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Analysis

Estimates of the Genuine Progress Indicator (GPI) for Oregon from 1960–2010 and recommendations for a comprehensive shareholder's report

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ABSTRACT

The Genuine Progress Indicator (GPI) is a significantly more comprehensive approach to assessing economic progress than conventional measures, such as Gross Domestic Product (GDP). We estimated the GPI for the state of Oregon from 1960–2010. We found that it tracked the Gross State Product (GSP) for the period 1970–2000, but began to diverge and flatten out in 2000. The major reasons for this divergence were increasing inequality, loss of farmland, and decreasing personal consumption expenditures as a fraction of GSP. Oregon GPI/per capita leveled off in 2000, while the US GPI/capita leveled off in 1975. The GPI is not the perfect indicator of economic and social well-being, but it is a better approximation than GDP. As more states and countries begin to recognize the inappropriateness of GDP as a policy goal we can expect to see much more emphasis on and use of alternative indicators like GPI. We recommend extending these indicators to include a comprehensive shareholder's report that reflects all the state's capital assets, including built, human, social, and natural capital.

1. Introduction

A reliable yardstick for evaluating the overall performance of nations, subnational regions, and the planet as a whole, is an essential tool for rational policymaking. The gross domestic product (GDP) has long been one of the most common proxies used to measure economic performance. GDP is an appropriate, though imperfect, metric to use when calculating the market value of goods and services produced within a selected geographic area during a selected interval in time (Leamer, 2009). However, it is frequently and erroneously interpreted as a measure of the social and economic welfare, or well-being, in a country. While upward GDP trends may correlate with perceived well-being for a period, the 'threshold hypothesis' suggests that there may be a point beyond which continued growth in GDP ceases to contribute to improvements in the quality of life within a society (Max-Neef, 1995; Kubiszewski et al., 2013; Costanza et al., 2014). This divergence is thought to occur because GDP was never designed to measure societal well-being and as the components it does not measure become more important, GDP becomes less useful as a proxy. The components of GDP (consumption expenditures, capital formation, and net exports) do not include goods or services that are not bought and sold in market transactions. It also counts many market transactions as benefits, which are actually better thought of as costs. For example, although spending on security and crime prevention are costs to be minimized as they decrease human well-being, they increase GDP. Consequently, the widespread interpretation of GDP as a measure of economic welfare is quite problematic and produces misleading results around well-being.

A growing number of scholars, as well as policymakers, are aware that GDP growth is inappropriate as an overall national policy goal. Over several decades, economists have identified serious deficiencies in following the policy of endless growth in GDP, and have stressed the importance of using GDP only within the context of its intended, technical purpose. An extensive scientific literature drawing on insights from not only economics but also a wide array of environmental and social sciences has documented many shortcomings of GDP growth as a national policy goal (Kuznets, 1934; Nordhaus and Tobin, 1972; Daly and Cobb, 1989; Costanza et al., 2009; van den Bergh, 2009; Stiglitz et al., 2010).

The State of Oregon's commitment to alternative metrics for evaluating its citizens' quality of life extends back to 1989, when the Oregon

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Progress Board was created to oversee the collection and reporting of data to measure progress in categories very similar to those included in the GPI. Support for this work waxed and waned with the political tides over the next 20 years until, in 2009, funding for the Oregon Progress Board was eliminated entirely.

In the meantime, other national and sub-national governments are looking for new metrics that incorporate those goods and services that greatly influence the well-being of a population, but operate outside the confines of the market such as volunteerism, housework, inequality, and environmental degradation (Talberth et al., 2007; Wilkinson and Pickett, 2009).

Three different groups of well-being indicators exist (Costanza et al., 2014):

1. Adjustments to economic measures to reflect social and environmental factors (e.g., Genuine Progress Indicator and Inclusive Wealth Index);
2. Subjective measures of well-being drawn from surveys (e.g., World Values Survey and Bhutan's Gross National Happiness);
3. Weighted composite indicators of well-being including housing, life expectancy, leisure time and democratic engagement (e.g., United Nations' Human Development Index and Happy Planet Index).

The Genuine Progress Indicator (GPI) (Cobb et al., 1995; Talberth et al., 2007), was developed as a variant of the Index of Sustainable Economic Welfare (ISEW) originally proposed by Herman Daly and John Cobb (Daly and Cobb, 1989). GPI utilizes Personal Consumption Expenditures (PCE), a major component of GDP, as a starting point, but makes adjustments based on the added values or costs associated with monetized estimates of social and environmental elements unaccounted for in the GDP. For example, various indicators of natural resource degradation are subtracted from the GDP, and the value of household labor is added to it.

The GPI has been calculated at multiple scales, from state to national to global level (Hamilton, 1999; Pulselli et al., 2006; Nourry, 2008; Wen et al., 2008). On the state level, seven states in the United States (Colorado, Hawaii, Maryland, Massachusetts, Ohio, Utah, and Vermont) have calculated their GPI (Costanza et al., 2004; Berik and Gaddis, 2011; Posner and Costanza, 2011; Bagstad and Shammin, 2012; McGuire et al., 2012; Erickson et al., 2013; Stiffler, 2014; Erickson et al., 2015), as have a few provinces in Canada (Anielski, 2001). However, as of 2014, Maryland (Posner and Costanza, 2011; McGuire et al., 2012) and Vermont (Costanza et al., 2004) were the only two states that have officially adopted GPI as a tool in policy analysis and regularly report results (Bagstad et al., 2014). On the national level, the GPI has been estimated for approximately seventeen countries, including Australia, Austria, Belgium, Chile, China, Germany, India, Italy, the Netherlands, New Zealand, Poland, Sweden, Thailand, the United Kingdom, the United States, and Vietnam (Kubiszewski et al., 2013). GPI was also calculated on the global level, using the 17 countries stated above (Kubiszewski et al., 2013).

There are many issues related to using GPI, including subjectivity in distinguishing costs from benefits, subjectivity in which non-market values to include, as well as ongoing debate surrounding the methodology (Lawn, 2003; Costanza et al., 2009; Bagstad et al., 2014). There are also several key advantages to using the GPI. It is easily compared to the state GDP, and in comparing Oregon to other states and countries that already measure GPI. Additionally many other indicators, especially survey-based indicators like subjective well-being, are expensive to track over time and impossible to analyze before the year they were implemented (McGuire et al., 2012).

2. Methods

The methods employed in this analysis were adopted from the Maryland GPI report (McGuire et al., 2012) to facilitate meaningful comparison. Maryland adopted the framework provided in the national Genuine Progress Indicator (Talberth et al., 2007), but applied specific adjustments to reflect indicators relevant to a state approach. This resulted in 26 indicators among three domains: Economic, Environmental, and Social. The Maryland study provided methodological notes and data sources for each of their 26 indicators, which were duplicated as closely as possible in this analysis for Oregon. Where necessary data did not exist for estimating the Oregon GPI, interpolation and extrapolation were employed, or the equations derived by the Maryland GPI group were used. Interpolation and extrapolation of data reduces the precision of some of the data. However, it allows for the completion and extension of time-series, which allows for better identification of patterns over time, a major use of GPI studies.

The calculation of GPI begins with personal consumption expenditures (PCE), a major component of GDP, measured in Indicator 1. Next, because unequal distribution of income has detrimental effects on economic and social welfare (Wilkinson and Pickett, 2009), income inequality in included through the use of the Gini coefficient, which measures the differences between actual distribution and equal distribution. By adjusting PCE figures (Indicator 1) with the income inequality (Indicator 2) we get Indicator 3: Adjusted Personal Consumption Expenditures. Indicator 3, provides the base number from which all remaining indicators of economic activity in the GPI are either added or subtracted, depending on whether they have enhancing or diminishing effects on welfare. Posner and Costanza (2011) summarizes the methodology using the following equation:

$$GPI = C_{adj} + G_{nd} + W - D - E - N.$$

In this equation, "C_{adj}" represents personal consumption expenditures adjusted for income inequality (Indicator 3), "G_{nd}" represents non-defensive government expenditures (such as Indicator 24: Services of Highways and Streets), "W" represents non-monetized contributions to welfare (such as Indicator 17: Value of Housework), D represents defensive private expenditures (such as Indicator 20: Personal Pollution Abatement), E represents the costs of environmental degradation (such as Indicator 11: Net Wetlands Change), and N represents the depreciation of natural capital stocks (such as Indicator 16: Cost of Nonrenewable Resource Depletion).

Table 1 summarizes methodology used in calculating Oregon's GPI, and is closely adapted from the methodology summary table produced by Posner and Costanza (2011) in their detailed report on methodology and findings in the Maryland GPI study.

3. Results

3.1. Status of Baseline Measurements

Fig. 1 shows the basic results for Oregon GPI compared to Gross State Product (GSP) and Personal Consumption Expenditures (PCE). A spreadsheet and appendix with the full results for each component of the Oregon GPI and a sensitivity analysis is in Supplementary information.

GPI for Oregon was relatively flat in the 1960–1970 decade, even though GSP and PCE were expanding rapidly. This was due largely to the impact on GPI of the large net loss of farmland that occurred during this period (see sensitivity discussion). From 1970 to around 2000, GPI, GSP, and PCE were highly correlated. The period from 1973–75 and 1979–1982 showed declines in GSP, probably due to the Arab oil embargos and recessions. This caused a smaller decline in PCE in the 1979–1982 recession, due to declines in government spending and net exports relative to declines in PCE. In the period from 2000 to 2010 GPI leveled off, even though GSP and PCE continued to increase. This was due in part to increasing inequality.

Looking at the individual costs and benefits that are added to adjusted consumption expenditure, the remaining indicators are split into

Table 1
Summary of methodology used to calculate GPI for Oregon.

Indicator # and name	+/−	Brief description	Calculation method
1. Personal consumption expenditures	+, base value	Component of GDP which represents money spent on goods and services for personal use and consumption	National ratio of consumption expenditure to income *times* Per capita income
2. Income inequality	+ or −	Measure of the difference between actual distribution and equal distribution by income quintiles, ranging from 0 (all households have same income) to 1 (one household has all income)	Gini coefficient in a given year *divided by* Gini coefficient at lowest value *times* 100
3. Adjusted personal consumption expenditures	+ or −	Consumption adjusted for income inequality becomes the base number from which all other indicators are then either added or subtracted	Indicator 1 (PCE) *divided by* Indicator 2 (Income Inequality)
4. Services of consumer durables	+	Adding in value of annual services provided by household appliances and equipment	Indicator 5 (Cost of Consumer Durables) *times* depreciation rate
5. Cost of consumer durables	−	Actual expenditures on consumer durables are subtracted from GPI to avoid double counting the value of their services (Indicator 4)	National percentage of spending on consumer durables *times* per capita PCE (Indicator 1)
6. Costs of underemployment	−	Subtracting for the decrease in community welfare due to wages not provided to constrained or unemployed workers	# of underemployed persons *times* hours not provided per constrained worker, *times* average hourly rate
7. Net capital investment	+ or −	Estimating the changes in stock of built capital available per worker	National figures scaled to Oregon's population
8. Cost of water pollution	−	Subtracting for the value of lost benefits of water quality due to impairment. Accounts for value of recreational fishing, boating, swimming, drinking water, as well as non-use benefits (ecology, esthetics, property value)	Percentage of river miles of impaired quality *times* benefits of unimpaired waters
9. Cost of air pollution	−	Subtracting for the damage cost estimates associated with air pollution to households, infrastructure, and the environment, excluding health or mortality costs	Pollution data *times* cost per unit of air pollution damage
10. Cost of noise pollution	−	Subtracting for estimated costs of noise pollution	Urbanization index values *times* WHO estimate of noise pollution costs
11. Net wetlands change	−	Subtracting for loss of purified water, wildlife habitat, and other ecosystem services provided by wetlands	Total ha wetland lost *times* estimated wetland value per ha
12. Net farmland change	−	Subtracting for losses in sustainable local food supply, esthetic, scenic, and historic values, decreases in water quality and flood control as well as degraded wildlife habitat associated with net loss of farmland	Farmland ha lost to urbanization *times* estimated farmland value per ha
13. Net forest cover change	−	Subtracting for loss of forests and associated goods and services provided by them including: flood control, air and water purification, biodiversity, habitat, medicinal products, as well as esthetic and recreational value	Forest ecosystem service value per ha *times* area of ha of forest cover lost
14. Cost of climate change	−	Subtracting for costs associated with long-term environmental degradation as a result of climate disruption	Marginal social cost of CO_2 emissions in a given year *times* energy consumption
15. Cost of ozone depletion	−	Subtracting for costs associated with loss of ozone including both health and economic costs of this long-term environmental problem	Measure of ozone depleting chemicals released *times* cost per kg
16. Cost of nonrenewable resource depletion	−	Subtracting for costs associated with depletion of nonrenewable resources by estimating renewable energy replacement costs	Consumption level of nonrenewable resources *times* renewable resource replacement cost
17. Value of housework	+	Adding in the positive value contribution of household labor including meal preparation, cleaning, repairs, and parenting, all of which are not included in calculation of GSP and GDP	Net opportunity cost method = total hours of housework performed *times* wage paid to hire outside help to perform equivalent tasks
18. Family changes	−	Subtracting for the negative economic costs on society associated with divorce and excessive amounts of time spent watching television	Cost of divorce *added to* cost of excessive television viewing
19. Cost of crime	−	Subtracting for the direct costs from crime such as medical expenses and lost property, as well as the indirect costs of preventing or avoiding crime	Defensive expenditures to avoid crime + Direct costs of property crimes
20. Personal pollution abatement	−	Subtracting for expenditures made to compensate for pollution-related externalities imposed by economic activity, such as spending on air filter equipment, waste treatment, and other compensatory costs	Cost of solid waste disposal *added to* cost of sewage and septic systems *added to* cost of automotive air filters and catalytic converters
21. Value of volunteer work	+	Adding in the positive value provided by volunteer work	Total hours of volunteer work performed *times* average hourly wage rate
22. Value of leisure time	−	Subtracting for loss of leisure time corresponding with increased economic output	Employment level *times* lost leisure hours *times* average hourly rate
23. Value of a higher education	+	Adding in the positive value contribution of higher education to society in the form of increased productivity, civic participation, charitable giving, savings rates, health, etc.	Number of people at least 25 years old with four years minimum of college completed *times* estimated value contribution of $16,000 per year
24. Services of highways and streets	+	Adding in the positive value contribution of government-provided services associated with functioning highway and street infrastructure	Net stock of highways and streets *times* 7.5% annual value
25. Cost of commuting	−	Subtracting for direct costs associated with spending on personal vehicle or public transit, plus the indirect costs of potentially productive time lost during transit	Cost of vehicle *times* percent vehicle use for commuting *plus* cost of public transit *plus* cost of commuting time using local wage rate
26. Cost of motor vehicle crashes	−	Subtracting for direct costs of motor vehicle crashes on property damage and healthcare expenditures, as well as indirect costs in the form of lost wages	Number of accidents *times* cost per accident

three main categories: economic, social, and environmental. Fig. 2 shows the value of the individual GPI components between 1960 and 2010 that are either added or subtracted, depending on whether they enhance or diminish the effects on welfare. We find that although economic indicators increase significantly, social indicators increase until about 1990 at which point they flatten out, while environmental indicators decrease significantly.

3.2. Comparing Oregon's GPI with Other GPI Studies

Fig. 3 shows a comparison of the GPIs per capita of the six states, including Oregon, Colorado (Stiffler, 2014), Maryland (Posner and Costanza, 2011; McGuire et al., 2012), Ohio (Bagstad and Shammin, 2012), Vermont (Costanza et al., 2004; Erickson et al., 2013), and Utah (Berik and Gaddis, 2011), for which GPI has been calculated. It also

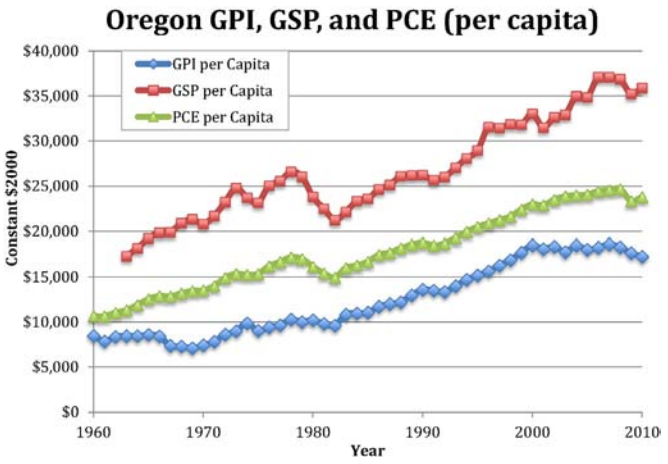

Fig. 1. Comparison of Oregon's personal consumption expenditures, gross state product, and genuine progress indicator for the years of 1960–2008.

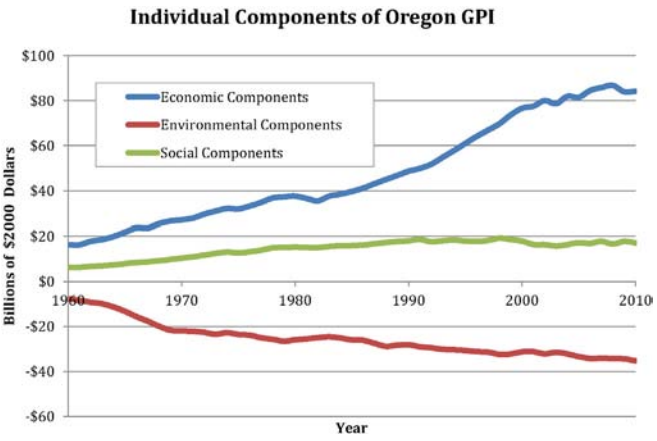

Fig. 2. Individual status of categorical components of Oregon GPI from 1960–2010.

shows the GPI per capita for the United States as a whole.[1] Although GPI estimates for these states use slightly different methods (see Table 1 in Bagstad et al. (2014) for a detailed description) these differences are not significant and do not change the pattern of the results or our conclusions. Fig. 3 shows that Maryland and Utah have the highest GPI/capita of the six states, of around $29,000 in 2005. The other three states, (Oregon, Ohio, Vermont) have a GPI/capita of about $18,000. The US, as a whole, has a GPI/capita of just under $14,000 in 2005.

4. Discussion

Policy-makers and the general public would benefit from better tools for measuring the well-being of people and the health of the environment and natural capital. This does not mean abolishing GDP as a measure of economic activity, but rather limiting its application to the function for which it was intended. A healthy system needs to be designed in terms of human well-being outcomes, so that initiatives to reduce greenhouse gases (GHGs), abate poverty, conserve resources, or improve child health are not seen as conflicting with economic 'progress.' For the general public, this redefinition could be achieved via a social marketing campaign — where citizens receive important information from a variety of media over a focused time period with the objective of changing public perception or behavior. For legislators and policymakers, raising awareness and elucidating how various policy initiatives would affect GPI would be a critical step.

4.1. Acknowledging the Limitations of GPI

There have been several critiques of GPI (Harris, 2007; Brennan, 2008; Neumayer, 2010; Brennan, 2013) based on valuation methods, substitutability issues, choice of items to include and exclude, and the theoretical basis of the index. These critiques are discussed in more detail in Kubiszewski et al. (2013). The key points are summarized below.

- *Valuation*: Certain environmental elements of GPI (e.g., cost of land degradation, lost wetlands, and long-term environmental damage) are calculated using the cumulative costs. This is done because the inclusion of long-term loss of natural capital is critical in generating economic welfare great than what can be provided by natural capital alone (Lawn, 2005).
- *Substitutability*: GPI assumes substitutability in the short run, but does not confuse substitutability of current welfare benefits with the substitutability of the capital that yields the welfare benefits in the long-term. In this sense GPI is a hybrid of weak and strong sustainability assumptions. It assumes weak sustainability in the short term (capital substitutability) but strong sustainability in the long term. In addition, GPI was never designed to be a strict measure of sustainability and needs to be supplemented by other indicators of scale, like planetary boundaries or ecological footprint.
- *Choice of items to include*: Any aggregate indicator requires subjective judgments about what to include or exclude. This applies equally to GDP. The elements of GPI have changed slightly over time as more research is done around well-being (Daly and Cobb, 1989; Kubiszewski et al., 2013; Bagstad et al., 2014). These inclusions, or their weights, may also vary between different societies, creating differences between the results. One of the reasons we decided to follow the Maryland version of GPI as closely as possible was to minimize the differences caused by these choices and allow better comparability.
- *Theoretical basis*: GPI's theoretical basis is at least as strong as GDP, if not stronger (Lawn, 2003). It merely tries to separate costs from benefits, something any accounting framework at any scale should strive for. The implementation of that theoretical basis is being improved on by the global GPI 2.0 effort (Bagstad et al., 2014).

4.2. GPI 2.0

Over the past few years, as a growing number of GPI studies have been performed globally, a divergence in methodologies has occurred. This lack of standardization is due to variations in data availability, varying needs to ensure policy relevance in specific regions, and identification of new issues such as treatment of nonrenewable resources, government spending, and others. To address these variations, an international effort has recently been initiated to update the current methodology of the GPI with the most up-to-date science. The goal of such an update is to ensure that GPI 2.0 has greater comparability between studies and an increased policy relevance (Bagstad et al., 2014).

4.3. Efforts in Use of Alternative Measures

Oregon's commitment to measuring its citizens' quality of life extends back to 1989, when the Oregon Progress Board was created to oversee the collection and reporting of physical data to measure progress in categories very similar to those included in the GPI.

In the meantime, other states have turned to the GPI as a tool to assist state government in identifying public policy priorities and in the application of outcomes-based budgeting. Maryland, the first state to adopt GPI as an official indicator and the one that has progressed furthest in its use, has formalized GPI calculation and reporting. Vermont, in 2013, became the first state to establish a system for GPI data

[1] Although the state of Hawaii has also calculated its GPI, we were, at the time of this writing, unable to find the data.

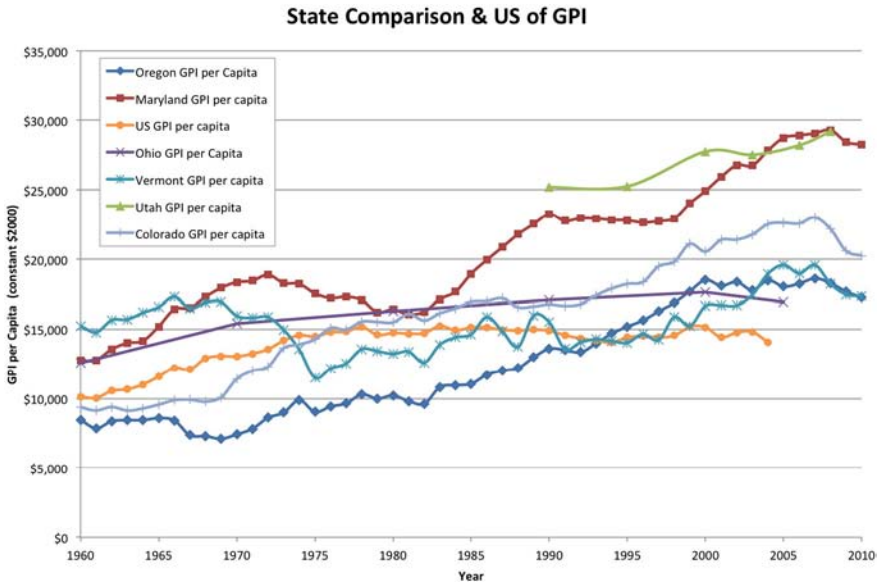

Fig. 3. A comparison of the 5 states for which GPI has been calculated, including the GPI for the United States as a whole.

collection by legislative mandate. Other state level organizations have also calculated GPI: the Colorado Fiscal Institute, the Utah Population and Environment Coalition, and the Hawaii Department of Health.

4.4. An Oregon Shareholder's Report

As demonstrated in previous sections, the GPI moves one step beyond Oregon's earlier benchmark categories, suggesting a "full cost" accounting system. GPI assigns monetary value to flows of natural, human, social, and built capital and their degradation or enhancement in the course of economic activity. The GPI adjusts personal consumption expenditures to account for the effect of income inequality, adding the value of Oregonians' time spent at socially enhancing unpaid work such as volunteering, and deducting "unfortunate" expenditures for social ills such as crime, and the depreciation value of natural resources. The result can be expressed as a GPI net income statement, as shown in Table 2.

The GPI Net Income Statement offers a substantially more complete accounting of Oregonians' economic activity and its impact on quality-of-life than conventional GDP-based measures of progress. But net income is only one part of any financial report. As the shareholders and stewards of the state's natural and other resources, Oregonians would be best informed by seeing full cost accounting applied to the remaining components of a shareholders' report: a balance sheet and cash flow statement. Just as an income statement does not tell shareholders about a company's net assets or shareholder wealth, GPI does not tell us about either the quantity or quality of Oregon's stocks of natural, human, social, and built capital. Neither does it reveal anything about the state's accumulated liabilities, such as the cost of infrastructure maintenance, stores of toxic waste, or health problems caused by loss of leisure time. It is the balance sheet that signals whether an organization is either creating wealth for its shareholders by making wise investments, or endangering its future by accumulating liabilities and degrading or depreciating its capital assets.

As an example, one of the Oregon GPI indicators, Net Forest Cover Change, assumes an underlying value for the functions performed by a healthy forest ecosystem. In addition to producing marketable products such as timber, forests provide a range of valuable services, such as storage and filtration of water, oxygen production, soil formation, nutrient cycling, wildlife habitat, and human recreation — to name a few that typically go unnoticed and unvalued. Unsustainable timber harvesting actually increases GDP, without accounting at all for the reduced asset value on the public balance sheet from lost forest cover. GPI is an improvement in that it accounts for the lost forest cover, subtracting it as an "unfortunate" cost of economic activity. Similar to what Utah did

Table 2
Oregon GPI net income statement for 2010.

		$ million (2000)	
2010 Oregon Gross Domestic Product (expenditure-based)		**133,381**	
Personal consumption expenditures		91,140	
Personal consumption expenditures adjusted for income distribution			**71,024**
Value of higher education		12,008	
Net capital investment		3720	
Benefit of household and public infrastructure			
Value of services of consumer durables	2225		
Value of public infrastructure services	3177		
		5402	
Value of unpaid time use			
Value of housework	15,977		
Value of volunteer work	1351		
		17,328	
Total additional beneficial output			**38,458**
Social costs			
Cost of consumer durables	(9660)		
Cost of unemployment and underemployment	(3669)		
Cost of motor vehicle crashes	(1642)		
Cost of commuting	(4132)		
Cost of crime	(495)		
Cost of lost leisure time	(5832)		
Cost of family changes	(1506)		
		(25,294)	
Environmental costs			
Cost of non-renewable energy resource depletion (oil, gas, coal)	(6193)		
Cost of net forest cover change	(1286)		
Cost of net farmland change	(17,116)		
Cost of water pollution	(190)		
Cost of air pollution	(540)		
Cost of noise pollution	(257)		
Cost of GHG (damage of climate change)	(3108)		
Cost of ozone depletion	(5943)		
Cost of loss of wetlands change	(608)		
Cost of personal pollution abatement	(1085)		
		(36,327)	
Total deleterious/unfortunate output			**(61,621)**
GPI (net beneficial output)			**$47,861**

in calculating their GPI (Berik and Gaddis, 2011), the Shareholder's Report balance sheet would provide the total stock of forest cover, accounting for each year's net change as an increase or diminution of total asset value. Like any capital asset, that value would be determined by calculating the net present value of the flow of goods it will yield and the services it will perform. State funds spent to protect or restore forest cover would be characterized as investment to the extent that they increase forests' value. Without this full accounting for the stock and value of forest cover, it is difficult to evaluate the financial benefits of conserving vs. depleting it.

Constructing an Oregon GPI Balance Sheet will require creating a chart of accounts that includes each of the domains addressed by GPI, and taking inventory of accumulated assets and liabilities as they are found among those domains. Assigning value to multiple domains of capital, many of which are made up of non-market assets that have never been monetized, is a challenging endeavor. However, it is one that some governments and sub-national entities have begun, with pioneering methodologies. The U.K.'s Office of National Statistics released an experimental estimate of its human capital stock, including a detailed methodology for valuing the productive capacity of citizens (Jones and Chiripanhura, 2010). The United Nations' System of Integrated Environmental and Economic Accounts (SEEA) (United Nations, 2014) has been revised to include a framework for valuing the market and non-market goods and services provided by natural capital. The Province of Nova Scotia, Canada, has officially committed to the task of valuing natural, human, and social capital, in addition to built and financial capital, toward the goal of producing "a new form of budget estimates, a new set of accounts, and a new economic paradigm" (Pannozzo and Colman, 2009). Canada has extended its System of National Accounts to value volunteerism and the non-profit sector as an element of its social capital (Haggar-Guenette et al., 2007). Meanwhile, the most developed conceptual framework for expanded GPI accounting has been described by the Pembina Institute for the Province of Alberta, Canada (Anielski, 2001).

The balance sheet shown in Table 3 is a prototype modeled after the Alberta framework. The values, where they appear, are calculations we have performed based on data derived from our work on the GPI Income Statement.

The balance sheet prototype proposed here for GPI accounting in Oregon is an approximation in need of considerable development and refinement. Ultimately the identification of Oregon's assets—public goods, natural endowments, and accumulated commonwealth—should be informed, in part, by how Oregonians conceptualize quality of life.

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Appendix A. Supplementary Data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.ecolecon.2015.08.004.

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Table 3
Oregon GPI balance sheet prototype.

	$ millions (2000)		
Assets		**Liabilities**	
Natural capital		**Environmental liabilities**	
Renewable resources		Ecological footprint	
Agricultural land	52,451	Industrial footprint	
Forest and wilderness	9263	Toxic waste	
Wetlands	8894	GHG and carbon emissions	
Water		Other…	
Air			
Other…		**Total environmental liabilities**	**$–**
Non-renewable resources		**Human liabilities (NPVP of human capital expenses)**	
Natural gas, minerals		Time stress	
		Mental illness	
Total natural capital	**$70,842**	Physical illness/disease	
		Unhealthy lifestyles	
		Other…	
Human capital		**Total human liabilities**	**$–**
Healthy, productive workforce			
Education and knowledge		**Social liabilities (NPV of social capital liabilities)**	
Life expectancy		Income–wealth inequality	
Optimism		Under- and unemployment	
Other…		Family breakdown	
		Other…	
Total human capital	**$–**	**Total social liabilities**	**$–**
Social capital		**Built/physical capital**	
Social institutions and cohesion		Infrastructure liabilities	
Democracy and political processes		Other…	
Other…		**Total infrastructure liabilities**	**$–**
Total social capital	**$–**		
		Total liabilities	
Built/physical capital			
Consumer durables			
Household infrastructure, real estate		**Net worth/owners equity**	
Public infrastructure		Common wealth	–
Total built/physical capital	**$–**	**Common wealth per capita**	**$–**
Total assets			

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