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CENTRE FOR THE STUDY OF LIVING STANDARDS

# THE INCLUSION OF NATURAL RESOURCE WEALTH IN THE INDEX OF ECONOMIC WELL-BEING: RESULTS FOR OECD COUNTRIES, 1980-2013

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# The Inclusion of Natural Resource Wealth in the Index of Economic Well-being: Results for OECD Countries, 1980-2013


## Abstract

This report presents augmented estimates of the Index of Economic Well-being (IEWB) for 14 OECD countries for the 1980-2013 period. The new estimates account for the inclusion of an internationally comparable measure of natural resource wealth which had been absent from previous IEWB reports. It finds that in 2013 Norway had the highest level of economic well-being and Spain the lowest. Despite being a resource rich country, Canada ranked eleventh among the fourteen countries for economic well-being. Australia ascended the most in the Index of Economic Well-being rankings with the inclusion of natural resource wealth, rising from seventh to fourth. A case study on the sensitivity of Norway's natural capital to oil prices revealed that Norway's first place ranking in the Index of Economic Well-being is robust to volatility in resource prices.

# The Inclusion of Natural Resource Wealth in the Index of Economic Well-being: Results for OECD Countries, 1980-2013

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# The Inclusion of Natural Resource Wealth in the Index of Economic Well-being: Results for OECD Countries, 1980-2013

## Executive Summary

Traditionally, questions surrounding economic well-being have been answered by analyzing trends in gross domestic product (GDP) per capita. However, GDP per capita serves as a poor measure of economic well-being. It inadequately measures consumption by omitting the value of leisure and government services. Moreover, GDP per capita ignores the value of accumulation. The value of human capital, natural resources, the capital stock, and research should be accounted for in any adequate measure of economic well-being. Furthermore, GDP per capita fails to capture measures of inequality and economic security; it provides no indication of the likelihood that an individual will share in a nation's prosperity, nor does it reflect the degree of anxiety with which individuals contemplate their futures.

In 1998, the Centre for the Study of Living Standards (CSLS) released the first estimates of the Index of Economic Well-being (IEWB) for Canada (Osberg and Sharpe, 1998), which is a composite index based on a conceptual framework developed by Osberg (1985). The objective of the Index is to better capture the state of economic well-being. It compromises the four following domains of economic well-being: effective per capita consumption, net societal accumulation of stocks of productive resources, economic inequality, and economic security. Each domain is composed of sub-domains. For example, included in the net societal accumulation of productive resources is the value of natural resources per capita. It should be noted that in order to combine the four domains into a single index, it is necessary to specify relative weights for each dimension. While this report equally weights each component, the weightings are subjective and analysts will generally hold different subjective positions as to which dimension is the most important.

The objective of this report is to present augmented estimates of the IEWB for 14 major OECD countries (Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, the United Kingdom and the United States) which reflect the inclusion of natural resource wealth per capita. Previous IEWB estimates for OECD countries omitted natural resource wealth from the wealth dimension of well-being due to a lack of internationally comparable time series data. This report aims to shed light on natural capital's significance as a form of wealth and ultimately develop a more accurate depiction of economic well-being for the fourteen OECD countries under analysis. In addition to producing updated Index rankings, the report also includes a case study on the sensitivity of Norway's natural capital wealth to resource prices.

## *Results*

The significance of natural capital as a form of wealth varies substantially between nations. In absolute terms, the United States leads the 14 selected OECD countries with US$2.2 trillion in natural capital, predominantly in the form of energy wealth. Australia and Canada follow the United States with US$1.4 trillion and US1.3 trillion in natural resource wealth, respectively. European nations boast substantially less natural capital. For example, Belgium's natural resources are valued at just US$4 billion.

In per capita terms, Norway tops the 14 selected OECD nations with US$95,825 in natural resource wealth, forming one fifth of Norway's total wealth. Composing just over ten percent of total wealth, Canada once again ranks third with US$37,397 in natural capital per capita. It should be noted that natural capital accounts for an insignificant share (less than one percent) of per capita wealth in five countries: Italy, Germany, Spain, France and Belgium.

The composition of natural resource wealth varies greatly by country. Forestry resources account for the entirety of Belgium's natural wealth, whereas energy garners the lion's share of wealth for countries such as Norway, Denmark, the Netherlands, Canada, and the United States.

Norway ranked first in the overall Index of Economic Well-being in 2013, followed by the Netherlands and Finland, respectively. The U.S., Italy, and Spain had the lowest level of economic well-being. Canada ranked eleventh among the fourteen OECD countries. Australia's substantial stock of mineral resources resulted in it ascending three positions, from seventh to fourth. Unsurprisingly, the limited resource stocks of Belgium, France and Germany led to their decline in the rankings. In terms of total wealth per capita, Norway, Canada and Australia remained in first, second and third position, respectively.

In addition to ranking nations in terms of wealth and the IEWB, growth rankings for both of the aforementioned variables are also produced. Spain ranked first in average annual wealth per capita growth, whereas Canada declined from third to seventh. Nations that outperformed in the growth rankings tended to be ones with an insignificant share of total IEWB wealth in the form of natural capital. In terms of overall IEWB growth, Australia ranked as the fasted growing selected OECD country. The inclusion of natural capital pushed Australia to first from third. Australia was followed by France and Norway, who declined by a single position each. The weak wealth growth attributable to resource-rich countries contributed to the decline of Norway and Canada in the overall IEWB rankings.

It should be noted that superior performance in the IEWB rankings is not directly associated with outperformance in GDP per capita rankings. An exception is Norway, who ranked first both in terms of overall IEWB and GDP per capita. Finland ranked third in the IEWB but tenth in terms of GDP per capita, largely reflecting its strong social safety net and limited prevalence of economic inequality. Also of note is the discrepancy between the GDP per capita and IEWB rankings of the United States: twelfth in the IEWB but second in GDP per capita.

The rankings are produced using average commodity prices in the last year under analysis (in the case of this report, the last year under consideration is 2013). Variation in commodity prices therefore affect the rankings. To test the robustness of the results, a case study was conducted on Norway's rankings to study its sensitivity to oil rents (Norway's oil rents are equal to the difference between the price OF Brent crude and the average extraction cost of Norway's energy producers). Note that energy wealth accounts for over 97% of Norway's natural capital, making a robustness check on its rankings particularly appropriate.

For every US$10 increment in the unit rent per barrel of Brent crude, natural resource wealth per capita increases by US$9,514. This implies a 16% gain in natural capital per capita when oil rents rise from US$20/barrel to US$30/barrel, and an 8% gain in natural wealth per capita when oil unit rents increase from US$90/barrel to US$100/barrel. While highly sensitive to the price of oil, Norway maintains its first place ranking in both wealth per capita and the overall IEWB for all oil rents between US$20/barrel and US$100/barrel. Norway's third place wealth growth ranking approaches first place as the unit rent per barrel of oil approaches US$100. Furthermore, Norway's third place ranking in overall IEWB growth improves by one position—to second place—as the unit rent per barrel of oil approaches US$100.

Further research may wish to compare the World Bank's resource wealth data for Canada with the natural capital figures produced by Statistics Canada, explore the sensitivity of Canada's rankings to commodity prices, and cross reference a broader range of wealth estimates produced by the Centre for the Study of Living Standards with the corresponding estimates produced by the World Bank.

# The Inclusion of Natural Resource Wealth in the Index of Economic Well-being: Results for OECD Countries, 1980-2013[1]

## I. Introduction

The Index of Economic Well-being (IEWB) is a composite index conceptually formulated by Osberg (1985) that measures economic well-being across four dimensions: effective per capita consumption, net societal accumulation of stocks of productive resources, poverty and inequality, and economic security. Since 1998, the Centre for the Study of Living Standards (CSLS) has produced on a regular basis estimates of the Index of Economic Well-being for Canada at both the national and provincial level (Thomas and Uguccioni, 2016a), as well as a selected group of major OECD countries (Thomas and Uguccioni, 2016b).

Each dimension of economic well-being is itself an aggregate measure that includes subcomponents. For example, included in net societal accumulation of stocks of productive resources is natural resource wealth per capita, R&D per capita, human capital per capita, fixed capital per capita, and a measure of the cost of greenhouse gas emissions that is netted against the other forms of wealth.

Previous work by the CSLS has produced IEWB estimates for Canada and the provinces which include natural resources wealth using data provided by Statistics Canada (Thomas and Uguccioni, 2016a). However, due to a lack of internationally comparable time series on natural capital, previous IEWB estimates for selected OECD countries omit per capita natural resource wealth from the stock of productive resources (Thomas and Uguccioni, 2016b). Being an important component of wealth for many countries, the focus of this report is on introducing natural resource wealth into the IEWB for a group of 14 selected OECD countries.

This report is divided into five sections. The first part briefly reviews the current literature and available datasets regarding internationally comparable estimates of natural resource wealth. The second part provides a thorough description of the chosen data to be incorporated into the augmented IEWB, including factors such as the number of countries covered, the length of the time series, and the theoretical methodology used to construct it. The third section presents and discusses the augmented estimates of the IEWB for major OECD countries. The fourth section constitutes a sensitivity analysis of the results and the fifth section concludes.

[1] This paper was written by Richard Beard, an economist at the Centre for the Study of Living Standards (CSLS), under the supervision of CSLS Executive Director Andrew Sharpe. The author thanks Doug May, Lars Osberg, Bert Waslander, Alexander Murray, and Andrew Sharpe for comments, as well as Christopher Sall from the World Bank for providing the necessary data to produce this report. Comments on the report are welcome and should be emailed to rbear029@uottawa.ca.

## II. Review of Available Data Sources

The objective of the review was to identify potential datasets with a measure of natural resource stocks either in real or nominal dollars for each of the selected OECD countries. Criteria for evaluating the appropriateness of a dataset included the length of the time series, the methodology used to measure natural resource wealth, and the types of natural resources included in the dataset.

Upon conducting the review it became apparent that most of the academic literature heavily relies on proxies for natural resource endowments. For example, both Frankel (2010) and Sachs and Warner (2001) make use of "exports of natural resources as a percentage of GDP" as a measure of natural resource abundance. This is often the case in literature regarding the Dutch disease and Natural Resource Curse. To this point, Frankel (2010) acknowledges this shortfall in mentioning that the "revisionists often emphasize that … it is wrong to treat data on mineral exports as if they represent geographic endowments." Moreover, this measure of natural resource endowment fails to distinguish a nation's resource composition (mineral, energy, forestry, etc.). Natural resource endowment has also been accounted for through the use of dummy variables. Lujala, Gleditsch and Gilmore (2005) quantify resource endowment by assigning a region a binary variable equal to "1" if said region is endowed with a resource deposit.

As part of its work on sustainability, the World Bank produces Adjusted Net Saving (ANS) estimates in pursuit of a clear, relatively simple national-level indicator of how sustainable any given country's investment policies are. A component of ANS is natural resource depletion, taken to be the ratio of the value of a natural resource's stock to its remaining reserve life. In other words, in order to calculate ANS, the World Bank must first calculate the dollar value of a nation's natural capital. Available from the World Bank are two databases which resolve the methodological limitations inherent to the previously discussed databases. Together, they exist as the most comprehensive attempts at measuring internationally comparable natural resource wealth (World Bank, 2017a, 2017b).

The World Bank (2017a) provides data on natural resource rents as a percentage of Gross National Income (GNI). It includes data on 167 countries for the 1970-2014 period, including all of the selected OECD countries in the IEWB estimates. Natural resource rents are broken into three categories: energy, forestry, and minerals. Energy resources consist of oil, gas, and coal. Mineral resources include copper, iron, lead, nickel, phosphate, tin, zinc, gold, silver, and bauxite rents. Forestry rents reflect both timber and non-timber resources.

As previously mentioned, the database expresses resource rents as a proportion of Gross National Income (GNI). In other words, natural resource endowments are measured as a flow variable. The unit rent for minerals is calculated as the world price for the commodity minus mining, milling, benefication, smelting and transportation costs, minus an average return to capital. The unit rent for energy resources is calculated as the world price minus lifting costs. [4] For resources that lack a distinct world price, such as natural gas, a shadow price is calculated and used in place of an observable commodity price (Bolt, Mampite, and Clemens, 2002). The

[4] All extraction costs are country-specific. In other words, Canada's extraction costs associated with oil production would be different than extraction costs associated with Saudi oil production.

unit rents are then multiplied by the quantity of resource extracted to arrive at a resource rent value, which is then divided by GNI. Production costs are estimated on the basis of industry and government data. Almost without exception, commodity price data comes from the World Bank Commodity Price Database (also known as the Pink Sheet). Refer to Note 1 and Note 2 in the appendix for a detailed list of data sources on production costs and commodity price data associated with each resource. Also note that at times when market fluctuations render the price of the commodity less than the average production cost for a nation, a unit rent equal to 0 was used in place of a negative value.

As described in World Bank (2011), unit rents for forestry resources are calculated as the average export unit value, *E*, for fuelwood, coniferous industrial roundwood, and non-coniferous industrial roundwood. Unit rents are then weighted by production volume and multiplied by a unit rental rate*, r*. Forestry data were obtained from FAOSTAT.[5] Also note that estimates of *E* are constructed using regional prices instead of country-specific prices. The unit rental rate is calculated as the ratio of the difference between total revenue and the cost of the revenue to total revenue.

The second World Bank (2017b) contains estimates of stock values of natural resource wealth for the 1970-2013 period.[6] Stock values of natural resource wealth were produced using the natural resource rent data included in the aforementioned World Bank database and measured in constant 2010 U.S. dollars.

Stock values of mineral and energy resources were estimated by employing the notion that an asset should be valued at the present discounted value of its future cash flows. This principle is expressed in the context of natural resources by the following equation:

$$V_t = \sum_{i=t}^{t+T-1} \frac{\pi_i q_i}{(1+r)^{(i-t)}}$$

where $\pi_i q_i$ represents the total rent at time *i, r* is the social discount rate, and *T* is the lifetime of the resource (World Bank, 2011). Note that *r* was assumed to be 4 percent. Variable $q_i$ is defined as the quantity of production and $\pi_i$ refers to unit resource rents.

The aforementioned methodology of resource valuation necessarily requires information about future resource rents. Thus, the World Bank employs a more restrictive valuation technique that assumes constant real rents over time period *T:*

$$V_t = \pi_t q_t \left(1 + \frac{1}{r}\right)\left(1 - \frac{1}{(1+r)^T}\right)$$

[5] See http://www.fao.org/faostat/en/

[6] The dataset available online contains estimates only for the years 1995, 2000, and 2015. World Bank (2015) contains the 1970-2013 series but is not publicly available. It is, however, obtainable by request from the World Bank.

Note that the choice of *T,* the exhaustion time value, depends on both the total reserves remaining in a resource deposit as well as the rate at which resources are being exhausted from said deposit. Thus, reserves-to-production ratios were employed to choose values for *T.* Reserves are defined to be a portion of a resource deposit that could be economically extracted at current market prices. As a result, the resource stock necessarily depends on the market price for the resource.[7] Although some countries boast deposits deserving of a greater lifespan, future cash flows discounted past 25 years are unlikely to have a significant effect on the asset's valuation. As a result, most resource exhaustion time values were capped at 25 years.[8] Note 3 in the appendix presents a detailed list of sources used to compile national resource reserves.

With respect to timber resources, the methodology behind calculating the present value is slightly more complex. The value of standing timber is equal to the discounted future stumpage price received by the owner of the forest netted against the costs of bringing the timber to maturity. Also note that forests were labeled as either having an available wood supply or an unavailable wood supply. This reflects the premise that some forests would be economically unviable to harvest or inaccessible given transportation and infrastructure constraints. A forest with an available wood supply was required to be within a 50km radius of existing infrastructure. As with energy and mineral resources, rents were capitalized with a growth rate of zero and future cash flows were discounted using a 4 percent social discount rate. Provided the forest is sustainably harvested, a horizon of $T$=25 years was applied to estimate the value of the forest. Alternatively, if annual harvests exceeded a sustainable rate, then a time horizon to exhaustion was calculated. Incremental time horizons are calculated as the forest volume divided by the difference between annual harvest and annual incremental tree growth. Non-timber forest resources, representing the value of land used for recreational activities, such as hunting, were assumed to be equal to one tenth of the value of timber resources.

As is mentioned in De Soya and Neumayer (2007), the World Bank's dataset is not without its drawbacks. First, the database excludes several measures of natural capital such as water resources, thereby omitting the national wealth attributable to fresh water and hydroelectric power. Moreover, the database fails to capture the economic value of renewable energy resource wealth, such as land available for solar power and wind farms. Finally, the variety of mineral resources captured by the data is far from comprehensive as it contains only ten minerals.[10]

Second, extraction costs are obtained through consultations with private sector corporations, but often only cover individual countries for a select number of years. The missing values required interpolation. With respect to this report, the time series is short of the existing IEWB estimates by one year (the World Bank series ends in 2013 whereas existing OECD

[7] This characteristic of reserves propagates vicious cycles when commodity markets experience significant price fluctuations. When commodity prices increase, both the unit rent and quantity of available resource for profitable extraction increase. This creates the potential for large upward movements in a nation's resource wealth in both physical and monetary terms. The opposite holds true when resource prices decline.

[8] A discount factor of 2.67 is obtained when $T$=25 using a 4% social discount rate. In comparison, a discount factor of 1.28 is obtained when discounting at a 1% social discount rate.

[10] As was previously mentioned, the dataset includes copper, iron, lead, nickel, phosphate, tin, zinc, gold, silver, and bauxite. It does not, however, include minerals such as diamonds, uranium, and potash.

IEWB estimates extend to 2014). Moreover, estimates for Belgium's natural resource wealth begin in 2000.[11]

Third, careful attention must be paid to the implications of the World Bank's assumptions for calculating natural resource wealth stocks. Natural resource wealth is taken to be the present discounted value of future resource rents, implying that several factors determine the stock of resource wealth in a given year: rents, production, and the quantity of available reserves. Unit rents are calculated as the per unit economic profit of extracting a resource, meaning that resource rents are a function of both the price of the resource and the cost of extraction. Therefore, upward movements in price then increase the value of per unit resource rents; however, higher prices also increase the reserve base. Thus, the quantity of available reserves is both endogenously and exogenously determined.[12] Any change in reserves flows through to the exhaustion time value of a resource, or the choice of $T$, which has important consequences for the present value calculation. Also note that resource rents in year $i$ are assumed to be constant over the exhaustion time period, meaning that the natural resource wealth in a given year reflects the wealth stock that exists under the assumption of constant market prices and no improvements to extraction technology.

A further consequence of the World Bank's methodology is that a nation's resource wealth increases in response to higher extraction rates, holding the reserve base constant. One might consider a scenario whereby a nation is presented with the option of extracting its entire reserve base in a given year or extracting it over time. Employing the methodology used by World Bank, total natural resource wealth would be greatest if the entire resource base was entirely depleted in period $t$=1, since future rents are discounted to a greater extent than current rents. As a result of the assumptions used in calculating the wealth stock, the World Bank's measure of natural resource wealth reflects the interaction between market price, the cost of production, the quantity of resource extracted, and reserves.

To provide further context for these assumptions, it is possible to imagine a scenario where resource production declines at the same time as resource prices rise and resource wealth increases. This property is compounded by the fact that the World Bank has capped the exhaustion time at $T$=25 for resource rich countries. Without the cap, a decline in commodity prices would result in a lower exhaustion time value, so lower commodity prices would almost certainly result in a lower value of natural resource wealth.[13]

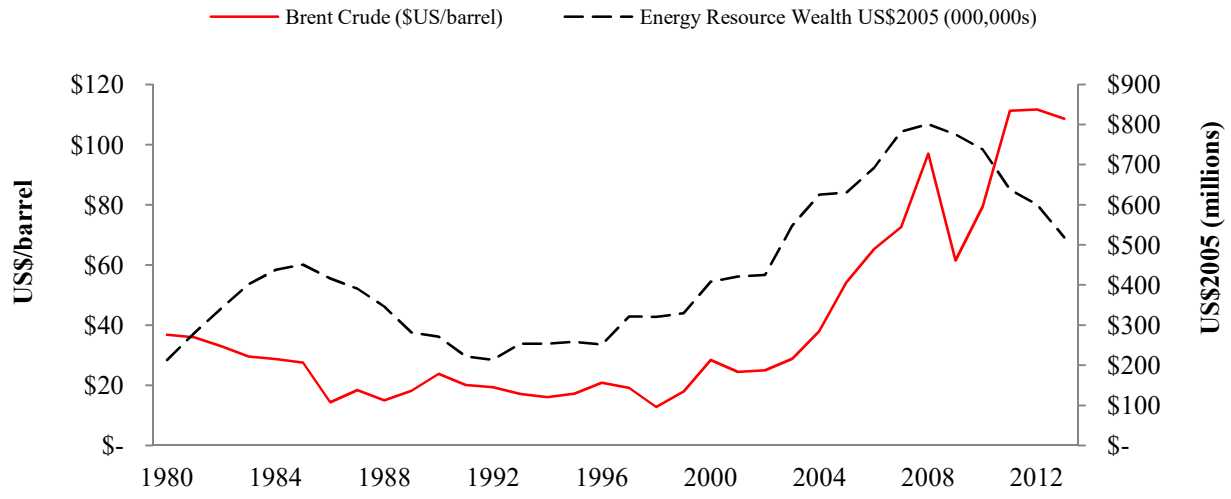
An illustration of this property can be seen in Chart 1. Brent crude prices recovered from post-financial crisis lows over the course of 2009 to 2013. However, despite the recovery in crude prices, Norway's energy resource wealth has continued to decline over the past decade. Note that this decline has materialized because the quantity of crude oil produced by Norway declined from 2,465,000 barrels per day in 2008 to 1,848,000 barrels per day in 2013, for a total decline of 30% in energy resource extraction ($q_i$) during the period (U.S. Energy Information Administration, 2017a).

[11] This issue was resolved by applying the net present value methodology presented above to Belgium's natural resource rent data in order to generate stock wealth accounts dating back to 1980.

[12] Reserves fluctuate in response to changes in market prices for a given commodity or through newly discovered resources available for profitable extraction.

[13] The lower time exhaustion value would be a result of a reduced supply of available resources for profitable extraction.

**Chart 1: Norway's Natural Resource Wealth, 1980-2013**




Source: World Bank, 2017b., U.S. EIA, 2017a.

Despite the limitations, the natural resource wealth estimates provided by the World Bank are by far the most appropriate data source to apply in updating the Index of Economic Well-being for major OECD countries.

## III. Analysis of the World Bank Data

The remainder of this report examines the economic well-being of 14 major OECD countries: Australia, Belgium, Canada, Denmark, Finland, France, Italy, Germany, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States.

Integrating the World Bank natural resource wealth data into the IEWB estimates first required the conversion of wealth stocks into constant US$2005. This was necessary as other measures of wealth, such as human capital, R&D, and fixed capital are also measured in US$2005. A U.S. GDP deflator was used to translate the US$2010 data into constant US$2005 terms (U.S. Bureau of Economic Analysis, 2017). National resource stocks were then converted into per capita values using population data provided in the IEWB data (OECD Statistics, 2016).

### A. Summary Statistics

As Table 1 demonstrates, natural resource wealth is highly variable among the fourteen OECD countries. In absolute terms, the United States ranks first with US$2.2 trillion in natural resource wealth. Australia and Canada follow with resource endowments valued just above US$1.4 trillion and US$1.3 trillion, respectively.

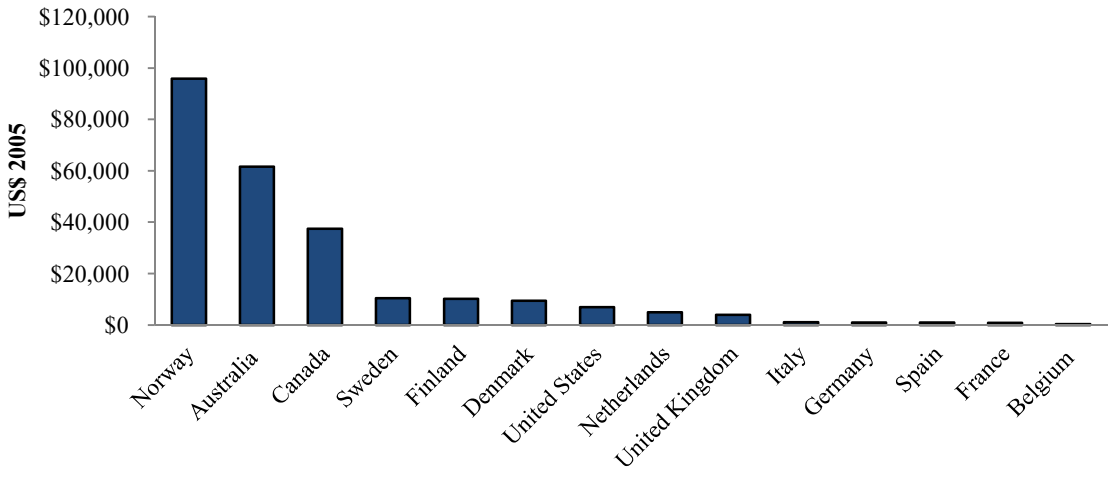
**Table 1: Components of Natural Resource Wealth, Selected OECD Countries, 2013, (Billion US$2005)**

| Country | Energy Wealth | Mineral Wealth | Forestry Wealth | Total Resource Wealth |
|---|---|---|---|---|
| Australia | 330 | 1,006 | 88 | 1,424 |
| Belgium | n.a. | n.a. | 4 | 4 |
| Canada | 955 | 135 | 231 | 1,321 |
| Denmark | 51 | 0 | 2 | 53 |
| Finland | 0 | 7 | 49 | 56 |
| France | 6 | 1 | 50 | 57 |
| Germany | 25 | 1 | 55 | 80 |
| Italy | 46 | 0 | 17 | 62 |
| Netherlands | 83 | n.a. | 1 | 84 |
| Norway | 471 | 4 | 11 | 487 |
| Spain | 3 | 7 | 33 | 43 |
| Sweden | n.a. | 39 | 61 | 100 |
| United Kingdom | 238 | 0 | 9 | 248 |
| United States | 1,546 | 257 | 396 | 2,198 |

Source: World Bank (2017b)

However, on a population adjusted basis, Chart 2 illustrates that by far the most endowed nation is Norway with US$95,825 in per capita natural resource wealth. Belgium, by comparison, ranks fourteenth with US$348 in natural capital. Canada once again ranks third with just over US$37,397 in per capita natural resource wealth.

**Chart 2: Natural Resource Wealth Per Capita, 2013**




Source: World Bank, 2017b,

Chart 2 also illustrates that for the majority of countries, natural capital contributes an insignificant quantity to per capita wealth. In fact, for 11of the 14 OECD countries, natural resource wealth is valued at or below US$10,000 per capita. Of those 11 coutnries, five countries (Italy, Germany, Spain, France and Belgium) are endowed with less than US$1,000 in natural capital.

It is possible to classify nations into three distinct categories reflecting natural capital's share of the nation's total IEWB wealth stock. Table 2 illustrates that natural resources account for a significant portion (over 10%) of the Index of Economic Well-being's total real per capita wealth measure for three nations: Australia, Canada, and Norway. Norway's share of total wealth composed of natural capital is the largest at 18.2%, followed by Australia at 17.4% and Canada at 12.1%. Natural capital accounts for a modest share (between 1% and 10%) of total wealth for Denmark, Finland, the Netherlands, Sweden, the United Kingdom, and the United States. For Belgium, France, Germany, Italy, and Spain, natural capital accounts for less than 1% of the nation's total wealth stock. In other words, for over a third of the sample, natural resource wealth can be regarded as an irrelevant component of the total IEWB wealth stock.

**Table 2: Component Share of the IEWB Total Wealth Stock (%), Selected OECD Countries, 2013**

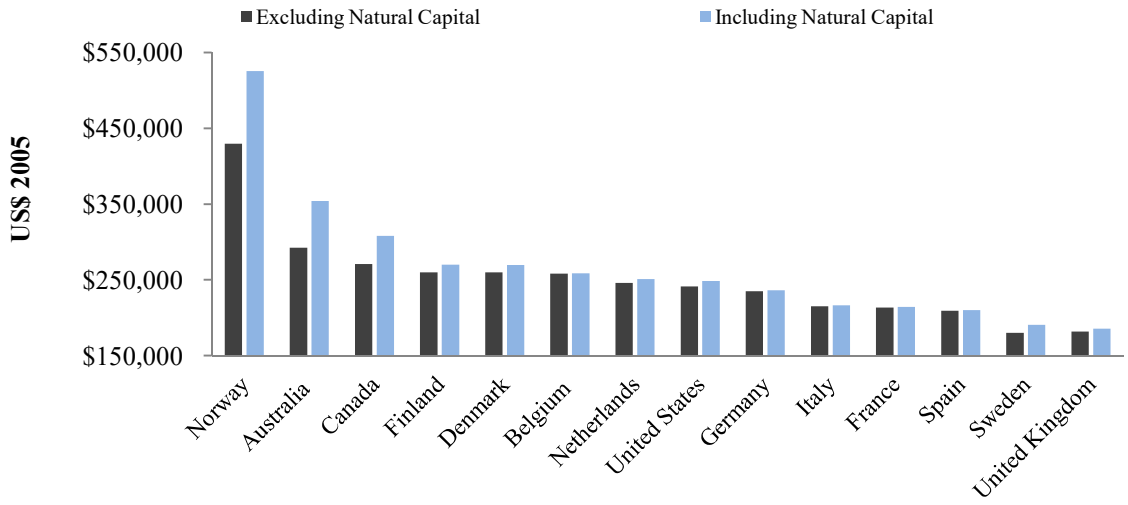
| Country | Stock of Fixed Capital | Expenditures on R&D | Net International Investment Position | Human Capital Stock | Cost of Green-house Gas Emissions | Stock of Natural Resources | Total Wealth |
|---|---|---|---|---|---|---|---|
| Australia | 65.1 | 1.2 | -8.7 | 25.7 | -0.6 | 17.4 | 100 |
| Belgium | 58.8 | 1.5 | 9.2 | 31.1 | -0.8 | 0.1 | 100 |
| Canada | 55.4 | 1.1 | 0.2 | 31.8 | -0.7 | 12.1 | 100 |
| Denmark | 53.5 | 2.2 | 8.4 | 33.2 | -0.7 | 3.5 | 100 |
| Finland | 59.6 | 2.4 | 1.0 | 33.9 | -0.7 | 3.8 | 100 |
| France | 64.7 | 1.8 | -3.5 | 37.5 | -0.9 | 0.4 | 100 |
| Germany | 56.2 | 2.3 | 6.7 | 35.3 | -0.9 | 0.4 | 100 |
| Italy | 68.5 | 0.9 | -4.6 | 35.4 | -0.7 | 0.5 | 100 |
| Netherlands | 54.2 | 1.6 | 6.4 | 36.6 | -0.9 | 2.0 | 100 |
| Norway | 41.0 | 0.9 | 22.9 | 17.6 | -0.6 | 18.2 | 100 |
| Spain | 70.7 | 0.9 | -13.3 | 41.9 | -0.8 | 0.4 | 100 |
| Sweden | 51.6 | 3.5 | -4.6 | 45.1 | -1.1 | 5.5 | 100 |
| U.K. | 55.3 | 1.6 | -3.2 | 45.3 | -1.1 | 2.1 | 100 |
| U.S. | 62.8 | 2.6 | -6.4 | 39.0 | -0.7 | 2.8 | 100 |

Source: CSLS, World Bank (2017b)

Table A1 in the appendix provides the component share of natural resource wealth as a percent of GDP for the selected OECD countries in 2013. The significance of natural capital for Norway, Australia, and Canada is again observed. Whereas natural resources represent 166.3% of GDP for Norway, 152.1% of GDP for Australia, and 97.9% of GDP for Canada, natural capital accounts for just 0.9% of GDP for Belgium.

Whereas energy, mineral, and forestry wealth significantly contribute to the wealth stock of Norway, Canada, and Australia, the total wealth stock of other nations—particularly those in Continental Europe—hardly benefits from natural resource wealth. Chart 3 depicts the change in total per capital IEWB wealth once the World Bank natural resource data is introduced to the IEWB dataset.

**Chart 3: Total Wealth Per Capita, Select OECD Countries, 2013**




The change in total wealth per capita following inclusion of natural capital is most evident for Norway, Australia, and Canada, whose per capita wealth gained 22%, 21%, and 14%, respectively. With the exception of Sweden, nations whose wealth expanded most had relatively high levels of total per capita wealth prior to the introduction of the World Bank data. Modest gains are visible for countries whose natural resource wealth forms between 1% and 10% of wealth.

**Table 3: Component Share of Natural Resource Wealth (%), Selected OECD Countries, 2013**

| Country | Energy Wealth | Mineral Wealth | Forestry Wealth | Total Resource Wealth |
|---|---|---|---|---|
| Australia | 23.2 | 70.7 | 6.2 | 100 |
| Belgium | n.a. | n.a. | 100.0 | 100 |
| Canada | 72.3 | 10.2 | 17.5 | 100 |
| Denmark | 95.5 | 0.2 | 4.3 | 100 |
| Finland | 0.0 | 12.4 | 87.6 | 100 |
| France | 10.1 | 1.0 | 88.9 | 100 |
| Germany | 31.3 | 0.7 | 68.0 | 100 |
| Italy | 73.1 | 0.3 | 26.6 | 100 |
| Netherlands | 98.8 | n.a. | 1.2 | 100 |
| Norway | 96.8 | 0.8 | 2.3 | 100 |
| Spain | 7.3 | 15.5 | 77.2 | 100 |
| Sweden | n.a. | 39.1 | 60.9 | 100 |
| United Kingdom | 96.2 | 0.0 | 3.8 | 100 |
| United States | 70.3 | 11.7 | 18.0 | 100 |

Source: World Bank (2017b)

Thus far, it has been established that natural capital varies in importance between nations. With this understanding, Table 3 explores the components of natural capital and their relative importance for each country. The composition of natural resource wealth varies greatly by country. Belgium's forests account for the entirety of its small quantity of natural wealth, whereas energy resources garner the lion's share of wealth for countries such as Norway,

Denmark and the Netherlands. At 72.3%, oil, coal and natural gas also account for a dominant share of Canada's natural capital. Norway's natural capital is almost entirely composed of energy wealth, forming 96.2% of total resource wealth. The most mineral intensive economy in both absolute and relative terms is Australia. In fact, Australia's mineral wealth is greater than the sum of the remaining thirteen nation mineral accounts combined.

## B. Relevance to Sustainable Development

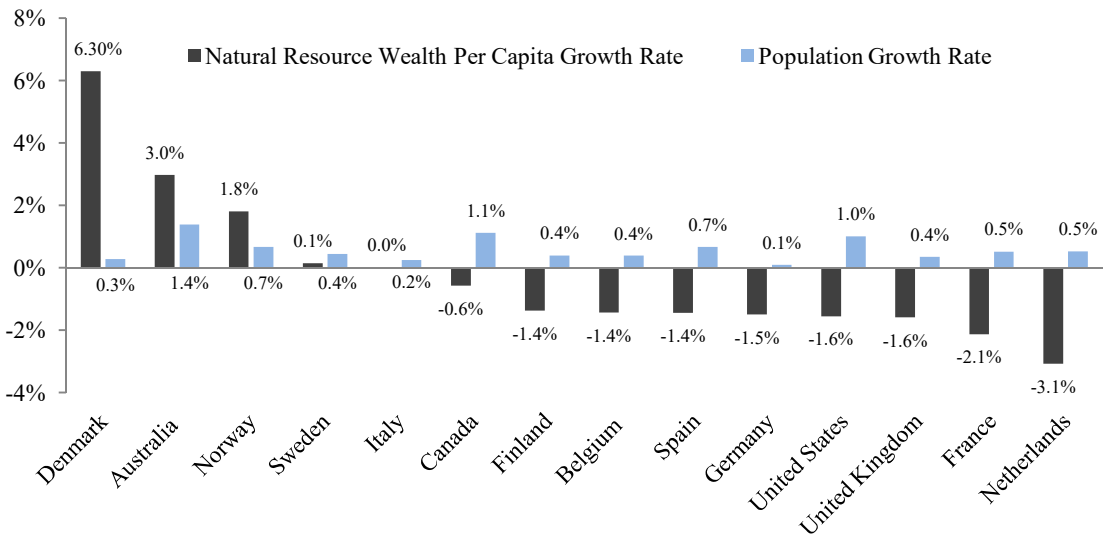
Natural capital warrants particular attention in the context of sustainable development. For countries particularly dependent on nonrenewable natural capital, sustainable development necessitates an ability to efficiently transform natural capital into other forms of productive capital; failing to do so risks depleting a valuable pool of resources in the near term at the expense of future wealth (World Bank, 2011). Such a requirement aligns itself with the concept of weak sustainable development, which suggests that natural capital and reproducible capital are substitutes. In this way, natural capital may decline so long as other stocks of capital, such as human capital, increase (Pearce and Atkinson, 1993). Such a result would imply that the level of overall capital should remain non-decreasing.

The remainder of this paper considers a narrower form of sustainable development which may be referred to as the "capital theory approach of sustainability", which requires that sustainable development be the result of maintained and, if possible, growth, in a nation's per capita wealth over time. Thus, a sustainably managed resource base must necessarily grow at a rate which exceeds the pace of population growth in order to overcome the "population dilution effect". Provided wealth increases to a greater extent in relative terms than population, the country's residents are afforded a larger share of resources. Failing to achieve a wealth growth rate at least equal to population growth ensures that average social welfare will decline as more and more individuals share a fixed (or relatively smaller) base of resources.

Chart 4 presents per capita resource wealth growth over the 1980-2013 period. During this period, only five of the 14 OECD countries realized growth in per capita natural resource wealth: Denmark, Australia, Norway, Sweden and Italy. Most notably, Denmark's natural resource wealth grew by an average of over 6% per year during this period. Ranking sixth is Canada with an annual loss of -0.6% in per capita natural capital, predominantly due to a declining base of forestry resources (forestry resources have more than halved in value since 1980). At 14$^{th}$ is the Netherlands, whose per capita resource wealth in 1980 approached US$ 14,000 but sat at US$5,000 in 2013, declining by an average of 3% per year. The decline is primarily explained by lower quantities of petroleum production beginning in the mid-1990s in addition to dwindling forestry resources (U.S. Energy Information Administration, 2017b). Interestingly, such a noteworthy drop was realized despite a modest population growth rate.

Following the introduction of natural resource wealth into the IEWB estimates, only two of the 14 OECD countries experience an increase in the growth rate of total real per capita wealth: Australia and Denmark. The trend towards slower growth following the inclusion of natural capital is primarily a result of total real per capita wealth (excluding natural resources) growing at a faster rate than natural resource wealth per capita.

**Chart 4: Natural Resource Wealth per capita and Population Growth Rate, 1980-2013**



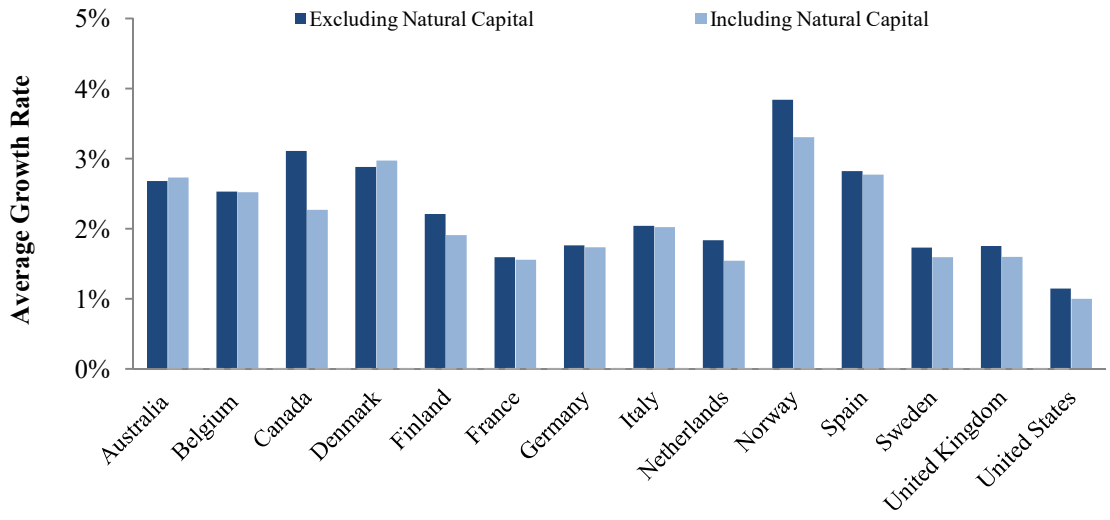

Sources: World Bank, 2017b., OECD Statistics, 2016.

Nine witnessed negative natural resource wealth per capita growth: Belgium, Canada, Finland, France, Germany, the Netherlands, Spain, the United Kingdom, and the United States. The remaining three countries—Italy, Norway, and Sweden—had positive growth in resource wealth per capita but failed to match total wealth (excluding natural resources) growth, thereby lowering the latter's growth rate once natural resources were integrated into the wealth estimates.

On an absolute basis, Canada's total per capita wealth growth rate declined by 0.9 percentage points, the largest drop of any country (Chart 5). This is primarily due to natural capital's relatively large weighting in Canada's total wealth in conjunction with its negative growth rate.[19]

[19] As a point of comparison, the natural resource wealth estimates provided by Statistics Canada yield an average annual growth rate of -0.96%.

**Chart 5: Growth Rate of Wealth Per Capita Including and Excluding Natural Capital**




Source: World Bank, 2017b.

## IV. Augmented Estimates of the Index of Economic Well-being

The focus of this section is to analyze both the wealth rankings as well as the Index of Economic Well-being rankings for 14 selected OECD countries as of 2013. Where possible, a discussion is provided to contrast the updated estimates with the results produced by omitting natural resource wealth. The discussion first considers wealth rankings and follows by discussing IEWB rankings, given that total per capita wealth is one of four equally-weighted components of the Index of Economic Well-being.

Table 4 provides the augmented rankings for total wealth per capita which include natural capital. Norway, Australia and Canada remained in first, second and third position in the per capita wealth index, respectively. Scandinavian forestry resources pushed Finland and Sweden up by one ranking in the total wealth per capita rankings. Both the United Kingdom and Denmark declined by one position. The United Kingdom is now ranked fourteenth in terms of wealth per capita. Refer to Table A2 in the appendix for the components of the IEWB total wealth stock on a per capita basis for 2013.

**Table 4: Total IEWB Wealth Per Capita Rankings, Selected OECD Countries, 2013**

| Country | Including Natural Resource Wealth | Excluding Natural Resource Wealth | Change in Ranking |
|---|---|---|---|
| Norway | 1 | 1 | 0 |
| Australia | 2 | 2 | 0 |
| Canada | 3 | 3 | 0 |
| Finland | 4 | 5 | 1 |
| Denmark | 5 | 4 | -1 |
| Belgium | 6 | 6 | 0 |
| Netherlands | 7 | 7 | 0 |
| United States | 8 | 8 | 0 |
| Germany | 9 | 9 | 0 |
| Italy | 10 | 10 | 0 |
| France | 11 | 11 | 0 |
| Spain | 12 | 12 | 0 |
| Sweden | 13 | 14 | 1 |
| United Kingdom | 14 | 13 | -1 |

Source: CSLS, World Bank (2017b)

Table 5 provides augmented estimates for the Index of Economic Well-being for fourteen selected OECD countries. Among the fourteen countries in the study, Norway ranked highest in the overall Index of Economic Well-being in 2013, followed by the Netherlands and Finland. The United States, Italy, and Spain had the lowest economic well-being. Canada ranked eleventh among the fourteern OECD countries.

**Table 5: Index of Economic Well-being Rankings, Selected OECD Countries, 2013**

| Country | Including Natural Resource Wealth | Excluding Natural Resource Wealth | Change in Ranking |
|---|---|---|---|
| Norway | 1 | 1 | 0 |
| Netherlands | 2 | 2 | 0 |
| Finland | 3 | 3 | 0 |
| Australia | 4 | 7 | 3 |
| Belgium | 5 | 4 | -1 |
| France | 6 | 5 | -1 |
| Germany | 7 | 6 | -1 |
| Denmark | 8 | 8 | 0 |
| Sweden | 9 | 9 | 0 |
| United Kingdom | 10 | 10 | 0 |
| Canada | 11 | 11 | 0 |
| United States | 12 | 12 | 0 |
| Italy | 13 | 13 | 0 |
| Spain | 14 | 14 | 0 |

Source: CSLS, World Bank (2017b)

Australia's ranking improved from seventh to fourth in the revised estimates, the largest absolute increase by any country. This is a direct result of Australia's significant increase in total per capita wealth, from US$292,400 to US$353,981. Unsurprisingly, the small resource stocks of

Belgium, France and Germany led to their decline in the rankings. Each fell one rank and now occupy the fifth, sixth, and seventh positions in the IEWB, respectively.

In addition to ranking nations in accordance with the magnitude of wealth per capita and the IEWB, growth rankings for both of the aforementioned variables are also produced. Growth rankings distinguish between countries that have advanced the most during the 1980-2013 period and those that have produced modest (or even negative) compounded returns in wealth per capita and the IEWB.

**Table 6: Growth in Total Wealth Per Capita, Selected OECD Countries, 1980-2013**

| Country | Including Natural Resource Wealth | Excluding Natural Resource Wealth | Change in Ranking |
|---|---|---|---|
| Spain | 1 | 2 | 1 |
| Denmark | 2 | 4 | 2 |
| Norway | 3 | 1 | -2 |
| Belgium | 4 | 6 | 2 |
| Australia | 5 | 5 | 0 |
| Italy | 6 | 8 | 2 |
| Canada | 7 | 3 | -4 |
| Finland | 8 | 7 | -1 |
| Germany | 9 | 12 | 3 |
| United Kingdom | 10 | 9 | -1 |
| Sweden | 11 | 10 | -1 |
| France | 12 | 13 | 1 |
| Netherlands | 13 | 11 | -2 |
| United States | 14 | 14 | 0 |

Source: CSLS, World Bank (2017b)

Table 6 reports growth in per capita wealth. Spain ranked first in average annual wealth per capita growth and Canada declined from third to seventh. Again, Canada's performance is primarily a result of negative average growth rate in per capita natural capital, which accounts for 14% of Canada's total wealth. It is interesting to note that outperforming countries were those with an insignificant share of total IEWB wealth in the form of natural capital.

At a compounded annual increase of 1.5%, the inclusion of natural resource wealth resulted in Australia ranking as the fastest growing OECD country in terms of the IEWB, up from third excluding natural resource wealth (Table 7). Australia was followed by France and Norway, who declined by a single position each. Despite Spain's last place ranking in the IEWB growth tables, it ranked first in average annual per capita wealth growth.

**Table 7: Growth in the IEWB, Selected OECD Countries, 1980-2013**

| Country | Including Natural Resource Wealth | Excluding Natural Resource Wealth | Change in Ranking |
|---|---|---|---|
| Australia | 1 | 3 | 2 |
| France | 2 | 1 | -1 |
| Norway | 3 | 2 | -1 |
| United States | 4 | 4 | 0 |
| Denmark | 5 | 6 | 1 |
| Canada | 6 | 5 | -1 |
| United Kingdom | 7 | 7 | 0 |
| Finland | 8 | 8 | 0 |
| Netherlands | 9 | 9 | 0 |
| Germany | 10 | 10 | 0 |
| Belgium | 11 | 11 | 0 |
| Sweden | 12 | 12 | 0 |
| Italy | 13 | 14 | 1 |
| Spain | 14 | 13 | -1 |

Source: CSLS, World Bank (2017b)

The relatively weak wealth growth characteristic of resource-rich countries contributed to the decline of Norway and Canada. However, Australia's notable natural capital growth during the 1980-2013 was substantial enough to earn it the top ranking in the IEWB growth rankings.

High performance in the Index of Economic Well-being does not necessarily translate into a higher ranking in the more narrowly defined measure of a nation's standard of living, GDP per capita. Table 8 reports each nation's ranking in the IEWB against GDP per capita in US$2010. Norway ranked first in both the IEWB and GDP per capita. Interestingly, the United States ranked 12$^{th}$ in IEWB growth but second in terms of GDP per capita.

**Table 8: IEWB Ranking vs. GDP Per Capita Ranking, Selected OECD Countries, 2013**

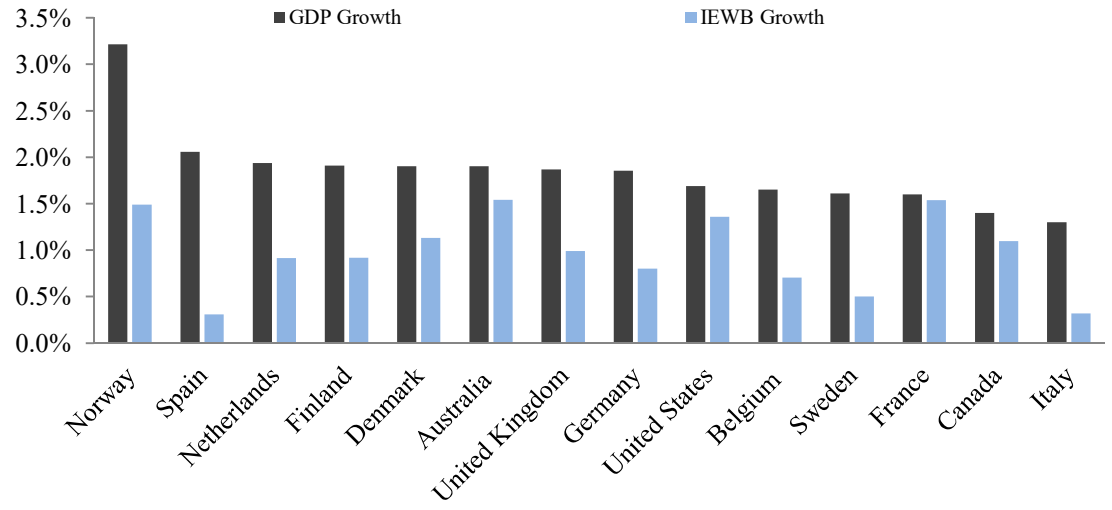
| Country | Augmented Index of Economic Well-being | GDP Per Capita | Difference in Ranking |
|---|---|---|---|
| Norway | 1 | 1 | 0 |
| Netherlands | 2 | 3 | 1 |
| Finland | 3 | 10 | 7 |
| Australia | 4 | 4 | 0 |
| Belgium | 5 | 9 | 4 |
| France | 6 | 11 | 5 |
| Germany | 7 | 7 | 0 |
| Denmark | 8 | 5 | -3 |
| Sweden | 9 | 6 | -3 |
| U.K. | 10 | 12 | 2 |
| Canada | 11 | 8 | -3 |
| United States | 12 | 2 | -10 |
| Italy | 13 | 13 | 0 |
| Spain | 14 | 14 | 0 |

Source: CSLS, World Bank (2017b)

This result suggests that merely considering the value of goods and services produced by the United States masks the United States' underperformance in terms of economic security and income equality. Finland, on the other hand, ranked tenth in terms of GDP per capita but third in the augmented Index of Economic Well-being, largely reflective of its high wealth (fourth), income equality (first), and economic security (sixth) rankings.

Finally, one should consider the fact that GDP per capita growth exceeded IEWB growth for each of the 14 selected OECD countries. Canadian gross domestic product per capita grew at an average annual pace of 1.4% between 1980 and 2013 but only 1.0% per year in terms of the IEWB. At 1.75 percentage points, the discrepancy between Spain's GDP per capita growth and IEWB growth is the largest of any nation. This is primarily a result of Spain's limited growth in the IEWB coupled with its notable growth in GDP per capita, which is the second highest among the 14 nations for the 1980-2013 period. Chart 6 provides a comparison of average annual GDP per capita growth rates and average annual IEWB growth rates between 1980 and 2013.

**Chart 6: Compounded GDP Per Capita Growth vs. IEWB Growth, 1980-2013**




Source: World Bank, 2017b.

## V. Sensitivity Analysis

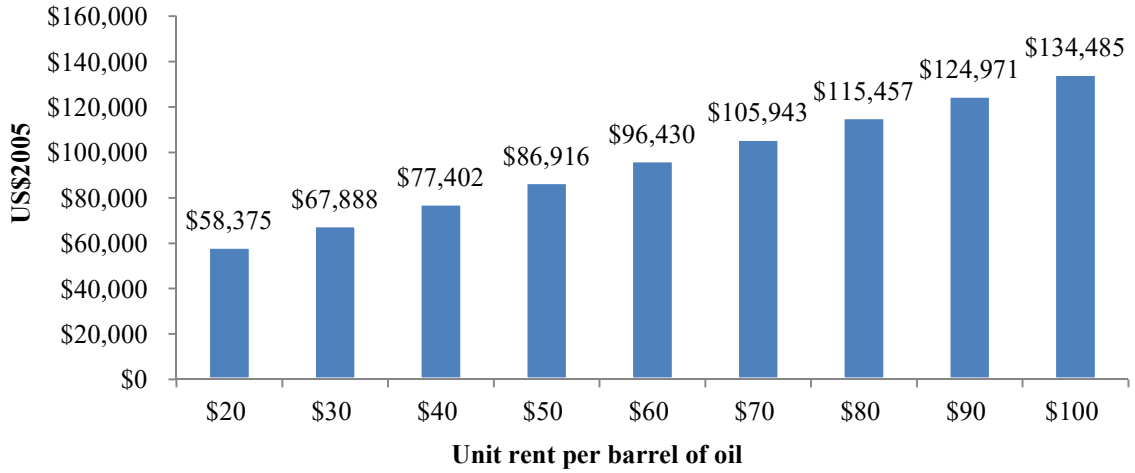
It should be noted that the rankings are produced using natural resource prices in 2013. Therefore, volatility in resource prices affect the ranking of each country—had commodity prices been lower in 2013 than what was realized, the ranking of resource rich countries would have been relatively lower.

A case study was conducted on Norway in order to determine its sensitivity to oil rents. Note that energy wealth accounts for 97% of Norway's natural capital, so a sensitivity analysis on the price of oil is particularly appropriate. As previously mentioned, resource rents are equal

to the difference between the revenues and production cost attributable to the resource. Moreover, in any given year, production costs are assumed to be constant, which implies that fluctuations in resource prices directly translate into identical fluctuations in resource rents.

Chart 7 illustrates how per capita natural resource wealth changes in response to volatility in oil rents at 2013 production levels. Per capita wealth varies from US$58,675 to US$134,485 in accordance with a US$20/barrel and US$100/barrel oil rent, respectively. In the base case scenario, in which Norway's per capita natural resource wealth is equal to US$95,825, the oil rent is approximately equal to US$57 per barrel.

**Chart 7: Natural Wealth Per Capita Sensitivty to Oil Rents**




Source: World Bank, 2017b.

For every US$10 increment in the unit rent per barrel of oil, natural resource wealth per capita increases by US$9,514. This translates into a 16% gain in natural capital per capita when oil unit rents rise from US$20/barrel to US$30/barrel, and an 8% gain in natural wealth per capita when oil unit increase from US$90/barrel to US$100 barrel. Norway's natural wealth is therefore highly sensitive to the price of oil.

Table 9 integrates natural wealth per capita into total IEWB wealth per capita. Total IEWB wealth per capita varies from US$488,070 at a US$20/barrel unit rent to US$564,180 at a US$100/barrel unit rent. Recall from Table A2 in the appendix that the Australia's US$353,981 in per capita total IEWB wealth places it as the second wealthiest country on an IEWB wealth per capita basis. Thus, even at a US$20/barrel oil unit rent, Norway's substantial stock of fixed capital (US$215,373 per capita), as well as its net international investment position (US$120,446 per capita) absorbs any declines brought about by a lower natural capital valuation.

**Table 9: Sensitivity Analysis: Components of Total IEWB Wealth Per Capita, 2013**

| Oil Unit Rent | $20 | $40 | $60 | $80 | $100 |
|---|---|---|---|---|---|
| Stock of Natural Resources | 58,375 | 77,402 | 96,430 | 115,457 | 134,485 |
| Stock of Fixed Capital | 215,373 | 215,373 | 215,373 | 215,373 | 215,373 |
| Expenditures on R&D | 4,550 | 4,550 | 4,550 | 4,550 | 4,550 |
| Net Int. Inv. Position | 120,446 | 120,446 | 120,446 | 120,446 | 120,446 |
| Human Capital Stock | 92,238 | 92,238 | 92,238 | 92,238 | 92,238 |
| Cost of Green-house Gas Emissions | -2,912 | -2,912 | -2,912 | -2,912 | -2,912 |
| **Total IEWB Wealth Per Capita** | **488,070** | **507,098** | **526,125** | **545,153** | **564,180** |

Source: CSLS, World Bank (2017b)

Table 10 furthers this analysis by illustrating that Norway remains first in both the wealth and IEWB rankings for all oil rents between US$20 and US$100 per barrel. It can safely be concluded that Norway's first place ranking in both total IEWB wealth per capita and the IEWB are robust to volatility in resource prices.

The table below also provides insight into both the total wealth and IEWB growth rankings for the 1980-2013 period. Norway's third place position in the base case scenario for total per capita wealth growth ascends to second place as oil's unit rent approaches US$80/barrel and achieves the highest ranking at a US$100/barrel unit rent. It maintains its third place ranking even at a US$20/barrel unit rent. Moreover, Norway remains in third place for growth in the IEWB for all rents up to US$100 per barrel, at which points it climbs to second place.

**Table 10: Sensitivity Analysis: Norway's Position in Rankings, 1980-2013**

| Ranking | Base Case | $20 Rent | $40 Rent | $60 Rent | $80 Rent | $100 Rent |
|---|---|---|---|---|---|---|
| Wealth Per Capita | 1 | 1 | 1 | 1 | 1 | 1 |
| IEWB | 1 | 1 | 1 | 1 | 1 | 1 |
| Growth in Wealth Per Capita | 3 | 3 | 3 | 3 | 2 | 1 |
| Growth in IEWB | 3 | 3 | 3 | 3 | 3 | 2 |

Source: CSLS, World Bank (2017b)

## VI. Conclusion

This report provides augmented estimates of the Index of Economic Well-being for fourteen OECD countries for the 1980-2013 period. The inclusion of natural resources benefited some nations more than others. Norway boasted the largest natural resource wealth at US$95,825 per capita in 2013. By contrast, Belgium's per capita natural resource wealth ranked fourteenth at US$348 for the same period. Previous IEWB estimates omitted this variation in wealth. Thus, introducing internationally comparable estimates of natural resource wealth has improved the Index's ability to capture a nation's economic well-being.

The updated results further Norway's ranking as the nation with the highest level of economic well-being. The Netherlands and Finland again followed in second and third place, respectively. Prior to the inclusion of natural resource wealth, Norway's index value was 18% larger than the second largest index value. With the inclusion of natural capital, Norway's index value is now 24% above the second largest index value assigned to the Netherlands. Despite Canada's abundance of natural capital, it remained in the eleventh position. Australia rose from seventh to fourth overall, the most significant gain in IEWB position of any nation. At an average annual increase of 1.54%, Australia also replaced France as the nation with the highest growth rate of IEWB over the 1980-2013 period.

Following this report, three projects related to the World Bank wealth accounts data warrant exploration. First, sensitivity analysis on Canada's ranking in terms of total IEWB wealth per capita as well as its ranking in the IEWB will be conducted upon the receipt of updated data from the World Bank. Second, an analysis comparing the World Bank's resource wealth data for Canada with the natural capital figures produced by Statistics Canada would provide valuable insights into the discrepancy between each institution's estimates.[22] Third, a project comparing a broader range of wealth estimates produced by the Centre for the Study of Living Standards (e.g. human capital and fixed capital wealth) with the corresponding estimates produced by the World Bank may serve as a valuable exercise in cross validating wealth estimates.

[22] In particular, attention should be paid to the significant difference in natural resource wealth estimates related to energy resources.

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# VIII. Appendix

**Table A1: Component Share of Natural Resource Wealth as a Percent of GDP, Selected OECD Countries, 2013**

| Country | Energy Wealth | Mineral Wealth | Forestry Wealth | Total Resource Wealth |
|---|---|---|---|---|
| Australia | 35.2 | 107.4 | 9.4 | 152.1 |
| Belgium | n.a. | n.a. | 0.9 | 0.9 |
| Canada | 70.8 | 10.0 | 17.1 | 97.9 |
| Denmark | 22.9 | 0.0 | 1.0 | 24.0 |
| Finland | 0.0 | 3.6 | 25.3 | 28.9 |
| France | 0.3 | 0.0 | 2.3 | 2.6 |
| Germany | 0.8 | 0.0 | 1.7 | 2.6 |
| Italy | 2.4 | 0.0 | 0.9 | 3.3 |
| Netherlands | 11.9 | n.a. | 0.1 | 12.0 |
| Norway | 161.0 | 1.4 | 3.8 | 166.3 |
| Spain | 0.2 | 0.5 | 2.5 | 3.2 |
| Sweden | n.a. | 10.5 | 16.3 | 26.8 |
| United Kingdom | 11.2 | 0.0 | 0.4 | 11.6 |
| United States | 10.8 | 1.8 | 2.8 | 15.3 |

Source: World Bank (2015)

**Table A2: Components of the IEWB Total Wealth Stock, Per Capita , 2013 (US$2005)**

| Country | Stock of Fixed Capital | Expenditures on R&D | Net Int. Invest. Position | Human Capital Stock | Cost of GHG Emissions | Stock of Natural Resources | Total Wealth |
|---|---|---|---|---|---|---|---|
| Australia | 230,324 | 4,152 | -30,930 | 91,137 | -2,283 | 61,580 | 353,981 |
| Belgium | 152,020 | 3,985 | 23,817 | 80,359 | -1,994 | 348 | 258,534 |
| Canada | 170,856 | 3,490 | 574 | 98,158 | -2,281 | 37,397 | 308,194 |
| Denmark | 144,108 | 5,822 | 22,708 | 89,465 | -1,996 | 9,460 | 269,566 |
| Finland | 161,048 | 6,402 | 2,638 | 91,666 | -1,883 | 10,215 | 270,087 |
| France | 138,724 | 3,944 | - 7,579 | 80,433 | -1,886 | 887 | 214,523 |
| Germany | 132,722 | 5,414 | 15,906 | 83,274 | -2,117 | 995 | 236,195 |
| Italy | 148,214 | 1,996 | - 9,986 | 76,538 | -1,560 | 1,018 | 216,220 |
| Netherlands | 136,206 | 3,978 | 16,161 | 92,000 | -2,201 | 4,975 | 251,119 |
| Norway | 215,373 | 4,550 | 120,446 | 92,238 | -2,912 | 95,825 | 525,520 |
| Spain | 148,621 | 1,932 | -27,856 | 88,052 | -1,576 | 920 | 210,093 |
| Sweden | 98,484 | 6,658 | - 8,743 | 86,067 | -2,180 | 10,423 | 190,709 |
| U.K. | 102,624 | 2,985 | - 6,028 | 84,179 | -1,996 | 3,915 | 185,678 |
| U.S. | 155,913 | 6,342 | -15,970 | 96,959 | -1,850 | 6,945 | 248,339 |

Source: CSLS, World Bank (2015)

**Table A3: Components of the IEWB Total Wealth Stock, Selected OECD Countries, 2013, (Billions US$2005)**

| Country | Stock of Fixed Capital | Expenditures on R&D | Net Int. Invest. Position | Human Capital Stock | Cost of GHG Emissions | Stock of Natural Resources | Total Wealth |
|---|---|---|---|---|---|---|---|
| Australia | 5,326 | 96 | -715 | 2,107 | -53 | 1,424 | 8,185 |
| Belgium | 1,702 | 45 | 267 | 900 | -22 | 4 | 2,895 |
| Canada | 6,034 | 123 | 20 | 3,467 | -81 | 1,321 | 10,885 |
| Denmark | 809 | 33 | 128 | 502 | -11 | 53 | 1,514 |
| Finland | 876 | 35 | 14 | 499 | -10 | 56 | 1,469 |
| France | 8,849 | 252 | -483 | 5,130 | -120 | 57 | 13,684 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Germany | 10,703 | 437 | 1,283 | 6,716 | -171 | 80 | 19,048 |
| Italy | 9,068 | 122 | -611 | 4,682 | -95 | 62 | 13,228 |
| Netherlands | 2,289 | 67 | 272 | 1,546 | -37 | 84 | 4,220 |
| Norway | 1,094 | 23 | 612 | 469 | -15 | 487 | 2,670 |
| Spain | 6,925 | 90 | -1,298 | 4,103 | -73 | 43 | 9,789 |
| Sweden | 946 | 64 | -84 | 827 | -21 | 100 | 1,833 |
| U.K. | 6,490 | 189 | -381 | 5,323 | -126 | 248 | 11,742 |
| U.S. | 49,346 | 2,007 | -5,055 | 30,687 | -585 | 2,198 | 78,599 |

Source: CSLS, World Bank (2015)

## Table A4: Canadian Natural Resource Data, 2013 (Current Dollars)

| Commodity (1) | Unit (2) | Price of Commodity (3) | Cost of Production (4) | Rent from Commodity (5) = (3)-(4) | Quantity Produced (6) | Reserves (7) | Time Exhaustion Value (8) = (7) / (6) | Present Value (9) |
|---|---|---|---|---|---|---|---|---|
| **Energy Resources** | | | | | | | | |
| Oil | barrel | $94.29 | $69.36 | $24.93 | 1,197,450,025 barrels | 173,037,535,500 barrels | 145 | $485,033,388,412 |
| Natural Gas | barrel | $3,793 | $3,793.00 | $0 | 5,881,342 TJ | 76,406,284 TJ | 13 | $0 |
| Thermal Coal | tons | $12.65 | $5.99 | $6.66 | 4,219,000 tons | n.a. | n.a. | $4,583,650,698 |
| Brown Coal | tons | $12.65 | $2.46 | $10.19 | 30,626,000 tons | 2,236,210,384 tons | 73 | $20,305,781,775 |
| Hard Coal | tons | n.a. | n.a. | $3.52 | 38,282,000 tons | 4,628,258,754 tons | 121 | $13,084,873,609 |
| Met Coal | tons | $20.74 | $18.15 | $2.59 | 201,613,452 Gcal | n.a. | n.a. | $8,501,222,910 |
| | | | | | | **Total Energy Wealth** | | **$531,508,917,405** |
| **Mineral Resources** | | | | | | | | |
| Copper | tons | $7,332 | $1,166 | $6,166 | 631,900 tons | 11,000,000 tons | 17 | $50,119,395,847 |
| Gold | tons | $45,379,493 | $11,769,578 | $33,609,915 | 124 tons | 2,000 tons | 16 | $50,803,251,890 |
| Iron Ore | tons | $135 | $53 | $83 | 42,063,000 tons | 6,300,000,000 tons | 150 | $56,593,321,649 |
| Lead | tons | $2,140 | $747 | $1,393 | 20,188 tons | 247,000 tons | 12 | $278,724,127 |
| Nickel | tons | $15,032 | $6,865 | $8,167 | 223,295 tons | 2,900,000 tons | 13 | $18,923,694,051 |
| Phosphate | tons | $148 | $62 | $86 | 300,000 tons | 76,000,000 tons | 253 | $419,024,015 |
| Silver | tons | $766,795 | $730,083 | $36,713 | 646 tons | 7,000 tons | 11 | $213,492,011 |
| Zinc | tons | $1,910 | $1,309 | $601 | 426,089 tons | 5,900,000 tons | 14 | $2,789,625,613 |
| | | | | | | **Total Mineral Wealth** | | **$180,140,529,203** |
| **Forestry Resources** | | | | | | | | |
| Forestry | $m^3$ | $137.91 | $129.09 | $8.82 | 20,972,752,259 $m^3$ | n.a. | n.a. | 21801719527 |
| | | | | | | **Total Forestry Wealth** | | **21,801,719,527** |
| | | | | | | **Total Resource Wealth** | | **733,451,166,134** |

Source: Unpublished World Bank data.
Note: The wealth estimates provided in this table does not equal the wealth estimates provided in World Bank (2015). Note that the database omits diamonds uranium, both of which serve as economically important minerals for Canada. The value of future resource rents approaches zero past 25 years. The World Bank caps the time exhaustion value at 25 years when calculating present value estimates.