are needed to effectively address social ecological problems. Steady-state economics has potential in this respect. It starts from a promising preanalytic vision of how ecological and social economic systems are interrelated and a strong normative position about the necessity to include distribution and sustainability issues into economic analyses. However, it does not carry this logic fully through to all domains. In fact, it remains heavily infused with 'old' neoclassical economic thinking, for instance, regarding static equilibrium or externality logic. I highlight several cases in which steady-state economics relies on neoclassical reasoning and show why this is problematic: it hinders the detection of how and where social ecological problems arise and thinking about how to tackle them; it also contradicts constitutive pillars of ecological economics: a systemic, holistic, evolutionary and realistic understanding of economy-environment relations.

3.1 Unrealistic vs. realistic thinking

Steady-state theory is ambiguous about the realism of assumptions. Certain key neoclassical assumptions are adopted as first approximations, most others are rejected as being overly abstract. Above all, Daly attacks the failure of the mainstream to address reality. He accuses neoclassical economics of committing the 'fallacy of misplaced concreteness', i.e. confusing reality with abstractions of reality (Daly, 1991a; Daly and Cobb, 1989). What matters in reality – and from a steady-state perspective – is addressing absolute resource scarcities and relative social wants. However, two of the most important assumptions in neoclassical theory are relative scarcity and absolute wants. On the other hand, diminishing marginal utility, increasing marginal costs, perfect competition and individualistic maximizing behaviour are explicitly accepted as solid evidence and good starting points for theory (Daly, 1991: 82, 83, 87). Implicitly, further neoclassical assumptions are incorporated by bringing allocative efficiency on board.

The adoption of unrealistic neoclassical assumptions is problematic. A straightforward reason is inconsistency. Accepting that markets lead to allocative efficient outcomes but refuting some of the underlying assumptions for this claim to hold, e.g. insatiable consumer wants, leaves the analysis in a confused position. Yet another, more profound reason why realism matters is that the heavy use of idealisations hides topics that are relevant for steady-state ambitions. Issues of power and vested interests, for instance, do not arise in the positivist neoclassical tradition in which facts are assumed to be separable from values. In reality, the distribution of power between market participants is never equal and it is important to capture these differences to address distribution conflicts or consider the enforcement of resource limits (Fuchs et al., 2015). Who wins and who loses? Whose interests are represented and whose are not? These questions do not arise in the neoclassical framing and are issues steady-state theory barely addresses. Or take the assumption of perfect competition: in a fictitious world of perfect competition in which a myriad of enterprises produce up to levels at which marginal cost equal marginal revenue, profit-making is ruled out (Keen, 2001). This explains why neoclassical economics cannot provide a sensible theory of profit, which is clearly

important to understand dynamics in real-world economies and resistance to resource caps or distribution policies (Fine, 2016a). The need for a realistic account of the social world is widely acknowledged and indeed a defining characteristic of ecological economics[12] (Gowdy and Erickson, 2005; Söderbaum, 1999, 2008; Spash, 2012).

3.2 Externality vs. systemic thinking

Whilst being sceptical about the strategy of 'internalising externalities' (Daly, 1974a: 18; 1991a: 69; Daly and Cobb, 1989: 56), steady-state economics does not fully break with the externality logic of neoclassical environmental economics. Daly calls the internalisation of externalities inadequate and contradictory as a general solution to environmental problems and believes *"it is past time to change the basic framework of our thinking"* (Daly, 1996: 45). But instead of abandoning this conception, the suggestion is to *externalise* rather than internalise the biggest externalities, i.e. dealing with scale and distribution politically outside the market sphere and then, within constrained limits, leaving the market alone to *"safely function"* (Daly, 1991a: 89). This reasoning is not fundamentally different from standard market failure theory. It accepts the conceptualisation of externalities as issues the amoral market is incapable of dealing with, and maintains that, due to market failure, political intervention is needed to avoid social damage. The resulting better market will yield an efficient outcome. *"Depletion quotas"*, Daly maintains, *"can be regarded as the correction of a market failure"* (Daly, 1974b: 164). This is the same logic and language as in standard environmental economics. The difference is to limit quantity first (e.g. by depletion quotas), and let prices adjust, rather than fixing prices (e.g. by taxes) and let quantities adjust.

This approach contradicts systemic thinking – another pillar of ecological economics. Externalities cannot be externalised either as they are endogenous features of the system (Ayres and Kneese, 1969; Daly and Cobb, 1989: 55; Kapp, 1971; Mäler, 1990). Understanding social ecological phenomena from a systemic perspective, as ontologically sketched by Daly in the preanalytic vision and widely advocated for in ecological economics (Bertalanffy, 1968; Boulding, 1956; Meadows, 2009) and also by himself (Daly, 1991a: 46), needs to conceptually grasp interdependencies, relations and feedbacks rather than trying to separate them out. The analytical separation of economics from politics, positive from normative, and allocation from distribution, as pursued in neoclassical economics and upheld by the steady-state approach to a certain extent, runs counter to a systemic approach. It falls short of providing a sensible representation of complex systems and, in addition, frames political and moral issues as technical exercises, thus depoliticising politics (Bromley, 1990; Pirgmaier and Urhammer, 2015; Vatn, 2015). The issue is hence not one of tackling scale and distribution outside rather than inside the market realm but to recognise that these issues

[12] Gowdy and Erickson, in their seminal paper on '*The approach of ecological economics'* argue that ecological economics is different from neoclassical economics because of a more realistic understanding of the world. This includes, for instance, rejecting the rational actor model in favour of a more comprehensive analysis of humans as social actors, or rejecting marginal analysis in favour of capturing total effects and discontinuous changes (Gowdy and Erickson, 2005). In this spirit, Peter Söderbaum is a key example of introducing concepts such as 'political economic person' or 'political economic organisation' to account for multi-faceted human behaviour (Söderbaum, 1999, 2008).

are intrinsically intertwined in reality and therefore need conceptual interconnections in theory.

3.3 Equilibrium vs. evolutionary thinking

Steady-state economics operates in a static framework, where equilibrium and 'optimal' states are envisaged as ideal outcomes. Equilibrium in economics refers to states in which counteracting forces have no tendency to change (Bannock et al., 1984). As the name 'steady-state' suggests, the economy is envisaged to level off in physical terms. 'Physical equilibrium' is the optimal level of matter-energy stocks that, once reached, will be maintained by minimal throughput (Daly, 1974b: 161). This steady-state is not considered static, but oscillating around a 'dynamic equilibrium' that can be compared to a mature forest that still develops in qualitative terms without growing in quantitative terms. Elements of dynamism are also reflected in the possibility of different steady-states levels:

> *"It may happen that as a result of technical and moral evolution it becomes both possible and desirable to grow (or decline) to a different level of stocks. We may certainly do it. But growth (or decline) will then be seen as a temporary adjustment process of moving from one steady state to another, not as an economic norm" (Daly 1974b: 157).*

Moving from one equilibrium state to another is thus perceived possible, but as soon as the adjustment process is complete, the economy would tend to balance again.

Equilibrium thinking stands in contrast to an evolutionary perspective of the economy, another pillar of ecological economics. Equilibrium thinking emphasises stability removed from space and time (and therefore history). In a world in flux static equilibrium has no practical meaning (Ackerman, 2002). Key to understanding the economy as an evolving process is portraying economies as 'complex adaptive systems' (Foxon, 2011). This explains the ecological economic research agenda concentrating on unsustainable lock-ins, crises, processes, path dependencies, time lags, resilience, co-evolution between social, technical and ecological systems, leverage points of change, transition pathways, diversity, adaptation, learning, and complexity, to mention some important aspects (Foxon, 2011; Gowdy, 1994; Holling, 1986; Kallis and Norgaard, 2010; Norgaard, 1994). Veblen insisted as early as 1898 that progressive economics needs to break with static thinking, as it prevents a deep understanding of economic systems (Veblen, 1898)[13]. Daly repeatedly refers to co-evolving systems, however, it is difficult to see how equilibrium thinking can be aligned with a co-evolutionary perspective. Despite attaching 'dynamic' to equilibrium, steady state economics remains situated in a static framework.

[13] This view was shared by most early marginalists, such as Marshall and Jevons, who saw static analysis as a transitional methodology until economics reached maturity. However, this approach was later shown to be misguided: it was impossible to derive a dynamic understanding of the economy from static foundations (Keen, 2001). However, as much of the neoclassical architecture is bound to the idea of equilibrium, it remains in place, as it does in steady-state economics.

3.4 Biophysical vs. monetary thinking

Steady-state economics clearly presents a biophysical perspective of the economy (Farley, 2015). Most concepts applied or introduced are thought of in matter-energy terms: scale, growth, equilibrium, population, allocation, or capital. Even distribution becomes a matter of the relative division of resource flow amongst people (Daly, 1992). Conceptualising the value of physical stocks and flows in biophysical terms is considered necessary to correct the mainstream isolated circular flow model of exchange value (Daly, 1996: 193). Daly portrays the circular flow model as a perpetual motion machine independently of any material requirements fetishizing money (Daly, 1996: 193). He claims that Georgescu-Roegen's introduction of 'the entropic flow model' provides a bridge to reality (Georgescu-Roegen, 1971). Instead of misconceptualising the economy as a mechanistic, reversible, quantitative loop, the alternative offered is a one-way throughput process from sources to sinks and wastes that accounts for irreversibilities and qualitative changes. The material view of the economy in which both quantity and quality of matter-energy throughput matter is meant to complement and improve the conventional perspective of the economy, in which value is mainly expressed in monetary terms.

Daly's move is admirable, as it attempts to emphasise use value aspects that are neglected in mainstream economics. However, the way this is done is inadequate. A biophysical perspective of the economy attached to a flawed neoclassical theory does not yield a satisfactory theory. What we need to understand theoretically is how use value and exchange value considerations are related, rather than separating them out. Use value relates to the material properties by the virtue of which a commodity becomes useful for people (Brown, 2008). The use I gain from drinking coffee, for instance, stems from the coffee beans, the metal of the coffee machine and foamed milk that give rise to its specific taste and consistency. Exchange value, in contrast, is the quantity of other commodities for which coffee exchanges. As there are as many exchange values as there are different commodity combinations (coffee-tea; coffee-sugar, coffee-hats etc.) and as this is impractical, money serves as the socially accepted measure of exchangeability. This means use value relates to biophysical considerations and exchange value to monetary considerations. It is crucial to understand that a commodity is always bearer of both, like a coin that has a 'qualitative' picture on one side and a 'quantitative' number on the other. A material perspective is without doubt an essential step to gain a deeper understanding, however, most economists work, think and talk about the economy in exchange value terms expressed in money, as this is the predominant value form in capitalist economies. It is essential to understand material and monetary relations, which remains underexplored in steady-state economics.

3.5 Open vs. closed systems thinking

The preanalytic vision Daly introduces represents an open systems ontology of the social world.

> *"What is needed is not an ever more refined analysis of a faulty vision, but a new vision [...] The necessary change in vision is to picture the macroeconomy as an open subsystem of the finite natural ecosystem (environment), and not as an isolated circular flow of abstract exchange value, unconstrained by mass balance, entropy and finitude" (Daly, 1996: 48).*

In this vision, 'open systems' are defined in thermodynamic terms, i.e. exchanging matter-energy with their surroundings. This conceptualisation sounds trivial, but has far-reaching implications. It means that all economic processes are ultimately natural processes in terms of biological, physical and chemical transformations and thus subject to the laws of thermodynamics (Georgescu-Roegen, 1971). However, as complexity rises from natural to social systems (Luhmann, 1987), dynamics of the economy cannot be exclusively explained in biophysical terms. There is more to inflation than atoms and molecules. Also, seeing the economy as embedded in the environment implies a hierarchical understanding: the economy needs the environment for its survival, but not vice versa (Spash, 2012). As economies are open they can become smaller or bigger in terms of throughput and natural capital stock, giving rise to Daly's 'empty' vs. 'full' world perspective. Moreover, the outcomes of social environmental systems interdependence are unpredictable and indeterminate and subject to uncertainty and constant change.

Every sensible person (or economist)[14] agrees with this view. The crucial question is how economic theory relates to this ontology. To pick up Whitehead's fallacy of misplaced concreteness again: Given the preanalytic vision, what is a sensible abstraction of it? What does economic theory need to look like to capture essential dynamics of this worldview? If Daly's ambition is to offer an alternative vision that is more 'realistic' to account for the nature of open reality, then it seems sensible to embrace an open system methodology that accounts for fundamental uncertainty, imperfect knowledge and mutability (Chick and Dow, 2005). Most of the foundations of ecological economics are tied to open systems methodology: the commitment to value pluralism and incommensurability (Martinez-Alier et al., 1998), the need for a different (post normal) understanding of science (Funtowicz and Ravetz, 1994), the importance of inter- and transdisciplinarity (Lélé and Norgaard, 2005) and holism (Meadows, 2004). However, the steady-state approach unconsciously incorporates the core of an economic theory that is based on a closed systems methodology, in which certainty, atomism and isolation of linear cause-effect mechanisms prevails. As a consequence, the steady-state approach falls back into the isolated-loop architecture Daly detests so much. In the end, the ontological foundations of steady-state economics clash with the closed systems methodology of neoclassical economics.

4. Discussion

Steady-state economics is presented as a solution-oriented and desirable alternative of a future sustainable world overcoming some fundamental pitfalls of 'standard growth economics' (CASSE, 2016). It was meant to offer an approach targeted at institutions that have the potential to set in motion, direct, and progressively foster transformational change towards sustainability and equity (Daly, 2008, 2010b). In a pragmatic spirit, Daly argues: *"theorists must not allow themselves to be debilitated and rendered irrelevant by too deep a philosophical reflection on the infinite interconnectedness of all things"* (Daly, 1994: 91). In other words, instrumentalists can do without theoretical

[14] This also becomes clear in the correspondence between Daly and Solow / Stiglitz in which they all agree that economic processes are subject to thermodynamic laws, embedded in a larger environmental system and dependent on it for sources and sinks (Daly, 1997a, 1997b; Solow, 1997; Stiglitz, 1997).

rigour and waterproof philosophical and methodological foundations (and even systems thinking). What matters is a convincing narrative to gain political credibility and achieve desired outcomes, i.e. limiting resource use under a relatively fair governance regime. Given this motivation, do the theoretical, methodological and ontological inconsistencies presented in this article really matter?

It seems necessary to ask what criteria a 'good' theory should fulfil. In my view, ecological economic theory of the human-planetary system should aspire to meet three criteria, at least. One is to offer deep explanations why current economic development trajectories and policies prioritising GDP growth are unsustainable and increasingly unjust. Only a realistic account of how market dynamics unfold and how central capitalist dynamics relate to destructive environmental change can give rise to meaningful insights beyond naivety and utopianism. In order to do so, theory needs to arise out of concepts and assumptions that are rooted in reality (Brown and Spencer, 2012; Kapp, 1961). Besides an explanation based on realistic concepts, there is a need for logical consistency. We can only make sense of the world by logically tracing how core concepts of a theory are related. In addition, theories should aim for impact – in terms of reaching and influencing Realpolitik and societal awareness about the need for social ecological change. The criteria of deep explanation based on realism, logical consistency and real-world impact need to be balanced such that no one criterion becomes paramount. Consistent theory detached from reality is not sound, neither is aiming for impact at the expense of consistency or realism.

Steady-state economics addresses these ambitions to some extent, but falls short on most of them. It provides a vision of where to go and first steps into this direction in terms of institutions and policy proposals (Dietz and O'Neill, 2013), but fails in terms of logical consistency[15] and deep explanation based on realism, as it does not offer a developed theory of how capitalist dynamics relate to ecological disruptions. Without such a sound theoretical basis, the steady-state project remains a rather shallow attempt of listing normative goals and policies that bear little resonance to real-world implementation challenges. The lack of a realistic conception of growth and power dynamics constitutes a central critique of steady-state economics (Burkett, 2009; Hahnel, 2012; Mujezinovic, 2013; Smith, 2010; Spash, 2015; Trainer, 2011), which Daly has not taken very seriously (Daly, 2010a). If we believe that systems and their structures follow dynamics emerging from the parts and relations they consist of, then the problems are not 'out there' but 'in here' (Meadows, 2008). There is a need for a realistic perspective on how markets operate and a debate about the benefits and limits of non-market vs. market economic order (Polanyi, 2001 [1944]).

Advances in this direction are attempted with the development of a new ecological macroeconomics (Rezai and Stagl, 2016; Røpke, 2016) and the economics of degrowth (Kallis et al., 2012). This is not the space to review this evolving body of literature, however, what this paper offers is an impulse to carefully think about the theoretical foundations of 'alternatives' proposed. Jackson, for instance, claims that "*Daly's pioneering work provides a solid foundation from which to rectify this [ecological*

[15] I would like to clarify that two inconsistencies need to be distinguished: internal inconsistency of neoclassical theory (as shown by Keen, 2001, for instance) and inconsistency of neoclassical theory with steady-state ambitions and ecological economics more broadly. This article mainly addresses the latter, however, it also highlights the former in the discussion of the theory of the firm and general equilibrium theory in section 2.

macroeconomics]" (Jackson, 2009: 123) and proceeds to explain macroeconomics basics in terms of the neoclassical production function approach. This is highly problematic. This is just one example that illustrates the need for caution and awareness of the limits of neoclassical theory in developing constructive ecological-economic theory.

Daly's position on neoclassical economics remains ambiguous. He is highly critical of mainstream theory, including environmental economics (Røpke, 2005). However, if Daly is so critical, what is the rationale for adopting mainstream concepts and reasoning? My speculation is threefold. First is a belief that standard market theory, when corrected for its 'freely floating' character that abstracts from biophysical realities, provides a satisfactory framework for analysing economic systems (Daly and Farley, 2011). This article shows that this is not the case. Second might be long training in mainstream thinking and lack of exposure to alternatives. Apart from the classical economists as a source of inspiration, John Stuart Mill's vision of a stationary state in particular (Mill, 2006 [1876]), Daly speaks of 'economics' as if there was no alternative to the mainstream[16]. This articles shows that there are heterodox alternatives. A third reason might be linked to pragmatism (Spash, 2013) and Daly's early ambitions to change the discipline of environmental economics from within, rather than creating a new field. As an expert of subtle and ironic formulations (Røpke, 2005), Daly developed concepts such as 'uneconomic growth', 'optimal scale' or the index of sustainable economic welfare (ISEW) to show that the pursuit of economic growth is no longer desirable, even when considered from a mainstream perspective. However, Daly's pragmatic use of mainstream theory weakens the analytical and political contribution as well as the relevance of steady-state economics. It has neither convinced mainstream economists, nor led to the implementation of steady-state policies. Rather, it has contributed to a split ecological economics community (Spash, 2013), with an unfortunate tendency to become more mainstream again (Anderson and M'Gonigle, 2012), whilst social ecological crises continue to worsen.

What became clear for me, and what others highlight as well (Nadeau, 2015; Spash, 2013) is that internalising neoclassical economics and its reasoning impedes the ability to address social ecological crises as it remains caught in an ahistorical, static, universal, purely subjective and individualist methodological architecture. These foundations cannot provide sound theories of growth dynamics, profit, money or distribution, which are key to understand the contemporary political economy landscape. It is important to know neoclassical reasoning as most of contemporary economics relies upon it; however, basing central theories of ecological economics on it seems utterly misleading. Instead, it is necessary to let go of neoclassical foundations altogether, as they contradict a systemic, holistic, dynamic and realistic understanding of the interrelation

[16] A few references are made to Marxist economics, which are however quickly abandoned. Daly believes that *"Marx, with his theory that labor was the source of all value, was even more eager than standard economists to deny any important role to nature in the functioning of the economy and creation of value"* (Daly and Farley, 2011: 32). This thought seems to have been passed onto Daly's student Bob Costanza, who argues that *"Marx and his followers in communist countries have made a negative contribution to the allocative efficiency problem"* which has contributed to much environmental destruction in former-communist countries (Costanza et al., 2015: 45). These accounts are based on misinterpretations of Marx's work, confuse Marxist theory with socialist dictatorships and do not acknowledge that Marxist theory cannot provide insight into 'the allocative efficiency problem' because it rejects the conception of allocation in favour of a more comprehensive understanding of production, exchange and distribution.

between the economy and the environment with a view to proposing effective policies and triggering change towards sustainability (Gowdy and Erickson, 2005; Klitgaard and Krall, 2012; Krall and Klitgaard, 2011; Spash, 2011). The new generation of ecological economists needs to be aware of the pitfalls of neoclassical theory and pragmatic strategies to maintain mainstream language and concepts to fruitfully advance ecological economics.

5. Conclusions

This paper reveals that steady-state economics is internally flawed as it heavily relies on neoclassical theory and reasoning. By accepting allocative efficiency of markets, the core of neoclassical economics is incorporated into the steady-state framework. The hidden implications of this move are profound. It means accepting a utility-based preference satisfaction account of wellbeing, stable and unquestioned preferences, the neoclassical theory of the firm, general equilibrium theory, rational economic man, instrumentalism regarding the unrealism of assumptions, and a neoclassical definition of what economics is and should be. Adopting the scope, reasoning, and core assumptions of neoclassical theory and adding a biophysical and ethical flavour to it does not lead to its improvement, but rather to fundamental internal inconsistencies between the 'old' economics paradigm and 'new' progressive ecological economic thinking.

Critique is never a satisfying end result but rather the starting point for constructive alternatives. This paper offers a prelude for progressive advances in ecological economic theory along heterodox lines. Marxist economics, 'old' institutionalism, post-Keynesian economics, parts of classical political economy, evolutionary economics, feminist economics, Polanyian approaches and environmental sociology are amongst the most promising sources of inspiration to think about the intertwined nature of economic and ecological systems and better understand environmentally destructive feedbacks of the system as a whole. They provide a broad conception of the economy as a social and historical process, focus on social structure, crises, dynamics and change, the role of money and finance, the impact of politics, and offer methodologies that fit the preanalytic vision of ecological economics. More bridges between heterodox traditions and progressive ecological economics are needed to collectively establish a new economics that is supportive of socially just sustainability transitions[17].

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[17] One attempt to establish a new economics based on a cooperation between many streams of heterodox economics is 'New paradigm economics' (see e.g. Fullbrook, 2013 and 2014).

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