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Analysis

The Kenneth E. Boulding Memorial Award 2014
Ecological economics: A personal journey

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ABSTRACT

This speech was delivered at the meeting of the International Society for Ecological Economics at Reykjiavik, Iceland on the 13th of August 2014 at the presentation of the 2014 Kenneth E. Boulding Memorial Award. In the speech Peter Victor pays tribute to Kenneth Boulding, one of the pioneers of ecological economics, and then describes his own principal contributions to ecological economics over a period of 45 years. These contributions include environmental applications of input–output analysis, the problematic extension of the concept of capital to nature, the definition and analysis of green growth, and his research on ecological macroeconomics and the challenge to economic growth.

1. Introduction

I am deeply honoured to receive the Boulding Award for 2014 and I thank the Boulding Award selection committee of the ISEE for recognizing my work in this way. And I am especially pleased to be receiving the award in Iceland, a peaceful country of great beauty.

In 1967, when I first read Boulding's brilliant essay on the Economics of the Coming Spaceship Earth (Boulding, 1966), I realized that it was well ahead of its time. Sad to say, it still is for most economists, present company excepted. As a graduate student at UBC I was very fortunate to hear Boulding speak. Although I can't recall the details of his presentation, I do remember leaving the seminar with aching sides, never having laughed so much, before or since, at an academic meeting, or at any meeting come to think of it. Kenneth Boulding was a very funny man with an impish sense of humour. You may not agree with everything he said, but you sure had fun hearing him say it.

Although Boulding did not describe himself as an ecological economist, he did contribute to its foundations. And he exemplified the importance for ecological economists of having a wide and deep knowledge of economics as well as a solid appreciation of numerous other disciplines and their interconnections. This is why ecological economics is hard but it can also be fun, and no one appreciated that more than Boulding. I have spent my entire career as an academic, public servant, private consultant and development advisor, working on the ecological economics agenda that Boulding set out all those years ago, and I have had plenty of fun along the way. So this award given in Boulding's name is especially meaningful to me.

Boulding's metaphor of the ‘spaceman economy’, in the language of the day, was inspired by the race in the 1960s between the USA and USSR to land a man on the moon. The space race gave rise to famous photographs of the Earth that, over the years, have changed our perception of ourselves and of our place in the universe. Speaking in particular of economics, Boulding argued that “the closed earth of the future requires economic principles which are somewhat different from those of the open past” (Boulding, 1966, p. 9). In his inspirational essay, he gave important clues about the required changes in economic principles he foresaw. What I want to do in my remarks today is to remind ourselves of his key insights from 50 years ago, and then consider some areas in which we have progressed since his day as we build an ecological economics fit for the twenty-first century.

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So what is the foundation that Boulding gave us half a century ago? In describing the economy and its relation to the environment, Boulding distinguished between open and closed systems in relation to matter, energy, and information. He explained that economies are subsystems of the biosphere and considered the significance of the second law of thermodynamics for energy, matter, and information. This was five years before Georgescu-Roegen published his celebrated treatise on *The Law of Entropy and the Economic Process* (Georgescu-Roegen, 1971).

Boulding observed that fossil fuels are a short-term, exhaustible supplement to solar energy, and that fission energy does not change this picture. He considered the prospects for much better use of solar energy enhanced perhaps by the biological revolution. He challenged the conventional wisdom on consumption and its contribution to well-being by suggesting that human welfare should be regarded as both a stock and a flow. He asked, for instance, whether it is "eating that is a good thing, or is it being well fed?" (Boulding, 1966, p. 8).

Boulding wondered what the present generation owes to posterity and why we should care about the future, noting the historical evidence which suggests "that a society which loses its identity with posterity and which loses its positive image of the future loses also its capacity to deal with present problems, and soon falls apart" (Boulding, 1966, p. 11). And he observed our natural propensity to discount the future and that perhaps "conservationist policies almost have to be sold under some other excuse which seems more urgent" (Boulding, 1966, p. 12).

Boulding thought the law of torts was quite inadequate to correct the price system where "damages are widespread and their incidence on any particular person is small" (Boulding, 1966, p. 14). Corrective taxation, he said, might play a useful role, especially in addressing more immediate problems of environmental deterioration, but he also recognized that human impacts on the environment have spread from the local to the global. He commented that technological change has become distorted through planned obsolescence, competitive advertising, poor quality, and a lack of durability.

Boulding famously summed up his analysis by comparing what he termed a "cowboy" economy, which is designed to maximize throughput (for which gross domestic product (GDP) is a rough measure), with a "spaceman" economy in which stocks are maintained with minimum throughput. He said all this and more in 11 short pages. If there is a better and more succinct account of the principles of ecological economics than the one he gave in 1966 I haven't seen it.

I will now turn to aspects of ecological economics in which considerable progress has been made since Boulding's time. I'll focus on four in which my own work has played a part:

- The extension of input–output models to include material throughput.
- Sustainable development and the widening definition of capital.
- Utilization of conventional economic tools to examine green growth.
- Managing without growth.

2. Input–output Analysis and the Environment

In the late 1960s a few economists began to realize that input–output analysis, described by Leontief in the 1930s, could be applied to environmental problems. Leontief himself published a paper in 1970 in which he introduced a pollution abatement sector that purchases goods and services from other sectors and sells the service of pollution abatement. He showed how the model could be used to estimate the price impacts of pollution abatement expenditures (Leontief, 1970). However, he did not incorporate the principle of materials balance in his model, though in 1969 Ayres and Kneese had shown how this could be done theoretically within the Walrasian multi-market model (Ayres and Kneese, 1969). According to the materials balance principle, materials are neither created nor destroyed in an economic process, only their form is changed.

Working independently as a doctoral student at the University of British Columbia in the late 1960s, I realized that the concept of externalities was grossly inadequate to capture the comprehensive links between economies and the environment. Externalities is a microeconomic concept, one that is not up to the task of addressing the macroeconomic problem of scale. I became preoccupied with the materials balance principle: the idea that all materials (including fossil fuels) obtained by an economy from the environment, eventually become waste products. I began to conceive of economies as embedded in the environment and dependent upon it, and I wondered about applying the materials balance principle to an entire economy. Fig. 1 shows one of my earliest sketches of an integrated economy–environment system as I struggled to conceptualize the key relationships. There is an economic system in which various stocks (R, K, F and A) are interconnected through material flows. There are also material flows linking each stock to the encircling environment comprised of land (L), air (E) and water (W).

A few pages on in my notes is my first rendition of the materials balance framework as an input–output table in which the material flows that connect an economy to the environment are shown (Fig. 2). The zero in the bottom right hand cell signifies that the sum of materials used as inputs (row totals) equals the sum of wastes disposed of into the environment (column totals).

At the time I drew this table I did not know much about input–output analysis, but by good fortune Professor Gideon Rosenbluth had already agreed to supervise my dissertation and he happened to be an expert in this methodology. It took me less than a minute to explain to him my dissertation proposal: to apply the materials balance principle to the Canadian input–output model, theoretically and empirically. He approved and I was on my way. Relying solely on information sources in the UBC library I completed the dissertation in less than a year and in 1972 it was published as a book: *Pollution: Economy and Environment* (Victor, 1972). I take some pride in the fact that the book is still referred to in publications on environmental extensions of input–output analysis and that the methodology I developed has been taken up and adapted by academics, researchers, public servants and commercially successful companies such as TruCost in the UK.

Fig. 3 is a recent example (developed with Brett Dolter and Tim Jackson) of how input–output analysis can be used to examine the relationship between greenhouse gas (GHG) emissions and employment at the sector level. It shows the direct and indirect emissions and employment for $1 m spent on final demand in each of 12 sectors. The estimates come from a highly aggregated version of Canada's input–output model using data for 2010. They illustrate how a suitably modified input–output model can provide detailed, consistent, comprehensive, quantitative measures of key economic and environmental variables and relationships, in this case the direct and indirect GHG emissions and employment arising from $1 million of final demand for the output of each sector. The figure shows substantial variation among the sectors suggesting the possibility of changing the composition of GDP and simultaneously reducing GHG emissions and increasing employment.

The methodology of applying input–output analysis to quantify economy–environment interactions has advanced in the past 40+ years as have the available databases. In particular, there are now global, multi-regional input–output tables that include a range of material flows and which are in the public domain. One such database is the World Input–output Database (Timmer, 2012). Working with my doctoral student Brett Dolter, we used this database to compare the GHG emissions embedded in the consumption of numerous countries regardless of where the consumed goods and services are produced (their GHG 'shadows'), with their domestic emission of greenhouse gases (Dolter and Victor, submitted for publication).

Fig. 4 shows that throughout 1995–2009 the GHG shadows of Sweden, Germany and the USA exceeded the release of GHGs within their territorial borders, and especially in the case of Sweden, by a very considerable amount. Meanwhile, Canada saw its GHG shadow