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Source: *Consilience*, No. 21 (2019), pp. 32-50

Published by: Columbia University

Stable URL: <https://www.jstor.org/stable/26775082>

Accessed: 17-04-2020 04:19 UTC

REFERENCES

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Examining the Validity of the Environmental Kuznets Curve

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Abstract

This research essay analyzes the environmental Kuznets curve, the first hypothesis to make the correlation between economic development, environmental clean-up, and the Kuznets Curve. In essence, the EKC states that environmental quality deteriorates in the initial stages of a country's economic development, but once a particular average income is reached that this trend will reverse and environmental degradation will begin to slow down considerably. Thus, rather than being a threat to the environment, economic growth would actually be the means to eventual environmental improvement. Although proponents of the EKC have shown some empirical evidence suggesting that rising income levels in developing countries can be advantageous rather than detrimental for the environment, this article demonstrates that there is no guarantee that economic growth will lead to an improved environment. More specifically, this essay proves that the notion that income growth by itself will be beneficial for the environment is fictitious, as a causal relationship between income and environmental quality cannot be consistently demonstrated.

Author's Note

I have always been interested in the relationship between economic development and environmental sustainability. The environmental Kuznets curve was a hypothesis that I came across when I was finishing my undergraduate degree at King's University College at Western University, and I dedicated the vast majority of my final year examining its validity. For me, this research is significant in the field of sustainable development as it demonstrates a very important thing: that the EKC hypothesis does not reflect real world outcomes. Therefore, it must be acknowledged that there are environmental limits to growth. In terms of future avenues for research, I am interested in focusing on the environmental impacts of destructive mining practices as well as the politics of the Arctic.

Keywords: Environment, Environmental Kuznets Curve, EKC, Economic Growth, Economic Development, GDP

Introduction

In the article “The environmental Kuznets curve in a world of irreversibility,” University of Montpellier professor Fabien Prieur (2009) articulates that during the early 1990s, there was a substantial amount of interest in the relationship between economic growth and various indicators of environmental degradation. As a direct consequence of this attention, a hypothesis referred to as the environmental Kuznets curve (EKC), arguably the single most important concept to emerge at the time, surfaced. It insisted that economic growth would be the means to eventual environmental improvement (Stern, 2004).

The EKC predicts that in the early stages of industrialization, a developing country will experience an increase in environmental degradation and pollution because individuals are far more concerned with their income and their employment than with environmental quality - until a specific level of income per capita is met (Prieur, 2009). As soon as a country reaches a state of overall affluence, this trend will completely reverse. The EKC emphasizes that once individuals no longer feel economically insecure, they will be in a position to concentrate extensively on responding to the environmental degradation that made their wealth accumulation possible. As such, the EKC postulates that when an economy reaches full maturity, the environmental damage that occurred during its development will fall dramatically (Stern, 2004).

While literature on the EKC has increased exponentially over the past two decades, it has not yet produced a serious consensus, as the vast majority of studies are devoted to either confirming or invalidating its existence (Prieur, 2009). Critics of the EKC assert that it is troublesome that it blatantly supports economic growth at the expense of environmental protection, that assuming that economic growth will inevitably lead to an improved environment is highly problematic, and that there is insufficient proof that it holds across all environmental problems including biodiversity loss, energy use, and the most pressing issue of our time: climate change. On the other hand, proponents of the EKC contend that economic growth can be compatible with an improved environment, that there are highly industrialized nations that have been successful in cleaning up the environment, and that it is unnecessary to worry about the potential of irreversible environmental ruin because the damage can always be repaired. This essay argues that although the attention of economists has been captured by some empirical evidence which suggests that rising income levels in developing countries could be environmentally advantageous, the notion that income growth itself will eventually be beneficial for the environment is unfounded, as a causal relationship between income and environmental quality cannot be demonstrated consistently.

Origins and Explanation of the Environmental Kuznets Curve

As a result of increasing public concern over extensive environmental deterioration in the 1990s, an effort sparked to more clearly comprehend the dominant causes of environmental degradation (Dinda, 2004). The vast majority of the discussion at the time was motivated by a widespread fear concerning the real

ramifications that economic development could have on the environment. In particular, an uncertainty about whether or not economic growth could be compatible with environmental improvement emerged as countless individuals questioned if it was actually possible for intense economic growth to refrain from triggering extreme environmental degradation (Dinda, 2004). In response to this prevalent skepticism, a concept known as the environmental Kuznets curve emerged. It was the first theory to draw a correlation between economic development, environmental clean-up, and the Kuznets curve (Franklin & Ruth, 2012).

Deriving its name from the work of Simon Kuznets – who demonstrated that the shape of the relationship between economic development and income inequality is an inverted ‘U’ – renowned economists Gene Grossman and Alan Krueger coined the term EKC to characterize the relationship between economic development and environmental degradation (Franklin & Ruth, 2012). They publicized evidence which indicated that while certain measures of environmental quality appear to deteriorate in the initial stages of a country’s economic development, they progressively improve as the economy grows. In other words, Grossman and Krueger maintained that environmental pressures increase more quickly than income in the earliest stages of a country’s development, but that they slow down once a particular income per capita is reached (Allen & Webber, 2010). Grossman and Krueger insisted that this certain amount of income was a turning point: at high income levels the rate of environmental degradation would begin to slow down considerably (Allen & Webber, 2010). Therefore, rather than being a threat to the environment as is often claimed by environmentalists and ecological scientists, economic growth would actually be the means to eventual environmental improvement (Stern, 2004).

Their explanation was relatively simple and intuitively appealing and it attracted more detailed empirical analysis as well as theoretical research hoping to support the “grow first, then clean up” expression. In contrast to the idea that economic growth itself is the root of environmental deterioration, numerous advocates of the EKC endeavored to substantiate the relationship between economic development and environmental quality (Franklin & Ruth, 2012). In fact, proponents of the EKC contended that it was unnecessary for governments of pre-industrial and agricultural economies to be worried about their environments as they transitioned from low levels of per capita income to high levels of per capita income (Munasinghe, 1999). For EKC advocates, this worry was inessential because economic growth would enable a country to pay for a better environment down the road. Although economic growth would undoubtedly be initially environmentally onerous, EKC supporters argued that once a country achieved a level of acceptable economic growth, they would be able to address all forms of environmental degradation. Proponents explained that as development and industrialization progress, material output is prioritized, and the environmental consequences of growth are vastly overlooked. Therefore, everything from the increased use of resources to more emissions of toxic pollutants to less efficient and dirty technologies would all contribute to environmental damage (Munasinghe, 1999). However, this damage is not everlasting, as the EKC stresses that things take a radical turn for the better during a county’s final post-industrial stage. Once an economy reaches this stage, supporters of the EKC state that it will have achieved a level of economic stability with greater financial surpluses which can then

be used to pay for a more preemptive approach to environmental protection.

Along with these surpluses, because citizens feel economically secure, they will urge their governments to invest in cleaner technologies and encourage corporations to include environmental externalities in the final costs of their goods or services (Munasinghe, 1999). Proponents of the EKC also claim that due to the improvement in economic development there will be public demand for better quality of life and a cleaner environment, which they maintain can be achieved through the implementation of natural conservation policies and improved coastal, forest, urban, and marine management (Al-Mulali & Ozturk, 2015). With this justification, supporters of the EKC insist that economic growth is not something to be apprehensive about because while it does lead to environmental degradation in the earliest stages of industrialization, in the end, the best way to attain a decent environment is for a country to prosper (Stern, 2004).

Evidence of the Environmental Kuznets Curve

The idea that economic growth is necessary for environmental quality to be maintained or improved was first popularized by Grossman and Krueger's study of the potential impacts of NAFTA in the early 1990s. The World Development Report by the World Bank in 1992 similarly insisted that "as incomes rise, the demand for improvements in environmental quality will increase, as will the resources available for investment" (Proops & Safonov, 2004). Other proponents of the EKC have also provided empirical proof that environmental degradation does fall after an economy achieves a certain level of income. More importantly, they have reached a general consensus that:

"At higher levels of development, structural change towards information-intensive industries and services, coupled with increased environmental awareness, enforcement of environment regulations, better technology and high environmental expenditures, result in leveling off and gradual decline of environmental degradation" (Proops & Safonov, 2004).

A substantial amount of research has been published which tests the existence of the EKC in China. One of the most comprehensive articles is "Searching for an Environmental Kuznets Curve in China's Air Pollution", which compiles empirical evidence from a large number of general papers. To help present a more complete picture of China's true relationship to the EKC, this article not only incorporates statistics from 1982 to 2005 but also examines a wide variety of pollutants (Brajer et al., 2011). The article summarizes one specific instance in which de Groot, Withagen, and Zhou surveyed Chinese industrial gas emissions in thirty provinces between 1982 and 1997. The results were consistent with the Kuznets hypothesis. Another experiment by Shen and Hashimoto investigated four different water pollutants and SO₂. They discovered the expected inverted U relationship. Furthermore, as part of a broader overview of environmental issues in China, Rousmasset, Burnett, and Wang observed concentration levels of NO_x and TSP in eleven Chinese cities and found evidence of the EKC in each of them (Brajer et al., 2011). Similarly, after analyzing data from 1995 to 2005, Diao, Zeng, and Tam found that China had an inverted U

shape for discharges of industrial waste gas, soot, and industrial dust. Interestingly, Yaguchi, Sonobe, and Otsukua conducted a comparative study of SO₂ and CO₂ emissions in China and Japan from 1985 to 1999. While no EKC relationship seems to exist in Japan, their research concluded that it is definitely evident in China (Brajer et al., 2011).

With evidence spanning many different pollutants as opposed to one specific type, this article effectively demonstrates persuasive evidence that China does exhibit EKC-type behavior. While China is a significant case because it has experienced tremendous economic growth in recent years, there are other countries that can also convincingly prove the existence of the EKC from earlier time periods. Notably, empirical results from the United Kingdom show very strong support for an EKC, especially in terms of CO₂ and SO₂ (Mann & Sephton, 2016). When the United Kingdom was on its way to full development, emissions of CO₂ and SO₂ were so substantial that a thick fog engulfed most of the country.

This caused significant visibility problems, which was highly dangerous for transportation. Official figures also indicate that over the course of just five days in December 1953, approximately 4,000 people died prematurely due to severe health implications (Mann & Sephton, 2016). To combat the smog, the United Kingdom introduced its Clean Air Act in 1956, which “banned emissions of dark smoke from chimneys, trains, and industrial furnaces”. Later on in 1968, the Clean Air Act was revised to include harsher prohibitions on the emission of dark smoke and, by the 1970s, the UK had decided to transition from a coal-based economy into one based on nuclear power and later on the establishment of North Sea Oil (Mann & Sephton, 2016).

By the time the UK entered the 1980s, it had realized that a considerable amount of CO₂ and SO₂ was still being released into the atmosphere, and appropriate adjustments were made to environmental standards and policies. As a result of these adjustments – which included reducing greenhouse gas emissions using an assortment of policy tools including environmental taxation and increased use of renewable energy – CO₂ emissions began to flatten out and SO₂ emissions began to steadily decline (Mann & Sephton, 2016). Since the mid-1990s, the UK has been one of the world’s largest economies in both GDP and purchasing power, yet it has simultaneously strived to maintain low levels of greenhouse gas emissions so as reduce its contributions to anthropogenic climate change (Lapinskiene, Tvaronaviciene, & Vaitkus, 2014).

While it is clear that the UK does exhibit some EKC-type behavior, the evidence is limited; the only available literature studies only CO₂ and SO₂. In contrast, a great deal of research has been published which seeks to establish relationships between economic growth, environmental degradation, consumption of energy from fossil fuels, and trade liberalization in Iceland from 1960 to 2010. While Iceland was impacted when major financial institutions collapsed in 2008, it has been able to recover quite remarkably. Its GDP has grown considerably, investment and consumption have increased, and unemployment is extremely low (Pacheco-Borja et al., 2016). Alongside these achievements, Iceland has made enormous strides towards

environmental sustainability. Nearly all of its electricity is generated from geothermal sources and it has vowed to completely eliminate the use of fossil fuels for cars by 2025. Not only is Iceland considered to be a world leader in renewable energy use and in the treatment of environmental pollution, it is also the highest-ranking country on the Environmental Performance Index (Pacheco-Borja et al., 2016). Iceland has also endorsed the Kyoto Protocol and has agreed to reduce its greenhouse gas emissions by 50-75% by 2050. The nation has invested in greater social and technological development to improve production efficiency, and has openly declared that it will only exploit marine and land resources if the country can do so sustainably (Pacheco-Borja et al., 2016).

Evidently Iceland, as an advanced industrialized country, pays much attention to the environment. With the correct policies and regulations in place, Iceland is exerting itself to mitigate the environmental damage that precipitated as a result of its industrialization. In addition to the admirable accomplishments listed above, Iceland has also reached a point at which its growth translates into lower CO₂ emissions (Pacheco-Borja et al., 2016). As a result of the Icelandic government disseminating necessary information to raise awareness about the benefits of forests, the total area of forests in the country has doubled or even tripled since the 1950s. Moreover, 95% of the total energy in Iceland currently comes from renewable energy sources and one of the most ambitious goals of the Icelandic government is to get this number to 100% by 2020 (Pacheco-Borja et al., 2016).

Criticism of the Environmental Kuznets Curve

Even though there is certainly some empirical evidence supporting the EKC, the vast majority of the literature is econometrically weak (Stern, 2004). Various studies have endeavored to prove its existence mainly by showing how a certain environmental issue is rectified after a country reaches a certain level of income. However, countless researchers have contended that the EKC has never actually been shown to apply to all pollutants or environmental impacts. For example, the results of Shafik and Bandyopadhyay's famous study, which was incorporated into the 1992 World Development Report, looked for EKCs in ten different indicators of environmental deterioration in a number of countries (Stern, 2004). What the final report failed to include was that within these countries, only two out of the ten indicators conformed to the hypothesis. Therefore, even if emissions of some pollutants do decline over time, it seems that most indicators of environmental degradation consistently rise rather than decrease as incomes grow (Stern, 2004). Critics of the EKC also argue that the idea that wealthy nations will be at the forefront of environmental reform is naïve, as the world's most modern countries are accountable for escalating environmental degradation (Clausen & York, 2008).

Mills and Waite (2009) powerfully show that economic growth and biodiversity conservation are incompatible goals. While affluent countries do have the luxury of investing more heavily into conservation efforts, Mills and Waite claim that the increased growth of the human economy poses a major threat to biodiversity: species are currently disappearing 1000 times faster than in all of history. While the EKC suggests that a country will invest in conservation practices once it has acquired

enough wealth, the authors emphasize that the EKC is only valid in cases where environmental damage is reversible (Mills & Waite, 2009). They claim that an EKC for biodiversity is impossible, as anthropogenic-driven extinctions are permanent. The authors investigated the five richest countries in Central America, South America, Africa, and Asia and discovered that despite their relative prosperity, these countries have never tried to address deforestation, which is responsible for driving many species to extinction. More specifically, Malaysia and Mexico have lost more forest area than more than thirty-five other nations, and Brazil, Gabon, and Venezuela follow this trend (Mills & Waite, 2009). Because these are richer countries, to validate the EKC they would need to be actively addressing their high deforestation levels. Instead, the opposite is occurring as the number of threatened species in these countries is escalating with their increasing prosperity. A vast variety of plant, amphibian, reptile, and invertebrate species have become extremely threatened in these countries while others have completely vanished (Mills & Waite, 2009).

Although often overlooked, some EKC critics also point out that even if certain pollutants do decrease with economic growth, industrial society has a tendency to constantly create new, unregulated, and potentially toxic pollutants. From this perspective, it does not matter whether some sources of contamination follow the EKC because new, lesser-known pollutants will simply take their place (Dasgupta et al., 2002). Researchers Mazzanti, Montini, and Zoboli (2008) examined nine different pollutants, including greenhouse gases and other emissions in Italy, and discovered that only a handful of them have actually decreased. While all nine emissions are a result of economic activity, only CO₂, N₂O, NO_x, and NH₃ support the EKC relationship. In contrast, the evidence for the other pollutants, which include PM₁₀, NMVOC, SO_x, CO, and CH₄, subvert the hypothesis (Mazzanti et al., 2008). Though Italy is a thriving developed nation, it does not verify the existence of the EKC since the inverted U-shaped relationship between income and pollution does not hold across all nine of these contaminants. Moreover, others have proven that when Italian data for CO₂ and NO_x is split into two samples representing the southern and central northern provinces, the EKC is only supported in the central-north region (Sica, 2014). Not only does this imply that the inverted U-shaped relationship for CO₂ and NO_x can only be found at the national level because of the contributions of the central-northern provinces, it also indicates that Italy's southern provinces have not attempted to address their exceedingly high CO₂ and NO_x emissions.

Of countries that have been reluctant to confront their environmental degradation, Canada is one of the most prominent examples. Its severe carbon dioxide problem has not been resolved. Using data published by the World Resources Institute and Statistics Canada from 1948 to 2004, researchers found that following the oil crisis of 1973, Canada was one of only two nations that continued the increasing trend of CO₂ emissions (He & Richard, 2010). Currently Canada has the second largest fossil fuel reserve on Earth, is the largest producer of natural gas after Russia and the USA, and fossil fuels continue to dominate its energy market. Canada's emissions per capita are also considerably higher than most developed countries. Its total CO₂ emissions have increased by an overwhelming 50% over the past forty years and it is the top oil exporter among the OECD countries (Gohari et al., 2015).

Although the above examples clearly illustrate that the EKC hypothesis does not always hold, there are those who claim that economic growth is not a threat to sustainability. In response to this optimism, critics argue that resources are oftentimes exploited beyond a safe limit. Thus, even if there is a demand for environmentally friendly goods once a country's income is high enough, an environment may be too degraded to fully recover. For example, when comparing direct material flow data over a span of twenty years in Germany, the USA, Finland, Japan, and the Netherlands, researchers found that the EKC hypothesis does not hold (Haukioja et al., 2001). If ecological systems are to be sustained, reductions of material flows are necessary, including minerals, fossil fuels, wood, forest by-products, fisheries output, and agriculturally cultivated resources produced in agriculture. Researchers discovered that even though these countries are incredibly rich, they have the highest direct material flows per capita. For the EKC hypothesis to have been supported, the empirical evidence needed to show that environmental stresses had declined rather than escalated (Haukioja et al., 2001).

The majority of EKC literature maintains that the development trends of many developed countries proved to be vastly unsustainable. After analyzing numerous publications, it is evident that the main shortcoming of the EKC hypothesis is that it does not acknowledge that economic growth is limited by the resilience of the environment. On the contrary, the EKC encourages unrestrained economic growth as it mistakenly posits that all forms of environmental degradation will eventually be repaired. EKC critics argue that an absolute fixation to accumulate more while allowing "transient" environmental damage, as the EKC suggests, is immensely dangerous (He, 2003). Not only does the EKC fail to consider environmental limitations, critics spotlight how it falsely believes that all forms of environmental damage can be remediated. Relatedly, a major fault of the EKC is that it implies that economies can grow infinitely but does not acknowledge that economies are mainly based on finite natural resources on a finite planet. In other words, once certain environmental limits have been surpassed, they are incapable of returning to their original conditions. Worse, the EKC does not recognize that there are some environmental issues such as animal extinction that are permanent, and therefore no amount of money or time can rectify it after the fact.

As opposed to waiting for priorities to shift as income increases, EKC critics suggest that developing nations embrace an economic route that respects environmental protection throughout all stages of development (Gara, 2019). While already developed countries may claim that they lacked knowledge regarding various forms of environmental deterioration – mainly because some effects do not show up immediately – it is now known that the pollute first and fix later approach is both reckless and unsustainable. The "making money, makes sense" route of industrialized nations in particular gave no consideration to the environment that provided valuable resources. In their pursuit of economic luxury, industrialized nations created an exhausted and dangerous world for future generations, which has resulted in the vicious problem of climate change. As a direct consequence of this approach, millions of individuals are fearful of the impending global warming disaster, and EKC critics highlight the need to redefine the concept of development to incorporate sustainability (Gara, 2019).

Since it is anticipated that developing nations will want to follow the development route of industrialized nations to emulate their economic prosperity, EKC critics bring attention to the importance of reducing the value attributed to a high GDP. While GDP has been the traditional measure of economic development, there are certain things that it does not consider which are absolutely necessary for the economy (“GDP,” 2013). Specifically, the only time that natural resources are included in GDP calculations is when they are being sold, which means that neither the value of natural capital nor the environment are included. For example, if a country decided to sell all its fish in a single year, their GDP would rise immensely even though the entire fishing industry would collapse and that resource would forever be depleted (“GDP,” 2013). Due to this country’s unquenchable thirst for a high GDP, it mismanaged its fish supply so dramatically that it was incapable of keeping up with demand. For EKC critics, it is not a question of whether a developing country is willing to sacrifice rapid growth of their GDP to protect the environment (Gara, 2019). Instead, they emphasize that if developing nations strive to copy the development route of industrialized nations, as opposed to paying attention to ecological constraints, it will prove vastly counterproductive. The resources necessary to maintain growth will cease to exist and the world will be one step closer to a total climate catastrophe.

Which Position is More Convincing?

Before analyzing existing literature in depth, it is important to examine basic concerns with the hypothesis itself. The EKC supports unrestrained economic growth because it is confident that a country will experience environmental improvement once it reaches a turning point. However, it does not consider the possibility that a nation may struggle to attain the income level necessary to begin prioritizing the environment. Without achieving economic stability, a nation cannot pay for high environmental damage costs or introduce more modern and less pollution-intensive technology (Özdemir & Özokcu, 2017). Furthermore, the “grow now, clean up later” logic of the EKC is naïve. The EKC assumes that all nations will prioritize restoring the environment after a turning point. There is no guarantee, however, that a country would ever put environmental improvement before the economy. It cannot be assumed that a country would care enough to address environmental degradation even if it could shoulder the substantial costs of remediation (Neumayer & Van Alstine, 2010). The EKC also drastically downplays how much work is necessary to restore the environment to an appropriate condition. Besides major structural changes towards information-intensive industries and services, a nation would also need to increase environmental awareness and education, pass and then enforce compliance with environmental regulations, and adopt new technologies such as renewable energy (Stern, 2017). Even with these changes in place, it may take years to create tangible improvements in the environment and there is the very real possibility that some things would never improve. For example, extinctions are classified as permanent changes in biodiversity, which means that once a species is considered extinct there is no possibility of bringing it back. Thus, no matter how much money or effort a country invested into environmental restoration, some things can simply never be restored. In other words, the EKC does not consider resilience capacity or acknowledge the

possibility that uncontrolled economic growth may not be a requirement for environmental improvement.

Clearly the relationship between economic growth and environmental quality is a contentious topic, and it is especially controversial when it is argued that economic growth is ultimately advantageous for the environment (Dinda, 2004). Both researchers and policymakers have voiced conflicting opinions regarding whether prominent industrial sectors have become cleaner, if regulatory institutions have become more effective, and most importantly, if countries actually begin to value the environment once they successfully transition from a middle-income country to a high-income country (Dasgupta et al., 2002). Concerns have also arisen regarding the income range that is associated with maximum pollution on the EKC, as it is strikingly evident that there are some countries not even close to achieving this income per capita. For example, in purchasing power parity dollars, per capita GDP in 1998 was \$1440 in the countries of sub-Saharan Africa, \$2060 in India, and \$2407 in Indonesia (Dasgupta et al., 2002). It is clear that these countries have a long way to go before they are considered wealthy. Because they are still developing, a literal interpretation of the curve implies that substantial increases in pollution will occur over the course of the next several decades. Besides the risk of this pollution having irreversible impacts on the environment, empirical evidence from researchers suggests that pollution in these countries is already having dangerous consequences. The World Bank issued a report in the early 2000s stating that estimates of mortality and morbidity from air pollution in India imply annual losses in the range of 2-3% of GDP (Dasgupta et al., 2002).

Beyond these worries, there is widespread uneasiness about industrialized countries pretending to have made progress as their income rises. For one thing, while a country may indeed reduce a handful of well-known and easily measurable pollutants, it is likely that new and potentially greater environmental problems will emerge (Dasgupta et al., 2002). It is important to note that the only available data is for the most well-known air pollutants; a broader class of emissions referred to as toxic pollutants have not been subjected to laboratory analysis. Thousands of pollutants that could be incredibly damaging are currently untested and unregulated (Dasgupta et al., 2002). Above all, the likelihood of irreversible environmental degradation contradicts the notion that nature is somehow equipped to constantly regain its strength after encountering challenge after challenge (Prieur 2009). Researchers have insisted that it is unwise to assume that the environment's ability to absorb pollution will increase as it encounters more and more of it. Countries must acknowledge that as pollution levels continue to rise, the environment will gradually lose its ability to respond to excessive demands. Critics contend that due to the irreversible character of some pollution, even if a wealthy country does decide to engage in restorative efforts, their attempts will not be enough: the environment will already be permanently degraded (Prieur, 2009).

After evaluating evidence from both sides of the debate, those who try to invalidate the EKC are far more persuasive than those who strive to confirm it. While there is empirical evidence in China, the United Kingdom, and Iceland which demonstrates that some environmental impacts do decline at high income levels, it is

important to acknowledge that economic activity is always environmentally disruptive in some way. More importantly, as renowned economist Nemat Shafik underlines in her research, at no time has it ever been proven that all negative environmental impacts are remediated at high-income levels (Stern, 2017). Moreover, the only environmental problems that have actually declined in wealthy countries are those that are relatively uncomplicated to solve, are well known, and are incredibly well documented (Dinda, 2004). Other environmental problems are much more complex and considerably harder to document. Available research indicates that they either follow an N shape rather than an inverted U, or that they never actually decrease. Furthermore, land-use change and biodiversity loss, which are conceptually different from certain air pollutants that can decline, are completely irreversible and therefore it is impossible for the EKC to apply (Dinda, 2004). Additionally, research on global environmental indicators such as municipal waste, energy consumption, traffic volumes, and CO₂ demonstrate that they either increase monotonically with income or have very high turning points. In other words, most countries are nowhere near wealthy enough to address their worsening environmental conditions (Dinda, 2004).

The EKC also holds a basic but equally important assumption that economic development trajectory will be the same for all countries. Not only should this be criticized because countries vary considerably in terms of economic, political, biophysical, and social factors, but due to the heterogeneity of conditions, very little attention has been given to specific countries (Dinda, 2004). Consequently, data from different countries is thrown into one large group, which means that little attention has been given to individual trends. Transboundary and intergenerational externalities have been completely ignored in existing EKC literature, and trade is often left out of discussion despite being an extremely relevant component. Examining trade shows that high-income countries have the means to move their most environmentally destructive industries to other, less developed countries (Dinda, 2004). By disregarding trade, existing EKC literature mistakenly points out that certain countries have tried to tackle their environmental problems when in fact they have simply relocated them elsewhere. Finally, there is mounting evidence that the countries with the worst environmental restoration records, or the countries that have been the least successful in reducing environmental degradation, are among the most prosperous (Bradshaw, Hiam, & Sodhi, 2010). Particularly in terms of deforestation, marine captures, habitat conversion, species threats, carbon emissions, and water pollution, the countries with the worst proportional records include Singapore, the Netherlands, and Qatar. The countries with the worst absolute records are the USA, Australia, and Japan (Bradshaw, Hiam, & Sodhi, 2010). In traditional economic terms, these countries are some of the world's wealthiest; however, they have the most irresponsible environmental performances. This clearly shows that economic growth is not the solution but rather the cause of environmental problems (Dinda, 2004).

Significance

Despite encountering criticism from the beginning, the EKC remains one of the most popular topics in environmental economics. Given that empirical evidence of the EKC is neither consistently supportive nor statistically strong, it is clear that developing countries should not strive to achieve faster economic growth so as to accelerate out of a high rate of environmental pollution. As noted above, some of the world's most prosperous nations still have appalling environmental records. Powerful statements from EKC proponents such as "the best – and probably only – way to attain a decent environment in most countries is to become rich" must continue to be challenged (Allen & Webber, 2010). Without question, one of the most dangerous issues with this type of literature is that it could encourage policymakers to pursue economic growth while simultaneously de-emphasizing the environment (Stern, 2017). Worse, if policymakers believe that economic growth is not a threat to sustainability, they may not see the point of pursuing environmental policy at all (Haukioja et al., 2001). However, since it is indisputable that the EKC is not irrefutably valid, it is unwise to believe that economic growth on its own will inevitably lead to a better environment in the long run. Additionally, it would be reckless for world leaders to believe that nations can simply grow their way out of environmental dilemmas (Raymond, 2004). Policymakers should refrain from making any policy recommendations that propose that environmental pressures be solved with even greater economic growth. Though proponents of the EKC would insist that there is a causal relationship between income growth and environmental outcomes, it has been proven time after time that their hypothesized explanations are not accurate reflections of real-world outcomes. There is no evidence that eventual environmental improvement occurs as a result of all affluent nations investing in eco-friendly and cleaner technologies, nor is there proof that every wealthy society begins to demand environmental quality once their basic needs have been met (Raymond, 2004). Accordingly, it is imperative that effective public policy measures be implemented which are directly aimed at reducing environmental burdens, as it is apparent that economic growth will not come to the rescue (Egli & Steger, 2007).

Rather than waiting for economic growth to come to the aid of the environment, policymakers everywhere must endeavor to fulfill plans of action that can enable countries to become environmentally sustainable. Not only does this require a country to ensure that vital environmental systems are recovering rather than deteriorating, it also involves cooperating with other countries to control common issues such as transboundary pollutants (Raymond, 2004). For example, one effective way to regulate and limit emissions that are currently causing dramatic changes in the climate is to set clear targets and severe penalties for violating them. Since a reliable world government does not presently exist, international policy is entirely dependent on what each country is prepared and able to implement (Victor, 2011).

Because every nation has various resources that it can spend, it is up to each to make its own decision about how much of their own resources they will dedicate to mitigation. For instance, a developing nation may not have an administrative system in place that can monitor emissions. A developed country would almost certainly have the resources to prioritize regulating emissions. Thus, the entire global effort depends

on developed countries' environmental ambition and how they organize national mitigation policies (Victor, 2011).

As countries gradually become wealthier, it is imperative that they increase their efforts as well as their penalties so that they contribute more to reducing emissions that are dangerous for the entire planet. A government in a developing nation, for instance, can create market signals like a pollution tax, which will encourage emitters to change their ways. It can also introduce regulations that require industries to install specific technologies. Since it is difficult to know how fast industries can adjust, it is important to start with simple reductions and then progressively set strict emission limits that require both technological and behavioral change (Victor, 2011). When these strict limits are firmly in place, it is crucial that companies and individuals be aware that they must pay a high cost if they either perform insufficiently or blatantly fail to comply. This is far more likely to be successful with international agreements that are well matched to what nations are actually capable of implementing. Moreover, if all nations did their part to reduce emissions, countries will no longer believe that such regulations will plunge their economies into disaster and will strive to find new green industries that can help alleviate the dangers of global warming (Victor, 2011).

With current research indicating that within the next thirty years most developing economies will have become developed, it is absolutely imperative to disprove the notion that an inverted-U shaped EKC will exist for all of these countries and across different environmental issues (Waslekar, 2013). As shown throughout this paper, only some wealthy nations have experienced environmental improvements, and only a small handful of them have observed recovery in more than one area. Because developing economies will most likely strive to achieve wealth in the same way that others have, it may be advantageous to focus on the exceptional instances where an inverted-U relationship can be found. More importantly, it is beneficial to analyze the courses of action that were effective in achieving that relationship and examine which strategies proved to be valuable. As observed previously, Iceland is an example of a very prosperous country that has seen remarkable environmental improvement. Even though Iceland experienced rapid economic growth during the beginning of the twentieth century - just as other countries did - it was different than the rest in that its first environmental policies arose at the same time (Gregory, 2016). World War II, in fact, led to major economic and social changes in Iceland such as the introduction of the heavy industry sector, population movement to urban areas, and the utilization of renewable energy resources due to a growing aluminum industry. Around the same time, Iceland gained control of approximately 200 miles of cod fishing zones from Britain and was able to entice large energy companies such as Alcoa and Century Aluminum to construct facilities in the nation (Gregory, 2016).

As growth accelerated, Iceland concentrated on how the country could move past a history of severe poverty and economic constraints into a period of prosperity. The country acknowledged that to maintain long-term economic success, certain strategies that would encourage sustainable action had to be implemented (Gregory, 2016). Therefore, in 1907, a main newspaper published an article emphasizing that the government was serious about protecting the environment not only to preserve the

country's unique scenery but to also provide for the Icelandic population. This particular article resonated with the Icelandic population as it reminded them of Fjölur Jónas Hallgrímsson, an iconic native poet who first called Iceland the "Fjallkonan" in 1835 (Gregory, 2016). Translated as The Mountain Woman, Hallgrímsson instilled the idea of Iceland as a nurturing mother that would continuously provide for its citizens so long as those resources were well conserved. Consequently, the Icelandic people believed that conserving their environment was necessary to maintain their national identity and disapproved of activities that disrupted it. Thus, Iceland first legislated the protection of plants and animals, then approved the Planting of Woodland and Prevention of Wind Erosion Act in 1907, and the country's first land preservation named Þingvellir a National Park in 1928 (Gregory, 2016). Landvernd, a non-governmental organization focusing on conservation, was founded in 1965. As early as the 1960s, the Icelandic government put a significant amount of money into geothermal energy research and utilization. By the early 1970s, Iceland was no longer relying on imported fossil fuels for a large portion of their energy consumption and instead constructed independent hydropower plants across the country (Gregory, 2016; "Sustainable Energy Sector", 2015). Iceland passed the Iceland Nature Conservation Act in 1971, which states that neither life nor land can be needlessly wasted or polluted, and the Fisheries Management Act of 1990, which mandates that fishing stocks are common property of the nation and therefore cannot be exploited or depleted ("Bagheera," 2019).

Presently, nearly 100% of the country's electricity comes from renewable energy sources, 9 out of 10 homes are heated with geothermal energy, and more than 2,000,000 hectare of land is protected under the Nature Conservation Act ("Sustainable Energy Sector", 2015; "Environmental Protection", n.d). The Global Peace Index of 2019 named Iceland the most peaceful nation on Earth, and it is ranked at the top the 2016 Environmental Performance Index ("Index", 2019; "Ecofriendly Countries", 2017). It is the fourth richest among 44 European regions and has one of the lowest unemployment and poverty rates of any nation ("Economic Freedom", 2019; "Word Leader", 2017). Clearly, Iceland is an extraordinary example of a country that has proven that it is possible to achieve economic security without sacrificing the environment. What is most remarkable about Iceland is that it did precisely what needed to be done for both the environment and the economy to succeed before sustainability discourse was popularized. The country successfully accelerated economic growth and implemented structural changes that respected environmental constraints long before the World Commission on Environment and Development (WCED) – more commonly known as the Brundtland Commission – coined the term "sustainable development" in 1987 (Gregory, 2016). The Brundtland Commission emphasized that the environment and development were one single issue and stressed the importance of nations meeting current needs without compromising the ability of future generations to do the same ("Global Futures Past", 2017). The Brundtland Commission also publicly disapproved of traditional economic routes. It declared that developed nations became rich due to unsustainable patterns of consumption and production as well as unchecked economic growth ("Brundtland Report", n.d).

Overall, it is clear that Iceland understood that it could not allow the environment to endure extreme deterioration on the country's way to economic comfort. Besides very targeted policy – which included plans to give up a dependency on fossil fuels by ceasing all imports by the 1970s – the Icelandic government also claimed at the onset of the country's economic revolution that it was wholeheartedly committed to conserving the environment. This very proclamation evoked memories of Hallgrímsson's poetry among the Icelandic people, who viewed their nation as a nurturing entity that would provide for its people. By proposing specific courses of action early on and by speaking to the nationalistic ideology within Iceland, the country was able to meet its development goals without undermining the stability of natural systems. Given that the Earth is in the midst of a global climate catastrophe, it is imperative that countries do all that they can to emulate Iceland's achievements. By doing so, it is probable that they too can propel themselves out of economic precariousness and into prosperity.

To aid transitioning countries with their development, it is important that international organizations give the same level of prominence to the environment as they do to poverty, peace, health, and economic security. This is significant because international organizations are crucial for providing leadership and outlining goals, and they can set priorities for global environmental policies (“Governing Council”, n.d). International organizations are oftentimes regarded as authoritative and as the most legitimate sources of information. These organizations are essential for progressing into an era where nations can work towards economic and social development while focusing on environmental protection. One notable example of an international organization that is calling for environmental action is the United Nations Environment Assembly (UNEA). The highest-level decision-making body on the environment, the UNEA was founded in 2012 to more fully comprehend environment challenges and to accelerate intergovernmental action (“Governing Council”, n.d). The UNEA is comprised of 193 member states and its focal point is the need for all nations to improve their resource management strategies and achieve resource-efficient and low-carbon economies (“Sustainable Development Goals”, 2019). As a result of its eminence in global environmentalism and its ability to disseminate information universally, the UNEA has the potential to emphasize to all nations what is considered sustainable and what has proven to be ineffective. More specifically, it can stress how following the traditional path to economic security only undermines the environment, and that the “grow now, fix later” approach that the EKC highlights has weak credibility. As more international organizations like the UNEA encourage a new development course, countries may no longer wait until they have reached a turning point to reconcile economic growth and environmental improvement (He, 2003).

Conclusion

Seldom do many see eye to eye on what precisely must be done to alleviate environmental degradation, but it is clear that we should not be convinced that economic growth on its own will be the solution to these problems. Nor must we be persuaded that at higher levels of development, countries will surely level off and gradually decrease their environmental degradation. It is not certain that they will have

increased environmental awareness, that they will invest in cleaner technology, that they will enforce effective environmental regulations, or that they will put money into conservation efforts. Because the data in this paper plainly demonstrates that very few true EKC curves actually exist, each of us, especially our policymakers and scholars, must not propose unlimited economic growth as the answer to environmental ills. As long as the literature continues to illustrate that evidence of an actual EKC is scarce, we should not rely on the erroneous hypothesis that countries can merely grow their way out of the most pressing environmental issues.

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