ANALYSIS

Measuring sustainable development: Some empirical evidence for France from eight alternative indicators

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ABSTRACT

This paper presents results from a time-series analysis of eight measures of development and/or sustainability for France. The measures chosen are green national net product, Genuine Savings, ecological footprint, Indicator of Sustainable Economic Welfare, Genuine Progress Indicator, Pollution-sensitive Human Development Indicator, Sustainable Human Development Indicator and French Dashboard on Sustainable Development. A theoretical description of each index highlights their advantages and drawbacks, underlining the fact that no indicator is perfect and no one can give an exhaustive view of sustainable development. Therefore, the analysis of various indicators is necessary to evaluate sustainable development with accuracy. Empirical results of measures of well-being show that French development was improving between 1990 and 2000. Concerning sustainability, indicators support different conclusions. It seems that French development was weakly sustainable but unsustainable in the strong sense over the period examined.

1. Introduction

In 1992, the United Nations Conference on Environment and Development in Rio de Janeiro underlined the limitations of gross domestic product (GDP) as a measure of sustainable development for a country. Indeed, “common indicators such as gross domestic product and measures of different resources or pollution flows do not assess the sustainability of economic systems” (paragraph 40.4 of Agenda 21). This article also points out that “sustainable development indicators must be constructed in order to form a useful basis for decision making”. Therefore, since the beginning of 1990, measures aiming at completing the GDP and limiting its supremacy have been built. This paper lies within the framework of development of indicators of sustainable development. In fact, whereas alternative and competitive measures have been created, none of them is perfect: each index is based on a specific definition and so takes into account only some aspects of sustainable...
development. Therefore, it is important to begin with a
definition of sustainable development. In this paper, I used the
widespread definition of the Brundtland Report (Our common
Future, 1987): “sustainable development is development that
meets the needs of the present without compromising the
ability of future generations to meet their own needs. It aims at
assuring the on-going productivity of exploitable natural
resources and conserving all species of fauna and flora”. In my
view, two key ideas are expressed in this definition: i) concern
for the well-being of future generations and ii) recognition of the
bi-directional impacts between economic activity and the state
of the environment and natural resources. In this context,
sustainable development takes into account human develop-
ment (in terms of welfare) and sustainability of such develop-
ment (in terms of condition on the stock of capital). Within this
broad definition, two main approaches can be described: weak
sustainability and strong sustainability. Although these two
views define development as a non-declining level of well-being
for future people, the requirement for sustainability is different.
Weak sustainability only requires a non-declining combined
stock of all capital. It is then possible to substitute between
human, man-made and environmental capital. In this
approach, natural capital is not different from other resources.
The aim is to keep the stock of total capital constant or
increasing, whatever the combinations of the three types of
capital are. On the contrary, strong sustainability gives an
essential position to natural capital. It is a different form of
capital without which human life cannot exist. Strong sustain-
bility requires the maintenance of environmental functions
and critical natural capital needed for the life of ecosystems.
Therefore, models of strong sustainability incorporate real
world constraints on the possibility of substitution between
man-made, human and environmental capital. Contrary to
weak sustainability that focuses on maintaining a combined
stock of capital intact, strong sustainability deals with specific
environmental functions that ought not to be undermined by
economic activity and possible ecological limits to growth.

In this context, an indicator of sustainable development must
assess human development (i.e. is welfare non-declining?) and
sustainability (i.e. is the stock of total capital (weak sustainability
approach) or natural capital (strong sustainability view) intact?).
However, no single measure does a perfect job at reflecting
sustainable development per se. Therefore, it is necessary to look
at different indicators of development and sustainability to give
a better valuation of the sustainable development of a country.
This paper presents results from time-series analysis of eight
measures for France. Whereas the green national net product,
the Genuine Savings and the ecological footprint are indicators
of sustainability, The Indicator of Sustainable Economic Welfare,
the Genuine Progress Indicator and the two “green” Human
Development Indicators measure national welfare. The French
Dashboard on sustainable development is an imperfect assess-
ment of both concepts of sustainable development (i.e. well-
being and sustainability). This paper adopts the same methodol-
y as the one used by Hanley et al. (1999).1 These authors

date seven alternative indicators for Scotland. Whereas the
measures are supposed to assess the same phenomena, their
results lead to opposing views of the national sustainability.
The main aim of my paper is to draw a parallel between the
eight measures to determine whether the indexes show a trend
towards sustainable development. In other words, what are the
results concerning the sustainable development of France
emerging from the connection between the eight indicators? To
sum up, this article attempts to highlight that the study of
results concerns the sustainable development of a country and policies based on the conclusion
of only one indicator should not be implemented because the
empirical results could be misleading.

The remainder of this paper is divided into four sections.
Section 2 deals with indicators of sustainability and Section 3
with measures of welfare. Section 4 presents the French
Dashboard on sustainable development, an assessment of
sustainable development per se. Sections 2, 3 and 4 have the
same structure. Firstly, they give a description of each kind of
indicator by focusing on the theoretical basis and practical
problems. Then, empirical results for France are presented.
Finally, Section 5 concludes by confronting opposite trends
and presenting missing indicators and research prospects.

2. Measures of sustainability

2.1. Green national net product

2.1.1. Theoretical description

Gross national product (GNP) is the traditional measure of
economic performance and is implicitly used to assess
national development and welfare. GNP measures the value
of goods and services produced by domestically owned factors
of production. This indicator takes into account human capital
imperfectly but does not integrate natural capital. The first
step to compute green national net product (gNNP) is to work
out national net product (NNP) by subtracting depreciation of
physical capital from GNP. Then, many adjustments are
necessary to obtain gNNP. These modifications are derived
from a neoclassical model of growth with a constant rate of
discount and are linked to specific environmental variables
(exhaustible resources, renewable natural resources, pollution
flows, discoveries) (see Hamilton, 1994 and Hanley, 2000 for a
review of the different optimal adjustments). Note that there
is not a consensus among economists concerning the reasons
for those modifications and on the techniques used to
compute them.

Another point of disagreement is the interpretation of
gNNP. According to some authors (e.g. Solow, 1993; Hartwick,
1990), gNNP is a measure of the Hicksian income, i.e. it
represents the maximum amount of possible consumption
during a period that does not reduce the possibilities of future
consumption. In this context, if gNNP is rising and superior or
equal to current consumption, the studied country will be
sustainable. Note that an increase of gNNP means that the
maximum level of sustainable consumption is improving
(Hanley, 2000). On the contrary, a falling gNNP is a sign of
unsustainability in the sense that the maximum amount that
can be consumed without undermining productive capacity is

1 Note that only five indicators are identical between Hanley’s
paper and mine (green GNP, genuine savings, ISEW, GPI and
ecological footprint). The three other measures studied are two
green HDI and the French Dashboard on sustainable development.
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