

Environmental Justice

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ABSTRACT: This article proposed three innovative and heterodox ways to aid understanding and unleashing a sustainable economy in Three Essays on Environmental Justice: *First*, behavioral insights are presented about real-world relevant, easily-implementable nudges to steer human into future-oriented discounting. *Second*, macroeconomic modelling highlights countries' different economic prospects on a warming globe in order to find a redistribution of benefits and burdens of climate change to share the gains and losses of a warming globe equally *within society, between countries* and *over time*. *Third*, a creative financialization strategy is introduced in bonds that help weight the burden of climate change more equally between today's and tomorrow's society.

KEYWORDS: Climate Bonds, Climate Change, Economics of the Environment, Ecotax, Environmental Justice, Environmental Governance, Fiscal Policy, Green New Deal, Monetary Policy, Multiplier, Sustainability, Teaching

Introduction

A warming earth under climate change is pressuring future generations' living conditions. Never before in the history of humankind have environmental concerns in the wake of economic growth heralded governance predicaments as we face today (Puaschunder 2019a, b). Climate change presents societal, international and intergenerational fairness as challenge for modern economies and contemporary democracies. In today's climate change mitigation and adaptation efforts, high and low income households, developed and underdeveloped countries and overlapping generations are affected differently (Puaschunder 2018, 2020).

The Paris Climate Agreement signed in 2015 by 195 UNFCCC member countries recognizes the importance of combining mitigation, adaptation and finance to effectively deal with global warming and its negative consequences worldwide. While the climate change scientific community is convinced that urgent actions are needed to prevent further global warming and that keeping the global average temperature below 1.5°C above the pre-industrial level is necessary to avoid catastrophic damages (Schleussner et al., 2016), economists are concerned with finding feasible incentives and financing mechanisms of emission reduction and dealing with future damages (High-Level Commission on Carbon Prices 2017; Stern 2008). Innovative strategies and unconventional compensation schemes to raise funds for climate stabilization are therefore currently required by public and private sector entities alike. This article proposed three innovative and heterodox ways to aid understanding and unleashing a sustainable economy in Three Essays on Environmental Justice:

First, behavioral insights are presented about real-world relevant, easily-implementable nudges to steer human into future-oriented discounting.

Second, macroeconomic modelling highlights countries' different economic prospects on a warming globe in order to find a redistribution of benefits and burdens of climate change to share the gains and losses of a warming globe equally within society, between countries and over time.

Third, a creative financialization strategy is introduced in bonds that help weight the burden of climate change more equally between today's and tomorrow's society (Puaschunder 2020).

Mental Temporal Discounting

Starting with a review of behavioral insights on discounting, the hyperbolic discounting literature (Laibson 1997) finds individuals to pay attention to the present more closely than future conditions are taken into consideration. Mental discounting outlines that individuals have different mental accounts for financial allocations (Thaler 1985, 1999).

The idea how hyperbolic discounting and the present bias could be related to mental discounting categories in the domain of time has not been studied (Puaschunder 2021). In the ample literature on mental accounting in the finance domain, the scarce resource time has not been tested. While all humans face the same natural constraints of 24-hours days, behavioral economics found individuals differing in discounting preference for immediate rewards over delayed gratification (Estle, Green, Myerson & Holt 2007; Kahn 2005; Rubinstein 2006; Samuelson 1937). Regarding monetary gains, individuals were also shown to hold mental accounts dependent on a reference point but also in regards as to how to allocate money to causes individuals care about (Thaler 1985).

A behavioral economics study investigated if there is a present bias in regards to time use and individuals have mental temporal discounting categories for the scarce resource of time. Building on the behavioral economics idea of mental accounting, which was tested in the domain of time with special attention to the reference points of age and parenthood, the study examined whether people report differently perceived uses of time when averaging at differences frequencies and whether different frames of mind may lead to discounting preferences.

Hypothesis 1 investigated if people report differently perceived uses of time when averaging at differences frequencies these different frames of mind may lead to different discounting preferences, which may manifest themselves in malleable time perception. People may easily be manipulated to perceive time differently and experience their time use dependent on time categories they are focusing on. If so, we derive clear recommendations on how to nudge people into a better time use and more fruitful life experience.

Hypothesis 2 scrutinized if individuals differ in time spent on their own and social time but also vary in their choices of time spent working and time in the natural environment, we could show that the classical mental accounting theory (Thaler 1999) actually describes similar processes as mental temporal accounting how to spend time but also dependent on the reference points of age and parenthood.

Method: In total, four studies examine whether people report differently perceived uses of time when averaging at differences frequencies and whether different frames of mind may lead to discounting preferences. After a meta-analysis of the American Time Use Survey of the Bureau of Labor Statistics that found that there is no clear account of how much time individuals spend in social, economic and environmental conditions; three studies were conducted using Amazon Mechanical Turk (MTurk) online that tested 565 subjects from around the world.

Empirical results: Regarding monetary gains, individuals were shown to hold mental accounts dependent on a reference point but also in regards as to how to allocate money to causes individuals care about. Over all subjects, time is reported to be used differently for social, economic and environmental purposes. The social, economic and environmental time use varies over mental temporal accounting compartments of a day, week, month, year and decade. Social time was defined as time spent with other people and engaging in social interaction, communication or activities with others. Economic time was meant as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. Environmental time was given as time spent outdoors in the open environment. While there are no gender differences to report; age groups and parenthood make a difference when it comes to time allocation perceptions in the social sphere

and the environmental domain. Time allocation depends on the economic, social and environmental context. In the environmental frame, time use is reported as highest over all categories. Then follows time use perception of those subjects in economic mindsets. Lastly, in the social condition, time use is perceived to be the lowest, even lower than the neutral baseline condition.

The insights gained provide a starting ground on hyperbolic discounting having an influence on mental temporal accounting and that the context individuals find them in is likely connected to their perception of time use. All results hold invaluable insights on incentives to nudge individuals into benevolent time use and use external cues to motivate positive change. These results have also implications for determining behavioral nudges to bring individuals on board with climate stabilization efforts. Elucidating how contexts and experiencing critical life stages influence temporal activity allocation choices holds manifold implications to improve decisions on education, health, asset management, career paths and common goods preservation throughout life. The found differences of social, economic and environmental cues impacting on temporal discounting but not social, economic and environment monetary allocations demand for future investigations of the relation of mental temporal discounting and financial allocation preferences (Puaschunder, forthcoming).

Mapping Climate Justice

Based on insights from the current endeavor to finance the post-COP21 Paris agreement action plan, the *Mapping Climate Justice Project* proposes a 3-dimensional climate justice approach in order to find a universally fair climate strategy. *Mapping Climate Justice* elucidates international climate regimes around the world based on geographic, technological, socio-economic and political factors. An interactive graphic solution highlighting different countries' climate stability efforts targets at finding ways to share the benefits and burdens of climate change equally *within society, between countries and over time*.

Based on insights on the current endeavor to finance climate change mitigation and adaptation around the globe, a 3-dimensional climate justice approach is introduced to share the burden of climate change fair within society. First, climate justice *within a country* should pay tribute to the fact that low- and high-income households share the same burden to stabilize the climate proportional to their dispensable income via taxation redistribution efforts. Secondly, fair *climate change burden sharing between countries* comprises of argumentations that those countries benefiting more from a stable climate also bear a higher responsibility to protect a stable climate. Thirdly, *climate justice over time* is proposed in an innovative climate change burden sharing strategy enacted via a tax-and-transfer bonds solution.

Comparing international climate mitigation and adaptation as well as unraveling complex interdependencies will help protect vulnerable communities from variegated climate change risks while opening ways for all to enjoy the upsides of a warming earth. While law, economics and governance scientifically grounding, international climate change mitigation and adaptation regimes are discussed in order to derive fair climate stability implementation strategies. Deriving respective policy recommendations for the wider climate change community is aimed at sharing the burden but also the benefits of climate change *within society, between countries and over time* in an equitable way.

Method: A macro-economic model integrating world temperatures, climate change expectations and Gross Domestic Product (GDP) temperature peak conditions captures economic gain and loss prospects of a warming globe on a country level in order to propose redistribution strategies to alleviate an unequal society and world.

Based on the optimal temperatures for the agriculture, industry and service sectors productivity as well as climate projections of the year 2100 under the business-as-usual path

per country, climate winners and losers around the world are revealed from now on until the year 2100.

The climatorial imperative is introduced advocating for the need for fairness in the distribution of the global earth benefits among nations based on Kant's imperative to only actively engage in actions that one passively wants to endure. The novel introduction of attention to climate change benefits leads to the demand of distributing the gains from a warming earth equally around the globe. In the distribution allocation decision, a climatorial imperative may lay foundation to the demand for sharing the positive externalities of climate change. With reference to Immanuel Kant's Categorical Imperative proposing to 'not impose on other what you do not wish for yourself' and suggesting to 'treat others how you wish to be treated,' the climatorial imperative should fortify the common but differentiated responsibility to ensure a stable climate and share the benefits among the world to alleviate those parts of the world that have run out of favorable climate time already (Kant 1788/2012). The climatorial imperative advocates for the need for fairness in the distribution of the global earth benefits among nations based on Kant's (1783/1993) imperative to only engage in actions one wants to experience themselves being done to oneself. Passive neglect of action on climate mitigation is argued as an active injustice to others. Countries passive or agnostic about global warming mitigation that reap benefits from a warming earth should therefore be obliged to finance international aid for those that are directly and negatively impacted by climate change. In addition, building on common and international law, those countries that have better means of protection or conservation of the common climate should also face a greater responsibility to protect the earth. While the method to measure the gains from climate change can certainly be refined in future studies, the following research is meant as very first preliminary step to open a gate to find climate mitigation incentives from a welfare redistribution perspective.

Results: Overall and simply seen from a narrow-minded GDP perspective, the world will macro-economically benefit more from climate change until 2100 than lose. Winning and losing from a warming earth is significantly positively correlated with the Paris COP 21 emissions country percentage of Greenhouse Gas (GHG) for ratification.

These preliminary insights aid in answering what financial patterns can we expect given predictions the earth will become hotter. Already now human capital flows and financial market inflows into areas that are winning economically from a warming globe. The degree of climate flexibility is found to be related to human migration inflow. Based on a 187 country-strong dataset and under the implicit assumption of an open economy, a significantly positive inflow of migrants was found into the climate change winner countries. A statistically significant correlation outlines a positive Foreign Direct Investment (FDI) remaining financial inflow into the winning countries. As a cross validation of the finding of financial inflows into climate change winner countries, a non-significant correlation and independent t-test reveal that there are no significant financial returns in form of remittances to the climate change loser countries in order to highlight that the money transfer into winning countries is only one sided and not reversed by remittances. The results underline the importance of climate change benefits transfers to offset the losses incurred in the global warming-burdened areas of the world.

As for concrete industry changes, data over all three GDP pillars of the agriculture, service and industry sectors suggests that climate change will affect economic performance large-scale. As the temperature will be rising, we may see a shift from industry production with lowest optimum temperature to service sector activities with medium peak cardinal temperature and then agriculture sector productivity with the highest optimum temperature as recalculated by a meta-analysis of literature sources. Overall, the literature meta-analysis results outline that the peak condition for happiness at 14°C has passed when considering the world mean temperature of 18.6°C (65°F). In addition, the peak condition for workplace temperature has passed when measure by the world mean temperature of 18.6°C (65°F). Heat waste production is prospected to become a luxury good in the future; as well as winter sports related activities.

When it comes to safety, Legionella bacteria in the water will soon become a problem and medical and hygiene markets that combat these risks are likely to prosper soon. The results have implications for global warming mitigation and adaptation strategies as well as hold invaluable novel insights for the implementation of a transition into renewable energy.

Implications: Climate justice is introduced to comprise of fairness between countries but also over generations in a unique and unprecedented tax-and-bonds climate change gains and losses distribution strategy. Climate change winning countries could use taxation to raise revenues to offset the losses incurred by climate change. Climate change losers could issue bonds that have to be paid back by taxing future generations. Regarding taxation, within the winning countries, foremost the gaining GDP sectors should be taxed. Climate justice within a country should also pay tribute to the fact that low- and high-income households share the same burden proportional to their dispensable income, for instance enabled through a progressive carbon taxation. Those who caused climate change could be regulated to bear a higher cost through carbon tax in combination with retroactive billing through inheritance tax to map benefits from past wealth accumulation that potentially contributed to global warming.

Green Bonds solution

Orlov, Rovenskaya, Puaschunder and Semmler (2018) examined the potential of green bonds to accelerate the transition to a low-carbon economy and whether the use of green bonds in principle can reduce inter-temporal inequity by smoothening the burden sharing of climate change abatement in a DICE model approach. Orlov et al. (2018) examined the potential of green bonds to accelerate the transition to a low-carbon economy and the extent to which they can help distribute the burden more evenly over generations. Green bonds might also include credit flows from banks, since both represent current borrowing with the promise to pay back in the future. Once a certain level of emission reduction is achieved, the economic activity is being taxed and bonds are being repaid. Orlov et al. (2018) provide quantitative estimates of the key policy effects to demonstrate the effectiveness of green bonds in terms of the emission reduction, the welfare improvement and the intergenerational inequity minimization.

Results: Orlov et al. (2018) show that bonds at 3% interest rate can enhance mitigation and enable a decrease of peak atmospheric carbon concentrations by about 20%. However, bonds can only reduce the inter-temporal inequities in social welfare rather than provide a Pareto improvement. Lower bond interest rates would shorten the initial time during which the society would have to be worse off if a mitigation policy were implemented. For example, bonds with a 3% annual interest rate shorten this period by 30 years. Additional compensation mechanisms ensuring that current generations retain the same consumption level as the one without mitigation could be implemented, which would require either a decrease in the initial abatement efforts or a lowering of the bond interest rate.

Conclusion: Future Climate Wealth of Nations

The contemporary attention to global warming and climate shocks is assumed to affect the price expectations and hence actual market prices of commodities in light of potential scarcities. Paying attention to supply and demand side perspectives, inflated prices surrounding scarcity are first modelled and then back-tested on data about prices in commodities of food and beverages. Future wealth of nations is introduced by the concept of climate flexibility defined as the range of temperature variation of a country. A broad spectrum of climate zones is defined as asset when climate change requires territories become more flexible in 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. The range of temperature variation implies comparative advantages of countries.

In a changing climate, temperature range spreads determine production flexibility and advantages in international trade of commodities and services. Climate-related degrees of freedom are thus captured as an unprecedentedly-described future *climate wealth of nations* concept. Based on Adam Smith's concept of wealth of nations, the dissertation ends with a future-oriented outlook on an inquiry into the nature and causes of tomorrow's economic productivity determinants based on temperature and a wide range of climate flexibility. The two concepts of climate change winners and losers but also climate wealth of nations based on climate flexibility ranges are integrated into a novel index determining countries that have an economic gains perspective in light of global warming.

Potential Future Implications: *Temperature-dependent growth*

Drawing from historical foundations that included land in productivity measurement, future work could feature theoretical macro-economic modelling that re-integrates temperature (T) and climate flexibility into growth theory with attention to differences in seasonality and latitude-altitude climate variations. Climate change-induced market changes could be back-tested on actual commodity prices. Lastly, future climate change induced market changes are pegged to scarcity of agriculture production and a prospect of commodity price spikes is given. A behavioral economics and finance model could be brought forward arguing for price spikes in light of scarcity. Counter-gentrification trends in light of environmental degradation could be empirically tested to account for applied social justice pledges. Public policy implementation strategies should be proposed to aid environmental justice now and for future generations.

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