

ANALYSIS

Scale and topology in the ecological economics sustainability paradigm

Geraldine J. Jordan ^{a,*}, Marie-Josée Fortin ^b

^a *School of Resource and Environmental Management, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada V5A 1S6*

^b *Department of Zoology, University of Toronto, Toronto, Ontario, Canada M5S 3G5*

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Abstract

An ecologically sustainable scale of the economic system requires inclusion of spatial-temporal dimensions and topological relationships. While Herman E. Daly and Marcus Stewen have deliberated some of the issues surrounding economic scale in their papers (“Allocation, distribution and scale: Towards an economics that is efficient, just and sustainable” [Ecol. Econ. 6 (1992) 185], “The interdependence of allocation, distribution, scale and stability—A comment on Herman E. Daly’s vision of an economics that is efficient, just and sustainable” [Ecol. Econ. 27 (1998) 119] and letters to the editor [Ecol. Econ. 30 (1999) 1], [Ecol. Econ. 30 (1999) 2], they do not address spatio-temporal constraints on ecological processes. Although Daly frames the scale of the economy based on sustainable throughput of resources relative to the environment, the pragmatic approach to defining this sustainable scale must incorporate other dimensions of scale. While Daly [Ecol. Econ. 6 (1992) 185], [Ecol. Econ. 30 (1999) 1] correctly promotes a logical sequence of policy instruments, scale should indeed elicit dependence from allocation and distribution decisions. Stewen’s [Ecol. Econ. 27 (1998) 119], [Ecol. Econ. 30 (1999) 2] arguments included that these instruments have co-evolutionary interdependencies, but such arguments do not guarantee economic nor ecological sustainability. A more useful definition of sustainable economic scale includes spatial and temporal dimensions, scale constraints and topological relationships as they are framed by ecological components and processes. The spatial scale of the global economy is large, but temporally the global economy is diminutive: two characteristics that typically define catastrophic events in ecological parlance. Using a spatio-temporal framework, Daly’s boat analogy can be extended to real-world linkages and possible solutions through supplementing the current view of economic scale with spatio-temporal distance and topology. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

The debate between Daly (1992, 1999) and Stewen (1998, 1999) continues to improve how a sustainable scale of economic structures and sys-

* Corresponding author. Tel.: +1-604-291-4659; fax: +1-604-291-4968.

E-mail address: gjbergma@sfu.ca (G.J. Jordan).

tems is defined. In this commentary, we argue that ecological and economic sustainability imply both intragenerational spatio-temporal distribution and allocation issues as well as relations of trade formed between units and framed by topological linkages. Since there is a need to incorporate space over which economic activity is undertaken, we elaborate Daly's (1992) definition of economic scale based on comprehensive scale definitions (such as Csillag et al., 2000; Gibson et al., 2000). We agree with Daly's (1992, 1999) premise of a logical sequence of economic policy instruments that promotes scale to be the primary instrument required in decision-making for sustainability. Stewen's (1998, 1999) view of interdependence contributes to the idea of mutual reliance of policy tools. However, according to hierarchical scaling paradigms (for ecological context see Allen and Hoekstra, 1992), allocation and distribution must be dependent on scale, although these former policy instruments may indeed be mutually interdependent. While containment of economic instruments can be determined, the idea of sustainable dependence remains insufficient without understanding constraints of ecological systems and topological relationships. We, therefore, argue that a sustainable scale of economic systems requires applied knowledge of the spatio-temporal constraints of ecological systems and linkages.

2. Review of the scale debate

Daly (1992) stated in his seminal paper, "Allocation, distribution and scale: Towards an economics that is efficient, just and sustainable", that scale "has not been formally recognized and has no corresponding policy instrument" (p. 186). He suggested that a third policy instrument, related to scale, is required. This instrument would contribute to sustainability as "a good scale is one that is at least sustainable, that does not erode environmental carrying capacity over time" (Daly, 1992, pp. 186–187). He elaborated the definition of an "optimal scale" as being one which does not erode the services of the ecosystem which, marginally compared, are worth more than the production benefits which we may derive from

them. Daly (1992) stated that the typical way that economists deal with scale is "to subsume it under allocation" p. 189. Since the protection of ecological services requires that we maintain economic activities within ecological capacity, Daly suggested a logical sequence of policy instruments, illustrated with tradable permits, of scale, allocation and distribution. He stated furthermore that scale must be a social decision based on ecological carrying capacity.

In a commentary on Daly's paper, Stewen (1998) criticized Daly's "independence" of policy goals as deceptive, since they can be misinterpreted as a hierarchy, as well as removing the goal of stabilization. Stewen (1998) stated that "it is not necessarily Daly's intention to suggest that allocation, distribution and scale are independent" (although Daly (1992) indeed stated this). Stewen (1998) considered it dangerous ("possibly fatal") to interpret "independence" as the "possibility of dealing with scale issues isolated from other goals" and criticized the fact that Daly argued in neo-classical parlance with rhetoric rather than operational remarks. Stewen appeared to interpret Daly's use of independent goals as "isolated goals". Moreover, "... if the general scale should be limited or reduced, the effects depend on the chosen instruments" (p. 125). Stewen preferred a "magical triangle of allocation, distribution, and scale, with societal stability and sustainability as 'meta level' goals" (p. 128).

Daly's (1999) reply to Stewen's (1998) commentary was a clarification of independence, whereby Daly provided the mathematical analogy of three equations with three unknowns, aiming to solve scale, allocation and distribution. Furthermore, Daly stated that his independent goals are a "logical sequence", not a "normative hierarchy" as Stewen (1998) had (mis)interpreted. To this, Stewen (1999) replied that in real life "political decisions are not made in sequence of mathematical equations.... allocative, distributive and scale decisions are mixed together in political process" p. 2. Stewen's view is indeed positivist, and does not lead to mitigating the sustainability problem, which exists because of this "mixed together" process, i.e. no prescriptive constraints are placed in economic activity. Daly's view of scale policy is

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