RAIS RESEARCH ASSOCIATION for INTERDISCIPLINARY STUDIES
August 3-4, 2023

DOI:10.5281/zenodo.8310077

Climate Flexibility: Introducing Nature in National Accounting

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ABSTRACT: The European and North American Green New Deals have become springfeathers of change in the national and international accounting of natural resources. The European Sustainable Finance Taxonomy accounts for the carbon impact of industries in order to quantify economic impacts on natural resources to make industry impacts on environmental conditions more transparent and accountable. The United States Joseph Biden and Kamala Harris administration has also launched efforts to put nature on the nation's balance sheet. The Biden-Harris White House multi-year strategy plans to connect environmental conditions with economic outcomes by collecting data and using innovative methods to capture nature's role in the U.S. economy. On the global level, integrating natural resources into economic productivity prospects has the potential to change power dynamics and international politics driven by economic opportunities. Linking nature to the economy and productivity as well as the human standard of living is the driver for the World Bank project on "Changing Wealth of Nations." Integrating natural capital in global macroeconomic and financial models is thereby meant to feature systematically forward-looking wealth estimates as a source to inspire restoration and conservation policies. The 'Mapping Climate Justice' project housed at Columbia University measures the impact of climate change on economic productivity around the world and has found vast climate injustices. Future wealth of nations was introduced by the concept of climate flexibility defined as the range of temperature variation of a country. Climate flexibility is the leeway countries have in coping with a changing climate due to a broad range of climate zones prevalent in their territory. Climate flexibility can be grounded on the relative latitude and altitude of countries around the globe. Climate flexibility directly influences a country's productivity in agriculture production opportunities, trade possibilities, industry development favorable conditions as well as service sector offerings. Climate wealth of nations so far has also been proposed to stem from climate zones, which vary around the world. Climate justice redistribution strategies have been proposed in order to alleviate climate injustices, by which countries that benefit from a relative climate advantage are meant to redistribute some of the expected economic gains to countries that lose out the most and the fastest from global warming. The redistribution could be implemented via a taxation-bonds redistribution strategy. Overall, the concerted efforts to marry the idea of natural resource description are believed to stimulate environmental policy and protection, change sustainable development and macroeconomic calculus. Policy and regulatory settings are meant to be aligned with wealth derived from natural resources. Natural resource accounting is also likely to change the estimation of competitiveness around the world. The integration of local community assets can thereby facilitate conservation holistically. Scientifically, environmental and economics interactions are likely to inspire ground-breaking insights for monetizing the value of natural assets and stimulate the future discourse on resilient finance.

KEYWORDS: Climate Change, Climate Flexibility, Climate Wealth of Nations, Comparative Advantage, Diversification Advantage, Economics, Ethics, National Accounting, Natural Resources, Resilient Finance, Sustainable Finance Taxonomy, Trade

Introduction

The European and United States Green New Deals account for the most drastic economic changes in the post-pandemic world (Puaschunder 2020b; The United States Congress 2019). The Green New Deal and the European Green Deal, in combination with the European Sustainable Finance Taxonomy, are the most widescale efforts to marry the idea of economic growth in line with the natural resources pool and with respect for environmental limitations (Puaschunder 2021). Both programs target at creating an economic multiplier by a focus on the conservation and restoration of natural resources, which are meant to be integrated into the national and international accounting (Keynes 1936/2003).

In the European Union, the European Green Deal connects finance with sustainability. The European Sustainable Finance Taxonomy quantifies the carbon emission impact of various industries to make economic impacts on environmental conditions more transparent and accountable. Both initiatives are large-scale endeavors to quantify natural resources in relation to economic productivity outcomes with long-term impact. The overarching goal of the European and US Green Deals is to improve the current and future management of economic outputs, outcomes and impacts so that they work towards a more sustainable future world.

The Joseph Biden Kamala Harris administration has also launched efforts to put nature on the national agenda and national accounting balance sheet (Reamer 2023). The Biden-Harris White House multi-year strategy plans to connect environmental conditions with economic outcomes in collecting data and using innovative methods to better capture nature's role in the U.S. economy. The results are expected to influence public and private sector endeavors. The environment-economy connex is meant to inform policy for natural resource preservation but also to generate business opportunities on the international level (Reamer 2023; The White House 2023a, b). National accounting standards will thereby include resources like land, water, minerals, animals and plants (Reamer 2023; The White House 2023a, b). Linking nature with the economy in a more inclusive and comprehensive accounting will also inform international relations and science diplomacy.

Linking nature to the economy and productivity as well as the human standard of living is also the driver for the World Bank to advocate for a "Changing Wealth of Nations" (World Bank 2023). The World Bank has been measuring wealth since the 1990s and holds a consistent global database for 146 countries from 1995 to 2018 (Onder 2023). Comprehensive wealth is based on produced capital (machinery, structures, urban land), non-renewable natural capital (fossil fuels, minerals), renewable natural capital (cropland and pastureland, forest timber and eco-services, protected areas, fisheries, mangroves), human capital (male/female, employed/self-employed) and net foreign assets (assets-liabilities) (Onder 2023). In a revised version of the Wealth of Nations index, the World Bank team now targets integrating natural capital in global macroeconomic and financial models to feature systematically forward-looking wealth estimates.

Puaschunder (2020a) measured the Gross Domestic Product (GDP) prospect differences under climate change worldwide and found exacerbating climate inequalities. Puaschunder (2020b) introduced a climate change winners and losers index, representing relative economic climate change windfall gain reaper and victim countries, based on the economic prospects under climate change around the world and over time. The model assumes that there are relative economic climate change reapers that have a relative economic windfall gain from a warming globe while other relative economic climate change victims face immediate disadvantages due to global warming. The model primarily focuses on shedding light on the inequality in countries and regions of the world exacerbated by climate change determining economic prospects. The index attributed relative economic gain and loss prospects based on the medium temperature per country and the optimum temperature for economic productivity per GDP agriculture, industry, and service sector, and the GDP sector composition per country to determine how far countries are deviating from their optimum productivity levels on a time scale based on an overall changing climate prospect (Puaschunder 2020a). It is to be noted that the 'relative economic climate change windfall gain reapers and victims' are categories on a spectrum, that the gain and loss perspective addressed only concerns GDP growth and that the gains/losses distribution are windfall/victim categories that countries did not accomplish or chose willingfully. Gains and losses are somewhat random distributions throughout the world. It is sheer luck in the birth lottery, where one falls into.

Climate justice addresses inequalities inherent in global warming with a mandate to alleviate imbalances and enact fairness regarding climate benefits and burden-sharing. To alleviate inequalities in climate change impacts between countries, ethical imperatives of

Immanuel Kant's categorical imperative (1783/1993) and John Rawls' veil of ignorance (1971) but also economic calculus as put forward in Kaldor-Hicks' compensation criteria guide redistribution schemes (Law & Smullen 2008).

For the implementation of redistribution to alleviate climate inequality around the world, climate change-winning countries that also feature relative climate flexibility in terms of temperature ranges on their territory and that contribute to human-made global warming in CO_2 emissions could pay for the establishment and maintenance of climate bonds via carbon taxation; while climate change losing territories with low CO_2 emissions and a narrow range of temperatures on their soil and thus low climate flexibility could be recipients of climate bonds with relatively high interest rate premium and thus be relative beneficiaries in the common climate taxation-and-bonds transfer scheme.

This paper pays tribute to the connection between economic productivity and natural resources. First, the European Green Deal and the European model of a Sustainable Finance Taxonomy are presented as a classification of the impact of economic production on natural resources and environmental assets. Second, the contemporary efforts of the United States Biden-Harris administration to account for natural resources in national accounting are outlined. Third, the international strategy to measure the "Changing Wealth of Nations" around the world at the World Bank in Washington, D.C. is discussed for integrating natural resources in productivity measurements. Fourth, the climate change impact in terms of climate flexibility as an economic advantage and trade asset that varies around the globe is depicted. Fifth, the different strategies are discussed and an outlook for future research is given.

European Green Deal and the Sustainable Finance Taxonomy

The European Green Deal and the European Sustainable Finance Taxonomy but also the dichotomy of European Union efforts (foremost the Next Generation EU) are part of the concurrent European national COVID-19 rescue and recovery packages. The Sustainable Finance Taxonomy accounts for the carbon impact of industries on natural resources to make economic productivity's effect on environmental conditions more transparent and accountable. Organized by sector and technology, the European Sustainable Finance Taxonomy provides references to classify climate change mitigation and adaptation activities, including environmental objectives (European Union Technical Expert Group on Sustainable Finance 2020).

The goal of the European Green Deal is to improve the current and future management of outputs, outcomes and impact of economic behavior. In the European Green Deal large-scale endeavor with a long-term impact, the effectiveness will be evaluated by the sustainability assessment of the performance of projects, institutions and programs by governments, international organizations, non-governmental organizations (NGOs) as well as social media campaigns. As the continuous assessment of programs, controlled evaluations of large-scale projects' relevance, effectiveness, efficiency and impact will be needed on a grand scale and with a future-oriented outlook.

Biden-Harris White House strategy to integrate natural resources in national accounting

The Joseph Biden Kamala Harris administration has launched efforts to put nature on the nation's balance sheet (Reamer 2023). The Biden-Harris White House multi-year strategy plans to connect environmental conditions with economic outcomes in collecting data and using innovative methods to better capture nature's role in the U.S. economy. National accounting standards will thereby include resources like land, water, minerals, animals and plants (Reamer 2023; The White House 2023a, b). The results are expected to influence public and private sector endeavors. The environment-economy connex is meant to inform public policy makers for natural resource preservation but also business opportunities on the international level (Reamer 2023; The White

House 2023a, b). Linking nature with the economy in a more inclusive and comprehensive accounting will also guide international relations and science diplomacy.

The involved agencies are the "White House Office of Science and Technology Policy (OSTP), the Office of Management and Budget (OMB), and the U.S. Department of Commerce working with more than 27 federal departments and agencies on the development of the final National Strategy to Develop Statistics for Environmental-Economic Decisions" (Reamer 2023; The White House 2023a, b). The overall effort is believed to change the appreciation and perception of natural resources as key to economic prosperity, financial risk accounting in light of climate change, international trade opportunities and the overall societal quality of life (Reamer 2023; The White House 2023a, b). On the global level, integrating natural resources into economic productivity prospects has the potential to change power dynamics and international politics driven by economic opportunities.

International efforts to measure the Changing Wealth of Nations

Linking nature to the economy and productivity as well as the human standard of living is also the driver for the World Bank project named "Changing Wealth of Nations" (World Bank 2023). The World Bank has been measuring wealth since the 1990s and holds a consistent global database for 146 countries from 1995 to 2018 (Onder 2023). Comprehensive wealth is based on produced capital (machinery, structures, urban land), non-renewable natural capital (fossil fuels, minerals), renewable natural capital (cropland and pastureland, forest timber and eco-services, protected areas, fisheries, mangroves), human capital (male/female, employed/self-employed) and net foreign assets (assets-liabilities) in a yearly reporting (Onder 2023).

The yearly reports are now improved by adding carbon storage, renewable energy and aquaculture pilot systems (Onder 2023). Integrating natural capital in global macroeconomic and financial models is thereby meant to feature systematically forward-looking wealth estimates. Future research endeavors thereby include the impact of climate on diversification (Onder 2023). The report additions address the growing demand to understand the interlinkage of the economy and the environment as a source to inspire restoration and conservation policies (Onder 2023).

Climate Flexibility

Climate flexibility as the range of temperatures a country enjoys was recently introduced to be a future wealth of nations (Puaschunder 2020a). Climate flexibility – defined as the range of temperature variation per country – determines the future climate wealth of nations based on economic production and comparative trade advantages (Puaschunder 2020a). If a country has a natural climate flexibility in terms of a range of different temperatures that vary within its territory, then the country is assumed to have more economic degrees of freedom and future trade assets in a changing climate (Puaschunder 2020a).

Puaschunder (2020a) measured the Gross Domestic Product (GDP) prospect differences under climate change worldwide and found exacerbating climate inequalities. Puaschunder (2020b) introduced a climate change winners and losers index, representing relative economic climate change windfall gain reaper and victim countries, based on the economic prospects under climate change around the world and over time. The model assumes that there are relative economic climate change reapers that have a windfall gain from a warming globe while other relative economic climate change victims face immediate disadvantages due to global warming.

The wider the range of latitude and altitude within a nation-state, the more climate flexibility and favorable economic degrees of freedom for multiple production peaks are assumed. A broad spectrum of climate zones is portrayed as a future asset in light of climate change-induced shrinking climate flexibility. Global warming will continue diminishing

territories' economic production flexibility when climate variation sinks. The more climate variation a nation-state possesses right now, the more degrees of freedom a country has in terms of GDP production capabilities in a differing climate. These insights aid in answering what financial patterns we can expect given predictions the earth will become hotter. Already now human capital flows and financial market inflows are significant in areas that are economically gaining from a warming globe.

The climate winners and losers model primarily focuses on shedding light on the inequality in countries and regions of the world exacerbated by climate change determining economic prospects. The index attributed relative economic gain and loss prospects based on the medium temperature per country and the optimum temperature for economic productivity per GDP agriculture, industry, and service sector, and the GDP sector composition per country to determine how far countries are deviating from their optimum productivity levels on a time scale (Puaschunder 2020a). It is to be noted that the 'relative economic climate change windfall gain reapers and victims' are categories on a spectrum, that the gain and loss perspective addressed only concerns GDP growth and that the gains/losses distribution are windfall/victim categories that countries did not accomplish or chose willingfully. Gains and losses are somewhat random distributions throughout the world. It is sheer luck in the birth lottery where one falls into.

The economic analysis of the economic gains and losses of a warming earth around the world but also an economic estimation of future trade prospects in light of global warming, help quantify how to enact climate change burden-sharing fairness in legally-instigated redistribution and compensation schemes. Those countries that benefit from rising GDP productivity given climate change and those countries with relatively higher degrees of climate flexibility thereby should redistribute some of the expected wealth increase to places that have a declining GDP prospect under global warming and low climate flexibility.

An international climate change fund could be based on indices that integrated the relative country's initial position on the climate change gains and losses index spectrum and a country's climate flexibility understood as the future climate wealth of nations trading assets in combination with CO_2 emissions production and consumption levels as well as changes in CO_2 emissions over time and the bank lending interest rate per country but also historic resilient finance and trade positions (Puaschunder 2020a). An overall redistribution key was introduced to determine per-country transfers based on the climate change winner or loser status and climate flexibility as well as the contribution to the climate change problem measured per country and over time by CO_2 emissions of production and consumption as well as CO_2 emission changes and the bank lending rate per country. In order for the redistribution scheme to work, those countries with climate change losing prospects and low ranges of climate flexibility as well as low CO_2 emissions in production and consumption as well as decreasing CO_2 emissions and high bank lending rates could be granted climate bonds prospects with high bond yield rates that are financed by countries that have climate change winning prospect and high ranges of climate flexibility as well as high CO_2 emissions in production and consumption as well as increasing CO_2 emissions trends and low bank lending rates via taxation.

A better propensity to enact a common climate justice solution on the international level should predestine countries to face a higher responsibility to act on global warming and lead the world solution for climate justice. Those countries that have historically-proven financial crisis intervention expertise and resilience finance capabilities as well as are connected in science diplomacy and economic terms should thereby take on a leadership role in raising the funds for the common climate justice taxation and transfer bonds solution. These countries would raise the funds necessary to be redistributed to countries that do not have a good starting ground on financial crisis intervention and resilient finance expertise and are not well connected in regard to science diplomacy and economic transfers.

An in-between country regime could enact fairness on the different starting grounds of countries as relative climate change winners or losers coupled with incentivizing countries and/or corporations to compete over better bond conditions. Incentives could thereby target lowering CO2 emissions or moving production to places that are climate losers to help revitalize economies that have a shrinking prospect under climate change.

The idea of differing climate bond regimes is also extendable to sector-specific bond yield interest rate regimes. On a country level, high CO_2 emitting industries should face climate taxation to set market incentives for a transition to renewable energy. The revenues generated from the taxation of carbon-intensive industries should be used to offset the losses of climate change and subsidize climate bonds.

Within a country, the bonds could be offered by commissioning agents, such as local investment banks, who could install industry-specific premium bond payments and maturity bond yields based on the environmental sustainability of an industry, e.g., as measured by the European Sustainable Finance Taxonomy or U.S. attempts to include nature into national accounting. The more sustainable an industry performs; the higher bond yield should be granted in sector-specific interest rate regimes within a country. This strategy should set positive market incentives via subsidies. Funding industries for not polluting could change the traditional race-to-the-bottom price-cutting behavior driving CO_2 emitting energy supply to have industries compete over subsidies for using clean energy. In this way, bond yield differences between industries could set positive market incentives for transitioning to renewable energy productivity solutions.

Discussion

The presented concerted efforts to integrate natural resources in economic productivity calculus are believed to stimulate environmental policy and protection, change sustainable development and macroeconomic calculus. Policy and regulatory settings are meant to be aligned with wealth derived from natural resources. Natural resource accounting is also likely to change the estimation of competitiveness around the world. The integration of local community assets can facilitate conservation holistically. Scientifically, environmental and economics interactions are likely to inspire ground-breaking insights for monetizing the value of natural assets and stimulate the future discourse on resilient finance.

Future efforts to integrate natural capital into national accounting should be fortified. Foremost the European Sustainable Finance Taxonomy but also the United States research on how to integrate natural resources into national accounting standards can guide the preservation and conservation of natural wealth. Climate justice redistribution strategies could become pegged to sustainable finance and the natural resource-based wealth of nations.

The European classification of industries' contribution to climate change in the European Sustainable Finance Taxonomy could become the basis for setting positive market incentives to change market dynamics via differing bond regimes. Within a country, the bonds could be offered by commissioning agents, such as local investment banks, who could install industry-specific premium bond payments and maturity bond yields based on the environmental sustainability of an industry, e.g., as measured by the European Sustainable Finance Taxonomy or U.S. attempts to include nature into national accounting. The more sustainable an industry performs; the higher bond yield should be granted in sector-specific interest rate regimes within a country. This strategy should set positive market incentives via subsidies. Funding industries for not polluting could change the traditional race-to-the-bottom price-cutting behavior driving CO_2 emitting energy supply to have industries compete over subsidies for using clean energy. In this way, bond yield differences between industries could set positive market incentives for transitioning to renewable energy productivity solutions.

Future measurements should refine the concept of climate flexibility defined as the range of temperature variation of a country (Puaschunder 2020a). In a changing climate, temperature range flexibility is portrayed as a future asset for international trade of commodities but also for production flexibility leading to comparative advantages of countries. A broad spectrum of climate zones has never been defined as an asset and comparative edge in free trade but climate change will require territories to be more flexible in terms of changing economic production. The more climate variation a nation-state possesses, the more degrees of freedom a country has in terms of GDP production capabilities in a differing climate. These preliminary insights aid in answering what financial patterns can we expect given predictions the earth will become hotter. Already now, the degree of climate flexibility is found to be related to human migration inflow and is predicted to determine the future climate wealth of nations in a climate-changing world (Puaschunder 2020a). The actual natural external impact but also human-built influences on the natural wealth of nations should lead to the unprecedented outlook on the future climate wealth of nations in the age of the Anthropocene. How future climate change-induced market changes are pegged to scarcity of climate flexibility and a prospect of commodity price spikes in the interrelation between environmental, political and demand patterns should become unraveled.

Global governance institutions play a crucial role in measuring the impact of economic productivity on natural resources. Governance experts are also at the forefront of implementing the proposed relative economic climate change gains redistribution scheme with plurilateral summit capabilities. Comprised of all nations of the world, global governance entities can instigate the idea of a 'Global Green New Deal,' which could globalize ideas of the Green New Deal and the European Green Deal to enact a binding taxation-and-bonds solution for alleviating the disparate impact of climate change. Empirically-driven redistribution schemes could thereby build the support of all the international actors involved and imbue a notion of economically-driven rationality in fairness that could win countries to act and comply. Global governance institutions, such as the World Bank, IMF, or the United Nations, could act as norm entrepreneurs and action catalysts of a Global Green New Deal that redistributes the unequally-distributed relative economic gains of a warming earth to places that face economically-declining economic prospects. The important role that global governance institutions can play in supporting and implementing a Global Green New Deal targets at redistribution to overcome global inequalities in regard to climate change. Global governance institutions can shape the conduct and array of international actors to contribute to a commonly-agreed global scheme. Economically-driven indices in a concerted governance and science diplomacy accord could aid in taking the political nature out of redistribution politics and historically-laden international relations. Drawing attention to the need for future research on this nexus will serve as a first step in finding economically-driven redistribution schemes to conserve and protect the earth inbetween generations.

All the presented programs are large-scale endeavors with a long-term impact to make the world a more sustainable place and economies more resilient. The success of these long-term large-scale endeavors will depend on future conditions and long-term implementation compliance. Monitoring and Evaluation (M&E) can currently only give a short-term assessment of the performance of projects, institutions and programs by governments, international organizations, non-governmental organizations (NGOs) as well as social media campaigns. In the continuous assessment of programs younger generations and the most diverse stakeholders should be included as all these projects require a long-term and large-scale transformation. In the end, to the young and the diverse groups within society and around the world but also over time, the relevance, effectiveness, efficiency and impact of all these endeavors will matter the most if implemented sustainably and meaningfully for the global community of this generation and the following.

References

European Union Technical Expert Group on Sustainable Finance. 2020. Financing a sustainable European economy: Technical report: Taxonomy: Final report of the Technical Expert Group on Sustainable Finance March 2020. Retrieved at https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf.

Kant, Immanuel. 1783/1993. *Grounding for the metaphysics of morals.* Cambridge: Hackett.

Keynes, John Maynard. 1936/2003. *The general theory of employment, interest and money.* Cambridge, MA: Harvard University Press.

Law, Jonathan. & John Smullen. 2008. *A dictionary of finance and banking*. Oxford: Oxford University Press.

Office of the U.N. High Commissioner for Human Rights. 2015. Understanding Human Rights and Climate Change. Submission of the Office of the High Commissioner for Human Rights to the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCC, COP21), 27 November 2015.

Onder, Stefanie. 2023. The changing wealth of nations (CWON). The World Bank Group. Presentation delivered to the U.S. Committee for IIASA at the National Academy of Sciences, Washington D.C., May 9, 2023.

Puaschunder, Julia Margarete. 2020a. *Governance and Climate Justice: Global South and Developing Nations.* New York: Palgrave Macmillan. Cham, Switzerland: Springer Nature.

Puaschunder, Julia Margarete 2020b. The Green New Deal: Historical foundations, economic fundamentals and implementation strategies, The FinReg Blog: Global Financial Markets Center Duke University School of Law Blog, October 30, 2020. Retrieved at, https://sites.law.duke.edu/thefinregblog/author/julia-m-puaschunder/.

Puaschunder, Julia Margarete. 2021. "Monitoring and Evaluation (M&E) of the Green New Deal (GND) and European Green Deal (EGD)." 21st Research Association for Interdisciplinary Studies (RAIS) Conference Proceedings, pp. 202-206, March 1, 2021.

Rawls, John. 1971. *A theory of justice.* Cambridge, MA: Harvard University Press.

Reamer, Andrew. 2023. National Strategy to Develop Statistics for Environmental-Economic Decision: OSTP/Commerce/OMB, January 19, 2023. Retrieved at https://www.aeaweb.org/forum/3447/national-strategy-statistics-environmental-economic-decisions

The United States Congress. 2019." Recognizing the duty of the Federal Government to create a Green New Deal." Retrieved at https://www.congress.gov/bill/116th-congress/house-resolution/109/text

The White House. 2023a. Fact Sheet: Biden-Harris Administration releases national strategy to put nature on the nation's balance sheet, January 19, 2023. Retrieved at https://www.whitehouse.gov/ostp/news-updates/2023/01/19/fact-sheet-biden-harris-administration-releases-national-strategy-to-put-nature-on-the-nations-balance-sheet/

The White House. 2023b. A national strategy to develop statistics for environmental-economic decisions: A U.S. system of natural capital accounting and associated environmental-economic statistics. Office of Science and Technology Policy. Office of Management and Budget. Department of Commerce. Retrieved at https://www.whitehouse.gov/wp-content/uploads/2023/01/Natural-Capital-Accounting-Strategy-final.pdf