Tracking physical stocks, material/energy flows and the scale of economies: A case study of Canada and Spain (1995-2009) - methodology and preliminary results

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Relevant themes:

1. Post-growth economics

1.1 – Degrowth and steady-state economics

Abstract Summary

This paper will report results of an 3-year research project (2013-2016) that aims to construct a time series of biophysical and social accounts at national and sub-national levels for Canada and Spain. The focus here will be on biophysical accounts that aim to inform the following central issue in ecological economics: how do we measure national (or sub-national) economies' movement towards, or away from, a steady state economy (SSE)? The main contribution of this research will be to compile national accounts for Canada and Spain and two sub-national regions that will be suitable for cross-country comparison of physical stocks, flows and scale of economic activities over a 15-year time period (1995-2009). Significant limitations of the methodologies utilized exist and will be discussed critically. Despite limitations, this information is important because it provides an indication of whether physical degrowth is needed for these economies and if so, most importantly, how much?

Extended Abstract

How do we enhance human well-being in the 21st century without surpassing critical ecosystem limits? The importance of this challenge, and the desirability of addressing it, has been widely recognized especially over the past 5-10 years as unsettling estimations of the global scale of the environmental burden from humanity's economic activities have become increasingly refined (MA, 2005; Rockström et al., 2009; Steffen et al., 2011, Hoekstra and Wiedmann, 2014). Although few would disagree that we ought to enhance human well-being without degrading the capacity of the planet to support life, how to do so is open to both uncertainty and diverse interpretations that seemingly increase exponentially as one goes from global to local levels of environmental pressure and governance.

This paper will report results of a 3-year research project (2013-2016) that aims to construct a time series of biophysical and social accounts as broadly outlined in O'Neill (2012) at national and sub-national levels for Canada and Spain. The focus here will be on the biophysical accounts that aim to inform the following central issue in ecological economics: how do we measure national (or sub-national) economies' movement towards, or away from, a steady state economy (SSE)? An SSE is defined as an economy with constant stocks of people, built capital and livestock with material/energy flows sustaining those stocks being stabilized within the regenerative and absorptive capacity of the biosphere (Daly, 1991).

Tracking these physical stocks, material/energy flows and the scale of national economies are particularly important in terms of operationalizing the SSE concept because countries act as sovereign units in the current international governance framework. And even within most, if not all nations, jurisdiction over many resource flows and the economic policies that affect them are divided further among sub-national regions.

At the national level, a common framework is lacking for attempts to track the three key elements of a SSE – namely, physical stocks, material/energy flows and the scale of economic activity relative to ecosystem limits – in an integrated manner (O'Neill, 2012). Taking the above into account, the main contribution of this research will be to compile national accounts for Canada and Spain and two sub-national regions that will be suitable for comparisons of physical stocks, flows and scale of economic activities both within and between nations over a 15-year time period (1995-2009). This analysis is currently ongoing and results are expected in advance of the ESEE conference. The methodology is outlined briefly as follows.

For physical stocks, data on human population and livestock for the study areas have been gathered from United Nations sources. Estimating and aggregating physical stocks of built capital is the least understood variable in this project to date though insights gained from researchers tackling this issue have been identified (van der Woet et al., 2002; Weisz et al., 2006; Pauliuk and Muller, 2013 and references therein) and a strategy is being developed.

Material and energy flows sustaining national economies are now being compiled regularly by both Eurostat and Statistics Canada. This research project makes use of environmentally-extended input-output tables (EE-IOTs) compiled by the World Input-Output Database (Dietzenbacher et al., 2013) publicly available at www.wiod.org for 40 nations covering the period 1995-2011. Following standard input-output analysis methods (Miller and Blair, 2009), a two-region EE-IOT analysis based on the methodology described in Jackson et al. (2007) has been used to estimate direct and total material and energy flows in Canada and Spain that incorporate international trade based on both production and consumption perspectives (Wiedmann et al., 2013).

Finally, to link the scale of material and energy flows to ecosystem limits for both countries, three environmental pressure indicators adapted from the "Footprint-family" will be compiled within the EE-IOT described above for the 15-year period of analysis. For renewable resources, a comparison of Land Footprint within available biocapacity (in global hectares) using National Footprint Accounts (GFN, 2014) for Canada and Spain will be compiled. For environmental pressure from non-renewables, two indicators are under construction. First, a greenhouse gas (GHG) Footprint will be benchmarked to maximum sustainable units of CO2-equivalents needed to keep climate warming below 2 degrees as described in Hoekstra and Wiedmann (2014). Second, for the remaining non-renewable "Minerals Footprint", Dittrich et al. (2012) discuss a number of global sustainability targets for raw materials ranging from 4-9 tonnes per capita that have been decomposed to reflect shares of metal and minerals consumption. It is recognized that the above indicators of environmental pressure do not capture all planetary boundaries as described in Rockstrom et al. (2009) but together they provide a comprehensive picture of renewable and non-renewable resource use at national (and sub-national) levels that can be adapted relatively easily to changes in the emerging consensus on global earth-system thresholds.

The compilation of the biophysical accounts for Canada and Spain over a 15-year time period as described above is hoped to provide a step towards a practical, relatively up-to-date and integrated framework for tracking these countries' transitions towards a steady state economy. An important aspect of this research will be the ability to not only monitor but also compare changes in physical stocks, flows and scale over time, within and across countries using publicly available data sources. Significant limitations of the methodologies exist and will be discussed critically. Despite limitations, this information is important to quantify because it provides an indication of whether or not physical degrowth is needed for these economies and if so, most importantly, how much? Subsequent research in this project will use these results together with social accounts for each site as the basis to assess calls for changes in growth-based economic policy and a means to explore alternative options for living within an ecologically safe and equitable space for each community.

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