

A Review of *The Age of Sustainable Development* by Jeffrey Sachs[†]

MATTHEW E. KAHN*

How does economic science inform the study of sustainable development? In his new book, Jeffrey D. Sachs analyzes the challenges of achieving economic growth while protecting the environment and achieving an equitable distribution of resources. This review presents an overview of this ambitious book with special emphasis on the role of the objectives of local and national leaders and their incentives to pursue the sustainability agenda. Given the huge migration to cities now playing out in the developing world, special attention is paid to the role of urbanization as a cause of sustainability opportunities and challenges. (JEL Q01, Q54, Q56, R11)

1. Introduction

At Columbia's School of International and Public Affairs, the Fletcher School at Tufts, and at UCLA, I have taught interdisciplinary students about sustainable development. Many of these students have not been exposed to basic economics concepts. Some of them are deeply skeptical about our core ideas related to the benefits of free markets and international trade. My students are smart and idealistic. They understand that capitalism gave us Snapchat and Instagram, Google and their cell phones, but they are greatly concerned that free market growth causes pollution and exacerbates income inequality. They have never heard of Milton

Friedman or Paul Samuelson. They do not follow me on Twitter and they do not read my blog or any other economist's blog. My window of opportunity for teaching them neoclassical economics ideas is narrow!

My UCLA students would unanimously declare that "sustainable development" is a good thing. They want to be prosperous and they deeply hope that world poverty declines. They want their future grandchildren to live well. My students are worried about specific environmental challenges such as climate change, air pollution, and biodiversity protection. They worry that we are unintentionally depleting key natural resources such that their children will not have as good a quality of life as they have enjoyed. But, they reject the deep ecological vision that world population growth and per capita income growth both must cease in order to protect the environment. Very few of these students would embrace a libertarian vision of simply

*University of California, Los Angeles, University of Southern California, and NBER.

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unleashing free market growth to reduce global poverty.

My students would greatly enjoy reading and debating Jeffrey Sachs's *The Age of Sustainable Development*. Sachs's book is written for a popular audience and could be used as a complementary text for courses in environmental or development economics or in public health classes or environmental studies classes. Its breadth of insights and coverage is staggering and students and general readers will find new ideas on every page of the book.

During his time leading the Harvard Institute for International Development and Columbia's Earth Institute, Sachs has traveled the world and written many very highly cited papers related to malaria, poverty, and economic geography (Sachs and Malaney 2002). He is the ideal author to write a definitive book focused on economic development and the environment. In recent years, several excellent popular books on development have been published, but none of these books have had an environmental focus (see Acemoglu and Robinson 2012, Banerjee and Duflo 2011, Easterly 2001). Sachs's idealism and his academic reputation together provide him with the "street credibility" to convey neoclassical ideas.

Sachs provides his definition of sustainable development:

As an intellectual pursuit, sustainable development tries to make sense of the interactions of three complex systems; the world economy, the global society and the Earth's physical environment. How does an economy of 7.22 billion people and \$90 trillion gross world output change over time? What causes economic growth? Why does poverty persist? What happens when billions of people are suddenly interconnected through markets, technology, finance and social networks? How does a global society of such inequality of income, wealth and power function? Can the poor escape their fate? Can human trust and sympathy surmount the divisions of class and power? And what happens when the world economy is on

a collision course with the physical environment? Is there a way to change course, a way to combine economic development with environmental sustainability? (chapter 1).

Sachs's book is ambitious in its attempt to comprehensively cover the "three Es" of sustainable development: economy, equity, and the environment. He seeks to explain the underlying causes of poverty and pollution and inequality and in a similar spirit as a practicing physician, he seeks to cure these problems.

To organize this review, I will briefly sketch out each chapter's main themes. I will quote Sachs directly to convey his tone and emphasis. In the second half of the review, I focus on two chapters that relate to resilient cities (chapter 11) and climate change (chapter 12). Given that my own research focuses on the effects of urban economic growth on the environment and on the impact of the environment on urban economic growth, I will discuss these chapters in detail. A distinctive feature of this book is that Professor Sachs voices a strong normative agenda for what policies cities and nations ought to adopt. I will discuss the implementation challenge concerning whether national and local officials have strong incentives to adopt Sachs's recommendations. I will emphasize the importance of empirical hypothesis testing on subjects at the intersection of environmental and development economics. New entrants to the field of economics gain from learning how we go about conducting our research and how such empirical findings translate into policy advice.

2. *An Overview of Each Chapter*

Chapter 1 lays out the book's major themes as it discusses technology, economic growth, and long-run trends in world population and per capita income and major environmental threats caused by economic development. The chapter takes a surprising turn when

Sachs rejects the standard “efficiency versus equity” tradeoff that students encounter in an Econ 101 class. “That view is much too pessimistic. We will see throughout this book why investing in fairness may also be investing in efficiency and why attention to sustainability can be more fair and more efficient at the same time.” The chapter ends by adopting a normative tone. “The first part of sustainable development—the analytical part—is to understand the interlinkages of the economy, society, environment and politics. The second part of sustainable development—the normative part—is to do something about the dangers we face to set Sustainable Development Goals (SDGs) and to achieve them! Our overarching goal should be to find a global path, made up of local and national paths, in which the world promotes inclusive and sustainable economic development, thereby combining the economic, social and environmental objectives. This can only be accomplished if a fourth objective—good governance of both government and business—is also achieved.”

The book presents many graphs and figures. Chapter 2 sketches some facts about economic growth and income inequality over time and across countries at a point in time. Sachs debates whether per capita GDP is a good indicator of national well-being as he points out that there are some nations such as Australia whose Human Development Indicator (HDI) ranking is much higher than its GDP per capita rank, while there are other nations such as Kuwait and Saudi Arabia whose HDI ranking is much lower than their respective GDP ranks.

This ambitious book not only covers the entire globe and many of the major social challenges we face, but it also provides a long-run history of world economic growth. Chapter 3 quickly sketches a 150,000-year history of world economic growth before landing in the midst of the Industrial Revolution in England. The confluence of

several trends—James Watt’s invention, natural resources, rule of law, the existence of great universities—together create the special conditions that converged in mid-eighteenth-century England to make possible the Industrial Revolution. Readers will gain from the sophisticated discussion of the role of innovation, versus adopting existing innovations, in contributing to economic growth. “For catch-up growth, a strong role of government (as in China, The Republic of Korea, and Singapore), for example, can often be a major spur to the rapid adoption of advanced technologies from abroad.”

Why have some countries developed while others stayed poor? Chapter 4 tackles a big question. A highly influential hypothesis is the central role of institutions in determining economic outcomes (Acemoglu and Robinson 2012). Sachs is known for his emphasis on the role of geography as a crucial factor (Sachs 2003). In this chapter, he mentions that geographic areas suffering from malaria and areas that are landlocked face fundamental disadvantages in achieving economic growth. Sachs eschews uncausal theories of economic development. He traces out a much more complex explanation. Sachs invokes an intriguing analogy comparing himself as an economist seeking to diagnose different “patients” (i.e., nations) with his wife Sonia, who is a clinical pediatrician. “When she sees a young child with a fever, she doesn’t immediately think she knows what the problem is, that all fevers have the same cause. Her training, knowledge and experience inform her that there could be thousands of reasons for the fever. To treat the patient effectively, she needs to make a diagnosis of the actual cause of the disease in this particular patient.”

The disease that Sachs is focused on eradicating is extreme poverty. He notes that a billion people are still trapped in extreme poverty and offers a seven-item poverty explanation list that includes: the poverty trap,

bad economic policies, financial insolvency of the government, physical geography, poor governance, cultural barriers, and geopolitics. He provides a sophisticated discussion of the potential causal role of each of these factors and he emphasizes the complexity of the problem. “There is no single explanation of the persistence of extreme poverty. . . .”

In chapter 5, the book takes a normative turn as its title, “Ending Extreme Poverty,” suggests. Sachs returns to his clinician role. “By adopting the methods of differential diagnosis, we can help regions still stuck in poverty to overcome the chronic low growth that has kept poverty rates high throughout modern history. . . . Those parts of the world still stuck in extreme poverty can get out of the poverty trap if they pursue policies aimed at overcoming the specific barriers to growth that now hold them back.” The chapter lists the eight Millennium Development Goals (MDGs):

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat infectious disease
7. Ensure environmental sustainability
8. Create a global partnership for development

This discussion could be improved by an explicit discussion of the cost of service delivery for each of these items and some sketches of the public finance of how such MDGs could be financed. How much of sustainable

development is related to sustainable financing of public goods and redistribution? Must the international aid community take the lead on these issues or are there other financing mechanisms such as issuing bonds and allowing socially responsible investors to purchase these that could help launch these well-intentioned (but expensive) efforts?

Sachs’s most prominent intervention has been the Millennium Villages. “We wanted to see how the MDGs could be approached in each of these distinctive (West African) agro-ecological zones, because each eco-zone poses specific challenges. How can farmers best grow each type of crop? How can pastoralists best manage their livestock, especially in the face of repeated droughts?” The chapter conveys his optimistic outlook as Sachs notes that his Villages have triggered a “guinea pig effect,” causing other host governments to “scale up large national programs in malaria control, AIDS treatment, help for smallholder farmers, and electrification with off grid solar based systems.” There is no mention of what performance criteria should be used to conduct a cost-benefit analysis of the Villages and no discussion of the empirical criticism that his field experiment has faced because the initial site selection was not chosen at random. Critics have argued that the causal effects of these Millennium Villages cannot be evaluated without such a randomized control group (Clemens and Demombynes 2011).¹ A key counterfactual issue arises here. What would quality of life in these treated villages have been in the absence of his intervention? Below, I will return to this point about the scientific investigation of testing and learning about the causes of sustainable development.

In chapter 6, Professor Sachs discusses several environmental challenges. “Does

¹ <http://blogs.worldbank.org/impactevaluations/jeff-sachs-the-millennium-villages-project-and-misconceptions-about-impact-evaluation>.

Earth have adequate resources—water, land, air, and ecosystem services such as the harvest of forests and fisheries—to sustain a growing world economy? In short, can economic growth be reconciled with environmental sustainability?” This chapter sketches trends in biodiversity and presents Engel curves for energy consumption to show the challenges posed by economic growth. A distinctive feature of this chapter is its full-hearted defense of Malthus. “Malthus really had a stronger case than we recognize and we should thank Malthus wholeheartedly for pointing out a deep conundrum that continues to this day. . . . Malthus was correct to worry. Second, when economists claim that Malthus neglected the potential for technological advance, we can note that economists on their part neglect the environmental damage caused by modern farming. . . . We don’t want Malthus to have the ‘last laugh’ (that indeed would be tragedy for humanity) but we do want to correct the farm system before it does irreversible damage to the global environment.” The chapter ends with Sachs performing a vital intellectual service as he defends the benefits of economic growth and counters the old environmentalist argument that economic growth must end. “Most importantly, choosing the right technologies, we can achieve continued economic growth and also honor the planetary boundaries.” Note the optimism that we can attenuate trade-offs between the depletion of natural capital and enjoying economic growth.

In this chapter, Sachs offers a careful discussion of the economics of fertility.

In some countries, women are not allowed to work or are restricted to working in the home or in just a few occupations. Fertility rates in these settings tend to be high. When women are working outside the home, the fertility rates are much lower. This is a direct “opportunity cost” of foregone earning when women are home raising many children.

The quantity-versus-quality child trade-off is central to understanding the dynamics of many sustainability challenges. The combination of increasing urbanization and women’s rising educational attainment raises the likelihood of reduced fertility, and hence reduced global population growth, as women increasingly pursue occupations and careers in cities (Costa 2000, Goldin 2014). Many environmentalists are adamant in their support for limits to world population growth. Urban economic development would appear to be a less draconian way to stabilize the world’s population.

Chapters 7, 8, and 9 focus on equity and investment in the less fortunate. In chapter 7, time trends in CEO to average worker compensation and time trends in earnings of the 1 percent and the top 0.01 percent are described. Time trends in the rising US wage differential between college and high school graduates are presented. One potential solution for the inequality challenge is to expand access to education. Chapter 8 is titled “Education for All.” James Heckman’s policy suggestion of increasing investment in disadvantaged young children is fully embraced. “Societies around the world are finally recognizing based on rigorous evidence across pediatrics, psychology, physiology and economics that investments in early child development are the best investments they can make. These investments in young children not only lead to efficiency in these of high economic returns but to fairness and social inclusion as well.” Such early investments are linked to later adult upward mobility. A second component of achieving greater equity is to invest in the health of the less fortunate. In chapter 9, Sachs presents data on long-run trends in life expectancy. One figure displays the positive correlation between life expectancy and per capita income. “When countries are very poor, even small incremental changes in income lead to very steep gains in life

expectancy while the gains in health as the result of higher incomes tend to level off at higher incomes.” Sachs dismisses the easy inference from such cross-national data: “Get rich and get healthy as well. But that would be a mistaken interpretation. The fact that very small changes in the income of the poor can lead to huge changes in health outcomes suggests an alternative interpretation; that modest but targeted investments in public health for poor people can make a profound difference for their health outcomes.”

Sachs makes a compelling case that targeted investments in early education for children and targeted investments in public health yield large returns. Are local and national leaders aware of this causal relationship? If they are aware, then why aren't they making these investments? A discussion of the political economy of support for such investment/redistribution would greatly improve this chapter. I would like to see more of an analysis by this prominent “poverty doctor” focused on the political economy of when governments are willing and able to direct capital to its highest and best use.

In the second half of chapter 9, Sachs seeks to explain the high health costs in the United States. He salutes Canada's single-payer model and sketches a lobbying model that current health care laws in the United States are set due to powerful interest groups. “This means politicians are attentive to the interests of this concentrated group, and not necessarily to the interests of the taxpayers or the citizens more generally.” While there certainly may be some merit to this argument, Sachs downplays the key role that the US “rules of the game” play in promoting drug innovation. Does the rest of the world free ride on US drug innovation? How much future innovation progress would we sacrifice now under different “rules of the game”? In a book focused on sustainable development,

the role of incentives and government policy in promoting directed technological change are under-discussed.

Starting in chapter 10, Sachs returns to issues at the intersection of environmental and sustainable studies. Chapter 10 focuses on food security. In discussing food security, Sachs presents illustrations of stunted children, presents the healthy eating pyramid, and contrasts food expenditure shares in rich and poor nations. He discusses the geography of global agricultural production and discusses how greenhouse gas emissions increase ocean acidification and injure shellfish. To my surprise, there is no discussion of international trade barriers and the role of free trade in agriculture. Do the urban poor gain from having access to cheaper, higher quality food imports? Do the rural poor lose from free trade because they face more domestic competition or do they gain from having the possibility of exporting?

Sachs emphasizes the interaction between the food system and the environment. Growing food impacts the environment through channels such as excess nitrogen use. Climate change impacts rural farmers through exacerbating drought and heat conditions in very poor subsistence places. He adopts a geographic focus, as farmers must cope with location-specific ecological conditions. “People living in food-secure, well-watered (and often irrigated) croplands of the temperate regions often have little feel for the complexity of food production and the potential for food insecurity in seasonal tropical environmental, especially those of low average rainfall and high vulnerability to drought.” He writes:

The world has especially failed to grasp the deep crises of the hyperarid regions, such as the Horn of Africa (including parts of Ethiopia, Kenya, Somalia, and other neighbors) and the Sahel (including parts of Senegal, Mali, Niger, Chad, and others). These are agro pastoralist regions or in some cases solely pastoralist regions. They tend to be very poor, utterly

dependent on rainfall and suffering under the burdens of climate change, instability of rainfall, rising populations, falling trends in total precipitation, increasing hunger, and resulting instability and violence.

This section of the book could have been improved by discussing ongoing empirical research related to the coping mechanism that the rural poor engage in as they face various market and climate risks (see Mendelsohn and Dinar 1999; Rosenzweig and Binswanger 1993; Townsend 1994; Fafchamps, Udry, and Czukas 1998). By discussing such frontier research, Sachs could convey to readers an appreciation about how economists test sustainable development hypotheses. Such a discussion would also highlight for new sustainability scholars the key role that markets play in improving the lives of poor rural people. Do farmers have access to cell phone technology so that such individuals are informed about opportunities in other locations (Jensen 2007)? A novice reading this chapter would feel a hopelessness that the individual farmers in these nations have no coping strategies for dealing with the serious challenges they face. Is this true? The value of international aid efforts to improve quality of life for these rural people hinges on a key counterfactual. How is their quality of life evolving in the absence of such well-intentioned interventions? Can these individuals move to nearby cities? Would their family's quality of life be improved by urbanizing?

In one of the last chapters of the book, Sachs explores the challenge of preserving biodiversity and ecosystems during a time of ongoing population and per capita income growth. "We have examined at length what happens when a growing world economy pushes against planetary boundaries. . . . This trespassing of planetary boundaries is occurring in many ways including climate change and pollution, but one of the most dramatic ways is the loss of the planet's biodiversity." This chapter takes the readers on a tour of

the challenges of ocean pollution and deforestation. A weakness of this chapter is that it could have been written thirty years ago. Over the last several decades, microeconomists have conducted increasingly sophisticated studies of the causes of such natural capital depletion. Examples include work on the deforestation impacts of road construction in Brazil and Thailand (see Pfaff 1999, Cropper, Puri, and Griffiths 2001), work on elephant harvesting (Kremer and Morcom 2000), and marine reserves harvesting (Smith and Wilen 2003, Costello, Gaines, and Lynham 2008). I recognize that environmental studies students and general readers will not be interested in the specific elasticity estimates reported in the applied papers cited above. However, a detailed discussion of some of these studies would convey our scientific approach for how we rigorously test hypotheses. The book's core reasoning could be strengthened with an explicit discussion of the role that natural experiments and field experiments have played in advancing the economic analysis of environmental challenges in the developing world. Given its "macro focus," this book never delves into how large an incentive must be in a specific context to achieve a worthy sustainable development goal. For example, if private property rights are established over rural lands does resource exploitation slow because the owners now face a higher opportunity cost of extraction?

3. *Five Cs—Cities, Competition, Capitalism, and Climate Change*

This brief overview of the book highlights its breadth and ambition. Given my own research focus on the impact of urban growth on climate change and on the economics of urban adaptation to climate change, I will now provide a detailed analysis of chapters 11 ("Resilient Cities") and 12 ("Climate Change").

3.1 *Urbanization*

Billions of people are moving to cities. Thus, the future of “sustainable development” hinges on the new urbanites’ quality of life and how their choices impact local and global environmental challenges. The private benefits of such urbanization include their urban wage premium, the learning possibilities offered by cities, and the variety in consumption and marriage market opportunities provided by living and working in cities (Glaeser 2011). The social costs of such urbanization include the marginal Pigouvian damage imposed through the scaling up of urban congestion, and air pollution and through increased GHG emissions due to rising urban incomes. Urban growth also imposes pecuniary externalities as migrants raise incumbents’ rents and lower their wages through market competition effects.

In chapter 11, Professor Sachs discusses several of these dimensions. He documents the positive correlation between urbanization and per capita GDP. Cities are more productive areas of the national economy. The migration of workers from rural to urban areas is often accompanied by a significant rise in national productivity. Cities are also the centers of innovation and centers of inequality. Sachs emphasizes such topics as geography (that cities tend to be on coasts), and focuses on sustainability challenges including social inclusion, environmental sustainability, urban water, waste, and carbon footprints.

To my surprise, this 500-plus-page book never discusses market competition and choice. How do rural people choose which city to move to? What role do wage differences and rents and nonmarket quality of life play in determining where they move? In the developing world, when poor people move to a city, where do they live within the city? What types of shelter do they live in? What diet do they eat? How often are they

sick? Do their children have access to education? What prices do they pay for the necessities of life? During their time in the city, how quickly does their income rise to allow them to afford key necessities? Answers to these questions would provide some clues about sustainable development and the quality of life of the urban poor.

Sachs does not discuss the role of the “system of cities” in protecting the urban poor during a time of urban growth. If cross-city migration costs are low, then spatial wages and rents will adjust so that migrants and firms are indifferent between locating in different areas (Rosen 2002). If an area experiences an influx of rural migrants, perhaps because climate change has lowered farming profits, then rural migrants may move to the closest city, but this is not a spatial equilibrium because inhabitants of that city will move to other cities (see Borjas, Freeman, and Katz 1997). Migration between cities in the aftermath of shocks means that the effects of a shock are not localized. While all of this reallocation occurs instantaneously in models with no migration barriers, urban research has documented that different demographic groups face different migration costs (Bayer, Keohane, and Timmins 2009, Kennan and Walker 2011). Those groups (the old and the less educated) that tend to be less mobile are more likely to bear the incidence of place-based shocks. This discussion highlights the importance of quantifying such migration costs.

3.2 *The Incentives of National and Urban Leaders to Invest in Sustainable Development*

Throughout the book, Sachs prescribes policies that national and local leaders should implement to achieve the goals of sustainable development. Do urban and national leaders have incentives to implement his agenda? At various points in the book, Sachs suggests that such leaders are overestimating the net

costs of such equitable policies because they are underestimating the efficiency benefits of equitable policies. He would point to greater investments in early child development (based on evidence assembled by James Heckman) and investment in health capital (see chapters 8 and 9). This raises an empirical question of whether such leaders would increase their investments in these equitable and efficient policies if they would only be exposed to the recent research on this topic. I wish this were true, but I wonder. In my work on voter support for pre-K investment in the United States, I find that Californian suburbanites and Republicans are less likely to vote in direct democracy ballots to expand pre-Kindergarten investment to poor children. We posit a simple urban economic theory that this group is likely to live far from the beneficiaries, and thus does not directly benefit in the medium-term from investing in this group, and in cases with progressive taxation that richer suburbanites will face a higher tax price (see Kahn and Barron 2015).

Urban political economy centered in the developing world would appear to be an important new research frontier. Under what circumstances do mayors supply local public goods that enhance the city's quality of life and reduce inequality? In the developing world, are urban leaders rewarded for supplying well-governed green cities? Pande (2011) provides a detailed survey of recent empirical work and optimistically concludes that voters in the developing world are more likely to support leaders who are responsive to providing public goods. Greenstone and Hanna (2014) document the role of environmental regulations in India causing later air pollution progress. In recent research, my coauthors and I have documented that Chinese mayors are more likely to be promoted if air quality has improved in their cities (Zheng et al. 2014). But Feler and Henderson (2011) document in the case of Brazil that mayors choose to undersupply

water connections for new migrants, as they anticipate that such local public goods lead to even greater migration of the poor to their cities. This is an important paper because it raises the question of which cities in the developing world actively seek to attract the poor to move there. What would Sachs say to the mayors of these cities? Would the mayors of these cities change their behavior once they read Sachs' book?

Within a system of cities, some cities will seek to have a comparative advantage in low skill labor intensive industries. Such cities will actively seek to attract rural uneducated people to move there. Low land prices and cheap wages will attract factories and economic growth will result. As households climb the income ladder, they would be free to choose to move to another city that offers different opportunities. If there is perfect competition in the local labor market for hiring talent, then workers will be implicitly protected from exploitation as firms with unpleasant working conditions would have to pay a compensating differential of higher wages.

This discussion highlights that a key issue in urban sustainable development is that nations should have "enough cities" for heterogeneous workers and firms to choose from. Such a menu is likely to enhance sustainable development. For example in Henderson's World City Database, Vietnam has twenty-five cities, and Thailand has fifteen cities.² Is this sufficient for there to be competition between these cities? What are the barriers to entry for a new city to form? A city does require specific fixed costs to be incurred for housing, sanitation, water delivery, and transportation infrastructure. How cheaply can such infrastructure be provided to help a new city launch? How can it be financed? Could a city issue bonds and pay back the

²<http://www.econ.brown.edu/faculty/henderson/worldcities.html>.

loans using future collected property taxes? Are there sustainable financing mechanisms? If a nation had more migration options for the new urbanites, how much would such increased variety increase poor workers' quality of life? Do national leaders have any incentives to use their resources to subsidize the creation of such new cities?

3.3 *Urbanization and Climate Change Adaptation*

Sachs only touches on the topic of climate change adaptation in chapter 10, when he discusses the challenges that African farmers will face due to changing climatic conditions and in chapter 12 when he states, "Adaptation will require adjustments in many sectors. In agriculture, crop varieties must be made more resilient to higher temperatures and more frequent flood and droughts (depending on location). Cities need to be protected against rising ocean levels and greater likelihood of storm surges and flooding. The geographic range of diseases, such as malaria, will spread as temperatures rise. . . . The list, in short, is very long and location specific."

In my own work, I have argued that urbanization and a nation's system of cities can greatly help people to adapt to the climate change that we have already collectively unleashed (Kahn 2010, 2015). Urban economic activity is less sensitive to climate shocks than agriculture. We build durable structures that can withstand extreme heat and even sea-level rise. With access to real time Internet information from our cell phones, we can choose in real time to reduce our exposure to fat tail short-term risk. Given the serial correlation of climate shocks, there is a predictability to climate shocks that helps us to adapt to them. If certain coastal cities are at risk for sea-level rise, forward looking investors recognize this point and build either sturdy capital that can take a punch or build less durable capital such that as sea level rises, this depreciated capital can be

walked away from or can be disassembled like Lego pieces and reassembled on higher ground.

As climate scientists make progress in modeling the spatially delineated risks caused by climate change, they will identify safer "higher ground" and with changes in zoning codes, we can build Hong Kong-style density in these safer areas. Singapore's success highlights that geography and heat can be offset through urban income. Critics counter that nations such as Bangladesh have impossible geography for adapting to climate change. But per capita income is rising in Bangladesh and its citizens know that they face a sea-level rise challenge.³ Whether human ingenuity figures out new solutions for these new challenges remains an important open question. Empirical research studying the damage caused by natural disasters documents the negative correlation between disaster deaths and economic development (Jongman et al. 2015, Kahn 2005).

4. *The Environmental Kuznets Curve as a Benchmarking Sustainability Metric*

A weakness of the book is the absence of benchmarks: for a specific nation, how do we know if sustainability progress is taking place? We do not have a market for a time machine or an international market for passports. If we could observe the willingness to pay to live in Australia versus the United States today or the willingness to pay to live in the United States in the year 1975 versus today, then we would have clear benchmarks for judging sustainability trends. Given that equity is one of the three sustainability criteria, we could sample a group of poor people and find out whether they would want to live at a different point in time in the same country or to move to another country. This

³<http://www.nytimes.com/2013/07/01/world/asia/floating-schools-in-bangladesh.html>.

revealed-preference test would be informative in terms of each nation's performance over time and to rank them at a point in time. Facing incomplete markets for time travel and international passports, how do we benchmark progress?

To my surprise, the environmental Kuznets curve (EKC) hypothesis is not mentioned once in the book (Grossman and Krueger 1995, Stokey 1998, Brock and Taylor 2005, 2010). The EKC is a prediction about the relationship between different environmental indicators and per capita income. In its simplest form, the EKC posits that there is a quadratic relationship between a given sustainability indicator such as local air pollution for a city or a nation's per capita greenhouse gas emissions and per capita income.

Ongoing empirical research has sought to study whether this hypothesis holds for many different pollutants and what is the best empirical function form for explaining the relationship between pollution and per capita income (Harbaugh, Levinson, and Wilson 2002). This reduced-form relationship is not a structural relationship, and ongoing research on human capital has suggested the importance of studying the causal impact of pollution on income production (Graff Zivin and Neidell 2013).

The World Bank's economists have used the EKC to focus on two metrics for benchmarking environmental progress. Dasgupta et al. (2002) argue that, over time, developing countries suffer less pollution exposure as their economies grow from very low incomes to middle-income levels and that such nations reach the EKC turning point at a lower level of per capita income. The rate of decrease for different pollution indicators is one salient metric of progress that could be used to incorporate public goods into the GNP accounting framework (see Stiglitz, Sen, and Fitoussi 2010). A nation would get credit if its pollution is lower than what would be expected given its income.

Several research teams have noted the EKC relationship is more likely to be observed for local public goods challenges such as particulate matter. In this case, the social costs of the pollution challenge are locally faced, and this incentivizes richer nations to take action. In contrast, for greenhouse gas emissions, abstracting from cobenefits of burning less coal, richer nations have an incentive to free ride (Auffhammer and Carson 2008, Schmalensee, Stoker, and Judson 1998).

5. *Conclusion*

Jeffrey Sachs has greatly advanced environmental sustainability studies both as an academic and as a policy advisor. His new book will help to transform the squishy field of sustainability studies. For years, neoclassical economists have had little impact on the typical sustainability student's curriculum. This troubles me. Our marginal value added in such courses would be very high if only we could be given a chance to express our ideas.

In recent years, the economics of persuasion has blossomed as an important research subfield. The award of the 2014 Clark Medal to Matthew Gentzkow highlights the influence of this field (Shleifer 2015). We economists care about the market for ideas, but up until now we have not been influential in the broad sustainability discussion. My explanation for this fact is that we have not connected with environmental activists and passionate young people who seek to change the world. Yet, we have imperialistic designs. Our intention is "to treat them" with our ideas but they are free to choose to ignore us. In randomized field experiments, researchers often randomize a payoff for taking a treatment. Such a randomization creates a monotonic propensity score such that the probability of actually taking the treatment is higher as the randomly assigned financial payment increases. In the case of encouraging the study of sustainable development from

the neoclassical economics perspective, we have not been able to induce the treatment group to take the treatment! This is where Sachs plays a pivotal role. Jeffrey Sachs, as a world-class scholar and as a friend of Bono and Angelina Jolie, has the heart and the street credibility to connect with environmental studies students, activists and general readers who have no interest in reading neoclassical economics books. While they may read Paul Krugman's *New York Times* columns, this group has little interest in engaging with other neoclassical economists. An alternative way to "induce" participation is for them to respect the messenger.

My major concern with this book is that it is detached from the recent peer reviewed literature in development and environmental and urban economics. This book could have been written twenty years ago, yet we have collectively made great progress over this time. Much of the new empirical research focuses on implementing natural experiments and field experiments to try to recover causal effects of the role of policy and incentives on individuals' and firms' choices.

For example, today California faces a drought, but the governor is ordering water rationing rather than raising the price of water. We need credible estimates of the short-term and medium-term price elasticity of demand for water for California farmers and urbanites. With such estimates, a leader could devise better policies for achieving the 3Es of economy, environment, and equity. Interesting political economy issues arise when there are trade-offs between these three. If water prices rise, how much will the poor's purchasing power decline by? How much in profits would the agricultural sector lose by growing fewer water intensive crops such as rice, almonds and alfalfa?

In a popular book, can a leading authority admit to not knowing many key parameters that play a central role in designing efficient sustainable development policies? I must

admit that I would like to see superstar academic economists embrace a more humble outlook when communicating with the public. If we could communicate to the public that "we know that there is much we do not know," but at the same time teach the public about the methodology of how we create new scientific knowledge, then we might be granted greater leeway to experiment and to study so that we can discover the right strategies for promoting overall sustainable development.

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