



Analysis

Natural capital, subjective well-being, and the new welfare economics of sustainability: Some evidence from cross-country regressions

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ABSTRACT

The measurement of natural capital and its management during the economic development process are important aspects of the capital approach to sustainable development. However, the assessment of social welfare in terms of genuine savings (or changes in total wealth per capita) is arguably too limited. This paper tries to make a case for the incorporation of subjective well-being measures in debates about sustainable development by exploring the macro-level relationship between subjective well-being and natural capital in a cross-country setting. It is tested whether natural capital per capita is correlated with subjective well-being in a sample of fifty-eight developed and developing countries, using natural capital data from the World Bank's Millennium Capital Assessment. Bivariate regressions indicate that it is. When multiple regression models are estimated that include (a) major country-level determinants of subjective well-being (GNI per capita, social capital, income distribution, unemployment, inflation), and (b) regional dummy variables for ex-Soviet Union and Latin American countries, the positive correlation remains. The role of data outliers is carefully explored, and the sensitivity of the results to the use of alternative subjective well-being measures (i.e. life satisfaction, happiness, and a combined life satisfaction and happiness index) is investigated. This does not change the nature of the results. The findings arguably strengthen the case for a 'new welfare economics of sustainability' that takes subjective well-being measures into account.

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1. Introduction

The capital approach to sustainable development aims to measure the comprehensive wealth of nations in order to make sure that future generations will at least have the same total wealth per capita available to them as the current generation (see, for example, World Bank, 2006; Ruta and Hamilton, 2007; Strange and Bayley, 2008; UN, 2008). In that context, total wealth per capita and changes in its value have been interpreted as measuring social welfare. This paper takes the view that these social welfare measures are still too limited, and tries to strengthen the case for the incorporation of subjective well-being measures in debates about sustainable development.

Engelbrecht (2008) has explored bivariate macro-level wealth-happiness relationships across countries, focussing on total wealth and its three major sub-categories (i.e. natural, produced, and intangible capital) as measured in the Millennium Capital Assessment (World Bank, 2006). It was found that total wealth per capita is strongly correlated with Gross National Income (GNI) per capita. This is due mostly to produced capital per capita and intangible capital per capita, but not to natural capital per capita (NatCpc). In contrast, NatCpc is highly correlated with subjective well-being, especially in

samples of higher income countries that exclude the most natural capital intensive countries as outliers. On that basis it was argued that discussions of sustainable development and social welfare should incorporate subjective well-being measures. Showing the importance of natural capital for the subjective well-being of the current generation should make it easier for politicians to support policies aimed at preserving, if not enhancing, natural capital, thereby also benefiting future generations.

The current paper explores whether the bivariate macro-level relationship between subjective well-being and NatCpc is robust to the inclusion of major macro-level determinants of subjective well-being established in the literature (i.e. GNI per capita, social capital, income distribution, unemployment and inflation), as well as to the inclusion of dummy variables capturing major regional effects. The regression estimates reported in this paper suggest that it is, especially when the issue of data outliers is carefully addressed. Moreover, use of alternative subjective well-being variables instead of the preferred one (i.e. life satisfaction) does not change the nature of the results. The findings arguably strengthen the case for a 'new welfare economics of sustainability', to use Gowdy's (2005) term, that takes subjective well-being measures into account.

However, it should be noted at the outset that the aim of this paper is not to develop a comprehensive model of the causal relationships between subjective well-being and its major determinants, with NatCpc

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being one of them, although it will hopefully stimulate research on such a model. There might well be reverse causation, at least to a certain extent, between the 'dependent' and some of the 'explanatory' variables, as well as amongst the latter. Such effects can only be taken into account when additional data in the time dimension become available. Moreover, the paper does not comment on how to improve the still imperfect measurement of natural capital, how to maintain or increase natural capital, or to what extent there is substitutability between natural capital and other inputs in the production process (the issue of strong versus weak sustainability; see, for example, Ekins et al., 2003; Comolli, 2006).

The paper is organized as follows. Section 2 briefly introduces the vexed issue of how to define sustainable development, and reviews some prior literature that focuses on the link between subjective well-being and environmental variables. The general methodology is introduced in Section 3. Section 4 reports the definition of variables and data sources. Bivariate and multiple regression results are reported in Section 5. Section 6 contains concluding comments. Appendix A reports summary statistics and lists the countries included in the data sample. The main data set used is available from the working paper version of this paper (<http://econ.massey.ac.nz/publications/discuss/DP0903.pdf>).

2. Natural capital, sustainable development, social welfare and life satisfaction

Natural capital is an important concept in the sustainable development literature and a key concept in environmental economics (Ekins et al., 2003; Barbier and Heal, 2006; Brand, 2009). Numerous papers have been written about its measurement, its role in the development process and its relationship to social welfare.¹ However, how social welfare should be measured is itself contested. In contrast to the World Bank (2006), some ecological economists have argued that the debate about sustainability has to go beyond the framework of traditional welfare economics and the capital approach to sustainability, which are focussed on Pareto efficiency, and sustainable consumption as a measure of social welfare (see, for example, Gowdy, 2005; Azqueta and Sotelsek, 2007). While, undoubtedly, the capital-based approach to sustainability is an improvement over income-based measures of sustainable development (see Mäler, 2007), it is arguably still too limited.

The limitations of the capital approach have become clearer in recent discussions of genuine savings (a measure of the change in total wealth per capita). World Bank (2006) interprets it as an indicator of sustainability of a country's development path. However, Pillarissetti (2005) provides a rather critical appraisal of the genuine savings concept and argues that policy implications based on it are erroneous. He prefers to focus on natural capital without mixing it up with other forms of capital (such as physical and human capital). Also, Gnègnè (2009) tests whether genuine savings (and, by extension, change in total wealth per capita) can explain changes in welfare (measured by the infant mortality rate and the Human Development Index [HDI]). The author confirms such a link, but finds it to be weak.

To be fair, it has been acknowledged by proponents of the capital approach to sustainable development that genuine savings and changes in total wealth per capita are "ideal measures of the potential for future well-being under certain conditions" (UN, 2008, p. 55). They assume, for example, that substitution possibilities among different forms of capital are high and that capital stocks can be measured in monetary terms. This is, however, not the case for 'critical' natural capital, or critical amounts of other forms of capital (ibid, pp. 6 and 54–58).² It should also be noted

that World Bank (2006) reports that for high income countries they cannot find an empirical relationship between genuine savings and future well-being. In short, for theoretical and empirical reasons the usefulness of genuine savings and change in total wealth per capita as indicators of changes in social welfare seem mixed at best.

Furthermore, a central theme of UN (2008) is "that the concept of well-being has much potential for measuring sustainable development if it is broadened beyond its traditional scope in economics ... Consumption ... must include the enjoyment of any good or service that contributes to well-being, including things freely provided by nature like forest products and beautiful sunsets" (ibid., 2008, p. 2/3). This, arguably, supports the approach taken in this paper of estimating subjective well-being equations that include NatCpc.³

Focussing on natural capital's impact on subjective well-being does not imply that measurement of this type of capital is assumed to be easy or uncontroversial. Its measurement in the Millennium Capital Assessment exercise relies on many assumptions, i.e. its components are measured with varying degrees of accuracy, and some important elements that ideally should be included are not.⁴ It is expected that measurement of natural capital will improve further over time, but progress will not be easy (see, for example, Barbier and Heal, 2006; Azqueta and Sotelsek, 2007; Mäler et al., 2009, on the issue of trying to account for ecosystems).

This is not the first paper to analyse the relationship between measures of subjective well-being and natural capital or other indicators of the quantity and quality of the natural environment. In recent years, there has been an increase in the number of studies, mostly by economists, that use what can be called a "life satisfaction approach to environmental welfare analysis"⁵. They all find that there is a significant correlation between the two types of variables.⁶

Welsch (2002) is probably the first to examine how subjective well-being (i.e. 'happiness') varies with material prosperity and environmental conditions across countries. Using macro-level data, he calculates the subjective monetary value of changes in pollution, focussing mostly on the pollutant nitrogen dioxide. Welsch (2007) extends the welfare analysis of his earlier study.

Brown and Kasser (2005) provide micro-level evidence from samples of U.S. adolescents and adults that subjective well-being and 'ecologically responsible behaviour' (like turning off the lights, re-using paper and plastic bags) are positively correlated due to psychological factors like intrinsic values and mindfulness. This suggests that a sustainable way of life might not require a happiness sacrifice. Instead, it might enhance both personal and collective well-being.

Ferrer-i-Carbonell and Gowdy (2007) use micro-level data from the British Household Panel Survey and find robust correlations between individuals' subjective well-being (i.e. 'life satisfaction') and their environmental awareness about ozone depletion and biodiversity loss.

³ However, this is *not* the conclusion drawn by UN (2008). Subjective well-being measures are nowhere mentioned in the report. Instead, it focuses on supplementing indices derived from the capital approach to sustainable development with physical indicators of critical natural capital and of other forms of critical capital.

⁴ One of the referees argued that one cannot a priori rule out that the findings reported in this paper are just an artefact of the imperfect natural capital data being used, and their strong positive correlation with other forms of capital. We have two, albeit not fully satisfactory, responses to that comment. First, the analysis in Engelbrecht (2008), which also includes other forms of capital, would seem to contradict the latter possibility. Secondly, the Millennium Capital Assessment estimates of natural capital are the best macro-level natural capital data currently available for a large group of countries. In our view, it is better to work with imperfect data than not to undertake the analysis at all.

⁵ An alternative approach to using 'standard' subjective well-being measures and exploring their relationship with environmental variables is to modify the subjective well-being measures so that they reflect the state of the environment. See, for example, Marks et al. (2006) and Ng (2008).

⁶ Also see Welsch's (2009) survey of the implications of happiness research for environmental economics, which, however, does not focus on aggregate natural capital.

¹ For an up-to-date survey, see Dasgupta (2009).

² Other reasons why genuine savings and wealth per capita may be imperfect measures of social welfare include imperfect markets, complexity and ethical concerns (see the discussion in UN, 2008, chapter 3).

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