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A COMPARISON OF SUSTAINABILITY INDICES ASSOCIATED WITH THE CAPITAL APPROACH TO DEVELOPMENT, NON-MONETARY SUSTAINABILITY INDICES, AND LIFE SATISFACTION: MIXED MESSAGES FROM OECD COUNTRIES

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A Comparison of Sustainability Indices Associated with the Capital Approach to Development, Non-Monetary Sustainability Indices, and Life Satisfaction: Mixed Messages from OECD Countries

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ABSTRACT

The paper contributes to the debate about the nexus between comprehensive or total wealth, sustainability, social welfare and subjective well-being (SWB). With the publication of comparable total wealth data for more than one year it has become possible to have a closer look at the controversial concept of 'change in total wealth per capita', which is arguably the preferred measure of economic sustainability and social welfare associated with the capital approach to development. The analysis is conducted for a group of over twenty OECD countries. After documenting changes in GDP per capita and wealth per capita over 1995-2005, the paper explores how closely a number of monetary sustainability indices associated with the capital approach are correlated with each other, i.e. whether they provide consistent messages. While some are highly correlated across countries, this is not the case for the conceptually preferred measure, and all indices sometimes provide inconsistent messages for particular countries. We further analyse how the monetary indices are correlated with a number of composite non-monetary sustainability indices and with average life satisfaction, our proxy for SWB. Life satisfaction is interpreted as a societal well-being measure that incorporates not only outcome utility, as in conventional welfare economics, but also procedural utility. Apart from providing empirical evidence on the degree of correlation between the twelve sustainability indices included in the analysis, the paper raises a number of important conceptual and measurement issues which should be addressed further in the debate about how to measure sustainability and achieve sustainable development.

Keywords: Total wealth, natural capital, intangible capital, sustainability indices, life satisfaction, correlation.

JEL: D60, O47, Q01, Q56

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1. INTRODUCTION

There is growing recognition of the nexus between comprehensive or Total Wealth (TW), sustainability, social welfare and subjective well-being (SWB). World Bank (2006) reports TW measures for the year 2000 as part of its advocacy of the capital approach to development, which sees development as a process of using the proceeds derived from natural capital (NC) to build up other forms of capital. They also advocate use of sustainability indices inspired by the capital approach, for example Adjusted Net Savings (ANS), a measure that is widely reported for many countries. They further argue that 'change in TW per capita' (TWpc) is an appropriate measure of economic sustainability and social welfare.[1] In fact, the principal reason for the development of macro-level wealth accounts seems to be a concern for the future:

> "...measuring changes in wealth permits us to measure the *sustainability* of development ... measuring changes in real, comprehensive wealth provides an indication to governments of whether policy, broadly conceived, is producing increases in both current and future well-being – what economists would term "social welfare"... It certainly could be argued that the fundamental duty of government is to ensure that its policies lead to increases in social welfare."
>
> (World Bank, 2011, p. 3/4, italics in the original)

With the publication of comparable wealth data for more than one year in World Bank (2011) it has become possible to have a closer look at 'change in TWpc'. We argue that it is a controversial concept, involving important unresolved conceptual issues and difficult measurement issues. Furthermore, World Bank (2011) reports major sub-categories of TW, making it possible to calculate 'change in NC per capita' (ΔNCpc) as a different, i.e. environmental, sustainability measure.

It is widely recognised that sustainability is an elusive, essentially vague and controversial concept and that an abundance of definitions exist (Solow, 2002, Stiglitz et al., 2009, Moldan et al., 2012, White, 2013). The diversity of indicators only highlights the diversity of views about what sustainability means, and what should, therefore, be measured. Gasparators et al. (2009) argue that adopting many diverse indices is the key for a more holistic and robust sustainability assessment, i.e. they are in favour of methodological pluralism. Earlier, Hezri and Dovers (2006) expressed a relatively positive view about the potential policy use of sustainability indicators. By contrast, Böhringer and Jochem (2007) come to the pessimistic conclusion that all of the indices they analyse are inherently inconsistent and useless, if not misleading, for policy advice.

We do not attempt to resolve this debate. Rather, we confine our analysis to the more modest task of comparing and critically assessing five sustainability indices derived from the capital approach to development, and some other composite sustainability indices that try to measure societal well-being and/or the state of the environment more directly. Splitting the

[1] See World Bank (2011), Note 1, p. 24, for references to papers that establish the theoretical link between changes in TW and changes in social welfare.

sustainability indices into these two groups makes sense because the capital approach reflects a particular value system and perspective. It should be of interest to explore how different indices based on the same approach compare, i.e. whether they convey consistent messages. The other indices represent a range of very different value systems and perspectives.

Turning to SWB, it has been found to be correlated with TW and also with, especially, NC and intangible capital (IC) (Vemuri and Costanza, 2006, Engelbrecht, 2009, 2012). SWB has also been used by, for example, Welsch (2002, 2007) as a measure of utility in the context of environmental economic analysis. Diener et al. (2009, Chapter 9) highlight many other applications of SWB measures to environmental policy issues.

We interpret SWB and TWpc as alternative, and very different, types of societal well-being measures. TWpc is still an orthodox economic social welfare measure. Its use in the context of the sustainability debate has been questioned (see, for example, Gowdy, 2005). By contrast, SWB measures are based on mental-state accounts (Dolan and White, 2007). With the rise of 'happiness' or SWB research, they have gained importance in recent decades, to the extent that many governments now regard them as at least complementary well-being measures. Moreover, SWB is used as a component in some prominent composite non-monetary sustainability indices, for example in the Happy Planet Index (Murphy, 2009), and findings from SWB research are now discussed in natural resource and environmental as well as ecological economics textbooks in the context of trying to develop an alternative to conventional welfare economics (see Daly and Farley, 2011, Perman et al., 2011). We include average SWB, proxied by average life satisfaction (LSF), as an additional societal well-being index in our analysis. It accounts for SWB impacts across all life domains (work, family, leisure, etc.), thereby being a much more comprehensive societal well-being indicator than orthodox economic welfare measures based only on 'outcome utility' from consumption. LSF takes into account not only outcome utility, but also LSF impacts of conditions and processes that lead to outcomes, i.e. 'procedural utility' (Frey et al., 2004, Frey and Stutzer, 2005), as well as social comparison and adaption effects (Welsch, 2009, Welsch and Kühling, 2011).

We argue that incorporation of both outcome and procedural utility is important when trying to measure societal well-being. It means that LSF effects of both 'means and ends' are implicitly included. By contrast, it is debatable whether social comparison effects should be included in LSF in the context of sustainability. However, they are likely to be much less important at the macro-level of analysis used in this paper, compared to micro-level analysis. Nevertheless, to us such effects indicate that values are a separate issue that is not comprehensively captured and dealt with by our SWB measure (neither is it in conventional welfare economics). In short, while we regard LSF as an improvement over mainstream economic welfare measures, it is not perfect and future research should refine its use in the context of sustainability. This is one of the reasons why we do not argue that LSF should be maximised to the neglect of all other objectives. Instead, we share the view expressed by Diener et al. (2009), Hirata (2011) and others that SWB is an important *additional* indicator to be taken into account in policy-making.

The paper is organised as follows. Section 2 first discusses the wealth data and country coverage. We then compare annual growth rates of TWpc, its major subcomponents, and Gross Domestic Product per capita (GDPpc), and also comment on changes in the composition of TWpc. Section 3 first introduces the LSF data and the twelve sustainability indices employed in this study, and then analyses how closely they are correlated with each other. Both Sections 2 and 3 also highlight a number of important measurement and conceptual issues. Section 4 provides concluding comments.

2. TOTAL WEALTH PER CAPITA VERSUS GDP PER CAPITA

2.1. Data Sources and Some Conceptual Issues

<u>Wealth Data</u>[2]

Total Wealth per capita (TWpc)

Economic theory suggests that TW can be estimated as the present value of sustainable future consumption (Hamilton and Hartwick, 2005). World Bank (2006, 2011) adopt this approach and implement it empirically for a large number of countries. In order to obtain estimates of TW, the initial level of consumption, which is calculated as a five year average, has to reflect sustainability, defined as consumption that leaves the total capital (i.e. wealth) stock intact. In cases where savings adjusted for depletion of natural and physical capital are negative, this amount is subtracted from the consumption level. Many assumptions have to be made to derive TW which involve questions of judgement. For example, estimation of the discount rate requires values for the pure rate of time preference (set to 1.5%) and elasticity of the marginal utility of consumption (set to 1). Also, wealth accounting is done on a generational basis, i.e. a maximum lifetime for all assets is set at 25 years. These choices can be criticized. World Bank (2011) assesses how reasonable they are by calculating the implicit rate of return on wealth for each country. They find 80 percent of these rates of return lie between 4 and 6 percent, which is judged acceptable.

An alternative, and some would argue preferable, way to derive TW estimates is to estimate all capital stocks separately and then add them up using shadow prices (Dasgupta, 2009, Arrow et al., 2012). This circumvents the need to have a good forecast of future consumption, which according to Arrow et al. (2012, p. 329) "amounts to assuming that we know how sustainable the economy is, when that is what we are trying to determine". However, using the alternative approach is currently impossible for most countries.[3] Cairns (2011, 2012)

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[2] For a more detailed explanation of the methodology used to build the wealth estimates, see World Bank (2011, Appendix A).

[3] Arrow et al.'s (2012) alternative methodology arguably improves on that used in World Bank (2006, 2011) in many ways. They introduce a number of innovations when estimating capital stocks. They also include an additional form of capital, i.e. health capital, which turns out to be far larger that other forms of capital, and they allow total factor productivity to differ between countries. However, they only apply their methodology to five countries, using mostly period-average data from 1995-2000, i.e. for one point in time. They admit that many significant theoretical and empirical challenges remain.

criticises both approaches and advocates the use of a maximin criterion instead. This requires accounting prices that cannot be calculated. In short, Cairns does not currently provide an empirical alternative. However, he does provide a useful reminder that all current sustainability indices apply to temporary, often short, periods of time, and not to the very long-run. Smulders (2012), commenting on Arrow et al. (2012), expresses a similar view.

An issue neglected when determining sustainable consumption is whether consumers could have spent their money more wisely. Frank (1999) has emphasised the negative effects on human well-being of conspicuous consumption and spending on goods we easily adapt to. He argues that more wealth would be good, if only we spend it in better ways. Common (2007) also notes that TW does not take into account consumption externalities. Evidence is accumulating that alternative ways of consuming might well lead to higher levels of human well-being (Welsch and Kühling, 2011, Dun et al., 2011), but this issue is not properly addressed in the World Bank's estimates, nor is it by Arrow et al. (2012). Neither are intratemporal equity issues. Arrow et al. (2004, 2007) have acknowledged some of these problems, while also arguing that some of the criticisms are incorrect. The debate continues.

Natural Capital per capita (NCpc)

NCpc includes agricultural land, protected areas, forests, minerals, and energy. Only those natural resources are included for which price and quantity data were available for many, if not all, countries. Numerous assumptions and approximations have been used in their derivation. We just mention a few: Stock values of metals and minerals include only reserves that, at the time of measurement, could be economically extracted or produced, i.e. technological progress that might result in an increase in the stock of subsoil assets is excluded. The value of energy, metals and minerals is calculated at the present discounted value of (estimated) rent over the exhaustion time. The latter is set at 25 years for all countries. Also, a zero growth rate of rents is assumed.

Some other important forms of NC, like ecosystems services, are only partially or indirectly included. World Bank (2011) points out that one group of excluded ecosystem services, of potentially great economic significance in high-income countries, are the aesthetic services provided by natural landscapes. Therefore, the share of NC in TW is likely to be underestimated in our sample of countries. Moreover, it is acknowledged (ibid., p. 23) that "public goods, such as carbon storage and biodiversity, pose special challenges and are not well represented in the wealth accounts". Some resources are completely left out due to lack of data (water, diamond and fishery resources). They are implicitly and erroneously included in the residual measure of intangible capital.

Produced Capital per capita (PCpc)

The estimates for PCpc include the value of machines, structures, equipment and urban land. Apart from urban land, they are estimated using the perpetual inventory method. The service life of capital is set at 20 years, with a 5% depreciation rate. Urban land is simply measured as 24% of the stock of machines, structures and equipment. World Bank (2011) admits this is most likely an underestimation, but lack of data prevented estimation of country-specific proportions.

Intangible Capital per capita (ICpc)

ICpc is measured as a residual by subtracting NCpc and PCpc from the estimate for TWpc. In all countries, but especially in high-income countries, IC accounts for the vast majority of TW, and its proper allocation is therefore crucial to economic performance. ICpc is assumed to capture 'raw labour', human capital, social capital, institutional capital ('quality of institutions') and similar forms of capital, as well as technical progress and items that should have been included in NCpc and PCpc. We are tempted to borrow a phrase from Abramovitz (1956) and call ICpc the "measure of our ignorance" of the true sources of wealth in today's knowledge-based economies (KBEs). The definition of ICpc used in TW accounting is much broader than that adopted in the literature on business investment. Corrado et al. (2005), for example, define business intangibles to include only the three broad categories of computerized information, innovative property and economic competencies. This classification has been adopted by others (Hill, 2009, Andrews and de Serres, 2012).

World Bank (2011, Chapter 5) has conducted further analysis in order to assess how reasonable the ICpc estimates are. They regress ICpc on human capital adjusted for health differences, institutional quality (proxied by a rule of law index), as well as on a number of dummy variables (time, country, income level). They find human capital to be the main form of IC in rich countries, and the only statistically significant production factor in high-income OECD countries.

It should also be noted that 'net foreign financial assets' are treated in most of World Bank (2011) as part of ICpc. However, in the empirical accounts they are netted out and listed as a separate category. The ICpc data used in this paper exclude them. Net foreign assets are total assets minus liabilities. The former are the sum of foreign direct investment, portfolio equity assets, debt assets, derivative assets and foreign exchange reserves. The latter are the sum of FDI liabilities, portfolio equity liabilities, debt liabilities and derivates liabilities (ibid., p. 150).

<u>Country Coverage</u>

Because comparable wealth data are only available for 1995, 2000, and 2005, we exclude countries that joined the OECD after 2005 (Chile, Estonia, Israel and Slovenia) and those for which no wealth data are reported in 1995 (Poland, Turkey, Czech Republic and the Slovak Republic). This reduces the sample to the 26 countries shown in Appendix Table I. They account for 85.6% (78.8%) of TW in 1995 (2005) of the over 120 countries included in World Bank (2011).

An advantage of restricting the analysis to OECD countries is their relative homogeneity. Institutional and other factors are likely to be much more similar compared to larger samples of countries. For example, Fleche et al. (2012) have analysed the determinants of LSF in 32 OECD countries over the period 1994-2008. They report that they do not vary a lot between these countries. In line with earlier studies, they find income, health status (especially mental health), unemployment and social relationships to be important. They further argue that cultural differences are not major drivers of differences in LSF.

Another reason for focusing on OECD countries is that NC is likely to play a different role in their development compared to poorer countries. This is simply due to the fact that, for most OECD countries, NC makes up a very small proportion of TW, i.e. transforming natural capital into other forms of capital is relatively less important. Furthermore, many *high-income non*-OECD countries, including natural resource intensive countries, tend to have very different patterns of development compared to OECD countries and warrant separate analysis. For example, Bahrain, Kuwait, Oman, Saudi Arabia, United Arab Emirates, Brunei Darussalam exhibit declines in TWpc from 1995 to 2005, whereas all OECD countries in our sample exhibit increases. Last but not least, there are no or insufficient SWB data for many high-income non-OECD countries.

2.2 GDPpc Growth versus TWpc Growth, and the Changing Composition of TWpc

Average annual growth rates of GDPpc and TWpc are shown in Appendix Table I (data for GDPpc in 1995 and 2005 based on purchasing power parity (PPP) in constant 2005 international $ are taken from the World Development Indicators database). They are highly correlated (see Table 1). In 19 countries the growth rate of GDPpc is higher than that of TWpc. The greatest different is in Norway. No country experienced negative growth in either GDPpc or TWpc over the decade.[4]

Table 1: Correlations - Growth rates of GDPpc and wealth variables, 1995-2005

GDPpc	1				
TWpc	**0.88[a]**	1			
NCpc	-0.21	-0.22	1		
PCpc	**0.71[a]**	**0.65[a]**	-0.16	1	
ICpc	**0.70[a]**	**0.88[a]**	-0.31	**0.35[c]**	1
	GDPpc	**TWpc**	**NCpc**	**PCpc**	**IPpc**

Notes: a = statistically significant at the 1% level (two-sided test);
c = statistically significant at the 10% level (two-sided test).

Trying to interpret differences in growth rates of GDPpc and TWpc is not straightforward. It might be tempting to argue that countries where TWpc has grown more than GDPpc have been, in some sense, less efficient in producing a return on their wealth. However, if, as suggested in World Bank (2006, 2011), TWpc and not GDPpc is the more appropriate measure of social welfare, growth of the former is the important variable to focus on, not growth of GDPpc. Similarly, it was recognised long ago that any attempt to derive a

[4] GDPpc and TWpc data in levels show that over the decade, rankings change for some countries but not for others. NZ ranks 21st in terms of GDPpc and 20th in terms of TWpc (in both 1995 and 2005). Australia and Canada rank appreciably higher in terms of GDPpc than TWpc. For France, Iceland, Sweden and the UK, the opposite holds.

productivity measure from the relationship between GDPpc and TWpc or their growth rates raises difficult issues, the resolution of which will be influenced by one's view of the nature of the economy. For example, Boulding (1966, p. 9/10) observed that, in the context of an economy where resources are limited (his 'spaceman economy'):

> "… throughput is by no means a desideratum, and is indeed to be regarded as something to be minimized rather than maximized. The essential measure of success of the economy is not production and consumption at all, but the nature, extent, quality, and complexity of the total capital stock, including in this the state of the human bodies and minds included in the system. In the spaceman economy, what we are primarily concerned with is stock maintenance, and any technological change which results in the maintenance of a given total stock with a lessened throughput (that is, less production and consumption) is clearly a gain."

In short, for Boulding it is the stock of TW, not flows that matter. In a spaceman economy it seems desirable to reduce the GDPpc/TWpc ratio, not to maximise it. It is somewhat ironic that the ideas of Boulding, one of the founders of general systems theory, ecological and evolutionary economics, have at least in part become a cornerstone of the World Bank's capital approach to development. Note, however, that the quote from Boulding seems to preclude measuring TW as the net present value of future consumption.

Looking at wealth subcategories, it is apparent that the growth rate of TWpc is highly correlated with that of ICpc (see Appendix Table I and Table 1). This seems to support the view of OECD economies as KBEs where IC is more important than PC and NC. However, there are exceptions to this cross-country finding. In some countries (Denmark, Ireland, Luxembourg and Spain), the growth rate of PCpc is higher than that of TWpc and ICpc. Moreover, Norway's estimate for ICpc is slightly smaller in 2005 compared to 1995. Switzerland is the only country to experience a decline in PCpc.

Next, turning to NCpc, its growth rates are the most diverse and they seem different in nature from those for PCpc and ICpc. Even in our group of OECD countries, NCpc has declined on average, and more often then not (17 countries had negative growth rates). The correlation coefficients between NCpc and the other variables shown in Table 1 are all negative, but they are not statistically significant.

Differences in growth rates of TWpc and NCpc hint at the issue of weak versus strong sustainability, which is about the degree of substitutability of other forms of capital for NC (Neumayer, 2010), although this is usually expressed in terms of absolute, not per capita, values. Perman et al. (2011, p. 86) argue that "roughly speaking, weak sustainabilists say do not let the size of the total stock of capital fall, while strong sustainabilists say do not let the size of the NC stock fall". TWpc has grown in all countries in our sample, in contrast to NCpc, suggesting that disagreements between weak and strong sustainabilists will continue.

Shares of NCpc, PCpc and ICpc in TWpc in 1995 and 2005 are shown in Appendix Table II. They do not necessarily sum to 100, because the (positive or negative) shares of net foreign assets are not shown explicitly. The average share of ICpc across all countries has increased slightly over the decade; average shares of NCpc and PCpc have declined. Looking at country-specific shares, it can be seen that NZ's NCpc share was the largest in 1995, followed by Mexico and Norway. By 2005, Mexico's share had more than halved, leaving the top three ranks to Norway, NZ and Australia. For only three countries did the NCpc share increase, i.e. for Norway, Australia and Belgium, with Norway showing the largest increase by far. Japan, Hungary and Switzerland had the highest PCpc share in 1995. Ten years later the top three ranked countries were Japan, Korea and Luxembourg. Countries with the highest shares of ICpc in TWpc in both years were the UK, US and Iceland. However, Iceland has overtaken the UK and US to rank first. The only countries with ICpc accounting for less than 70% of TWpc are Switzerland (both years), as well as Luxembourg and Norway (both in 2005). This seems to be due to their large positive per capita net foreign assets.

3. SUSTAINABILITY INDICES

We compare twelve sustainability indices in 2005 (or as close to that year as possible). They are classified into two groups. The first consists of five indices associated with the capital approach to development. Their comparison highlights some important unresolved issues with the capital approach. The remaining seven indices make up the second group. They are composite indices that go beyond economic sustainability. Some of them also include a SWB component. Stiglitz et al. (2009, pp. 237-239) are critical of composite indices because the normative implications of the weightings used to aggregate the components are seldom made explicit or justified, and such indices arguably lack a well-defined notion of what sustainability means. However, such criticism has not reduced the proliferation of composite sustainability indices. Another reason for dividing the twelve indices into two groups is data availability, i.e. not all indices in the second group are available for all twenty-six countries. We also include LSF in our analysis in order to explore correlations between this comprehensive measure of present societal well-being and the sustainability indices. First, however, we have to introduce the LSF data and the indices.

3.1 Life Satisfaction Data and Sustainability Indices

<u>Life Satisfaction Data</u>

Since we are interested in SWB as a societal well-being measure that covers utility across all life domains and that includes both outcome and procedural utility, we use the cognitive life evaluation measure LSF. Helliwell and Wang (2012) report that life evaluation measures show much less short-term variation compared to emotional report measures, and much more linkage to life circumstances. This is arguably preferable in our context. We use country averages for LSF that have been calculated *mostly* from responses to the question: *"All things considered, how satisfied are you with your life as-a-whole now?" Answers range from '10* *satisfied' to '1 dissatisfied'*, and have been transformed to a 0-10 scale. Data for the above are taken from the World Database of Happiness (Veenhoven, 2012).

It is still difficult to match LSF data with other data for particular years across countries. There are tradeoffs in terms of quality and fit of LSF data. For example, there are comparability issues when responses to similar, but not identical, survey questions are combined in one dataset, and when numerical response scales differ (Veenhoven, 2009). We minimize, but cannot completely eliminate, these issues by (almost exclusively) using responses to the same LSF question, which seemed the widest available measure for the time period covered in this study. The disadvantage of trying to avoid pooling responses from different numerical scales that fit particular years is that, where possible, we use simple interpolation to obtain values for 1995 and 2005 when only data for different years are available. In some cases even this was not possible: In the case of Greece, we use the 1999 value for 1995. Moreover, in the following instances data were taken from the World Value Survey databank for a very similar question (the only difference is that the question ends with '…these days?', instead of '…now?'): Canada (1 data point), Greece (1 data point), Iceland (2000 value is that for 1999, 1 data point taken from 11 step numerical LSF measure); Luxembourg (the 1999 value is used for 1995); New Zealand (only two data points available, for 1998 and 2004). Because not all LSF data are obtained from the same question, we use a 0 to 10 scale for all. Data for the UK were calculated from those reported for Great Britain and Northern Ireland, using population weights.

LSF data for 1995 and 2005 by country are shown in Appendix Table III. Given the relatively short time period and the nature of the LSF data, we do not analyse changes in LSF over time, apart from commenting on the data shown in the table. It can be seen that the average of LSF across all countries is, unsurprisingly for a group of mostly high-income countries, quite high and hardly changed over the ten years (-0.8%), although there are fifteen countries for which average LSF seems to have declined and eleven for which it seems to have risen. By far the largest percentage changes are observed for Spain (+11.5%), Mexico (+11%) and Portugal (-15.5%). When exploring the correlation of LSF with sustainability indices, we use only the 2005 data.

<u>Twelve Sustainability Indices</u>

The sustainability indices used in this paper are briefly described below. The data are shown in Appendix Table IV. They are for 2005, or as close as possible.

(1, 2) Adjusted Net Savings as percentage of GNI (ANS) and Adjusted Net Savings per capita (ANSpc), both for 2005

Adjusted Net Savings (ANS), also called 'genuine savings', are defined in general terms as "gross savings minus consumption of fixed capital, plus education expenditure, minus depletion of natural resources, minus pollution damages" (Perman et al., 2011, p. 662). For more details, see the World Bank website.

ANS is usually expressed as percentage of GNI. The data for ANS in 2005 are taken from the UNDP (2012) website. World Bank (2011, Appendix Table E.1), instead, report ANSpc. We use both. World Bank (ibid., p. 39) argues that "the rule for interpreting ANS is simple and clear: if ANS is negative, then we are running down our capital stocks and reducing future social welfare". When ANS is positive, the implication for development is less clear, because population changes are not taken into account. Especially in countries with high population growth, a positive ANS might be misleading as an indicator of sustainable development. That is why ANSpc is preferable.

Measurement of the components making up ANS can and has been criticized (ibid., chapter 19). It should also be noted that ANS focuses on changes in (part of) TW, not TWpc, despite repeated statements in World Bank (2006, 2011) that ANS indicates how TW changes. Given the way ANS is calculated, this is at best an approximation. Not only does ANS exclude agricultural land and parts of intangible capital (ibid., 2011, Box 2.1, p. 38), it also excludes changes in the real price of assets, i.e. capital gains or losses that are included in TW. That ANS does not measure changes in TW was also noted by Common (2007).

However, both ANS and ANSpc can be calculated on an annual basis. Therefore, they have the advantage over broader capital-based sustainability measures of providing more frequent feedback on whether the economy is on a sustainable development path or not. The trade-off is that they are less comprehensive. The World Bank further tries to justify the use of ANSpc by arguing that it 'includes most of the assets that policy makers can influence directly and for which the results can be directly measured" (World Bank, ibid., p. 37).

(3) Change in Total Wealth per capita, 1995-2005 (ΔTWpc)

The availability of comparable TW data for more than one point in time allows, at least in principle, the calculation of sustainability aimed at, but not achieved, with ANS, i.e. it allows calculation of the change in total wealth (that is in *all* capital stocks). We calculate Δ*TWpc* as the difference between TWpc in 1995 and 2005 (in constant 2005 US$) reported in World Bank (2011). TW, in contrast to ANS, also takes into account changes in real prices of assets, i.e. it includes capital gains. ΔTWpc is the most comprehensive and therefore conceptually 'ideal' economic sustainability measure associated with the capital approach to development. It is also advocated by Stiglitz et al. (2009).

(4) Change in Tangible (i.e. Partial) Wealth per capita, 2005 (ΔPWpc)

The use of the variable 'change in TWpc' in World Bank (2011) is somewhat confusing. It gives the impression that it is ΔTWpc discussed above. However, it includes only changes in tangible wealth, not in ICpc. It is therefore much closer to ANSpc. The argument used in World Bank (ibid., p. 157) to defend this approach is that both ANSpc and TWpc should be focussed on stocks and flows that are rival in nature. To distinguish this measure from ΔTWpc, we call it 'change in Partial Wealth per capita' (ΔPWpc).

In our view, because intangible wealth mostly included in people (human capital, social capital) is the largest resource in advanced KBEs, it should be included in a comprehensive measure of economic sustainability. Otherwise we implicitly devalue the role of human beings and divert attention away from issues like the ‘depreciation’ of human and social capital, stress, and mental health in general, which have become increasingly important in OECD economies. It would also sever a potentially important link between wealth accounting and SWB research.

This anthropocentric view seems similar to Boulding (1966) and also the approach taken by Stiglitz et al. (2009, p. 11) who state (italics added):

> “The report distinguishes between an assessment of current well-being and an assessment of sustainability … Whether levels of well-being can be sustained over time depends on whether stocks of capital that matter *for our lives* (natural, physical, human, social) are passed on to future generations.”

Another reason for including both ΔTWpc and ΔPWpc in our comparison of sustainability indices is that we are not aware that the two have been compared before. It should be of interest to find out to what extent they are correlated with each other, and with the other indices. It might provide new insights and an additional aspect to the sustainability debate.

A major caveat is current data quality. Common (2007) has highlighted that while it is conceptually preferable to include all capital stocks in a measure of TW, capital stock estimates are inevitably incomplete and inaccurate. This implies that fuller, but nevertheless incomplete, wealth accounting does not guarantee that ΔTWpc is a better indicator of economic sustainability than ΔPWpc, or even a measure based on only one component of capital, e.g. change in PCpc.

(5) Change in NC per capita, 1995-2005 (ΔNCpc)

According to this criterion, development is deemed sustainable if NCpc does not decline between two points in time. Δ*NCpc* is a more appropriate measure of sustainability than those based on TW if most of the concern is about depletion and destruction of the natural environment, i.e. environmental sustainability. As mentioned earlier, NC as currently measured does not include all natural resources, although one should expect measurement to improve over time. However, even a constant NCpc does not imply strong sustainability. The criterion could be refined by dividing NC into a number of components (for example renewable and non-renewable resources) or by focussing more specifically on forms of NC that are deemed critical, i.e. that need to be preserved. Heal (2011) explicitly discusses this issue and agrees with others that measures trying to capture changes in wealth should be supplemented with more specific indices of critical NC. This is usually done by using physical indicators, not indicators like NC that are measured in monetary terms. Here we measure Δ*NCpc* as the difference between NCpc in 1995 and 2005 (both in 2005 US$), provided in World Bank (2011).

(6) The New Economics Foundation’s *Happy Planet Index, 2005 (HPI)*

The creators of the HPI argue that it measures "what truly matters to us – our well-being in terms of long, happy and meaningful lives – and what matters to the planet – our rate of resource consumption" (Murphy, 2009, p. 1). HPI is calculated as 'happy life years' (life satisfaction × life expectancy) divided by an adjusted ecological footprint (a constant is added to the ecological footprint to dampen its variation). This ratio is then multiplied by another constant to insure that a country achieving maximum LSF and life expectancy (85 years) while living within 'its global fair share of resources' scores 100 on the HPI. It is reported that for OECD countries, HPI has decreased from 1961 to 2005: While happy life years have grown by 15%, ecological footprints increased by 72% (ibid., p. 4).

HPI is an ecological efficiency measure, i.e. it aims to capture the degree to which happy life years are achieved per unit of environmental impact (ibid., p. 13). That is a very different definition of sustainability, one that explicitly includes life outcomes and scales them by a measure of resource use. Like measures (7) to (12) described below, HPI is a composite index that combines objective and subjective variables, and an assessment of current well-being as well as sustainability.

(7) The Environmentally Responsible Happy Nation Index, 2003-05 (ERHNI)

Ng (2008, p. 425) argues that the HPI needs to be revised to make it "an internationally acceptable national success indicator that aims positively at long and happy lives but negatively at the external costs of environmental disruption." The revision involves different measurement of the variables as well as a different way of constructing the index. In particular, Ng makes two changes. First, he gives LSF a greater weighting. Secondly, instead of dividing happy life years by an adjusted ecological footprint, he subtracts a measure of per capita external costs imposed by a country on the global community in the present and the future. The calculation of the per capita global environmental cost is quite involved (for details, see the appendix in Ng, 2008). The starting point is an estimate of premature deaths from air pollution, from which total costs are estimated. Only a portion of total costs is taken as external (i.e. as imposed on other nations). Per capita contributions of each nation are calculated as being proportional to its per capita CO_2 emissions etc. Ng's per capita external costs are only rough estimates. He argues that "It is better to be roughly right on important things than to be perfectly accurate on things that are irrelevant" (ibid., p. 433/4). ERHNI can be positive or negative, the higher the index, the better.

(8) Environmental Efficiency of Well-being, 2005 (EWEB)

Similar to Ng (2008), Knight and Rosa (2011) argue that the scaling inherent in the design of the HPI is not trivial, and that regression results obtained when using such a ratio measure are difficult to interpret. After surveying a number of environmental efficiency of well-being indices, they devise their own index that takes SWB and the ecological footprint into account without directly combing them or being a ratio measure. They obtain their measure from regressing LSF (*not* happy life years) on per capita ecological footprint and computing the unstandardized residuals. These residuals are their EWEB estimates: A large positive one indicates a country with high well-being relative to their environmental consumption (and vice versa).

(9) Environmental Sustainability Index, 2005 (ESI)

Developed by researchers from Yale and Columbia Universities, the ESI is derived by integrating 76 data sets into 21 indicators of environmental sustainability, which are then aggregated further into five major components and finally into the overall ESI (Esty et al., 2005). The authors (ibid., Box 3, p. 23) argue that "The ISI score quantifies the likelihood that a country will be able to preserve valuable environmental resources effectively over the period of several decades … it evaluates a country's potential to avoid major environmental deterioration". The higher the ESI score, the better. Stiglitz et al. (2009, p. 238) provide some specific criticisms of the ESI. They argue it is often viewed as presenting the situation of developed countries too optimistically, and that it is also not much use for making comparisons between developed countries. 2005 was the last year for which the ESI has been reported.

(10) Environmental Performance Index, 2006 (EPI)

EPI is the successor to the ESI. Developed by the same group of researchers, it has only been reported since 2006. We use the EPI for that year (Esty et al., 2006). It is designed to better measure actual policy performance with respect to (1) reducing environmental stresses on human health and (2) promoting ecosystem vitality and sound natural resource management. This is done by measuring country performance against absolute targets (proximity-to-target methodology). The EPI is based on only 16 indicators (datasets). They are aggregated into six policy categories (sometimes with overlaps). Five of the six are then aggregated into the broad objective of 'ecosystem vitality'; one, environmental health, is directly identified as a broad objective. Finally, the two broad objectives are aggregated (by simply averaging) into the EPI. The methodology has been modified in subsequent years (for details, see http://epi.yale.edu/). The EPI is a measure of policy achievement in some core environmental areas, but it is not a comprehensive measure of environmental sustainability as such.

(11) Ecological Footprint, 2005 (EFP)

The Ecological Footprint "measures humanity's demand on the biosphere in terms of the area of biologically productive land and sea required to provide the resources we use and to absorb our waste" (WWF, 2008, p. 14). The ratio of required to available resources is interpreted as a measure of ecological sustainability, i.e. if it is greater than one, the current consumption level and lifestyle is unsustainable. A lower EFP is preferable. WWF (ibid., p. 42) states that "Ecological Footprint accounts provide snapshots of past resource demand and availability. They do not predict the future. Thus, while the footprint does not estimate future losses caused by current degradation of ecosystems, if this degradation persists it will be reflected in future accounts as loss of biocapacity." EFP for 2005 is taken from WWF (2008). It is the same as that used in construction of the HPI in 2005. There have been some major criticisms of EFP as a measure of sustainability (see, for example, Fiala, 2008).

(12) Human Development Index, 2005 (HDI)

The HDI is a composite measure of health, measured by life expectancy at birth, education, measured by a combination of the adult literacy rate and gross school enrolment, and income, measured by GDPpc. It is seen by its creators as an alternative to the narrow focus on income, providing a wider perspective on human development, although still only in a limited way. As argued in UNDP, 2010, p. 19), the emphasis on the multi-dimensionality of human development "complements conventional approaches to sustainability, reminding us that the debate about what should be sustained is as important as how to sustain it." The HDI for 2005 is taken from the 2010 Human Development Report (UNDP, 2010, Table 2). All countries in our sample, apart from Mexico, are in the 'very high human development' category. Mexico belongs to the 'high human development' group (ibid.). The HDI lies between 0 and 1; the higher, the better.

3.2 Analysis

Table 2 shows correlation coefficients between indices associated with the capital approach to development. The first four are indices of economic sustainability; the fifth, i.e. ΔNCpc, is closer associated with environmental sustainability.

The highest positive correlations are between ANSpc, ANS and ΔPWpc, which are the indices used by the World Bank. While ΔPWpc is a more comprehensive measure of changes in capital stocks than the other two, the high correlation suggests that perhaps the gain from using ΔPWpc over ANSpc and ANS might not be that great. However, in some cases the three indices provide different signals. The country-level data reported in Appendix Table IV indicate that, for Greece, NZ and the US, ΔPWpc is negative, while ANSpc and ANS are positive. Also, for Iceland and Portugal, ANSpc and ΔPWpc are negative, despite positive ANS.

Table 2: Correlation amongst wealth-based sustainability indices, 2005

ANSpc	1				
ANS	**0.85[a]**	1			
ΔPWpc	**0.97[a]**	**0.86[a]**	1		
ΔTWpc	**0.34[c]**	0.26	0.24	1	
ΔNCpc	0.07 **(-0.36[c])**	-0.005 (-0.21)	-0.002 (-0.26)	-0.10 (-0.23)	1
	ANSpc	**ANS**	**ΔPWpc**	**ΔTWpc**	**ΔNCpc**

Notes: All 26 countries are included, except for values in brackets, which are for 22 countries, i.e. the sample excluding the NCpc-intensive countries Australia, Canada, New Zealand and Norway. ANSpc and ΔPWpc are from World Bank (2011). ANS is ANS as percentage of GNI, taken from UNDP (2012). ΔTWpc and ΔNCpc are calculated from World Bank (2011). They are 10-year changes (1995-2005). The other variables are annual changes.
a = statistically significant at the 1% level (two-sided test)
c = statistically significant at the 10% level (two-sided test)

In marked contrast, ΔTWpc exhibits low, and mostly statistically insignificant, correlation with ANSpc, ANS and ΔPWpc. This raises the possibility that the economic sustainability indicators currently in official use might be misleading If the data are correct, ΔPWpc *understates* economic sustainability in OECD countries: It is negative for five countries (Greece, Iceland, NZ, Portugal, the US), whereas ΔTWpc is positive for all countries. Using a comprehensive definition of wealth that includes IC, we are less likely to find instances of unsustainable economic development amongst OECD countries.

Turning to correlations between ΔNCpc and the other indices, the disconnect between economic and environmental sustainability measures, even when both are based on the capital approach to development, is obvious. The correlation coefficients are very small, mostly negative and not statistically significant. Appendix Table IV shows that ΔNCpc is negative for 17 countries, with only Australia, Belgium, Canada, Denmark, Finland, Germany, Norway, Spain and the US showing an increase over the decade.

Engelbrecht (2009, 2012) finds that correlations between LSF and NCpc for OECD countries are greatly affected by the inclusion of the four NCpc intensive countries Australia, Canada, NZ and Norway. As shown in Table 2, when they are excluded, the negative correlations between ΔNCpc and all other wealth-based indices become larger but, given the small number of observations, only the correlation between ΔNCpc and ANSpc is weakly statistically significant. Nevertheless, it suggests that the disconnect between economic and environmental sustainability is even stronger when these countries are excluded.

To sum up, the correlations reported in Table 2 point to two issues. Firstly, if we define sustainability as non-declining NCpc, then our group of countries as a whole is probably on a non-sustainable path, whereas in terms of economic sustainability it is on a sustainable path. Secondly, the low correlation coefficients between, on the one hand, ΔTWpc, and, on the other hand, ΔPWpc, ANS and ANSpc, raise the question whether the latter three, which are currently the probably most widely used economic sustainability indices, are misleading. It would be interesting to sequentially add agricultural land and forms of IC, like human and social capital, to these indices to explore which of them account for most of the difference.

Next, we explore how closely the remaining, i.e. non-monetary, sustainability indices are correlated with each other and with LSF (Table 3). Most of them are not available for all 26 countries. Excluding Denmark, Iceland, Luxembourg and Switzerland due to missing observations, we are left with 22 countries. Three of the seven indices include LSF as a constituent variable (HPI, ERHNI, EWEB).

A mixed picture emerges with respect to statistically significant correlations. For example, HDI is positively correlated with ESI and EPI, but less encouragingly, it is also positively correlated with a larger EFP, and negatively with the HPI. That such prominent sustainability indices as HDI, HPI and EFP provide contradictory messages should not be too surprising, given their different construction, but it is nevertheless disconcerting for anyone searching for consistent messages about sustainability. Analysing changes over time, UNDP (2011, p. 3) also notes that a rising HDI has been associated with environmental degradation, largely due to economic growth.

Table 3: Correlations – Non-monetary sustainability indices and LSF, 22 countries, 2005								
LSF	1							
HPI	0.33	1						
ERHNI	**0.79**[a]	**0.46**[b]	1					
EWEB	**0.53**[b]	**0.94**[a]	**0.68**[a]	1				
ESI	**0.45**[b]	-0.05	**0.48**[b]	0.16	1			
EPI	0.07	-0.30	0.33	-0.11	**0.64**[a]	1		
EFP	**0.37**[c]	**-0.73**[a]	0.13	**-0.53**[b]	0.34	0.35	1	
HDI	0.35	**-0.37**[c]	0.30	-0.16	**0.52**[b]	**0.50**[b]	**0.66**[a]	1
	LSF	**HPI**	**ERHNI**	**EWEB**	**ESI**	**EPI**	**EFP**	**HDI**

Notes: Denmark, Iceland, Luxembourg and Switzerland are excluded from the sample. EPI is for 2006.
a = statistically significant at the 1% level (two-sided test)
b = statistically significant at the 5% level (two-sided test)
c = statistically significant at the 10% level (two-sided test)

The highest positive correlation shown in Table 3 is observed between HPI and EWEB. Although Knight and Rosa (2011) develop EWEB as an improvement over HPI, empirically the two indices are quite comparable. Knight and Rosa (2011) report a similar finding for their sample of 105 countries. Ng's (2008) ERHNI exhibits a lower correlation with HPI. Focussing on LSF, we see that ERHNI, EWEB, ESI and EFP are all positively and statistically significantly correlated with it. HPI and HDI are also positively correlated with LSF, but the correlations are not statistically significant.

ESI and EPI are positively, but far from perfectly, correlated. EFP is significantly negatively correlated with HPI and EWEB, i.e. focussing only on environmental aspects seems to provide quite different indications about sustainability compared to indices that also include a LSF component. This provides support for Stiglitz et al.'s (2009) view that well-being and environmental indices should not be combined.

Finally, we combine our two groups of indices (Table 4). We exclude EWEB, because it has missing observations for four countries. When all other indices are included, there are only missing observations for Iceland and Luxembourg, leaving 24 countries.

LSF is positively and statistically significantly correlated with ANSpc, ANS and ΔPWpc, but not with ΔTWpc and ΔNCpc. The difference between ΔTWpc and ΔPWpc is again noteworthy and should be explored further when more and better data become available. Also, it would be interesting to explore correlations between *changes* in LSF and, in particular, ΔTWpc, ΔPWpc and ΔNCpc, should it become possible to closer match wealth and LSF data.

Table 4: Correlations - Sustainability indices and LSF, 24 countries, 2005												
LSF	1											
ANSpc	**0.47**[b]	1										
ANS	**0.38**[c]	**0.83**[a]	1									
ΔTWpc	0.23	**0.34**[c]	0.29	1								
ΔPWpc	**0.38**[c]	**0.95**[a]	**0.85**[a]	0.26	1							
ΔNCpc	0.24 (-0.01)	**0.20 (-0.37**[c]**)**	0.03 (-0.18)	0.03 (0.14)	0.06 (-0.03)	1						
HPI	0.23	**0.37**[c]	**0.45**[b]	-0.21	**0.50**[b]	-0.22 (**-0.36**[c])	1					
ERHNI	**0.81**[a]	**0.66**[a]	**0.56**[a]	0.21	**0.62**[a]	0.03 (-0.09)	**0.36**[c]	1				
ESI	**0.46**[b]	**0.49**[b]	0.29	0.29	**0.43**[b]	**0.42**[b] (-0.09)	-0.02	**0.48**[b]	1			
EPI	0.12	0.20	0.09	**0.49**[b]	0.17	0.01 (0.22)	-0.32	0.32	**0.64**[a]	1		
EFP	**0.41**[b]	-0.02	-0.19	**0.42**[b]	-0.22	0.32 (0.33)	**-0.75**[a]	0.18	0.31	**0.37**[c]	1	
HDI	0.33	**0.48**[b]	0.23	**0.52**[a]	**0.35**[c]	**0.48**[b] (0.30)	**0.48**[b]	0.20	**0.52**[a]	**0.50**[b]	**0.62**[a]	1
	LSF	**ANSpc**	**ANS**	**ΔTWpc**	**ΔPWpc**	**ΔNCpc**	**HPI**	**ERHNI**	**ESI**	**EPI**	**EFP**	**HDI**

Notes: Data are for 24 countries (Iceland and Luxembourg are excluded from the sample). Numbers in brackets are for 20 countries, i.e. they exclude the four NC intensive countries Australia, Canada, New Zealand and Norway.
ΔTWpc and ΔNCpc are 10 year changes (1995-2005). ANS, ANSpc and ΔPWpc are annual changes. GNIpc, HPI, ERHNI and ESI are for 2005. EPI is for 2006.
a = statistically significant at the 1% level (two-sided test)
b = statistically significant at the 5% level (two-sided test)
c = statistically significant at the 10% level (two-sided test)

HDI is positively and statistically significantly correlated with all but one of the monetary indices (ANS is the exception). The correlation with ΔNCpc becomes statistically insignificant when the four NCpc-intensive countries are excluded.

ANSpc is positively and statistically significantly correlated with four of the six non-monetary indices shown in Table 4 (HPI, ERHNI, ESI HDI). A positive correlation between ANSpc and HDI has been observed by others (for example Gnégné, 2009). Correlations between ANS and the nonmonetary indices are very mixed. Only two of them (i.e. between ANS and HPI and ANS and ERHNI) are positive and statistically significant.

There are major differences in the correlations of the two wealth variables ΔTWpc and ΔPWpc with the non-monetary sustainability indices, again indicating that they convey quite different messages. ΔTWpc is significantly and positively correlated with EPI, EFP and HDI, whereas ΔPWpc is significantly and positively correlated with HPI, ERHNI and HDI.

Last but not least, it is of interest to see how closely the non-monetary indices are correlated with ∆NCpc. ∆NCpc is positively and significantly correlated with the abandoned index ESI and with HDI. This ceases to be the case when the four most NCpc-intensive countries are excluded. In that case, ∆NCpc is only statistically significantly and negatively correlated with HPI. Again, the different sustainability indices provide diverse messages.

4. CONCLUDING COMMENTS

We find that different indices derived from the capital approach to development provide different messages about economic sustainability, even for OECD countries. In particular, correlations between the conceptually preferred measure ∆TWpc and the commonly used ANSpc, ANS and ∆PWpc, are quite low. Moreover, although ANSpc, ANS and ∆PWpc are highly correlated with each other, they produce conflicting messages for some countries. Another finding is the disconnect between ∆NCpc and the other indices derived from the capital approach. Furthermore, less novel but important to point out, is the great diversity of correlations between the monetary and major composite non-monetary sustainability indices.

Our analysis comes with many caveats. The use of sustainability indices derived from the capital approach is not without its (diverse) critics (see, for example, Gowdy, 2005, Common, 2007, Cairns, 2011). Common (2007) rightly makes the point these indices should come with a health warning when suggested as basis for policy, and our findings shed further light on why this is the case. It is important to point out the diverse signals derived from indices associated with the same model of development and value system, and how they compare with those derived from other major indices. Sustainability indices should be but one type of input into policy-making. Like Gasparators et al. (2009), we favour methodological pluralism, and hope for continued efforts that may lead to theoretical and empirical advances in the sustainability debate.

Another major caveat concerns the LSF data, many of which are interpolated. In future, it should become easier to match SWB data and economic data across countries and years. In their recent survey, Helliwell et al. (2012, p. 94) state that “At this stage the science of happiness is in its infancy and its policy implications are inevitably piecemeal and tentative”. Combing happiness, comprehensive wealth and sustainability indicators research only compounds the difficulties. Moreover, given that our analysis is cross-sectional and all our sustainability indices are short-term indicators, their correlations say little about trends over longer time periods. It would be interesting to see how, for example, ∆TWpc changes over time by conducting a trend analysis similar to that of Uwasu and Yabar (2011).

Nevertheless, assuming the current wealth data are meaningful, though imperfect, our findings raise a number of issues which should be addressed further in the debate about how to measure sustainability and achieve sustainable development. How should differences in growth rates between GDPpc and TWpc be interpreted, and how should the importance of such differences be judged? How should ‘change in total wealth’ as a measure of economic sustainability be conceptualised and estimated? While there is much concern about depreciation of NC (after all, this is what motivated natural resource accounting), little or no attention seems to have been given to 'depreciation' of human capital and other forms of IC in the context of TW measurement. This is inappropriate for advanced KBEs. Related to this is an exploration of critical forms of IC. Pearce (1997, p. 26) notes that the issue of strong versus weak substitutability might not only apply to NC: "Some would argue that sustainable development is as likely to be threatened by the collapse of social norms as by environmental problems - i.e. some social capital is also 'critical'". One might add that this applies equally to other forms of IC, like human capital and organisational capital.

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APPENDIX TABLES

Appendix Table I: Annual growth rates of GDP per capita and wealth per capita variables for 26 OECD countries, 1995-2005

Country	Code	GDPpc	TWpc	NCpc	PCpc	ICpc
Australia	AUS	1.075	0.955	1.314	0.892	0.940
Austria	AUT	0.831	0.610	-0.827	0.692	0.649
Belgium	BEL	0.807	0.786	1.442	0.667	0.748
Canada	CAN	1.008	0.742	0.555	0.709	0.654
Denmark	DNK	0.729	0.680	0.787	0.862	0.536
Finland	FIN	1.466	1.363	0.010	0.261	1.608
France	FRA	0.726	0.734	-0.211	0.459	0.771
Germany	DEU	0.517	0.554	0.139	0.371	0.558
Greece	GRC	1.417	1.147	-0.882	0.673	1.519
Hungary	HUN	1.901	1.707	-1.477	0.616	2.364
Iceland	ISL	1.505	1.383	-1.505	0.906	1.646
Ireland	IRL	2.534	1.717	-1.911	2.709	1.636
Italy	ITA	0.468	0.623	-0.407	0.385	0.725
Japan	JPN	0.408	0.665	-2.354	0.273	0.763
Korea, Rep.	KOR	1.600	1.934	-0.309	1.997	2.003
Luxembourg	LUX	1.495	1.183	-2.600	1.600	0.506
Mexico	MEX	1.015	0.727	-2.434	0.663	1.002
Netherlands	NLD	0.911	0.909	-0.125	0.842	0.930
New Zealand	NZL	0.883	0.893	-0.120	0.570	1.095
Norway	NOR	1.007	0.514	2.533	0.496	-0.055
Portugal	PRT	0.851	0.817	-1.473	0.911	1.019
Spain	ESP	1.150	0.995	0.013	1.293	1.045
Sweden	SWE	1.234	1.036	-0.111	0.341	1.164
Switzerland	CHE	0.483	0.411	-2.221	-0.077	0.516
United Kingdom	GBR	1.107	1.202	-0.344	0.761	1.340
United States	USA	0.985	0.984	0.269	0.914	1.040
Average		**1.081**	**0.972**	**-0.471**	**0.799**	**1.028**

Data sources: GDP per capita data are from the World Development Indicators database; wealth data are from World Bank (2011). Net foreign assets are not included in ICpc.

Appendix Table II: Share of NCpc, PCpc and ICpc in TWpc, 26 OECD countries, 1995 and 2005						
	1995			**2005**		
Country Code	**NCpc (%)**	**PCpc (%)**	**ICpc (%)**	**NCpc (%)**	**PCpc (%)**	**ICpc (%)**
AUS	7.1	21.8	74.7	7.7	21.5	74.5
AUT	2.2	19.4	79.3	1.6	19.8	80.1
BEL	0.8	18.1	80.3	0.9	17.6	79.6
CAN	7.2	16.8	78.6	6.9	16.7	77.0
DNK	2.6	16.9	82.2	2.6	17.6	79.6
FIN	4.6	21.8	76.3	3.4	16.9	80.7
FRA	1.8	17.0	81.4	1.5	16.0	82.1
DEU	1.1	18.7	79.8	1.0	18.0	79.9
GRC	3.2	21.1	76.3	2.0	18.9	83.1
HUN	7.2	26.1	70.2	3.5	20.3	81.7
ISL	2.7	17.0	83.3	1.4	15.2	88.5
IRL	4.3	14.9	82.6	1.9	18.8	81.1
ITA	1.9	19.0	79.5	1.5	18.0	81.4
JPN	0.8	27.1	71.1	0.4	24.6	72.7
KOR	1.8	23.3	75.4	1.1	23.6	76.6
LUX	1.6	21.1	76.3	0.7	23.2	65.2
MEX	10.5	16.5	76.1	5.1	16.2	81.1
NLD	2.8	18.8	79.2	2.2	18.5	79.6
NZL	16.2	19.8	70.6	12.8	18.4	73.9
NOR	8.0	21.3	70.4	12.8	21.2	61.7
PRT	2.3	19.2	79.3	1.4	19.6	83.1
ESP	2.3	18.8	80.1	1.8	20.1	81.0
SWE	3.3	17.3	81.7	2.5	14.7	84.1
CHE	2.3	25.1	67.1	1.3	22.5	68.8
GBR	1.3	14.2	84.6	0.9	12.8	87.3
USA	2.2	13.9	84.3	1.9	13.6	85.4
Average	**3.9**	**19.4**	**77.7**	**3.1**	**18.6**	**78.8**
Data sources: Wealth data are from World Bank (2011). Net foreign assets are not included in ICpc. Therefore, the capital shares shown do not add up to 100.						

Appendix Table III: Life satisfaction, 1995 and 2005 (11 point scale)			
Country Code	**1995**	**2005**	**% change**
AUS	7.28	6.98	-4.1
AUT	7.05	7.06	0.1
BEL	7.33	7.24	-1.2
CAN	7.60	7.56	-0.5
DNK	8.00	8.26	3.3
FIN	7.51	7.60	1.2
FRA	6.52	6.57	0.8
DEU	7.34	6.88	-6.3
GRC	6.30	6.31	0.2
HUN	5.52	5.30	-4.0
ISL	7.82	8.31	6.3
IRL	7.82	7.36	-5.9
ITA	6.92	6.54	-5.5
JPN	6.36	6.66	4.7
KOR	6.08	5.95	-2.1
LUX	7.63	7.54	-1.2
MEX	7.24	8.03	11.0
NLD	7.62	7.38	-3.1
NZL	7.45	7.65	2.7
NOR	7.39	7.91	7.0
PRT	6.69	5.65	-15.5
ESP	6.33	7.06	11.5
SWE	7.56	7.51	-0.6
CHE	7.99	7.82	-2.2
GBR	7.28	7.05	-3.2
USA	7.41	7.07	-4.6
Average	**7.16**	**7.13**	**-0.8**

Appendix Table IV: Sustainability indices, 2005												
Code	**ANSpc**	**ANS**	**ΔTWpc**	**ΔPWpc**	**ΔNCpc**	**HPI**	**ERNHI**	**EWEB**	**ESI**	**EPI**	**EFP**	**HDI**
AUS	2,217	2.9	102,411	655	10,438	36.6	8.931	-0.47	61.0	80.1	7.8	0.925
AUT	3,100	14.5	74,781	2,284	-1,901	47.7	17.536	0.78	62.7	85.2	5	0.841
BEL	2,917	14.4	93,088	2,283	1,394	45.4	13.762	0.59	44.4	75.9	5.1	0.858
CAN	2,081	10.7	84,629	881	4,429	39.4	11.300	-0.01	64.4	84.0	7.1	0.880
DNK	2,891	14.5	107,664	2,475	3,250	35.5	19.339	**n.a.**	58.2	84.2	8	0.860
FIN	3,586	15.6	153,576	3,207	45	47.2	14.290	1.01	75.1	87.0	5.2	0.863
FRA	2,083	10.7	91,172	1,473	-429	43.9	9.409	0.36	55.2	82.5	4.9	0.856
DEU	2,808	10.9	65,585	2,871	180	48.1	12.133	0.51	56.9	79.4	4.2	0.878
GRC	217	0.7	91,183	-35	-1,797	37.8	5.562	-0.47	50.1	80.2	5.9	0.839
HUN	329	8.4	56,215	392	-2,421	38.9	2.040	-0.45	52.0	77.0	3.5	0.798
ISL	-1,091	4.9	246,313	-2,745	-5,119	38.1	**n.a.**	**n.a.**	70.8	82.1	**na**	0.881
IRL	6,847	21.9	195,652	4,327	-6,186	42.6	14.716	0.45	59.2	83.3	6.3	0.886
ITA	1,241	7.9	66,548	552	-737	44.0	11.135	0.27	50.1	79.8	4.8	0.838
JPN	2,265	9.0	77,954	2,252	-1,507	43.3	4.717	-0.11	57.3	81.9	4.9	0.873
KOR	3,300	21.8	89,195	3,045	-195	44.4	4.312	-0.17	43.0	75.2	3.7	0.851
LUX	13,885	26.3	218,828	11,484	-4,992	28.5	8.767	**n.a.**	41.8	**n.a.**	**na**	0.856
MEX	418	9.4	20,243	164	-4,991	55.6	12.151	1.33	46.2	64.8	3.4	0.727
NLD	3,825	14.1	112,071	3,541	-387	50.6	14.963	1.25	53.7	78.7	4	0.877
NZL	496	8.4	76,975	-501	-1,490	36.2	14.304	-0.42	60.9	88.0	7.7	0.896
NOR	5,504	15.4	96,193	3,254	48,678	40.4	13.827	0.16	73.4	80.2	6.9	0.932
PRT	-577	3.2	52,460	-811	-1,697	37.5	5.547	-0.80	54.2	82.9	4.4	0.775
ESP	1,869	10.7	83,645	584	22	43.2	12.001	0.33	48.8	79.2	5.7	0.848
SWE	4,540	19.4	133,321	4,184	-407	48.0	18.534	0.90	71.7	87.8	5.1	0.883
CHE	8,291	20.1	66,493	6,811	-6,284	48.1	22.789	**n.a.**	63.7	81.4	5	0.870
GBR	1,162	6.3	160,229	613	-516	43.3	11.458	0.33	50.2	85.6	5.3	0.845
USA	182	6.1	148,848	-821	831	30.7	8.064	-1.31	52.9	78.5	9.4	0.895

Notes: n.a. = not available. ANSpc, ANS and ΔWpc indicate annual changes (2004 to 2005). ΔTWpc and ΔNCpc indicate 10 year changes (1995 to 2005). HPI, ERNHI, EWEB, ESI, EFP and HDI are for 2005, EPI is for 2006.