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Economic freedom vs. egalitarianism: An empirical test of weak & strong sustainability, 1970–2017

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Abstract

Many argue that free markets drive climate change and harm environmental sustainability. They suggest that democratic controls over profligate capital and unregulated markets better secure economic wellbeing and environmental objectives. Eco-modernists, contrarily, argue that economic freedoms generate entrepreneurial technological change for reducing poverty and increasing environmental quality since people's demands for cleaner consumption are likely to be met by markets, and free markets are less likely to be affected by rent-seeking. Moreover, democratic publics also demand higher consumption and the protection of jobs in dirty industry, which would work against environmental causes. This study contrasts the effects of economic freedom and egalitarian democracy on environmental sustainability and atmospheric pollution, assessed as both weak and strong sustainability. The results show that economies that are friendlier to free markets increase physical capital (wealth) with *lower* damage to total environmental sustainability, measured as depletion of physical, human, and natural capital, including atmospheric pollution. Egalitarian democracy consistently reduces economic sustainability and increases atmospheric pollution. There is some evidence for an inverted-U shape relationship between egalitarianism and CO_2 emissions independently of economic freedom and the level of development. The results are robust to a battery of testing procedures, alternative models and data, different sample sizes, a barrage of relevant diagnostic tests of robustness, and potential endogeneity.

If the 2008 financial crisis failed to make us realize that unfettered markets don't work, the climate crisis certainly should: neoliberalism will literally bring an end to our civilization. **Nobel laureate, Joseph Stiglitz (2019). The Death of Neoliberalism and the Return of History. *Project Syndicate* November 04. Online magazine.**

Policies that squeezed the poor while allowing the rich to continue to produce much higher levels of emissions would be unlikely to gain widespread support. **Richard Wilkinson and Kate Pickett (2009). *The Spirit Level: Why More Equal Societies Almost Always Do Better*. London: Allen Lane. Pg. 218.**

1 | INTRODUCTION

Many argue that the spread of free-market capitalist ideas and practices drive climate change and reduce environmental sustainability (Dryzek et al., 2011; Mazzucato, 2021). Governments in both the rich and poor worlds debate whether more open free-market economic policies should be curbed for reducing environmental harm, or whether free-market dynamics might deliver both economic sustainability and investments in technological change required for greening economies and building resilience to climate change (Stern, 2015). Left-leaning parties argue, as Nobel laureate Joseph Stiglitz quoted above suggests, that governments should impose greater *democratic* control over free markets, equalizing wealth for the sake of more egalitarian approaches to achieving communitarian goals (Rodrik, 2011; Stiglitz, 2019b). Egalitarian values, they argue, foster "green" rather than "greed," and that the populistic backlash against environmentalism is driven by disaffections stemming from rising inequalities and unfettered globalization (Norris & Inglehart, 2019; Vidal, 2011; Wilkinson & Pickett, 2009). Yet, populations across the world also care about jobs and higher consumption, which often come at the expense of the environment (Arrow et al., 1996; Dryzek, 1997). Asking poor countries in particular to forego higher consumption might indeed be morally wrong, and also perhaps counterproductive if indeed environmental harms might be corrected with access to greater wealth (Wending et al., 2020). This study is the first to examine the relative effects of free-market capitalistic economic conditions, measured as economic freedom, and egalitarianism, measured as egalitarian democracy, on environmental sustainability and the emissions of greenhouse gas. Since it is well established that free markets associated with economic freedom generate economic growth and other forms of human wellbeing, the question of the environmental efficiency of this growth is critical (Berggren, 2003; Feldman, 2017; Stroup, 2007). The question is not just academic, but it carries heavy policy implications given the urgency of addressing climate change while ensuring economic growth for the world's poor (Griggs et al., 2013; Milanovic, 2016).

I use the Economic Freedom Index developed by the Fraser Institute and a measure of egalitarian governance from the Varieties of Democracy (VDEM) project on the World Bank's *adjusted net savings* and its subcomponents measuring air pollution and resource depletion as my primary measures of environmental sustainability. Holding constant several relevant control variables, I find that economies that are economically free increase their wealth with *lower* damage to environmental sustainability, measured as depletion of physical, human and environmental capital, including damage from atmospheric pollution. In other words, freer markets are more environmentally efficient at creating wealth, or put another way, are on more sustainable paths to development. Egalitarian governance robustly and consistently reduces sustainability and increases atmospheric pollution. The conditional effect of economic freedom and democracy, while reducing the intensity of atmospheric pollution has lower negative impacts than the effects of freer economies. Moreover, egalitarian democracy and economic freedom both show inverted-U shape relationships with CO_2 pollution when assessed on a per capita basis rather than as a share of gross domestic product (GDP). Economic freedom, however, clearly outperforms egalitarianism when considering ecological damage in the process of wealth creation. The results are robust to a battery of testing procedures, alternative models and data, different sample sizes, and a barrage of relevant diagnostic tests, including tests assessing omitted variables bias, and potential reverse causality. The rest of the paper discusses the tricky concept of sustainability and its measurement,

examines propositions on free markets versus egalitarianism for environmental protection, presents the data and method, examines the results, and briefly concludes.

2 | IDENTIFYING AND MEASURING SUSTAINABILITY

Many suggest that achieving sustainable development and reducing global warming require governance at all levels of society and economy (Meadowcroft et al., 2019). The constitutional choices of societies as well as government policies targeting the shape and form of social policy affect economic outcomes and environmental quality (Jeffords & Minkler, 2016; Persson & Tabellini, 2003). At the same time, people all over the world demand more consumption while expecting governments to address the pressing issue of climate change (Stern, 2015; Stiglitz, 2019b). Before addressing the mechanisms that may explain links from free-market capitalism and egalitarianism to environmental sustainability, I first examine useful distinctions about what people mean by sustainability and how best to measure it. Indeed, the United Nations has no less that 17 sustainability goals, with only some directly related to the environment. Can sustainability of consumption move apace with sustainability of planetary resources? What sort of socio-political organization matters for ensuring the most environmentally efficient wealth creation?

Over three decades ago, the World Commission on Environment and Development (WCED) proposed the idea of *sustainable development*, more narrowly defined as:

> development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987: 43).

Thus, increasing broad-based prosperity without unacceptable destruction of the local and global commons was placed at the heart of development priorities. Regardless, in the past three decades, atmospheric pollution, particularly CO_2 pollution, has been increasing across the world in absolute terms (see Figure 1).

As seen in Figure 1, the trend in CO2 emissions on a per capita basis globally, after a steep fall since highs in the 1980s, has seen a gradual upwards trend in the era after the WCED report. Moreover, total CO_2 emissions globally has risen steeply (thick line). Concerns about the unabated rise in greenhouse gases has made the issue of global warming a matter of high politics. In concrete terms, the International Panel on Climate Change's (IPCC) estimates that for a 50% chance of meeting the 2°C limit by century's end, requires halving global greenhouse gases by 2050. Achieving such a target without getting poorer in the processes, or harming the cause of global equity, can apparently be achieved with enough political will and proper investment in green technology (Stern, 2015). Understanding what political and economic social environments allow the most efficient policy paths for achieving sustainability, thus, is critical.

The idea of environmental sustainability can be separated broadly into two main categories —*weak* and *strong* sustainability. Weak sustainability places man's economic wellbeing at the center, evaluating success on the basis of the environmental efficiency of the production of wealth. Weak sustainability, in other words, places development first but with minimal cost to the natural environment, including the atmosphere. Strong sustainability, contrarily, places the natural environment first, where environmental pollution and resource depletion must cease, regardless of the economic costs to society (Atkinson et al., 2007). This position rejects the view that natural capital is substitutable with other forms of capital. Wealth creation, in other words, must happen with zero impact on the natural environment. If one were to hazard a guess, most people, and certainly most governments, work on the basis of weak sustainability goals, while adopting measures designed for achieving strong sustainability goals where feasible. For example, encouraging policies that have led to the adoption of zero-emission motor cars, or solar and wind power generation for replacing dirtier energy sources could be seen as paths to stronger sustainability but would occur only through investment in the new and the abandonment of the old. Technological solutions for reducing and eliminating climate-harming atmospheric pollution are preferred policy paths for most green parties and political groupings as

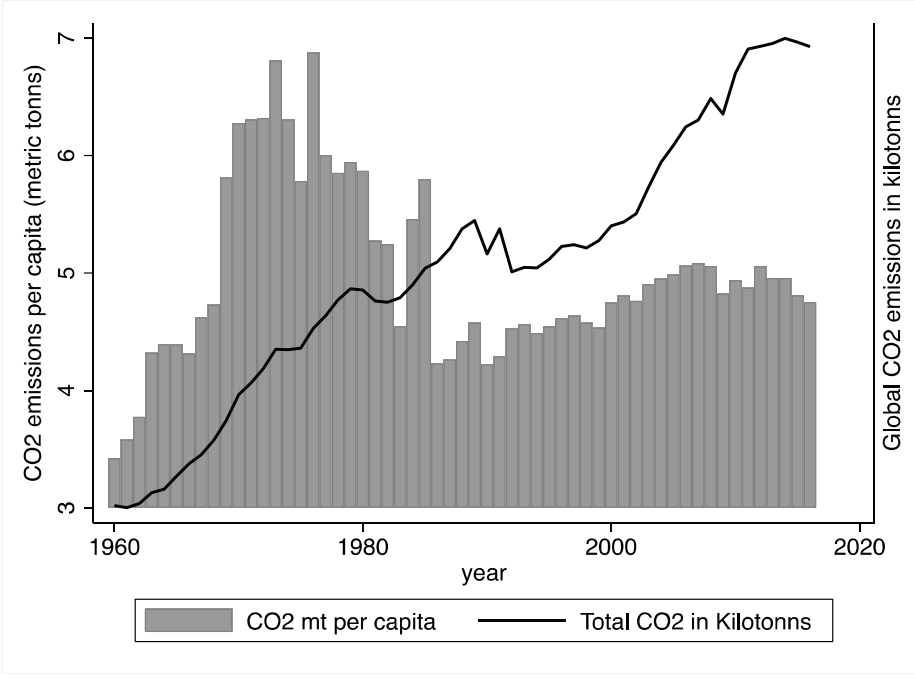

FIGURE 1 Global average trends in total CO2 & CO2 emissions per capita, 1960–2018 [Colour figure can be viewed at wileyonlinelibrary.com]

the long-term win-win solution to economic regeneration and climate stability (Stern, 2015). Yet, such investment may face opposition from vested interests (Mildenberger, 2020).

Indeed, according to some indicators, such as the "Environmental Performance Index" (EPI), richer countries have achieved greater levels of environmental protection than the poorer parts of the world due to reduced atmospheric pollution and higher levels of protection of vulnerable ecosystems, but per capita energy use and greenhouse gases emissions remain high despite gains in many other areas (Wending et al., 2020).[1] The EPI evaluates countries on the basis of investments in the protection of environmental and human health, which in itself forms a justification for why the poorer countries should catch up in wealth for making such investments in the future. The question addressed here is how well countries use their physical, human, and environmental assets for producing wealth, which is the idea of weak sustainability.

Weak sustainability is the foundation for the inclusion of natural capital in national accounting, which has led to the development of the concept known as *genuine savings*. Pearce and Atkinson (1993) developed genuine savings based on the idea that an economy is weakly sustainable if all forms of capital—physical, human, and natural—are non-declining over time. Since the traditional accounting system treated investment in human capital as a consumption and not a saving, the new way of thinking treats investment in human capital as a saving. The new accounting of sustainability, thus, adjusts traditional accounting to reflect savings in human and natural capital. These data now appear as 'adjusted net savings' in the World Bank datasets, such as the *World Development Indicators* (Hamilton & Ruta, 2009; Pearce & Atkinson, 1993; World Bank, 2020). This study uses the adjusted net savings and its components, such as the pollution efficiency of production measured by CO_2 damage as well as natural resource depletion per GDP as measures of weak sustainability. Additionally, using the same indicators on a per capita basis, this study will assess how free-market capitalistic governance contrasts with more egalitarian governance on sustainability

[1]See the Environmental Performance Index (EPI) generated by Yale University (https://epi.yale.edu).

defined as strong sustainability because the denominator is now a country's population rather than GDP (wealth). The indicators of sustainability are described in detail below, but first, I discuss theory relating economic and political governance to environmental sustainability.

3 | MARKETS *VERSUS* STATES

While many environmentalists and resource economists warned of the earth's limited carrying capacity and produced arguments about the "limits to growth," capitalist economies have generally proved many of these arguments wrong (Meadows et al., 1993; Simon, 1998). Neoclassical economists expect free markets to increase environmental sustainability because markets will more effectively adapt to what consumers want due to the price mechanism and generally minimize on inputs. While they acknowledge market failures and externalities, such as pollution and toxic wastes in the process of production, they expect that government regulations that affect prices could induce better environmental outcomes through both innovation for reducing waste and harmful toxins, which the price mechanism achieves better than would command and control (Berger, 1994; Stilwell, 2006). Put simply, solving environmental problems require more, not less, free markets because prices and consumption will adjust while incentivizing technological change and innovation. Herein lies the nub of the matter because skeptics of free markets claim that powerful commercial interests have incentives to abuse political processes to get away with destroying the commons and satisfying their own greed at the expense of the mass of society. Thus, neo-Marxists, critical theorists, and even some orthodox economists suggest that free-market capitalism induces a "race to the bottom" where commercial actors can hold communitarian interests hostage, increasing environmental harm (Rodrik, 2011; Stiglitz, 2019a). These scholars prescribe greater egalitarianism as the path to environmental sustainability, where egalitarian democratic governance tames the profligacy of elite driven capitalism (Dryzek et al., 2011; Wilkinson & Pickett, 2009). I address below the specific mechanisms associated with how free markets or egalitarianism might influence environmental sustainability.

As Nicholas Stern (2015) argues, using the insights of Joseph Schumpeter, innovation through entrepreneurial activity is what will drive technological change towards a carbon-neutral world. Schumpeter argued that capitalism is dynamic because it brings about entrepreneurial innovation, which needs to be supported by a set of social and political institutions, or what he terms a "social environment" (see Stern, 2015: ch. 3). Thus, which type of social environment one wants to preface for maximizing an outcome is critical for adjusting to climate change short of destroying society as we know it.

Access to wealth can allow society the luxury of change. The intensification of agriculture through technological inputs, for example, can produce more food and reduce forest and soil degradation (Boserup, 1965). Poorer countries have less access to cleaner technologies of production, cleaner sources of energy, and knowhow. While economic growth is associated with higher levels of pollution, the question might be how it may be obtained with minimal damage to the human environment, increasing total wellbeing. Countries that industrialized rapidly, such as the former Soviet states, polluted massively, while the technologically advanced West has generally cleaned up.[2] Indeed, some argue that environmental harm is reduced as countries become richer, following the shape of a so-called "environmental Kuznets curve" because one needs to be able to "afford" change, or afford the knowhow required to be cleaner and greener (Dinda, 2004; Stern, 2004). Here, the difference between the West and Eastern Bloc is interesting. Was it the relative wealth that mattered or the system of production and distribution?[3] Or some others might argue that it was the Schumpeterian political and social environment that really mattered in terms of the former Eastern Bloc since the state could not be easily influenced by civil society. What then is the optimal "social environment" for Schumpeterian change, if indeed we really care about sustainability?

[2]I find a correlation of $r = 0.86$ between the EPI for 2020 and per capita GDP (log) in 2020.

[3]It should be noted that Soviet planning, although targeting consumption as the objective, failed miserably in comparison to the market economies. Sadly, environmental destruction occurred with very little consumption for ordinary people.

Prometheans, sometimes called "cornucopians," argue that human ingenuity overcomes limits to economic growth by reducing the reliance on the earth's resources through substitution and technological change (Simon, 1998). Proponents of free markets might argue that free-market competition allows faster internalization of the costs of pollution by driving technological change—polluters give way to innovators. In other words, markets will punish laggards since "smart" consumers will vote with their wallets for cleaner products—notice the current growth of electric vehicles across the globe. More nationalistic, protected, dirigiste economies that do not face competition from "outside," or face the consumer demands for change, are likelier to have higher environmental footprints, regardless of the nature of command and control by states. Governments will get prices wrong, be susceptible to rent seeking by vested interests, such as unions, and will invest towards increasing environmentally harmful consumption rather than offer flexibility for market-driven change—i.e. monopolists can survive by having their inputs to production subsidized (Acemoglu & Robinson, 2012; Mildenberger, 2020). The processes of free market exchange and economic integration of economies, contrarily, would spread best practices more rapidly through diffusion and the processes of Schumpeterian "creative destruction" where new technologies replace old ones.

Private ownership and strong property rights are a hallmark of free-market economies. Proprietary rights to economic activity (profits) will dictate production. State decision makers, on the other hand, will be driven by incentives that might be less economically rational, leading to waste since profits are less interesting than production targets for political reasons. Governments that desire to survive in office might indeed pander to special interests, generating politically-rational policies (Bueno de Mesquita & Root, 2000). If markets are free, the theory of comparative advantage implies that countries will specialize in what they are most efficient at producing, thereby minimizing waste (Brack, 1995). Free markets are about free exchange of goods where the greater the number of producers, the greater the innovation and the greater the economization of inputs. Each actor knows and anticipates the actions of other actors, leading to greater "hidden" coordination. Markets that are not interfered in by the states reflect actual prices, which means that resources that are diminishing will become more expensive while resources that are more plentiful become cheaper, achieving greater savings for future generations though the process of substitution and efficiency of resource use. Businesses that are free to compete will enter markets with "environmentally better" products and invest in substitute inputs as environmental consciousness grows. The experience of price distortions in the Soviet Union and communist countries in Eastern Europe resulted in unsustainable natural resource management. The draining of the Aral Sea for cotton production stands as one of the saddest environmental disasters.

Another important benefit of increased free trade is that countries and corporations can secure access to environmentally friendly technologies more easily, and capitalist competition for markets should drive innovations, such as the recent growth in the production of electric cars. Indeed, such technologies as unleaded gasoline and catalytic converters spread around the world simply because car manufacturers were responding to calls for less air pollution by markets faraway. The free flow of capital (ideas) would also enhance the diffusion of best practices broadly. As many suggest, free trade can reduce pollution levels because export- oriented economies need to produce high-standard goods and will be forced to invest in cleaner industries (Birdsall & Wheeler, 2001). Finally, more stable price structures and more secure property rights can make it easier for a country to attract investment in environmental projects that are expected to pay off much later in the future (Carlsson & Lundström, 2001). Most importantly, capitalist economies that have seen high levels of financialization since the 1980s can have access to capital that can be deployed for new technology, outside of such concerns as political business cycles that might be based on short-term payoffs (Tamazian et al., 2009).

Opponents of free-market capitalism argue that capitalism harms the environment by promoting cultures of consumption and overuse, benefitting only powerful economic actors and harming societal and environmental interests (Storm, 2009). The economist, Mariana Mazzucato (2021: online) writes,

> World leaders have a simple choice: continue supporting a failed economic system, or jettison the Washington Consensus for a new international social contract....Why is a new consensus needed? The most obvious answer is that the old model is no longer producing widely distributed benefits – if

> it ever did. It has proven to be disastrously incapable of responding effectively to massive economic, ecological, and epidemiological shocks.

Critics of free markets argue that the profit motive is short-sighted because it would drive wasteful consumption by driving down prices and generating negative externalities on communities. Capitalistic overproduction and consumption carries externalities, for example, by creating demand for "bad" products and practices through advertising and the peddling of frivolous consumption (Stilwell, 2006). Free-market policies and processes could promote an individualistic ethos that breeds disregard for communitarian values and outcomes, where winner-take-all cutthroat competition can drive high resource extraction, lower taxes, and little investment in communitarian goals. Since natural resources are privately owned, current profit seeking will lead to high rates of extraction. As competition drives down prices, profits will depend on more intensive extraction. Others point out that the expected benefits from income growth and technological change in the long run may be offset by the environmental damage that occurs in the meantime (Røpke, 1994). In addition, consumers may not be that concerned about environmental degradation at the global scale, which would then not necessarily spur innovation through market competition—consumers, even if environmentally conscious, may not matter if producers are able to externalize the costs of environmental damage. As one scholar has put it (Shafik, 1994):

> Where environmental quality directly affects human welfare, higher incomes tend to be associated with less degradation. But where the costs of environmental damage can be externalized, economic growth tends to result in a steady deterioration of environmental quality (p. 758).

Indeed, since capitalism supposedly breeds income inequality, there is a danger that those who have access to wealth and power can enjoy all the gains and push all the harm on the poor, leading to little innovation and adaptation to green practices. If capitalists control states, for example, they could simply place the cost of environmental damage (clean up) on the taxpayers and save the money on researching new technology. The theoretical and empirical evidence on whether freer markets increase environmental damage or reduce it remains highly mixed thus far. Much depends on what types of variables have been used to measure free markets and what types of environmental damage are being assessed. More often than not, the debate has addressed either trade or foreign direct investment as measures of free markets, finding highly mixed evidence on environmental outcomes ranging from pollution to natural resource depletion (de Soysa & Neumayer, 2005; Grimes & Kentor, 2003). Moreover, since free-markets and free, more inclusive political processes often go together, unpacking how economic freedom and political freedoms matter is a thorny issue.

Broadly speaking, thus, if capitalism breeds inequalities and thereby negative externalities in terms of environmental harm, then what is needed is the empowerment of people so that externalities can be internalized, and market failures corrected. An active state directed by ordinary people then is the antidote to free markets because prices could be "made" to reflect these costs. Scholars argue that "inclusive" economic institutions that prevent monopoly and minimize market-distorting policy create the incentives for investment, technological change, and drive a society's wealth and wellbeing, presumably also in a "socially-responsible" direction (Acemoglu & Robinson, 2012). Contrarily, economies in the hands of a few, where monopoly and rent-seeking take place, where incentives for investment and technological development are blocked, "extract" wealth away from the many to the few, depressing investment and innovation and spoiling the common resource base. Bad economic policies of autocracies are not accidental—they are purposeful because they reflect a dictators support base (key supporters). The monopolists block the paths of others, leading to lower investment and no innovation, leading to vicious cycles of bad policy and stable autocracy (Bueno de Mesquita & Smith, 2011). Such predatory, extractive institutions and practices constrain markets and reduce a society's ability to be productive and innovative. Are such predatory processes behind environmentally unsustainable paths of economies, especially given that innovation and change towards being cleaner are unlikelier, even if the majority of market actors preferred such? Elites with a vested interest in keeping old technologies going, such as corporations invested in fossil fuels, or labor unions attached to coal, will

seek to block change. New opportunities for making profits by adopting new technologies and driving new innovations would be lost to such a society.

An open democratic society would allow people to demand a more climate friendly, sustainable policy path, which some refer to as the "folk theory of democracy" that shapes a lot of thinking around why democracy is a more responsive form of government (Achen & Bartels, 2017). Elections and other instruments available to a democratic public will allow it to control capricious elites, who will otherwise abuse nature by plundering for profit. New parties devoted to "green politics" and climate-friendly civil society groups will arise to lobby governments. Such groups will also directly lobby and influence powerful economic forces, such as corporations, unions, and consumers in climate-friendly ways (Jordan et al., 2003). Many observers argue that inclusive policymaking might gain more legitimacy and thereby be more effective (Niemeyer, 2013). A polity can be called inclusive when all the individuals that are affected by the decision have the opportunity to deliberate and provide input to the decision- making process. It is argued that climate change normally is easily crowded out by the prevailing character of the political debate, but that deliberation may make complex issues less confusing and solutions more tangible. The act of deliberation itself activates a commitment to environmental thinking, perhaps even sympathy for future generations and willingness to compromise on current solutions for achieving shared environmental goals.

Contrarily, others are less trusting of a democratic public's ability to know what's good for it—more specifically to endure short-term pain even if it is in the long-term interests of people to follow a particular policy path (Caplan, 2008; Hardin, 1993). They argue that democratic publics are often wrong and produce irrational outcomes because of problems of aggregating preferences and because of rational ignorance among the mass of voters about complex problems. The recent rise of populistic leaders hostile to green initiatives in some of the oldest democracies is supportive of such views. Many studies show how voters choose self-defeating policies when voting prospectively, even on relatively simple policies chosen in direct popular votes, and how the mass of voters generally cannot discern good and bad policy retrospectively, often using simple rule-of-thumb grounds for choosing political candidates (Achen & Bartels, 2017). Contrary to the folk theory of democracy, democratic publics may demand broad-based economic development over environmental factors, demand higher consumption regardless of pollution, and generally fail to act on preventing environmental degradation, particularly if one's actions are likely to be detrimental to others, such as future generations, or strangers. Democracies are liable, in other words, to patronage and rent-seeking in even more insidious ways than perhaps many dictatorships (Ward, 2008; Wurster, 2013).

4 | MARKETS *AND* STATES

Very few studies contrast the relative merits of democracy and capitalism when examining the effects of governance on environmental outcomes. In many ways, saying democracy matters for the environment compared with free markets cannot fully distinguish their relative effects since both phenomena generally are closely intertwined (Doucouliagos & Ulubasoglu, 2008; Iversen, 2008; Stroup, 2007). What is important for many reasons, however, is the distinction between free-market capitalistic environments and social democracy, distinguished by democracy that is far more egalitarian in terms of active welfare states and high degrees of social insurance and equity (Mudge, 2018; Przeworski, 2012). Since the 1980s, most social democratic political parties have adopted less radical Keynesian policies and reinvented themselves to be more neoliberal in orientation, adopting such governing strategies as "new public management" (Giddens, 1998; Mudge, 2018). High welfare state and economic freedoms coexist very well in countries, such as in Scandinavia, where the tax rates on corporations are now some of the lowest within the OECD, whereas traditionally more "liberal" economies, such as the United States have relatively higher rates, with higher shares of government consumption as a share of GDP.[4] Regardless, empirical evidence suggests that government ideology still determines the shape of market freedoms among the industrialized countries (Jäger, 2017).

[4]For OECD corporate tax rates, see https://www.oecd.org/tax/tax-policy/corporate-tax-statistics-second-edition.pdf. (last accessed June 03, 2021).

Currently, the evidence on the effects of democracy (variously measured) on sustainability and atmospheric pollution is highly mixed, suggesting that it may be due to how democracy is conceptualized and measured (Carlsson & Lundström, 2001; de Soysa et al., 2009; Li & Reuveny, 2006; Midlarsky, 2001; Roeland & de Soysa, 2021; Wurster, 2013). While examining the net effect of economic freedom holding egalitarian democracy constant might be revealing, we might also gain from looking at the conditional effects of both, mainly because egalitarian democracies also exhibit at least some of the core values of economic freedom, such as property rights protections and low corruption. Thus, I also examine the conditional effects between democracy and free markets to ascertain how these factors condition the effects of each other on environmental sustainability and atmospheric pollution. Theory discussed above allow us to formulate two main hypotheses:

H1. Egalitarian democracies increase sustainability while economic freedom reduces it.

H2. Egalitarian democracy conditions free markets in ways that increase sustainability.

5 | DATA & METHOD

As discussed above, first, I utilize indicators of weak sustainability to capture how most governments around the world seem to be approaching the future given the global need for poverty reduction and economic growth. Secondly, I use several measures of pollution intensity and resource depletion measured in per capita terms to capture strong sustainability (environmental quality assessed without considering economic impact). The main dependent variable measuring environmental (and economic) sustainability is the "adjusted net savings" (ANS) taken from the World Development Indicators (WDI) dataset. This indicator is essentially measured as:

ANS = (investment in manufactured capital – net foreign borrowing + net official transfers – depreciation of manufactured capital + current education expenditures – net depreciation of natural capital + cost of atmospheric pollution) /Gross National Income (GNI)

Note that investment in manufactured capital minus foreign borrowing plus net official transfers minus depreciation of manufactured capital is equal to net national savings as reflected in traditional growth accounting. While the traditional national accounting treats government spending on education as consumption, genuine savings treats it as investment, which enters back into the savings. This is regarded as a first approximation to the full value of human capital investment, which is difficult to measure precisely. Capturing human capital investment is critical because it has a major impact on behaviour in general, and economic activity in particular. A more educated population engages in economic activities that draw less directly on natural resources and the environment, and their demands upon government may also change in a post-materialist direction.

Depreciation of natural capital covers non-renewable resource extraction, such as fossil fuels and minerals, as well as forestry, and is measured as price minus average cost times the amount of resources extracted. Cost of atmospheric pollution is approximated by the damage caused by carbon dioxide emissions and particulate emissions. CO_2 damage is measured by assigning a value of 100 USD per metric ton of CO_2.[5] It is apparent then, from the formula above, that negative genuine savings could be driven by high consumption (i.e. low investment in manufactured capital), high resource depletion and high pollution, while investment in human capital remains low, a clearly profligate, unsustainable path for a society. On the other hand, higher genuine savings are achieved via investment in manufactured capital with relatively lower depletion of the resource base, higher investment in human capital and lower

[5]The economist William Nordhaus proposes 50$ as an appropriate price on carbon. Note, however, that since the price is the same for all countries, it is the amount emitted that is captured in the estimations over time. See https://carbon-price.com/william-nordhaus/.

damage to the environment. Savings of all forms of capital into the future, while increasing human capital, thus, is the essence of sustainable development (Atkinson et al., 1999).

Additionally, I also test two measures of strong sustainability that are based on per capita emissions intensity of CO_2 and other greenhouse gases measured by the CO_2 equivalent amounts consisting of by-product emissions of hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF6). CO_2 emissions per capita is defined by the WDI as:

> Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.

The other greenhouse gases are defined in the following way:

> Derived as residuals from total GHG emissions, CO_2 emissions, CH4 emissions, and N2O emissions in kt of CO_2 equivalent. Other greenhouse gases covered under the Kyoto Protocol are hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. Although emissions of these artificial gases are small, they are more powerful greenhouse gases than carbon dioxide, with much higher atmospheric lifetimes and high global warming potential. The emissions are usually expressed in carbon dioxide equivalents using the global warming potential, which allows the effective contributions of different gases to be compared.

Figure 2 displays the global trend in the weak sustainability variable on atmospheric pollution (CO_2 per GNI) as well as the strong sustainability indicator of CO_2 per capita emissions.

As seen there, CO_2 emissions per capita and CO_2 as a share of total economic output show somewhat diverging patterns. Emissions as a share of output has soared in the late 1990s and dropped drastically since about the mid-

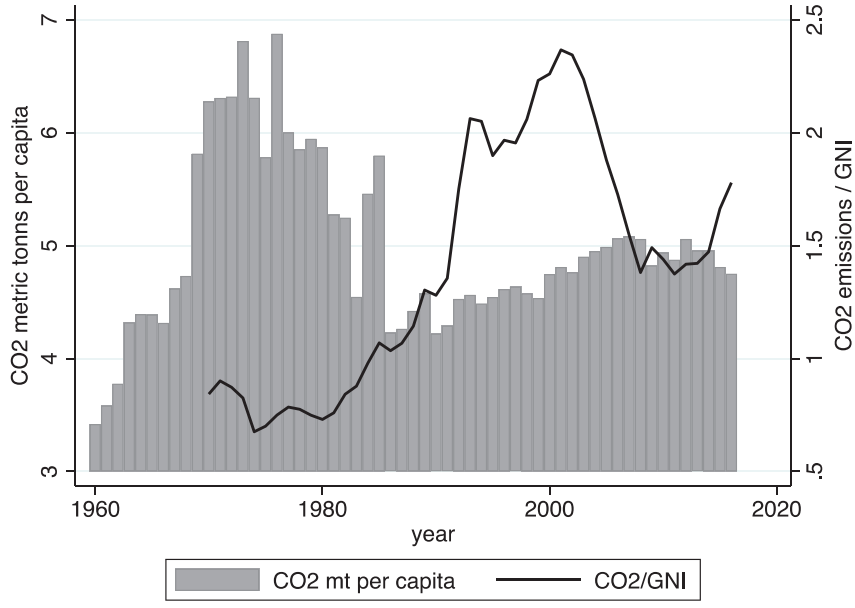

FIGURE 2 Global average trends in CO2 per capita & CO2/GNI, 1960–2018 [Colour figure can be viewed at wileyonlinelibrary.com]

2000s, presumably because of the massive rise in fossil-fuel prices or due to the financial crisis of 2008 (thick line). The intercorrelations between all the emissions indicators and other environmental indicators used appear in appendix Table A1. As seen there, none of the measures I test are highly correlated, suggesting that they all capture different aspects of environmental sustainability and differing intensities of climate-altering atmospheric pollution.

As the main independent variable, I use the Economic Freedom Index (EFW) obtained from the Fraser Institute (Gwartney et al., 2011).[6] These data are presented in quintiles until 2000, and then annually. I linearly interpolate the values between each of the quintiles covering the gaps between 1990 and 1995 until 2000, after which annual data are available. In robustness tests, the basic results were tested with the un-interpolated EFW and the results are unchanged. The economic freedom index is made up of 5 essential areas; namely, 1) limited government 2) the rule of law and property rights protection 3) access to sound money 4) freedom to trade internationally 5) minimal regulation of business in terms of labor regulation. The 5 components of the index are made up of roughly 45 subjective and objective indicators which are then aggregated to form a single value for each country for each year. Secondarily, I also contrast the results using the Fraser Institute's measure with the VDEM data's measure of "state ownership" of the economy, defined and measured as the extent to which "private" ownership of economic activity exists in any given country, which is expert coded. Figure 3 displays the degree of correspondence between these two measures that are differently conceptualized and defined. As seen there, the global trend between the EFW and VDEM's measure is uncannily close, suggesting excellent internal validity.

For examining the relative effects of economic versus political freedoms, I use democracy conceptualized and measured as "egalitarian democracy" by the VDEM data project. There are many conceptualizations of democracy, some of which relate to the rule of law essential to economic freedom. I choose to focus on egalitarian democracy because in the most general arguments, economic freedoms and free-market processes are supposedly constrained in more "egalitarian" processes of governance because of higher levels of regulation of market forces, more active public sectors, and state-sponsored social insurance requiring higher taxes and tariffs. Egalitarian democracies, in other words, have less inequality in terms of outcome and in terms of access. According to the VDEM researchers, an egalitarian democracy builds on the theorized notion that individuals from all social groups ought to be equally capable of exercising their political rights and freedoms, and of influencing political and governing processes.

Underlying this broad principle are two main sub-components: equal protection and equal distribution of resources and income protection. Equal protection implies that the state grants and protects rights and freedoms evenly across social groups (Sigman & Lindberg, 2019). According to them, "an equal distribution of resources ensures that individuals have the basic necessities enabling them to exercise those rights and freedoms, leading towards an equal potential to influence decision making" (Sigman & Lindberg, 2015: 1). An egalitarian democracy must also assure equal access to political power for all social groups, so that there is inclusivity in political decision making. They argue that greater egalitarian processes make the democratic polity more effective. Equality among groups would produce lower levels of polarization and greater egalitarian democratic processes would resolve political and policy disputes more effectively than less egalitarian democratic processes (Sigman & Lindberg, 2015). Thus, egalitarian democracy includes several indicators capturing equal access to power, political resources, liberties and political inclusion, plus the degree of electoral democracy, or polyarchy, indicated by free and fair elections without coercion or violence in a competitive processes (VDEM, 2021). These data are generated by a number of country, regional, and subject-based experts, and the coding is subjected to rigorous reliability tests, such as item response theory analyses. A single value for each state is generated by minimizing the influence of any coding bias (Sigman & Lindberg, 2019). Figure 4 graphically displays the trends in egalitarian democracy and the EFW over time.

As discussed above, since at least the mid to late 1980s, egalitarian democracies and the degree of economic freedoms have converged, with the gap between the two narrowing since the late 1990s and early 2000s.

[6]For annual reports and access to data, see https://www.fraserinstitute.org/studies/economic-freedom-of-the-world-2020-annual-report?language=en (last accessed June 19, 2020).

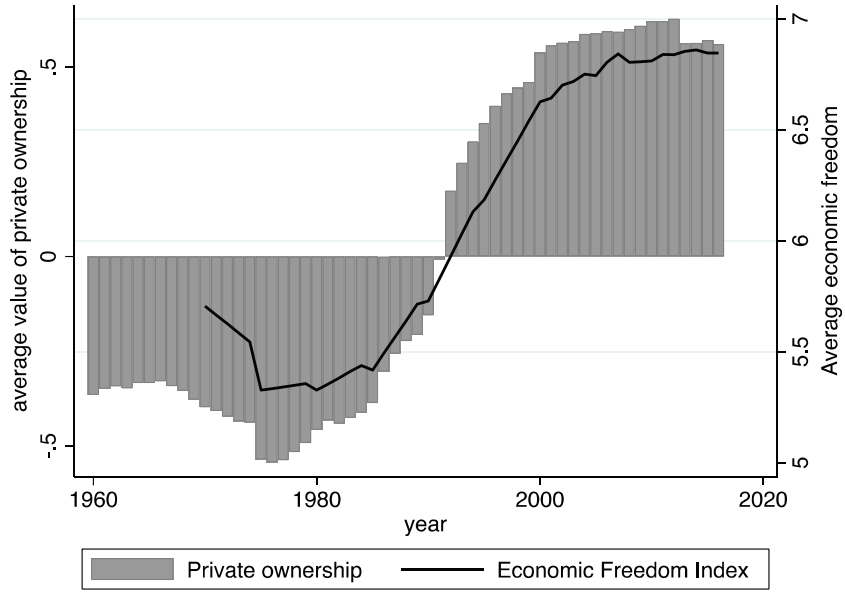

FIGURE 3 The global trend in the Economic Freedom Index (Fraser Institute) & private ownership of the economy (VDEM), 1970–2018 [Colour figure can be viewed at wileyonlinelibrary.com]

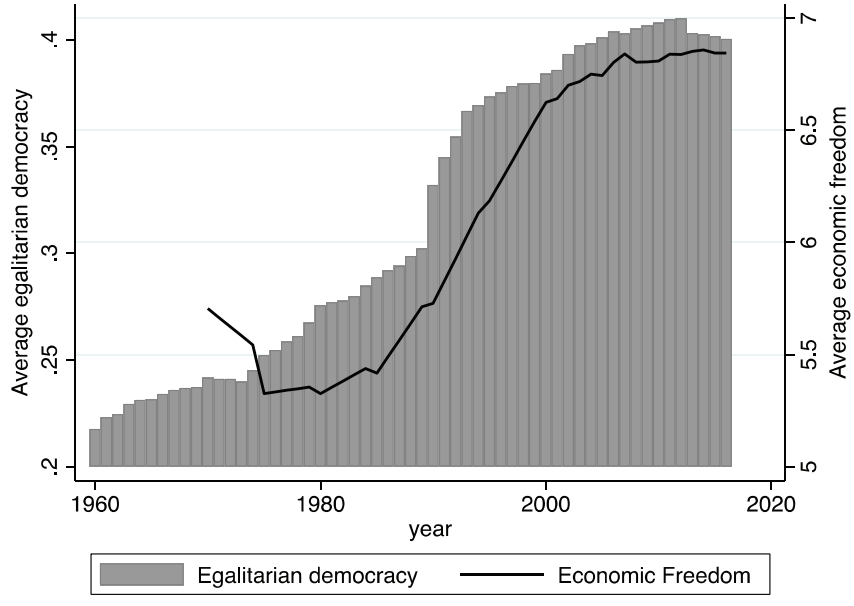

FIGURE 4 Average global trends in egalitarian democracy (VDEM) and the economic freedom (Fraser Institute), 1970–2018 [Colour figure can be viewed at wileyonlinelibrary.com]

I control for several relevant variables when estimating the effects of the two main variables on environmental outcomes. I keep models parsimonious to avoid overfitting but control as stringently as possible for variables that may confound the effects of both free-market economies and egalitarian democracy (Achen, 2005). As such, the

main control is per capita income, or the level of development of a country. Richer people are likely, regardless of the economic and political system, to manage their overall capital stock better than poor countries. Richer people may also demand greater environmental quality and exhibit higher levels of post-modern values that lower emissions (Granato et al., 1996). The effect of income on environmental quality, however, may follow a Kuznets curve pattern, where rising wealth increases pollution and decreases at only very high levels of wealth, a proposition that has received only very mixed support (Stern, 2004). I include tests with a quadratic term of income in robustness checks. The income data are obtained from the WDI data expressed as GDP per capita in constant 2010 US dollars, which is then logged to reduce skewness.

Additionally, I include several demographic terms that are thought to affect emissions and sustainability. First, I include the share of the population that is urban to capture both small-country effects as well as the consumption and pollution-effects of urbanization, independently of wealth and socio-political environments (Hess, 2010). In robustness tests (see online appendix), I also use the growth rate of the population.[7] Population growth can be a powerful determinant of environmental outcomes (Berger, 1994). While this indicator showed statistically significant effects in many tests, it never really affected the results on the main variables of interest. For brevity, thus, I provide the results including population growth in the online appendix. These data are obtained from the WDI. Importantly, I also include a measure of population density, which is important for assessing a state's extent of public goods provision and its dependence on international markets in terms of trade openness (Alesina & Wacziarg, 1998). Thus, demographic factors could determine both environmental outputs as well as the nature of economic governance.

Importantly, I include a measure of the resource dependence of an economy, since countries that have higher shares of extractive industry are likely to pollute more and have unsustainable paths of wealth creation due to the well documents "natural resource curse." These resource dependent countries are also likely to be less democratic and suffer mis-governance (Leite & Weidmann, 1999; Ross, 2012; van der Ploeg, 2011). I measure resource dependence as the share of natural resource rents in GDP taken from the WDI database. This variable is logged to reduce skewness.

I use a cross-sectional time-series (TSCS) dataset covering the period 1970 to 2017 that includes roughly 160 countries for which the Fraser Institute's economic freedom, the VDEM democracy measure, and the World Bank's data match. The dataset is unbalanced because countries enter the dataset at different times. The TSCS data setup can be plagued by complicated correlation patterns both temporally and across the units. The standard GLS method is discredited for being too optimistic about standard errors (Beck & Katz, 1995). Alternatively, in the presence of autocorrelation, one might estimate OLS regression with Newey-West standard errors that are robust to heteroscedasticity and autocorrelation (Newey and West 1987). Moreover, the Newey-West method works well when N is much greater than T. The Wooldridge test suggested that the null hypothesis of no serial correlation could not be rejected. Additionally, the data could be biased by spatial autocorrelation because some of the main independent variables, such as democracy, economic freedom, and levels of pollution may cluster in space. Thus, I mainly utilize the Driscoll-Kraay standard errors method robust to first order serial correlation and general types of spatial dependence (Driscoll & Kraay, 1998; Hoechle, 2007).

Additionally, a researcher needs to carefully specify whether fixed or random effects best suit the model specification for addressing the question posed. There is likely to be a great deal of country heterogeneity due to local-level factors associated with geography, history, and culture that might bias results. The usual way to address time-invariant omitted variables bias is to estimate fixed effects where the cross-sectional variance is estimated out and the results reflect the within-unit variance. However, there is a good case to be made that cross-sectional level effects are important to control for given that x variables, in my case, such as per capita income, democracy, and economic freedom correlate on the basis of levels across the cross-sectional units (Bell & Jones, 2015). The Hausman test suggests, however, that there is no systematic difference between the estimations of random and fixed effects in the basic models. Following the recommendations of others, I use one-way fixed effects, which cleanly isolates

[7]An online appendix displaying all reported results are available at *****.

and capture the overtime cross-unit variance in TSCS data (Kropko & Kubinec, 2020). Thus, I include time fixed effects for capturing mutual time-related shocks and trending effects in all models, lagging all x variables by 1 year to avoid any simultaneity.

A final critical question remains, which is the thorny issue identifying causality. Typically, even if time-invariant omitted variables bias is minimized in the fixed effects specification, the question of omitted variables bias (due to time varying omitted variables) and reverse causality remain. If indeed such factors as colonial history or culture are unmeasured confounders that explain the effect of the treatment (economic freedom) on the outcome (sustainability), then such time-invariant, country-specific factors, are accounted in the fixed effects specifications. However, if unobservables, such as technological change, or specific government policies that enhance sustainability may also explain economic freedom, then assigning causality to economic freedom could be spurious. Of course, even if the theories discussed above tell us why economic freedom produces the more favorable policies, we can still entertain some formal statistical tests for addressing the extent to which unobserved heterogeneity might be affecting the results of the treatment on the outcome. One such test, in a non-instrumental variable setting, works on the assumption that unobserved heterogeneity is proportional to the observed, and that a formal statistic δ might be computed from the movement of the coefficients and the R^2 in controlled and uncontrolled models relative to a max-R of 1, or an R proportional to a fully identified model (Oster, 2019). Thus, the proportional selection statistic δ tells us how strongly unobserved variables will need to be relative to the treatment for obtaining a beta of 0. I follow up with a similar but somewhat distinct approach suggested by Carlos Cinelli and Chad Hazlett, whose method also assesses the degree to which the treatment's effect on y is dependent on unobserved confounders (Cinelli & Hazlett, 2020).[8] The robustness tests section after the main results are addressed discuss these tests further.Two-stage instrumental variables analysis is yet another way to assess endogeneity. Finding valid instruments for economic freedom, or egalitarian democracy, however, is no easy task. An instrument essentially needs to explain the endogenous variable but be exogenous in relation to y. I follow William Easterly (2006), who instruments economic freedom with legal origins of countries and distance from the equator for explaining per capita income. As he (2006: 33) writes:

> Since the institutions of economic freedom originated in Europe and then spread to other temperate regions where Europeans settled (with some exceptions), I use distance from the equator as one instrument for economic freedom.

Following this logic, I use distance to major markets defined as the kilometer distance from the United States, Belgium, and Japan instead of the distance to the equator and a measure of common law legal system (Gleditsch & Ward, 2001; La Porta et al., 1998).[9] British colonial history is often identified with the common law legal tradition related to such factors as strong property rights (La Porta et al., 1998). For an instrument to be valid, it must meet two formal criteria—instrument relevance and instrument exclusion. Relevance is a function of how well the instrument relates to the endogenous variable, which is formally tested by a joint F-statistic in the first stage of the IV regression (Bound et al., 1995). Following others, I use the recommended F value of over 10 at the 10% level of the Stock-Yogo weak identification F test, as well as the Kleibergen-Paap and Cragg-Donald tests for weak instruments (Baum et al., 2003). The Hansen J statistic tests the instrument exclusion criteria (Hansen, 1982). Unfortunately, while most of the combinations of instruments showed strong instrument relevance, they mostly failed to pass the instrument exclusion, or overidentification test. Using VDEM's property rights protection measure lagged by 2 decades together with income per capita also lagged by 2 decades, however, pass both instrument relevance and the instrument exclusion tests. There is good reason to believe that property rights protection historically will persist to generate higher levels of contemporary economic freedom, but there is nothing to suggest that contemporary sustainability outcomes, such as pollution levels, determine property rights in the past, or that property rights in the

[8]Both methods are implemented in STATA as commands "psacalc" and "sensemakr" respectively.

[9]For more information on the distance data, see http://ksgleditsch.com/mindist.html. The legal origin data are taken from https://devecondata.blogspot.com/2007/05/legal-origin.html.

distant past should cause current environmental sustainability except through current economic freedom. These results will be explored further in the robustnesss tests. First, however, I test the simple associations of the two variables of interest on sustainability for assessing their relative impacts, the main concern of this paper.

6 | RESULTS

Table 1 reports results on the two main variables of interest, economic freedom and egalitarian democracy, on the aggregated weak sustainability measure, namely, the adjusted net savings rate.

Column 1 begins with the estimation of fixed effects using the Driscoll-Kraay standard error method. As seen there, economic freedom has a positive, statistically non-significant relationship with the adjusted savings rate. Egalitarian democracy shows a negative effect, but one that is also statistically not different from zero. In column 2, when random effects are estimated, the effect of economic freedom is positive and now statistically significant at the 1% level. Egalitarian democracy, however, is negative and statistically highly significant. These results taken together, thus far, suggest that egalitarianism is associated with on a non-sustainable path of development compared with countries that are more friendly to free-market capitalism, independently of each other.

These effects are far more pronounced in the post-Cold War period (Columns 3 & 4). Economic freedom increases sustainable development, while egalitarian democracy reduces it, results that are statistically highly significant. Substantively, a standard deviation increase in economic freedom increases the adjusted savings rate by roughly 16% of a standard deviation, holding all the other variables at their mean values. Contrarily, a standard deviation increase in egalitarianism reduces sustainable wealth production by 33% of a standard deviation (of the adjusted net savings). These effects, thus, are not just statistically significant but carry some substantive import. Concretely, if a country, such as Nigeria, increases its 2016 economic freedom score of 6.87 to that of Botswana's in 2016 (7.5), Nigeria could increase its adjusted net savings by an extra 9% on average of the within standard deviation (6.85) on an annual basis. Alternatively, if Nigeria adopts economic freedom to the level of Denmark (8.01), it increases sustainability by 17% of a standard deviation annually. Clearly, these gains over time are likely to be substantial, but the main issue is that economic freedoms seem to increase greater environmental efficiency and human capital accumulation as a share of total wealth produced while egalitarian governance shows the opposite effect, independently of all the controls.

The control variables are also interesting. Greater levels of income increase sustainable development as do more densely populated countries. Higher shares of urban populations, however, seem to reduce it. I ran the basic model (column 4) with a quadratic term for income per capita to model the environmental Kuznets curve. This effect shows a positive effect that flattens out at very high levels, but it does not show a Kuznets curve effect. Estimating a quadratic effect for egalitarian democracy shows a linear negative effect that accelerated downwards roughly after the mid-point of egalitarian democracy.[10] I continue the rest of the empirical tests using the most conservative estimating method, which is the Driscoll-Kraay method with fixed effects for the entire time period from 1970 as in column 1, which shows the least significant effects for my two variables of interest.

Table 2 displays estimations of economic freedom and egalitarian democracy on components of the adjusted net savings disaggregated as CO_2 damage per GNI and the depletion of natural resources per GNI produced (weaksustainability).

As seen in column 1, the effect of economic freedom is to lower CO_2 emissions per GNI produced, while egalitarian democracy increases it. These effects are statistically highly significant. Substantively, a standard deviation (within) increase in economic freedom reduces CO_2 emissions per GNI by roughly 15% of a standard deviation of CO_2/GNI (within). Comparatively, a similar increase in egalitarian democracy increases CO_2 per GNI by roughly 4% of a within standard deviation of CO_2/GNI, which is fairly small. Nevertheless, the relative effect of economic

[10]These figures.

TABLE 1 OLS fixed & random effects estimations of economic freedom and egalitarian democracy on weak sustainability measured as adjusted net savings, 1970–2017

Dependent variable Adjusted net savings rate	(1) Driscoll-Kraay Fixed effects 1970–2017	(2) Driscoll-Kraay Random effects 1970–2017	(3) Driscoll-Kraay Fixed effects 1990–2017	(4) Driscoll-Kraay Random effects 1990–2017	(5) Newey-West Two-way fixed effects 1970–2017
Economic Freedom	0.674 (0.444)	0.784* (0.465)	1.765*** (0.315)	1.729*** (0.324)	0.674** (0.333)
Egalitarian democracy	−4.958 (3.272)	−7.182** (2.806)	−15.84*** (3.967)	−15.92*** (2.840)	−4.958** (1.992)
Income per capita (log)	8.523*** (1.048)	4.761*** (0.690)	9.614*** (1.587)	5.169*** (0.527)	8.523*** (1.022)
Natural Resource Rents/GDP (log)	−0.822 (0.529)	−0.821 (0.770)	−0.101 (0.679)	−0.276 (0.867)	−0.822 (0.660)
Population density (log)	7.657** (2.944)	1.336 (0.925)	12.16*** (3.558)	1.312 (0.808)	7.657*** (1.914)
Urban Population % (log)	−4.635* (2.652)	−3.469 (2.328)	−11.82*** (3.395)	−6.279*** (1.519)	−4.635* (2.532)
Constant	−66.63*** (10.45)	−19.42*** (4.763)	0 (0)	0 (0)	−61.75*** (10.76)
Observations	3,978	3,978	2,859	2,859	3,978
Number of countries	145	145	145	145	145
Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.10					
Year fixed effects	YES	YES	YES	YES	YES
Country fixed effects	-	-	-	-	YES

TABLE 2 OLS fixed effects estimations with Driscoll-Kraay standard errors of economic freedom and egalitarian democracy on weak sustainability measured as CO2 pollution and resource depletion, 1970–2017

Dependent variables	(1) CO2/GNI	(2) Resource depletion/GNI	(3) Forest depletion/GNI
Economic Freedom	−0.0666*** (0.0201)	0.00136 (0.0151)	−0.0123 (0.00973)
Egalitarian democracy	0.177*** (0.0444)	0.172*** (0.0553)	0.204*** (0.0375)
GDP per capita (log)	−0.170*** (0.0321)	0.0562 (0.0391)	−0.124*** (0.0156)
Total Resource Rents/GDP (log)	0.101*** (0.0195)	0.628*** (0.0351)	0.0863*** (0.0140)
Population density (log)	0.756*** (0.0865)	0.194*** (0.0546)	0.121*** (0.0322)
Urban population % (log)	0.669*** (0.0685)	0.173** (0.0793)	0.127*** (0.0354)
Constant	0 (0)	0 (0)	0.184 (0.183)
Observations	4,876	4,710	4,763
Number of groups	154	153	153

Standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10. Year fixed effects estimated.

freedom compared with egalitarian democracy is favorable for achieving weak sustainability, or put another way, for generating wealth that is more environmentally efficient. When it comes to natural resource depletion (non-renewable and renewable), economic freedom is not statistically significantly related, whereas egalitarian democracy is again positively associated with resource depletion. Using the results in column 2, I compute the substantive impact. Raising egalitarian democracy by one within standard deviation increases the depletion of mineral and energy resources by roughly 4% of a standard deviation (within) of resource depletion per GNI. A similar calculation for forest depletion (column 3) suggests that raising egalitarian democracy by 1 standard deviation increases forest depletion by roughly 11% of a standard deviation of forest depletion, which is not negligible. Once again, I estimated a curvilinear effect of income on CO_2/GNI, and in this case, the results suggested a clear inverted U-shape. As income increases, CO_2/GNI rises and then after a point subsides to a level below initial levels when income is at higher levels (see Appendix Figure A1). Interestingly, these same effects exist for both economic freedom and egalitarian democracy, where initial increases are offset at very high levels of economic freedom and egalitarian democracy (see Appendix Figures A2 & A3).

Thus far, I have only examined the notion of weak sustainability, which only measures the *economic* efficiency of environmental use, including atmospheric pollution. I turn next to examining strong sustainability that measure the degree to which nature is degraded on a per capita basis rather than as a share of wealth produced. Table 3 provides the comparative results using the disaggregated measures of resource use and atmospheric pollution, estimated for the post-cold war period.

As seen across the columns in Table 3, economic freedom reduces CO_2 pollution per capita, is statistically not significantly associated with all greenhouse gas pollution, is statistically significantly related to CO_2 pollution per capita measured in metric tonnes, and is statistically significantly and positively related to energy, minerals, and forest depletion. These results taken together suggest that while economic freedom reduces atmospheric pollution relating to CO_2 from both weak and strong sustainability perspectives, it increases natural resource use in terms of per capita depletion. In so far as strong sustainability is the goal, then higher economic freedoms increase natural resource depletion rates. Comparatively, looking across the columns for egalitarian democracy, the effects on atmospheric pollution are positive and statistically highly significant, and egalitarian democracy associates positively with forest depletion. Clearly, economic freedoms seem to produce better outcomes for sustainability from the point of view of atmospheric pollution. Substantively, a standard deviation (within) increase in economic freedom reduces CO_2 per capita pollution by roughly 3% of a standard deviation of CO_2 per capita, which interestingly is roughly the

TABLE 3 OLS fixed effects estimations with Driscoll-Kraay standard errors of economic freedom and egalitarian democracy on strong sustainability measured as atmospheric pollution per capita & resource depletion on per capita basis, 1990–2017

Dependent variables	(1) CO2 emissions per capita	(2) GHG emissions per capita	(3) CO2 emissions mt per capita	(4) Energy depletion per capita	(5) Mineral depletion per capita	(6) Forest depletion per capita
Economic Freedom	−0.0258*** (0.00847)	0.0195 (0.0124)	−0.0243** (0.00882)	0.104*** (0.0202)	0.141*** (0.0276)	0.115*** (0.0142)
Egalitarian democracy	0.265*** (0.0678)	0.0181 (0.136)	0.276*** (0.0625)	−0.281 (0.198)	0.0740 (0.234)	0.703*** (0.135)
GDP per capita (log)	0.782*** (0.0240)	0.304*** (0.0374)	0.737*** (0.0275)	0.844*** (0.0620)	0.614*** (0.0679)	0.293** (0.122)
Total Resource Rents/ GDP (log)	0.0192 (0.0225)	0.0773*** (0.0211)	0.0233 (0.0194)	0.699*** (0.0666)	0.762*** (0.0976)	0.177*** (0.0411)
Population density (log)	0.580*** (0.0550)	0.00729 (0.130)	0.514*** (0.0532)	0.302* (0.152)	0.525*** (0.127)	0.668*** (0.0468)
Urban population % (log)	0.645*** (0.119)	0.522*** (0.0639)	0.591*** (0.109)	−0.673*** (0.138)	−0.148 (0.144)	0.538*** (0.114)
Constant	0 (0)	−9.928*** (0.794)	−9.945*** (0.652)	0 (0)	0 (0)	−8.078*** (1.528)
Observations	3,314	2,619	3,310	3,314	3,314	3,241
Number of groups	154	143	154	154	154	152

Standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10. Year fixed effects estimated.

same amount in increased CO_2 pollution if egalitarian democracy was to be increased by a 1 standard deviation (within). Testing a quadratic term of income per capita on CO2 emissions per capita shows a linear effect that is monotonic, rather than the curvilinear effect (see Appendix Figure A4). Richer countries, thus, produce higher levels of CO_2 per person, which flattens out slightly at the very top. The quadratic effects of economic freedom and egalitarian democracy on CO_2 emissions per capita (strong sustainability) both follow a curvilinear independently of each other, but the effect of economic freedom's negative effect seems stronger (see Appendix figures A5 & A6).

As argued above, egalitarian democracies have supposedly adopted more free-market policies in recent years, even if some areas, such as government spending, continue to display partisan tendencies (Jäger, 2017). Table 4 presents the conditional effects between economic freedom and egalitarian democracy on atmospheric pollution, assessed in terms of CO_2 intensity in wealth generation and CO_2 emissions per capita. Does economic freedom and egalitarianism work better in tandem?

As seen there, egalitarian democracy does not condition economic freedom in a pollution-reducing direction. Although the conditional effect is negative and statistically significant in column 2 when the strong sustainability measure is estimated, the independent effect of egalitarian democracy (when economic freedom is zero) is positive and highly significant. Since the joint F test of the conditional term does not capture the actual relationship of economic freedom at each of the values of egalitarian democracy, I provide the margins plot in Figure 5 for assessing this relationship, which seems to be small in comparison to the negative effect of the independent term of economic freedom. It does not seem to be the case that egalitarian democracies with greater economic freedoms are jointly better at reducing atmospheric pollution.

Finally, it might be argued that the index of economic freedom as constructed by the Fraser Institute might indeed be too broad, aggregating almost 50 indicators into a single number, thereby diluting its analytical value. We have already seen, however, that this measure has very high correspondence with the expert-coded measure of the extent of private ownership of the economy as measured by the VDEM project. Highly correlated variables, however, are often not interchangeable. In Table 5, I replicate the basic results with VDEM's private ownership variable.

As seen in column 1, private ownership of the economy, increases the adjusted net savings rate (weak sustainability) similar to that of overall economic freedom reported above. Private ownership, however, has no statistically significant effects on higher pollution rates, except that forest depletion increases. These results gel quite well with those reported for economic freedom. Egalitarian democracy in turn shows statistically highly significant negative effects on adjusted net savings, and positive effects that are highly significant on CO_2 emissions measured as a share of GNI and as per capita emissions. Egalitarian democracy shows a statistically significant negative effect on energy

TABLE 4 OLS fixed effects estimations of the conditional effects between economic freedom and egalitarian democracy on weak & strong sustainability measures of CO_2 emissions, 1990–2017

Dependent variables	(1) CO_2/GNI	(2) CO_2/per capita
Economic Freedom	−0.157*** (0.0192)	−0.00472 (0.0147)
Egalitarian democracy	0.366 (0.369)	0.636*** (0.200)
Econ. Freedon x Egal. Democracy	−0.00421 (0.0526)	−0.0596* (0.0310)
GDP per capita (log)	−0.220*** (0.0565)	0.790*** (0.0226)
Total resource rents/GDP (log)	0.141*** (0.0225)	0.0198 (0.0224)
Population density (log)	0.398*** (0.123)	0.559*** (0.0640)
Urban population% (log)	0.778*** (0.120)	0.613*** (0.127)
Observations	3,274	3,314
Number of groups	154	154

Standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10. year fixed effects estimated.

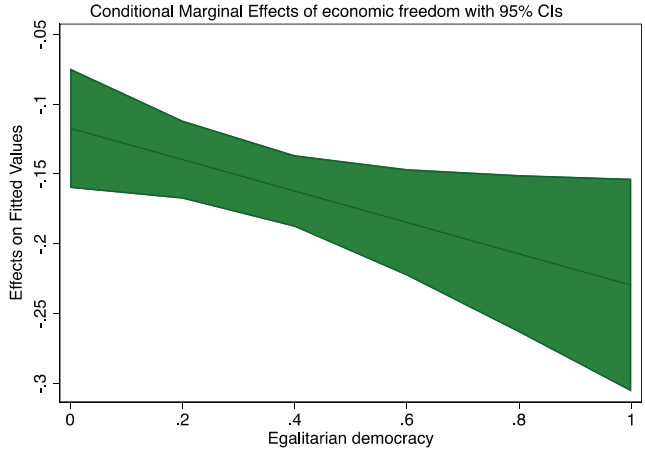

FIGURE 5 The effects of economic freedom on CO_2 damage conditional on egalitarian democracy, 1990–2017 [Colour figure can be viewed at wileyonlinelibrary.com]

depletion, a result possibly explained by the fact that few energy producing countries are democracies (Ross, 2012). GDP per capita has statistically significant positive effects on economic sustainability, but positive effects on pollution and the depletion of natural resources, except for forest assets, which are depleted less when wealth increases.

In summary, economic freedom increases overall sustainability while egalitarian democracy reduces it, independently of the control variables in the model. The effects of income per capita on the strong sustainability measure of CO_2 emissions per GNI follows the environmental Kuznets curve but is linear and monotonic when testing CO_2 per capita. Both economic freedom and egalitarian democracy show a curvilinear effect on CO_2 per capita. Thus, the "modernization" variables, captured by income and democracy, show somewhat contradictory results independently. The results taken together lead to the rejection of the two proposed hypotheses but there is some evidence to suggest that at the very high levels of democracy and economic freedom, the per capita output of CO_2 emissions is reduced independently of the level of development. Since economic freedom increases overall sustainability measured as adjusted net savings and reduces atmospheric pollution, its relative impact is more poverty- and environmentally friendly. Egalitarian democracy, contrarily, reduces overall sustainability in terms of weak sustainability while consistently increasing atmospheric pollution in terms of higher CO_2 pollution, at least up to a point. These results do not favor arguments suggesting that free markets must be constrained by egalitarian values for obtaining better sustainability outcomes. Indeed, it seems far better to encourage the conditions that increase and free markets, results consistent with at least two differently derived measures economic freedom.

7 | ROBUSTNESS TESTS

I conduct a barrage of robustness tests on these basic data. First, each of the models were run after dropping the so-called WENAO countries made up of the old, industrialized democracies of Western Europe, North America, Oceania (WENAO), plus Japan. In many cases, the statistical significance of the results improved with the so called "industrialized democracies" excluded, suggesting that statistical significance of the results thus far presented is particularly representative among developing countries. These results appear in the online appendix. Next, the basic CO_2 pollution results were run for only the two variables of interest, economic freedom and egalitarian democracy. In the case of weak sustainability (CO_2/GNI), the result remained negative and highly significant for economic freedom and positive and highly significant for egalitarian democracy. These results were replicated also for VDEM's measure of private ownership of the economy. Adding variables capturing ongoing civil conflict and another capturing the history of peace did not alter

TABLE 5 OLS fixed effects estimations of private ownership of the economy on atmospheric pollution and resource depletion in terms of strong sustainability measurements, 1990–2017

Dependent variables	(1) ANS/GNI	(2) CO2/GNI	(3) CO2 mt/pc	(4) Energy dep./pc	(5) Mineral dep./pc	(6) Forest dep./pc
Private ownership of economy	2.169*** (0.653)	−0.0289 (0.0206)	−0.0140 (0.0179)	−0.0392 (0.0329)	0.0428 (0.0284)	0.0758* (0.0411)
Egalitarian democracy	−17.27*** (3.422)	0.418*** (0.0775)	0.241** (0.105)	−0.525*** (0.149)	−0.124 (0.265)	1.057*** (0.159)
GDP per capita (log)	11.66*** (1.756)	−0.229*** (0.0689)	0.352*** (0.0392)	1.078*** (0.0667)	0.296*** (0.0499)	0.0427 (0.0479)
Natural resource rents/GDP (log)	−0.184 (0.584)	0.136*** (0.0332)	0.0348 (0.0266)	0.770*** (0.0515)	0.748*** (0.120)	0.151*** (0.0415)
Population density (log)	13.99*** (3.850)	0.417*** (0.135)	0.0807 (0.154)	0.494*** (0.132)	−0.0530 (0.142)	0.393*** (0.0385)
% Urban population (log)	−14.08*** (3.997)	0.861*** (0.130)	0.463*** (0.0919)	−0.733*** (0.109)	0.120 (0.170)	0.666*** (0.177)
Observations	3,250	4,103	3,345	4,185	4,187	4,012
Number of countries	157	171	167	171	171	168

Standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.10. Year fixed effects estimated.
ANS/GNI = adjusted net savings per GNI.
CO2/GNI = CO2 emissions per GNI.
CO2mt/pc = CO2 metric tonns per capita.
Energy dep./pc = energy depletion per capita.
Mineral dep./pc = mineral depletion per capita.
Forest dep./pc = forest depletion per capita.

the basic findings to any appreciable degree (see Table 6 in online appendix).[11] Economic freedom, thus, produces wealth more environmentally efficiently. In the case of the strong sustainability measure (CO_2/per capita), both economic freedom and egalitarian democracy showed the reported curvilinear effects. Could it be that the egalitarian democracy effects are capturing the former Soviet states, whose industries possibly lag behind in terms of green innovation? Adding a dummy variable (random effects model) to the basic models for weak and strong sustainability measures on atmospheric pollution uphold. The former soviet state dummy is positive and highly significant for CO_2 pollution levels independently of all the other variables in the model (see Table 7 in online appendix). Simply dropping all the controls and adding each of the controls step-wise in models examining CO_2 emissions per capita demonstrates that economic freedom robustly reduces emissions while egalitarianism increases them (see Table 8 in online appendix). Next, I perform formal tests of robustness to omitted variables discussed briefly in the methods section. I begin with the Oster method, computing the delta statistic for proportional selection by setting the max R value to 0.75 using the observed R^2 from the controlled model ($r = 0.73$) for obtaining a treatment effect $= 0$.[12] Running the basic model for economic freedom obtains a delta statistic of 2.75 suggests that unobservables will need to be at least 2.75 times the strength of the observables for producing a treatment effect equal to 0. Running this same test with the VDEM's private ownership variable produced a large negative value of delta (-4.5), suggesting that unobservables are negatively associated with the observed controls. A similar delta statistic is obtained when examining the effect of egalitarian democracy. The negative delta values have little interpretative value.

The Cinelli & Hazlett method of robustness conducted on the same basic models reveal that the effects of VDEM's private ownership and egalitarian democracy are very strongly robust compared with economic freedom's effects on the adjusted net savings rate. The extent of robustness is best observed graphically (see appendix Figures A7, A8 & A9). The contours show what the true treatment effect of economic freedom would be if there was an unobserved confounder of a given strength relative to the benchmark effect of GDP per capita. Such unobserved factors then would be responsible for inflating the unadjusted estimate, which appears at the bottom left corner. As seen in Figure A7 in the appendix, the unadjusted effect of economic freedom (1.786) decreases to 0.64 (statistically not significant) for an unobservable with a power equal to GDP per capita. This test suggests that the effect of economic freedom might not be too robust to unmeasured confounders. When the test is run on VDEM's private ownership measure, however, robustness looks more solid (Figure 8). Now, the unadjusted value of private ownership (1.599) persists in strength for potential unobservables up to 3 times the strength of the benchmark control GDP per capita. Figure 9 displays the test for egalitarian democracy, where the unadjusted effect of -15.37 shows only a slight reduction despite potential unobservables again up to 3 times the strength of GDP per capita. These tests generally show that the basic results hold up well to omitted variables bias.

Next, I run two-stage instrumental variables regressions on the basic model testing economic freedom on the adjusted net savings rate. The results are presented in the online appendix (see Tables 10 & 11). An array of basic instruments fail the instrument exclusion criteria, but in Table 11 in the online appendix, two instruments for economic freedom, namely VDEM's property rights respect lagged 20 years and GDP per capita also lagged 20 years pass both instrument relevance and instrument exclusion criteria. The coefficient of economic freedom on the adjusted net savings rate increases from roughly 1.78 to 5.1 after instrumenting, suggesting that the basic result may not be due to endogeneity bias resulting from omitted variables and reverse causality.

Finally, I check the basic models for bias from multicollinearity. The variance inflation factor (VIF) scores suggest no detectable multicollinearity in any of the models tested. The basic model was also checked for bias from influential observations, computed through the Cook's D statistic. Dropping roughly 200 observations with Cook's D values above the threshold of 4/n had little effect on the levels of significance and point estimates reported in Tables 1 & 3. Finally, I assessed the data for potential bias due to non-stationarity in the data series for economic freedom and

[11]The variable for ongoing civil war was obtained from the Uppsala-PRIO database (UCDP) which identifies a civil war as an armed conflict between a state and a rebel group (s) where at least 25 battle-related deaths have occurred. Using this dummy coded variable, I compute the number of years a country has been in peace since independence or 1946. See the UCDP website for more information https://ucdp.uu.se.

[12]See online appendix for the details of the results.

egalitarian democracy by conducting the augmented Dickey-Fuller unit-root test, which suggested that in both cases the panels did not contain a unit root. Thus, the basic results are robust to alternative models, sample sizes, estimation methods, endogeneity, potentially influential data points, and violations of regression assumptions.

8 | CONCLUSION

Orthodox economists generally see free markets as better than tight government command and control for gaining better environmental outcomes. Free markets can adapt faster to the needed technological change and spread such adaptation much farther due to market relations between firms and consumers (Stilwell, 2006). Indeed, greater wealth and technology have contributed significantly towards improving the environment measured in terms of reduced pollution and higher environmental standards (Wending et al., 2020). Critical theorists, communitarians, and many anti-globalization voices, however, blame free-market capitalism for climate change and unsustainable economic development (Mazzucato, 2021; Stiglitz, 2019a). They argue that free markets promote individualist attitudes, increases profligate consumption, and place profits over environmental concerns. The critics of free-market capitalism prescribe more egalitarian forms of governance (including greater democracy), encouraging heavy state investment and the promotion of social equity for driving communitarian values for garnering better environmental outcomes. This study has contrasted measures of economic freedom versus egalitarianism on several indicators of economic and environmental sustainability, such as the World Bank's *adjusted net savings* and several measures of strong sustainability measured as atmospheric pollution per capita. The results suggest robustly that economic freedom performs better than egalitarianism, especially when assessing the environmental efficiency of producing wealth. Egalitarian democracy on the other hand lowers net adjusted savings (weak sustainability). Similar effects obtain when assessing environmental damage, particularly atmospheric pollution measured as CO_2 emissions per capita, but there seems to be some evidence for inverted-U shaped relationships for both economic freedom and egalitarian democracy, but on balance, economic freedom shows kinder effects on environmental outcomes compared with egalitarianism. More importantly, economic freedom seems to produce wealth more environmentally efficiently, a path that poor countries would do well to adopt.

As many studies show, economic freedom increases economic growth, promotes human capital development, and increases human wellbeing, not to mention higher government respect for human rights and societal peace (Berggren, 2003; Stroup, 2007; Bjørnskov, 2015; de Soysa & Vadlamannati, 2013; de Soysa, 2020; Feldman, 2017). Since economic freedom increases overall sustainability and reduces atmospheric pollution, its relative impact is more poverty- and environmentally friendly than critics claim. Naturally, both forms of freedoms are ultimately valuable on many other grounds, and they may generally go together. However, the results reject the view that free markets destroy the global commons while egalitarianism potentially provides the solutions for addressing climate change. It seems that the aversion to free market freedoms shown by many communitarians and environmental groups might be misplaced. As some argue, while free markets may have won out, governments may still reflect ideological biases (Jäger, 2017). Addressing environmental sustainability may require governments to pragmatically harness the power of free markets and private sector actors for driving investments in environmentally friendly technologies and forging the markets for positive change. Simply resting on arguments that suggest that greater egalitarian values will generate the groundswell for positive change are likely to be mistaken given that government policies and regulations incentivize rent-seeking rather than meaningful investment in the green transition. Governments intent on political survival are likely to succumb either to rent-seeking vested interest or populistic policies that harm environmental causes. Moreover, policies that do not generate meaningful economic development among the vast majority of this globe's population will be unable to elicit the global cooperation required for long-term environmental cooperation if climate objectives are to be achieved. If economic freedom increases development and does so in ways that are environmentally efficient, then governments will do well to encourage it. Paradoxically, history has shown that social justice and equity, which are desirable in their own right, are best obtained with greater economic freedom (Friedman, 1962; Hayek, 1944; Otteson, 2021).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available on the author's personal website at URL *******

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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APPENDIX A.

TABLE A1 Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Economic Freedom	5,256	6.235046	1.324229	2.32	9.02
Private ownership	7,708	0.284502	1.131857	−4.078	2.69
Egalitarian democracy	7,708	0.353703	0.25139	0.018	0.876
Adjusted net savings rate	4,541	8.85814	11.83501	−97.525	77.3086
CO2/GNI (log)	6,427	0.009206	0.884713	−4.488	3.30945
Resource depletion/GNI (log)	5,955	0.936511	0.978033	0	4.2807
Forest depletion/GNI (log)	6,200	0.229352	0.552597	0	3.73224
CO2 damage/per capita (log)	6,691	3.027643	1.912589	−3.1871	7.3259
Greenhouse gas/per capita (log)	5,873	−5.20812	1.053726	−7.725	−1.7978
CO2 metric tonns per capita (log)	7,560	0.356481	1.649928	−7.0105	4.20963
Energy depletion per capita (log)	6,531	1.948802	2.345682	0	9.54983
Mineral depletion per capita (log)	6,798	0.879452	1.316868	0	7.23967
Forest depletion per capita (log)	6,462	0.548686	1.025184	0	5.05361
GDP per capita (log)	7,708	8.175502	1.495011	4.88339	11.6634
Resource rents/GDP (log)	6,728	1.458409	1.116958	0	4.48309
Population density (log)	7,535	3.864972	1.551562	−0.1631	8.97572
% Urban population (log)	7,691	3.747186	0.653174	0.73092	4.60517
Population growth rate	7,622	1.802404	1.43307	−6.7661	17.5122
Property rights protection	7,708	0.624635	0.253025	0.006	0.949
Common law system	7,644	0.295657	0.456367	0	1
KM distance to USA	7,644	8821.835	3626.984	737.043	16371.1
Developed countries (dummy)	7,708	0.164894	0.371109	0	1
Former communist state (dummy)	7,708	0.101583	0.302118	0	1

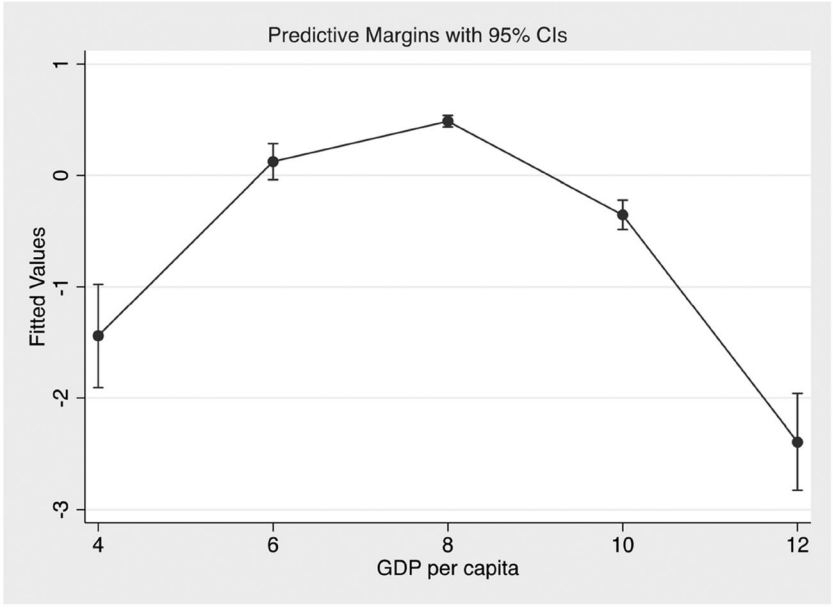

FIGURE A1 The quadratic effect of Income per capita on CO_2 emissions per GNI (weak sustainability)

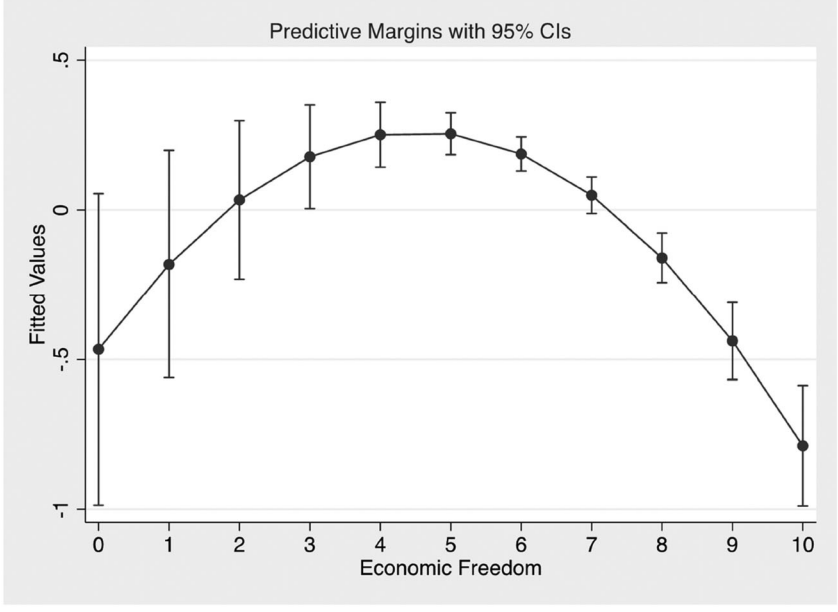

FIGURE A2 The quadratic effect of economic freedom on CO_2 emissions per GNI (weak sustainability)

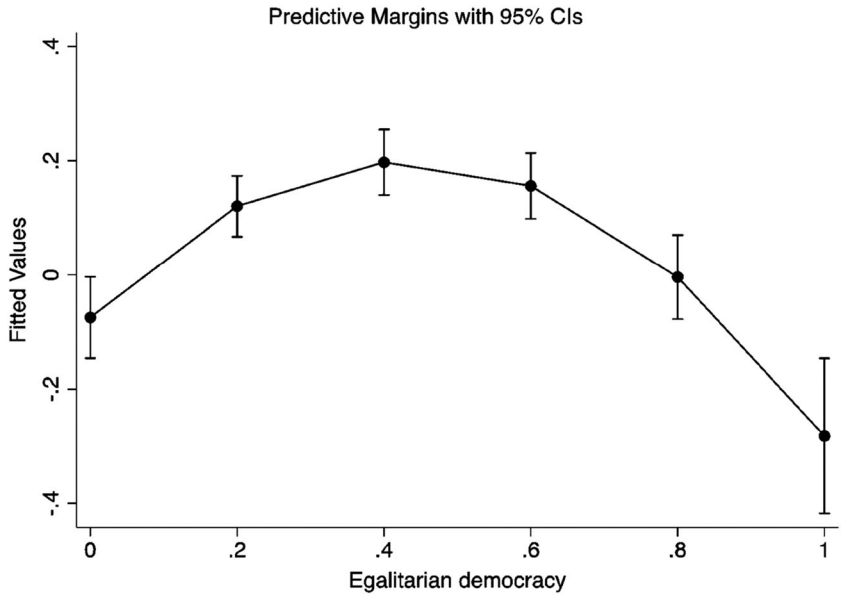

FIGURE A3 The quadratic effect of egalitarian democracy on CO_2 emissions per GNI (weak sustainability)

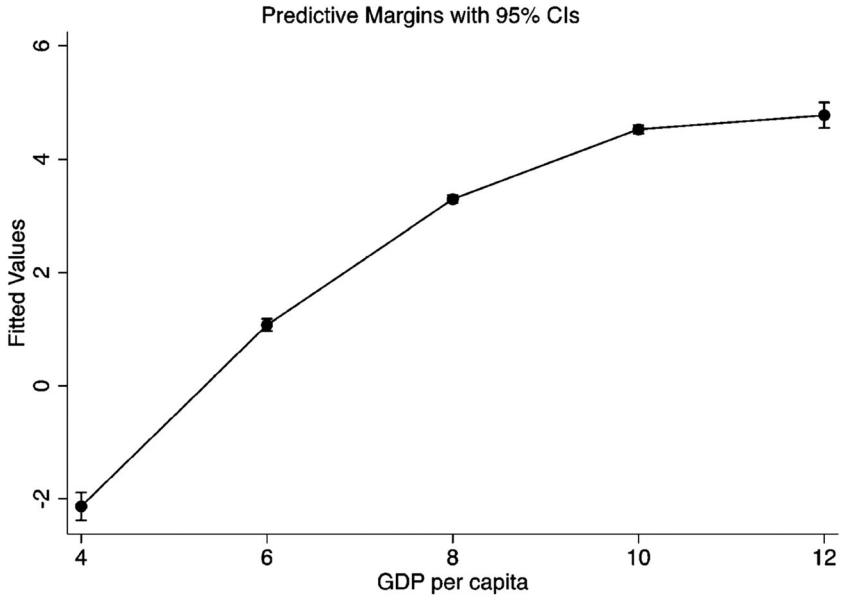

FIGURE A4 The quadratic effect of Income per capita on CO_2 emissions per capita (strong sustainability)

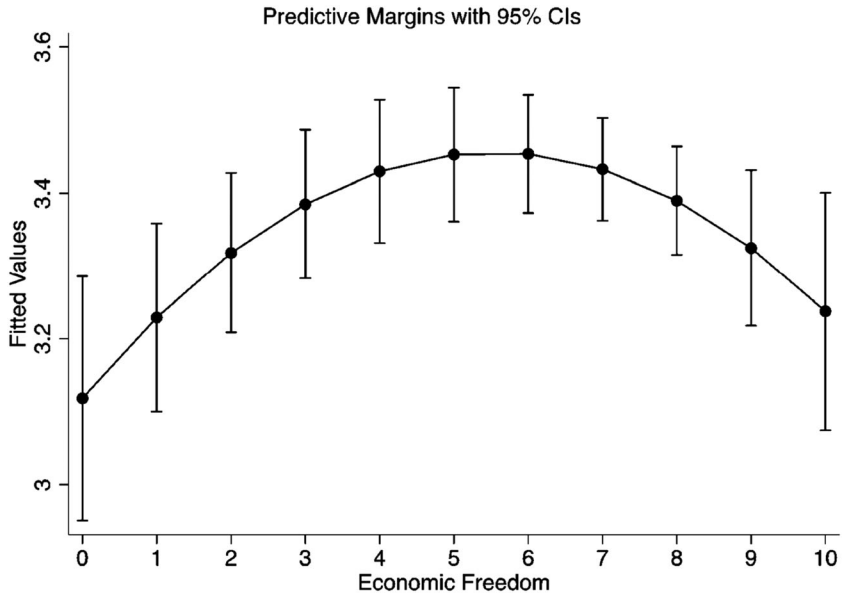

FIGURE A5 The quadratic effect of Economic Freedom on CO_2 emissions per capita (strong sustainability)

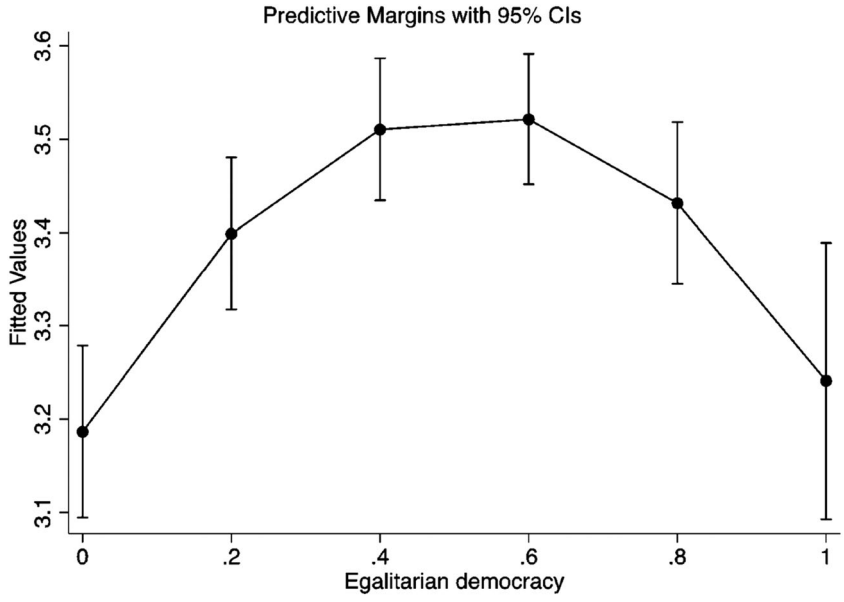

FIGURE A6 The quadratic effect of Egalitarian democracy on CO_2 emissions per capita (strong sustainability)

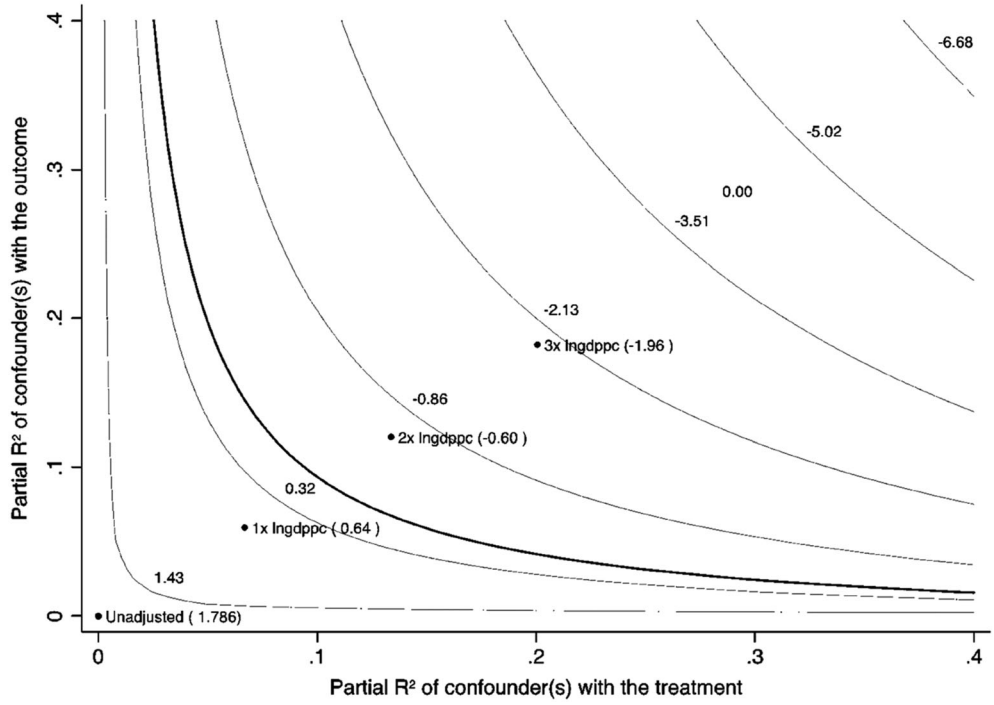

FIGURE A7 Contour plots of the robustness of the effect of economic freedom on adjusted net savings rate

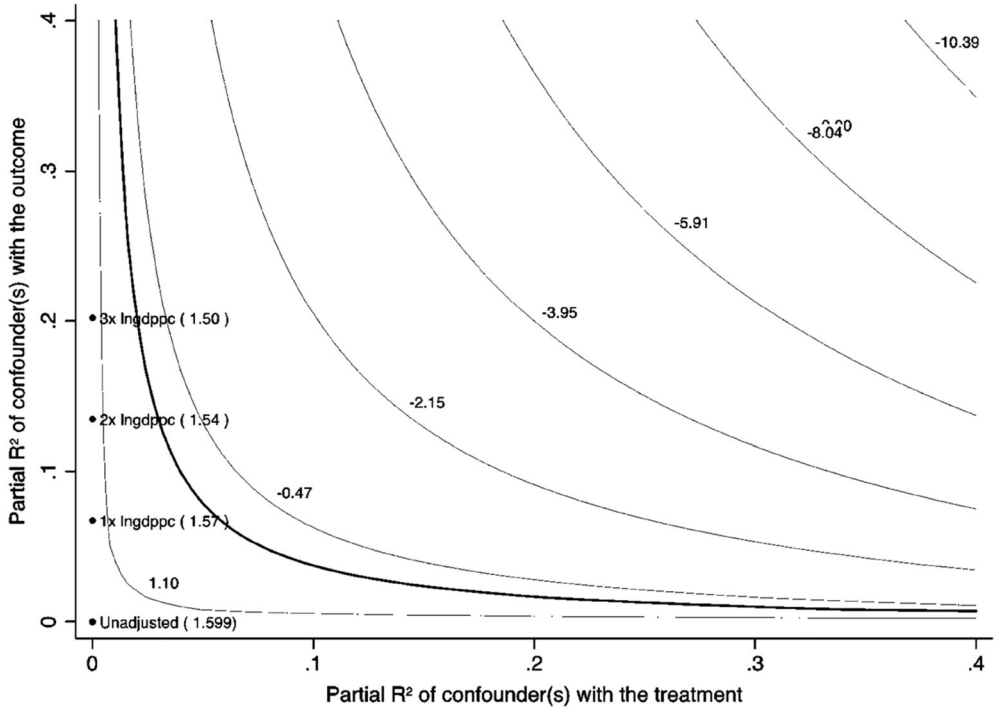

FIGURE A8 Contour plots of the robustness of the effect of private ownership of the economy on adjusted net savings rate

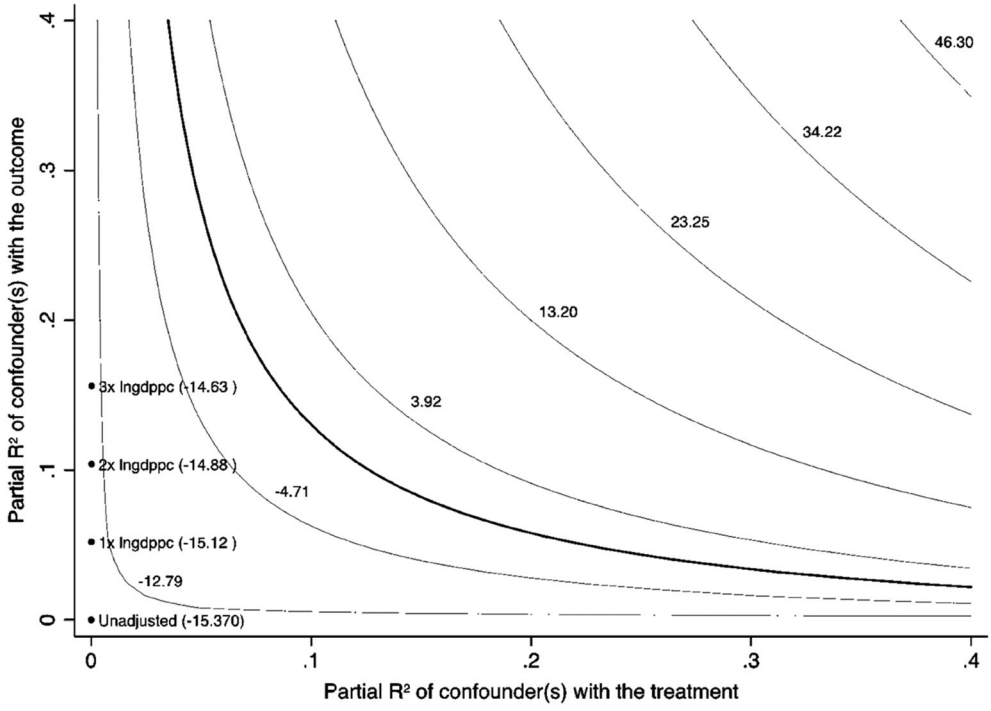

FIGURE A9 Contour plots of the robustness of the effect of egalitarian democracy on adjusted net savings rate