

Measuring progress in theory and practice

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There has been a recent resurgence of interest in the concept of progress and how it is measured. This paper explores the role that concepts of wellbeing and sustainability play in informing a framework for public policy analysis with a particular focus on the Australian Treasury. Treasury's policy objective, set out in its mission statement, is to improve the wellbeing of the Australian people. As such, sustainable social progress or improving wellbeing, and how it is measured, are of central concern to the work of the Treasury.

Wellbeing relates to the aspects of life that people and societies value. It is a multi-dimensional concept incorporating notions of individual freedoms, opportunities and capabilities. However, wellbeing should not be considered in isolation. Sustainability and intergenerational effects are important as the wellbeing of a particular generation is determined by the stock of resources inherited from previous generations, in addition to the choices that generation makes, and what they leave behind for future generations.

Improving the measures of wellbeing, and sustainability, is a complex task. For policy choices and decisions to have a reasonable prospect of improving wellbeing and sustainability, we need to base them on reason, as well as empirical evidence. Theory and practice need to work together. If we focus on the wrong metrics, or use them without acknowledging their limitations, they can lead us down the wrong path.

'Would you tell me, please, which way I ought to go from here?'
'That depends a good deal on where you want to get to,' said the cat.
'I don't much care where -,' said Alice
'Then it doesn't matter which way you go,' said the cat.
 (Carroll 1865)

Introduction

The development of national accounts arose from the need to understand the state of the economy during the Great Depression. Today, questions about patterns of development, including the current rate at which we use the Earth's resources, are raising concerns which are driving demand for additional measures to better understand and inform policy to promote wellbeing and sustainable development. As with the national accounts in the 1930s, what we require are indicators better suited to helping measure and address the challenges of today. An increased focus on progress has led to an abundance of measures. The demand for better indicators of wellbeing and the sustainability of wellbeing are arguably precursors to the next phase in the development of our modern statistical systems.

For public policy to be effective, a common understanding of wellbeing and sustainability is important. In the words of Schumacher, 'everything in this world has to have a structure, otherwise it is chaos' (Schumacher, 1973, p.50). Structure is all the more relevant when attempting to develop meaningful statistics or indicators on something as complex as wellbeing. Mapping the conceptual territory that is to be measured is one of the first steps in producing meaningful statistics. Measuring wellbeing essentially involves mapping the whole of life, considering each life event or social context that has the potential to affect the quality of individual lives, or the cohesion of society (ABS 2001). This is no easy task, which is why numerous frameworks have been developed to assist in identifying the key issues and to focus on which goals ought to be pursued.

Once the conceptual groundwork has been completed, metrics can be employed to evaluate outcomes and inform policy development and design. Yet, different measures provide different assessments. This is necessarily so as different measures focus on different aspects of progress — some on material aspects, some on socio-economic aspects, while others are more environmentally orientated. Further adding to the potential differences is that some measures focus on current levels while others focus on whether we can maintain or enhance current levels through time, that is sustainability.

In addition, whilst wellbeing and sustainability are closely intertwined, they are distinct concepts, and sustainability itself is not well understood. Beyond the basic idea of sustainability there is no common understanding of what sustainability actually entails in practice, resulting in a large number of alternate measurement approaches. However, most concerning is the potential for this confusion to lead to the pursuit of policies that are inconsistent with sustainable development.

Wellbeing according to the Australian Treasury

The Australian Treasury developed a wellbeing framework about a decade ago to provide some guidance about its mission, which is to improve the wellbeing of the Australian people.¹ It also identifies elements that need to be considered in providing thorough analysis, and are particularly relevant to our work. The framework is descriptive, providing a context for public policy analysis and advice that encourages a broad assessment of the costs and benefits of policy proposals.

It acknowledges that in addition to income and (material) consumption, a policy relevant assessment of

¹ Treasury's mission is to improve the wellbeing of the Australian people by providing sound and timely advice to the Government, based on objective and thorough analysis of options, and by assisting Treasury Ministers in the administration of their responsibilities and the implementation of Government decisions.

wellbeing, both at the individual and social level, depends on health, education, social relationships, and a myriad of other aspects of life that people have reason to value.

From an institutional perspective, the process of developing the framework was important in itself, as it required Treasury to think carefully about what people value, and how this relates to policy analysis and advice. It was intended that the framework facilitate an iterative learning process for the Department through an ongoing examination of each of the dimensions. Since late 2010, the Treasury has been reviewing the framework, talking to staff on their experiences with the framework and considering what updating, if any, is required.

It is important to note that the Treasury's interest in the issues, concepts and dimensions of wellbeing goes back a long way.² Treasury's association with wellbeing could be characterised as being evolutionary rather than revolutionary. Following the consultations, the next evolution of Treasury's association with wellbeing occurred, with some changes being made to the framework.³

In undertaking its mission Treasury takes a broad view of wellbeing as primarily reflecting a person's substantive freedom to lead a life they have reason to value.

This perspective recognises that the wellbeing of Australians encompasses more than is directly captured by commonly used measures of economic activity. It gives prominence to respecting the informed preferences of individuals, while allowing scope for broader social actions and choices. It is open to both subjective and objective notions of wellbeing, and to concerns for outcomes and consequences as well as for rights and liberties.

Treasury brings a whole-of-economy approach to providing advice to government based on an objective and thorough analysis of options. To facilitate that analysis, we have identified five dimensions that directly or indirectly have important implications for wellbeing and are particularly relevant to Treasury. These dimensions are:

- The **set of opportunities** available to people. This includes not only the level of goods and services that can be consumed, but good health and environmental amenity, leisure and intangibles such as personal and social activities, community participation and political rights and freedoms.
- The **distribution** of opportunities across the Australian people. In particular, that all Australians have the opportunity to lead a fulfilling life and participate meaningfully in society.
- The **sustainability** of opportunities available over time. In particular, consideration of whether the productive base needed to generate opportunities (the total stock of society's capital, including human, physical, social and natural assets) is maintained or enhanced for current and future generations.
- The overall level and allocation of **risk** borne by individuals and, in aggregate, the community. This includes a concern for the ability, and inability, of individuals to manage the level and nature of the risks they face.

² Two particular references are noteworthy. The November 1964 Supplement to the Treasury Information Bulletin, entitled *The Meaning and Measurement of Economic Growth* explored the nature of economic growth and its connection to wellbeing. Among other things, the supplement highlighted the importance of those aspects of wellbeing that were not reflected in the statistics of economic growth. The Treasury Economic Paper, *Economic Growth: Is it worth Having?*, published in June 1973, also explored the broader wellbeing impacts of policy. The paper, written partly in response to the apocalyptic claims of the *Limits to Growth* study sponsored by the Club of Rome, examined the costs and benefits of economic growth with a focus on non-pecuniary outcomes, such as those in the natural environment. Precursors to Treasury's current wellbeing framework can be glimpsed throughout the paper.

³ For information on the wellbeing framework prior to the 2010 review see Treasury 2004; Banerjee and Ewing 2004; Gruen and Wilkie 2009; Henry 2009, 2010.

- The **complexity** of the choices facing people and the community. Of concern is not only the costs of dealing with unwanted complexity, but also transparency of government and the ability of individuals and the community to make choices and trade-offs that better match their preferences.

These dimensions reinforce our conviction that trade-offs matter deeply, both between and within dimensions. The dimensions do not provide a simple checklist: rather their consideration provides the broad context for the use of the best available economic and other analytical frameworks, evidence and measures.

Having established a common understanding of wellbeing, at least for the purposes of the Australian Treasury, the logical next step would be to measure it. However, conceptualising and measuring wellbeing are distinct endeavours and, in this regard, Treasury's goal has been modest: merely seeking an identification of the things that are important in the formulation of public policy advice. Treasury is a potential user of different measures of progress, but does not have a primary role in developing better measures. However, it does have a role in thinking about what measures may assist in policy development and in achieving its objectives.

The demand for measures of progress has a long history

The idea of quantifying aspects of society in order to better understand our current situation is not new. Since ancient times governments have collected data on the population and other resources under their command, for a variety of reasons and purposes.

One of the earliest known collections is that of Sir William Petty who, in 1665, presented estimates of population, income, expenditure, stock of land, other physical assets and human capital for England and Wales. At the time, the second Anglo-Dutch war was underway, and Petty's estimates were intended to provide a quantitative framework for the implementation of fiscal policy and mobilisation of resources (Maddison 2004). From Petty's foundational work 'the art of reasoning by figures on things relating to government' was developed, otherwise known as *Political Arithmetick* (Schumpeter 1986).

Skipping forward to the 1930s, it was the absence of information of pressing need that led to the creation of the national accounts system, on which GDP is based. National income accounts rose to prominence at that time as policymakers, trying to recover from the Great Depression, recognised that they knew too little about how the economy was actually performing. Policymakers, even in advanced countries, were attempting to steer their economies out of the Great Depression armed with only partial information on some facets of the economy (BEA 2000).

Given the recurrent criticism of GDP, it is easy to forget that the system of national accounts represents a milestone in our measurement systems (Hall *et al* 2010). Simon Kuznets won the Nobel Prize in Economic Sciences in 1971 — in only the third year in which it was awarded — for his empirically founded interpretation of economic growth.⁴ And, at the close of the 20th Century, the U.S. Department of Commerce concluded that the invention of the national economic accounts was its greatest achievement of the century (BEA 2000).

Learning lessons from history (GDP is not a dirty word)

As mentioned, the development of national accounts arose from the need to understand the state of the economy during the Great Depression.

Today, issues and pressures around the environment, particularly climate change, the use of natural resources and questions about patterns of development have raised concerns that continued use of the Earth's limited resources at current (or increasing) rates may endanger the economic possibilities available to our descendants. These concerns are driving demand for additional measures to better understand and inform policy to promote sustainable development — as highlighted, for example, by Jose Manuel Barroso: 'we

⁴ The first Nobel Prize in Economic Sciences was awarded jointly to Ragnar Frisch and Jan Tinbergen in 1969, followed by Paul Samuelson in 1970 (<http://nobelprize.org/>).

cannot face the challenges of the future with the tools of the past' (Beyond GDP 2007). As with the national accounts in the 1930s, what we require are indicators better suited to helping measure and address the challenges of today.

An increased focus on progress has led to an abundance of measures. The demand for better indicators of wellbeing and the sustainability of wellbeing (discussed below) are arguably precursors to the next phase in the development of our modern statistical systems. Over the past two decades there has been an explosion in the number of alternative indicators, and a surge of initiatives tasked with developing new indicators of performance — economic, social, environmental, political and others. This explosion is not surprising given the multi-dimensional nature of progress, but the problem from a policy making perspective — and from the perspective of broader community acceptance — is that the abundance of measures can lead to confusion. Not surprisingly, different perspectives and different measures can provide conflicting signals. Sometimes, it is hard to keep sight of the big picture.

The Australian Bureau of Statistics (ABS) has identified over 70 indicator projects worldwide and about 50 for Australia alone — and they are still counting. Before developing competing sets of indicators, there are lessons to be learnt from history.

It is useful to draw on the factors that have made GDP, and more generally, the system of national accounts, such a success, separate from it meeting a clear need. Three in particular are worth highlighting: GDP is a simple and straightforward measure; national accounts are based on a conceptual framework, grounded on a clear understanding of the problem; and the national accounts are largely based on a set of international standards. These factors have assisted greatly in obtaining community acceptance. It is also the case that GDP provides important and useful information. For example, as a measure of market production, GDP is a useful tool in managing the macroeconomy because it is a key measure of the level of economic activity, and hence employment, in the market sector. Also, while far from perfect (see below), GDP per capita is still a useful measure of material living standards.

A problem is that, over time, GDP has been interpreted as a broader measure of progress by some policymakers, commentators and the public. This is despite a clear understanding by the inventors of the national accounts that 'the welfare of a nation can, therefore, scarcely be inferred from a measurement of national income' (Kuznets 1934, p.7). While it is true that GDP provides important and useful information, focusing on a single measure, for purposes for which it was never intended, and using it without acknowledging its limitations can lead us astray.

Statistics are admirable attempts at summarising complex activities taking place in society, and will invariably involve compromises. This is not a concern as such, as there are nearly always good reasons for these compromises (Stiglitz *et al* 2009). However, it is of concern if the users of these measures are unaware of their limitations.

This suggests a cautious approach to adopting new measures. Just as one number cannot tell us all we need to know about the economy, it will not be possible to develop a new single measure that can give us a complete summary of society's progress. After all, you cannot capture happiness on a spreadsheet any more than you can bottle it (Cameron 2010).

With this in mind, it is important to confine the use of measures to the purposes for which they are fit.

Measuring progress – beyond GDP

The Stiglitz-Sen-Fitoussi Report stressed that progress is more than increases in income, wealth or production (Stiglitz *et al* 2009). Nevertheless, we continue to struggle to adopt a consistent broader focus in defining and measuring progress.

There have been a number of reports outlining the limitations of GDP as a measure of progress, and recommendations for alternative measures. Alternative indicators of progress generally fall into one of three categories:

- *Adjusting* GDP usually involves adjusting traditional measures of economic performance to include

environmental and social factors.

- *Replacing* GDP includes indicators that attempt to assess progress more directly. For example, by assessing the achievement of basic human functions (like the Human Development Index) or average satisfaction (like the Happy Planet Index).
- *Supplementing* GDP includes approaches designed to complement GDP with additional environmental and/or social information (such as dashboards).

While it is beyond the scope of this paper to discuss all the various measures, a few alternate measures of progress are worth mentioning.

Adjusting GDP

A number of adjustments to GDP can be made to provide some, albeit limited, insights. In particular, being a measure of market production, GDP misses a significant amount of household activity as it excludes home production of goods and services (other than imputed rents). It does not measure appropriately the goods and services of the public sector. In fact, this was highlighted by Pigou who noted that ‘if a man marries his housekeeper or his cook, the national dividend is diminished’ (Pigou 1920, p.26).

Importantly, household income and consumption are more relevant measures of living standards than is real GDP. Real GDP ignores the income changes that arise from changes in the terms of trade which can be significant particularly for commodity exporting countries. In addition to terms of trade effects, divergences between production and domestic income may also arise where there are net foreign transfers — for example, the repatriation of profits to foreign investors. Thus, while higher foreign investment may increase profits and therefore GDP, profits repatriated by foreigners do not enhance the purchasing power of domestic residents. Adjusting for these effects would result in a more comprehensive measure of (material) progress.

GDP is also a gross measure, and therefore does not take into account the depletion of the capital stock; a cost associated with the production of output due to the erosion of an asset. Depreciation effectively means a proportion of output needs to be set aside to renew or replenish asset stocks. Removing depreciation of the physical capital stock converts GDP into Net Domestic Product (NDP). The theoretical foundation for NDP in terms of welfare was outlined by Hicks (1939) who argued that ‘the purpose of income calculations in practical affairs is to give people an indication of the amount which they can consume without impoverishing themselves in the future’. While real NDP is a better measure of what the economy is producing, and is often calculated by statistical agencies, GDP is more typically used because of the difficulties in measuring economic depreciation.

While NDP makes allowance for the depreciation of physical capital, the depreciation, or degradation, of environmental capital and resource depletion is often overlooked. Take for example the treatment of natural resources. The value of extracted natural resources is treated as production, an increase in GDP. However, natural resources are assets already owned by the community. Their extraction and sale represents the transformation of an asset (the natural resource) into another asset (cash). By not counting the depletion of the natural resource asset, production or valued added, as measured by GDP, is overstated, possibly at the expense of the wellbeing of future generations. Measures such as Green GDP, the Index of Sustainable Economic Welfare, the Genuine Progress Indicator and Adjusted Net National Income, all adjust GDP for environmental degradation, resource depletion or both.

As GDP can be adjusted to incorporate depreciation of physical capital, resource depletion and environmental degradation, so too can measures of wealth (and savings). Gross National Savings measures how much the country is saving for future consumption. Adjusted net savings (or Genuine Savings) measures the true rate of savings in an economy after taking into account depreciation, investment in human capital, depletion of natural resources and damage caused by pollution. Accounting for resource depletion and environmental degradation can provide interesting insights into whether countries are developing sustainably. A country that raises current consumption by running down its capital stocks, or by borrowing, may increase

current wellbeing, but possibly at the expense of its future wellbeing.

Replacing GDP

Addressing the issues with GDP outlined above will get us somewhat closer to better understanding material wellbeing. However, there are arguably a number of other dimensions which are also important for wellbeing. These include health, education, personal activities including work, political voice and governance, social connections and relationships, the environment and insecurity. Many of these non-material dimensions of wellbeing are reflected in Treasury's wellbeing framework. These non-material dimensions raise significant measurement difficulties for economists and statisticians. For example, a key dilemma for the 'capabilities approach' has been how to measure what people *could* do, as opposed to what they *actually* do. Non-material dimensions of wellbeing, both objective and subjective, have driven the development of measures that either replace GDP or supplement it.

One of the most widely known measures of progress that attempts to incorporate some of these non-material dimensions is the Human Development Index (HDI), developed by Mahbub ul Haq and Amartya Sen for the first Human Development Report in 1990. The HDI is a summary measure based on three aspects of human development: health (life expectancy at birth), education (mean years of schooling) and income (GNI per capita). Environmental issues are not considered.

Two prominent indicators that take into account environmental considerations are the Ecological Footprint (EF) and the related Ecological Balance (EB). The EF measures the area of land required to sustain a given population at present levels of consumption, technological development and resource efficiency. The EB measures the extent to which the ecological demand of an economy stays within or exceeds the capacity of the biosphere to supply goods and services.

The Environmental Sustainability Index (ESI) expands on traditional environmental measures of progress by incorporating institutions, in particular an economy's capacity to improve its environmental performance over time. This is done by measuring social and institutional capacity and global stewardship.

Incorporating and considering subjective measures of wellbeing has proven significantly more difficult. The Happy Planet Index (HPI), introduced in 2006 by the New Economics Foundation (*nef*), is an index of human wellbeing and environmental impact. The indicator is based on two objective indicators, life expectancy and ecological footprint, and one subjective indicator 'life satisfaction'.

Supplementing GDP

Given the difficulty of constructing single indexes, of estimating monetary equivalents for environmental and social indicators of progress, and of ensuring indicators are based on a common framework, a number of measures have also been developed to supplement GDP.

One approach used by a number of agencies, and also recommended by Stiglitz *et al* (2009), is the presentation of a select set or 'dashboard' of indicators to complement traditional economic measures. One example of this is the ABS *Measures of Australia's Progress* (MAP) publication. MAP presents approximately 80 headline and supplementary indicators which are split into three pillars of society, economy and environment. The ABS has long been acknowledged as a leader in the development of national account statistics, and has been influential in looking at new ways of measuring wellbeing and progress. The ABS started developing MAP in the late 1990s, and released the first MAP report in 2002, in response to the growing understanding that GDP should be assessed in conjunction with other measures spanning society and the environment as well as the economy.

Another measure supplementary to GDP is the United Nations' *System of Integrated Environmental and Economic Accounting* (SEEA). The SEEA is a satellite system of the System of National Accounts, which means that accounts produced under this standard bring environmental and economic information together within a common framework.

Different measures; different conclusions

The previous section briefly covered a small subset of the various measures of progress currently being promoted or developed. Even an examination of this small subset makes clear that the various measures focus on different aspects of progress. This different focus will have implications for the conclusions drawn — which in turn can have potentially different implications for public policy.

Comparing different indicators for a large sample of countries highlights the extent of the discrepancies across different measures of progress. This section of the paper compares six different measures of progress with each other and with per capita GDP.⁵ The measures are: the Human Development Index (HDI), Adjusted Net Savings (ANS), the Environmental Sustainability Index (ESI), the Ecological Footprint (EF), the Ecological Balance (EB) and the Happy Planet Index (HPI).⁶

Figure 1 presents scatter plots highlighting the relationship between all the selected indices. For most cases the relationship between indicators appears weak.

Most indicators have a positive relationship with per capita GDP, with the exception of EF and EB. The negative relationship between per capita GDP and EF (and to a lesser extent EB) reflects the link between EF and consumption patterns (and therefore income). Under the EF economies with higher levels of consumption will generally perform worse. This is not always the case for EB, as EB is also based on an economy's biocapacity. For example, Australia performs poorly against the EF, ranked 117 of the 120 countries, due to its high grazing, cropland and carbon footprints. However, Australia's biocapacity is significantly larger than its footprint and therefore has an ecological surplus unlike many advanced economies, and is ranked 6 on EB.

Interestingly the ESI, another environmentally based measure, typically has a positive relationship with most other measures. This is likely due to the inclusion of institutional factors in the index, with developed countries performing better on environmental policies, quality of institutions and global interaction. The positive relationship between per capita GDP and ANS is likely to reflect the greater capacity for developed economies to accumulate human and physical capital. The relationship between per capita GDP and the HPI is the weakest.

The scatter plots also highlight the conflicting conclusions that can be drawn from the various measures. For example, comparing ANS and EF (which are considered measures of sustainability), all points below 5.1 acres per person on the horizontal axis would be deemed unsustainable from an EF perspective, and all points below zero on the vertical axis would be considered unsustainable under the ANS. This divides the plot into quadrants reflecting: sustainable under both measures, unsustainable under both measures, sustainable under the ANS only, and sustainable under the EF only. There are 62 countries deemed unsustainable under the EF but sustainable under the ANS (mostly developed economies) and 11 countries deemed unsustainable under the ANS but sustainable under the EF (mostly low income countries).

The variation in conclusions across the various measures is highlighted further in Figures 2 and 3 which present the rankings of the indicators for selected advanced and developing economies. Developed economies perform worse on environmentally based measures such as the EF and EB, but perform better on the broader based measures, such as ANS, HDI and ESI. The opposite is the case for developing economies which typically have lower life expectancy and education, reducing their performance against the HDI (and the ANS); they don't have strong institutions reducing their relative performance against the ESI; and they have less capacity to invest in human capital and physical assets reducing their performance against the ANS.

One of the reasons for the different outcomes from the different measures is, of course, their focus on different aspects of progress. Some focus on material aspects (GDP), some on socio-economic aspects (HDI)

⁵ Altili (2010) presents detailed comparisons of different sustainability measures.

⁶ These measures were chosen because they are calculated for wide range of developing and developed economies, they are calculated by and use data collected by reputable international institutions (IMF, World Bank, Yale University, WWF and *nep*) and data were available for the same period (2005).

while others are environmentally focused (EF, EB and ESI). Another key difference is that some attempt to measure current wellbeing (HDI), while others focus on whether current levels of wellbeing can be maintained, or sustainability (ANS, EF and EB).

The distinction between current wellbeing and sustainability is important, and was highlighted by Stiglitz *et al* (2009) who made a case for the separate measurement of current wellbeing and sustainability. The two concepts are closely linked, as the wellbeing of the current generation may be affected by intergenerational considerations, although clearly future generations cannot care for the wellbeing of generations that came before them. Put another way, current wellbeing is affected by the way in which current resources are used, while sustainability is only affected if the stock of resources itself is affected (Neumayer 2004).

While most sustainability measures are focused on intergenerational equity, measures such as the Index of Sustainable Economic Welfare and the Genuine Progress Indicator attempt to combine measures of current wellbeing and intergenerational issues together. Other measures of sustainability, where the focus is solely on intergenerational issues can be divided into two distinct approaches: those where various forms of capital are assumed to be substitutable, at least to some extent (weak sustainability), and those where substitutability is rejected (strong sustainability), which has typically been the focus of environmental sustainability.

Measuring sustainability

What is sustainability?

One of the reasons for the significant number of alternative approaches to measuring sustainability is that, beyond the basic idea of sustainability, there is no common understanding of what it actually entails in practice. As Anand and Sen (2000) put it, 'economic sustainability is often seen as a matter of intergenerational equity but the specification of what is to be sustained is not always straightforward'.

This naturally leads us to the question of what is sustainability?

Sustainable development began to gain wide acceptance as an important societal goal following the Brundtland Report, *Our Common Future*. The Brundtland Report established a conceptual basis for sustainable development and produced what has become the most widely recognised definition of sustainable development: 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987).

But how can we interpret this definition? One interpretation, which is consistent with Treasury's wellbeing framework, is that sustainability requires that at least the current level of wellbeing per capita be maintained for future generations. In this regard, sustainability can be seen as requiring the per capita stock of capital, or the productive base for wellbeing, bequeathed to the next generation to be at least as large as the stock the current generation itself has inherited (Arrow *et al* 2004, Dasgupta 2007a).

This gives us a clear link between the concept of current wellbeing and sustainability. The wellbeing of a generation is determined by the productive base or 'stock' of resources inherited from previous generations and the choices that generation makes. The stock of resources inherited by a generation influences the set of opportunities available to them.

The choices made by a generation will dictate the quantity and quality of the stock of resources available, or 'bequeathed', to future generations. In some instances, choices made by a generation that raise their wellbeing will necessarily expend a particular component of the stock of resources. For example, the consumption of non-renewable resources by one generation will reduce the quantity of non-renewable resources bequeathed to subsequent generations. In other instances, the choices made by a generation that raise their level of wellbeing may result in an increase in the endowment of resources bequeathed to future generations. Human capital, such as education, is one example. A reduction in the endowment of a particular component of the stock does not necessarily lead to a reduction in the wellbeing of future generations if, for example, the use of that component of capital is converted into another form of capital (such as reinvesting

the proceeds from the exploitation of natural resources into human capital) or where technological advancements increase the range of opportunities available in the future.

An economy's productive base includes all capital relevant for the determination of wellbeing. An economy's productive base therefore includes not only its capital assets (stocks of manufactured and human capital) but also its natural capital (stock of environmental capital) and its institutions (stock of social capital). These are often referred to as the three pillars of sustainability — economic, environmental and social capital. The productive base, therefore, refers to the quantity and quality of all the tangible and intangible economic, social, human and environmental resources available to a generation. This stock of resources comprises a multitude of tangible and intangible elements that are interrelated and, not surprisingly, difficult to define and measure.

The challenge for each generation is making choices about the use of the stock of resources without knowing what knowledge and technological advancements will be available to future generations. Whether an economy is sustainable or not therefore is a question of whether the economy's productive base is being maintained or enhanced, or alternatively is contracting (Dasgupta 2007a).

Why output based measures will not do

Since sustainability relates to the change in an economy's productive base, it is easy to see why GDP and related measures, (such as HDI, green GDP, and GPI) are insufficient for assessing sustainability. For example, green GDP measures only what can be consumed in a period. But for sustainability we are interested in comprehensive investment — the difference between comprehensive production and consumption (Stiglitz et al 2009). To put it another way, instead of measuring current consumption, ideally what we require is a measure of over (or under) consumption — how much we draw down (or add to) our productive base in generating current wellbeing.

Therefore, while it is possible that an economy's productive base could grow along with GDP, it is also possible for an economy's productive base to shrink while GDP grows. One example of this is the exploitation of natural resources to fund current consumption. While the increased consumption will lead to higher GDP, where natural resources are not replaced with another form of capital of equal value, the productive base available to future generations may be eroded. Of course, the productive base available to future generations includes advances in knowledge and technology, which may compensate fully (or more than fully) for the depletion of at least some natural resources. However, if the economy's productive base is shrinking, at some point GDP would decline, the problem is that this could take some time, and possibly be recognised only when it is too late.

How can we measure sustainability?

There are two ways to use the stock based approach to measure sustainability. One version, consistent with Adjusted Net Savings, is to try to convert all stocks, economic, environmental and social into a monetary equivalent. This approach implicitly assumes that different forms of capital are substitutable or shadow prices can be correctly estimated. The second approach examines variations in each stock separately, with the degree of substitutability a matter for judgment, but with the main focus on ensuring that a particular stock does not fall below a critical threshold. At the extreme, sustainability is achieved where the specific stock does not decline at all, which of course implies complete non-substitutability. The Ecological Footprint is an example of such a measure.

From a policymaking perspective, it is important to recognise the complex inter-relationships between economic, environmental and social capital, and ensure policy is directed towards social optimal use.

Measures that attempt to convert stocks into a monetary equivalent would appear to show the most promise in this regard. However, such measures are often criticized because of the implicit assumption of substitutability between different forms of capital (weak sustainability). It is without doubt that capital assets will differ in their ability to be substituted with one another, and there are some forms of (natural) capital we

cannot replace. At one level, we could expect the price of each type of capital good to appropriately reflect its scarcity, but this is only the case for well functioning markets. For many natural resources, markets do not function well; in many cases they do not exist. As such, in order to be able to convert stocks into a monetary equivalent, we need to calculate shadow prices, which reflect the value of an asset to society — that is the increase in social wellbeing if an additional unit of the asset was made available to the economy (Dasgupta 2007a and 2007b). Ideally, these shadow prices would reflect the scarcity of an asset, where a vital asset is becoming scarce its shadow price would rise sharply, and all else being equal, it will become more difficult to replace it with another asset and hold wealth constant. By estimating shadow prices, policy makers are better equipped to consider the trade-offs between the various stocks that make up an economy's productive base.

While measures that convert stocks into a monetary equivalent show promise, as noted by Dasgupta (2007b), estimating shadow prices poses significant problems. Current measures are crude at best, and it is widely acknowledged that more work needs to be done. One significant problem is that for many stocks, particularly environmental and social capital, placing a monetary value on them is very difficult. Stiglitz *et al* (2009) recognised this and recommended that a monetary index of sustainability be complemented by a limited set of physical indicators to monitor the environment — particularly in the case of irreversible or discontinuous alterations. Such an approach seems entirely sensible as we determine better ways to value the environment.

The Australian Government's 2010 *Intergenerational Report* was one attempt to do this. The previous two Intergenerational Reports focused on fiscal sustainability, whereas the 2010 Report expanded the concept of sustainability to consider the environment. This report presented a range of indicators including threatened and extinct species and estimated vegetation cover. This was a first step but a lot more needs to be done before we can say it has been done well.

The inter-relationships between economic, environmental and social capital

Given the significant differences in the measures of progress highlighted earlier, we should ask what are the likely consequences of our current approaches to measuring wellbeing and sustainability?

The absence of a clear conceptual understanding of 'progress' has led some to formulate their own interpretations of the concept, or to use a definition that reflects their own value judgments. The lack of a clear conceptual framework for measuring progress combined with a lack of understanding of the limitations of the alternative measures of progress has led certain groups to try to impose their sets of values on the rest of society. This has led to confusion around measures of current wellbeing and sustainability, and a polarised debate on the elements that should be considered when measuring them.

Just as using GDP as a measure of progress can be misleading because it only measures market production, using other indicators that focus on other specific elements of wellbeing or sustainability could also lead us astray. Measures that confuse current wellbeing with sustainability can mislead because they do not measure 'overconsumption'. This does not mean that these other indicators are not useful. It simply means that, if we are to use indicators to develop and assess policy, we need to be clear about what they measure and their limitations.

In the case of measures of sustainability, the polarised debate has resulted in sustainability often been taken as to mean outcomes that are 'environmentally desirable' (Pezzey and Toman 2002). This is clearly the case for measures based on the strong form of sustainability. As outlined in Treasury (2002), the key risk of such a polarised debate is that it can lead to the pursuit of policies that are not consistent with sustainable development. For example, policies to protect the environment that do not take into account economic and social consequences can clearly violate sustainable development principles, just as poor economic policies can lead to excessive environmental degradation. In addition, what is less appreciated is that policies pursued under the sustainable development banner may involve implicit trade-offs between different environmental pressures (Treasury 2002). For example, policies focused solely on addressing a particular environmental

issue may lead to environmental problems elsewhere.

Conclusion

'...an adequate command of modern statistical methods is a necessary (but not sufficient) condition for preventing the modern economist from producing nonsense...'

(Schumpeter 1954)

Thinking about wellbeing and progress, and how to measure them, is probably among one of the oldest pastimes of humankind. And yet it seems that history continuously repeats, and we find ourselves trying to reinvent the wheel with 'new' measures, or worse still, ignoring the lessons provided by history. We currently have an array of different measures of progress, from which it is sometimes possible to derive different conclusions. This is not necessarily problematic, provided the users of these measures are familiar with their construction and limitations.

We have not yet developed any single measure to summarise all that wellbeing and progress encompass, and it is fair to say that we are unlikely to. It follows, that we — policy makers, commentators and the public — ought not to rely on any single measure to provide us with an assessment of the quality of individual lives or the cohesion of society. From a policy making perspective, it is important to recognise the complex inter-relationships between economic, environmental and social capital, and to be explicit about the value judgments we use when considering tradeoffs so as to ensure policy is directed towards socially optimal outcomes. Further, we must guard against creating confusion with a plethora of measures. Currently, there is seemingly little coordination between various measures. Perhaps it is the role of the modern statistician to improve the organisation and dissemination of data, in order to capitalise on the existing momentum of demand for better measures of wellbeing. Of course improving the quality of our conceptual frameworks and metrics will only help with this endeavour.

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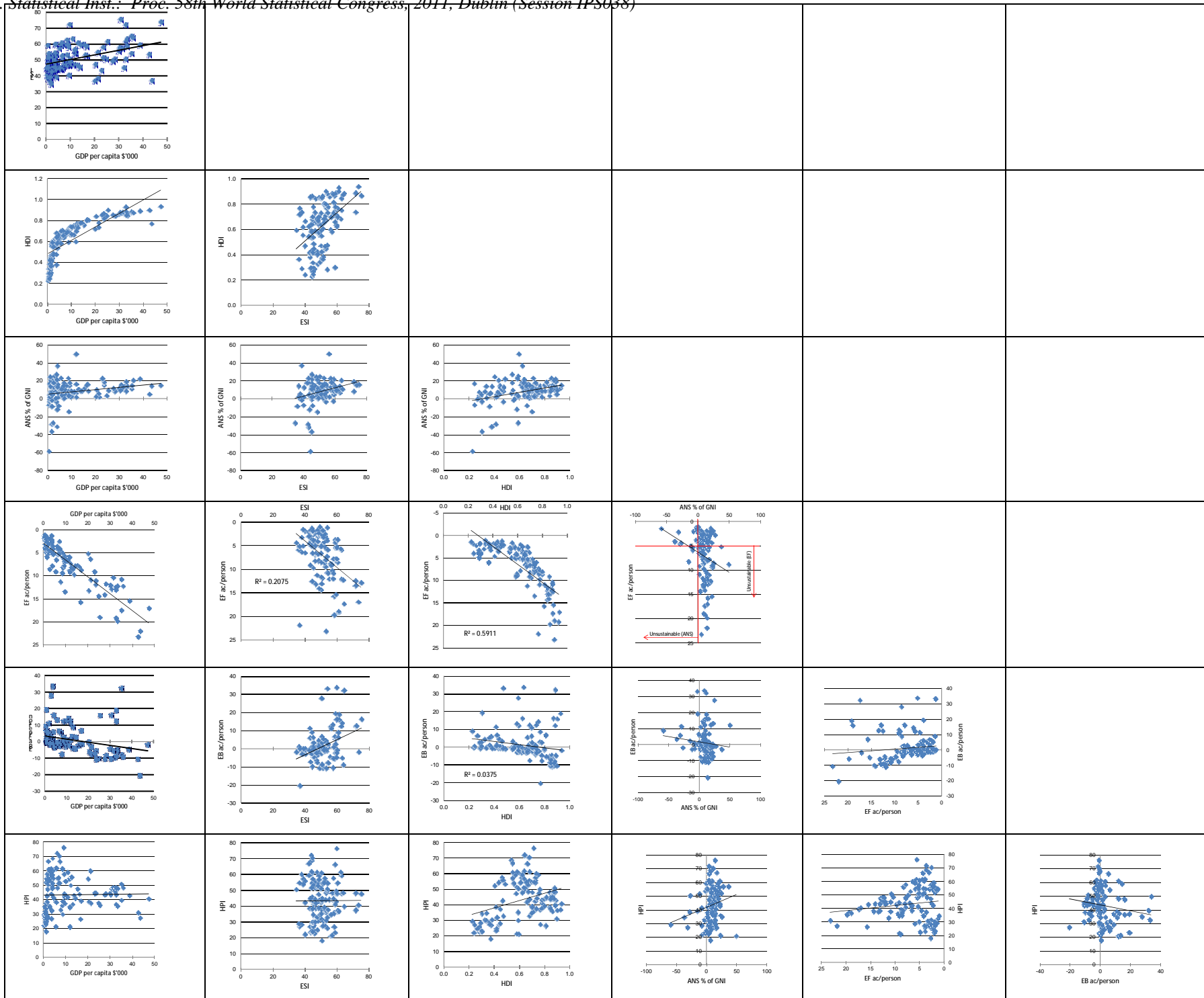


Figure 2: variation across measures for selected advanced economies

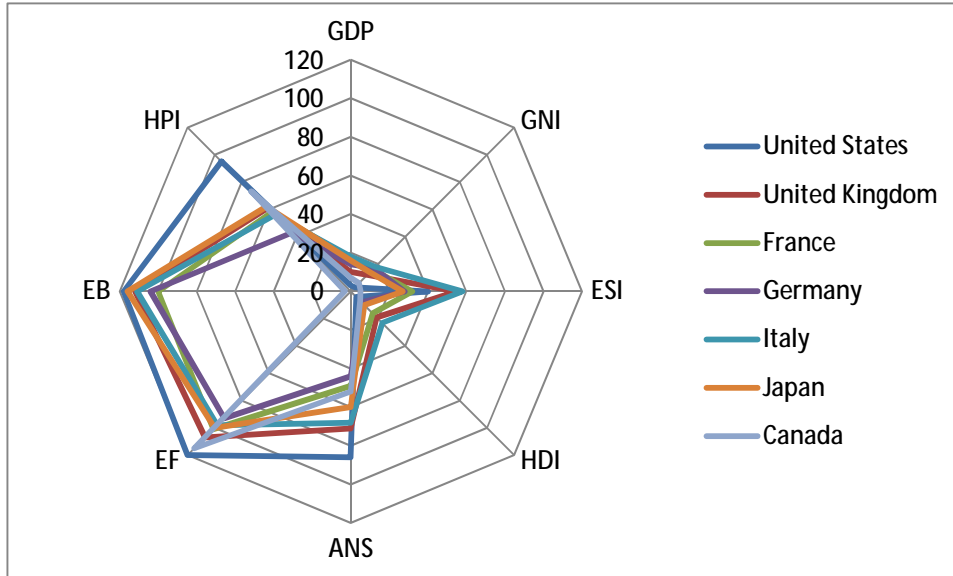


Figure 3: variation across measures for selected developing economies

