

The Silver Bullet? A Cross-National
Investigation of the Relationship Between
Educational Attainment and Sustainability

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**THE SILVER BULLET? A CROSS-NATIONAL INVESTIGATION OF THE
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ABSTRACT

The United Nations Sustainable Development Agenda (2015-2030) urges nation-states to engage in concerted efforts toward building an inclusive, sustainable, and resilient future for people and the planet. The 17 Sustainable Development Goals (SDGs) and 169 associated targets offer a roadmap for policymakers to achieve this complex agenda. An essential component of the quest for global sustainability is to understand the synergies and potential tradeoffs between these economic, social, and environmental targets. The theoretical and empirical tools developed in the sub-discipline of environmental sociology are particularly helpful in this regard because it is dedicated to unpacking the connections among people, institutions, technologies, and ecosystems.

The first portion of this dissertation considers some of the theoretical and empirical contributions of social scientists — and in particular environmental sociologists — to our understanding of sustainability. I also highlight the origins and value of the socio-ecological measure of sustainability used in this project, namely, the carbon intensity of wellbeing (CIWB). CIWB is a ratio of CO₂ per capita/life expectancy.

In the second portion of the dissertation, I engage development frameworks and macro-comparative sociological theories in two cross-national empirical investigations into the relationship between education and sustainability. Education is a social institution widely regarded as a useful mechanism for enhancing human wellbeing. However, much remains unknown about its relationship with global sustainability. To address this gap in our understanding, I assess the relationship between per capita rates

of educational attainment and nations' CIWB by estimating Prais-Winsten regression models using cross-national panel data from 1960 to 2010. In the first empirical investigation presented in chapter two, I hypothesize that gains in education may be associated with more sustainable societies, drawing on the ecological modernization perspective and Amartya Sen's conceptualization of education as the expansion of human capabilities. In this analysis, I find that education played an important historical role in reducing nations' CIWB. However, this relationship has mostly disappeared over time for nations located in most regions.

Chapter three builds on the findings of chapter two by assessing how economic factors affect the interplay between education and CIWB. Two theoretical traditions concerning global integration inform this chapter: world society and world-systems perspectives. In my analyses, I find that the magnitude of the relationship between education and CIWB varies by nations' levels of economic development. I also find that the relationship between per capita educational attainment and CIWB is moderated by national integration into the global economy, as measured by exports as a percentage of GDP. Notably, the nature of this relationship depends on nations' level of economic development, in that further integration into the global economy enhances the beneficial relationship between education and CIWB for high-income nations. The opposite trend can be observed in the middle- and low-income nations, whereby further integration into the global economy ameliorates the predicted beneficial relationship between education and CIWB. In all, my research contributes to sociological understandings of sustainability and if — and under what conditions — population gains in educational attainment can strengthen both human and ecological wellbeing.

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INTRODUCTION

In the wake of a series of alarming scientific reports, rising global temperatures, and an increase in climate-related disasters worldwide (Masson-Delmotte et al. 2018), public attention to the ecological crisis is growing (Katzung et al. 2020). Signaling increasing international political momentum to address the climate emergency, the United Nations General Assembly adopted a resolution to formally launch the United Nations Sustainable Development Goals (SDGs) in 2015. This round of international governance targets, which replaced the Millennium Development Goals (MDGs), has a broad mandate of inclusive economic growth, social inclusion, and the preservation of the planet (United Nations (UN) 2015). This tripartite conceptual framework of sustainability has been part of mainstream development discourse, in varying forms, for many decades (Purvis, Mao, and Robinson 2018). However, the SDGs are perhaps the most widely adopted global framework to integrate ecological, economic, and social concerns. Given the ambition and complexity of this agenda, stakeholders have urged cohesive policy implementation and evaluation at national and international scales (Nilsson et al. 2016, 2018; Pongiglione 2015; Leblanc 2015). Notably, siloed understandings and sectoral implementation of such targets have been an enduring weakness of previous development strategies (United Nations 2014; UNEP 2012; Leblanc 2015).

A variety of stakeholders have acknowledged the critical role of social scientists in the realization of the global sustainability agenda (Leach et al. 2013; ICSU and ISSC 2015; ISSC and UNESCO 2013; Eisenstein 2015; Jorgenson et al. 2019). The sub-discipline of environmental sociology is particularly helpful in this regard because it is dedicated to unpacking the connections among people, institutions, technologies, and ecosystems (Boström et al. 2018; Lockie 2016). For example, environmental sociologists have demonstrated how the characteristics of a society, such as population growth and technology, affluence and consumption, trade relations, power, and social inequality, have a considerable influence on the global climate (See Rosa and Dietz 2012; Jorgenson et al. 2019).

Scholars in this field have also developed an innovative metric to assess how socioeconomic characteristics simultaneously affect the biophysical world and human wellbeing, namely; the environmental or carbon intensity of wellbeing (E/CIWB) (Dietz, Rosa, and York 2012; Jorgenson 2014). This measure is a ratio of environmental stress (e.g., ecological footprint or carbon emissions) over a measure of human wellbeing such as life expectancy, which allows for a comparative assessment of the environmental costs of social gains (Jorgenson and Dietz 2015).

The ratio is a widely used metric for sustainability both within environmental sociology and beyond. It emerged as part of a larger body of literature that examines the

relationship between economic growth, the use of environmental resources, and human wellbeing (Mazur and Rosa 1974; Easterlin 1974, 2015; Daly 2005; Dietz, Rosa, and York 2007, 2009; Rosa and Dietz 2012; Dietz and Jorgenson 2014). This socio-ecological conceptualization has been used in a variety of investigations into the relationship between economic factors and sustainability (Dietz, Rosa, and York 2012; Jorgenson 2014; Jorgenson and Givens 2015; Sweidan 2018). Because of its versatility as an analytical tool, scholars are increasingly using CIWB to investigate how a variety of other features of a society can enhance or compromise national sustainability outcomes (Jorgenson 2015; Givens 2015, 2017, 2018; Sweidan 2018; Jorgenson et al. 2018; Kelly 2020). The relationship between a nations' education profile and sustainability is one such area of potential inquiry taken up in this project.

For the majority of independent nations, the provision of free mass education has been a cornerstone national social policy throughout the twentieth century (Griffiths and Irme 2013). Access to education has been part of global development policy since the Universal Declaration of Human Rights (1948, Article 26). Drafters have included the

goal in many subsequent international treaties and frameworks¹, including the current Sustainable Development Agenda (SDG 4). Therefore, if gains in educational attainment are also associated with reductions in environmental stress in some contexts, especially while human wellbeing is enhanced, it can be understood as having a positive effect on the global sustainability agenda.

However, much remains unknown about the relationship between national levels of educational attainment and sustainability. This dissertation project aims to help address this gap in our understanding by unpacking the relationship between education and sustainability, through in-depth and theoretically informed analysis.

The role of education for sustainability is undertheorized and, therefore, poorly understood. However, several macro-level sociological perspectives provide some insight

¹ Convention Relating to the Status of Refugees;1951 (Article 22); International Covenant on Economic, Social and Cultural Rights 1966 (Article 13, 14); International Covenant on Civil and Political Rights, 1966 (Article 18); Convention on the Elimination of All Forms of Racial Discrimination, 1966 (Article 5,7); Convention on the Elimination of All Forms of Discrimination against Women, 1979 (Article 10); Convention on the rights of the Child 1989 (Article 28, 29) International Convention on the Rights of Persons with Disabilities, 2006 (Article 24); Convention on the Protection of the Rights of All Migrant Workers and Members of their families, 1990 (Article 30).

into how education may relate to human and environmental wellbeing. Ecological modernization theory proposes that nations become less carbon-intensive and more ecologically-oriented as their economies develop (Mol 2001, 2002; Mol, Spaargaren and Sonnenfeld 2013). Though not directly explicated in this theory, I argue that more educated populations undergird the shifts in technologies and political engagement that this theory predicts. There is some conceptual overlap between this perspective and the capabilities approach, a popular framework within international development discourse. According to the capabilities framework (Sen 1999), education may generate a more sustainable development trajectory if it is instrumental in fostering a positive feedback loop between wellbeing, social equality, civic participation, and environmental protection.

World society theory is a perspective on global cultural integration which deals quite extensively with worldwide gains in educational attainment (Meyer 1977; Meyer et al. 1977, 1992, 2007; Boli, Ramirez, and Meyer 1985). From this perspective, the expansion of mass education is evidence of convergence toward a universal model of “the modern nation-state” (Meyer et al. 1997a; Schofer and Meyer 2005). According to this theory, global cultural scripts of socioeconomic progress, human development, and environmentalism inform this nation-state model (Meyer 1977; Meyer, Ramirez and Soysal 1992; Meyer et al. 1997b; Frank et al. 2000; Schofer and Hironaka 2005). World society theorists propose that educational institutions are evidence of adherence to and

potential receptor sites for these cultural scripts (Bromley et al. 2011; Frank et al. 2011; Meyer et al. 2007). Given how closely these global cultural ideals align with the goals of sustainability, it is possible to hypothesize that gains in educational attainment to be associated with a lower carbon intensity of wellbeing.

On the other hand, those who ascribe to a political economy perspective question the supposed alignment of human development and global sustainability. For example, scholars within comparative education, who are informed by the world-systems approach, theorize that rates of national educational attainment, standardized curricula, and international educational associations are designed to serve the capitalist system of production and the associated global division of labor (Arnove 1980; Wallerstein 1984; Ginsburg 1991; Clayton 1998, 2004; Griffiths and Arnove 2015). Environmental sociologists have shown that integration into this global economic system can result in deleterious social and ecological outcomes, particularly for low and middle-income nations (Bunker 1984; Burns, Kick and Davis 2003; Grimes and Kentor 2003; Jorgenson 2005, 2006a, 2006b, 2006c 2008, 2009a 2009b).

Empirically there is some support for the more consensus-oriented perspective on education and sustainability. Cross-disciplinary literature shows that gains in education enhance human wellbeing across national contexts (Meara, Richards and Cutler 2008; Hoyert and Xu 2012; Jayachandran and Lleras-Muney 2009; Marmot 2005). Further,

Dietz, Rosa, and York (2007) find that gains in education do not necessarily increase environmental stress. Jorgenson et al. (2018) find that the percentage of the population with a college degree has a modest attenuating effect on the carbon intensity of wellbeing at the U.S. state level. On the other hand, however, Jorgenson (2003, 2005) finds that the ecological footprint of nations is positively associated with literacy rates, net of various political-economic factors. In an analysis of cross-national panel data for the period 1998-2008, Mayer (2013) finds an association between both increases in national spending on education, tertiary enrollment rates, and per capita carbon emissions. Many of these studies include education as one of many control variables, as opposed to the main predictor of interest. This dissertation project aims to provide some clarity on the role of education for sustainability through theoretically informed and empirically rigorous analysis of the relationship between average years of educational attainment and the carbon intensity of wellbeing.

The rest of the dissertation proceeds as follows. In chapter one, I highlight the United Nations' influence on the conceptualization and implementation of sustainability strategies over the last four decades. Then, I consider some of the theoretical and empirical contributions of social scientists, and in particular environmental sociologists, to our understanding of sustainability. I highlight how social scientists have unpacked the evolution and implications of dominant discourses of sustainability within the field of international governance. Then, I underscore the value of the measure of sustainability

used in this project, namely, the carbon intensity of wellbeing. In particular, I emphasize that CIWB is a measure of “strong sustainability” in that it focuses exclusively on human and environmental wellbeing.

Chapter two and chapter three draw on macro-sociological and development theories to inform analyses of global and regional patterns in the relationship between education and the carbon intensity of wellbeing. In chapter two, I hypothesize that gains in education are associated with more sustainable societies, drawing on the ecological modernization perspective and Amartya Sen’s conceptualization of education as the expansion of human capabilities. I test the proposed hypothesis using two-way fixed effects longitudinal modeling techniques to assess the relationship between national educational attainment and the CIWB for a global sample of 76 nations between 1960 and 2010. Then, I assess how the relationship between education and CIWB changed in six geographic regions over time. This analysis includes deliberations on how historical, economic, and geopolitical factors may help explain the observed relationship between education and sustainability.

In the third chapter, I consider how the global economic system interacts with education to enhance or compromise sustainability outcomes. Two perspectives of global integration inform this analysis, namely; world society and global political economy. I explore the relationship between educational attainment operationalized as i) average

years of educational attainment and ii) the percentage of the population with a college degree and the CIWB using data for 73 countries with observations every five years from 1960 to 2010. This chapter focuses on how economic factors may interact with education to affect its relationship with CIWB. I do this by assessing if the relationship between education and CIWB varies by nations' level of economic development. I also explore if global trade relations, measured as exports as a percent of GDP, moderates the relationship between these two variables. I add to the scholarship arguing that these perspectives need not be understood as oppositional but instead focus on different dimensions of a complex and sometimes contradictory global system (Jorgenson 2009a Jorgenson et al. 2011; Shorette 2012; Longhofer and Jorgenson 2017).

In the final chapter, I explore the implications of these findings for the macro-sociological theories that informed the analysis. I also consider the implications of my findings for the global sustainability agenda. Finally, I outline some limitations of the current research project and offer some suggestions for future research.

REFERENCES

- Arnove, Robert F. 1980. "Comparative Education and World-Systems Analysis." *Comparative Education Review* 24(1):48–62.
- Blanc, David Le. 2015. "Towards Integration at Last? The Sustainable Development Goals as a Network of Targets." *Sustainable Development* 23(3):176–87.
- Boström, Magnus, Erik Andersson, Monika Berg, Karin Gustafsson, Eva Gustavsson, Erik Hysing, Rolf Lidskog, Erik Löfmarck, Maria Ojala, Jan Olsson, Benedict E. Singleton, Sebastian Svenberg, Ylva Uggla, and Johan Öhman. 2018. "Conditions for Transformative Learning for Sustainable Development: A Theoretical Review and Approach." *Sustainability* 10(12):4479.
- Bromley, Patricia, John W. Meyer, and Francisco O. Ramirez. 2011. "The Worldwide Spread of Environmental Discourse in Social Studies, History, and Civics Textbooks, 1970–2008." *Comparative Education Review* 55(4):517–545.
- Bunker, Stephen G. 1984. "Modes of Extraction, Unequal Exchange, and the Progressive Underdevelopment of an Extreme Periphery: The Brazilian Amazon, 1600-1980." *American Journal of Sociology* 89(5):1017–1064

- Burns, Thomas J., Edward L. Kick, and Byron L. Davis. 2003. "Theorizing and Rethinking Linkages between the Natural Environment and the Modern World-System: Deforestation in the Late 20th Century." *Journal of World-Systems Research*. Citeseer.
- Clayton, Thomas. 1998. "Beyond Mystification: Reconnecting World-System Theory for Comparative Education." *Comparative Education Review* 42(4):479–496.
- Clayton, Thomas. 2004. "'Competing Conceptions of Globalization' Revisited: Relocating the Tension between World-Systems Analysis and Globalization Analysis." *Comparative Education Review* 48(3):274–94.
- Daly, Herman E. 2005. "Economics in a Full World." *Scientific American* 293(3):100–107.
- Dietz, Thomas, and Andrew K. Jorgenson. 2014. "Towards a New View of Sustainable Development: Human Well Being and Environmental Stress." *Environmental Research Letters* 9(3):031001.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2007. "Driving the Human Ecological Footprint." *Frontiers in Ecology and the Environment* 5(1):13–18.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2012. "Environmentally Efficient WellBeing: Is There a Kuznets Curve?" *Applied Geography* 32(1):21–28.

- Easterlin, Richard A. 1974. "Does Economic Growth Improve the Human Lot? Some Empirical Evidence." Pp. 89–125 in *Nations and households in economic growth*. Elsevier.
- Easterlin, Richard A. 2015. "Happiness and Economic Growth—the Evidence." Pp. 283–299 in *Global handbook of quality of life*. Springer.
- Eisenstein, Michael. 2017. "The Needs of the Many." *Nature* 551(7682):S142–S144.
- Ginsburg, Mark B. 1991. *Understanding Educational Reform in Global Context: Economy, Ideology, and the State*. Taylor & Francis.
- Frank, David John, Ann Hironaka, and Evan Schofer. 2000. "The Nation-State and the Natural Environment over the Twentieth Century." *American Sociological Review* 96–116.
- Frank, David John, Karen Jeong Robinson, and Jared Olesen. 2011. "The Global Expansion of Environmental Education in Universities." *Comparative Education Review* 55(4):546–573.
- Givens, Jennifer E. 2015. "Urbanization, Slums, and the Carbon Intensity of WellBeing:: Implications for Sustainable Development." *Human Ecology Review* 22(1):107–28.
- Givens, Jennifer E. 2017. "World Society, World Polity, and the Carbon Intensity of WellBeing, 1990–2011." *Sociology of Development* 3(4):403–35.

- Givens, Jennifer E. 2018. "Ecologically Unequal Exchange and the Carbon Intensity of WellBeing, 1990–2011." *Environmental Sociology* 4(3):311–24.
- Griffiths, Tom G. and Robert F. Arnove. 2015. "World Culture in the Capitalist World-System in Transition." *Globalisation, Societies and Education* 13(1):88–108.
- Grimes, Peter and Jeffrey Kentor. 2003. "Exporting the Greenhouse: Foreign Capital Penetration and CO2 Emissions 1980 - 1996." *Journal of World-Systems Research* 9(2):261–275.
- Hoyert, Donna L., and Jiaquan Xu. 2012. "Deaths; Preliminary Data for 2011."
- ICSU, ISSC. 2015. "Review of the Sustainable Development Goals: The Science Perspective." *Paris: International Council for Science (ICSU)*.
- ISSC and UNESCO. 2013. *World Social Science Report, 2013: Changing Global Environments - UNESCO Digital Library*.
- Jayachandran, Seema, and Adriana Lleras-Muney. 2009. "Life Expectancy and Human Capital Investments: Evidence from Maternal Mortality Declines." *The Quarterly Journal of Economics* 124(1):349–397.
- Jorgenson, Andrew K. 2003. "Consumption and Environmental Degradation: A Cross-National Analysis of the Ecological Footprint." *Social Problems* 50(3):374–394.

- Jorgenson, Andrew K. 2005. "Unpacking International Power and the Ecological Footprints of Nations: A Quantitative Cross-National Study." *Sociological Perspectives* 48(3):383–402.
- Jorgenson, Andrew K. 2006a. "Global Warming and the Neglected Greenhouse Gas: A Cross-National Study of the Social Causes of Methane Emissions Intensity, 1995." *Social Forces* 84(3):1779–1798.
- Jorgenson, Andrew K. 2006b. "The Transnational Organization of Production and Environmental Degradation: A Cross-National Study of the Effects of Foreign Capital Penetration on Water Pollution Intensity, 1980–1995." *Social Science Quarterly* 87(3):711–730.
- Jorgenson, Andrew K. 2006c. "Unequal Ecological Exchange and Environmental Degradation: A Theoretical Proposition and Cross-National Study of Deforestation, 1990–2000." *Rural Sociology* 71(4):685–712.
- Jorgenson, Andrew K. 2008. "Structural Integration and the Trees: An Analysis of Deforestation in Less-Developed Countries, 1990–2005." *The Sociological Quarterly* 49(3):503–527.
- Jorgenson, Andrew K. 2009a. "Foreign Direct Investment and the Environment, the Mitigating Influence of Institutional and Civil Society Factors, and Relationships Between Industrial

Pollution and Human Health: A Panel Study of Less-Developed Countries.”

Organization & Environment 22(2):135–57.

Jorgenson, Andrew K. 2009b. “Political-Economic Integration, Industrial Pollution and Human Health: A Panel Study of Less-Developed Countries, 1980—2000.” *International Sociology* 24(1):115–143.

Jorgenson, Andrew K. 2014. “Economic Development and the Carbon Intensity of Human Wellbeing.” *Nature Climate Change* 4(3):186–89.

Jorgenson, Andrew K. 2015. “Inequality and the Carbon Intensity of Human Wellbeing.” *Journal of Environmental Studies and Sciences* 5(3):277–282.

Jorgenson, Andrew K., Christopher Dick, and John M. Shandra. 2011. “World Economy, World Society, and Environmental Harms in Less-Developed Countries.” *Sociological Inquiry* 81(1):53–87.

Jorgenson, Andrew K. and Thomas Dietz. 2015. “Economic Growth Does Not Reduce the Ecological Intensity of Human WellBeing.” *Sustainability Science* 10(1):149–56.

Jorgenson, Andrew K., Shirley Fiske, Klaus Hubacek, Jia Li, Tom McGovern, Torben Rick, Juliet B. Schor, William Solecki, Richard York, and Ariela Zycherman. 2019. “Social

Science Perspectives on Drivers of and Responses to Global Climate Change.” *Wiley Interdisciplinary Reviews: Climate Change* 10(1):e554.

Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. “Inequality, Poverty, and the Carbon Intensity of Human WellBeing in the United States: A Sex-Specific Analysis.” *Sustainability Science* 13(4):1167–74.

Katzung, Jennifer, Max Boykoff, and Ami Nacu-Schmidt. 2020. “Media and Climate Change Observatory Special Issue 2019: A Review of Media Coverage of Climate Change and Global Warming in 2019.”

Kelly, Orla. 2020. “The Silver Bullet? Assessing the Role of Education for Sustainability.” *Social Forces*. doi.org/10.1093/sf/soz144

Leach, Melissa, Kate Raworth, and Johan Rockström. 2013. “Between Social and Planetary Boundaries: Navigating Pathways in the Safe and Just Space for Humanity.” 84–89.

Longhofer, Wesley, and Andrew Jorgenson. 2017. “Decoupling Reconsidered: Does World Society Integration Influence the Relationship between the Environment and Economic Development?” *Social Science Research* 65:17–29.

Lockie, Stewart. 2016. “Sustainability and the Future of Environmental Sociology.” *Environmental Sociology* 2(1):1–4.

- Marmot, Michael. 2005. "Social Determinants of Health Inequalities." *The Lancet* 365(9464):1099–1104.
- Masson-Delmotte, Valérie. 2018. *Global Warming of 1.5 OC: An IPCC Special Report on the Impacts of Global Warming of 1.5 C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*. World Meteorological Organization.
- Mayer, Adam. 2013. "Education and the Environment: An International Study." *International Journal of Sustainable Development & World Ecology* 20(6):512–519.
- Mazur, Allan and Eugene Rosa. 1974. "Energy and Life-Style." *Science* 186(4164):607–10.
- Meara, Ellen R., Seth Richards, and David M. Cutler. 2008. "The Gap Gets Bigger: Changes in Mortality and Life Expectancy, by Education, 1981–2000." *Health Affairs* 27(2):350–360.
- Meyer, John W. 1977. "The Effects of Education as an Institution." *American Journal of Sociology* 83(1):55–77.

- Meyer, John W., Francisco O. Ramirez, David John Frank, and Evan Schofer. 2007. "Higher Education as an Institution." *Sociology of Higher Education: Contributions and Their Contexts* 187.
- Meyer, John W., Francisco O. Ramirez, Richard Rubinson, and John Boli-Bennett. 1977. "The World Educational Revolution, 1950-1970." *Sociology of Education* 50(4):242–58.
- Meyer, John W., John Boli, George M. Thomas, and Francisco O. Ramirez. 1997a. "World Society and the Nation-State." *American Journal of Sociology* 103(1):144–181.
- Meyer, John W., David John Frank, Ann Hironaka, Evan Schofer, and Nancy Brandon Tuma. 1997b. "The Structuring of a World Environmental Regime, 1870–1990." *International Organization* 51(4):623–651.
- Meyer, John W., Francisco O. Ramirez, and Yasemin Nuhoğlu Soysal. 1992. "World Expansion of Mass Education, 1870-1980." *Sociology of Education* 65(2):128–49.
- Mol, Arthur PJ, Gert Spaargaren, and David A. Sonnenfeld. 2013. "Ecological Modernization Theory: Taking Stock, Moving Forward." Pp. 31–46 in *Routledge international handbook of social and environmental change*. Routledge.
- Mol, Arthur PJ. 2001. *Globalization and Environmental Reform: The Ecological Modernization Of the Global Economy*. Cambridge, MA: MIT Press.

- Mol, Arthur PJ. 2002. "Ecological Modernization and the Global Economy." *Global Environmental Politics* 2(2):92–115.
- Nilsson, Maans, Dave Griggs, and Martin Visbeck. 2016. "Policy: Map the Interactions between Sustainable Development Goals." *Nature News* 534(7607):320.
- Nussbaum, Martha C. 2010. "Democracy, Education, and the Liberal Arts: Two Asian Models." *UC Davis L. Rev.* 44:735.
- Pongiglione, Francesca. 2015. "The Need for a Priority Structure for the Sustainable Development Goals." *Journal of Global Ethics* 11(1):37–42.
- Purvis, Ben, Yong Mao, and Darren Robinson. 2019. "Three Pillars of Sustainability: In Search of Conceptual Origins." *Sustainability Science* 14(3):681–95.
- Rosa, Eugene A. and Thomas Dietz. 2012. "Human Drivers of National Greenhouse-Gas Emissions." *Nature Climate Change* 2(8):581–86.
- Schofer, Evan and Ann Hironaka. 2005. "The Effects of World Society on Environmental Protection Outcomes." *Social Forces* 84(1):25–47.
- Schofer, Evan and John W. Meyer. 2005. "The Worldwide Expansion of Higher Education in the Twentieth Century." *American Sociological Review* 70(6):898–920.

Sen, Amartya. 1999. *Development as Freedom*. Oxford University Press.

Shorette, Kristen. 2012. “Outcomes of Global Environmentalism: Longitudinal and Cross-National Trends in Chemical Fertilizer and Pesticide Use.” *Social Forces* 91(1):299–325.

Sweidan, Osama D. 2018. “Economic Performance and Carbon Intensity of Human WellBeing: Empirical Evidence from the MENA Region.” *Journal of Environmental Planning and Management* 61(4):699–723.

United Nations 2014. Prototype Global Sustainable Development Report, Division for Sustainable Development: New York Retrieved March 3, 2020
<https://sustainabledevelopment.un.org/content/documents/1454Prototype%20Global%20SD%20Report2.pdf>

United Nations 2015. *70/1. Transforming our world: the 2030 Agenda for Sustainable Development- General Assembly, Resolution A. RES/70/1*. New York, USA. Retrieved March 14, 2020
https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf

United Nations Environment Programme (UNEP). 2012. *Global Environmental Outlook 5*. Nairobi. Retrieved November 20, 2019
<https://pdfs.semanticscholar.org/a606/249233c0d181c8e1d744d389c5a8c2991935.pdf>

Wallerstein, Immanuel. 1984. *The Politics of the World-Economy: The States, the Movements and the Civilizations*. Cambridge University Press.

1. INTERDISCIPLINARY PERSPECTIVES ON SUSTAINABILITY

The interdisciplinary literature dedicated to the study of sustainability is vast. Entire subfields across the social and natural sciences are dedicated to the topic. Even within the sub-discipline of environmental sociology alone, the concept is the focus of much scholarly work. As an editorial in the journal, *Environmental Sociology* proposes, “No other concept has done more to shape contemporary understanding of the social, economic and ecological interdependencies implicated in environmental change” (Lockie 2016: 1).

In this chapter, I focus on the role of global institutions, and in particular, the branches of the United Nations, in the construction of the concept of sustainability, within the field of international governance. I also provide an overview of social science deliberations on these intergovernmental approaches to sustainability, with a focus on work dedicated to unpacking whose values and interests these agendas represent. After that, I highlight social science approaches to measuring sustainability. Finally, I summarize the conceptual and methodological origins of the dependent variable in this project, the carbon intensity of wellbeing.

1.1 SUSTAINABILITY AS AN INTERNATIONAL DEVELOPMENT STRATEGY

In cataloging the rise of the concept of sustainability, environmental historian Jeremy Caradonna (2017) argues that the current discourse is the outcome of three centuries of work dedicated to unpacking the relationship between humanity and the natural world. Many historians trace the first usage of the term sustainability to eighteenth-century texts on forestry management (Groeber 2012; Caradonna 2017).

The term sustainability emerged in the international governance field during the 1970s. In 1972, a global think tank, the Club of Rome, argued that it was impossible for trends in human population growth, food production, industrialization, and the associated exploitation of natural resources, to continue without eventually causing the biosphere to collapse. The authors sought to specify a global systems model that was: “*1. sustainable without sudden and uncontrollable collapse; and 2. capable of satisfying the basic material requirements of all of its people.*” (Meadows et al. 1972:158).

Civil society organizations, such as the International Union for the Conservation of Nature (IUCN) and the World Wildlife Federation (WWF), in partnership with the United Nations Environment Program (UNEP), also helped push a sustainability discourse at this time. For example, in their “World Conservation Strategy,” the IUCN endeavored “to stimulate a more focused approach to living resource conservation and to

provide policy guidance on how this can be carried out” (IUCN-WWF 1980: iv). The IUCN approach to sustainability centered on environmental protection such as, “the maintenance of essential ecological process and life support systems, the preservation of genetic diversity and sustainable utilization of species and resources” (IUCN 1980:vi). These perspectives were representative of a larger political and academic environmental movement that had begun to gain traction during the 1960s and 1970s (Carson 1962; Commoner 1971; Goldsmith 1974; The Ecology Party 1975).

In step with the growth of this movement, the United Nations and other related international governance bodies led efforts to popularize the concept of sustainability. The 1972 UN Stockholm Conference on the Human–Environment was the first intergovernmental summit focused on human impacts on the environment. In 1983 the former Prime Minister of Norway, Gro Harlem Brundtland, was asked by the Secretary-General of the UN to create an independent organization to focus on environmental and developmental problems and solutions. The resultant World Commission on Environment and Development (WCED) released the first volume of “Our Common Future,” the organization’s main report in 1987. This document often referred to as the Brundtland report established the concept of “sustainable development” as a new guiding principle for the United Nations (WCED 1987). The report also contained what would become the most widely cited definition of sustainability within academic and policy fields. According to the WCED report, sustainability relies on “development that meets the

needs of the present without compromising the ability of future generations to meet their own needs” (1987:43).

However, the mainstream United Nations approach differed from the more ecologically oriented agenda of the IUCN. Notably, the Brundtland report placed a central emphasis on economic growth as the engine to achieve the goal of global sustainability². According to the WCED 1987, the critical objectives of sustainable development are; i) reviving growth; ii) changing the quality of growth; iii) meeting essential needs for jobs, food, energy, water, and sanitation; iv) ensuring a sustainable level of population; v) conserving and enhancing the resource base; vi) reorientation technology and managing risk; vii) merging environment and economics in decision making, and, viii) reorienting international economic relations (WCED 1987:47).

The sustainable development discourse that emerged from this report is subsequently summarized as a tripartite framework that aims to achieve economic and social development while protecting the environment (Dawe and Ryan 2002). The

² For some, the Stockholm conference (1972) marked the beginning of the effort to merge the goals of economic development and environmental protection (Caldwell 1984).

linkage of socio-ecological sustainability and national (economic) development was the result of complicated global political processes at the time (Burns 2012), including the increased influence of neo-classical economic strategies on global environmental governance (Ciplet et al. 2005; Redclift 2005). For some, this emphasis on economic growth differentiates the concept of sustainability from sustainable development (Lélé 1987; Robinson 2004), while many others use the terms interchangeably.

This development approach to sustainability grew in popularity during the 1980s (Redclift 2005). It was officially adopted at the Earth Summit in Rio de Janeiro in 1992 when the Commission on Sustainable Development was established. The Agenda proposed in Rio, consistent with the approach proposed in the Brundtland Report, stressed the congruence of social and economic development with environmental protection (UN 1992). However, political interest in sustainable development waned in the aftermath of the Rio Declaration (Holden et al. 2017). The UN World Summit in 2005 revitalized the agenda when attendees endorsed the three E's of sustainability: economic growth, equity, and environmental protection.

The political sustainable development agenda was reaffirmed by the UN Conference on Sustainable Development in June 2012, at the "Rio+20" conference. There, nations agreed to "work tirelessly" toward the full implementation of sustainable development goals (UN 2012, 2015). According to the framework adopted by 193

countries, the 17 Sustainable Development Goals (SDGs) and 169 associated targets aim to achieve sustainable development as defined as the following:

Sustainable development recognizes that eradicating poverty in all its forms and dimensions, combating inequality within and among countries, preserving the planet, creating sustained, inclusive, and sustainable economic growth and fostering social inclusion are linked to each other and are interdependent (UN 2015: 5).

Relevant to this research project, a fourth E, representing education, is often included as an additional component of the sustainable development framework (Caradonna 2014). Further, education is often positioned as a critical driver of sustainable development within sustainability theory, research, and policy, particularly concerning its role in promoting health and gender equality (Boström et al. 2018; UNESCO 2016).

Though not directly related to this research, there is also a growing academic and policy field dedicated to effective learning and education for sustainability³ (Henry 2009; Dietz 2013; Boström et al. 2018). Notably, the United Nations agencies, led by

³ The interdisciplinary academic journal *Environmental Education Research* is dedicated to advancing theoretically and empirically informed understandings of environmental and sustainability education.

UNESCO, implemented the United Nations Decade of Education for Sustainable Development for the period 2005-2014, which aimed to reorient education toward sustainability. As the follow-up, UNESCO launched the Global Action Programme (GAP) on Education for Sustainable Development (2015-2019) at the UNESCO World Conference on Education for Sustainable Development held in Aichi-Nagoya, Japan.

1.2 SOCIAL SCIENCE PERSPECTIVES ON SUSTAINABILITY

A variety of intergovernmental reports have acknowledged the critical role of social scientists in generating understandings of the climate crisis and for helping to formulate adequate responses (ISSC and UNESCO 2013). Social scientists, too, have argued for greater engagement between their work and the sustainable development political movement. They highlight that the presence of discourse on sustainability, and the accumulation of scientific data regarding the impact of humans on the environment, has not resulted in the structural reform needed to stem the climate crisis (Burns 2012; Lockie 2012; Longo et al. 2016; Boström et al. 2018).

One vibrant strand of social science literature within this field maps the ontology of sustainability. For example, environmental historian Cardonna (2017) has outlined some of the conceptual challenges facing the sustainability political agenda, proposing that the term has become a powerful and galvanizing buzzword which subsumes a variety of, sometimes adversarial, political movements, and interests. Political scientist John

Dryzek (2013) similarly argues that while sustainability is the most dominant discourse of ecological concern, it remains one of several discourses concurrently in circulation⁴. Analogously, environmental sociologist Lockie (2012) understands sustainability as an assemblage of ideas, techniques, institutions, and processes. The author argues that the complexity of sustainability as a symbolic and material construct inherently leads to multiple and sometimes conflicting interpretations, as well as tensions between temporal, moral, and economic interests (Lockie 2012, 2016). Relatedly Burns (2012) argues that the normative and political origins of the concept of sustainability negate the possibility of a meaningful definition.

While a unifying definition of sustainability is elusive, Ratner (2004) provides a useful typology, based on Weber's classic categories of value spheres and collective

⁴ The author provides a two-dimensional classification system to organize these approaches. He notes that discourses can be reformist or radical viz. discourses can propose either reforming industrialism (which the author defines as a commitment to economic growth) or radically departing from it. The second dimension is whether the approach is prosaic or imaginative. Prosaic approaches focus on addressing the environmental crisis through within the existing political economy as opposed to requiring a reimagining of society. On the other hand, imaginative approaches place a more central emphasis on rearranging the current social system around environmental concerns. According to the author, sustainable development can be classified as a "reformist-imaginative" approach.

rationality, to understand better this complicated construct. According to the author, three models of sustainability overlap, co-occur, and vie for legitimacy in practice, namely, sustainability as a technical consensus, an ethical consensus, and a dialogue of values. According to Ratner, sustainability as a “technical consensus” is an expert-driven technocratic process that focuses on the dimensions of sustainability, thereby producing an accounting framework through which nation-states can implement the complex agenda. Ratner highlights that Agenda 21, the primary policy document associated with the 1992 Rio Summit and related World Bank⁵ reports, exemplifies the technocratic approach to sustainability.

Sustainability as an “ethical consensus,” on the other hand, relies on common ethics for guiding social action, which positions sustainability as a version for the future, as opposed to an environmental issue requiring a technical fix. Ratner draws attention to the conclusion of the Brundtland Report as an example of this approach, which states that: “human survival and wellbeing could depend on success in elevating sustainable development to a global ethic” (WCED 1987:308). More recent examples of this approach abound as the impacts of the climate crisis become more severe. For example, in May 2019, an assessment of the state of global biodiversity led by the

⁵ See-*Making Development Sustainable: From Concepts to Action*- World Bank 1987.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) found that nearly one million species risk becoming extinct within decades. At the official release of the report, the UNESCO Director-General Audrey Azoual stated: “Following the adoption of this historic report, no one will be able to claim that they did not know... We can no longer continue to destroy the diversity of life. This is our responsibility towards future generations.” (United Nations 2019). Social scientists have expounded the power of social solidarity and shared principles for motivating social action (Holdgate 1996; Prades 1999; Dietz 2013). Holden et al. (2017) argue that there has even been “an ethical turn” in the academic literature on sustainability, given the gravity of the crisis.

Finally, Ratner (2004) proposes that sustainability is understood best as this third model: “sustainability as a dialogue of values”. This typology emphasizes both the subjective nature of the concept and conflicting priorities around acting toward sustainability. Contestations to the interpretation and implementation of the United Nations sustainable development agenda over the last four decades illustrate this third typology well. For example, many academics and activists are critical about the disproportionate power held by high-income nations in setting the inter-governmental sustainability agenda. These critics argue that this power imbalance preserves global inequalities, thereby foreclosing opportunities for systemic change (Redclift 1988, 2005; Lohmann 1990; Lélé, 1991; Banerjee 2003). For example, Banerjee (2003) argues that the

sustainable development agenda commodifies nature in low-income nations in a way that supports Western economic interests. Others have highlighted a misuse of the discourse by powerful actors to deflect from the deleterious environmental implications of their mainstream operations (Buttel and Gillespie 1988; Lohmann 1999; Downey 2015).

Many sustainability scientists argue that intergovernmental sustainable development policies are not attentive enough to our complete embeddedness in the natural world. For example, Rockström et al. (2009) propose a new approach for defining preconditions for human development, which identified nine planetary boundaries⁶. The authors argue that limiting the transgressions of these boundaries could help prevent human activities from causing catastrophic environmental change. Building on this work and other scientific studies on climate change, Griggs et al. (2013) argued for a list of sustainability ‘must-haves’ for human prosperity and Earth systems survival, termed global sustainability objectives (GSOs). These sustainability scientists argue that the Brundtland Commission’s 1987 definition of sustainability should be reformulated to ‘development that meets the needs of the present while safeguarding Earth’s life support

⁶ Consistent with the typology of sustainability as a technical consensus, it is argued that these scientific recommendations informed the drafting of the 2030 sustainable development agenda (See Leblanc 2015).

system, on which the welfare of current and future generations depends' (Griggs 2005:12 in Griggs 2013).

Intergovernmental sustainable development agendas have been criticized for being too vague and too broad to be effective (Daly 1996; Griggs 2014; Holden et al. 2017). Notably, a review coordinated by the International Council for Science and International Council for Social Science on the SDGs concluded that, of the 169 agreed targets, 54 percent should be more specific, and 17 percent require significant work (ICSU and ISSC, 2015).

1.2.1 Weak vs. Strong Sustainability

Perhaps the most enduring critique of intergovernmental approaches to sustainability is the extent to which they continue to embrace economic growth, both in discourse and practice, as a path to global sustainability (Lélé 1991; Giddings 2002; Banerjee 2003; Redclift 2005; Daly 2005; Daly and Farley 2011; Dietz 2015; Longo et al. 2016). The WCED report established the central role of economic growth in the United Nation's sustainability strategies. In which, it argued that poverty was primarily responsible for environmental degradation, thereby making economic growth as the taken for granted solution to the sustainability problem (Lélé 1991). From critical perspectives, intergovernmental approaches to sustainability represent little more than the superficial greening of development theory, whereby the overarching goal of economic development

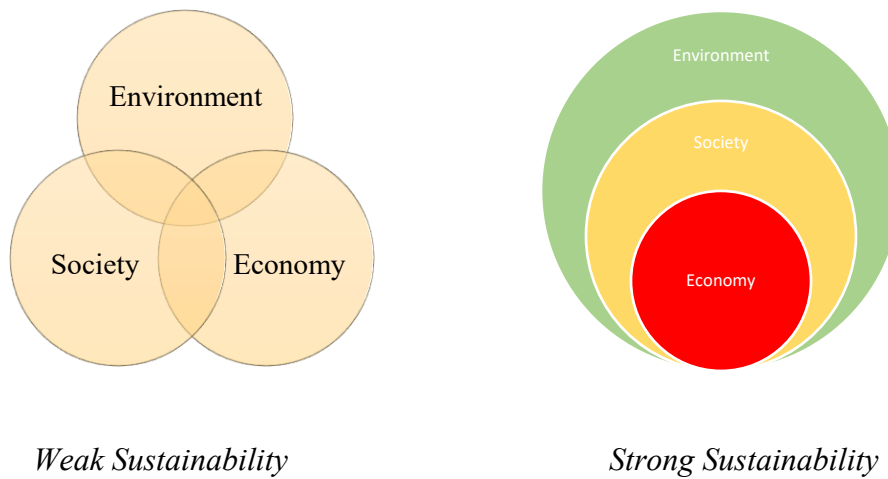
takes ecological concerns somewhat into account. This coupling of economic growth with the concept of sustainability can be partially explained by the influence of corporations on environmental policy during the 1980s (Bernstein 2000; Longo et al. 2016) and the broader associated political turn toward neoliberal market solutions within environmental governance during this era (Ciplet et al. 2015).

This embrace of economic growth, though less pronounced in the 2030 agenda⁷, is increasingly controversial as the strain the current economic system is placing on the global eco-system becomes more evident. Environmental sociologists have been particularly active in illustrating the problematic relationship between economic growth and environmental stress (York, Rosa, and Dietz 2003; Rosa, York, and Dietz 2004; Jorgenson and Clark 2011, 2012; Rosa and Dietz 2012; Knight and Schor 2014; Longhofer and Jorgenson 2017; Thombs 2018). Further, social science research has illustrated that economic growth does not enhance human wellbeing, after a certain threshold (Brady, Kaya, and Beckfield 2007; Diener, Kahneman, and Helliwell 2010; Easterlin 1974, 2015). Though, this wellbeing threshold has yet to be met in many low and middle-income nations.

⁷ Only goal 8 explicitly references economic growth: Goal 8: *Economic Growth and Decent Work*

The increasing precarity of the global biosphere (Rockström et al. 2009; Griggs et al. 2013; Holden et al., 2014, 2017) coupled with mounting evidence of the stress economic growth places on the natural world, has led a growing number of ecological economists environmental sociologists and others, to reassess how we define sustainability. Most notably, many have called for an approach to sustainability that is critical of the organization and operation of the dominant economic system, in order to secure our survival (Sweezy 2004; Daly 2005; Daly and Farley 2011; Dietz and Jorgenson 2014; Dietz 2015; Longo et al. 2016). The proposed approach to sustainability recognizes both the socially constructed nature of the economy and our dependence on the limits of the biosphere. It is sometimes visually presented as concentric circles, with the economy nested within society, and society within the sphere of the environment (Giddings 2002; Purvis, Mao and Robinson 2019), as opposed to the balanced tripartite framework presented in the Brundtland report (Dawe and Ryan 2003). See Figure 1.

Figure 1. Conceptualizations of Strong vs. Weak Sustainability



These models are sometimes classified as weak vs. strong sustainability (Morandín-Ahuerma et al. 2019). This distinction between approaches derives from the subfield of ecological economics. Within this field, the differentiation between weak and strong sustainability is based on contrasting positions on the long and short term fungibility of physical, natural, and human, and later social, capital for generating human wellbeing (Cobb and Daly 1989; Neumayer 2003; Dietz, Rosa and York 2009). Weak sustainability positions these sources of capital interchangeably, whereby the depletion of one can be justified in the interest of building another. Strong sustainability, on the other hand, positions these types of capital as less interchangeable, begetting the need to protect stocks of all types of resources, in particular natural capital. Ecological economists and environmental sociologists argue that weak sustainability is too

economically orientated to address the severity of the climate crisis (Daly 2005; Daly and Farley 2011; Dietz and Jorgenson 2014; Dietz 2015; Longo et al. 2016).

1.3 MEASURING SUSTAINABILITY

Researchers and policymakers have acknowledged state and interstate efforts to reach sustainability targets have fallen short because they have historically failed to account for the tradeoffs or synergies across goals and targets. For example, several United Nations reports recognize that Millennium Development Goal (MDG) targets relating to environmental protections were negatively affected by policies and actions targeting social and economic development (United Nations 2014; UNEP 2012; Leblanc 2015). As a result of these shortcomings, sustainability scientists highlight the need to understand better the interactions between social and biophysical targets (Griggs 2014; Nilsson et al. 2016, 2018).

A large body of social science literature has empirically tested the interdependence of the spheres of sustainable development as conceptualized by the United Nations, namely; social equity, economic growth, and environmental protection. As previously noted, the subfield of macro-environmental sociology has revealed the profoundly problematic relationship between economic growth and ecological outcomes (York, Rosa, and Dietz 2003; Rosa et al. 2004, 2007; Dietz, Rosa, and York 2007, 2009,

2012; Jorgenson and Clark 2011, 2012; Rosa and Dietz 2012; Jorgenson 2014; Jorgenson and Dietz, 2015).

Those within sociology and related social sciences have also shown that economic inequality compromises human wellbeing. For example, in a meta-analysis, Wilkinson and Pickett (2006) conclude that about seven out of ten studies on the topic find at least some association between economic inequality and worse population health outcomes. More recently, sociologists have shown how social inequality and environmental degradation are closely related. For example, domestic income and wealth inequality are both positively associated with carbon emissions (Jorgenson 2015; Jorgenson et al. 2015, 2017; Knight, Schor, and Jorgenson 2017). Similarly, Jorgenson et al. (2020) find that the harmful effect of fine particulate matter on life expectancy is greater in U.S. states with higher levels of income inequality and larger black populations. Further, those who hold disproportionate income often use their economic assets to promote their interests through political influence, at the costs of broader social and ecological considerations (Downey 2015; Jorgenson et al. 2017; Farrell 2016). Conversely, more pro-environmental governance can also mitigate some of the impacts of climate change (Dietz, Frank, Whitley, Kelly, and Kelly 2015).

A growing field of research is coupling these kinds of empirical investigations into the interdependence of the dimensions of sustainable development directly with the

United Nations policy framework. For example, some within the field of public health are addressing problems of social equity and health outcomes in terms of the sustainable development goals and associated targets. (Lim et al. 2016; Tulloch et al. 2016; Anand and Roy 2016). Recently, Xu et al. (2020) developed and tested an index score, which allows researchers to assess progress toward the entire sustainable development agenda over time. The comprehensive method facilitates the exploration of trade-offs and synergies between SDGs at national, regional, or other scales. In an application of the method to provincial-level data in China, the authors reveal significant spatio-temporal variations across regions with regards to progress toward the sustainable development goals, and a concerning decline in some important environmental outcomes, such as water access and quality.

The method proposed by Xu et al. (2020) adds to a wealth of interdisciplinary research dedicated to creating an integrated measure of sustainability (Parris and Kates 2003). Attempts to systematize sustainability are complicated by the heterogeneity of theoretical assumptions, scientific methods⁸, and norms on which they rely. Also, many of these frameworks fail to adequately capture the extent to which indicators are mutually

⁸ Composite indicators can be particularly problematic because they are particularly vulnerable measurement and cross-national comparability challenges (Parris and Kates 2003; Dietz et al. 2009).

reinforcing or contradictory (Hák, Molden and Dahl 2012). One integrative approach, particularly prominent among economists, is "green accounting" through which national measures of economic performance such as gross domestic product (GDP) are adjusted to reflect environmental and social tradeoffs or concerns (Hecht 2007). While popular, this approach is limited by the extent to which it is ingrained in the dominant economic system (Dietz et al. 2009). The energy/ecological/carbon intensity of wellbeing is an analytical tool that overcomes this issue by re-centering the concept of sustainability on the interplay of human wellbeing and the natural environment. In this way, it is a metric for strong sustainability.

1.3.1 The Environmental/ Carbon Intensity of Well Being

Building on the pioneering work of sociologists Mazur and Rosa (1974) and stochastic frontier production models used by economists, Dietz, Rosa, and York (2009) establish the sustainability framework which provides the basis for the Environmental/Carbon Intensity of Wellbeing metric. The authors propose a conceptual and methodological shift away from focusing on “environmental bads” to instead focusing on the “goods” nations produce from stressing the environment by measuring the environmental efficiency in producing human wellbeing (EWEB). They conceptualize sustainability as the efficiency with which nations produce human wellbeing from the use of resources. The inputs in the production function of

sustainability are financial, human, and natural capital, operationalized as GDP, adult literacy and school enrollment, and a nation's environmental footprint, respectively. The output of human wellbeing is operationalized as life expectancy. The authors note that while life expectancy is not the only indicator of human wellbeing, and not without limitations, it has many comparative strengths, including consistency across national contexts and through time (See Dietz 2015 for further discussion).

Dietz, Rosa, and York (2012) reformulate this production function to examine environmental intensity, as opposed to efficiency, of human wellbeing. The authors incorporate environmental stress into the outcome variable by creating a ratio of environmental stress/wellbeing, operationalized as environmental footprint/life expectancy. Countries with low environmental footprint but early mortality (low wellbeing) and countries with high life expectancy and ecological footprint both have high Environmental Intensity of Well Being (EIWB), an undesirable outcome. States with low environmental footprint but high wellbeing have low EIWB⁹. In this panel analysis of data between 1961 and 2003, the authors find a U-shaped quadratic

⁹ A related study illustrates the complexity of the drivers of this status, in that countries that produce high wellbeing per unit of carbon emissions do not represent a clear pattern or model of development (Lamb et al. 2014).

relationship between economic growth and EIWB. These findings challenge the presumed alignment between economic growth and sustainability.

A variety of related studies build on these findings, using the EIWB. For example, in a longitudinal analysis of the ecological intensity of wellbeing in developed and less developed countries, Jorgenson and Dietz (2015) find that since the early 1970s, economic growth has little effect on EIWB in less developed countries and leads to somewhat increased EIWB in developed countries. Jorgenson, Alekseyko, and Giedraitis (2014) analyze the energy intensity of wellbeing (EIWB) for nations in Central and Eastern Europe from 1992 to 2010 and find an increasingly less sustainable relationship between EIWB and economic development for the countries in this region.

Of particular relevance for this project, a growing body of sociological research investigates the factors impinging on the carbon intensity of wellbeing (CIWB). In these studies, the numerator is production-based or consumption-based carbon emissions, and the denominator is average life expectancy at birth. Jorgenson (2014), who first introduced the CIWB metric, analyzes the relationship between economic growth and the carbon intensity of wellbeing in regional samples of nations from 1970 to 2009. The author finds economic growth has a positive, relatively large, and persistent effect on CIWB through time for countries in North America, Europe, and Oceania and identifies an increasingly ecologically unsustainable relationship among nations in Asia and South

and Central America and Africa. Jorgenson and Givens (2015) complete a follow-up panel analysis on the relationship between economic development on consumption-based CIWB between 1990 and 2008, for 69 nations throughout the world. The authors find that the intensifying effect of economic development on CIWB increased through time for the overall sample with the most unsustainable relationships observed in OECD nations. Consistent with global analyses, Sweidan (2018) finds a problematic relationship between economic growth and CIWB in the MENA region for the period (1995–2013).

After an initial focus on economic growth, researchers applied the analytical tool to understand better how other characteristics of a society and or the global system affect a nations' CIWB. Jorgenson (2015) investigates the effect of domestic income inequality on CIWB¹⁰ for a sample of 22 OECD nations and a sample of 41 non-OECD nations for the period 1990-2008. The author finds that income inequality began increasing CIWB in the 1990s for both OECD and non-OECD nations, and the effect of inequality on CIWB continued to increase in magnitude through time. Givens (2016) explores the relationship between urbanization and CIWB between 1990 and 2011 for 78 countries. The author finds that economic development, urbanization, and the percentage of urban populations

¹⁰ In this study Jorgenson uses consumption-based carbon emissions in the numerator of the CIWB ratio.

with access to improved water and sanitation are associated with higher CIWB. In an analysis of 138 countries between 1990 and 2008, Mayer (2017) fails to find a significant relationship between the carbon intensity of wellbeing and measures of democratic governance.

Particularly relevant to the empirical investigation presented in chapter three of this project, Givens (2017) evaluates the world society proposition that more world society and world polity integration, indicated by INGO, EINGO, and IGO presence, will reduce the CIWB. The author finds that world society/world polity integration is associated with a reduction in CIWB, but only in more developed nations, and only when using the production measure for CO₂ emissions.

Also, relevant to the research presented in chapter three of this dissertation, in an investigation informed by the theory of ecological unequal exchange, Givens (2018) investigates if uneven integration into global trade networks affects the CIWB of nations. Based on an analysis of data for 81 countries from 1990 to 2011, Givens finds that exports to high-income countries did have an intensifying effect on CIWB, for the samples of non-high-income countries, especially from 1994 to 2002 and from 2006 to 2011. On the other hand, the author reveals a consistently beneficial relationship between global trade integration and CIWB for high-income nations.

The breadth and depth of this research illustrate the conceptual and analytical strengths of EIWB/CIWB as a measure of sustainability. First, by focusing solely on socio-ecological factors, the metric overcomes what Longo et al. (2016) classify as the “pre-analytic vision” of sustainability, which naturalizes capitalist social relations, thereby foreclosing essential questions regarding the dominant economic system. Also, the metric allows for comparative assessments of the driving forces of environmental change across nations and over time. Further, it allows the social science of sustainability to uncover which characteristics of society may enhance human wellbeing while limiting environmental costs, and how these social structures may interact with the economic system to enhance or compromise national sustainability. This dissertation project adds to this field by assessing how education, a social institution widely regarded as useful for enhancing human wellbeing, affects a nation’s CIWB. Furthermore, I investigate how global economic factors may moderate this relationship.

1.4 CONCLUSION

This chapter provides an abridged overview of social science, and in particular, sociological contributions to the study of sustainability. I sketch the evolution of the sustainability discourse within the field of international governance over the last four decades. I highlight social science perspectives on whose interests these sustainability plans and policies represent. I also provide a brief overview of the theoretical and

methodological origins, as well as the value of the dependent variable used to represent sustainability in this dissertation, namely, the carbon intensity of wellbeing.

In the following two chapters, I draw on macro-comparative theories of global development, global culture, and political economy to understand patterns in the relationship between education and the carbon intensity of wellbeing. The next chapter investigates this relationship across six geographic world regions between 1960 and 2010. The investigation is theoretically informed by ecological modernization theory and Amartya Sen's capabilities framework.

REFERENCES

- Anand, Ankit, and Nobhojit Roy. 2016. "Transitioning toward Sustainable Development Goals: The Role of Household Environment in Influencing Child Health in Sub-Saharan Africa and South Asia Using Recent Demographic Health Surveys." *Frontiers in Public Health* 4:87.
- Banerjee, Subhabrata Bobby. 2003. "Who Sustains Whose Development? Sustainable Development and the Reinvention of Nature." *Organization Studies* 24(1):143–80.
- Bernstein, Steven. 2000. "Ideas, Social Structure and the Compromise of Liberal Environmentalism." *European Journal of International Relations* 6(4):464–512.
- Boström, Magnus, Erik Andersson, Monika Berg, Karin Gustafsson, Eva Gustavsson, Erik Hysing, Rolf Lidskog, Erik Löfmarck, Maria Ojala, Jan Olsson, Benedict E. Singleton, Sebastian Svenberg, Ylva Uggla, and Johan Öhman. 2018. "Conditions for Transformative Learning for Sustainable Development: A Theoretical Review and Approach." *Sustainability* 10(12):4479.
- Brady, David, Yunus Kaya, and Jason Beckfield. 2007. "Reassessing the Effect of Economic Growth on WellBeing in Less-Developed Countries, 1980–2003." *Studies in Comparative International Development* 42(1):1–35.

- Burns, Tom R. 2012. "Sustainable Development. A Comment." *Sociologica* 6(2):0–0.
- Buttel, Frederick H. and Gilbert W. Gillespie. 1988. "Agricultural Research and Development and the Appropriation of Progressive Symbols: Some Observations on the Politics of Ecological Agriculture." *Bulletin* (151).
- Caldwell, Lynton K. 1984, "Political Aspects of Ecologically Sustainable Development." *Environmental Conservation* 11.4: 299-308.
- Caradonna, Jeremy L. 2014. *Sustainability: A History*. Oxford University Press.
- Carson, Rachel. 2009/1962. *Silent Spring*. 1962.
- Ciplet, David, J. Timmons Roberts, and Mizan R. Khan. 2015. *Power in a Warming World: The New Global Politics of Climate Change and the Remaking of Environmental Inequality*. MIT Press.
- Cobb, John, and Herman Daly. 1989. *For the Common Good, Redirecting the Economy toward Community, the Environment and a Sustainable Future*. Boston: Beacon Press.
- Commoner, Barry. 1971. *The Closing Circle: Nature, Man, and Technology*. Dover Publications.
- Daly, Herman E. 2005. "Economics in a Full World." *Scientific American* 293(3):100–107.

- Daly, Herman E., and Joshua Farley. 2011. *Ecological Economics: Principles and Applications*. Island Press.
- Dawe, Neil K., and Kenneth L. Ryan. 2003. "The Faulty Three-Legged-Stool Model of Sustainable Development." *Conservation Biology* 17(5):1458–60.
- Diener, Ed, Daniel Kahneman, and John Helliwell. 2010. *International Differences in Well Being*. Oxford University Press.
- Dietz, Thomas, and Andrew K. Jorgenson. 2014. "Towards a New View of Sustainable Development: Human WellBeing and Environmental Stress." *Environmental Research Letters* 9(3):031001.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2007. "Driving the Human Ecological Footprint." *Frontiers in Ecology and the Environment* 5(1):13–18.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2009. "Environmentally Efficient WellBeing: Rethinking Sustainability as the Relationship between Human Well Being and Environmental Impacts." *Human Ecology Review* 16(1):114–23.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2012. "Environmentally Efficient WellBeing: Is There a Kuznets Curve?" *Applied Geography* 32(1):21–28.

- Dietz, Thomas, Kenneth A. Frank, Cameron T. Whitley, Jennifer Kelly, and Rachel Kelly. 2015. "Political Influences on Greenhouse Gas Emissions from US States." *Proceedings of the National Academy of Sciences* 112(27):8254–59.
- Dietz, Thomas. 2013. "Bringing Values and Deliberation to Science Communication." *Proceedings of the National Academy of Sciences* 110(Supplement 3):14081–87.
- Dietz, Thomas. 2015. "Prolegomenon to a Structural Human Ecology of Human WellBeing | Sociology of Development." *Sociology of Development* 1(1):123–48.
- Downey, Liam. 2015. *Inequality, Democracy, and the Environment*. NYU Press.
- Dryzek, John S. 2013. *The Politics of the Earth: Environmental Discourses*. OUP Oxford.
- Easterlin, Richard A. 1974. "Does Economic Growth Improve the Human Lot? Some Empirical Evidence." Pp. 89–125 in *Nations and households in economic growth*. Elsevier.
- Easterlin, Richard A. 2015. "Happiness and Economic Growth—the Evidence." Pp. 283–299 in *Global handbook of quality of life*. Springer.
- Farrell, Justin. 2016. "Corporate Funding and Ideological Polarization about Climate Change." *Proceedings of the National Academy of Sciences* 113(1):92–97.

Giddings, Bob, Bill Hopwood, and Geoff O'Brien. 2002. "Environment, Economy and Society: Fitting Them Together into Sustainable Development." *Sustainable Development* 10(4):187–96.

Givens, Jennifer E. 2015. "Urbanization, Slums, and the Carbon Intensity of WellBeing: Implications for Sustainable Development." *Human Ecology Review* 22(1):107–28.

Givens, Jennifer E. 2017. "World Society, World Polity, and the Carbon Intensity of WellBeing, 1990–2011." *Sociology of Development* 3(4):403–35.

Givens, Jennifer E. 2018. "Ecologically Unequal Exchange and the Carbon Intensity of WellBeing, 1990–2011." *Environmental Sociology* 4(3):311–24.

Goldsmith, Edward. 1974. *Blueprint for Survival*. Vol. 7830. Houghton Mifflin.

Griggs, David, Mark Stafford Smith, Johan Rockström, Marcus C. Öhman, Owen Gaffney, Gisbert Glaser, Norichika Kanie, Ian Noble, Will Steffen, and Priya Shyamsundar. 2014. "An Integrated Framework for Sustainable Development Goals."

Griggs, David, Mark Stafford-Smith, Owen Gaffney, Johan Rockström, Marcus C. Öhman, Priya Shyamsundar, Will Steffen, Gisbert Glaser, Norichika Kanie, and Ian Noble. 2013. "Policy: Sustainable Development Goals for People and Planet." *Nature* 495(7441):305.

- Grober, Ulrich. 2012. *Sustainability: A Cultural History*, Trans. Ray Cunningham (Totnes, Devon, UK: Green Books, 2012).
- Hák, Tomás, Bedrich Moldan, and Arthur Lyon Dahl. 2012. *Sustainability Indicators: A Scientific Assessment*. Island Press.
- Hecht, Joy E. 2007. “National Environmental Accounting: A Practical Introduction.” *International Review of Environmental and Resource Economics* 1(1):3–66.
- Henry, Adam Douglas. 2009. “The Challenge of Learning for Sustainability: A Prolegomenon to Theory.” *Human Ecology Review* 131–140.
- Holden, Erling, Kristin Linnerud, and David Banister. 2014. “Sustainable Development: Our Common Future Revisited.” *Global Environmental Change* 26:130–139.
- Holden, Erling, Kristin Linnerud, David Banister, Valeria Jana Schwanitz, and August Wierling. 2017. *The Imperatives of Sustainable Development: Needs, Justice, Limits*. Routledge.
- Holdgate, Martin W. 1996. *From Care to Action: Making a Sustainable World*. Taylor & Francis.
- ICSU, ISSC. 2015. “Review of the Sustainable Development Goals: The Science Perspective.” *Paris: International Council for Science (ICSU)*. Retrieved February 13, 2020

<https://www.sei.org/publications/review-of-targets-for-the-sustainable-development-goals-the-science-perspective/>

IUCN, UNEP WWF. 1980. *World Conservation Strategy. Living Resource Conservation for Sustainable Development*. Gland, Switzerland, IUCN, UNEP, WWF. Retrieved March 5, 2020 <http://www.environmentandsociety.org/mml/iucn-ed-world-conservation-strategy-living-resource-conservation-sustainable-development>

Jorgenson, Andrew K. 2014. "Economic Development and the Carbon Intensity of Human WellBeing." *Nature Climate Change* 4(3):186–89.

Jorgenson, Andrew K. 2015. "Inequality and the Carbon Intensity of Human WellBeing." *Journal of Environmental Studies and Sciences* 5(3):277–82.

Jorgenson, Andrew K. and Brett Clark. 2011. "Societies Consuming Nature: A Panel Study of the Ecological Footprints of Nations, 1960–2003." *Social Science Research* 40(1):226–244.

Jorgenson, Andrew K. and Brett Clark. 2012. "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005." *American Journal of Sociology* 118(1):1–44.

- Jorgenson, Andrew K. and Jennifer Givens. 2015. “The Changing Effect of Economic Development on the Consumption-Based Carbon Intensity of WellBeing, 1990–2008.” *PLOS ONE* 10(5):e0123920
- Jorgenson, Andrew K. and Thomas Dietz. 2015. “Economic Growth Does Not Reduce the Ecological Intensity of Human WellBeing.” *Sustainability Science* 10(1):149–56.
- Jorgenson, Andrew K., Alina Alekseyko, and Vincentas Giedraitis. 2014. “Energy Consumption, Human WellBeing and Economic Development in Central and Eastern European Nations: A Cautionary Tale of Sustainability.” *Energy Policy* 66:419–27.
- Jorgenson, Andrew K., and Thomas Dietz. 2015. “Economic Growth Does Not Reduce the Ecological Intensity of Human WellBeing.” *Sustainability Science* 10(1):149–56.
- Jorgenson, Andrew K., Juliet B. Schor, Xiaorui Huang, and Jared Fitzgerald. 2015. “Income Inequality and Residential Carbon Emissions in the United States: A Preliminary Analysis.” *Human Ecology Review* 22(1):93–106.
- Jorgenson, Andrew K., Shirley Fiske, Klaus Hubacek, Jia Li, Tom McGovern, Torben Rick, Juliet B. Schor, William Solecki, Richard York, and Ariela Zycherman. 2019. “Social Science Perspectives on Drivers of and Responses to Global Climate Change.” *Wiley Interdisciplinary Reviews: Climate Change* 10(1):e554.

- Jorgenson, Andrew K., Terrence D. Hill, Brett Clark, Ryan P. Thombs, Peter Ore, Kelly S. Balistreri, and Jennifer E. Givens. 2020. "Power, Proximity, and Physiology: Does Income Inequality and Racial Composition Amplify the Impacts of Air Pollution on Life Expectancy in the United States?" *Environmental Research Letters* 15(2):024013.
- Jorgenson, Andrew, Juliet Schor, and Xiaorui Huang. 2017. "Income Inequality and Carbon Emissions in the United States: A State-Level Analysis, 1997–2012." *Ecological Economics* 134:40–48.
- Knight, Kyle W. and Juliet B. Schor. 2014. "Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries." *Sustainability* 6(6):3722–31.
- Knight, Kyle W., Juliet B. Schor, and Andrew K. Jorgenson. 2017. "Wealth Inequality and Carbon Emissions in High-Income Countries." *Social Currents* 4(5):403–412.
- Lamb, William F., Julia K. Steinberger, Alice Bows-Larkin, Glen P. Peters, J. Timmons Roberts, and F. Ruth Wood. 2014. "Transitions in Pathways of Human Development and Carbon Emissions." *Environmental Research Letters* 9(1):014011.
- Le Blanc, David. 2015. "Towards Integration at Last? The Sustainable Development Goals as a Network of Targets." *Sustainable Development* 23(3):176–87.

- Lélé, Sharachchandra M. 1991. "Sustainable Development: A Critical Review." *World Development* 19(6):607–621.
- Lim, Stephen S., Kate Allen, Zulfiqar A. Bhutta, Lalit Dandona, Mohammad H. Forouzanfar, Nancy Fullman, Peter W. Gething, Ellen M. Goldberg, Simon I. Hay, and Mollie Holmberg. 2016. "Measuring the Health-Related Sustainable Development Goals in 188 Countries: A Baseline Analysis from the Global Burden of Disease Study 2015." *The Lancet* 388(10053):1813–1850.
- Lockie, Stewart. 2012. "Sustainability and a Sociology of Monsters." *Sociologica* 6(2):0–0.
- Lockie, Stewart. 2016. "Sustainability and the Future of Environmental Sociology." *Environmental Sociology* 2(1):1–4.
- Lohmann, Larry. 1990. "Whose Common Future?" *The Ecologist* 20(3):82–84.
- Lohmann, Larry. 1999. *Forest Cleansing: Racial Oppression in Scientific Nature Conservation*. Corner House.
- Longhofer, Wesley and Andrew Jorgenson. 2017. "Decoupling Reconsidered: Does World Society Integration Influence the Relationship between the Environment and Economic Development?" *Social Science Research* 65:17–29.

- Longo, Stefano B., Brett Clark, Thomas E. Shriver, and Rebecca Clausen. 2016. "Sustainability and Environmental Sociology: Putting the Economy in Its Place and Moving toward an Integrative Socio-Ecology." *Sustainability* 8(5):437.
- Mayer, Adam. 2017. "Democratic Institutions and the Energy Intensity of WellBeing: A Cross-National Study." *Energy, Sustainability and Society* 7(1):36.
- Mazur, Allan and Eugene Rosa. 1974. "Energy and Life-Style." *Science* 186(4164):607–10.
- Meadows, Donella H., Dennis L. Meadows, Jorgen Randers, and William W. Behrens. 1972. *The Limits to Growth*. Universe Books, *New York* 102:27.
- Morandín-Ahuerma, Indra, Armando Contreras-Hernández, Dante Ariel Ayala-Ortiz, and Octavio Pérez-Maqueo. 2019. "Socio–Ecosystemic Sustainability." *Sustainability* 11(12):3354.
- Neumayer, Eric. 2003. *Weak versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms*. Edward Elgar Publishing.
- Nilsson, Maans, Elinor Chisholm, David Griggs, Philippa Howden-Chapman, David McCollum, Peter Messerli, Barbara Neumann, Anne-Sophie Stevance, Martin Visbeck, and Mark Stafford-Smith. 2018. "Mapping Interactions between the Sustainable Development Goals: Lessons Learned and Ways Forward." *Sustainability Science* 13(6):1489–1503.

- Nilsson, Maans, Dave Griggs, and Martin Visbeck. 2016. "Policy: Map the Interactions between Sustainable Development Goals." *Nature News* 534(7607):320.
- Parris, Thomas M., and Robert W. Kates. 2003. "Characterizing and Measuring Sustainable Development." *Annual Review of Environment and Resources* 28(1):559–586.
- Prades, José A. 1999. "Global Environmental Change and Contemporary Society: Classical Sociological Analysis Revisited." *International Sociology* 14(1):7–31.
- Purvis, Ben, Yong Mao, and Darren Robinson. 2019. "Three Pillars of Sustainability: In Search of Conceptual Origins." *Sustainability Science* 14(3):681–95.
- Ratner, Blake D. 2004. "'Sustainability' as a Dialogue of Values: Challenges to the Sociology of Development." *Sociological Inquiry* 74(1):50–69.
- Redclift, Michael. 1988. "Sustainable Development and the Market: A Framework for Analysis." *Futures* 20(6):635–650.
- Redclift, Michael. 2005. "Sustainable Development (1987–2005): An Oxymoron Comes of Age." *Sustainable Development* 13(4):212–227.
- Robinson, John. 2004. "Squaring the Circle? Some Thoughts on the Idea of Sustainable Development." *Ecological Economics* 48(4):369–384.

- Rockström, Johan, Will Steffen, Kevin Noone, Asa Persson, F. Stuart Chapin III, Eric F. Lambin, Timothy M. Lenton, Marten Scheffer, Carl Folke, and Hans Joachim Schellnhuber. 2009. "A Safe Operating Space for Humanity." *Nature* 461(7263):472.
- Rosa, Eugene A., Thomas K. Rudel, Richard York, Andrew K. Jorgenson, and Thomas Dietz. 2015. "The Human (Anthropogenic) Driving Forces of Global Climate Change." *Climate Change and Society: Sociological Perspectives* 2:32–60.
- Rosa, Eugene A., Richard York, and Thomas Dietz. 2004. "Tracking the Anthropogenic Drivers of Ecological Impacts." *AMBIO: A Journal of the Human Environment* 33(8):509–13.
- Rosa, Eugene A., and Thomas Dietz. 2012. "Human Drivers of National Greenhouse-Gas Emissions." *Nature Climate Change* 2(8):581–86.
- Dietz. 2015. "The Human (Anthropogenic) Driving Forces of Global Climate Change." *Climate Change and Society: Sociological Perspectives* 2:32–60.
- Sweezy, Paul M. 2004. "Capitalism and the Environment." *Monthly Review* 56(5):86.
- Sweidan, Osama D. 2018. "Economic Performance and Carbon Intensity of Human WellBeing: Empirical Evidence from the MENA Region." *Journal of Environmental Planning and Management* 61(4):699–723.
- The Ecology Party (1975) *Manifesto for a Sustainable Society*. The Ecology Party, Leeds.

Thombs, Ryan. 2018. "The Transnational Tilt of the Treadmill and the Role of Trade Openness on Carbon Emissions: A Comparative International Study, 1965–2010." *Sociological Forum* 33(2):422–42.

Tulloch, Olivia, Fortunate Machingura, and Claire Melamed. 2016. "Health, Migration and the 2030 Agenda for Sustainable Development."

UNESCO 2016 *UNESCO strategy on education for health and wellbeing: contributing to the Sustainable Development Goals* ED.2016/WS/35 Retrieved February 27, 2020
<https://unesdoc.unesco.org/ark:/48223/pf0000246453>

United Nations 1992. *Agenda 21*. United Nations, New York Retrieved March 13, 2020
<https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>

United Nations 2015. *70/1. Transforming our world: the 2030 Agenda for Sustainable Development- General Assembly, Resolution A. RES/70/1*. New York, USA: Retrieved November 23, 2019
<https://sustainabledevelopment.un.org/index.php?page=view&type=111&nr=8496&menu=35>

United Nations. 2019. "World Is 'on Notice' as Major UN Report Shows One Million Species Face Extinction." *UN News*. Retrieved February 23, 2020
(<https://news.un.org/en/story/2019/05/1037941>).

Wilkinson, Richard G., and Kate E. Pickett. 2006. "Income Inequality and Population Health: A Review and Explanation of the Evidence." *Social Science & Medicine* 62(7):1768–1784.

Xu, Zhenci, Sophia N. Chau, Xiuzhi Chen, Jian Zhang, Yingjie Li, Thomas Dietz, Jinyan Wang, Julie A. Winkler, Fan Fan, and Baorong Huang. 2020. "Assessing Progress towards Sustainable Development over Space and Time." *Nature* 577(7788):74–78.

York, Richard, Eugene A. Rosa, and Thomas Dietz. 2003. "Footprints on the Earth: The Environmental Consequences of Modernity." *American Sociological Review* 68(2):279–300.

2 EDUCATIONAL ATTAINMENT AND CIWB: A REGIONAL ANALYSIS

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2.1 INTRODUCTION

On September 25th, 2015, the United Nations General Assembly adopted a resolution formally launching the United Nations Sustainable Development Goals (SDGs). While the previous set of international development targets, the Millennium Development Goals, focused primarily on addressing extreme poverty, the SDGs aim to promote human and ecological wellbeing—in a balanced and integrated manner (United Nations 2015). Sustainability strategies have been part of mainstream development discourse since at least the 1980s (Purvis, Mao and Robinson 2019). However, the 2030 sustainable development agenda is the most widely adopted framework to position social and economic development with ecological sustainability, as cohesive, not parallel, objectives. Given the complexity of this plan, many scholars have highlighted the need to explore further the interdependence of these targets (Nilsson et al. 2018; Pongiglione 2015; Reddy and Kvangraven 2015).

The goal of raising nations' rates of per capita educational attainment has been part of global development policy since the Universal Declaration of Human Rights (UDHR1948, Article 26). Policymakers included it in many subsequent international treaties and frameworks, including the current Sustainable Development agenda (SDG 4). Gains in per capita educational attainment are known to affect social outcomes in a variety of ways. Higher rates of educational attainment are indirectly linked to gains in human wellbeing through spill-over effects into household-level and national-level income (Mankiw, Romer and Weil 1992). Relatedly, higher rates of educational attainment are associated gains in other social outcomes, such as health (Anand and Bärnighausen 2004; Arendt 2005; Goesling 2007; Marmot 2005) social capital (Helliwell and Putnam 1999; Coleman 2000), and self-assessments of wellbeing (Ross and Zhang 2008; Eide and Showalter 2011; Yakovlev and Leguizamon 2012).

Empirical evidence in sociology on the relationship between education and environmental outcomes at the macro level is mixed. For example, Jorgenson (2003, 2005) finds that the ecological footprint of nations is positively associated with literacy rates, net of various political-economic factors. In a cross-national study, Mayer (2013) finds an association between increased tertiary enrollment rates and per capita CO₂ emissions.

On the other hand, Dietz et al. (2007) find that gains in education do not necessarily increase environmental stress. Further, Jorgenson et al. (2018) find that the percent of the population with a college degree has a modest attenuating effect on the CIWB, within the United States. In this chapter, I delve into the relationship between educational attainment and sustainability and, in doing so, add to the social science literature on sustainability in three ways.

First, this study integrates the capabilities approach (Sen 1999; Nussbaum and Sen 1993) with a dominant theory within environmental sociology, thereby illustrating the potential analytical power of the capabilities approach for macro-comparative analyses in environmental sociology and other studies of sustainability. Specifically, in this chapter I integrate the central thesis of ecological modernization theory; that development leads to less carbon-intensive economies and more ecologically oriented societies (Mol 2001, 2002; Mol, Spaargaren, and Sonnenfeld 2013), with Sen's (1999) conceptualization of education as a critical capability, which enhances individual and community functioning. I test the related hypothesis that gains in education may support global sustainability.

Second, this study is the first to assess how global gains in educational attainment, between 1960 and 2010, concurrently affected human and environmental wellbeing. This kind of comparative assessment of the environmental costs of social gains is possible because the outcome variable, the carbon intensity of wellbeing (CIWB), captures how

socioeconomic processes simultaneously affect both the biophysical world and human wellbeing (Jorgenson and Dietz 2015). CIWB is a ratio of national environmental impact over average life expectancy. It is a widely used metric for sustainability within environmental sociology and other disciplines (Dietz et al. 2012; Jorgenson 2014, 2015; Jorgenson and Givens 2015; Givens 2015, 2017, 2018; Sweidan 2018; Jorgenson et al. 2018).

Third, in this chapter, I provide a regionally specific analysis; I consider how the complex historical, cultural, and geopolitical contexts in six geographic regions may have determined the relationship between education and sustainability. These temporal and regionally-specific analyses are necessary because, like other social institutions, the form and effect of education can differ across time and social-economic contexts (Collins 1971; Arnove 1980; Montenegro and Patrinos 2014).

In the next section, I summarize the relevant macro comparative perspectives and empirical research on the links between education and sustainability. After that, I outline the study methodology and follow with a presentation of the study findings. In the discussions section, I interpret the findings within the context of specific histories of the country groups. I also offer some brief concluding remarks. I provide a more detailed conclusion, which considers the implications of the findings in more depth, in the final chapter of this dissertation.

2.2 EDUCATION AND SUSTAINABILITY

A seminal document on sustainability published by the World Commission on Environment and Development (WCED) defines global sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (1987:43). The approach to sustainability outlined in this report is widely used across academic, policy, and commercial fields (Dryzek 2013). The approach is often presented as three interlocking spheres of sustainability; economy, society, and environment (UNESCO 2012).

Given the growing evidence on the problematic nature of the relationship between economic growth and environmental stress, many are advocating for an approach to sustainability which places a larger emphasis on social and ecological systems (Redclift 1987, 2005; Longo et al. 2016; Holden et al. 2017). To that end this research uses a purely socio-ecological measure of sustainability namely the carbon intensity of wellbeing (Dietz and Jorgenson 2014). In the proceeding sections focus on unpacking the interdisciplinary scholarship on the connection between education and the two components of socio-ecological sustainability: human wellbeing and environmental outcomes.

2.2.1 Education and Human Wellbeing

Conceptual frameworks of development have traditionally highlighted the importance of national educational attainment for its utility in facilitating economic growth through enhanced human capital (Psacharopoulos 1972, 1985). In recent decades, the conceptualization of the benefits of education within the international development scholarly community has evolved beyond this economically rooted framing of human capital stocks to a more socially oriented human capabilities approach (Nussbaum and Sen 1993; Sen 1999). Specifically, they position education as central to creating “an enabling environment for people to enjoy long, healthy, and creative lives” (United Nations Development Program (UNDP) 1990, 1). This discourse, though still inherently anthropocentric, stresses the intrinsic, as well as instrumental, value of education as a social good. For example, Nussbaum (2004) notes the importance of education for self-respect, cultivating the power of expression, and forming social relationships.

Empirically, increased educational attainment is associated with gains in subjective wellbeing (Ross and Zhang 2008; Eide and Showalter 2011; Yakovlev and Leguizamon 2012) and social capital (Coleman 2000; Helliwell and Putnam 1999) across high- and low-income national contexts. Investment in education has been linked to gains in other social spheres. Cross-disciplinary literature highlights the relationship between increased population health outcomes and gains in educational participation (Goesling 2007;

Marmot 2005; Arendt 2005; Anand and Bärnighausen 2004). Studies suggest that raising the average level of education of women in lower-income settings is associated with gains in wellbeing through a variety of mechanisms. Educated girls and women tend to get married later than their less-educated peers (Clark et al. 2006; Jain and Kurz 2007), and those who marry later are less likely to experience intimate partner violence (Speizer and Pearson 2011), thereby enhancing wellbeing.

Public health data show that female literacy rates and combined school enrollment are moderate predictors of maternal mortality rates (McAlister and Baskett 2006). Specifically, those with no education are 2.7 times more likely to experience a pregnancy-related death than those with a secondary level of education (Karlsen et al. 2011). Educated women are also better equipped to meet the health and nutritional needs of their children (Richards et al. 2013; Raj et al. 2010). In a systematic review of the estimated contribution of women's education to the reductions in child mortality, Gakidou et al. (2010) calculate that of the 8.2 million fewer deaths in children younger than five years between 1970 and 2009, 4.2 million (51.2 percent) could be attributed to increased educational attainment in women of reproductive age. Given these associations between education and other indicators of human wellbeing, it is unsurprising then that empirical analyses link gains in life expectancy (the denominator of the CIWB ratio) to better-educated populations in both high-income (Meara, Richards and Cutler 2008;

Ikeda et al. 2011; Hoyert and Xu 2012) and low-income nations (Marmot 2005; Jayachandran and Lleras-Muney 2009).

2.2.2 Education and the Environment

Much of the sociological literature on education and environmental outcomes focuses on the connection between an individual's educational attainment and their reported environmental values. One macro-level perspective, which is potentially fruitful for our understanding of the relationship between educational attainment and broader environmental impacts, is ecological modernization theory. Early iterations of this theory emphasize the role of technological innovation in allowing industries to prevent environmental problems from occurring, thus making it a critical factor in addressing a nation's impact on the biophysical world. The theory also proposes that the process of societal modernization is accompanied by ecological rationality, which advances environmental considerations within government decision-making. These technological and political shifts mediate the deleterious ecological outcomes of economic development over time (Mol 2002, 2003; Mol, Spaargaren, and Sonnenfeld 2013).

More recent iterations of the theory emphasize that "strong ecological modernization" is predicated on robust democratic participation, which allows citizens to demand environmental considerations in national policy (Mol, Spaargaren, and

Sonnenfeld 2013). Though not explicated in theory, much of the economic, technical, and political change that undergirds ecological modernization relies on educated populations.

Empirical testing of ecological modernization theory has found mixed (Liang and Mol 2013) and, in many cases, contradictory evidence (Dinda 2004; Jorgenson and Clark 2011, 2012; Jorgenson and Dietz 2015; York et al. 2003). Partly in response to these findings and other substantive critiques, some environmental sociologists have argued that ecological modernization should be understood as a spectrum. From this perspective, the extent to which societies place limits on economic growth in the interests of environmental protection is primarily determined by the distribution of political power (Shwom 2011).

There is some overlap between this interpretation of ecological modernization theory and the capabilities approach. The capabilities approach also stresses the positive relationship between democratic participation and sustainable development. For example, Sen (1999) notes that “more informed and less marginalized public discussion of environmental issues may not only be good for the environment; it could also be important for the health and functioning of the democratic system itself” (159). Building on this position, Sen (2013) advocates an approach to sustainability, that engenders reasoned and interactive agency governments and the communities they represent on how best to meet the challenge of sustainability. However, the capabilities approach

complicates the link between the functioning of social and democratic institutions and environmental sustainability. Sen stresses that these institutions cannot be viewed as mechanical devices for (sustainable or equitable) development. He stresses instead that “their use is conditioned by our values and our priorities, and by the use, we make of the available opportunities of articulation and participation” (1999:158).

There are other differences between these approaches that can help clarify how a social institution, such as education, shapes the environmental outcomes across varying national contexts. On the one hand, ecological modernization theory positions long-term economic growth and affluence as necessarily preceding national environmental protection mandates (Spaargaren and Mol 1992; Zahran et al. 2007).

On the other hand, the capabilities framework rejects the inherent linearity of this conceptualization, stressing the heterogeneity of national development paths and the important role of cultural values. The strong ecological orientations among more traditional, less economically oriented societies, such as many indigenous peoples, illustrate the importance of cultural values in mediating the relationship between human and natural systems (Weber 1998; Yohannan 2016). The capabilities approach emphasizes the importance of continuous investment in institutions and social goods, including education, as a country experiences economic growth, for the achievement of equitable national and individual wellbeing (Nussbaum and Sen 1993; Sen 1999).

Another critical distinction for ecological modernization scholars is the emergence of a technical prowess among a national population that facilitates the mitigation of environmental degradation. However, Nussbaum (2010) argues that scientific and technical education is not where the power for equitable and sustainable development lies.

Instead, she emphasizes that it is an education system geared toward empowering critical and agentic citizens, which leads to a national culture of accountability, which, in turn, is functional for equity and sustainability. Education is included in some empirical analyses of how socio-economic factors impact the environment, but it is usually treated as a control variable. For example, in a comparative analysis of economic stressors, Dietz et al. (2007) find that gains in education do not increase environmental stress. In a sex-specific study of how inequality and other socio-political factors affect the CIWB across the 50 United States, Jorgenson et al. (2018) find that the percentage of a state's population with a college degree has a modest attenuating effect on the CIWB.

In contrast, Jorgenson (2003, 2005) finds that the per capita ecological footprint of nations is positively associated with literacy rates, net of various political-economic factors. In an analysis of cross-national panel data for the period 1998–2008, Mayer (2013) finds an association between increases in national spending on education, and tertiary enrollment rates, and per capita CO₂ emissions. The findings I present in this

chapter build on this prior sociological work and aim to deepen our understanding of the role of education in national sustainability across regions and over time.

2.3 METHODS

2.3.1 Data

The data for this study is for 76 countries with observations every five years for the period of 1960–2010. The countries are grouped, based on World Bank regional classifications of nations (World Bank 2015).

Table 1. Countries Included in the Study by Region

Advanced Economies	East Asia and the Pacific	Latin America and the Caribbean	Middle East North Africa	South Asia	Sub-Saharan Africa
Austria	China	Argentina	Algeria	India	Benin
Australia	Fiji	Bolivia	Egypt	Sri Lanka	Cameroon
Canada	Hong Kong	Brazil	Iran	Nepal	Central African Republic
Denmark	Japan	Chile	Morocco	Pakistan	Cote d'Ivoire
Finland	Indonesia	Colombia	Tunisia		Congo
France	Korea, Rep of	Costa Rica	Turkey		Democratic Republic Congo
Greece	Philippines	Dominican Republic			Gabon
Ireland	Papua New Guinea	Ecuador			Ghana
Iceland	Singapore	Guatemala			Kenya
Italy	Thailand	Guyana			Liberia
Luxembourg		Honduras			Mauritania
Netherlands		Jamaica			Niger
Norway		Mexico			Rwanda
Portugal		Nicaragua			Sudan
Spain		Panama			Senegal
Sweden		Peru			Sierra Leone
USA		Salvador			South Africa
United Kingdom		Uruguay			Swaziland
		Venezuela			Togo

I selected a regional-income hybrid classification system instead of national income-based groupings because of the fluidity of the latter, particularly considering the longitudinal orientation of the study. Table 1 lists the countries included in the analyses. Western Europe, North America, Australia, and New Zealand are included in one regional category labeled as “advanced economies” because of the economic, social, and historical commonalities between these particular nations. This approach is common in past sociological research on CIWB (Jorgenson 2014; Jorgenson and Givens 2015).

2.3.2 Dependent Variable

The dependent variable in this study is the carbon intensity of wellbeing (CIWB). The CIWB ratio is based on a production function of sustainability produced by Dietz et al. (2009), which highlights the “goods” nations produce from stressing the environment by measuring the “environmental efficiency in producing human wellbeing” (EWEB). In this approach, sustainability is conceptualized as the efficiency with which human wellbeing is produced from the use of natural resources. The output of human wellbeing is operationalized as life expectancy. Later Dietz et al. (2012) incorporate environmental stress into the outcome variable, thereby creating a ratio of environmental stress/wellbeing operationalized as ecological footprint/life expectancy. Jorgenson (2014) introduces the CIWB ratio in an analysis of the relationship between economic growth and the CIWB in regional samples of nations from 1970 to 2009. A growing body of

sociological research investigates the factors impinging on production-based or consumption-based CIWB (Jorgenson 2014, 2015; Jorgenson and Givens 2015; Mayer 2017; Givens 2015, 2017, 2018; Sweidan 2018; Jorgenson et al. 2018).

In this approach, sustainability is conceptualized as the efficiency with which human wellbeing is produced from the use of resources. The output of human wellbeing is operationalized as life expectancy. Later Dietz et al. (2012) incorporate environmental stress into the outcome variable, thereby creating a ratio of environmental stress/wellbeing operationalized as ecological footprint/life expectancy. Jorgenson (2014) first introduces the CIWB ratio in an analysis of the relationship between economic growth and the CIWB in regional samples of nations from 1970 to 2009.

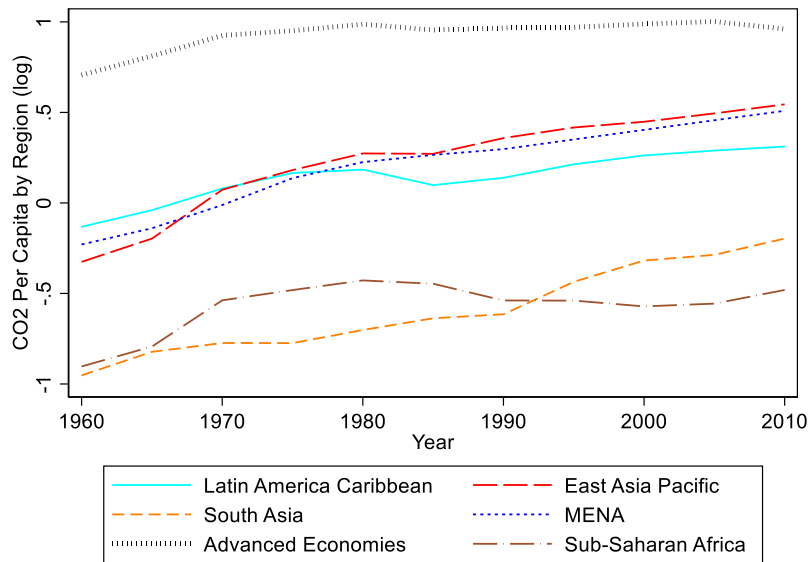
In keeping with this approach, the numerator in the ratio in this study is CO₂ emissions in metric tons per capita (from the burning of fossil fuels and the manufacture of cement). The denominator is average life expectancy at the time of birth. Countries with low carbon footprint but early mortality (low wellbeing) and countries with high life expectancy and carbon footprint both have high CIWB, an undesirable outcome. Nations with low carbon footprint but high wellbeing have low CIWB. The data for carbon emissions and life expectancy come from the World Bank's World Development Indicators online database (2010). To avoid either the numerator or the denominator having a disproportionate influence on the CIWB ratio, I take the same approach as

others (Dietz et al. 2012; Jorgenson 2014, 2015; Jorgenson and Dietz 2015; Givens 2015, 2017, 2018) and constrain their coefficients of variation to be equal by adding a constant to the numerator, the CO₂ measure. This method shifts the mean without changing the variance. The coefficient of variation for CO₂ per capita is 1.37, and for life expectancy, it is 0.185. Thus, to calculate CIWB, a constant of 24.2 is added to the carbon emissions data, which are then divided by average life expectancy, and then multiplied by 100 to scale the ratio. In particular;

$$CIWB = [(CO_2pc + 24.2)/LE] \times 100$$

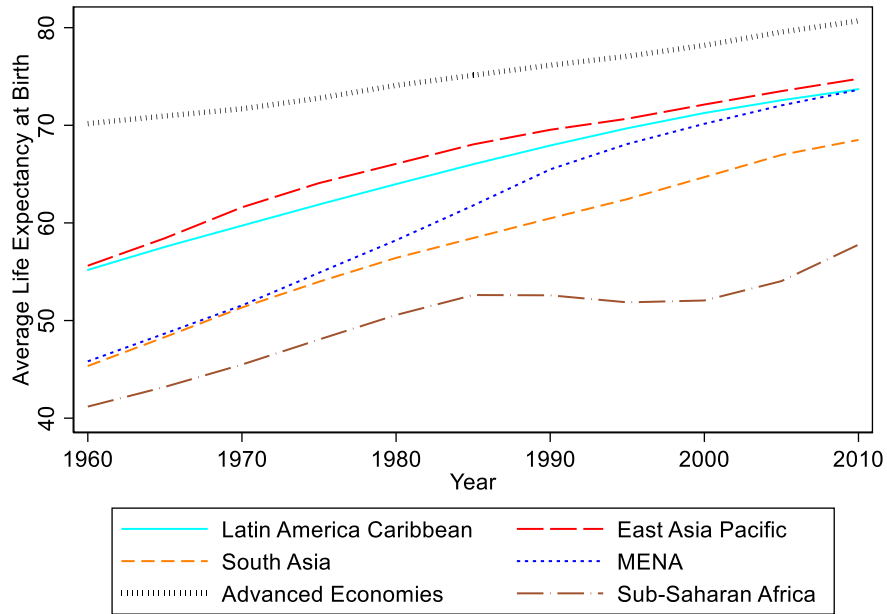
As Figure 2 illustrates, advanced economies are consistently the largest emitters of production-based carbon emissions per capita. Partly owing to the outsourcing of manufacturing to other regions, and the aftermath of the 2008 financial crisis, there is a slight decline in production-based CO₂ emissions in such nations after 2005. Both the East Asia-Pacific and Middle East North Africa (MENA) regions exhibit a steady increase in production-based emissions throughout the study period. Latin America's per capita emissions have not increased at the same rate as other regions during the study period. Emissions increased gradually in South Asia before 1990. After that, emissions increase more dramatically, partly due to the high rates of economic growth experienced in India since the early 1990s. Per capita, CO₂ emissions have remained relatively stagnant for nations in sub-Saharan Africa.

Figure 2. Per Capita Production Based CO₂ by Region (in log terms)



As Figure 3 illustrates, for the majority of nations included in this study, average life expectancy at birth has increased, though progress has not been uniform. Advanced economies consistently have the highest life expectancy rate, though the magnitude of this advantage diminished over time. The Latin American and the Caribbean regions have followed a similar trajectory to East Asia and Pacific with a starting average life expectancy of 55 and 54 years, respectively. Both regional samples of nations had average life expectancies of 74 years by 2010.

Figure 3. Average Life Expectancy by Region



Similarly, the MENA region had an average life expectancy of 74 by 2010, while the estimated life expectancy for nations included in this regional sample was just 46 in 1960. The average life expectancy for the South Asian countries in this study was also 46 in 1960 and increased to 68.5 years by 2010. In sub-Saharan African nations included in this study, average life expectancy went from 41 to 58, with a period of stagnation between 1980 and 2000.

Figure 4. Select CIWB for Eight Nations and the Sample Average, 1960–2010

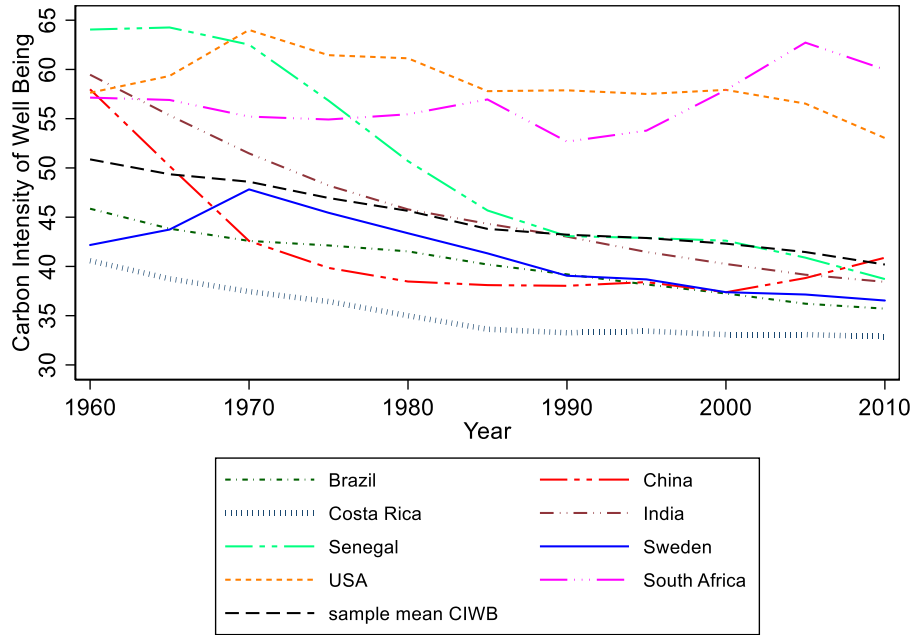


Figure 4 graphs the CIWB measure for eight nations from the different regions and the overall sample’s average. The eight nations were chosen to illustrate the diversity in levels and trajectories of national-level CIWB throughout the world. As the figure shows, the CIWB for the United States moderately decreased over time, but its value in 2010 remained the second largest of the nations included in the illustration. In other words, throughout the study period, the environmental cost of enhancing citizens’ wellbeing remained consistently high in the United States. By contrast, Sweden, another high-income nation, had a substantially lower CIWB value at both the starting point and the endpoint of the study. China showed a substantial decline in CIWB between 1960 and

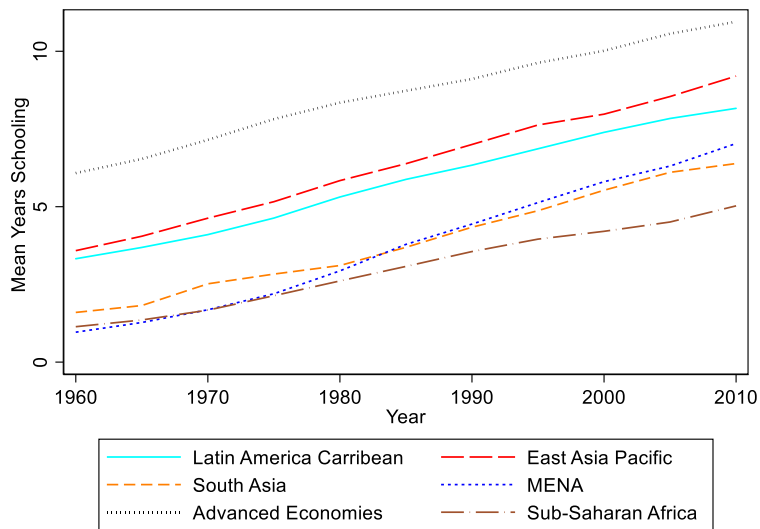
1980, owing to the 17-year leap in life expectancy that occurs during these 20 years. The carbon intensity with which China produced wellbeing for its citizens stagnated between 1980 and 2000 but rose sharply after that. Costa Rica and Brazil, the Latin American nations highlighted in Figure 4, had CIWB values consistently well below sample averages throughout the 50 years. India experienced a steep decline in CIWB between 1960 and 1980 and was below the sample average for CIWB by 2010. Steeper still was the decline in CIWB for Senegal. This African nation had the highest CIWB value of the eight nations presented in 1960 but was below the sample average by 2010. South Africa, on the other hand, had a CIWB value above the sample average, but below China in 1960, and climbed to the position of highest CIWB value for the nations in the figure by 2010.

2.3.3 Independent Variable

The independent variable of interest for this study is average years of educational attainment for men and women aged 15–64. These data are from the Barro- Lee Educational Attainment Database and are recorded in 5-year increments for the age group 15 years and over (Barro and Lee 2013). They are drawn from census/survey information, as compiled by UNESCO, Eurostat, and other sources. As Figure 5 illustrates, the average years of schooling per person have increased over the 50 years under consideration. Advanced economies had the highest rate of educational attainment

in 2010 with 11 years of schooling per capita aged 15–64, up from 6 years in 1960. East Asia became the region with the second-highest rate of educational attainment by 2010, at nine years per capita up from just three years in 1960. For the nations included from the Middle East and North Africa region, rates of educational attainment were comparable to sub-Saharan Africa in 1970, at only one year per capita, but increased to more than seven years per capita by 2010. South Asia had the second-lowest rate of per capita attainment in 2010 at 6.4 years per capita, up from 1.6 years in 1960. In 2010, sub-Saharan Africa had the lowest regional attainment rate at five years of schooling per person aged 15–64.

Figure 5. Average Per Capita Educational Attainment for the Population aged 15-64 by Region



2.3.4 Control Variables

In this dissertation, I focus on the relationship between education and a socio-ecological definition of sustainability. Therefore, estimated models control for GDP per capita (economic resources), while evaluating the effects of education (social resource) on the CIWB (sustainability). GDP per capita is measured in constant 2010 US dollars (World Bank, World Development Indicators 2010).

By controlling for GDP, it is possible to extricate the direct effect of education on national sustainability, net of economic inputs. Parsimonious models, such as these, are also the methodological approach of choice in related studies of CIWB where the case-specific and time-specific intercepts, included as two-way fixed effects, explain a very substantial amount of variation in the dependent variable (Jorgenson 2014, 2015; Jorgenson and Dietz 2015; Jorgenson and Givens 2015; Givens 2015, 2017, 2018).

2.3.5 Estimated Models

Models were estimated using Prais-Winsten regression techniques with panel-corrected standard errors, using the software package Stata (version 15). This approach is an appropriate method for dealing with cross-sectional dependence (i.e., within-group error correlation), which occurs in cross-sectional time-series data with 10–100 units, observed over relatively long periods (Wooldridge 2005). I include country-specific and

year-specific intercepts, making the models equivalent to two-way fixed effects models. The country-specific fixed effects explain away between-country variation by removing the influence of factors unique to each country that are time-invariant. Year-specific intercepts account for factors common to all nations that are unique to each time point.

In the first model, I examine the relationship between education and CIWB for the full sample of nations. Consistent with past studies of CIWB that focused on other predictors, to account for potential regional variation, interaction terms between education and region are included in the model for the overall sample.

The main effect of the region is perfectly correlated with and thus accounted for by the country fixed effects (Allison 2009). To better understand how the effect of education manifests across different regional contexts over time, I estimate the same two-way fixed-effects models for each of the six regional subsamples. These models include interactions between education and time dummy variables (Allison 2009), an approach common in much sociological research on CIWB and other related topics (Givens 2015, 2017; Huang 2018; Jorgenson 2014, Jorgenson and Clark 2011, 2012; Thombs 2018). All variables were transformed with the base ten logarithms. Therefore, the estimated coefficients are elasticity coefficients, where a 1 percent change in the independent variable leads to an estimated percent change in the dependent variable.

2.4 RESULTS AND DISCUSSION

Estimates for all models are presented in Tables 2 and 3. The R-square statistic did not fall below 0.98 in any of the reported models. These high R-square statistics are consistent with other research using similar methods and are primarily due to the unreported country-specific and year-specific intercepts which combined account for a substantial amount of variation in the outcome, leading to relatively conservative hypothesis testing.

Table 2 presents the results of the first model, which examined the relationship between education and CIWB, controlling for GDP, country-specific, and time-specific effects for the full sample of 76 nations. The model includes interaction terms between education and region to determine how the impact of mass education differs across regional contexts during this 50-year study period. In this model, the baseline effect of education on CIWB in advanced economies was not significantly different from zero. Therefore, the elasticity coefficients for the other regional categories were equal to the coefficient for the interaction effect of region and educational attainment, if the interaction was statistically significant.

Table 2. Elasticity Coefficients for the Regression of Average Years of Schooling on CIWB 1960-2010 (controlling for GDP, time, and country-level effects)

Advanced Economies	East Asia and the Pacific	Latin America and the Caribbean	Middle East, North Africa	South Asia	Sub-Saharan Africa
0.10	-.19**	-.29***	-0.30***	-0.40***	-0.27***
<p>* p<0.05, ** p<0.01, *** p<0.001 R²= 0.9891 Estimates derived from Prais-Winston two-way fixed-effects elasticity model with panel-corrected standard errors and AR(1) corrections; No of observations 824 No of countries 76</p>					

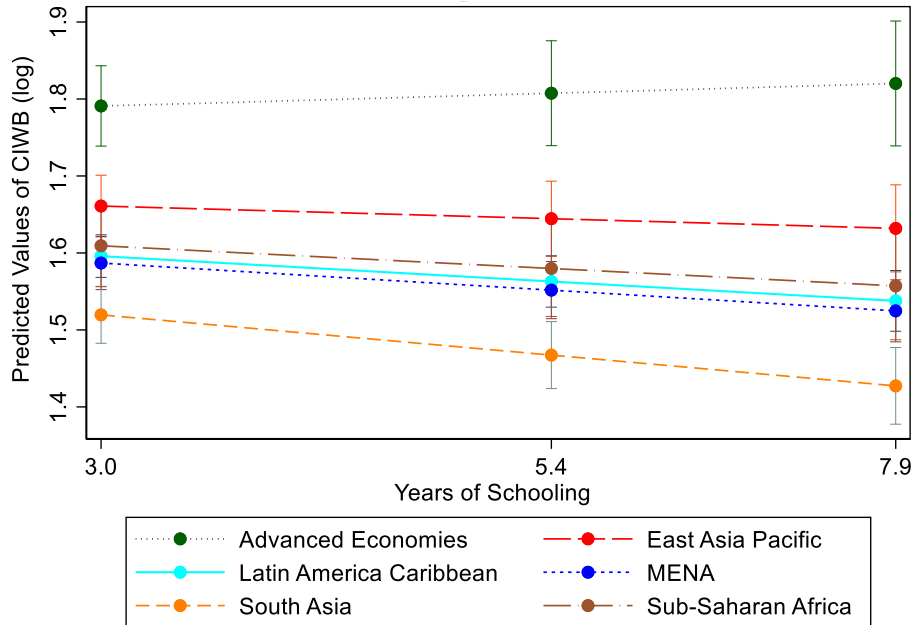
As the results in Table 2 show, between 1960 and 2010, average years of per capita schooling was inversely related to the carbon intensity with which nations produce wellbeing for their citizens for all regions outside of advanced economies. The inverse relationship between years of schooling and CIWB, observed for most regional samples of nations, is a desirable outcome from a sustainability perspective. Over the 50 years, the most substantial effects were observed in South Asia, where a 1 percent increase in education was associated with a 0.4 percent lower predicted value for CIWB. The next most substantial effect was seen in the Middle East/North Africa region, where a 1 percent increase in per capita education was associated with a 0.3 percent lower CIWB.

Similarly, in Latin America and the Caribbean region, a 1 percent increase in education was associated with a 0.29 percent lower predicted value in CIWB. In sub-Saharan Africa, a 1 percent increase in education was associated with a 0.27 percent lower CIWB. Finally, in the East Asia-Pacific region, a 1 percent increase in education was associated with a 0.19 percent lower CIWB. These findings suggest that, except for advanced economies, gains in education have had positive spill-over effects on the sustainability of nations between 1960 and 2010, though to varying degrees.

To illustrate the importance of regional context, Figure 6 graphs the estimated values of CIWB for each region at three values for education, keeping all other variables at the sample constant at their global means. This method effectively isolates the effect of the regional context. The predicted values for CIWB are plotted at 3, 5.4, and 7.9 years of education; the 25th, 50th, and 75th percentile sample values for years of schooling, respectively. As Figure 6 shows, there is a considerable variation in the predicted intensity with which regions produced wellbeing for their citizens, even keeping all other variables in the model constant at their global means.

Advanced economies had the highest predicted values for CIWB and South Asia, the lowest. The magnitude of this predicted difference increased at higher levels of education.

Figure 6. Predicted CIWB by Region and Education (all other predictors held a global means)



Note: Selected values for years of schooling represent the 25th 50th and 75th percentile of the global sample

In the next set of analyses, I further investigate the nature of these regionally specific relationships between education and CIWB. The models presented in Table 4 estimate the relationship for each region individually, with interactions between education and time dummy variables. These interactions allow us to assess how the relationship evolved in each region. In this set of models, the main effect of education can be interpreted as the effect of education on CIWB in 1960. Figure 7 graphs the statistically significant elasticity coefficients for the estimated impact of per capita years of schooling on the CIWB over time, based on the models reported in Table 3. A negative

coefficient represents a reduced carbon cost of wellbeing associated with gains in education.

Table 3. Elasticity Coefficients for the Estimated Effects of Education on Production-based CIWB 1960 to 2010 by Region

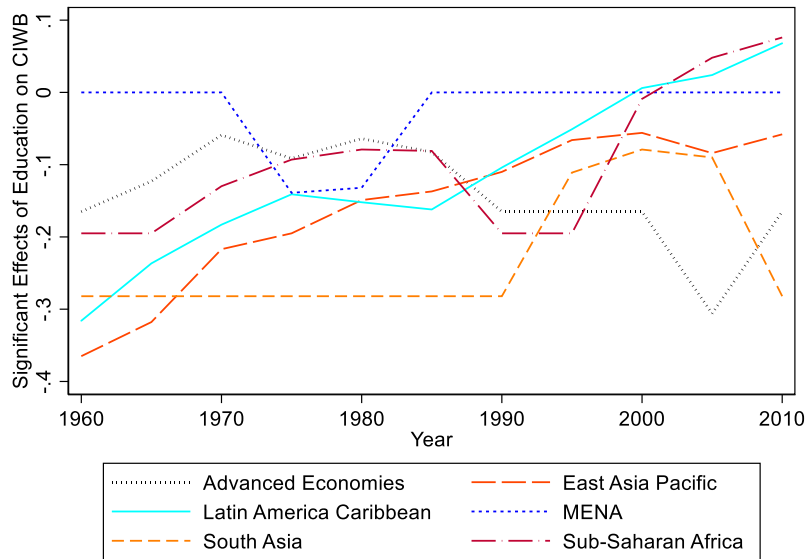
	Advanced Economies	East Asia Pacific	Latin America and the Caribbean	MENA	South Asia	Sub-Saharan Africa
Education	-0.165*	-0.365***	-0.316***	0.0773	-0.282*	-0.195***
	(-2.35)	(-3.81)	(-11.01)	-1.03	(-2.51)	(-3.43)
GDP	0.0643	0.0662***	0.0153	0.0076	0.101*	0.00637
	(1.44)	(5.36)	(1.39)	(0.28)	(2.01)	(0.32)
education x1965	0.0424*	0.0472***	0.0794***	-0.0835	-0.0561	0.0328
	(2.23)	(4.86)	(8.92)	(1.42)	(-0.79)	(1.38)
education x1970	0.106***	0.148***	0.133***	-0.0873	0.0191	0.0652*
	(3.78)	(8.47)	(12.56)	(-1.32)	(0.28)	(2.06)
education x1975	0.0736*	0.170***	0.175***	-0.139*	0.0279	0.102**
	(2.03)	(8.30)	(14.09)	(-1.98)	(0.4)	(2.62)
education x1980	0.101**	0.216***	0.164***	-0.132*	0.0296	0.116**
	(2.65)	(8.11)	(11.05)	(-1.97)	(0.41)	(2.63)
education x1985	0.0824*	0.228***	0.154***	-0.0459	0.0462	0.114*

	(2.04)	(8.03)	(9.15)	(-0.65)	(0.61)	(2.37)
education x1990	0.00848 (0.17)	0.274*** (10.43)	0.212*** (11.14)	-0.0904 (-1.21)	0.0982 (1.24)	0.012 (0.24)
education x1995	-0.0153 (-0.23)	0.265*** (14.44)	0.265*** (14.44)	-0.104 (-1.35)	0.171* (2.19)	0.0527 (1.02)
education x 2000	-0.0685 (0.78)	0.309*** (8.53)	0.322*** (15.58)	-0.0507 (-0.69)	0.203** (2.60)	0.186*** (3.38)
education x 2005	-0.141* (-1.97)	0.281*** (5.97)	0.340*** (17.62)	0.00358 (0.05)	0.192* (2.13)	0.243*** (4.26)
education x 2010	-0.12 (-1.43)	0.307*** (5.80)	0.384*** (13.62)	0.0834 (1.04)	0.194 (1.76)	0.271*** (5.06)
_cons	1.127* (2.28)	1.168*** (9.67)	1.725*** (15.63)	1.623*** (5.79)	0.773 (1.39)	1.795*** (9.75)
No of Countries	18	10	19	6	4	19
No of Obs.	196	109	206	63	43	207
R ²	0.9942	0.9891	0.9985	0.9981	0.9991	0.9906
Estimates derived from Prais-Winston two-way fixed-effects elasticity models with AR(1) correction. (t-statistics in parentheses).						
* p<0.05, ** p<0.01, *** p<0.001						
Time and Country Level Fixed Effects Included						

In advanced economies, in 1960, there was a marginal, but statistically significant, predicted effect of education on CIWB, where a 1 percent increase in education was

associated with a 0.17 percent lower predicted value of CIWB. The magnitude of this effect diminished until 1985. For the periods after that, the desirable effect of education on CIWB was at least as large as that observed in 1960 (Figure 6).

Figure 7. Statistically Significant Elasticity Coefficients for the Estimated Effect of Education on the CIWB



In 2005, the beneficial effect of education was even larger than in 1960, whereby a 1 percent increase in education was associated with a 0.3 percent lower predicted value for CIWB, within this region. Given the inherent ceiling effects of life expectancy, and the reduction in per capita production-based CO₂ emissions among advanced economies in recent years, these results could be interpreted as providing some support for

ecological modernization theory. Another potential explanation is that wealthy countries reduced their production-based carbon emissions (the numerator of the outcome variable in this study) through international trade and the related outsourcing of carbon-intensive manufacturing (Givens 2018; Jorgenson 2012; Jorgenson and Rice 2005; Rice 2007), thereby lowering their production-based carbon emissions and in turn their CIWB. This process may be associated with a more educated workforce.

The most substantial effect of education on CIWB, in 1960, was observed in East Asia–Pacific, where a 1 percent increase in education was associated with a 0.37 percent lower CIWB. During the 50 years covered in the study, the magnitude of the attenuating effect of education on CIWB steadily decreased in this region. Unlike other regions such as Latin America–Caribbean and sub-Saharan Africa, the elasticity coefficients in East Asia–Pacific remained below 0, even at the study endpoint. Given that a negative coefficient implies the presence of attenuating effect of per capita years of education on CIWB, the East Asia–Pacific region appears to be an encouraging case for the potential of education for enhancing human wellbeing while limiting environmental impacts— at least during this period.

Many nations in East Asia saw substantial social and economic gains between 1965 and 1990; a phenomenon often referred to by development economists as the “East Asian Miracle” (Sen 1997, 1999; Tilak 2001). Some development scholars, including Amartya

Sen, have underscored the supportive role education played in the economic growth, improved human welfare, and reductions in inequality that occurred during this period. For example, ul-Haq and Haq deem gains in per capita education as the “miracle behind the economic miracle” (1998: 31). The findings of the present study would suggest that this model of development has had comparatively favorable socio-environmental outcomes too. However, contrary to both the ecological modernization and human capabilities position on the interdependence of economic and social outcomes and democratic participation, many of the nations in the region were not democratically governed during the study period.

By 2010, the desirable effects of education on CIWB almost disappeared within this region. The decline in the education effect is potentially due to the ceiling effect of life expectancy. However, it may also owe to the fact that many nations in the region, such as China, have, in the recent past, become hubs for export-orientated manufacturing, which increases production-based carbon emissions, the numerator in the outcome ratio of this study. Relatedly, the entrenchment of global economic relations, and growth in consumerism associated with more educated populations, within many nations in the region, is also likely a contributing factor in their growing carbon footprint.

In Latin America and the Caribbean, a 1 percent increase in education was associated with a 0.32 percent decrease in CIWB in 1960. However, the beneficial effect

of education on the CIWB weakened for the nations in this region over time and disappeared toward the end of the study period. This trend coincides with the aftermath of the Third-World debt crisis. In the mid-1980s, an economic crisis and the subsequent bailouts granted significant power to international financial institutions in setting the policies for many nations in the Latin America-Caribbean region. The strategies included market-liberalizing structural reforms and deep cuts in public spending (Babb 2013; Haggard and Kaufman 2018). These mandated reforms resulted in increased inequality, environmental degradation (McMichael 2012) and added to the intransigence of poverty rates for many nations in the region (Chen and Ravallion 2004). Looking at education specifically, in the aftermath of the crisis many affected countries exhibited a “secondary education deficit,” whereby abnormally low proportions of the population achieved some secondary education without going on to the tertiary level, compared to levels predicted by per capita GDP (De Ferranti et al. 2003). Interpreting the disappearance of the beneficial education effect on CIWB, with this attainment deficit, the long-term harmful impact of the debt crisis may have blunted the potential of education for enhancing wellbeing in the region.

In the MENA region, education was associated with a significantly lower predicted value for CIWB for the time points 1975 and 1980, when a 1 percent increase in education was associated with a 0.14 and 0.13 lower predicted value of CIWB, respectively. However, at the other time points, the effect was not significantly different

from 0. As the descriptive statistics graphed in Figure 3 illustrate, life expectancy for nations in the region jumped substantially, from 45 to 74 years, between 1960 and 2010, the largest absolute gain of all six world regions. Given this increase in human wellbeing, the absence of a persistent education effect is surprising. One potential explanation relates to the relative educational and political dysfunctionality, accompanied by high fossil fuel use within the region during this period. Between 1960 and 2010, educational attainment increased from just one year per capita to seven for the MENA nations included in this study. However, the average attainment rate in MENA in 2010 was still lower than in all but two of the other world regions (Figure 5). A World Bank study found attainment rates in MENA to be lower than other nations with similar levels of GDP outside the region (Mondiale 2008) during the study period. This outcome is striking, given that from 1965–2003, MENA governments spent an average of approximately 5 percent of their GDP on education. In contrast, East Asian and Latin American countries spent close to 3 percent (World Bank 2008). The comparatively lower rates of educational attainment, despite higher rates of investment, may be partly attributable to the dramatic rise in population for nations in this region compared to other parts of the world.

Additionally, some scholars have called attention to the inefficiencies in state spending during the regional economic boom years between 1960 and 1985. This misspending has been described as going largely unchecked within education and other

public sectors due to a lack of political accountability (Sirageldin 2002; Mondiale 2008). Further, autocrats in the region directed large portions of state resources towards inward-oriented uncompetitive businesses and redundant infrastructure, both of which were highly polluting (Rubin 2015). These activities and these nations' rates of fossil fuel use led to a doubling of carbon emissions in recent decades (Carboun 2018). The complicated interplay between economic dividends, fossil fuel production, redistributive social goods, and public accountability may help explain the mostly null finding between education and the CIWB for nations in this region.

For nations in the South Asia region, the magnitude of the desirable relationship between education and CIWB remained steady until 1995, when a 1 percent increase in per capita education was associated with a 0.28 percent decrease in CIWB. At each of the five-year intervals between 1995 and 2005, the beneficial effect of education on CIWB was substantially smaller than in 1960, though the coefficients remained below 0. The effect of education on CIWB in 2010 was not significantly different from the base year, suggesting that the magnitude of the desired effect was as large in 2010 as it was in 1960.

One potential explanation for the enduring relationship between education and CIWB in South Asia could be the reduction in child and maternal mortality rates in this region over the last 20 years of the study period. From 1990 to 2010, the under-five child mortality rate for nations in South Asia decreased from 129 to 67 deaths per 1,000 live

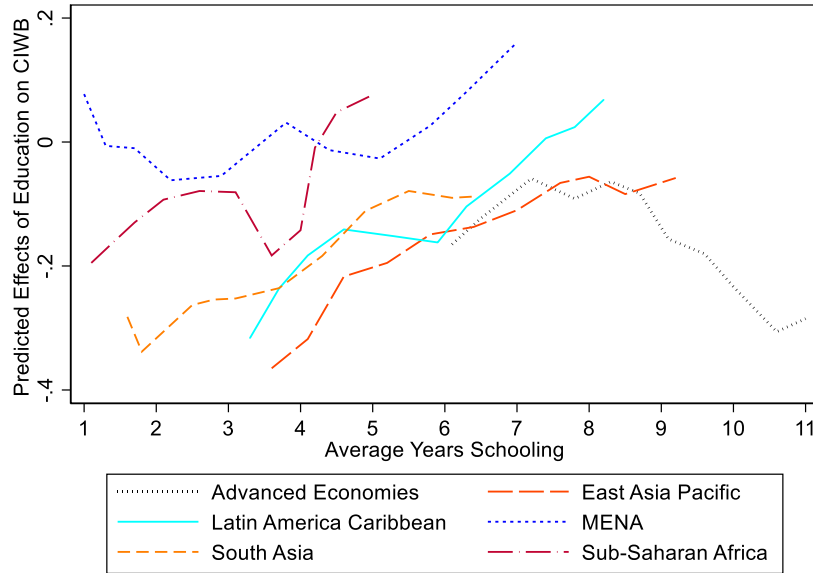
births (UNICEF 2012). Similarly, between 1990 and 2013, the maternal mortality rate per 100,000 live births dropped from 550 in 1990 to 190 in 2013, the most substantial reduction among the six world regions (El-Sahartynaoko and Ohno 2015). As discussed in the preceding literature review section, there is an established link between maternal education and lower rates of maternal and child deaths, which in turn enhances life expectancy—the denominator in the CIWB ratio. This explanation is consistent with the capabilities approach, which underscores the role of women’s education for a well-functioning society. Specifically, Sen notes; “women’s agency and voice, influenced by education and employment, can in turn influence the nature of public discussion on a variety of social subjects including fertility rates (not just in the family of the particular woman themselves) and environmental priorities” (Sen 1999:193).

For the nations in the sub-Saharan Africa region, a 1 percent increase in educational attainment was associated with a 0.2 percent decrease in CIWB in 1960. This effect remained constant for 10 years. Between 1970 and 1985, the magnitude of the predicted effect on CIWB declined by half but remained below 0. In contrast to nations in the other regional samples, between 1985 and 1995, the magnitude of the desired effect of education on CIWB grew. Specifically, in 1985, a 1 percent increase in education was associated with a 0.08 percent decrease in CIWB. In contrast, by 1990, the effect of education returned to 1960s levels, where a 1 percent increase in education was once more associated with a 0.2 lower predicted value of CIWB. However, during this period,

life expectancy for nations in the region decreased from 52.6 to 51.9. The stagnation in life expectancy during this period is attributable to, among other things, the HIV-AIDS epidemic (UNDP 2006). Thus, it seems that higher levels of national educational attainment may have played a protective role in the context of a regional public health epidemic. Between 1995 and 2000, the positive impact of education dramatically declined. Notably, the rate of educational attainment for nations in this region began to fall further behind all other regions, including both MENA and South Asia, post-1995, as Figure 5 illustrates. By the end of the study period, there was no observable attenuating effect of education on CIWB. The stagnation of educational attainment and the disappearance of the education effect on CIWB could be explained by a combination of factors, including population growth, debt repayments to international financial institutions, and ecological disasters, which have stymied progress in social institutions, most notably education access and quality for many nations in the region (Verspoor, Mattimore, and Watt 2001).

To further illustrate the relevance of regional and temporal context for the relationship between educational attainment and CIWB, Figure 8 plots the elasticity coefficients for the estimated impact of per capita years of education on the CIWB against average years of education.

Figure 8. Elasticity Coefficients for the Estimated Effect of per-capita Years of Education on the CIWB by Years of Education (controlling for GDP)



For advanced economies, a negative (desirable) relationship between education and CIWB was present at every time point. It increased in magnitude after 9 years of per capita education, with the most substantial effect observed at approximately 11 years. By contrast, the (desirable) impact of education on CIWB in sub-Saharan Africa peaked at less than four years of education, then quickly became null. By just five years of per capita educational attainment, an undesirable relationship develops between education and CIWB, whereby gains in education are associated with a higher CIWB. Despite the heterogeneity in many of these trajectories, the estimated effect of education on CIWB at six years of education, approximately primary schooling, is very similar for East Asia-

Pacific, South Asia, Latin America–Caribbean, and for the advanced economies. This cohesion is striking, considering the differing temporal, economic, and social conditions for these regional samples of nations, even when education attainment rates overlap.

2.5 CONCLUSION

The various nations in this study followed unique economic, social, and ecological trajectories between 1960 and 2010. However, their regional groupings suggest that gains in educational attainment have played an essential role in reducing the carbon intensity with which nation-states produce wellbeing for their citizens. These results support the central thesis put forward by Sen and the capabilities approach: it is how a nation-state invests the “fruits of its prosperity” that matters for economic, social, and environmental wellbeing.

More specifically, these findings suggest that investments in raising national educational attainment rates have helped to lower the carbon intensity with which nations produced wellbeing for their citizens, in some contexts. However, the magnitude of this beneficial effect differs, depending on regional and temporal contexts. The findings also suggest a diminishing beneficial effect of education on CIWB over time for the majority of the regional samples of nations. These associations may be partly explained by potential ceiling effects in both life expectancy and education measures. However, the desired impact of education on CIWB in advanced economies at the end of the study

period, when both life expectancy and educational attainment levels are highest, contradicts that conclusion. Moreover, the desirable relationship between education and CIWB disappears at just four years of education in sub-Saharan Africa—well below any ceiling in potential educational attainment.

Looking more closely at the unique downward trend exhibited among advanced economies, it may be that in nations with high levels of attainment, education is functional for a reduction in CIWB through a pathway of carbon emissions reduction, as ecological modernization theory suggests. However, such a conclusion must be situated within a broader context of global trade and production networks (Givens 2018). This potential explanation is explored in more detail in chapter three.

As Figure 8 shows, the point and rate of decline in the education effect are different for each region. For example, in sub-Saharan Africa, the effect of education disappeared at levels of educational attainment far lower than in other world regions. This finding underscores the complex web of historical, geopolitical, economic, and cultural factors that contribute to how intensely from an environmental perspective, a nation produces wellbeing for its citizens.

In the next chapter, I explore how national and global economic factors may determine the nature of the relationship between education and sustainability. First, I explore if the nature of the association observed between per-capita educational

attainment and CIWB depends on a nations' level of economic development. Then, I also explore if integration into the global trade system, as measured exports as a percent of GDP, moderates the relationship between education and CIWB. Perspectives on global integration theoretically inform this inquiry, namely: world society and global political economy.

REFERENCES

- Allison, Paul D. 2009. *Fixed Effects Regression Models*. Vol. 160. SAGE publications.
- Anand, Sudhir, and Till Bärnighausen. 2004. "Human Resources and Health Outcomes: Cross-Country Econometric Study." *The Lancet* 364(9445):1603–1609.
- Arendt, Jacob Nielsen. 2005. "Does Education Cause Better Health? A Panel Data Analysis Using School Reforms for Identification." *Economics of Education Review* 24(2):149–160.
- Arnove, Robert F. 1980. "Comparative Education and World-Systems Analysis." *Comparative Education Review* 24(1):48–62.
- Babb, Sarah. 2013. "The Washington Consensus as Transnational Policy Paradigm: Its Origins, Trajectory and Likely Successor." *Review of International Political Economy* 20(2):268–297.
- Barro, Robert J., and Jong Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." *Journal of Development Economics* 104:184–98.
- Carboun 2018. "Climate Change in the Middle East and North Africa: Carbon Intensity." accessed May 2019. <http://www.carboun.com/infographics/climate-change-in-the-middle-east-and-north-africa-carbon-intensity> EN_13Mar2012.pdf.

- Chen, Shaohua, and Martin Ravallion. 2004. "How Have the World's Poorest Fared Since the Early 1980s?" *The World Bank Research Observer* 19(2):141–169.
- Clark, Shelley, Judith Bruce, and Annie Dude. 2006. "Protecting Young Women from HIV/AIDS: The Case against Child and Adolescent Marriage." *International Family Planning Perspectives* 32(2):79–88.
- Coleman, James S. 2000. "Social capital in the creation of human capital." In *Knowledge and Social Capital: Foundations and Applications*, edited by Lesser, E., pp. 17–41.
- Collins, Randall. 1971. "Functional and Conflict Theories of Educational Stratification." *American Sociological Review* 1002–19.
- De Ferranti, David, Guillermo E. Perry, Indermit Gill, J. Luis Guasch, William F. Maloney, Carolina Sánchez-Páramo, and Norgert Schady. 2003a. *Closing the Gap in Education and Technology*. The World Bank.
- Dietz, Thomas, and Andrew K. Jorgenson. 2014. "Towards a New View of Sustainable Development: Human Wellbeing and Environmental Stress." *Environmental Research Letters* 9(3):031001.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2007. "Driving the Human Ecological Footprint." *Frontiers in Ecology and the Environment* 5(1):13–18.

- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2009. "Environmentally Efficient Wellbeing: Rethinking Sustainability as the Relationship between Human Wellbeing and Environmental Impacts." *Human Ecology Review* 16(1):114–23.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2012. "Environmentally Efficient Wellbeing: Is There a Kuznets Curve?" *Applied Geography* 32(1):21–28.
- Dryzek, John S. 2013. *The Politics of the Earth: Environmental Discourses*. OUP Oxford.
- Eide, Eric R., and Mark H. Showalter. 2011. "Estimating the Relation between Health and Education: What Do We Know and What Do We Need to Know?" *Economics of Education Review* 30(5):778–791.
- El-Saharty, S., and N. Ohno. 2015. "South Asia's Quest for Reduced Maternal Mortality: What the Data Show." *World Bank Group*. Retrived November 29:2017.
- Gakidou, Emmanuela, Krycia Cowling, Rafael Lozano, and Christopher J.L. Murray. 2010. "Increased Educational Attainment and Its Effect on Child Mortality in 175 Countries between 1970 and 2009: A Systematic Analysis." *The Lancet* 376(9745):959–974.
- Givens, Jennifer E. 2015. "Urbanization, Slums, and the Carbon Intensity of Wellbeing: Implications for Sustainable Development." *Human Ecology Review* 22(1):107–28.

- Givens, Jennifer E. 2017. "World Society, World Polity, and the Carbon Intensity of Wellbeing, 1990–2011." *Sociology of Development* 3(4):403–35.
- Givens, Jennifer E. 2018. "Ecologically Unequal Exchange and the Carbon Intensity of WellBeing, 1990–2011." *Environmental Sociology* 4(3):311–24.
- Goesling, Brian. 2007. "The Rising Significance of Education for Health?" *Social Forces* 85(4):1621–1644.
- Haggard, Stephan, and Robert R. Kaufman. 2018. *The Politics of Economic Adjustment: International Constraints, Distributive Conflicts and the State*. Princeton University Press.
- Helliwell, John F., and Robert D. Putnam. 1999. *Education and Social Capital*. National Bureau of Economic Research.
- Holden, Erling, Kristin Linnerud, David Banister, Valeria Jana Schwanitz, and August Wierling. 2017. *The Imperatives of Sustainable Development: Needs, Justice, Limits*. Routledge.
- Hoyert, Donna L., and Jiaquan Xu. 2012. "Deaths; Preliminary Data for 2011."
- Huang, Xiaorui. 2018. "Ecologically Unequal Exchange, Recessions, and Climate Change: A Longitudinal Study." *Social Science Research* 73:1–12.

- Ikeda, Nayu, Eiko Saito, Naoki Kondo, Manami Inoue, Shunya Ikeda, Toshihiko Satoh, Koji Wada, Andrew Stickley, Kota Katanoda, and Tetsuya Mizoue. 2011. "What Has Made the Population of Japan Healthy?" *The Lancet* 378(9796):1094–1105.
- Jain, Saranga, and Kathleen Kurz. 2007. *New Insights on Preventing Child Marriage: A Global Analysis of Factors and Programs*. International Center for Research on Women (ICRW).
- Jayachandran, Seema, and Adriana Lleras-Muney. 2009. "Life Expectancy and Human Capital Investments: Evidence from Maternal Mortality Declines." *The Quarterly Journal of Economics* 124(1):349–397.
- Jorgenson, Andrew A., and James Rice. 2005. "Structural Dynamics of International Trade and Material Consumption: A Cross-National Study of the Ecological Footprints of Less-Developed Countries." *Journal of World-Systems Research* 11(1):57–77.
- Jorgenson, Andrew K. 2003. "Consumption and Environmental Degradation: A Cross-National Analysis of the Ecological Footprint." *Social Problems* 50(3):374–394.
- Jorgenson, Andrew K. 2005. "Unpacking International Power and the Ecological Footprints of Nations: A Quantitative Cross-National Study." *Sociological Perspectives* 48(3):383–402.

- Jorgenson, Andrew K. 2012. "The Sociology of Ecologically Unequal Exchange and Carbon Dioxide Emissions, 1960–2005." *Social Science Research* 41(2):242–252.
- Jorgenson, Andrew K. 2014. "Economic Development and the Carbon Intensity of Human Wellbeing." *Nature Climate Change* 4(3):186–89.
- Jorgenson, Andrew K., and Brett Clark. 2011. "Societies Consuming Nature: A Panel Study of the Ecological Footprints of Nations, 1960–2003." *Social Science Research* 40(1):226–244.
- Jorgenson, Andrew K., and Brett Clark. 2012. "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005." *American Journal of Sociology* 118(1):1–44.
- Jorgenson, Andrew K., and Jennifer Givens. 2015. "The Changing Effect of Economic Development on the Consumption-Based Carbon Intensity of Wellbeing, 1990–2008." *PLOS ONE* 10(5):e0123920.
- Jorgenson, Andrew K., and Thomas Dietz. 2015. "Economic Growth Does Not Reduce the Ecological Intensity of Human Wellbeing." *Sustainability Science* 10(1):149–56.

- Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. "Inequality, Poverty, and the Carbon Intensity of Human Wellbeing in the United States: A Sex-Specific Analysis." *Sustainability Science* 13(4):1167–74.
- Karlsen, Saffron, Lale Say, João-Paulo Souza, Carol J. Hogue, Dinorah L. Calles, A. Metin Gülmezoglu, and Rosalind Raine. 2011. "The Relationship between Maternal Education and Mortality among Women Giving Birth in Health Care Institutions: Analysis of the Cross Sectional WHO Global Survey on Maternal and Perinatal Health." *BMC Public Health* 11(1):606.
- Lesser, Eric L. 2000. *Knowledge and Social Capital: Foundations and Applications*. Routledge.
- Longo, Stefano B., Brett Clark, Thomas E. Shriver, and Rebecca Clausen. 2016. "Sustainability and Environmental Sociology: Putting the Economy in Its Place and Moving toward an Integrative Socio-Ecology." *Sustainability* 8(5):437.
- Mankiw, N. Gregory, David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics* 107(2):407–437.
- Marmot, Michael. 2005. "Social Determinants of Health Inequalities." *The Lancet* 365(9464):1099–1104.

- Mayer, Adam. 2013. "Education and the Environment: An International Study." *International Journal of Sustainable Development & World Ecology* 20(6):512–519.
- Mayer, Adam. 2017. "Democratic Institutions and the Energy Intensity of Wellbeing: A Cross-National Study." *Energy, Sustainability and Society* 7(1):36.
- McAlister, C., and T. F. Baskett. 2006. "Female Education and Maternal Mortality: A Worldwide Survey." *Journal of Obstetrics Gynaecology Canada* 28.
- McMichael, Philip. 2012. *Development and Social Change: A Global Perspective*. Sage Publications.
- Meara, Ellen R., Seth Richards, and David M. Cutler. 2008. "The Gap Gets Bigger: Changes in Mortality and Life Expectancy, by Education, 1981–2000." *Health Affairs* 27(2):350–360.
- Mol, Arthur P. J. 2002. "Ecological Modernization and the Global Economy." *Global Environmental Politics* 2(2):92–115.
- Mol, Arthur PJ, Gert Spaargaren, and David A. Sonnenfeld. 2013. "Ecological Modernization Theory: Taking Stock, Moving Forward." Pp. 31–46 in *Routledge international handbook of social and environmental change*. Routledge.

- Mol, Arthur PJ. 2001. *Globalization and Environmental Reform: The Ecological Modernization Of the Global Economy*. Cambridge, MA: MIT Press.
- Mondiale, Banque. 2008. "The Road Not Traveled: Education Reform in the Middle East and North Africa." MENA Development Report Washington DC.
- Nilsson, Maans, Dave Griggs, and Martin Visbeck. 2016. "Policy: Map the Interactions between Sustainable Development Goals." *Nature News* 534(7607):320.
- Nilsson, Maans, Elinor Chisholm, David Griggs, Philippa Howden-Chapman, David McCollum, Peter Messerli, Barbara Neumann, Anne-Sophie Stevance, Martin Visbeck, and Mark Stafford-Smith. 2018. "Mapping Interactions between the Sustainable Development Goals: Lessons Learned and Ways Forward." *Sustainability Science* 13(6):1489–1503.
- Nussbaum, M. C. 2004. "Women's Education: A Global Challenge." *Signs* 29.
- Nussbaum, Martha C. 2010. "Democracy, Education, and the Liberal Arts: Two Asian Models." *UC Davis L. Rev.* 44:735.
- Nussbaum, Martha, and Amartya Sen. 1993. *The Quality of Life*. Oxford University Press.
- Patrinos, H. A., and C. E. Montenegro. 2014. "Comparable Estimates of Returns to Schooling around the World (No. 7020)." *Washington, DC; Education Global Practice Group, World Bank Group*.

- Pongiglione, Francesca. 2015. "The Need for a Priority Structure for the Sustainable Development Goals." *Journal of Global Ethics* 11(1):37–42.
- Psacharopoulos, George. 1972. "Rates of Return to Investment in Education around the World." *Comparative Education Review* 16(1):54–67.
- Psacharopoulos, George. 1985. "Returns to Education: A Further International Update and Implications." *Journal of Human Resources* 583–604.
- Purvis, Ben, Yong Mao, and Darren Robinson. 2019. "Three Pillars of Sustainability: In Search of Conceptual Origins." *Sustainability Science* 14(3):681–95.
- Redclift, Michael. 1988. "Sustainable Development and the Market: A Framework for Analysis." *Futures* 20(6):635–650.
- Redclift, Michael. 2005. "Sustainable Development (1987–2005): An Oxymoron Comes of Age." *Sustainable Development* 13(4):212–227.
- Rice, James. 2007. "Ecological Unequal Exchange: Consumption, Equity, and Unsustainable Structural Relationships within the Global Economy." *International Journal of Comparative Sociology* 48(1):43–72.
- Richards, Esther, Sally Theobald, Asha George, Julia C. Kim, Christiane Rudert, Kate Jehan, and Rachel Tolhurst. 2013. "Going beyond the Surface: Gendered Intra-Household

Bargaining as a Social Determinant of Child Health and Nutrition in Low and Middle Income Countries.” *Social Science & Medicine* 95:24–33.

Ross, Catherine E., and Wei Zhang. 2008. “Education and Psychological Distress among Older Chinese.” *Journal of Aging and Health* 20(3):273–289.

Rubin, Barry. 2015. *The Middle East: A Guide to Politics, Economics, Society and Culture*. Routledge.

Sen, Amartya. 1997. *Resources, Values, and Development*. Harvard University Press.

Sen, Amartya. 1999. *Development as Freedom*. Oxford University Press.

Sen, Amartya. 2013. “The Ends and Means of Sustainability.” *Journal of Human Development and Capabilities* 14(1):6–20.

Shwom, Rachael L. 2011. “A Middle Range Theorization of Energy Politics: The Struggle for Energy Efficient Appliances.” *Environmental Politics* 20(5):705–726.

Sirageldin, Ismail Abdel-Hamid. 2002. *Human Capital: Population Economics in the Middle East*. American University of Cairo Press.

- Spaargaren, Gert, and Arthur P.J. Mol. 1992. "Sociology, Environment, and Modernity: Ecological Modernization as a Theory of Social Change." *Society & Natural Resources* 5(4):323–344.
- Speizer, Ilene S., and Erin Pearson. 2011. "Association between Early Marriage and Intimate Partner Violence in India: A Focus on Youth from Bihar and Rajasthan." *Journal of Interpersonal Violence* 26(10):1963–1981.
- Sweidan, Osama D. 2018. "Economic Performance and Carbon Intensity of Human WellBeing: Empirical Evidence from the MENA Region." *Journal of Environmental Planning and Management* 61(4):699–723.
- Thombs, Ryan. 2018. "The Transnational Tilt of the Treadmill and the Role of Trade Openness on Carbon Emissions: A Comparative International Study, 1965–2010." *Sociological Forum* 33(2):422–42.
- Tilak, Jandhyala BG. 2001. *Building Human Capital in East Asia: What Others Can Learn*. World Bank Institute.
- Ul Haq, Mahbub, and Khadija Haq. 1998. *Human Development in South Asia 1998*. Oxford University Press.

- UNDP. 1990. Human Development Report 1990: Concept and Measurement of Human Development New York. Retrieved December 14, 2019. <http://hdr.undp.org/hdr2006/>.
- UNICEF 2012 *The State of the World's Children 2012: Children in an Urban World*. eSocialSciences, 2012. Retrieved May 30, 2018. http://www.unicef.org.proxy.bc.edu/sowc2012/pdfs/SOWC2012-MainReport_
- United Nations 2015. *70/1. Transforming our world: the 2030 Agenda for Sustainable Development- General Assembly, Resolution A. RES/70/1*. New York, USA:
- United Nations Development Program (UNDP). 2006. "Human Development Report 2006: Beyond scarcity: Power, poverty, and the global water crisis. New York. Retrieved May 2018. <http://hdr.undp.org/hdr2006/>.
- Verspoor, Adriaan, Angel Mattimore, and Patrick Watt. 2001. *A Chance to Learn: Knowledge and Finance for Education in Sub-Saharan Africa*. The World Bank.
- World Commission on Environment and Development (WCED), SPECIAL WORKING SESSION. 1987. "Our Common Future" 17:1–91.
- Weber, Thomas. 1998. *Hugging the Trees: The Story of the Chipko Movement*. New Delhi: Viking

- Wooldridge, Jeffrey M. 2005. "Introductory Econometrics a Modern Approach 3rd Edition."
Cincinnati: South-Western College Publishers.
- World Bank World Development Indicators. 2010. Retrieved April 5, 2017.
<http://databank.worldbank.org/data/home.aspx>.
- Yakovlev, Pavel, and Susane Leguizamon. 2012. "Ignorance Is Not Bliss: On the Role of
Education in Subjective Wellbeing." *The Journal of Socio-Economics* 41(6):806–815.
- Yohannan, Alina. 2016. "The Standing Rock Sioux Indians: An Inconvenience for the Black
Gold." *Journal. Land & Dev.* 6:19.
- York, Richard, Eugene A. Rosa, and Thomas Dietz. 2003. "Footprints on the Earth: The
Environmental Consequences of Modernity." *American Sociological Review* 68(2):279–
300.
- Zahran, Sammy, Eunyi Kim, Xi Chen, and Mark Lubell. 2007. "Ecological Development and
Global Climate Change: A Cross-National Study of Kyoto Protocol Ratification." *Society
and Natural Resources* 20(1):37–55.

3 GLOBAL SYSTEMS, EDUCATIONAL ATTAINMENT, AND CIWB

3.1 INTRODUCTION

The human causes and consequences of the climate crisis have accentuated nations' social, economic, and ecological interdependencies. Likewise, the scientific community emphasizes that national pledges are not enough to protect us from the worst effects of climate change. Combatting the environmental crisis, while raising the standard of living of those living in poverty, requires a cohesive global response that integrates transformative systemic change with sustainable development (Intergovernmental Panel on Climate Change (IPCC) (2018)).

There is an extensive corpus of sociological scholarship dedicated to understanding the implications of global structures, such as cultures, institutions, and economies, for national societies. These perspectives can help us better understand the structural causes of the climate crisis. For example, scholars informed by global political economy perspectives highlight that global structural inequalities shape national and subnational human and environmental outcomes (Wallerstein 1974; Bunker 1984; Chase-Dunn and Hall 1997). Whereby those nations disadvantaged by their position in the global hierarchy can be detrimentally impacted by increased integration into the world economy (Grimes and Kentor 2003; Jorgenson 2005; Jorgenson 2006; Brady, Kaya, and Beckfield 2007).

Global and transnational perspectives can also provide insight into the origins, form, and utility of sustainability policy. For example, the world society tradition proposes that global cultural scripts, rooted in ideals of socioeconomic progress, human development, and environmentalism, increasingly shape the structure and policies of nation-states (Meyer, Boli Thomas, and Ramirez 1997a). While this perspective does not propose that the mere existence of this global culture results in a universal implementation of human rights and environmental protection¹¹, integration into the world society can lead to a diffusion of these norms at the national and sub-national levels.

In this chapter, I add to this growing field of literature, integrating political economy and world culture perspectives to understand better global processes and their implications for sustainability (Jorgenson 2009a; Jorgenson, Dick, and Shandra 2011; Shorette 2012 Longhofer and Jorgenson 2017). I add to the literature by comparing these traditions' perspectives on the role of increased per capita educational attainment for promoting human and environmental wellbeing. Both perspectives have, to some extent, theorized the role of education from a global-transnational perspective. For example,

¹¹ The impacts depend on state level conditions and the strength of ties to international regimes. See Shorette et al. 2017 for discussion.

those in the world society perspective tend to use the convergence in organizational form and institutional objectives of educational institutions, as well as the growth in educational attainment rates, as evidence of the influence of a standardizing world model (Meyer, Ramirez, and Soysal 1997). Per this perspective, educational institutions can act as receptor and diffusion sites for ideals of human rights and environmentalism (Frank et al. 1997; Frank, Hironaka, and Schofer 2000, Schofer and Hironaka 2005; Meyer, Ramirez, Frank, and Schofer 2007; Bromley, Meyer, and Ramirez 2011a; 2011b).

On the other hand, political economy scholars, particularly those informed by the world-systems perspective, emphasize that mass education and standardized curricula and international educational association are best understood when situated within the capitalist system of production and the associated global division of labor (Arnove 1980; Wallerstein 1984; Ginsburg 1991; Clayton 1998, 2004; Griffiths and Arnove 2015). Environmental sociologists have illustrated that the entrenchment of this global capitalist hierarchy has compromised both human (Jorgenson 2009a; Jorgenson 2009b; Jorgenson et al., 2009; Jorgenson & Rice, 2005; Rice, 2007, 2008) and environmental outcomes (Jorgenson 2006, 2010, 2011, 2012; Givens and Jorgenson 2014; Roberts and Parks 2007; Jorgenson and Clark 2009, 2012; Shandra et al. 2009, 2009b) in many contexts.

To help advance these theoretical perspectives and research, and especially work that attempts to integrate them, I test the relationship between national-level education

and sustainability using longitudinal modeling techniques. Specifically, I assess whether i) the expansion of mass education, measured in terms of average years of educational attainment or the percentage of the population with a college degree, is associated with more sustainable outcomes, as the world society perspective might predict; ii) if this relationship varies across the low-, middle-, and high-income nations; iii) if nations' level of integration into the global economy moderates the nature of the relationship between education and sustainability, as we might expect from a political economy perspective.

Consistent with the previous chapter, I use the carbon intensity of wellbeing (CIWB) as my sustainability outcome. This ratio, first used by Jorgenson (2014) and closely related to other sustainability metrics (Dietz, Rosa, and York 2012), measures the carbon costs of increasing human wellbeing through a ratio of per capita carbon emissions/life expectancy. It is a widely used metric of sustainability across the field of environmental sociology and sustainability science more generally (Jorgenson 2014, 2015; Jorgenson, Dietz, and Kelly 2018; Jorgenson and Givens 2015; Givens 2015, 2017, 2018; Mayer 2017; Sweidan 2017, Kelly 2020). This variable allows us to understand better how features of a given society, such as the economy or educational profile, simultaneously impact human and environmental wellbeing (Dietz and Jorgenson 2014; Jorgensen and Dietz 2015). Such integrative approaches are critical to the scholarship that seeks to understand how societies can meet their own needs without compromising the ability of future generations to do the same. The approach also provides a valuable

opportunity to integrate insights from literature dedicated to examining the relationship between a particular societal characteristic — in this case, education— and human wellbeing with scholarship focused on the relationship between the same societal feature and environmental outcomes.

The chapter proceeds as follows; I provide an overview of world society and global political economy scholarship on the relationship between education and human and environmental outcomes. Then, I outline data sources, descriptive statistics, and the chapter methodology. The next section details the results from the estimated statistical models. The penultimate section discusses the implications of these findings for the theoretical perspectives that inform the analysis. In the conclusion section, I summarize the findings. Study limitations and suggestions for future research are discussed in the final chapter of this dissertation.

3.2 WORLD SOCIETY PERSPECTIVES

The world society tradition explores the extent to which a global culture and associated processes shape nation-states' identities, behaviors, and structures. From this perspective, states are subject to influence from exogenous world culture, thereby leading to increasing homogeneity in the structures and policies of nation-states. This culture is theorized to reflect liberal understandings of the universalistic rights and obligations of

individuals, progress, environmentalism, and the role of the state for the rational ordering of society (Ramirez and Boli 1987; Meyer et al. 1997a).

3.2.1 World Society and Education

World society theory developed mainly through an analysis of the rapid expansion and structuration of mass schooling (Meyer 1977; Meyer, Ramirez, Rubinson and Boli-Bennett 1977; Boli, Ramirez, and Meyer 1985; Meyer, Ramirez, and Soysal 1992; Schofer and Meyer 2005). Therefore, the perspective provides a useful theoretical lens for considering the link between educational attainment and sustainability. In early studies within this tradition, Meyer and colleagues empirically assess a variety of possible explanations for the large-scale expansion of educational systems in the post-World War II era. They find that national factors such as history, expenditures, and political regimes do not provide an adequate explanation for this trend. The authors conclude that the expansion in educational attainment is explained best by both the intensification of the nation-state principle and the centrality of mass education to the global model of the nation-state (Meyer et al. 1977; Boli et al. 1985). These scholars offer the cross-national standardization in school curricula, teaching, learning, and assessment (Meyer, Kamens, and Benavot 1992; Meyer, Bromley, and Ramirez 2010), and the convergence in enrollment rates in tertiary education (Schofer and Meyer 2005; Schofer,

Ramirez, and Meyer 2007), despite different national contexts, as proof of the growing influence of world society.

3.2.2 World Society and the Environment

Similarly, world society theorists see the growth in attention, resources, and organizations dedicated to environmentalism as accompanying the rising influence of global society (Meyer et al. 1997a; Meyer et al. 1997b; Frank, Hironaka, and Schofer 2000). By contrast, this perspective proposes differing pathways through which the influence of world culture on education and environmentalism diffuse. On the one hand, these theorists argue that the expansion of mass education broadly aligns with the agenda of, and therefore is implemented by national technocrats who adhere to myths of progress and rationalization. The alignment of priorities and values across national contexts is cited as an essential factor in explaining the rapid structuration of education as an institution (Meyer et al. 1992).

On the other hand, these theorists credit international non-governmental organizations (INGOs) with the construction of the global environmental regime and the diffusion of environmentalism (Meyer et al. 1997b; Boli and Thomas 1997,1999; Frank et al. 2000). In a foundational text, Meyer et al. (1997b) argue that the rise of global environmental organizations facilitated the worldwide expansion of both scientific discourses on the environment and national environmental associations. In turn, the

organizations facilitated the adoption of environmental treaties by nation-states and the establishment of intergovernmental organizations such as environmental commissions within the UN. From this perspective, the world environmental regime, therefore, can be understood as being part of the architecture of the rationalized world culture, whereby environmentalism will diffuse most quickly in those nations most embedded within the world society.

Consistent with broader neo-institutionalist theory, Boli and Thomas (1999) propose that while INGO's play an essential role in the diffusion of environmental norms and policies, over time, the cultural norms become embedded in national social organizations. Similarly, others have highlighted that the spread of environmentalism at the national level is not inevitable but instead relies on national actors and institutions to allow environmental problems to be defined as social problems and commit resources towards solutions (Hironaka, 2014; Shorette et al. 2017). Analogously, Cole (2015) reveals the vital role of state institutions in mediating the effect of world cultural norms on national human rights standards.

The world society perspective considers the role of the social institution of education for the diffusion of environmentalism in two ways. First, Boli and Thomas (1985) find that INGO participation closely correlated with educational expansion. In this way, access to education may facilitate the spread of INGOs, which, in turn, enables the

spread of environmentalism. Second, more recent literature explores the possibility that educational institutions themselves, and the associated university-educated experts, play an essential role in the spread of global cultural scripts, including those related to environmentalism (Meyer et al. 2007, Meyer 2009). For example, Schofer and Hironaka argue that the penetration of “Western-style education systems and scientific professionals are increasingly implicated as "receptor sites" and carriers of world culture and norms, and their incorporation of pro-environmental views represents an essential form of penetration” (2005:30). Further, Frank et al. (2011) find that the rise in environmental education in universities is explained best by top-down causal mechanisms¹², whereby universities’ growing embrace of environmental education coincides with the growth in understandings of the substance and significance of the human-nature relationship in other global institutions. Likewise, in a cross-national analysis Bromley et al. (2011a) find increased attention to the environment in high school textbooks parallels both world environmental crises and the closely related rise of world environmentalism.

¹² These mechanisms are operationalized in the study as the number of memberships in environmental INGOs and measured as the number of years a state’s national scientific body has belonged to the International Council of Scientific Unions) in each nation state

In a well-known critique of this perspective, Buttel (2000) asks if world society integration makes a difference in environmental outcomes. Partly in response to this critique, a new stream of research within this tradition tests the effect of the world society, often operationalized as INGO or EINGO presence, on environmental outcomes (Schofer and Hironaka 2005; Jorgenson et al. 2011; Hironaka 2014). For example, Schofer and Hironaka (2005) find that national policies tend to be most beneficial to environmental outcomes when institutions are highly structured, and when subnational actors, such as individuals and NGOs, are regularly exposed to world society, and its associated rationalistic culture. Other studies within environmental sociology find that world society integration mitigates other forms of environmental harms including carbon dioxide emissions, deforestation, organic water pollution, and synthetic fertilizer and pesticide use (Jorgenson, 2007; Shandra, 2007; Jorgenson et al. 2011; Shorette, 2012; Longhofer and Jorgenson, 2017). For example, in a recent study, Longhofer and Jorgenson (2017) find that the problematic relationship between economic growth and greenhouse gas emissions weakens modestly over time for countries more embedded in world society. Of particular relevance to this study, Givens (2017) finds that world society integration is associated with a reduction in CIWB. However, this relationship only holds in more economically developed nations, and only when using the production measure for CO₂ emissions.

3.3 POLITICAL ECONOMY PERSPECTIVES

While world society scholars focus on the effect of world culture on the structure and actions of nations states, political economy scholars focus on the exploitative nature of the global economy. In particular, the world-systems perspective focuses on how a nations' relative position within the global economic system shapes differences in nations' social and environmental outcomes (Chase-Dunn and Hall 1993). The perspective introduces the terms "core," "periphery," and later "semi-periphery" to classify economic zones and variable positions within the capitalist world system over time¹³. These concepts are relational whereby the profitability of production in a core region is often dependent on an exploitative economic human and ecological resource exchange with a state that hosts periphery production. Rooted in classical Marxist and Weberian theory, this perspective characterizes nation-state governments as acting as agents of the global economic elites (Chase-Dunn and Hall 1993; Chase-Dunn 1998).

¹³ According to this perspective, the hierarchical statuses in the global economic system facilitate an unequal exchange of goods and services, whereby "much of the surplus-value extracted in the peripheral zones of the world-economy is transferred to the core zones." (Wallerstein 1984 p.15).

The world-system's emphasis on the unequal impact of core-based production and consumption on the natural environment in non-core regions informed the development of the theory of ecologically unequal exchange (EUE). The theory posits that economically powerful actors within the global system restrict developing countries' economies to raw material extraction and export, perpetuating the colonially rooted system of unequal exchange of labor and nature (Bunker 1984; Bunker and Ciccantell 2005; Clark and Foster 2009; Givens, Huang, and Jorgenson 2019). Not only does this power asymmetry allow wealthy nations to profit from other national environmental assets, but extraction and waste dumping also allow the powerful to increase national consumption levels without significantly affecting their intra-national environmental burdens (Hornborg 2009; Rice 2007; Roberts and Parks 2007).

3.3.1 Political Economy and Education

The world-systems perspective, as a global political economy orientation, has directly critiqued consensus perspectives on both the rise of mass education and its implications for human wellbeing. Of particular relevance for this study, Wallerstein is attentive to the roles of dominant knowledge systems in producing the ideological conditions necessary for such a system to persist. He emphasizes that core states “legitimize their role in the interstate system” through the “imposition of modes of thought and analysis (Wallerstein 1984:17) and further stresses the “subtle and effective”

role of education for the perpetuation of perception of an achieved status system (155). From this perspective, scientific universalism is the latest iteration of European universalism, which is used as an ideological and moral framework to legitimate the invasion and other forms of intervention by those groups with power in the world system (Wallerstein 2001, 2006).

The application of this perspective to the subfield of comparative education began with Robert Arnove (1980), who argued that the development, or underdevelopment, of human capital viz. national educational attainment could be best understood within this broader historical global economic context and the associated global division of labor. According to this perspective on education, the stratified global political economy determines what skills are developed in whom, and who benefits from national talent. National education priorities, particularly at the upper levels, tend to be heavily influenced by international aid and lending networks through the provisions of loans and technical assistance, which reproduces intra- and international inequalities (Arnove 1980; 2003). Many scholars applied this theory to comparative education research during the 1980s. In a summary of the world-system perspective on comparative education, Clayton (1998) notes that researchers within this tradition have contended that educational assistance from the core to periphery regions served as a form of “intellectual socialization” (Samoff 1993 as quoted in Clayton 1998) that supports the expansion of global capitalist system through financial assistance (Keith 1978), curriculum reform and

the training and enculturation of in-country “indigenous experts” (Berman 1983). Accordingly, through these mechanisms, national education systems in low- and middle-income countries act as an international credentialing and stratifying force for the global economy. This strand of literature portrays the nation-state as balancing conflicting national public and global capitalist interests. From the world-systems perspective on education, then, gains in human wellbeing associated with higher rates of educational attainment may depend on a nation’s location within the world-economy.

3.3.2 Political Economy and the Environment

The world-systems perspective is also applied as a critical lens for understanding global environmental degradation, which, from this perspective, can be understood as both a cause and consequence of underdevelopment in non-core regions (Bunker 1984; Chase-Dunn and Hall 1997; Boswell and Chase-Dunn 2000; Burns, Kentor, and Jorgenson 2003). For example, in a cross-national analysis, Jorgenson (2003) estimates the direct, indirect, and total effects of a world-system position, domestic inequality, urbanization, and literacy rates on a nation’s ecological footprint. The author finds that degradation associated with high levels of consumption is displaced spatially to less developed areas, a situation termed the consumption/degradation paradox. Notably, in this and a related study (Jorgenson 2005), the author finds that the ecological footprint of nations is positively associated with literacy rates, net of various political-economic

factors. However, this kind of association is not consistent in the literature (Dietz, Rosa, and York 2007).

Similarly, empirical testing of the theory of ecological unequal exchange has linked unequal global economic integration with a host of problematic environmental outcomes, including nations' carbon emissions (Roberts and Parks 2007; Jorgenson 2011, 2012; Givens and Jorgenson 2014), ecological footprints (Jorgenson 2009; Jorgenson and Clark 2009, 2011), biodiversity loss (Shandra et al. 2009b), deforestation (Shandra et al. 2009a; Jorgenson 2006, 2010), water pollution (Shandra et al. 2009c; Jorgenson 2009b) and agrochemical use (Jorgenson and Kuykendall 2008; Shorette 2012). Research on the effects of the power-laden global political economy illustrates that the effects are not just environmental. Countries disadvantaged by their positions in the global economic hierarchy have suppressed resource consumption (Jorgenson and Rice 2005; Rice 2007, 2008; Jorgenson 2009b; Jorgenson et al., 2009) which in turn compromises health outcomes, such as maternal mortality (Rice 2008) and infant mortality rates (Jorgenson 2009a).

Particularly relevant to the focus of this study, Givens (2018) finds that uneven integration into global trade and uneven trade relationships affect the CIWB of nations. The author finds that the nature of the association between trade relations and CIWB varies by nations' level of development. Consistent with the theory of ecological unequal

exchange, the author finds that there is an undesirable impact on the CIWB of low-income countries when they engage in export relationships with high-income countries. On the other hand, higher trade integration can have beneficial impacts on the CIWB of high-income countries. Given these findings, it is possible that the global political-economic factor, trade integration, operationalized as the percent exports of GDP, may moderate the relationship between education and sustainable development, as measured by the CIWB.

3.4 METHODS

3.4.1 Data & Methods

The data for this study are for 73 countries with observations every five years for the period of 1960-2010. See Table 4. For these nations, there are no missing observations for the dependent variable or the primary independent variable of interest, educational attainment. I include cases with a maximum of two missing observations total across per capita GDP and exports as a percent of GDP. To more accurately test the political economy perspective, I group nation-states using an economic, as opposed to regional, classification system. Specifically, I group countries as low, middle- or high-income based on the classification of the World Bank at the mid-point of the study (World Bank 1990). I log all variables to the base 10.

Table 4. Nations Included in Study

	Low Income	Middle income	High Income
	Benin	Algeria	Australia
	Central African Republic	Argentina	Austria
	China	Bolivia	Canada
	Congo	Brazil	Denmark
	Ghana	Cameroon	Finland
	Indonesia	Chile	France
	India	Costa Rica	Hong Kong
	Liberia	Cote d'Ivoire	Iceland
	Kenya	Democratic Republic of the Congo	Ireland
	Mauritania	Colombia	Italy
	Niger	Ecuador	Japan
	Nepal	Egypt	Luxembourg
	Pakistan	El Salvador	Netherlands
	Sri Lanka	Fiji	Norway
	Rwanda	Gabon	Portugal
	Sudan	Greece	Spain
	Sierra Leone	Guatemala	Sweden
	Togo	Guyana (no data)	United Kingdom
		Honduras	USA
		Iran (Islamic Republic of)	
		Jamaica	
		Republic of Korea	
		Morocco	
		Mexico	
		Nicaragua	
		Panama	
		Peru	
		Philippines	
		Senegal	

		El Salvador	
		South Africa	
		Thailand	
		Tunisia	
		Turkey	
		Uruguay	
		Venezuela	

3.4.2 Dependent Variables

Consistent with the previous chapter, the dependent variable is the Carbon Intensity of Well Being (CIWB). To make this ratio, I use production-based CO₂ emissions in metric tons per capita (from the burning of fossil fuels and the manufacture of cement) and average life expectancy at the time of birth (see also Givens 2015, 2017, 2018; Jorgenson 2014, 2015; Jorgenson et al. 2018). The data for carbon emissions and life expectancy come from the World Bank’s World Development Indicators online database (2015).

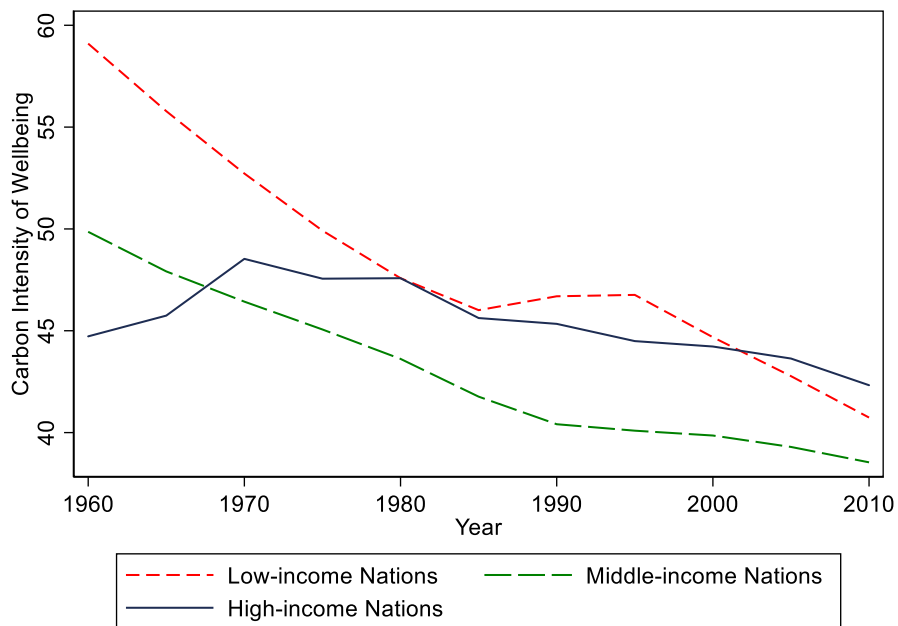
In order not to have either the numerator or the denominator have a disproportionate influence on the CIWB ratio, this study takes the same approach as others (Dietz et al. 2012; Jorgenson 2014, 2015; Jorgenson and Dietz 2015; Givens 2015, 2017, 2018) and constrains their coefficients of variation, the standard deviation over the mean, to be equal by adding a constant to the numerator, the CO₂ measure. This method shifts the mean without changing the variance. The coefficient of variation for CO₂ per

capita is 1.37, and for life expectancy, it is 0.185. Thus, a constant of 24.2 is added to the carbon emissions data, divided by life expectancy, and multiplied by 100 to scale the ratio.

$$CIWB = [(CO_2pc + 24.2)/LE]*100$$

As Figure 9 illustrates for the nations included in this study, there has been a general downward trend in terms of the carbon intensity with which nations produce wellbeing for their citizens. The most pronounced decline can be observed in low-income nations.

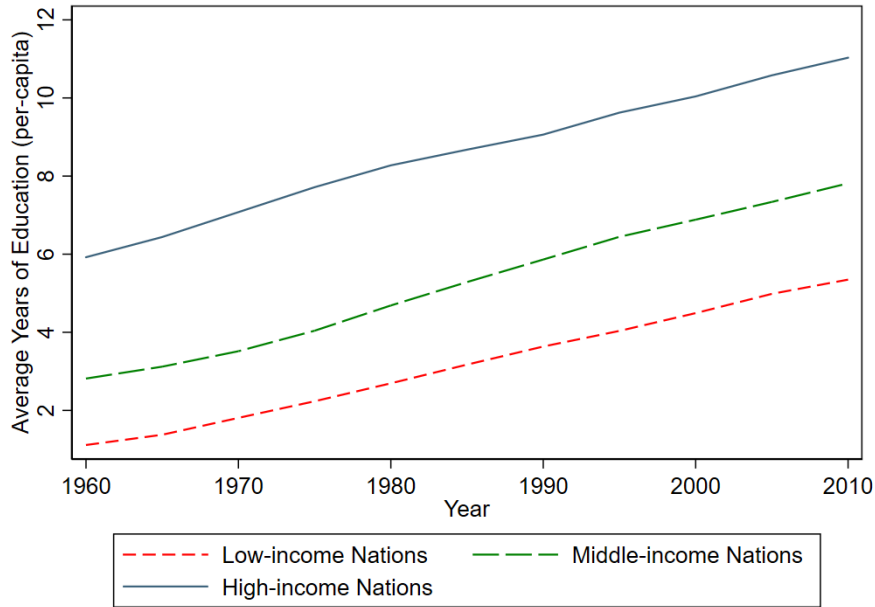
Figure 9. Carbon Intensity of Wellbeing by Income Group over Time



3.4.3 Independent Variable

I use two measures of educational attainment in this study. The first is the average years of educational attainment for men and women aged 15-64. As Figure 10 illustrates, the average years of schooling per person has increased across all three income groups over the 50 years under consideration. I also use a second education metric, the percentage of the population that completed tertiary- level education. Both of these measures of education are from the Barro-Lee Educational Attainment Database. Data are recorded in 5-year increments (Barro and Lee 2013). They are drawn from census/survey information, as compiled by UNESCO, Eurostat, and other sources. A large number of empirical studies have used these data, across a range of disciplines.

Figure 10. Average per capita Educational Attainment for the Population aged 15-64 by Income Group



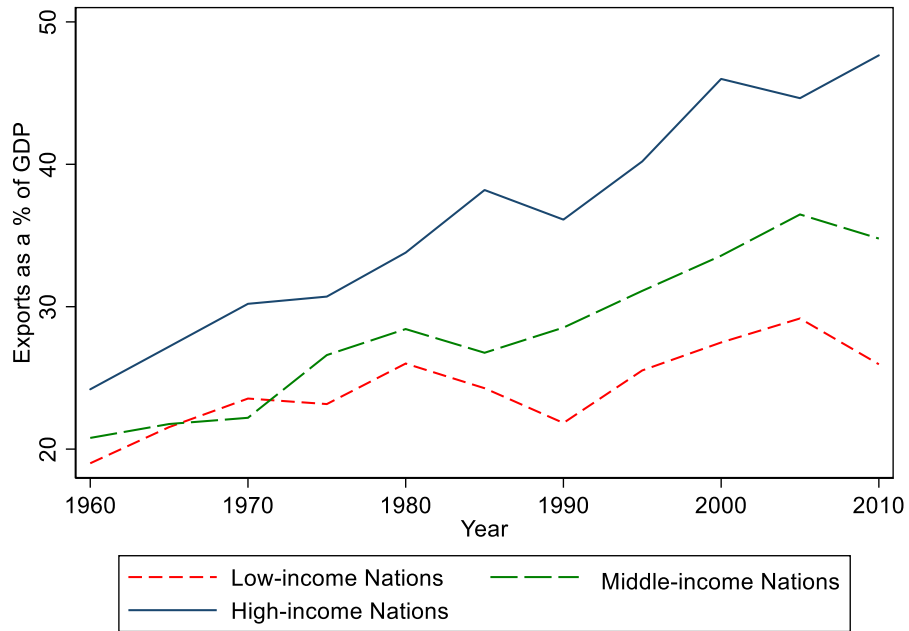
3.4.4 GDP per capita

In all of the models, I control for the level of economic development, measured as GDP per capita. Previous research has illustrated that GDP is an important predictor of both production-based carbon emissions and life expectancy: the two components of the outcome variable. GDP per capita is measured in constant 2010 US dollars (World Bank, World Development Indicators 2010). By controlling for GDP, it is possible to extricate the direct effect of education on national sustainability, net of economic inputs.

3.4.5 Exports as a Percent of GDP

Global political economy perspectives such as world-systems theory and ecological unequal exchange theory draw attention to how the unequal world-economic system creates and perpetuates inequality in levels of development, environmental degradation, and human wellbeing outcomes (Hornborg 1998, Hornborg and Martinez-Alier 2016; Jorgenson 2012; Jorgenson 2016). To test if a nation's level of integration into the global economy moderates the nature and magnitude of the relationship between education and sustainability, I test for an interaction effect between exports as a percentage of total GDP and per capita education rates for each of the income groups. Exports as a percent of GDP represents the value of all goods and other market services provided outside the nation-state, including "merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services" (World Bank. 2010). This variable has been used as a proxy for the level of integration into the global economy by several related studies (e.g., Jorgenson and Clark 2012; Shorette 2012; Givens 2015, 2018). As Figure 11 illustrates, exports as a percent of GDP have also increased in all three income groups over the 50- year study period.

Figure 11. Exports as a percent of GDP by Income Group over Time



As the correlation matrix in Table 5 illustrates, exports as a percent of GDP are not strongly correlated with any of the variables included in the models. As one might expect, the percentage of those with a tertiary degree is strongly correlated with average years of educational attainment. There is also a moderate correlation between both measures of education and GDP.

Table 5. Bi-variate Correlation Matrix (Log Terms)

	CIWB	Years of Schooling	% with Tertiary Degree	GDP	Exports as % GDP
CIWB	1				
Years of Schooling	-0.4609	1.0000			
% Tertiary Degree	-0.4456	0.8339	1		
GDP	-0.2356	0.6016	0.6057	1	
Exports as % of GDP	-0.1096	0.2993	0.2123	-0.2137	1

3.4.6 Models

For this analysis, I estimate Prais–Winsten regression models with panel-corrected standard errors using the software package Stata (version 15). This method is appropriate for dealing with cross-sectional time series data with 10-100 units observed over relatively long periods. This approach is particularly useful when errors may be serially (temporally) correlated, contemporaneously related, and characterized by heteroscedasticity (all the error processes may not have the same variance) (Beck and Katz 1995). Country-specific and year-specific intercepts are included, making the model equivalent to a two-way fixed effects model. The country-specific fixed-effects explain away between-country variation by removing the influence of factors unique to each country that are time-invariant. Year-specific intercepts account for elements common to all nations that are unique to each time point. Such models are common in related studies

of CIWB where the case-specific and time-specific intercepts, included as two-way fixed effects, explain a very substantial amount of variation in the dependent variable, which leads to relatively conservative hypothesis testing (Jorgenson 2014, 2015; Jorgenson and Dietz 2015; Jorgenson and Givens 2015; Givens 2015, 2017, 2018)

The R-square statistic did not fall below 0.98 in any of the reported models. High R-square statistics are consistent with other research using similar methods. The high values are caused by the unreported country-specific and year-specific intercepts, which combined account for a substantial amount of variation in the outcome, leading to relatively conservative hypothesis testing.

I transform all variables with the base ten logarithms, a widespread approach in cross-national research on various sustainability outcomes (e.g., York, Rosa, and Dietz 2003; Jorgenson and Clark 2012; Jorgenson 2014; Kelly 2020). Therefore, the estimated coefficients are elasticity coefficients, where a 1 percent change in the independent variable leads to an estimated percent change in the dependent variable.

3.5 RESULTS

The first model presented in Table 6 estimates the relationship between education and CIWB for the full sample of nations ($n=73$). I use both measures of educational attainment: average years of educational attainment for the population, and the percent of

the population that completed a tertiary level degree. The results show that for the nations included in this model, population gains in the average years of education are associated with lower carbon costs of wellbeing. Between 1960 and 2010, one percent higher rates of educational attainment were associated with a 0.23 percent lower CIWB.

On the other hand, there was no significant predicted relationship between increases in the percentage of the population with a tertiary degree and CIWB. Consistent with other studies, there is a positive relationship between increases in GDP and the carbon cost of wellbeing (Jorgenson 2014) and a negative relationship between the exports as a percentage of GDP and CIWB (Givens 2018). Of note, these results represent the estimates for high-, middle-, and low-income nations for the entire 50-year time frame.

Table 6. Elasticity Coefficients for the Estimated Effects of Education on Production Based CIWB for the Global Sample (n=73)

Results from Global Sample			
Average Years of educational Attainment (log)	Percent of the population with a tertiary degree (log)	GDP (log)	Exports as % of GDP (log)
-.23*** (-6.35)	-.001 (-0.23)	.032*** (2.49)	-.014** (2.86)
*p < 0.05. **p < 0.01. ***p < 0.001. R ² = 0.9917 Estimates derived from Prais-Winston two-way fixed-effects elasticity model with panel- corrected standard errors and AR(1) corrections. No of observations 783; no of countries 73.			

To more accurately test the political economy perspective, the next set of analyses investigate the relationship between education and CIWB for nations, grouped by level of economic development, over time. I group nations as low-, middle-, or high- income based on a World Bank country classification system (World Bank 1990). The models presented in Table 7 estimate the relationship for each income group individually, with interactions between education and the time dummy variables. In this set of models, the main effect of education can be interpreted as the effect of education on CIWB in 1960.

Table 7. Estimate Elasticity Coefficients for the Regression of Production-based CIWB 1960 to 2010 by Income Group

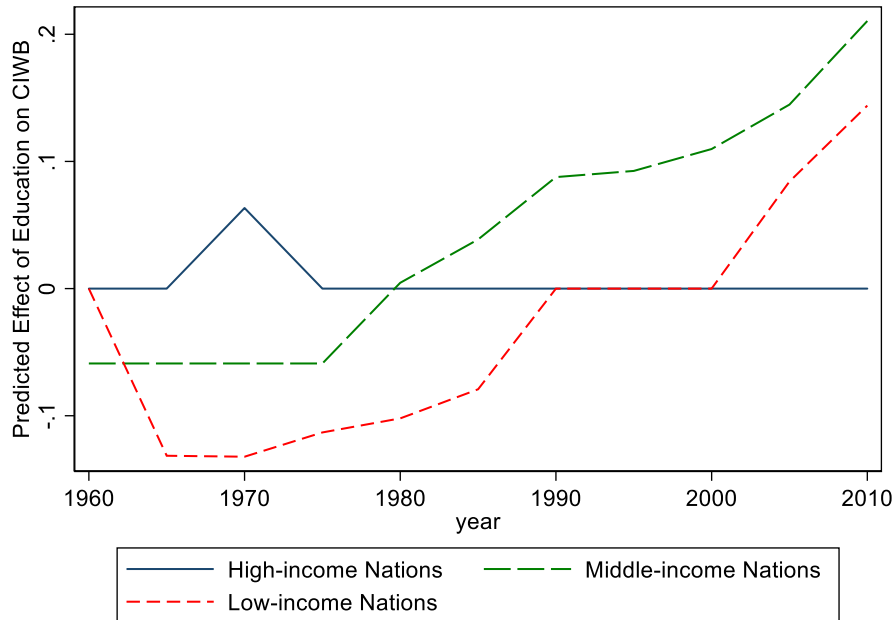
	High Income	Middle Income	Low Income
Education (1960)	-0.032	-0.0589**	-0.0273
	(-1.25)	(-2.58)	(-0.71)
GDP	0.0707**	0.0153	-0.0016
	(2.75)	(1.38)	(-0.07)
Exports as % of GDP	-0.018	-0.00203	-0.0272**
	(-1.00)	(-0.41)	(-3.06)
Education x1965	-0.0003	-0.0219	-0.131***
	(-0.00)	(-1.29)	(-5.14)

Education x1970	0.0634*	0.00146	-0.132***
	(1.99)	(0.07)	(-5.91)
Education x1975	0.0431	0.0289	-0.113***
	(1.14)	(1.36)	(-4.90)
Education x1980	0.0748	0.0634**	-0.102***
	(1.79)	(2.78)	(-3.98)
Education x1985	0.0636	0.0975***	-0.0792**
	(1.30)	(3.96)	(-2.66)
Education x1990	0.0174	0.147***	-0.110***
	(0.34)	(5.39)	(-3.37)
Education x1995	0.0280	0.151***	-0.0676
	(0.42)	(4.96)	(-1.90)
Education x 2000	0.0162	0.169***	0.0328
	(0.20)	(5.19)	(0.91)
Education x 2005	-0.0737	0.204***	0.0842*
	(-1.19)	(6.60)	(2.25)

Education x 2010	-0.0427	0.269***	0.144**
	(-0.62)	(7.17)	(3.27)
_cons	0.942**	1.582***	1.836***
E	(3.15)	(13.93)	(9.10)
No of Countries			
No of Obs.	206	387	191
<p>Estimates derived from Prais-Winston two-way fixed-effects elasticity models with AR(1) correction. (t-statistics in parentheses). * p<0.05, ** p<0.01, *** p<0.001 Time and Country Level Fixed Effects Included</p>			

Figure 12 graphs the statistically significant elasticity coefficients for the estimated impact of per capita years of schooling on the CIWB over time, based on the models reported in Table 7. These interactions allow us to assess how the relationship evolved in each group. In this set of models, the main effect of education can be interpreted as the effect of education on CIWB in 1960. A negative coefficient implies the presence of a desirable association, from a sustainability perspective, between per capita years of education and CIWB. Values above 0 indicate that gains in education are estimated to be associated with a higher carbon cost of well being.

Figure 12. Significant Elasticity Coefficients for the Estimated Effect of Education by Income Group over Time



Model estimates presented in Table 7 and Figure 12 indicate that the relationship between education and the CIWB is null for high-income nations at all time points, except for one. In 1970, a one percent increase in education is associated with a 0.06 percent higher value of CIWB. For middle-income nations, a 1 percent increase in educational attainment rates is associated with a .06 percent lower CIWB for the time points 1960, 1965, 1970, and 1975. So, for the nations in this region during this period, education enhanced sustainability outcomes. For the time points between 1980 and 2010, gains in education are associated with consistently higher carbon costs of wellbeing. In

other words, from 1980 to 2010, gains in per capita education rates are associated with increasingly more unsustainable national development trajectories. By the study endpoint, a 1 percent increase in per capita rates of educational attainment is associated with a 0.21 percent larger predicted value for CIWB.

In low-income nation-states, the relationship between education and CIWB is null at the first point of the study; 1960. For the time points, 1965 and 1970, increases in population education rates are associated with 0.13 lower predicted values of CIWB. The coefficients for education and time interactions remain negative until 1990. So, gains in education are associated with more sustainable development trajectories for nations in this group until 1990. For the time points 1990-2000 inclusive, the relationship between education and CIWB is null; there is no predicted difference in CIWB associated with an increase in education. For the last two time points in the study, 2005 and 2010, the models predict more carbon-intensive costs of wellbeing for the nations in the low-income group. By the study endpoint, a 1 percent increase in the average rates of educational attainment is associated with 0.14 percent higher predicted values of CIWB.

As discussed in the literature review section, studies within global political economy perspectives have found that integration into the world economy impacts human and environmental wellbeing. This impact is advantageous for powerful countries and deleterious for middle- and low-income nations. To test if the relationship between

education and CIWB is dependent on a nations' level of integration within the global economy, the next of set models test if there is a significant interaction effect between education and exports as a percent of GDP.

Table 8. Estimated Elasticity Coefficients for Regression of Production Based CIWB by Income Group with Moderation Effect

	High Income	Middle Income	Low Income
Education (log)	0.269*	-0.382***	-0.619***
	(2.50)	(-8.43)	(-9.92)
GDP (log)	0.0532**	-0.0104	-0.00304
	(2.84)	(-0.92)	(-0.17)
Exports as % GDP	0.278	-0.067**	-0.172***
	(3.20)	(-2.60)	(-6.35)
Educ*Exports	-0.322*	0.0859**	0.234***
	(-3.84)	(2.73)	(6.36)
_cons	0.875**	2.030***	2.112***
	(3.67)	(18.47)	(14.27)
N	206	387	191
Estimates derived from Prais-Winston two-way fixed-effects elasticity models with AR(1) correction. (t-statistics in parentheses).			
* p<0.05, ** p<0.01, *** p<0.001			

As the fixed effects panel model estimates presented in Table 8 show, there is a significant interaction effect between per capita educational attainment rates and exports as a percent of GDP in each of the three groups of nations. Namely, exports as a percent of GDP moderate the predicted association between CIWB and rates of educational attainment. Notably, the nature of this moderation effect differs for high-income nations, compared to the middle- income and low-income groups. On average, higher levels of exports as a percentage of GDP is predicted to strengthen the desirable relationship between education and sustainability for the high-income group but is predicted to weaken the relationship for the middle- and low-income groups.

As the model coefficients presented, Table 8 illustrates in high-income nations a 1 percent increase in education is associated with 0.27 percent higher values of CIWB if exports are 0 percent of GDP. However, with every 1 percent increase in exports as a percent of GDP, the predicted effect of education on CIWB is 0.32 percent lower. In other words, as the portion of exports as a percent of GDP grows in high-income nations, we expect gains in education to be associated with less carbon-intensive societies.

In the middle-income group, exports as a percentage of GDP also moderate the relationship between education and GDP, but it does so differently than in the high-

income context. Taking the main effect of education and interaction terms together, the model predicts that a one percent increase in education is associated with 0.38 percent lower values for CIWB if exports are 0 percent of GDP. However, the predicted effect of a one percent increase in education on CIWB is .086 percent higher with every 1 percent increase in exports as a percent of GDP.

A similar but more pronounced association between education and global trade integration is predicted for low-income nations. As the coefficient for the main effect of education indicates, a 1 percent increase in educational attainment is associated with a 0.62 percent lower value of CIWB, if exports are 0 percent of GDP. However, with every 1 percent increase in exports as a percent of GDP, the predicted effect of education on CIWB is 0.23 percent higher. So, the (desirable) ameliorating effect of education is the largest in low-income nations. However, the moderating effect of exports as a percent of GDP is also the largest for this group.

These results illustrate the complexity of the relationship between the social institution of education and the global political economy, across levels of economic development. Of particular note, at the beginning of the study, education was associated with more sustainable development trajectories in low- and middle-income nations. However, by the study endpoint, gains in education were associated with more carbon-intensive societies for the majority of nations (Table 7 and Figure 12). For the nations

included in this study, the change in the nature of this relationship between education and sustainability is partially explained by increased integration into the global economy (Table 8). In essence, these findings illustrate the effect of global structural economic factors on national human and environmental outcomes.

3.6 DISCUSSION AND CONCLUSION

This chapter tests world society and political economy perspectives on the role of education for sustainability. From a world society perspective, the existence of standardized measures of educational attainment, on which this analysis relies, and the upward trend in education attainment (Figure 10), are themselves evidence of the entrenchment of the nation-state model. According to the world society perspective, educated professionals, technocrats, and educational institutions can act as receptor sites for global cultural scripts such as those related to human rights and environmentalism (Schofer and Hironaka 2005; Meyer et al. 2007; Meyer 2009). So, one might expect the expansion of mass education to be associated with enhanced sustainability outcomes. In the first set of models, I investigate if the expansion of mass education supports more sustainable development trajectories (Table 6). I find no evidence that the percentage of the population who completed a tertiary level degree is associated with more or less sustainable development trajectories in the global sample. The findings of this chapter,

therefore, fail to support the proposition that a higher portion of a highly educated population results in more sustainable national development outcomes.

On the other hand, in both the global model (Table 6) and the follow-up regional analyses (Table 7 and Figure 12), I find evidence that education, measured as average years of educational attainment, to be associated with a lower carbon cost of wellbeing at some time points in low- and middle-income nations. However, the ameliorating effect of education on CIWB dissipates throughout the study period. Indeed, from 1980 onward, gains in education are associated with a higher carbon intensity of wellbeing in middle-income nations. The same trend can be observed in low-income nations. Namely, for the nations included in the low-income group, gains in education are associated with lower levels of CIWB until 1990. After 2000, however, education is associated with higher carbon costs of wellbeing.

When interpreting the disappearance of the beneficial education effect from a world society perspective, it is important to note that this theory does not propose that the expansion of mass education necessarily enhances sustainability or societal functioning across all contexts. Meyer, Nagel, and Snyder emphasize that totalizing claims about the functional benefits of the expansion of mass education require a “breathtaking leap of faith” (1993:150). Instead, education is understood as constituting the ultimate initiation

ritual, which promises a “displaced form of salvation expressed as progress, both for the individual and for the nation” (Ramirez and Boli, 1987).

Further, Meyer and Ramirez (2000) highlight that mass schooling both historically and in present times is designed to prepare young persons for an imagined and idealized future society and not necessarily for the prevailing opportunity structure. An analogous argument is made by Hironaka and Schofer (2002) about environmental outcomes when interpreting their finding that environmental impact assessment requirements have little direct impact on the environment due in part to inefficient implementation, or local resistance. While the world society perspective does accommodate the “decoupling” of gains in human and environmental wellbeing from gains in educational attainment, the integration of that political economy perspective provides is a useful addition for explaining these results.

The second set of models presented in Table 8 tests the political economy proposition that a nations’ level of integration in the world economy may moderate the gains in sustainability associated with increased educational attainment. Consistent with other studies in the field, this concept is operationalized as exports as a percentage of GDP (Jorgenson 2012; Shorette 2012; Givens 2015, 2017, 2018). For high-income nations, I find higher levels of exports as a percentage of GDP enhances gains in sustainability associated with higher educational attainment. On the other hand, for

middle- and low-income nations, the opposite trend can be observed. The gains in sustainability associated with increased educational attainment decrease as exports as a percent of GDP rise. The moderating role of trade on the relationship between education and CIWB is even more pronounced for low-income nations. These findings lend support to political economy perspectives, such as world-systems analysis — that national and subnational outcomes are shaped by a nation’s position in the global hierarchy (Wallerstein 1974; Chase-Dunn 1998).

The interaction effect between exports as a percentage of GDP and education also supports a central hypothesis in ecological unequal exchange (Hornborg 1998, Hornborg and Martinez-Alier 2016; Givens et al. 2019), that unequal power dynamics within international trade affect the distribution of environmental harms and social goods. Furthermore, the findings build on a wealth of empirical work within this tradition, which illustrates that environmental impacts are likely being displaced to lower-income countries via trade (Steinberger et al. 2012; Jorgenson 2012; Jorgenson and Givens 2015; Givens 2017). In particular, these results add to Givens’ (2018) finding that trade integration is more beneficial for high-income countries than non-high-income countries in terms of CIWB. I demonstrate that social spoils associated with states' expanded access to education are also dependent on that nation's level of integration in the world economy. This research also builds on the growing subfield that reveals the complexity of the relationship between the economy (Jorgenson 2014) and societal characteristics such

as inequality (Jorgenson 2015), urbanization (Givens 2015), world society integration (Givens 2017), and democracy (Mayer 2017) and sustainability, using the outcome variable CIWB.

This project adds to the growing literature that illustrates the advantages of taking a theoretically integrative approach in macro-sociological studies (Jorgenson 2009a Jorgenson et al. 2011; Shorette 2012; Longhofer and Jorgenson 2017). Understanding these perspectives as complementary, as opposed to competing, schools of thought offer a fruitful opportunity to address subfield critiques. For example, within the field of comparative education, world society theory has been criticized for creating as opposed to proving the presence of world society by focusing on metrics such as enrollment rates (Carney, Rappleye, and Silova 2012). Others have lamented the perspectives inattention to economic aspects/implications of the education system (Griffiths and Arnove 2015). Similarly, Ramirez (2003) argues that political economy perspectives, which make power/dependency ties the main dynamic to account for many educational developments throughout the world, cannot adequately account for convergence in the organizational form and attainment rates across diverse nations states (p.250). Taking a theoretically integrative approach allows for a more sophisticated understanding of social reality at the global and cross-national level, whereby the world society model may partially explain

the convergence in educational outcomes and the divergence in outcomes is accounted for by attention to the coercive power of the global political economy¹⁴

As Meyer emphasizes, realist (or political economy) perspectives are not in conflict with world society perspectives for theoretical or methodological reasons. Instead, the issue is mainly normative (2009). As the subfield of environmental sociology has shown, integrating these perspectives can facilitate a broader understanding of global processes and their sustainability implications.

¹⁴ Notably, Schofer & Hironaka (2005) acknowledge that nations face tremendous pressure to avoid or undermine environmental protections that are in conflict with economic interests.

REFERENCES

- Arnove, Robert F. 1980. "Comparative Education and World-Systems Analysis." *Comparative Education Review* 24(1):48–62.
- Arnove, Robert F. 2003. "Introduction: Reframing Comparative Education: The Dialectic of the Global and the Local." *Comparative Education: The Dialectic of the Global and the Local* 2:1–23.
- Barro, Robert J. and Jong Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." *Journal of Development Economics* 104:184–98.
- Beck, Nathaniel and Jonathan N. Katz. 1995. "What to Do (and Not to Do) with Time-Series Cross-Section Data." *American Political Science Review* 89(3):634–47.
- Boli, John, Francisco O. Ramirez, and John W. Meyer. 1985. "Explaining the Origins and Expansion of Mass Education." *Comparative Education Review* 29(2):145–170.
- Boli, John and George M. Thomas. 1997. "World Culture in the World Polity: A Century of International Non-Governmental Organization." *American Sociological Review* 171–190.
- Boswell, Terry and Christopher K. Chase-Dunn. 2000. *The Spiral of Capitalism and Socialism: Toward Global Democracy*. Lynne Rienner Publishers.
- Bromley, Patricia, John W. Meyer, and Francisco O. Ramirez. 2011a. "Student-Centeredness in Social Science Textbooks, 1970-2008: A Cross-National Study." *Social Forces* 90(2):547–570.

- Bromley, Patricia, John W. Meyer, and Francisco O. Ramirez. 2011b. "The Worldwide Spread of Environmental Discourse in Social Studies, History, and Civics Textbooks, 1970–2008." *Comparative Education Review* 55(4):517–545.
- Bunker, Stephen G. 1984a. "Modes of Extraction, Unequal Exchange, and the Progressive Underdevelopment of an Extreme Periphery: The Brazilian Amazon, 1600-1980." *American Journal of Sociology* 89(5):1017–1064.
- Bunker, Stephen G. 1984b. "Modes of Extraction, Unequal Exchange, and the Progressive Underdevelopment of an Extreme Periphery: The Brazilian Amazon, 1600-1980." *American Journal of Sociology* 89(5):1017–1064.
- Bunker, Stephen G. and Paul S. Ciccantell. 2005. *Globalization and the Race for Resources*. JHU Press.
- Burns, Thomas J., Jeffrey D. Kentor, and Andrew Jorgenson. 2003. "Trade Dependence, Pollution, and Infant Mortality in Less-Developed Countries." *Contributions in Economics and Economic History* 1:14–28.
- Buttel, Frederick H. 2000. "World Society, the Nation-State, and Environmental Protection: Comment on Frank, Hironaka, and Schofer." *American Sociological Review* 65(1):117–121.
- Carney, Stephen, Jeremy Rappleye, and Iveta Silova. 2012. "Between Faith and Science: World Culture Theory and Comparative Education." *Comparative Education Review* 56(3):366–393.
- Chase-Dunn, Christopher and Thomas D. Hall. 1997. "Ecological Degradation and the Evolution of World-Systems." *Journal of World-Systems Research* 3(3):403–31.

- Chase-Dunn, Christopher K. 1998. *Global Formation: Structures of the World-Economy*. Rowman & Littlefield.
- Clark, Brett and John Bellamy Foster. 2009. "Ecological Imperialism and the Global Metabolic Rift: Unequal Exchange and the Guano/Nitrates Trade." *International Journal of Comparative Sociology* 50(3–4):311–334.
- Clark, Brett and Richard York. 2005. "Carbon Metabolism: Global Capitalism, Climate Change, and the Biospheric Rift." *Theory and Society* 34(4):391–428.
- Clayton, Thomas. 1998. "Beyond Mystification: Reconnecting World-System Theory for Comparative Education." *Comparative Education Review* 42(4):479–496.
- Clayton, Thomas. 2004. "'Competing Conceptions of Globalization' Revisited: Relocating the Tension between World-Systems Analysis and Globalization Analysis." *Comparative Education Review* 48(3):274–94.
- Cole, Wade M. 2015. "Mind the Gap: State Capacity and the Implementation of Human Rights Treaties." *International Organization* 69(2):405–441.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2007. "Driving the Human Ecological Footprint." *Frontiers in Ecology and the Environment* 5(1):13–18.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2012. "Environmentally Efficient Wellbeing: Is There a Kuznets Curve?" *Applied Geography* 32(1):21–28.
- Frank, David John, Karen Jeong Robinson, and Jared Olesen. 2011. "The Global Expansion of Environmental Education in Universities." *Comparative Education Review* 55(4):546–573.

- Frank, David John, Ann Hironaka, and Evan Schofer. 2000. "The Nation-State and the Natural Environment over the Twentieth Century." *American Sociological Review* 96–116.
- Ginsburg, Mark B. 1991. *Understanding Educational Reform in Global Context: Economy, Ideology, and the State*. Taylor & Francis.
- Givens, Jennifer E. 2015. "Urbanization, Slums, and the Carbon Intensity of WellBeing:: Implications for Sustainable Development." *Human Ecology Review* 22(1):107–28.
- Givens, Jennifer E. 2017 "World Society, World Polity, and the Carbon Intensity of WellBeing, 1990–2011." *Sociology of Development* 3(4):403–35.
- Givens, Jennifer E. 2018. "Ecologically Unequal Exchange and the Carbon Intensity of WellBeing, 1990–2011." *Environmental Sociology* 4(3):311–24.
- Givens, Jennifer E. and Andrew K. Jorgenson. 2011. "The Effects of Affluence, Economic Development, and Environmental Degradation on Environmental Concern: A Multilevel Analysis." *Organization & Environment* 24(1):74–91.
- Griffiths, Tom G. and Robert F. Arnove. 2015. "World Culture in the Capitalist World-System in Transition." *Globalisation, Societies and Education* 13(1):88–108.
- Grimes, Peter and Jeffrey Kentor. 2003. "Exporting the Greenhouse: Foreign Capital Penetration and CO2 Emissions 1980–1996." *Journal of World-Systems Research* 9(2):261–75.
- Hironaka, Ann. 2014. *Greening the Globe*. Cambridge University Press.

- Hironaka, Ann and Evan Schofer. 2002. "Decoupling in the Environmental Arena: The Case of Environmental Impact Assessments." *Organizations, Policy, and the Natural Environment: Institutional and Strategic Perspectives* 214–231.
- Hornborg, Alf. 2009. "Zero-Sum World: Challenges in Conceptualizing Environmental Load Displacement and Ecologically Unequal Exchange in the World-System." *International Journal of Comparative Sociology* 50(3–4):237–262.
- Hornborg, Alf and Joan Martinez-Alier. 2016. "Ecologically Unequal Exchange and Ecological Debt." *Journal of Political Ecology* 23(1):328–333.
- Jorgenson, Andrew A. and James Rice. 2005. "Structural Dynamics of International Trade and Material Consumption: A Cross-National Study of the Ecological Footprints of Less-Developed Countries." *Journal of World-Systems Research* 11(1):57–77.
- Jorgenson, Andrew K. June 1, 2009a. "Foreign Direct Investment and the Environment, the Mitigating Influence of Institutional and Civil Society Factors, and Relationships Between Industrial Pollution and Human Health: A Panel Study of Less-Developed Countries." *Organization & Environment* 22(2):135–57.
- Jorgenson, Andrew K. 2009b. "Political-Economic Integration, Industrial Pollution and Human Health: A Panel Study of Less-Developed Countries, 1980—2000." *International Sociology* 24(1):115–143.
- Jorgenson, Andrew K. 2003. "Consumption and Environmental Degradation: A Cross-National Analysis of the Ecological Footprint." *Social Problems* 50(3):374–394.

- Jorgenson, Andrew K. 2005. "Unpacking International Power and the Ecological Footprints of Nations: A Quantitative Cross-National Study." *Sociological Perspectives* 48(3):383–402.
- Jorgenson, Andrew K. 2006. "Global Warming and the Neglected Greenhouse Gas: A Cross-National Study of the Social Causes of Methane Emissions Intensity, 1995." *Social Forces* 84(3):1779–1798.
- Jorgenson, Andrew K. 2007. "The Effects of Primary Sector Foreign Investment on Carbon Dioxide Emissions from Agriculture Production in Less-Developed Countries, 1980-99." *International Journal of Comparative Sociology* 48(1):29–42.
- Jorgenson, Andrew K. 2011. "Carbon Dioxide Emissions in Central and Eastern European Nations, 1992-2005: A Test of Ecologically Unequal Exchange Theory." *Human Ecology Review* 105–114.
- Jorgenson, Andrew K. 2012. "The Sociology of Ecologically Unequal Exchange and Carbon Dioxide Emissions, 1960–2005." *Social Science Research* 41(2):242–252.
- Jorgenson, Andrew K. 2014. "Economic Development and the Carbon Intensity of Human Wellbeing." *Nature Climate Change* 4(3):186–89.
- Jorgenson, Andrew K. 2015. "Inequality and the Carbon Intensity of Human Wellbeing." *Journal of Environmental Studies and Sciences* 5(3):277–82.
- Jorgenson, Andrew K. 2016. "Environment, Development, and Ecologically Unequal Exchange." *Sustainability* 8(3):227.

- Jorgenson, Andrew K., Alina Alekseyko, and Vincentas Giedraitis. 2014. "Energy Consumption, Human WellBeing and Economic Development in Central and Eastern European Nations: A Cautionary Tale of Sustainability." *Energy Policy* 66:419–27.
- Jorgenson, Andrew K., Kelly Austin, and Christopher Dick. 2009. "Ecologically Unequal Exchange and the Resource Consumption/Environmental Degradation Paradox: A Panel Study of Less-Developed Countries, 1970-2000." *International Journal of Comparative Sociology* 50(3–4):263–84.
- Jorgenson, Andrew K. and Brett Clark. 2009. "The Economy, Military, and Ecologically Unequal Exchange Relationships in Comparative Perspective: A Panel Study of the Ecological Footprints of Nations, 1975-2000." *Social Problems* 56(4):621–646.
- Jorgenson, Andrew K. and Brett Clark. 2011. "Societies Consuming Nature: A Panel Study of the Ecological Footprints of Nations, 1960–2003." *Social Science Research* 40(1):226–244.
- Jorgenson, Andrew K., Christopher Dick, and John M. Shandra. 2011. "World Economy, World Society, and Environmental Harms in Less-Developed Countries." *Sociological Inquiry* 81(1):53–87.
- Jorgenson, Andrew K. and Thomas Dietz. 2015. "Economic Growth Does Not Reduce the Ecological Intensity of Human WellBeing." *Sustainability Science* 10(1):149–56.
- Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. "Inequality, Poverty, and the Carbon Intensity of Human WellBeing in the United States: A Sex-Specific Analysis." *Sustainability Science* 13(4):1167–74.

- Jorgenson, Andrew K. and Kennon A. Kuykendall. 2008. "Globalization, Foreign Investment Dependence and Agriculture Production: Pesticide and Fertilizer Use in Less-Developed Countries, 1990–2000." *Social Forces* 87(1):529–60.
- Kamens, David H. and Aaron Benavot. 1992. "A Comparative and Historical Analysis of Mathematics and Science Curricula, 1800-1986." MEYER, JW, KAMENS, DH and BENAVIDOT, A.: *School Knowledge for the Masses*.
- Kelly, Orla. 2020. "The Silver Bullet? Assessing the Role of Education for Sustainability" *Social Forces*. <https://doi.org/10.1093/sf/soz144>
- Longhofer, Wesley and Andrew Jorgenson. 2017. "Decoupling Reconsidered: Does World Society Integration Influence the Relationship between the Environment and Economic Development?" *Social Science Research* 65:17–29.
- Mayer, Adam. 2017. "Democratic Institutions and the Energy Intensity of WellBeing: A Cross-National Study." *Energy, Sustainability and Society* 7(1):36.
- Mayer, Adam. 2013. "Education and the Environment: An International Study." *International Journal of Sustainable Development & World Ecology* 20(6):512–519.
- Meyer, John W. 1977. "The Effects of Education as an Institution." *American Journal of Sociology* 83(1):55–77.
- Meyer, John W. 2009. "Reflections: Institutional Theory and World Society." *World Society: The Writings of John W. Meyer* 36–63.
- Meyer, John W., John Boli, George M. Thomas, and Francisco O. Ramirez. 1997a. "World Society and the Nation-State." *American Journal of Sociology* 103(1):144–181.

- Meyer, John W., David John Frank, Ann Hironaka, Evan Schofer, and Nancy Brandon Tuma. 1997b. "The Structuring of a World Environmental Regime, 1870–1990." *International Organization* 51(4):623–651.
- Meyer, John W., Patricia Bromley, and Francisco O. Ramirez. 2010. "Human Rights in Social Science Textbooks: Cross-National Analyses, 1970–2008." *Sociology of Education* 83(2):111–134.
- Meyer, John W., Joane Nagel, and Conrad W. Snyder Jr. 1993. "The Expansion of Mass Education in Botswana: Local and World Society Perspectives." *Comparative Education Review* 37(4):454–475.
- Meyer, John W. and Francisco O. Ramirez. 2000. "The World Institutionalization of Education." *Discourse Formation in Comparative Education* 111–132.
- Meyer, John W., Francisco O. Ramirez, David John Frank, and Evan Schofer. 2007. "Higher Education as an Institution." *Sociology of Higher Education: Contributions and Their Contexts* 187.
- Meyer, John W., Francisco O. Ramirez, Richard Rubinson, and John Boli-Bennett. 1977. "The World Educational Revolution, 1950-1970." *Sociology of Education* 50(4):242–58.
- Meyer, John W., Francisco O. Ramirez, and Yasemin Nuhoğlu Soysal. 1992. "World Expansion of Mass Education, 1870-1980." *Sociology of Education* 65(2):128–49.
- Ramirez, F. 2003. *The Global Model and National Legacies*, in Kathryn Anderson-Levitt (Ed.) *Local Meanings, Global Schooling: Anthropology and World Culture Theory* (Pp. 239-254). New York: Palgrave MacMillan.

- Ramirez, Francisco O. and John Boli. 1987. "The Political Construction of Mass Schooling: European Origins and Worldwide Institutionalization." *Sociology of Education* 2–17.
- Rice, James. 2007. "Ecological Unequal Exchange: Consumption, Equity, and Unsustainable Structural Relationships within the Global Economy." *International Journal of Comparative Sociology* 48(1):43–72.
- Rice, James. 2008. "Material Consumption and Social WellBeing within the Periphery of the World Economy: An Ecological Analysis of Maternal Mortality." *Social Science Research* 37(4):1292–1309.
- Schnaiberg, Allan. 1980. "The Environment: From Surplus to Scarcity." *Eweb*:31283.
Retrieved November 17, 2019
(<https://repository.library.georgetown.edu/handle/10822/785551>).
- Schnaiberg, Allan and Kenneth Alan Gould. 2000. *Environment and Society: The Enduring Conflict*. Blackburn Press.
- Schofer, Evan and Ann Hironaka. 2005. "The Effects of World Society on Environmental Protection Outcomes." *Social Forces* 84(1):25–47.
- Shandra, John M. 2007. "The World Polity and Deforestation: A Quantitative, Cross-National Analysis." *International Journal of Comparative Sociology* 48(1):5–27.
- Shandra, John M., Christopher Leckband, and Bruce London. 2009a. "Ecologically Unequal Exchange and Deforestation: A Cross-National Analysis of Forestry Export Flows." *Organization & Environment* 22(3):293–310.
- Shandra, J. M., C. Leckband, L. A. McKinney, and B. London. 2009b. "Ecologically Unequal Exchange, World Polity, and Biodiversity Loss: A Cross-National Analysis of

- Threatened Mammals.” *International Journal of Comparative Sociology* 50(3–4):285–310.
- Shandra, John M., Eran Shor, and Bruce London. 2009c. “World Polity, Unequal Ecological Exchange, and Organic Water Pollution: A Cross-National Analysis of Developing Nations.” *Human Ecology Review* 53–63.
- Shorette, Kristen. 2012. “Outcomes of Global Environmentalism: Longitudinal and Cross-National Trends in Chemical Fertilizer and Pesticide Use.” *Social Forces* 91(1):299–325.
- Shorette, Kristen, Kent Henderson, Jamie M. Sommer, and Wesley Longhofer. 2017. “World Society and the Natural Environment.” *Sociology Compass* 11(10):e12511.
- Steinberger, Julia K., J. Timmons Roberts, Glen P. Peters, and Giovanni Baiocchi. 2012. “Pathways of Human Development and Carbon Emissions Embodied in Trade.” *Nature Climate Change* 2(2):81–85.
- Sweidan, Osama D. 2018. “Economic Performance and Carbon Intensity of Human WellBeing: Empirical Evidence from the MENA Region.” *Journal of Environmental Planning and Management* 61(4):699–723.
- Timmons Roberts, J. and Bradley C. Parks. 2007. “Fueling Injustice: Globalization, Ecologically Unequal Exchange and Climate Change.” *Globalizations* 4(2):193–210.
- Wallerstein, Immanuel. 1974. *The Modern World-System I: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century (Studies in Social Discontinuity) (v. 1)*.
- Wallerstein, Immanuel Maurice. 2006. *European Universalism: The Rhetoric of Power*. The New Press.

World Bank. 1990. World Development Report 1990 : Poverty. New York: Oxford University Press. World Bank. Retrieved July 6, 2019
<https://openknowledge.worldbank.org/handle/10986/5973> License: CC BY 3.0 IGO.”

World Bank World Development Indicators. 2015. retrieved April 2018
<http://databank.worldbank.org/data/home.aspx>.

CONCLUSION

A large body of macro-comparative work in sociology is dedicated to understanding the relationship between the economy and socio-ecological sustainability (York, Rosa, and Dietz 2003; Rosa, York, and Dietz 2004; Jorgenson and Clark 2011, 2012; Rosa and Dietz 2012; Knight and Schor 2014; Longhofer and Jorgenson 2017; Thombs 2018). By comparison, the question of how the institution of education functions for sustainability is empirically and theoretically neglected. This omission is notable since social institutions, such as the economy, cannot be understood in isolation (Weber 2002).

Understanding the relationship between education and sustainability has important policy implications as the international governance community already widely embraces the presumed alignment between education and broader sustainability outcomes (UNESCO 2016). Indeed, extensive cross-disciplinary literature has identified associations between higher rates of educational attainment and increases in a variety of measures of human wellbeing (Patrinos and Montenegro 2014; Baker et al 2011; Helliwell 2003). If gains in educational attainment are associated with reductions in environmental stress, especially in contexts when human wellbeing is enhanced, it represents a powerful mechanism for attaining global sustainability. On the other hand, if the gains in human wellbeing associated with increased educational attainment are

marginal, or, if high environmental costs accompany such gains, critical questions about the function of this cornerstone social institution need to be addressed.

To better understand the role of education for sustainability, this project explored if gains in average per capita educational attainment enhanced sustainability outcomes in nations across varying income and regional groups, during the period 1960-2010. In the project, I use a measure of sustainability developed by social scientists (Dietz et al. 2012; Jorgenson 2014), namely, the carbon intensity of wellbeing (CIWB). CIWB is a ratio of per capita CO₂/ life expectancy. By focusing exclusively on the socio-ecological domains of sustainability, this measure overcomes what Longo et al. (2016) classify as the “pre-analytic vision” of sustainability, which naturalizes the dominant economic system. I use this dependent variable in two nuanced empirical investigations into the relationship between education and CIWB.

In chapter two, I estimate Prais-Winsten regression models with panel-corrected standard errors on data at five-year intervals for 76 nation-states across six geographic regions. I estimate these models both for a global sample of nations and for each of the following six regional subsamples; advanced economies, East Asia and the Pacific, Latin America and the Caribbean, the Middle East and North Africa (MENA), South Asia, Sub-Saharan Africa.

Through this analysis, I find that gains in education are associated with a lower carbon intensity of wellbeing across all six regional samples, with the largest predicted effects observed at the early time points of the study. The magnitude of these results varies across regions. I find the largest and most consistent desirable relationship between education and sustainability for nations in the South Asia region.¹⁵ Conversely, I find the relationship between these two variables to be null for nations in the MENA region in all, but two, time points. Interestingly, the trajectory of the relationship between years of education and CIWB is similar for nations in East Asia and the Pacific, and Latin America and the Caribbean regions. In these regional groups of nations, the desirable effect of education is largest at the early study time points but the effect gradually disappears over time¹⁶ (See Figure 7). Notably, at the last time point of the study, 2010, gains in education are associated with a higher carbon intensity of wellbeing for nations in Latin America and the Caribbean.

¹⁵ For the majority of the time periods a 1 percent gain in per-capita years of schooling was associated with 0.28 percent lower predicted values of CIWB.

¹⁶ For example, in the first timepoint of the study period, 1960, a 1 percent increase in education is associated with a .32 and .37 percent lower values for CIWB for East Asia-Pacific and Latin America-Caribbean respectively.

Similarly, for nations in Sub-Saharan Africa, gains in education are also associated with lower carbon costs of human wellbeing between 1960 and 2000. However, the magnitude of these gains is less in this sample than for nations in Asia and Latin America during this period. Similar to the trend observed for nations in the Latin America and the Caribbean region, for the final two-time points included in the study (2005, 2010), I found gains in education to be associated with higher carbon costs of wellbeing for nations in Sub-Saharan Africa.

Advanced economies provide an interesting counterpoint to the trend observed in the other regional samples of nations. The predicted gains in sustainability associated with increased education are smaller when compared to other regional samples of nations from 1960 to 1985. However, the predicted desirable association between education and sustainability increases in magnitude in the latter periods of the study. As discussed in chapter two, complex national and subnational economic, social, cultural, and historical factors underlie these trends. The analysis presented in chapter three provides some insight into the economic factors that may have contributed to these findings.

My analysis in Chapter two is informed by insights from Sen and Nussbaum's capabilities approach and from ecological modernization theory. The capabilities approach proposes that education is a foundational human capability, which has both instrumental and intrinsic value and is, therefore, an essential component of

sustainable societies (Sen 1999; Nussbaum 2011; Alkire 2005). Notably, ecological modernization—a dominant theory within environmental sociology— fails to substantively engage with the social institution of education. This omission represents an opportunity for further theorization because many of the features attributed to the “modern nation-state”, such as technologically advanced economies and a more engaged electorate, are undergirded by access to education (Mol 2001, 2002). Despite the lack of direct engagement with education from ecological modernization theory, this project proposes that both perspectives lend support to the proposition that more educated populations may lead to more sustainable development trajectories.

My findings on the relationship between per capita years of educational attainment and CIWB in chapter two provide some support for Sen’s contention that gains in education enhance human functioning and, therefore, may be associated with more sustainable societies. However, the strength of this relationship decreases over-time, across nearly all regions. The decline in the desired effect of education on CIWB for nations in the majority world regions in the study runs counter to the modernization-informed linear conceptualization of development, in which ecological modernization is rooted. Findings in related research also counter this ecological modernization position, whereby economic development is mostly associated with a higher carbon intensity of wellbeing (Jorgenson 2014, Jorgenson and Givens 2015).

On the other hand, education is associated with less carbon-intensive societies among advanced economies in the later periods of the study, which supports the ecological modernization perspective. However, related research by Givens (2018) and others (Jorgeson 2012; Rice 2005) suggests that during the contemporary period, high-income nations can lower their environmental footprint, and thereby their production-based CIWB, through integration into the global economic system. That same integration intensifies the carbon intensity of wellbeing in lower-income nations. To understand if integration into global systems affected the relationship between education and sustainability, I explore if a nation's level of economic development and integration into the global economy affects the relationship between CIWB and education in Chapter Three.

In chapter three, I group nations based on their level of economic development, per the World Bank classification (World Bank 1990). For this analysis, I estimate Prais-Winsten Models regression techniques with panel corrected standard errors on data for 73 nation-states, across three income groups, with data at five-year intervals. For a global sample of nations, I find no significant relationship between CIWB and the percentage of the population with a college degree. On the other hand, I find that on average, a 1 percent increase in rate of educational attainment is associated with a 0.23 percent lower predicted value for CIWB for the same group of nations between 1960 to 2010.

I find that the magnitude of gains in sustainability associated with growing rates of educational attainment depends on a nation's level of economic development. Specifically, the relationship between average years of educational attainment and CIWB for high-income nations is mostly null. In middle-income nations, gains in educational attainment are associated with lower predicted values of CIWB until 1980 (See Figure 12). However, after that point, gains in education are associated with more carbon-intensive societies. I find a similar trajectory for low-income nations. Education is associated with lower predicted values for CIWB between 1960 and 1990. After 2000, gains in education are associated with higher carbon costs of human wellbeing.

Informed by Givens (2018) and other related investigations, I explore if integration into the global economic system moderates the relationship between education and sustainability. I find a significant interaction effect between education and integration into the global economy, as measured by exports as a percentage of GDP. Moreover, the nature of this relationship is different depending on the level of a nation's economic development. On average, higher levels of exports as a percent of GDP are predicted to strengthen the desirable relationship between education and sustainability for the high-income group. On the other hand, increases in exports as a percentage of GDP are predicted to weaken the desirable association between education and CIWB for middle- and low-income groups.

Chapter three is informed by political economy and world society perspectives on education. The world society perspective is cautiously optimistic about the role of mass education in generating more sustainable trajectories. From this perspective, education institutions are seen both as evidence of adherence to, and sites of transmission for global cultural scripts, which espouse ideals of human development and environmentalism. The finding that gains in education are on the whole associated with a lower carbon intensity of wellbeing, particularly in the early part of the study period, is somewhat in line with this perspective. On the other hand, the finding that gains in education are associated with higher carbon costs of wellbeing in the middle- and low-income groups, in the latter part of the study period, supports political economy perspectives. In particular, these findings are consistent with the world-systems perspective, which argues that mass education serves to socialize national labor forces in “periphery regions” for participation in an exploitative global capitalist system (Arnové 1980; Griffiths and Arnove 2015).

Further, the moderating role of global trade relations on the relationship between education and CIWB suggests that gains in educational attainment facilitate increased participation in the global economic system. This form of integration is disadvantageous for some nations because they represent historic relations of dominance and subordination. As a result, the social spoils associated with states’ expanded access to education are also dependent on that nation's level of integration in the world economy.

This finding is mostly in keeping with an ecological unequal exchange perspective (Hornborg 1998, Hornborg and Martinez-Alier 2016; Givens et al. 2019).

On the whole, I argue that these findings lend broad support and contribute to political economy understandings of the role of education for sustainability. Though, I also argue that these findings do not necessarily disprove the existence of world society. Indeed, the broad engagement with the United Nations' sustainable development agenda as described in chapter one is arguably evidence of a common language, reproduced by world society institutions, and rooted in an idealistic global culture. However, as scholars of global institutions have shown, the multi-dimensional and power-laden nature of the global system results in contradictory agendas by institutions and the society they reproduce (Goldman 2005; Weaver 2008). These results do, however, provide further concerning evidence of the limited efficacy of this environmentally-oriented dimension of global society for achieving sustainability in the face of strong countervailing global economic interests (Jorgenson 2009a; Jorgenson et al. 2011; Shorette 2012; Longhofer and Jorgenson 2017 Givens 2017).

Combining these macro-comparative theories helps to generate insights into how the complicated social institution of education operates for sustainability at a global scale, thereby illustrating the advantages of integrative approaches for macro-sociological studies of sustainability. This project also advances macro-sociological theoretical

understandings of education by contrasting a variety of perspectives on the role of mass education for enhancing human and environmental wellbeing. The comparisons also reveal some of the contradictions and space for further development of these theories in terms of their treatment of education. One cross-cutting omission of the theories included in this work is the lack of engagement with the question of how dominant approaches to education may have foreclosed other more ecologically orientated transmissions of knowledge and values.

These theoretical insights also raise important considerations for how we understand the relationship between education and sustainability going forward. Dietz (2015) offers a useful framework for thinking about how education may be instrumentalized as an institution for strong sustainability. The author makes an analytical differentiation between manufactured, human, and natural “resources” on the one hand, and the more commonly used concepts of manufactured, human, and natural “capital” in discussions of sustainability. Dietz notes that historically, societies have used all three types of resources in the pursuit of generating human wellbeing. However, the end of achieving wellbeing has increasingly replaced or is at least conflated with, profit, and the related concept of economic growth, in the contemporary capitalist society. The author notes that drawing a distinction “between resources and capital avoids the presumption that the only value of a resource is the exchange value that comes from market transactions” in the context of the contemporary market system (Dietz 2015: 135).

Extending this reasoning to the current project provides an opportunity to consider whether national education systems function to build human capital or human resources. Building human capital could be considered consistent with the world systems' pessimistic view of a standardized global education system designed to serve the needs of the exploitative global division of labor. In turn, gains in human capital can compromise sustainability outcomes because of the problematic impact of the current economic system and sustainability.

From an ecological modernization perspective, this kind of market-oriented education system could provide the human capital necessary to provide the expertise necessary for a technical fix to the challenge of sustainability¹⁷. Unfortunately, evidence to date, including this project, does not support this prediction. As states develop the human capital necessary to achieve technical advances associated with more efficient production, at the macro-economic level, their environmental footprint has risen (Jorgenson 2009b; York 2006, 2010; York, Rosa, and Dietz 2009). In fact, gains in

¹⁷ Notably Shwom 2011 highlights the need to be more attentive to national socio-cultural conditions and power relations within states to better understand the likelihood of nations' embracing components of ecological modernization. A more in-dept theorization and exploration of the role a nations education system could yield some fruitful insights in this regard.

efficiency are often associated with rebound effects that exacerbate environmental problems (Foster et al. 2011; York 2006; Grant, Jorgenson and Longhofer 2016).

Building human resources, on the other hand, could be understood as a concept more closely related to Sen and Nussbaum's conceptualization of education as an expansion of human capabilities, whereby education is valued for its intrinsic as well as instrumental use-value. Put in terms of the capabilities approach, education can enhance human functioning (a concept more closely related to human capital) but should foremost be operationalized and institutionalized in ways that build human capabilities, thereby engendering human dignity and freedom (Sen 1999; Nussbaum 2004, 2010, 2011). This conceptualization of education is also similar to the world society view of educational institutions as receptor sites for ideas of expanded rights and environmentalism (Bromley et al 2011a; Bromley et al. 2011b; Meyer et al 2010; Frank et al. 2011).

The advantages of building capabilities, including education, have traditionally been foundational to frameworks focused purely on human development goals, such as the Human Development Index (HDI), and separate from debates on sustainability (Neumeyer 2010). More recent iterations of the 'broad' capabilities approach apply to the protection of the natural environment (Alkire 2010; Martins 2010, 2013; Sen 2013). Notably, Nussbaum argues that "Being able to live with concern for and in relation to animals, plants, and the world of nature" (2011:34) should be counted as one of ten core

human capabilities to be supported by all democracies. Arguably, the severity of the current ecological breakdown (FAO 2011; MEA 2005; Masson-Delmotte 2018) impinges not only this particular capability (IPBES 2019), but also on the other nine¹⁸ core capabilities for human development that Nussbaum proposes.

While this project contributes to our theoretical and empirical understandings of the role of education for sustainability, it is not without its limitations. A notable limitation of this study is that the empirical chapters are based on data for just 76 and 73 nation-states, respectively. Other research could also focus on a shorter timeframe, which could allow for the inclusion of more nation-states.

Second, the independent variables of interest in this study are based on nationally reported measures of educational attainment. These measures are limited as they miss intrastate variation. Further, the quality of the raw data relies on the commitment and resources of each nation's education and statistic ministries. While the Barro and Lee (2013) dataset improve the accuracy of estimates by drawing on multiple sources and

¹⁸ These include life; bodily health; bodily integrity; senses, imagination, and thought; emotions; practical reason; affiliation; other species: play; control over one's political and material environment.

refining the data using a variety of statistical techniques, some reliability issues likely persist.

Another limitation is that the outcome variable of interest is a ratio of production-based carbon emissions relative to average life expectancy. Other studies could capture the relationship between gains in per capita education and consumption-based processes by using consumption-based carbon emissions as the numerator for the outcome variable, CIWB (e.g., Jorgenson and Givens 2015). Also, it should be noted that that chapter three uses exports as the percentage of GDP as a measure of integration for the global economy. Another possibility is to use the percent exports to high-income nations as a measure of ecological unequal exchange, as related studies have done (Jorgenson 2012; Givens 2018).

Finally, this work does not capture the complexities of the relationship between education and sustainability within nations. A fruitful opportunity for future research could involve an in-depth analysis of the relationship between education and sustainability at the subnational level, such as within and across US states. Shifting the unit analysis from nation-states to U.S. states has advantages in that subnational units of analyses fall under the same overarching set of national institutions and have higher cultural consistency.

REFERENCES

- Alkire S. 2010. *Human Development: Definitions, Critiques, and Related Concepts*. Background paper for the 2010 Human Development Report, OPHI working paper no. 36. Oxford Poverty & Human Development Initiative (OPHI).
- Alkire, Sabina. 2005. *Valuing Freedoms: Sen's Capability Approach and Poverty Reduction*. Oxford University Press on Demand.
- Arnove, Robert F. 2003. "Introduction: Reframing Comparative Education: The Dialectic of the Global and the Local." *Comparative Education: The Dialectic of the Global and the Local* 2:1–23.
- Baker, David P., Juan Leon, Emily G. Smith Greenaway, John Collins, and Marcela Movit. 2011. "The Education Effect on Population Health: A Reassessment." *Population and Development Review* 37(2):307–332.
- Barro, Robert J., and Jong Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." *Journal of Development Economics* 104:184–98.
- Bromley, Patricia, John W. Meyer, and Francisco O. Ramirez. 2011a. "Student-Centeredness in Social Science Textbooks, 1970-2008: A Cross-National Study." *Social Forces* 90(2):547–570.

- Bromley, Patricia, John W. Meyer, and Francisco O. Ramirez. 2011b. "The Worldwide Spread of Environmental Discourse in Social Studies, History, and Civics Textbooks, 1970–2008." *Comparative Education Review* 55(4):517–545.
- Dietz, Thomas, Eugene A. Rosa, and Richard York. 2012. "Environmentally Efficient Wellbeing: Is There a Kuznets Curve?" *Applied Geography* 32(1):21–28.
- Dietz, Thomas. 2015. "Prolegomenon to a Structural Human Ecology of Human Wellbeing | Sociology of Development." *Sociology of Development* 1(1):123–48.
- Food and Agriculture Organization (FAO). 2011 *Climate Change, Water and Food Security*; Food and Agriculture Organization of the United Nations: Rome, Italy. Retrieved February 11, 2020. <http://www.fao.org/3/i2096e/i2096e00.htm>
- Foster, John Bellamy, Brett Clark, and Richard York. 2011. *The Ecological Rift: Capitalism's War on the Earth*. NYU Press.
- Frank, David, J. Karen Jeong Robinson, and Jared Olesen. 2011. "The Global Expansion of Environmental Education in Universities." *Comparative Education Review* 55(4):546–573.
- Givens, Jennifer E. 2017. "World Society, World Polity, and the Carbon Intensity of Wellbeing, 1990–2011." *Sociology of Development* 3(4):403–35.

- Givens, Jennifer E. 2018. "Ecologically Unequal Exchange and the Carbon Intensity of WellBeing, 1990–2011." *Environmental Sociology* 4(3):311–24.
- Givens, Jennifer E., Xiaorui Huang, and Andrew K. Jorgenson. 2019. "Ecologically Unequal Exchange: A Theory of Global Environmental Injustice." *Sociology Compass* 13(5):e12693.
- Goldman, Michael. 2005. *Imperial Nature: The World Bank and Struggles for Social Justice in the Age of Globalization*. Yale University Press.
- Grant, Don, Andrew K. Jorgenson, and Wesley Longhofer. 2016. "How Organizational and Global Factors Condition the Effects of Energy Efficiency on CO2 Emission Rebounds among the World's Power Plants." *Energy Policy* 94:89–93.
- Griffiths, Tom G., and Robert F. Arnove. 2015. "World Culture in the Capitalist World-System in Transition." *Globalisation, Societies and Education* 13(1):88–108.
- Helliwell, John F. 2003. "How's Life? Combining Individual and National Variables to Explain Subjective Wellbeing." *Economic Modelling* 20(2):331–60.
- Hornborg, Alf, and Joan Martinez-Alier. 2016. "Ecologically Unequal Exchange and Ecological Debt." *Journal of Political Ecology* 23(1):328–333.

- Hornborg, Alf. 2009. "Zero-Sum World: Challenges in Conceptualizing Environmental Load Displacement and Ecologically Unequal Exchange in the World-System." *International Journal of Comparative Sociology* 50(3–4):237–262.
- IBES. 2019 *Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating'*; The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services: Bonn, Germany, 2019
- Jorgenson, Andrew K. 2009b. "The Transnational Organization of Production, the Scale of Degradation, and Eco-efficiency: A Study of Carbon Dioxide Emissions in Less-Developed Countries." *Human Ecology Review* 64–74.
- Jorgenson, Andrew K. 2012. "The Sociology of Ecologically Unequal Exchange and Carbon Dioxide Emissions-, 1960–2005." *Social Science Research* 41(2):242–252.
- Jorgenson, Andrew K. 2014. "Economic Development and the Carbon Intensity of Human WellBeing." *Nature Climate Change* 4(3):186–89.
- Jorgenson, Andrew K. 2009a. "Foreign Direct Investment and the Environment, the Mitigating Influence of Institutional and Civil Society Factors, and Relationships Between Industrial Pollution and Human Health: A Panel Study of Less-Developed Countries." *Organization & Environment* 22(2):135–57.

Jorgenson, Andrew K., and Brett Clark. 2011. "Societies Consuming Nature: A Panel Study of the Ecological Footprints of Nations, 1960–2003." *Social Science Research* 40(1):226–244.

Jorgenson, Andrew K., and Brett Clark. 2012. "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005." *American Journal of Sociology* 118(1):1–44.

Jorgenson, Andrew K., and Jennifer Givens. 2015. "The Changing Effect of Economic Development on the Consumption-Based Carbon Intensity of Wellbeing, 1990–2008." *PLOS ONE* 10(5):e0123920.

Jorgenson, Andrew K., Christopher Dick, and John M. Shandra. 2011. "World Economy, World Society, and Environmental Harms in Less-Developed Countries." *Sociological Inquiry* 81(1):53–87.

Knight, Kyle W., and Juliet B. Schor. 2014. "Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries." *Sustainability* 6(6):3722–31.

Longhofer, Wesley, and Andrew Jorgenson. 2017. "Decoupling Reconsidered: Does World Society Integration Influence the Relationship between the Environment and Economic Development?" *Social Science Research* 65:17–29.

- Longo, Stefano B., Brett Clark, Thomas E. Shriver, and Rebecca Clausen. 2016. "Sustainability and Environmental Sociology: Putting the Economy in Its Place and Moving Toward an Integrative Socio-Ecology." *Sustainability* 8(5):437.
- Martins, Nuno O. 2013. "The Place of the Capability Approach within Sustainability Economics." *Ecological Economics* 95:226–230.
- Martins, Nuno. 2011. "Sustainability Economics, Ontology and the Capability Approach." *Ecological Economics* 72:1–4.
- Masson-Delmotte, Valérie. 2018. *Global Warming of 1.5 OC: An IPCC Special Report on the Impacts of Global Warming of 1.5 C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*. World Meteorological Organization.
- Millenium Ecosystem Assessment (MEA). 2005. *Ecosystems and Human WellBeing*; Island Press: Washington, DC, USA. Retrieved February 20, 2020.
<https://www.millenniumassessment.org/documents/document.356.aspx.pdf>
- Meyer, John W., Patricia Bromley, and Francisco O. Ramirez. 2010. "Human Rights in Social Science Textbooks: Cross-National Analyses, 1970–2008." *Sociology of Education* 83(2):111–134.

- Mol, Arthur PJ. 2001. *Globalization and Environmental Reform: The Ecological Modernization Of the Global Economy*. Cambridge, MA: MIT Press.
- Mol, Arthur P. J. 2002. "Ecological Modernization and the Global Economy." *Global Environmental Politics* 2(2):92–115.
- Neumayer, Eric. 2010. *Weak versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms*. Edward Elgar Publishing.
- Nussbaum, M. C. 2004. "Women's Education: A Global Challenge." *Signs* 29.
- Nussbaum, Martha C. 2010. "Democracy, Education, and the Liberal Arts: Two Asian Models." *UC Davis L. Rev.* 44:735.
- Nussbaum, Martha C. 2011. *Creating Capabilities*. Harvard University Press.
- Patrinos, H. A., and C. E. Montenegro. 2014. "Comparable Estimates of Returns to Schooling around the World (No. 7020)." *Washington D.C: Education Global Practice Group, World Bank Group*.
- Rosa, Eugene A., and Thomas Dietz. 2012. "Human Drivers of National Greenhouse-Gas Emissions." *Nature Climate Change* 2(8):581–86.

- Rosa, Eugene A., Richard York, and Thomas Dietz. 2004. "Tracking the Anthropogenic Drivers of Ecological Impacts." *AMBIO: A Journal of the Human Environment* 33(8):509–12.
- Sen, Amartya. 1999. *Development as Freedom*. Oxford University Press.
- Sen, Amartya. 2013. "The Ends and Means of Sustainability." *Journal of Human Development and Capabilities* 14(1):6–20.
- Shorette, Kristen. 2012. "Outcomes of Global Environmentalism: Longitudinal and Cross-National Trends in Chemical Fertilizer and Pesticide Use." *Social Forces* 91(1):299–325.
- Shwom, Rachael L. 2011. "A Middle Range Theorization of Energy Politics: The Struggle for Energy Efficient Appliances." *Environmental Politics* 20(5):705–726.
- Thombs, Ryan. 2018. "The Transnational Tilt of the Treadmill and the Role of Trade Openness on Carbon Emissions: A Comparative International Study, 1965–2010." *Sociological Forum* 33(2):422–42.
- UNESCO 2016. UNESCO strategy on education for health and wellbeing: contributing to the Sustainable Development Goals ED.2016/WS/35 Retrieved July 8, 2019, <https://unesdoc.unesco.org/ark:/48223/pf0000246453>
- Weaver, Catherine. 2008. *Hypocrisy Trap: The World Bank and the Poverty of Reform*. Princeton University Press.

Weber, Max. 2002. *The Protestant Ethic and the " Spirit" of Capitalism and Other Writings*. Penguin.

York, Richard, Eugene A. Rosa, and Thomas Dietz. 2003. "Footprints on the Earth: The Environmental Consequences of Modernity." *American Sociological Review* 68(2):279–300.

York, Richard, Eugene A. Rosa, and Thomas Dietz. 2010. "Ecological Modernization Theory: Theoretical and Empirical Challenges." In *The International Handbook of Environmental Sociology*, edited by M. R. Redclift and G. Woodgate. Cheltenham, UK: Edward Elgar Publishing Limited.

York, Richard. 2006. "Ecological Paradoxes: William Stanley Jevons and the Paperless Office." *Human Ecology Review* 143–147.

York, Richard. 2010. "The Paradox at the Heart of Modernity: The Carbon Efficiency of the Global Economy." *International Journal of Sociology* 40(2):6–22