Ecological Economics 136 (2017) 266–281

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

# Optimal Versus Sustainable Degrowth Policies☆

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ARTICLE INFO

*Article history:*
Received 15 June 2016
Received in revised form 7 December 2016
Accepted 1 February 2017
Available online 8 March 2017

*JEL classification:*
O44
O49
Q57

*Keywords:*
Degrowth
Steady state economics
Pollution tax
Intergenerational equity

ABSTRACT

This paper introduces a natural resource and pollution in a Ramsey growth model which relies on the postulates of ecological economics. It studies the impact of voluntary degrowth policies on production and welfare. The instrument of these policies is a tax on the natural resource. These public policies are implemented after the downturn of the households' welfare following from the increased pollution.
Two kinds of policies are considered and rely either on an optimality criterion or on an intergenerational equity criterion. With respect to the laissez-faire case, they decrease both production and pollution but increase welfare. Classes of sustainable degrowth paths characterized by time-constant or time-increasing tax rates are determined.



## 1. Introduction

Economics of degrowth has been developing as a new research topic for some years. Unsurprisingly, most contributors belong to the school of ecological economics which is notably interested in alternatives to unsustainable growth paths. By unsustainable paths, we mean paths that violate the biophysical limits of the economy but also paths that are undesirable from a social point of view (for example because welfare decreases or because social inequalities increase).

Although relatively recent, Economics of degrowth has been the subject of numerous contributions. In a review of the literature, Kallis et al. (2012) classify the contributions in three streams of thoughts: (i) Steady-State Economics whose figurehead is Herman Daly, (ii) New Economics of Prosperity around Tim Jackson and (iii) Degrowth *à la* Serge Latouche and Joan Martinez-Alier[1].

If there are differences and even disagreements between these streams, they all consider that current economic growth is unsustainable and that another trajectory is desirable. Degrowth is then defined as the *voluntary and fair* transition from an unsustainable growth path to a stationary and sustainable state of the economy (O'Neill, 2012). Moreover, even though the transition implies a decrease in production and consumption, it simultaneously aims at increasing welfare while complying with environmental constraints in the short and long terms (Schneider et al., 2010). It is thus a chosen process and it goes without saying that no author pleads for a perpetual degrowth that would lead to generalized misery.

If there is an abundant literature in Degrowth Economics, few contributions attempt to assess the impacts of a degrowth transition quantitatively. Bilancini and D'Alessandro (2012) and Heikkinen (2015) offer theoretical assessments. Bilancini et D'Alessandro contrast "unhappy growth" with "happy degrowth" in the framework of an endogenous growth model with externalities in consumption, leisure and production. The consumption externality is negative and leads to a competition between consumers in terms of social status. The leisure externality is positive and linked to the fact that leisure contributes to social activities that act like a public good and increase welfare. The third externality is linked to the accumulation of capital which stimulates knowledge and technical progress. The authors show that a decentralized economy is suboptimal from a welfare

☆ I thank Géraldine Thiry, Jean-François Fagnart and two anonymous referees for useful comments.

[1] The interested reader will find in Kallis et al. (2012) the references to the contributions of these authors as well as many others. Another interesting survey dedicated to Degrowth is Petridis et al. (2015).

http://dx.doi.org/10.1016/j.ecolecon.2017.02.001
0921-8009/

point of view. They however identify a "happy" transition toward an optimal path where all externalities are taken in account. This transition is characterized by (i) a temporary reduction in production and consumption and (ii) an increase in welfare, the decrease in consumption being more than compensated by the increase in relational activities allowed by a more extensive leisure time. Heikkinen (2015) enriches the model by considering consumers with heterogeneous and time-varying preferences with respect to the importance of social status and voluntary simplicity. This one is defined as the deliberate choice of an agent to limit her consumption expenditures. The author shows that the weakening of status consumption increases aggregate welfare while decreasing the economy growth rate. Moreover, the voluntary simplicity adopted by a subset of consumers less sensitive to status competition has a positive impact on welfare.

Applied contributions include those of Peter Victor (see Victor, 2015 for an autobiographical note). In one of his contributions, Victor uses a macroeconomic model (called LowGrow) to assess how policies reducing GHG emissions would affect the Canadian economy, in particular growth, public spending and employment (Victor, 2012). Among the considered scenarios, the author studies a degrowth scenario where the standard of living of the Canadians is more in line with the respect of the planet's limits. Using the methodological approach of societal metabolism[2], Sorman and Giampietro (2013) analyze the implications of possible degrowth paths from an energetic point of view. The recent Ph.D. thesis of Briens (2015) is also worth being mentioned. On the basis of an input/output macroeconomic model, the author assesses different degrowth scenarios suggested by several interviews of people involved in the Degrowth movement (or interested in it) in order to obtain different detailed visions of what could be degrowth. As those of Victor (2012) and Sorman and Giampietro (2013), his results show that the degrowth required given the environmental constraints is likely to have a considerable impact on the economy and that it is barely conceivable without a deep reorganization of society.

The theoretical contributions of Bilancini and D'Alessandro (2012) and Heikkinen (2015) develop growth models that ignore environmental and resource constraints. The analysis is done in terms of balanced growth paths and the degrowth phase is actually a transition from a suboptimal to an optimal growth path. If consumption and/or production decrease during the transition, they start to increase again once it is achieved. Their approach has the merit to show that, *even* when perpetual growth is possible and there is no pollution, a degrowth transition may be desirable with respect to the outcome of a decentralized economy while ensuring welfare growth.

Now as mentioned above, the applied studies of Victor (2012), Sorman and Giampietro (2013) and Briens (2015) have shown the importance of environmental constraints when studying degrowth. But despite their indisputable interest, these studies do not develop growth models in the usual sense, i.e. models that adopt a welfare approach in a general equilibrium perspective. Furthermore natural resources are ignored[3]. Finally let us mention that most of the above mentioned contributions (either theoretical or applied) ignore sustainability issues, in particular from an intergenerational point of view.

The present paper develops a stylized theoretical model which aims at studying the impact of voluntary degrowth policies. We distinguish three types of externalities, linked respectively to the exploitation of a natural resource, to pollution and to production. In accordance with ecological economics, the model assumes that (i) substitution between natural and human factors is limited and (ii) technical progress in the use of the resource as well as in the treatment of pollution is bounded. Given that the resource is itself limited, infinite growth is impossible and the economy can at best converge to a stationary equilibrium. In the laissez-faire situation, the model generates after some time a decrease in households' welfare which echoes the *threshold hypothesis* of Max-Neef (1995): beyond a certain GDP per capita level (the threshold), welfare (or quality of life) declines with economic growth. This welfare decrease motivates the public authorities' intervention and the implementation of a degrowth policy whose instrument is a tax levied on the exploitation of the natural resource. Two kinds of policies are distinguished whether they rely on an optimality criterion (à la Ramsey) or on an intergenerational equity criterion (à la Brundtland).

The model is voluntarily parsimonious and relies on strong assumptions, in particular w.r.t. the environment. The natural resource as well as the pollution are modeled as flows rather than stocks. Thus phenomena like pollution accumulation (such as the one of greenhouse gazes) or of resource over-exploitation are ignored. If the resource and/or the pollution were modeled as stocks, then the variety of possible paths of the economy would be much larger[4]. Another important simplification is that all man made inputs are bundled in one aggregate factor named capital. Therefore labour is not explicitly distinguished. Despite these shortcuts and thanks to its postulates in accordance with ecological economics, the model is however able to generate a non monotonous behavior of welfare in a laissez-faire context, which motivates the implementation of a degrowth policy. A further advantage of the model's simplicity is to make it tractable so that most results are derived analytically.

The structure of the paper is as follows. Section 2 presents the equations of the model. We consider two institutional organizations of the economy depending on whether it is decentralized or centrally planned. The stationary equilibria of the economy are determined in Section 3. The dynamic paths (including the transitional phase) are computed in Section 4. Section 5 studies the impacts of voluntary optimal degrowth policies. The role of technical progress is also considered. Section 6 characterizes voluntary sustainable degrowth paths satisfying an intergenerational equity criterion. In Section 7 we consider two other kinds of externalities and discuss their possible impact on the determination on sustainable degrowth paths. The conclusion summarizes the principal results.

## 2. The Model

The economy enjoys an exogenous constant flow $R$ of a renewable natural resource. There is a continuum of identical price-taking producers defined on the interval $[0, N]$. They use physical capital and the natural resource (NR) to produce final goods.

To produce $y_t$ units of final output in time $t$, the representative firm needs a quantity $x_t = \mu_t y_t$ of NR. $\mu_t$ measures the quantity of NR per unit of final good and is assumed exogenous and bounded from below by a strictly positive value $\mu$:

$$\mu_t \geq \mu > 0, \ \forall t. \tag{1}$$

It is thus never possible to produce a unit of final good with an infinitesimal quantity of NR, even if $\mu_t$ may be decreasing through time.

[2] For an introduction to this literature, see Fischer-Kowalski and Haberl (2015).
[3] Sorman and Giampietro (2013) is an exception in this respect.
[4] For example a non monotonous behavior and even a collapse of production and consumption would be possible in a laissez-faire framework (see for example Germain, 2012).