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Macroeconomic Measurement:
Environmental and Social Dimensions

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An ECI Teaching Module on Social and Environmental Issues in Economics

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NOTE – terms denoted in **bold face** are defined in the **KEY TERMS AND CONCEPTS** section at the end of the module.

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1. INTRODUCTION

In the 80-plus years since the introduction of national income accounting in major industrial countries, GDP has become the official barometer of living standards and business cycles. It appears in newspapers and political debates as an indicator of economic, political, and social progress and it is widely used in formulating national and international policies.

Although GDP numbers are widely used as a proxy for national success, GDP was never intended to play such a role. Economists dating back to Simon Kuznets, the originator of U.S. national accounting systems, have warned that GDP is a specialized tool for measuring market activity, which should not be confused with national well-being. National well-being is affected by social and environmental factors, such as inequality, political participation, security, quality of healthcare and education, and access to clean air and water, which are no less important than marketed economic activity. In order to measure economic well-being more accurately, national governments need to create new indicators that account for these factors. The metrics used to measure well-being have important implications for designing and assessing economic policies, going beyond GDP growth as an economic goal.

Before we discuss specific options for adjusting, replacing, or supplementing GDP, we need to ask three important questions:

1. *What should we measure?* GDP measures only economic production. Are there some things that GDP excludes that should be included as a component of well-being, such as health outcomes or environmental quality? Should some parts of GDP be excluded because they actually harm well-being?
2. *What should be used as the unit of measurement?* GDP is measured in dollars, but what units should be used to measure other variables affecting wellbeing, such as education, health, levels of crime, or environmental quality?
3. *Should we seek to combine disparate well-being indicators into a single "bottom-line" number, or should we keep the variables disaggregated (i.e., split up into component categories)?* One tempting approach is to convert all variables to dollars to allow for comparability. But what techniques can we use to measure variables such as environmental quality or social capital in dollars, and should we even try?

This module presents some alternatives to national accounting that address these questions and reflect our growing awareness of the importance of social and environmental contexts of economic activity. We begin by listing some of the limitations of GDP as a measure of well-being, and then discuss how the alternative indicators attempt to tackle these limitations.

2. WHY GDP IS NOT A MEASURE OF WELL-BEING

GDP was never intended to measure well-being. As suggested in Box 1, GDP often rises with increases in things that most people would want to have less of, while it often fails to rise with positive contributions to individual and social well-being that are not bought and sold in markets. Even if increases in GDP contributes to increasing well-being, *ceteris paribus*, many other factors, such as inequality levels, environmental quality, and work-life balance, may be equally or more important in determining well-being levels. Thus, if we rely only on GDP to measure well-being, we may obtain policy prescriptions that focus only on the money value of

output, with too little attention to questions of what is being produced and how it affects human well-being.

BOX 1: THERE'S NO G-D-P IN "A BETTER ECONOMY"

The United States is the largest economy in the world, ranked by total GDP. In terms of GDP per capita, it ranks high but falls below some other countries such as Luxembourg, Norway, Ireland, and Switzerland.[1] But how significant is this measure?

"Gross domestic product has become the most watched and most misinterpreted of all economic indicators. It's a measure of economic activity—of money changing hands. Despite the mundane nature of this economic indicator, politicians fiercely compete with each other to see who can promise the fastest GDP growth. Government programs and investments in technology get the green light only when they are predicted to spur GDP growth. Economists, bankers, and businesspeople pop the champagne corks when they hear 'good news' about quarterly GDP numbers.

"And while the United States leads in GDP, it also leads in military spending and the number of people in prison. These other first-place finishes seem at odds with America's position atop the GDP standings—that is, until you realize that spending on war, incarceration, and disease, as well as other 'defensive expenditures,' all count toward GDP. The arithmetic of GDP doesn't consider what the money is actually being spent on, and over time, we've been spending more and more money on remedial activities and calling this 'progress'."[2]

Alternative GDP indicators can be constructed that correct for these negative aspects of production, as well as taking into account positive factors such as a clean environment, household production, or volunteer work that contribute to well-being but are not included in GDP. Such indicators have drawn increasing interest from economists and policymakers in recent years.

Many important issues are not included adequately, if at all in GDP. In addition, some things that are included in GDP can be misleading or represent harmful activities.

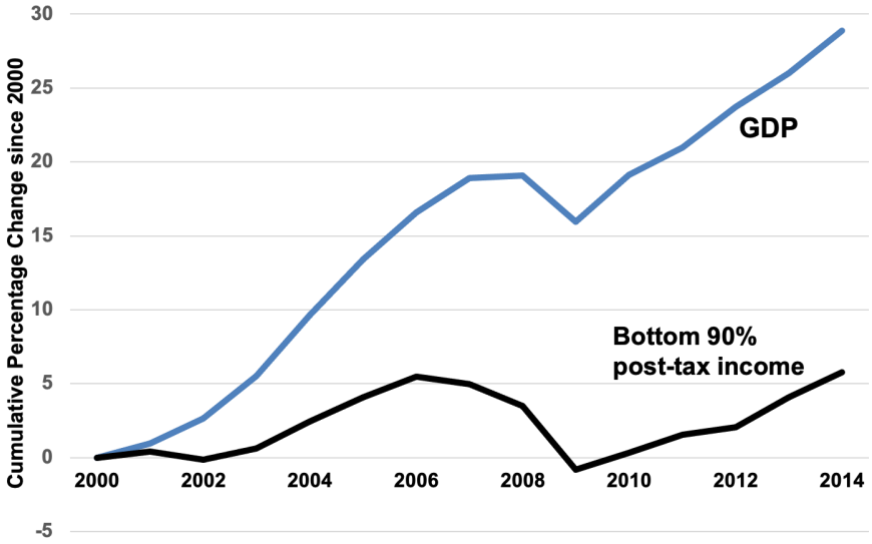
- A critical issue is *household production,* which is examined in Section 4 of this module. While standard accounting measures include the paid labor from such household activities as childcare and gardening, these services are not counted when they are unpaid.
- Standard measures do not count the benefits of *volunteer work,* even though such work clearly contributes to social well-being. Also, the free services provided by many non-profit organizations (e.g., a homeless shelter funded by donations) go unaccounted for, even if the workers in the organization are paid.
- Some other significant *services provided for free,* such as free services from Wikipedia, which relies on unpaid volunteer work, are not counted, even though they might increase well-being.

[1] Based on 2020 data from the World Development Indicators, World Bank.
[2] Dietz and O'Niell, 2013.

- *Leisure* is another important neglected factor. A rise in output might come about because people spend more time and effort on paid work. The resulting increase in measured output does not take into account the fact that overwork makes people more tired and stressed and takes away from time that they could use for enjoying other activities. But if people spend more time as leisure, increasing their well-being, this will not be reflected in GDP (except insofar as they spend money on leisure-related activities).
- Also inadequately reflected are issues around loss (or gain) of *human and social capital formation.* Social and political factors that may significantly affect well-being include the health and education levels of a country's citizens, as well as political participation, government effectiveness (or lack thereof), and issues of trust, corruption, or other aspects of the economic and social culture. Expenditures on health and education are counted in GDP, but may not reflect the full picture, since some factors contributing to health and education outcomes come from unpaid activities.
- Another significant criticism of GDP, when used as a general measure of economic progress, is that it generally does not account for environmental degradation and resource depletion, and treats natural resources that do not go through the market (such as the water purification services provided by natural systems such as forests and wetlands) as having no monetary value.
- Some outputs merely compensate for, or defend against, harmful events that result from the economic activity represented in GDP. Referred to as **defensive expenditures**, these show up as positive contributions to GDP, but standard GDP measures do not account for the associated negative impacts. Consider, for example, the 2011 Deepwater Horizon oil spill in the Gulf of Mexico. The billions of dollars spent in clean-up efforts were counted as positive additions to GDP, while environmental and human losses caused by the spill were mostly not accounted for at all. When environmental issues are mostly invisible, there can be an appearance of economic growth even as the ecological basis for future economic health is being seriously undermined.
- *Products or production methods that reduce, rather than increase, well-being* may show up as additions to GDP. Unhealthy foods and drugs and dangerous equipment, for example, may lower, not raise, overall well-being. Even if people are willing to pay for such goods and services, such decisions might reflect poor information or bad judgment. In terms of production methods, if people are miserable at their jobs, suffering boring, degrading, or harmful working conditions, their well-being is compromised. The divergence between output and well-being is especially obvious in cases where workers' lives or health are threatened by their working conditions, even while their work results in an increase in GDP.
- Another gap between GDP and well-being is *financial debt.* GDP counts consumption levels as rising even if the rise is financed by unsustainably large debt burdens, whether the debt is held by consumers or by governments. When debts are high enough to require painful changes in future consumption, not accounting for financial debt is similar to not accounting for unsustainable tolls exacted on the natural environment.
- Finally, increased economic activity in a given country is counted as an addition to GDP even if it increases inequality. Two countries with the same per-capita GDP may have a significantly different income distribution and, as a result, different levels of well-being. At an individual level, if someone making just $20,000 per year receives a raise of $1,000, this is counted as the same societal gain as it would be if that raise went

to someone with an income of $100,000. Obviously, the additional income means much more for the individual well-being of the person with the lower income. Although economists generally accept this concept (called the diminishing marginal utility of income), GDP counts income gains the same regardless of whether the person receiving the increase is rich or poor. The failure of GDP to account for inequality is illustrated in Figure 1, showing a significant rise in U.S. GDP over the last two decades, while average income for a majority of the population has barely risen.

Figure 1. *Cumulative Changes in GDP and Average Incomes of the Bottom 90 Percent of Earners since 2000*



Sources: Piketty, Saez and Zucman, 2016; Bureau of Economic Analysis; Leonhardt, 2018.

The foregoing examples all indicate the dangers of pursuing policies geared only to raising GDP. A narrow national focus solely on increasing output may result in decreased leisure and less time for parenting, friendships, and community relations; it can increase levels of stress and mental illness, raise economic inequality, or cause environmental degradation. For all these reasons, improvements are needed in the design of measures of national success. The next section describes some leading alternative measures.

3. A BROADER VIEW OF NATIONAL INCOME ACCOUNTING

A number of national and international initiatives have been taken to create alternative indicators that account for social and environmental factors in measuring economic progress. One approach to creating alternative indicators focuses on refining measures of national assets and production, supplementing the National Income and Products Account (NIPA) framework with information on resources and environmental impacts. Another approach involves developing separate indicators for the different aspects of well-being and using these additional measures in combination with GDP to get a better assessment of well-being. Other measures rely on creating wholly new indicators based on a composite index including a set of variables measuring different aspects of well-being. Examples of some of these indicators, along with their estimation and application, are presented in this section.

3.1 Satellite Accounts

Satellite accounts supplement standard national income accounts by tracking data on well-being indicators, such as health, education, and other aspects of social and environmental well-being.[3] For example, the United Kingdom maintains environmental accounts that track data on forested area, oil and gas reserves, waste generation, greenhouse gas emissions, and expenditures on environmental protection.

Satellite accounts can be viewed as a "dashboard" approach to national accounting. The dashboard on a car provides indicators of speed, temperature, battery level, and miles driven per gallon of fuel. Though the economy is considerably more complex than a car, a set of indicators that measure various aspects of well-being can be used to measure economic health. Proponents of this approach agree that GDP is a useful measure of national output for historical and international comparisons, but believe that GDP tells us only one of the things that we want to know about the economy. Some of the things that it does not tell us are important, and they deserve to have their own indicators.

The U.S. Bureau of Economic Analysis (BEA) uses dollar-denominated satellite accounts to highlight certain existing components of GDP by presenting data on some special topics.[4] These topics include arts and cultural production, outdoor recreation, travel and tourism, and health care (measuring spending on health care classified by diseases being treated instead of goods and services purchased). More recently satellite accounts to measure the economic contribution of small businesses, the digital economy, the marine economy, and the space economy have been added to the BEA accounts. These satellite accounts eliminate some of the obscurity in the aggregate GDP measure, by estimating the contributions of particular sectors to the national income.

The BEA also tracks the value of unpaid work in the Household Production Satellite Account, based on surveys that ask people how they spend their time (time-use surveys). Unlike the other BEA satellite accounts that are incorporated within broader statistics like GDP, household production measures are not included in BEA's other statistics.

The BEA has explored "an accounting framework that covers the interactions of the economy and the environment".[5] Future uses of satellite accounts in the BEA may start counting environmental damages as losses.

In general, the BEA's satellite accounts rely on monetary valuation and are readily comparable to GDP. Other countries use satellite accounts in which the unit of measurement is physical units such as tons of carbon dioxide emitted or numbers of children in poverty. Even where resources can be easily valued in dollars, data in physical units may be more meaningful. Consider that we can measure the economic value of mineral reserves by multiplying the quantity of reserves in physical units by the market price. But suppose that the market price

[3] The United Nations differentiates between "internal" satellite accounts (those that are linked to standard accounts and typically measured in monetary units) and "external" satellite accounts (not necessarily linked and measured in either physical or monetary units). See: http://unstats.un.org/unsd/nationalaccount/AEG/papers/m4SatelliteAccounts.pdf.
[4] Information on BEA Satellite Account is available at: https://www.bea.gov/resources/learning-center/what-to-know-special-topics
[5] BEA, 1994.

increases considerably at the same time that reserves are drawn down. Although the economic value of reserves could increase due to the higher prices, the dollar valuation would fail to tell us that our physical reserves have declined.

Moreover, it is often very difficult to convert some variables to monetary units. How can we express changes in crime levels or health status in terms of dollar values? Such questions raise important methodological issues, such as whether the economic value of higher asthma rates includes only medical expenditures and lost productivity, or whether other quality of life factors need to be considered. Some people may also raise ethical objections to attaching dollar values to variables such as traffic deaths or biodiversity.

As we delve into additional categories that we might wish to have reported in national accounts, we may find ourselves straying into areas where measurement becomes more difficult. Thus, we can add a fourth question to our list above: Should our "dashboard" include data from surveys that directly ask people about their well-being? We consider this possibility next.

3.2 Measuring Well-Being

Recognizing the limitations of GDP and the need to develop indicators that incorporate social and environmental factors, in 2008 French president Nicolas Sarkozy created the Commission on the Measurement of Economic Performance and Social Progress. The commission, which included many distinguished social scientists, was headed by Nobel laureates Joseph Stiglitz and Amartya Sen, and coordinated by prominent French economist Jean-Paul Fitoussi.

The commission's 2009 report concluded that it is necessary to shift from an emphasis on measuring economic production to measuring well-being. It also distinguished between current well-being and sustainability, recognizing that whether current well-being can be sustained depends upon the levels of capital (natural, physical, human, and social) passed on to future generations. The commission defined well-being based on the following eight dimensions: material living standards, health, education, work and personal activities, political voice, social connections, economic and physical security or insecurity, and the environment.

Objective data can be collected that provide information on many of these dimensions, such as average life expectancy, literacy rates, and air pollution levels. But such data still do not tell us exactly how these factors relate to well-being. If the goal of economics is to promote well-being, you may wonder if we can measure it directly. **Subjective well-being (SWB)** attempts to measure well-being by asking individuals a question such as: "All things considered, how satisfied are you with your life as a whole these days?" Respondents then answer based on a scale from 1 (dissatisfied) to 10 (satisfied).

Although this approach may seem unscientific, a large body of scientific research has emerged in recent decades that suggests that data on SWB provide significant information. For example, higher subjective well-being is generally associated with good health and longevity, stronger social relationships, democracy and freedom, and better work performance and creativity.[6] A wide variety of efforts, such as the World Happiness Report, the Gallup World Poll, and the European Quality of Life Survey, have come up with remarkably consistent measures of "happiness" or "life satisfaction." The Stiglitz-Sen-Fitoussi Commission recommends using

[6] Diener, et al. 2018; Jorm and Ryan, 2013.

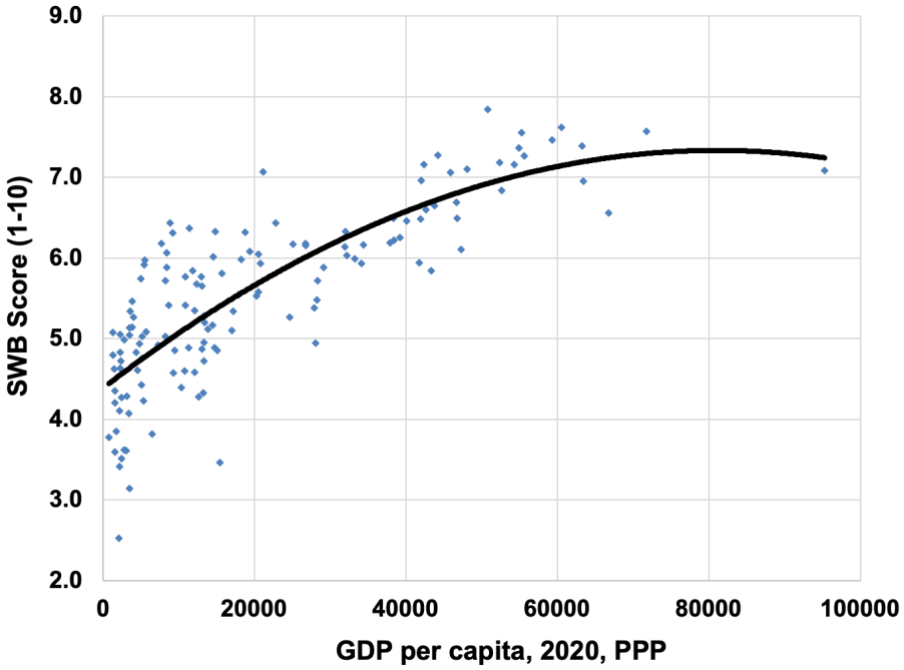
SWB data in conjunction with objective data on various well-being dimensions, concluding that:

> Research has shown that it is possible to collect meaningful and reliable data on subjective as well as objective well-being. Quantitative measures of [SWB] hold the promise of delivering not just a good measure of quality of life per se, but also a better understanding of its determinants, reaching beyond people's income and material conditions. Despite the persistence of many unresolved issues, these subjective measures provide important information about quality of life.[7]

We can ask two relevant questions about the relationship between SWB and measures of national welfare such as GDP:

1. Are average SWB levels higher in countries with higher GDP per capita?
2. As GDP per capita increases in a particular country over time, do SWB levels rise?

Figure 2. *Average Subjective Well-Being 2018-2020 and GDP per Capita 2020, PPP*



Sources: SWB from Helliwell et al., World Happiness Report 2021; GDP per capita data is from World Development Indicators online database.

Note: The trendline is a statistically fitted line showing a "best fit" estimate of the relationship between GDP per capita and SWB. "PPP" is Purchasing Power Parity.

SWB data have been collected for many developed and developing countries. Figure 2 plots average SWB against per-capita GDP, adjusted for differences in purchasing power, for 138 countries. In general, SWB is positively correlated with higher levels of GDP per capita, but note that the benefits of income gains decline at higher income levels, as shown by the curved trendline. However, SWB can be high in both rich and poor countries. For example, middle-income countries like Brazil, Jamaica, and Uzbekistan rank relatively high on the SWB index, with values greater than 6.0.

[7] Stiglitz, Sen and Fitoussi, 2009, p. 16

Figure 2 also shows that while SWB varies among richer countries, all developed countries have relatively high SWB. Almost all countries with a per-capita GDP above US$20,000 per year have an average SWB above 5.5, and countries with per-capita GDP below $5,000 have an average SWB of 4.5. Thus, it appears from this graph that for at least some developing countries, increasing GDP could lead to higher SWB levels. But income gains in richer countries are associated with much smaller increases in SWB.

The other way to analyse SWB data is to consider how SWB changes as a country develops economically over time. The longest time series of SWB data comes from the United States, dating back to 1946. While real GDP per capita has increased by about a factor of four since 1946, average SWB levels have essentially remained constant. An analysis of country trends in SWB over the period 1981–2007 found that average SWB rose in 45 of 52 countries, with economic growth associated with greater SWB gains for low-income countries. India is an example of a country that has experienced significant gains in SWB levels as its economy has grown in recent decades.[8]

Based on both approaches to evaluating SWB, the results imply that as people are able to meet their basic needs, such as adequate nutrition and basic health care, their happiness generally increases. Beyond that, further income gains are associated with smaller increases in SWB or no increase at all (as shown by the flattening out of the trendline in Figure 2). One explanation for this might be that at higher income levels, people are more likely to judge their happiness relative to others. So even if everyone's income increases by the same percentage, average happiness levels may be unchanged. Another possibility might be that consuming more goods and services is simply not making people any happier, or that the benefits of increased consumption are offset by negative factors such as increased congestion and stress.

As the Stiglitz-Sen-Fitoussi Commission mentions, further work is needed to understand the relationship between SWB and other well-being measures. But the results so far suggest that SWB should be one of the indicators on our "dashboard" of well-being measures.

3.3 The Genuine Progress Indicator (GPI)

In 1989, economist Herman Daly and theologian John Cobb Jr. suggested an alternative measure to GDP that they called the Index of Sustainable Economic Welfare (ISEW). This measure was later transformed into the Genuine Progress Indicator (GPI), one of the most ambitious attempts to date to design a replacement to GDP.[9] The GPI is a monetary measure of economic well-being for a given population in a given year that adds many benefits and subtracts many costs that are not included in GDP. It is designed to differentiate

> between economic activity that diminishes both natural and social capital and activity that enhances such capital. . . In particular, if GPI is stable or increasing in a given year the implication is that stocks of natural and social capital on which all goods and services flows depend will be at least as great for the next generation, while if GPI is

[8] Ingelhart et al., 2008.
[9] Another predecessor to the GPI and the ISEW was the Measure of Economic Welfare, by William Nordhaus and James Tobin. This 1973 effort was the first serious attempt to create an alternative to GDP.

> falling it implies that the economic system is eroding those stocks and limiting the next generation's prospects.[10]

Over time, the GPI measure has been modified to respond to theoretical critiques and to integrate new data sources and valuation methods. The most recent version of GPI (termed GPI 2.0) has three main components: market-based welfare, services from essential capital, and environmental and social costs.[11]

Market-Based Welfare

With the assumption that economic welfare derives at least in part from consumption levels, the personal consumption expenditures (PCE) component of GDP is taken as the starting point of market-based welfare. In the United States, personal consumption accounts for about 70 percent of GDP. In calculating the GPI 2.0, PCE is relabeled as household budget expenditure (HBE) and components of consumption that have zero or negative contribution to the household's current well-being are subtracted from HBE. This includes defensive and wasted expenditures, such as medical care, legal services, insurance, food and energy waste, household pollution abatement, and security expenses. Also, to keep the focus on current welfare, expenditures on household investments that may contribute to long-term sustainability, including spending on consumer durables, household maintenance, higher education, savings, retirement, and charitable giving, are subtracted from HBE (though some of these will be accounted for later as "services").

Next, an adjustment is made for income inequality to reflect the negative impact of inequality on well-being. Finally, benefits from provision of public goods and services are added to HBE since the exclusion of government spending from PCE underestimates the actual value of household consumption. The resulting value after making these adjustments gives the total market-based welfare.

Services from Essential Capital

Unlike GDP, which focuses on manufactured capital, GPI accounts for welfare benefits from services of human, social and natural capital. Services from human capital include benefits from higher education, knowledge, and skills. Value of household and volunteer work, leisure time, and benefits from internet services fall under social capital. Services from manufactured (built) capital include benefits from consumer durables, home improvement and infrastructure. All economically valuable functions of nature such as provision of food and medicine, pollination of crops, and benefits from lakes, rivers, forests, wetlands, deserts, and other ecosystems constitute the services from natural capital. The gains from services provided by these capital resources are added to the total market-based welfare.

Social and Environmental Costs

Social and environmental costs include aspects of economic activity that have a negative effect on well-being. For instance, homelessness, underemployment, increasing crime rate, more time spent in traffic, and vehicle accidents all have an adverse impact on human well-being and are counted as social costs. Environmental costs include the depletion of natural capital such as the loss of wetlands, groundwater depletion, productivity losses due to soil erosion, as well as the

[10] Talberth et al., 2007
[11] Talberth and Weisdorf, 2017, p. 142

increase in air pollutants, greenhouse gas emissions, and noise and water pollution. Social and environmental costs are subtracted from the total of market-based welfare and services from essential capital to get the final GPI measure.

The adjustments made to household budget expenditure in order to arrive at the GPI for 2014 are shown in Table 1.

Table 1. *Genuine Progress Indicator ($2012 per Capita), United States 2014*

Indicator	Value
Market-based welfare	
Household budget expenditures (HBE)	$25,529
Defensive and regrettable expenditures	- $3,967
Household investments	- $7,278
Costs of income inequality	- $3,121
Public provision of goods and services	+ $7,025
Total market-based welfare	$18,188
Services from essential capital	
Services from human capital	+ $5,223
Services from social capital	+ $12,857
Services from built capital	+ $6,042
Services from protected natural capital	+ $1,555
Total services from essential capital	$25,677
Environmental and social costs	
Depletion of natural capital	- $6,496
Costs of pollution	- $3,715
Social costs of economic activity	- $5,195
Total environmental and social costs	$15,406
GPI per capita total	**$28,459**

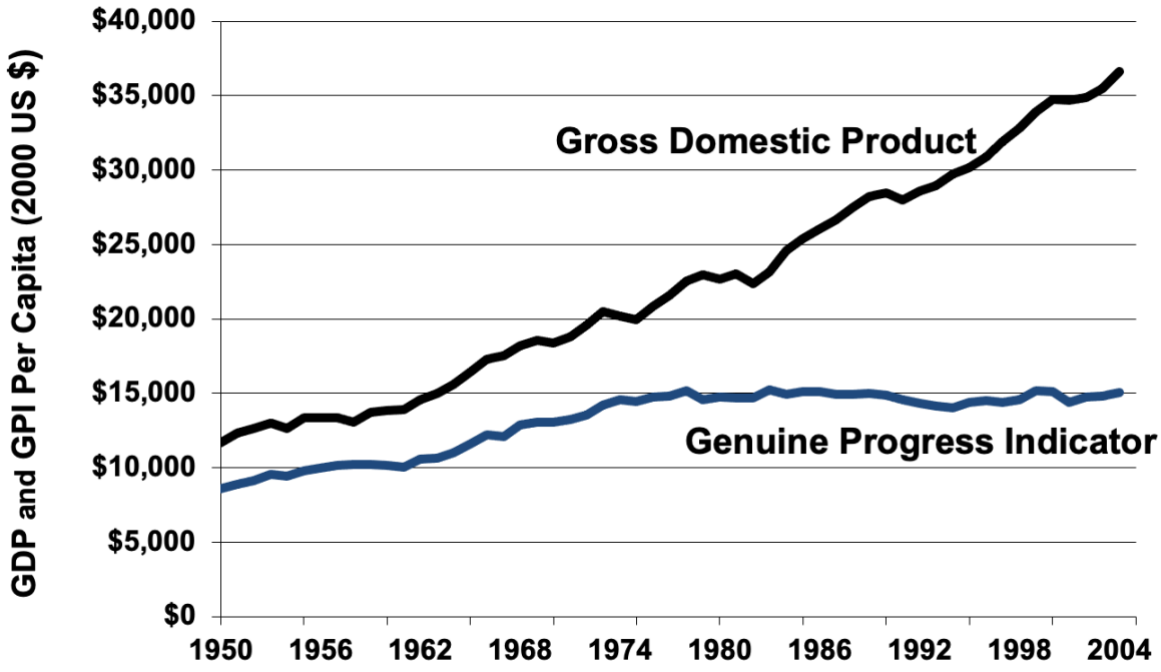
Source: Talberth and Weisdorf, 2017.

With the adjustments outlined above, the GPI differs significantly from GDP in magnitude and trends. The largest positive adjustments to GPI come from the benefits of social capital, which include unpaid work and the value of leisure time and internet services. The largest deductions come from the depletion of natural capital.

Over the long term, not only is per-capita GPI much lower than per-capita GDP, but its growth trajectory is different from that of GDP. This can be seen in the case of the United States (Figure 3). U.S. GDP per capita and GPI per capita both increased from 1950 to about 1978, but in recent decades GPI has flat-lined while GDP continued to grow, indicating that environmental and social costs omitted from GDP have been increasing faster than the value of the omitted

benefits.[12] A 2013 study estimating global GPI values, using data from 17 countries covering over 53 percent of the world's population, shows similar trends—both GDP and GPI per capita increased from 1950s to mid-1970s, but GPI per capita has remained flat since then while GDP per capita has continued to increase.[13] Relying on the GPI instead of GDP might suggest significantly different policy recommendations, focusing more on reducing environmental damage, increasing reliance on renewable energy, and redressing rising inequality.

Figure 3. *GPI vs. GDP per Capita for the United States, 1950-2004*



Source: Talberth et al., 2007.

GPI estimates have been developed for countries other than the United States, including Australia, China, Germany, India, Japan, Italy and Brazil. The GPI has also been applied at the subnational level, not only in the United States but also in other countries such as China (Liaoning Province), Italy (Tuscany), Canada (Alberta), and Belgium (Flanders). For example, a 2009 analysis of the Auckland region in New Zealand showed that between 1990 and 2006 the GPI grew at nearly the same rate as the region's GDP. Even in this case, environmental losses grew at a more rapid rate than the GPI—rising 27 percent during this period, while the GPI rose 18 percent. But the positive contributions to the GPI, in particular growth in personal consumption, were enough to more than offset the environmental losses.[14]

A 2018 study estimating GPI values for the fifty U.S. states for 2011 ranks Alaska at the top and Wyoming at the bottom, with seven states (Arizona, Arkansas, Louisiana, Mississippi, North Dakota, West Virginia, and Wyoming) estimated to have negative GPI values due to very high environmental and social costs outweighing benefits from consumption and household work.[15]

[12] Talberth et al., 2007.
[13] Kubiszewski et al., 2013.
[14] Note that this study is based on an earlier variation of GPI, but the underlying method of estimation of GPI−taking the total personal consumption expenditure, adding the positive contributions to well-being and subtracting the negative ones−is the same.
[15] Fox and Erickson, 2018.

More extensive analysis on GPI measures have been conducted for the states of Maryland and Vermont and the city of Baltimore. In Maryland, while economic contributions to the GPI rose steadily over the period 1960–2010, the net social contributions increased only slightly, and the environmental costs more than doubled (based on the earlier variation of GPI). In Vermont, 2011 GPI per capita was 40 percent less than state GDP due to rising income inequality and a strong dependence on fossil fuels.[16] According to a 2017 analysis of the Maryland GPI, "the GPI can help to show net societal benefits of policies such as investing in public transit, increasing the minimum wage and reducing greenhouse gases—giving policymakers and advocates additional ammunition for political battles over such issues," but actual influence on policy was limited.[17]

3.4 The Better Life Index (BLI)

One of the challenges of using multiple indicators to evaluate well-being, as suggested by the dashboard approach, is that it is sometimes difficult to communicate the results. How do we assess overall well-being if the poverty rate falls by 5 percent, but emissions of greenhouse gases increase by 10 percent? On the other hand, summing up production, poverty, inequality, environmental degradation and other aspects of well-being in one single index, as is done with the GPI measure, also poses the difficult problem of having to attach monetary values to each dimension to add them up.

The Organization for Economic Cooperation and Development (OECD) has therefore tried a mixed approach.[18] With its **Better Life Index (BLI)**, it combines eleven dimensions, many of which are hard to measure and difficult to value in monetary terms, into one single indicator using different possible weights for each dimension. The 2015 BLI report argues that "a better understanding of people's well-being is central to developing better policies for better lives".[19]

To account for the multidimensional nature of well-being and get a thorough assessment of whether people's lives are improving, the BLI considers the following 11 dimensions:

1. Income, Wealth, and Inequality: The main variables used for this dimension are disposable household income, net financial wealth, and the degree of inequality in income and wealth.[20]
2. Jobs and Earnings: The main variables comprising this dimension are the unemployment rate, the long-term unemployment rate, and average earnings per employee.
3. Housing: Sufficient housing is important to provide security, privacy, and stability. Rooms per person, dwellings with basic facilities, and housing expenditure are used to measure housing conditions.

[16] Ceroni, 2014.
[17] Hayden and Wilson, 2018, p. 462.
[18] The OECD is a group of the world's advanced industrialized countries, now including some developing countries, such as Mexico. The BLI was created, in part, as a response to the Stiglitz-Sen-Fitoussi Commission report.
[19] BLI, 2015.
[20] In addition to these main variables, most of the dimensions also consider secondary variables. For example, the dimension of income and wealth also includes data on household consumption and a subjective evaluation of material well-being.

4. Health Status: The BLI includes life expectancy and a subjective evaluation of one's overall health status.
5. Work-Life Balance: The proportion of employees who work long (50 or more) hours per week, the time available for leisure and personal care, and the employment rate for women with school-age children are used as indicators of work-life balance.
6. Education and Skills: This measure is based on average duration of formal education, percentage of the adult (25–64-year-old) population with a secondary-school degree, and average performance of students in standardized testing.
7. Social Connections: This dimension is measured by the strength of social network, based on the percentage of people who believe they can rely on friends in times of need.
8. Civic Engagement and Governance: This dimension is based on voter turnout data and a composite index that measures citizen input into policymaking.
9. Environmental Quality: The main variable used to measure environmental quality is air pollution levels, specifically levels of particulate matter. Secondary environmental variables include an estimate of the degree to which diseases are caused by environmental factors, people's subjective satisfaction with their local environment, and access to green space.
10. Personal Security: This dimension focuses on threats to one's safety. It is measured using homicide rate and data on percentage or people who feel safe walking alone at night.
11. Subjective Well-Being: This dimension measures people's overall satisfaction with their lives, as well as reported negative feelings.

The BLI is designed to produce an overall well-being index. The results for each dimension are standardized across countries, resulting in a score from 0 to 10. But how do we assign a weight to the various components? One approach would be simply to weigh each of the 11 dimensions equally. But it is likely that some dimensions contribute more to well-being than others. The BLI report makes no specific recommendations for weighting the different dimensions, but its Web site allows users to select their own weights for each of the dimensions (see www.oecdbetterlifeindex.org). The OECD collects user input and uses this information to gain a better understanding of the factors that are most important for measuring well-being.

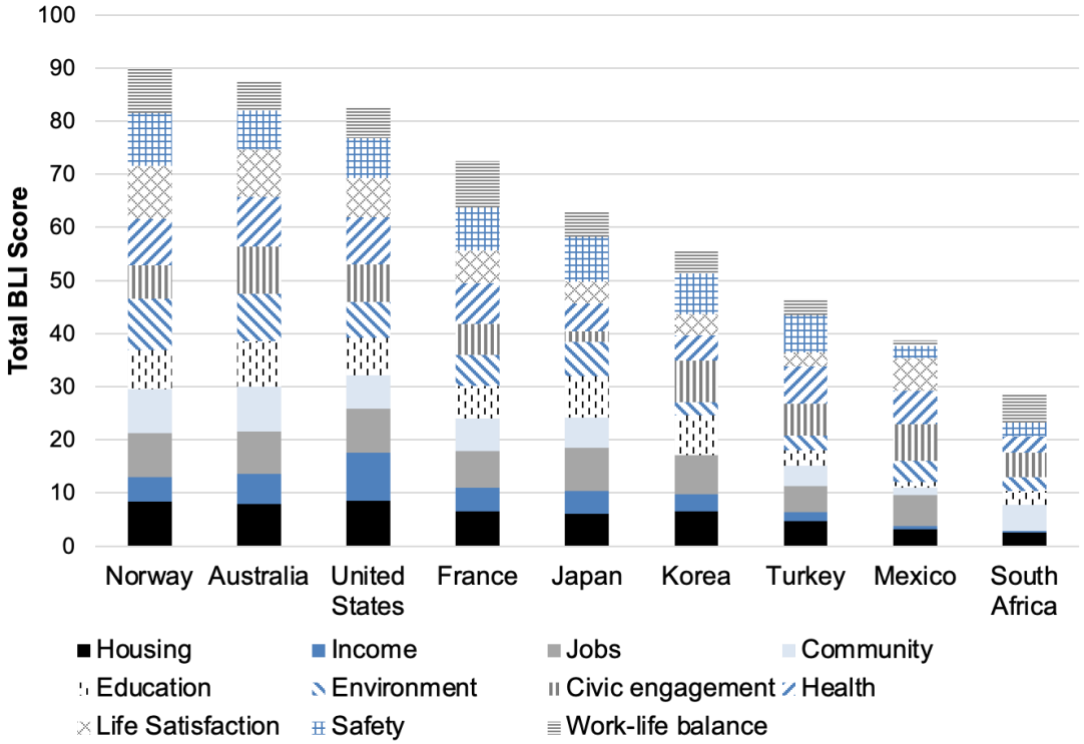
Based on input collected from over 130,000 users about their preferred weight for each dimension, the OECD 2018 report shows a considerable variation in the importance of the eleven well-being dimensions across regions. The highest ranked dimensions are education in South America, life satisfaction in North America, health in Europe, and work-life balance in Asia-Pacific and Australia.[21]

The BLI has been measured for 41 countries, including the 38 OECD member countries[22], along with Brazil, South Africa, and Russia. Figure 4 shows the total BLI for nine countries. Among these countries, Norway and Australia rank the highest, scoring highly on life satisfaction, jobs, environment, and health of the population (other Nordic nations along with Switzerland, New Zealand, and Canada have similar scores). Countries with low income and

[21] OECD, 2018.
[22] Costa Rica became the 38th member of OECD in 2021. BLI data is not available for Costa Rica as of early 2022.

employment levels, poor education, health, and environmental outcomes, including Mexico and South Africa, rank the lowest in BLI. The United States performs well in terms of housing, income, and jobs, but ranks relatively low in terms of work-life balance and inequality in income.

Figure 4. *BLI for Selected Countries, 2020*



Source: OECD, 2020.

The 2020 BLI report indicates that since 2010 the overall quality of life has improved in all 41 countries. In general, life expectancy has increased, people feel safer and are living in less overcrowded conditions, incomes and jobs have been on the rise, and life satisfaction levels have improved. But these average outcomes do not reflect inequalities across and within countries. For example, housing affordability, relative income poverty, and voter turnout have worsened in some OECD countries, and there has been some decline in social support and time spent with friends and family. Income inequality is still as prevalent as it was in 2010, with those in top 20 percent of income earners still earning five times more than the people in the bottom 20 percent.

All OECD countries also face new environmental challenges, as nearly two-thirds of people in these countries are exposed to dangerous levels of air pollution. And while there has been a slight reduction in per capita emissions of greenhouse gases, most OECD countries have not done enough to meet climate policy goals.[23]

3.5 The Human Development Index (HDI)

In contrast to the BLI, the United Nations' **Human Development Index (HDI)** is calculated based on only three components of well-being: life expectancy at birth, years of formal

[23] OECD, 2020.

education, and real Gross National Income (GNI) per capita.[24] Although these are denominated in different units, no attempt is made to translate one into the other. Rather, relative performance is presented in a scaled index (Table 2).

Like the BLI, the HDI faces the issue of how to assign relative weights. The standard HDI approach is to give equal weight to each of the three indicators. Although the GNI measure is modified to account for the principle, discussed above, that additional income is worth more to a person with lower income than to a person with higher income, the inclusion of standard measures of income as one-third of the indicator makes it highly, although not perfectly, correlated with GDP; of the 30 countries with the highest HDI scores in 2022, all were ranked in the top 38 by national income per capita.

Table 2. *Human Development Index, 2019, Selected Countries*

Human Development Index (Scale 1-100)	
90-100	Switzerland, Norway, Australia, Denmark, Sweden, Germany, Canada, Japan, Singapore, South Korea, United States, France, Spain, United Kingdom
85-89.9	Cyprus, Italy, Greece, Poland, Bahrain, Portugal, Saudi Arabia, Latvia, Croatia, Qatar, Chile
80-84.9	Argentina, Turkey, Kuwait, Russia, Romania, Bahamas, Uruguay, Georgia, Serbia, Costa Rica, Malaysia, Thailand
75-79.9	Ukraine, Iran, Sri Lanka, Cuba, Mexico, Peru, Brazil, China, Colombia
70-74.9	Ecuador, Egypt, Libya, Lebanon, Jamaica, South Africa, Indonesia, Vietnam
65-69.9	Philippines, Botswana, Venezuela, Iraq, Morocco, Bangladesh, El Salvador
60-64.9	India, Ghana, Guatemala, Namibia, Nepal
55-59.9	Zimbabwe, Cambodia, Angola, Congo, Syria, Kenya, Zambia
50-54.9	Pakistan, Haiti, Rwanda, Nigeria, Uganda, Malawi, Lesotho, Madagascar, Sudan
45-49.9	Ethiopia, Liberia, Afghanistan, Sierra Leone, Yemen
40-44.9	Mozambique, Mali, Burundi, Central African Republic, Niger
35-39.9	Chad, South Sudan

Source: UNDP, Human Development Report, 2022 data.

At the same time, the results often show that countries with similar income levels measured by GNI per capita vary dramatically in overall human welfare, as measured by the HDI. For example, Jamaica and Namibia have similar levels of GNI per capita, but Jamaica has a much higher HDI score (0.709) than Namibia (0.615). The higher HDI score for Jamaica is explained by its higher life expectancy and better educational outcomes.

The relative simplicity of the HDI has made it much easier to apply in countries with less money to spend on data collection; hence, it has been especially valuable for developing

[24] GNI is another name for GNP or Gross National Product. The key difference between GNI/GNP and GDP is based on whether foreign earnings are included. While GDP includes all earnings within a country's borders, including those earned by foreign citizens and corporations, GNI accounts for the earnings of a country's citizens and corporations, regardless of where they are located.

countries. The HDI has been an annual feature of every UN *Human Development Report* since 1990, and it is now an official government statistic in a number of countries. One limitation of the HDI is that it does not consider distributional issues, as it is based on average measures of health, education, and income across population. The HDI has also been criticized for focusing on a narrow set of indicators and failing to account for other important aspects of human well-being, such as social stability and environmental sustainability. Recognizing these concerns, four new indices to monitor poverty, inequality, gender inequality, and planetary pressures have been launched by the UN:

1) Multidimensional Poverty Index (MPI): The MPI is based on the same three dimensions as the HDI—living standards, education, and health— but it uses a broader set of indicators to measure each dimension. Living standards is measured using a composite of six variables (cooking fuel, sanitation, drinking water, electricity, housing, and assets); health is measured by nutrition and child mortality; and education is measured by years of schooling and school attendance rate. The 2022 MPI report finds that 1.2 billion people in 111 developing countries are living in acute multidimensional poverty. This is nearly double the number of people identified as poor based on an income measure using $1.90 a day as the poverty line.[25]
2) Inequality-Adjusted HDI (IHDI): The IHDI measure starts with the same three indicators as the HDI to measure health, education, and living standards. It then makes an adjustment for inequality by discounting the average value of each dimension by the level of inequality. The global HDI value for 2018 dropped by 20 percent after accounting for inequality.
3) Gender Inequality Index (GII): The GII includes measures of reproductive health, women's empowerment, and gender disparities in the labor market to expose the differences in achievements of men and women. The GII measure shows highest gender-based inequality in sub-Saharan Africa and Arab states and lowest gender inequality in Europe and central Asia. Another indicator for measuring gender inequality, Gender Development Index (GDI), was introduced in 2014. This measure disaggregates the HDI value by gender. In 2018, the average HDI for women was 6 percent lower than that for men.
4) Planetary Pressures-Adjusted Human Development Index (PHDI): The PHDI index adjusts the human development index by carbon dioxide emissions per person and material footprint per capita to account for human pressure on the planet. The global HDI value for 2021 drops by 9 percent after adjusting for planetary pressures.[26]

3.6 Other National Accounting Alternatives

Aside from the measures just described, many other proposals have been made either to supplement GDP, adjust it, or replace it. To give a sense of this landscape, we briefly describe a sample of measures developed for use in specific locales. One alternative measure that has been used more widely, the Happy Planet Index, is discussed in Box 2.

- **The Measure of America** presents an HDI modified for application in the United States. For example, although the standard HDI measures access to knowledge using the average number of years that students spend in school, Measure of America uses

[25] UNDP, 2022b.
[26] UNDP, Data Center, Table 7, https://hdr.undp.org/data-center/documentation-and-downloads.

average achievement scores at various grade levels. The results, calculated down to the level of congressional districts, are available at www.measureofamerica.org.

- **The Canadian Index of Well-Being** was created by collecting information from Canadians about what factors they thought were important for their well-being. The indicator tracks changes in eight domains including: community vitality, democratic engagement, education, environment, healthy populations, leisure and culture, living standards, and time use.
- Italy has an **Index of Quality of Regional Development,** a composite index of 45 variables pertaining to environment, economy and labor, rights and citizenship, gender equity, education and culture, health, and democratic participation.
- The **Gross National Happiness (GNH)** concept was proposed in Bhutan in 1972 as a guiding principle for economic development that takes a holistic approach to improving the quality of people's lives. In 2010 it was formally defined along nine different dimensions of welfare (psychological well-being, standard of living, good governance, health, education, community vitality, cultural diversity and resilience, time use, and ecological diversity and resilience), including 33 distinct indicators.[27] The 2015 report from the Centre for Bhutan Studies, based on a survey of over 7,000 households, indicates that 43 percent of Bhutanese households have sufficiency in at least six domains and are thus considered either "deeply" or "extensively" happy.[28]
- The government of New Zealand launched the **Well-Being Budget** initiative in 2019 with the goal of reshaping the government's budget towards the well-being needs of the country. A dashboard of indicators on civic engagement and governance, cultural identity, environment, health, housing, income and consumption, jobs and earnings, knowledge and skills, safety and security, social connections, subjective well-being, and time use is used to evaluate the quality of life. Based on this approach, the government allocated billions of dollars to mental health services, child poverty, and measures to tackle family violence, improve conditions of the native population, and build a sustainable, low-emissions and productive economy.[29]
- The **Comprehensive Wealth** measure, developed by the International Institute for Sustainable Development (IISD), estimates the total resources that a nation has to continue social and economic activities into the future. This indicator estimates the value of five types of assets—produced capital including roads, ports, machineries, and other manufactured assets; natural capital including resources such as timber, minerals, and gas, and ecosystems such as wetlands and forests; human capital, measuring collective knowledge and skills of the labor force; financial capital covering stocks, bonds, and other kinds of financial assets and investments; and social capital, representing norms that define social behavior, trust on institutions, and inclusivity. The comprehensive wealth measure, initially estimated for Canada for 2018, reveals various concerns including excessive levels of household debt, stagnant human capital, and vulnerability to climate change. More recently the IISD has expanded its effort to measure wealth to countries in Africa, Asia, and the Caribbean.[30]

[27] Ura et al., 2012.
[28] Center for Bhutan Studies, 2015.
[29] The Treasury of New Zealand, 2019.
[30] IISD, 2014.

BOX 2: HAPPY PLANET INDEX

The Happy Planet Index, created by the New Economics Foundation of London, asserts that the goal of society is to create long and happy lives for its members. The HPI is made up of three variables.

Average life expectancy: This measures whether a society's members lead long lives.
Average subjective well-being: This measures whether a society's members lead happy lives. The data are based on a survey, which asks people how satisfied they are with their lives overall, on a scale of 1 to 10.
Ecological footprint: This measures a society's overall ecological impact. It is defined as the amount of land required to provide a society with the resources that it consumes and assimilate the waste that it generates.

In order to obtain the HPI, a country's well-being is multiplied by their life expectancy and divided by their ecological footprint. Some technical adjustments are made to this measure to adjust for inequality in each of the three dimensions and to ensure that no single component dominates the overall score.

In 2021, the HPI was calculated for 152 countries. The countries with the highest HPI scores are those that have rather happy and long-lived citizens, and relatively modest ecological footprints. Examples of countries with high HPI include Costa Rica, Colombia, Switzerland, Ecuador, and Jamaica.

One interesting aspect of the HPI is that a country's HPI ranking tends to be unrelated to its GDP. Most wealthy nations including the United States, Japan, Canada, Australia and developed countries in Europe all score highly on life expectancy and subjective well-being, but their HPI rank is lower than that of some of the less developed countries in Latin America and Asia Pacific region because of their larger ecological footprint. Luxembourg, for example, ranks 4th by GNI per capita and 17th by the HDI, but ranks 143rd by the HPI. The United States ranks 122nd, just above Tanzania, Namibia, and India, mainly because of its relatively large ecological footprint. The low HPI rank for most Sub-Saharan countries, in contrast, is due to the low life expectancy and low subjective well-being despite the relatively low ecological footprint of this region. [31]

The interpretation and policy implications of the HPI are unclear. For example, El Salvador and Dominican Republic have a higher HPI score than Sweden or Australia.[32] Does this imply that El Salvador and Dominican Republic are more desirable to live in, or more ecologically sustainable, than Sweden or Australia? Probably not. Another issue is to what extent a country's policies can affect happiness levels, which may be more a result of inherent social and cultural factors rather than policy choices. Despite its limitations, the HPI has received attention as an alternative or supplement to GDP, especially in Europe. So while the HPI is unlikely to become a widespread alternative to GDP, it does provide information that is not currently captured in any other national accounting metric.

[31] Wellbeing Economy Alliance, 2021.
[32] Ibid.

One lesson from all these alternatives is that there is not necessarily a positive correlation between economic production in an economy (as measured by GDP) and other measures of well-being. In many instances, GDP is rising while other measures stay flat or fall.

The next two sections focus on the issues surrounding two particular elements that have been seriously underrepresented in GDP. Section 4 discusses issues of accounting for household production. Section 5 takes up environmental accounting, including subsections on the methodological problems of how to assign values to things that are not sold through markets.

4 MEASURING HOUSEHOLD PRODUCTION

As discussed above, one key limitation of GDP is that it ignores productive activity that occurs outside the market and without the exchange of money, such as caring for families, raising children, and maintaining homes. Hence, many countries, including the United States, Australia, Canada, India, Japan, Mexico, Thailand, and the United Kingdom, have conducted national time-use surveys to aid their understanding of unpaid productive activities. The United Nations Statistical Commission and Eurostat (the statistical office of the European Union) are encouraging countries to develop satellite accounts to take into account both household production and interactions between the economy and the environment.

4.1 Measuring Household Labor

Efforts to measure household labor predate standard GDP accounts. In 1921 a group of economists at the National Bureau of Economic Research calculated that the value of household services would be about 25 to 30 percent of marketed production. Decades later, in 1988, economist Robert Eisner reviewed six major proposed redesigns of the National Income and Product Accounts (NIPA), all of which included substantial estimated values for household production.[33] Despite numerous demonstrations of its practicality dating back for over 100 years, household production has never been included in the U.S. GDP accounts.

The COVID-19 pandemic has underscored the importance of recognizing work done within the household, as closures of schools, childcare centers, and other businesses, shifted the burden of providing these services to households. One study, based on data from 16 countries, reveals that on average women spent 5 more hours on childcare per week during the pandemic (increasing from 26 hours/week to 31 hours), while men spent 4 more hours (increasing from 20 hours/week to 24 hours).[34] In the U.S., during the first wave of the pandemic (March-April 2020), some 3.5 million women with school-age children left active work, either to provide care to family members or because of job losses.[35]

This increase in non-market work was not reflected in GDP, which dropped by over 30 percent in the second quarter of 2020 due to business and school closures. This recent example shows why exclusion of household production in the GDP accounts means that GDP values are significantly understated, as a substantial area of valuable productive activity has been overlooked (see Box 3).

[33] Eisner, 1988.
[34] UN Women, 2020.
[35] Heggeness et al., 2021.

BOX 3: WHAT ARE STAY-AT-HOME MOMS REALLY WORTH?

What is the fair market value of all the work a typical stay-at-home mom does in a year? To answer this question we can multiply the hours spent at different tasks by the typical wage paid to workers who perform those tasks. For example, if a typical mom spends 14 hours per week cooking, and the average wage for cooks is $10 per hour, then the market value of this work would be $140. Applying this approach to a selected set of household tasks, including child care, cleaning, shopping, yard work, and driving, the annual value of a full-time stay-at-home mom in 2021 is estimated to be $116,022.[36] Other research yields an even larger market value—$178,201 for 2019.[37]

While the share of stay-at-home dads in the United States has increased in recent decades, up to 7 percent in 2016 compared to 4 percent in 1989, they are still a minority accounting for 17 percent of all stay-at-home parents in 2016.[38] In recent decades, the number of stay-at-home moms has been declining as more women have entered the workforce. While this brings additional income to households, the income is partially offset by additional expenses, especially in childcare. According to the Economic Policy Institute, the cost of full-time childcare exceeds the typical annual cost of college tuition in 33 of the 50 U.S. states. [39]

Even the most conservative estimates of the total value of household production arrive at numbers equal to about 25–30 percent of standard GDP in the United States, and less conservative estimates put the value as equal to or greater than half of the value of marketed production. An analysis of 27 mostly high-income countries shows that the value of unpaid labor, primarily household production, equates to an average of more than 25 percent of GDP.[40] A recent study by Oxfam estimates the global value of women's unpaid work in 2019 as being close to $10.9 trillion—greater than the combined revenue of the fifty largest companies in the world.[41] The UK Office of National Statistics estimated that the value of unpaid labor in 2018 was equivalent to $1.6 trillion (55 percent of GDP), with the largest components of the value of unpaid work being child care and transportation.[42]

Neglecting household production not only underestimates the level of GDP, but might also give a wrong impression about growth trends. One of the major economic shifts during the twentieth century was the movement of a large proportion of women from unpaid employment as full-time homemakers to paid employment outside the home. In 1870, 40 percent of all U.S. workers were women working as full-time homemakers; by 2000, the proportion had dropped to 16 percent. Trends in many European countries were similar, but timing often differed. This increase in work outside the home, as well as the increase in purchases of substitutes for home production, such as paid childcare and prepared foods, was counted as an increase in GDP. The value of *lost* household production, however, was not subtracted. This failure to account for

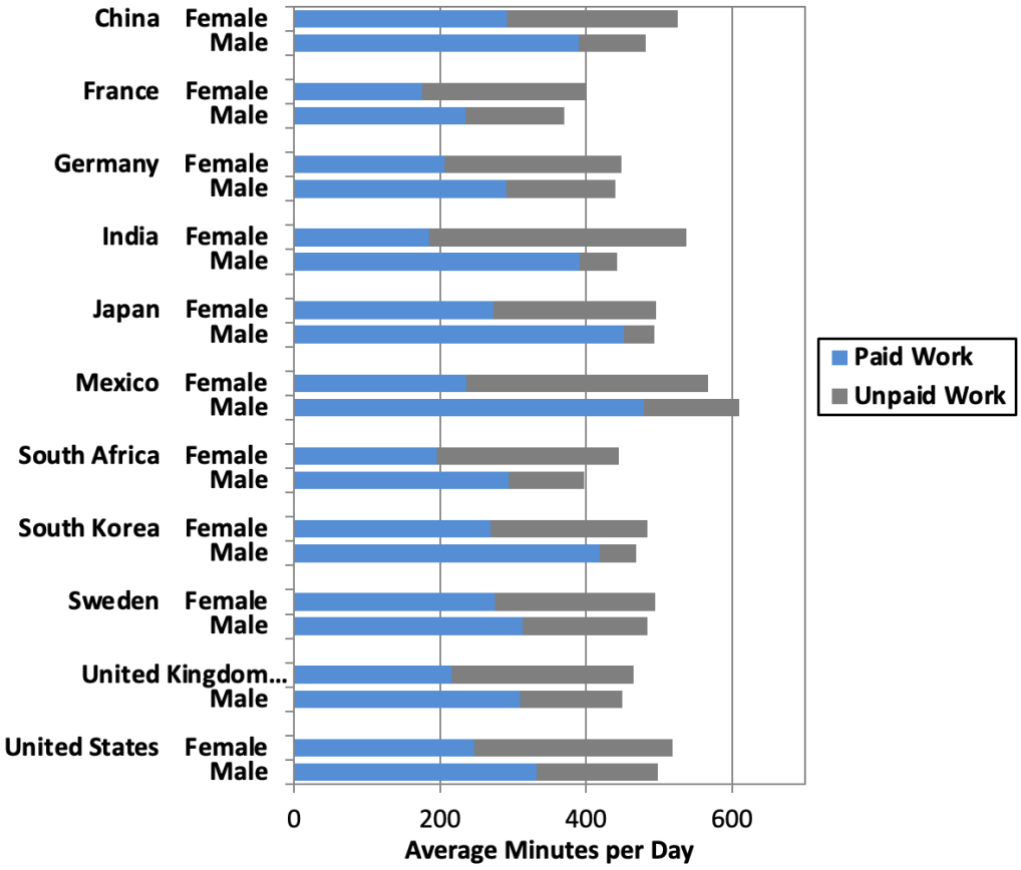
[36] Shelton, 2021.
[37] Salary.com, 2020.
[38] Livingston and Parker, 2019.
[39] Economic Policy Institute, 2020.
[40] Folbre, 2015.
[41] Oxfam, 2019.
[42] Yeginsu, 2018.

reductions in some home-produced goods and services means that GDP growth during the period was overstated.

For example, a 2019 article in the *Survey of Current Business* found that if "home production" were counted nominal GDP would have been 24 percent higher in 2017 and 37 percent higher in 1965, when fewer women were in the formal labor force. Because the inclusion of "home production" would have added more to GDP in 1965 than in 2017, factoring in non-market activities reduces the average annual growth rate of GDP over this period.[43]

The International Labor Organization estimates that globally about 76 percent of non-market work is carried out by women and that on average women spend three times more time per day on unpaid care work than men.[44] Data on unpaid labor from the United Kingdom indicate that men do an average of 16 hours per week of unpaid labor, while women do an average of 26 hours.[45] In the United States, women spend an average 2.4 hours per day on household production while men spend 1.6 hours.[46] The gender imbalance is even more significant in developing countries, where household production makes up a much higher proportion of total production than in developed countries. Hence, GDP is even more inadequate as an indicator of national production in developing countries.

Figure 5. *Paid and Unpaid Work by Gender, Selected Countries*



Source: OECD, OECD *Stat,* Time Spent in Paid and Unpaid Work, by Gender.

[43] Kanal and Kornegay, 2019.
[44] ILO, 2018.
[45] Office for National Statistics (UK), 2016.
[46] BLS, 2021.

We see in Figure 5 that when we add paid and unpaid labor, women almost always do more total work than men (Mexico is the only exception in the figure). The overall gender imbalance is greatest in India, where women do 21 percent more total work than men, and in the South Africa where women do 18 percent more total work than men. If we only consider paid work, we might reach the conclusion that men contribute more to the economy than women. But when we consider both paid and unpaid work, women generally contribute more time on economically productive activities overall.

Why does this matter? One important reason is that the omission of most household production from the national accounts may contribute to a subtle bias in the perceptions of policymakers who base their economic decisions on them. The U.S. Social Security retirement system, for example, makes payments to people based only on their market wages and years in paid work. Some advocates suggest that people should also get credit for time spent raising children—for example, a year of Social Security credit for time taken off with each child, in recognition of the contribution that such unpaid work makes to social and economic life. Having home production counted in GDP might help make policymakers more aware of its productive contributions.[47]

4.2 Methods of Valuing Household Production

Standard national accounting procedures require that time spent on household production be valued using market or quasi-market prices. Economists have developed two main methods of assigning a monetary value to household time use: the replacement-cost method and the opportunity-cost method.

In the **replacement-cost method**, hours spent on household labor are valued at what it would cost to pay someone else to do the same job. In the most popular approach—and the one used to generate the most conservative estimates—economists use the wages paid in a general category such as "domestic worker" or "housekeeper" to impute a wage. A variant of this method, which usually results in higher estimates, is to value each type of task separately: child-care time is valued according to the wage of a professional child-care worker, housecleaning by the wages of professional housecleaners, plumbing repair by the wages of a plumber, and so forth (as discussed in Box 3).

The **opportunity-cost method** starts from a different view, based on microeconomic "marginal" thinking. Presumably, if someone reduces their hours at paid work to engage in household production, they might value time spent in household production (at the margin) at least at the wage rate that they could have earned doing paid work. That is, if you give up $30 that you could have earned working an extra hour to spend an hour with your child, the value of spending that hour with your child is at least $30. This method uses the wage rate that an individual would have earned in the market to value the time spent doing household work. In this case, estimates of the value of non-market production can be higher than using the replacement-cost method, since some hours would be valued at the wage rates earned by doctors, lawyers, and other more highly paid workers.

Neither approach to imputing a wage rate is perfect. However, it would be hard to argue that perfection has been achieved in any of the other measurements and imputations involved in

[47] A prominent advocate of this view is Marilyn Waring, author of *If Women Counted* (San Francisco: Harper and Row, 1988).

creating the national accounts, and many argue that imputing any value for household labor time, even using minimal replacement costs, is more accurate than imputing a value of zero.

Similar arguments have been made concerning unpaid volunteer work in communities and non-profit organizations—the time that people spend coaching children's sports teams, visiting nursing homes, serving on church and school committees, and so on. In the United States, 8 percent of men and 13 percent of women reported participating in organizational, civic, and religious activities, a figure that includes organized volunteer activities. If volunteer work and household work were counted in national accounts, the proportion of production attributed to the core sphere of the economy would rise considerably.

5. ACCOUNTING FOR THE ENVIRONMENT

The natural environment underpins all economic activities. It provides inputs of natural resources and environmental services that are essential to economic activity and also assimilates the waste products released from economic activity. Environmental economists describe economic functions of the natural world under three headings:[48]

1. *Resource functions:* The natural environment provides natural resources that are inputs into human production processes, including renewable resources, such as fisheries and forests, and nonrenewable resources, such as minerals and crude oil.
2. *Environmental service functions:* The natural environment provides the clean air, drinkable water, and suitable climate that directly support all forms of life on the planet. Water filtration provided by wetlands and erosion control provided by tree-covered hillsides are other examples of services provided by ecosystems. People receive the services of the natural environment directly when they enjoy pleasant scenery or outdoor recreation.
3. *Sink functions:* The natural environment also serves as a "sink" that absorbs (up to a point) the pollution and waste generated by economic activity. Car exhaust goes into the atmosphere, for example, while used packaging goes into landfill, and fluid industrial waste ends up in rivers and oceans. Some waste breaks down relatively quickly into harmless substances. Others are toxic or accumulate over time, eventually compromising the quality of the environment.

Although for centuries these environmental functions were treated as though they were provided "free" and in unlimited amounts, more recently the problems of depletion of resources, degradation of environmental services, and overuse of environmental sink functions have become increasingly apparent. Consider the example of a country that depends heavily on natural resources. If its forests are cut down, its soil fertility depleted, and its water supplies polluted, surely the country has become poorer. But national income accounting will merely record the market value of the timber, agricultural produce, and industrial output as positive contributions to GDP.

[48] A fourth category of environmental value stems not from use but from mere appreciation of the existence of species and environmental amenities; this is felt by some people even if they do not expect to see, for example, a blue whale or Victoria Falls. The "existence value" of a given species or resource is difficult to quantify, but it is recognized as a legitimate economic value by economists.

Global declines in soil fertility and depletion of water resources, along with increased incidence of droughts, extreme weather events, biodiversity loss, and rising global temperatures are already increasing global food prices and threatening to worsen food insecurity.[49] In the United States, food prices increased by 6.3 percent in December 2021 compared to the previous year and the price of poultry, meat, fish and eggs jumped by 12.5 percent. While part of this increase is due to supply disruptions caused by the pandemic, the increase in extreme weather events (especially droughts in the West and Midwest) and rise in energy costs also contributed to this rise.[50]

As increased greenhouse gases emissions lead to serious disruptions in climate, more severe storms, and rising sea levels, more and more money must be spent in what we have described as "defensive expenditures." Omitting such important environmental considerations from our measures of success could seriously undermine our goals for sustainability. We therefore need to account for the environmental costs of economic activity.

5.1 Methods of Valuing the Environment

System of Environmental-Economic Accounting

In 1993 the United Nations put forth a comprehensive framework, called the **System of Environmental-Economic Accounting (SEEA)**, to add statistics on environmental accounting to the existing methods of national accounting, using supplementary tables. The SEEA framework, revised most recently in 2014, covers measurement of the environment and its relationship with the economy using three key approaches:

1. ***Measuring the physical flows of materials and energy***. This approach measures the physical flows of natural capital from the environment to the economy as inputs to production, such as extracting metal, drilling for oil, and cutting trees. It also looks at flows from the economy to the environment, such as disposal of solid waste and emission of air and water pollutants. Flows into, or out of, different sectors of the economy are quantified into tables. A table for water pollution, for example, would include quantities of chemical waste, insecticides, fertilizers and industrial discharges into the water from various sectors of the economy.
2. ***Measuring the stocks of environmental assets***. The SEEA lists seven categories of environmental assets: mineral and energy resources, land, soil, timber, water, aquatic resources, and other biological resources. These assets are either measured in physical units such as tons of soil, or acres of wetlands, or in monetary units by multiplying a physical quantity of an environmental asset by its per-unit market price or through some nonmarket valuation process discussed in Section 5.2 below.
3. ***Measuring economic activity related to the environment.*** This approach lists monetary transactions related to the environment, such as the amount of spending on environmental protection and resource management, and environmental taxes and subsidies. The measure also includes production of environmental goods and services, "environmentally friendly" products and technologies, and pollution-control equipment.

[49] Flavelle, 2019.
[50] Swanson. 2022.

These approaches are not necessarily mutually exclusive—we could theoretically implement all of them simultaneously. While many countries have adopted one or more of these accounts to some extent, no country has fully implemented the SEEA recommendations, and there is currently no universally accepted approach to environmental accounting.

Green GDP

The most basic approach to "green" accounting is to start with traditional measures and make adjustments that reflect environmental concerns. The current national income accounting recognizes that some of each year's economic production is offset by the depreciation of manufactured, or fixed, capital such as buildings and machinery. National accounting methods produce estimates of net domestic product (NDP), which start with GDP and then deduct the annual depreciation value of existing fixed capital. For example, in 2020 the GDP of the United States was $20.9 trillion. But the depreciation of fixed capital that year totaled $3.6 trillion. Thus, the NDP of the United States in 2020 was $17.3 trillion.

Extending this logic, we can see that each year the value of natural capital may also depreciate as a result of resource extraction or environmental degradation. In some cases, the value of natural capital could also increase if environmental quality improves. The net annual change in the value of natural capital in a country can simply be added or subtracted from NDP to obtain what has been called an environmentally adjusted measure of national product, or **Green GDP**. Thus:

$$\text{Green GDP} = \text{GDP} - D_m - D_n$$

where D_m is the depreciation of manufactured capital and D_n is the depreciation of natural capital.

This measure requires estimating natural capital depreciation in monetary terms, rather than physical units such as biomass volume or habitat area. Estimating the value of all types of natural capital depreciation in monetary terms is a daunting task that would require many assumptions. For this reason, the estimates of Green GDP that have been produced generally focus on only a few categories of natural capital depreciation.

Attempts to estimate Green GDP date back to the 1980s. A pioneering 1989 analysis estimated the value of depreciation in Indonesia for three categories of natural capital: oil, forests, and soil.[51] The analysis found that accounting for natural capital depreciation could reduce GDP by 25 percent or more. A 2001 analysis in Sweden looked at a broader set of natural resource categories, including soil erosion, recreation values, metal ores, and water quality.[52] The results found that accounting for these factors would reduce GDP in Sweden by about 1–2 percent for 1993 and 1997, with some sectors being particularly affected, such as agriculture, forestry, and fisheries. Another study estimated the value of changes in forest resources in India in 2003.[53] Based on timber and firewood market prices, the results indicated that while the overall physical stock of timber decreased, the value of timber resources actually increased due to higher prices. This illustrates the potential distortionary effect of looking at natural capital in monetary, rather than physical, terms.

[51] Repetto et al., 1989.
[52] Skånberg, 2001.
[53] Gundimeda et al., 2007.

A significant effort to estimate Green GDP occurred in China in the early 2000s. The initial findings by China's State Environmental Protection Agency (SEPA) in 2006 indicated that environmental costs equaled about 3 percent of China's GDP. The report was widely criticized because it failed to include numerous categories of environmental damage, such as groundwater contamination. Shortly afterward, a separate report concluded that environmental damage was closer to 10 percent of China's GDP. And in a 2007 report jointly produced by the World Bank and SEPA, the costs of air and water pollution alone were estimated at 5.8 percent of China's GDP.[54] Green GDP efforts in China were subsequently cancelled in response to opposition from provincial officials who viewed Green GDP as a threat to their efforts to promote high growth. But in 2015 China announced it was restarting its efforts with the implementation of "Green GDP 2.0," with pilot projects in certain regions. Most recently, a 2020 journal article estimated China's Green GDP in 2017 to be 4 percent less than its traditional GDP.[55]

A 2019 analysis, estimating Green GDP for 44 countries, found that Green GDP was lower than standard GDP in all cases, from 1 to 10 percent. Countries with the highest environmental impacts included China (5 percent), Chile (9 percent), Norway (7 percent), and Mexico (4 percent). Some countries, including Japan, Germany, and France had Green GDP adjustments of less than 0.5 percent.[56] This does not mean that environmental damage in these developed countries was insignificant, but rather that it amounted to a smaller percent of their relatively high GDP values. Such studies have also been criticized for inadequately valuing damages due to carbon emissions and climate change.

Adjusted Net Savings

The World Bank has developed an indicator of **Adjusted Net Saving** that seeks to measure what a society is truly saving for its future, starting with net savings (gross savings minus manufactured capital depreciation) and making adjustments for education, pollution, and the depreciation of natural capital.[57] Expenditures on education are added to national savings to reflect investment in human capital. Adjustment for pollution damages accounts for the negative impacts of carbon dioxide emissions and local air pollution. Accounting for depreciation of natural capital involves deducting the depletion of non-renewable fossil fuels (oil, coal and natural gas), extraction of non-renewable minerals and adding the net change in forest area.

The World Bank has calculated ANS rates for most countries of the world, with selected results presented in Table 3. For many countries, the environmental adjustments are relatively minor, but in some cases they are a large proportion of net savings. The deduction for energy depletion is particularly high in Russia and Nigeria. High rates of both mineral and forest depletion are observed in the Democratic Republic of Congo. The pollution adjustment tends to be a smaller share of national income, but is still high in such countries as India, Russia, Nigeria and China.

[54] World Bank and SEPA, 2007.
[55] Wang et al., 2020.
[56] Stjepanović et al., 2019.
[57] See World Bank data on environmental accounting.

Table 3. *Adjusted Net Saving (ANS) Rates, Selected Countries, Percent of Gross National Income, 2019*

Country	Net national saving	Education Spending	Energy depletion	Mineral depletion	Net forest depletion	Pollution + Carbon damage	ANS
Brazil	4.4	6.3	-1.7	-0.3	0.00	-1.3	7.4
China	27.0	1.8	-0.6	-0.2	0.00	-3.5	24.5
Congo, Dem. Rep.	17.1	2.1	-0.5	-2.4	-2.4	-1.9	12.0
Germany	9.7	4.5	-0.0	-0.0	0.0	-0.8	13.3
India	18.1	3.1	-0.4	-0.4	-0.1	-5.1	15.1
Kenya	-7.5	4.9	-0.0	0.0	-0.6	-1.9	-5.0
Mexico	6.4	4.5	-1.6	-0.1	0.0	-1.8	7.4
Nigeria	10.9	0.9	-3.7	-0.0	-0.6	-3.7	3.7
Philippines	19.8	1.8	-0.1	-0.2	-0.1	-2.1	19.1
Russia	15.6	4.4	-7.3	-0.1	0.0	-4.6	8.0
Uganda	15.5	1.7	0.0	0.0	-6.2	-2.2	8.9
United States	2.7	4.4	-0.3	-0.0	0.0	-1.0	5.8

Source: World Bank, World Development Indicators database.

About 20 countries have a negative ANS, most of them in Africa and the Middle East. On average, ANS rates are highest in middle-income countries such as China and India, which helps explain why these countries have generally been growing faster in recent years than high-income countries. But note that their high ANS is based on a high basic savings rate; they have significant environmental adjustments in the range of 4-5 percent of GDP. Low-income countries have the lowest average ANS rates, suggesting that low financial saving rates and natural capital degradation are undermining future well-being in these countries.

5.2 Monetary Valuation of Environmental Factors

Estimating monetary values for natural assets requires various assumptions, as these assets are rarely traded in markets unless they are exploited commercially. For example, in recent decades there has been a worldwide decline in populations of amphibians (frogs, toads, and salamanders), along with a large increase in deformities in these animals. Clearly, degradation of the natural environment is occurring. But since the market value of most frog species is zero, there are wide disagreements about how—or even whether—a monetary value can be put on these losses.

As another example, suppose that a hillside is stripped of its forest covering, and the wood is sold as pulp for papermaking. The lack of vegetation now means that runoff from rain increases, and could lead to flooding in downstream towns. In the national accounts as currently constructed, the timber from logging contributes to GDP, but so does the cost of repairing flooding damage (since this is considered an economic activity). Two things are wrong with this accounting approach. First, there is no accounting for the loss of the flood protection benefits of the forest. Second, the costs of repairing the flooding damages count as a positive contribution to GDP, instead of as a net cost that could have been avoided with better resource management.

How could we go about evaluating the environmental services received from the trees on the hillside? Using the **damage-cost approach,** an environmental service can be valued based on the damages done when the service is withdrawn. Suppose that the cost of flooding repairs is $5 million—we can then say that the value of the flood protection services of the hillside forest is $5 million.

Another approach to valuing the water retention services of an existing forest would be to consider the costs of replicating these services. Let's suppose that the damage from flooding could be avoided, despite the loss of the forests, by spending $100,000 on sandbagging. Using a **maintenance-cost approach**, we could say that the value of the forest's services is $100,000. As often happens, the results of the two approaches may differ significantly—in this case the value of the forest's services could be estimated at either $5 million or $100,000.

Economists and environmental scientists face a similar choice in many other areas; for example, whether to measure the value of unpolluted air in terms of effects of pollution on human health (damage) or in terms of the cost of pollution-control devices (maintenance). So far, some national and international agencies have adopted one convention and some the other in their experimental environmental accounts.

If the withdrawal of environmental services makes people suffer or die, then we enter the even more controversial area of trying to assign dollar values to human suffering and human lives. And many environmental effects cross national lines. What is the monetary value of a global "public good" such as a stable climate? On whose account should we tally the loss of deep-sea fisheries located in international waters?

One approach to the problem of valuation is simply to use satellite accounts, as described above, which can be recorded in physical terms, without monetary valuation. So, for example, we might note that the forest cover in a country has declined by 10 percent without attempting to value all the ecological functions of forests. Many governments have already committed in principle to creating such accounts for their own country, and some, such as Norway, maintain extensive satellite accounts for many resource and environmental categories.

6. CONCLUSION: MEASURING ECONOMIC WELL-BEING

No one—and especially not their creators—would argue that alternative macroeconomic indicators have been perfected. Nor has any single approach emerged as the "best" way to adjust, replace, or supplement GDP. As we have seen, any macroeconomic indicator involves numerous assumptions. One of the strengths of some of the new measures is that they allow users to see how the results change under different assumptions. For example, the BLI allows users to adjust the weights on each of the 11 well-being dimensions according to their personal preferences. Some have suggested that the best approach is to use multiple indicators, along the lines of the "dashboard" analogy mentioned earlier. One thing is clear—reliance on a single traditional GDP measure omits or distorts many crucial variables. Thus, all the alternative approaches discussed in this module have some value in providing broader perspectives on the measurement of well-being.

7. KEY TERMS AND CONCEPTS

Better Life Index (BLI) an index developed by the OECD to measure national welfare using 11 well-being dimensions

damage-cost approach: assigning a monetary value to an environmental service that is equal to the actual damage done when the service is withdrawn

defensive expenditures: money spent to counteract economic activities that have caused harm to human or environmental health

Green GDP: GDP less depreciation of both manufactured and natural capital

Human Development Index (HDI): a national accounting measure developed by the United Nations, based on three factors: GNI per capita level, education, and life expectancy

maintenance-cost approach: assigning a monetary value to an environmental service that is equal to what it would cost to maintain the same standard of services using an alternative method

opportunity-cost method (for estimating the value of household production): valuing hours at the amount that the unpaid worker could have earned at a paid job

replacement-cost method (for estimating the value of household production): valuing hours at the amount it would be necessary to pay someone to do the work

satellite accounts: additional or parallel accounting systems that provide measures of social and environmental factors in physical terms, without necessarily including monetary valuation

subjective well-being: a measure of welfare based on survey questions asking people about their own degree of life satisfaction

8. DISCUSSION QUESTIONS

1. GDP can be characterized as a (rough) measure of the amount of "throughput" taking place in an economy—processes whereby renewable and non-renewable resources (inputs) are turned into new products (outputs). How does "throughput" relate to sustainable well-being? Is more "throughput" always a good thing?
2. Economic activities are based on inputs of natural, manufactured, social, and human capital. But only the value of manufactured capital (structures and equipment)—and recently, software—is estimated in the current national accounts. Can you think of ways that the stocks of natural, social, and human capital might be measured? What kind of information would be needed?
3. Does the Genuine Progress Indicator include anything that you think should be left out or fail to account for something that you think should be included? Think hard about what you really think human well-being is about.
4. Give examples of each of the following:
   - Efforts to supplement GDP
   - Efforts to adjust GDP
   - Efforts to replace GDP

   Are there some alternatives discussed above that would fit into more than one of these categories? Are there some that are difficult to fit into any of them? Would you suggest any other way of categorizing efforts that are being made to improve how we measure the success of an economy in achieving well-being for present and future people?
5. Do you think that national governments should incorporate a monetary estimate of the value of household production in national accounting statistics? How do you think the inclusion of household production would affect the measurement of economic activity in developed versus developing countries?
6. Think back on at least one household activity in which you have engaged in the past couple of days that in principle could be replaced by market or third-person services. How would that activity be valued by the replacement-cost method? By the opportunity-cost method? What sorts of manufactured capital goods were important, along with your labor, in the activity?
7. In Burgess County, current irrigation methods are leading to rising salt levels in agricultural fields. As a result, the number of bushels of corn that can be harvested per acre is declining. If you are a county agricultural economist, what two approaches might you consider using to estimate the value of the lost fertility of the soil during the current year? What sorts of economic and technological information would you need to come up with your estimates?
8. Some people have argued that the monetary valuation of environmental costs and benefits is important because "any number is better than no number"— without valuation, these factors are omitted from GDP accounts. Others say that it is impossible to express environmental factors adequately in dollar terms. What are some valid points on each side of this debate? How do you think this debate should be resolved?
9. Of the various alternative indicators presented in this module, which one would you advocate as the best approach for measuring economic well-being? What do you think are the strengths and weaknesses of this indicator?
10. Suppose that your national government officially adopted your preferred indicator from the previous question. How do you think this would change specific policy debates in your country? What new policies do you think could be enacted?

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