### tme1NC – T

#### Medicines are substances used to prevent, diagnose, or treat harms.

**MRS 20** [(MAINE REVENUE SERVICE SALES, FUEL & SPECIAL TAX DIVISION) “A REFERENCE GUIDE TO THE SALES AND USE TAX LAW” <https://www.maine.gov/revenue/sites/maine.gov.revenue/files/inline-files/Reference%20Guide%202020.pdf> December 2020] SS

[Medicines](https://www.lawinsider.com/dictionary/medicines) means antibiotics, analgesics, antipyretics, stimulants, sedatives, antitoxins, anesthetics, antipruritics, hormones, antihistamines, certain “dermal fillers” (such as BoTox®), injectable contrast agents, vitamins, oxygen, vaccines and other substances that are used in the prevention, diagnosis or treatment of disease or injury and that either (1) require a prescription in order to be purchased or administered to the retail consumer or patient; or (2) are sold in packaging.

#### Medicines solely refer to physical substances.

American Heritage Dictionary of Medicine 18 The American Heritage Dictionary of Medicine 2018 by Houghton Mifflin Harcourt Publishing Company <https://www.yourdictionary.com/medicine> //Elmer

"A **substance**, **especially a drug**, **used to treat** the signs and symptoms of a **disease**, condition, or injury."

#### CRISPR is a platform technology, not a medicine.

Editas Medicine [(a clinical-stage biotechnology company which is developing therapies based on CRISPR–Cas9 gene editing technology)., No Date, CRISPR Gene Editing, <https://www.editasmedicine.com/crispr-gene-editing/>] Justin

CRISPR (pronounced “crisper”) is an acronym for “Clustered, Regularly Interspaced, Short Palindromic Repeats,” and refers to a recently developed gene editing technology that can revise, remove, and replace DNA in a highly targeted manner. CRISPR is a dynamic, versatile tool that allows us to get to and edit nearly any location in the genome, and has the potential to help us develop medicines for people with a wide variety of diseases. We view CRISPR as a “platform” technology because of its ability to target DNA in any cell or tissue.

#### Negate –

#### Limits – their model explodes it to medical devices, any form of strategy for medical research, databases that are used to create medicines and more – only our definition creates a reasonable caselist for medicines while they make prep impossible and wreck engagement

### 1NC – T

#### Interpretation: The aff may not defend WTO member nations reducing intellectual property protections for a subset of medicines.

#### Violation: They only defend CRISPR

#### Vote neg:

#### Limits – you can pick anything from COVID vaccines to HIV/AIDS to random biotech to insulin treatments and there’s no universal disad since each one has a different function and implication for health, tech, and relations

### 1NC – CRISPR Bad

#### On Wachowicz,

#### 1] No effective gene editing governance, certainly not in the squo – tech evolves too fast, no institutional checks, no one cares

Monast 18 Monast, Jonas J. C. Boyden Gray Distinguished Fellow, Assistant Professor and Director of the Center on Climate, Energy, Environment & Economics at UNC. J.D., Georgetown University (2002) B.A., Appalachian State University (1995). "Governing Extinction in the Era of Gene Editing." NCL Rev. 97 (2018): 1329.

With CRISPR, the critical question is no longer whether humans can alter genes to eradicate some species and make others resilient to factors that may cause extinction. Instead, the questions are whether we should and, if so, under what circumstances. While the potential benefits are profound, CRISPR could also foment similarly profound, and potentially irreversible, negative impacts for the target species and the broader ecosystems in which they exist.10 Existing laws are not designed to grapple with these important value choices. Gene editing raises many of the hallmark challenges with emerging technology governance.11 These recent advances in biotechnology may fall outside the scope of existing regulatory schemes designed for earlier understandings of technologies. They may also require responses by multiple agencies operating under different bodies of law.12 The pace of scientific developments is occurring much faster than traditional regulation can typically respond.13 There are calls for flexibility and adaptability to allow the technologies to evolve.14 Continued research is necessary to develop new, potentially beneficial uses for the technology, but the research also creates unknown risks. The technology is widely accessible, allowing individual research labs to create and release edited organisms with potentially wide-ranging impacts.15 Nonbinding soft law measures, such as professional standards and codes of conduct, will play important roles in overseeing research and development of CRISPR-edited organisms. Gene editing implicates diverse and deep- seated values, but engaging a broad range of stakeholders is difficult. Developers seek rapid regulatory approval for releasing new genetically engineered (“GE”) organisms.

3] This card never even mentions regulations, it’s exclusively about harmonizing research activity and potential – no evidence that alone is sufficent to prevent bad usage

#### 4] Harmonization in the past is identical to the plan – no reason it works this time – inserted in blue

Wachowicz 19 [(Jessica, a third-year student at the University of Washington School of Law whose primary area of study is emerging technologies and the legal issues associated therewith.) “The Patentability of Gene Editing Technologies such as CRISPR & the Harmonization of Laws Relating to Germline Editing, “ Intellectual Property Breif, 2019 https://digitalcommons.wcl.american.edu/ipbrief/vol10/iss1/2/] RR

At present, countries take different approaches in applying the ordre public doctrine to cases involving germline editing. In Japan, the patent office examines scientific guidelines pertaining to stem cell research in rendering its decisions.8 1 Others simply look to the values held by that particular country in determining whether the invention would benefit society.82

Looking at the values held by a particular community will lead to varying results. Some countries may value the welfare of individuals over the progression of science.83 Others argue that because these inventions can dramatically improve healthcare, and because healthcare is a human right, this public interest should override any bans on germline editing. 84

A similar dispute arose under TRIPS with respect to pharmaceuticals. As stated previously, some countries, India in particular, argued that patenting pharmaceuticals was immoral because it raised the cost of healthcare. In 2016, the World Health Organization published the "Guidelines for the examination of patent applications relating to pharmaceuticals."86 The purpose of this guideline was to assist legislators in crafting laws that would allow for the patentability of pharmaceuticals generally, while imposing limitations that would prevent healthcare from becoming unaffordable.

One plausible solution is for the World Health Organization to create a set of guidelines for determining the patentability of technologies such as CRISPR. The guideline can look to other international treaties that focus on the preservation of human rights and the improvement of healthcare.87 By encouraging countries to take these agreed upon policy objectives into consideration when examining these controversial patents, results among different patent offices may be slightly less varied. A guideline from the World Health Organization (WHO) or a similar organization may assist countries' legislatures in crafting laws that allow for progression in this field of science while protecting their communities from potential human rights violations, such as the destruction of viable embryos.

Attempts at harmonization have been made in the past. There are currently numerous international instruments that prohibit inventions involving genomes, such as the UNESCO Universal Declaration on Bioethics and Human Rights and the Oviedo Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biotechnology and Medicine: Convention on Human Rights and Biomedicine. The former states that public welfare should be prioritized over the progress of science, and the latter states that genetic modification techniques should only be allowed if "serious hereditary sexrelated disease[s] [are] to be avoided."89 These agreements make clear that public welfare is of primary importance, and that germline editing techniques should only be applied where serious risks can be avoided. The Oviedo Convention limited the scope of the exception to the avoidance of sex-related diseases, but perhaps with the introduction of CRISPR, countries may need to consider the circumstances under which genome and germline editing may be permissible.

CONCLUSION

In summary, relying on the ordre public doctrine to determine the patentability of CRISPR technology will lead to dramatically varying results around the world. The need for a more harmonized approach is present. Despite countries' general avoidance of genome and germline editing, technology has developed in such a way that these practices may be highly beneficial to public welfare. Countries should reconsider their stances on such practices in light of the potential benefits CRISPR technology can offer and should attempt to reach a general consensus on the proper uses of CRISPR. Given recent events, the WHO should promptly issue guidelines to assist legislatures in crafting laws that promote progress in this area while maintaining consistency with concepts of morality.

#### Gene editing decouples Ghana’s cocoa industry from climate change and enables it’s survival

Gakpo 19 Joseph Opoku Gakpo, June 13, 2019 "Gene editing could save Ghana’s cocoa from extinction, scientists say - Alliance for Science." Alliance for Science, allianceforscience.cornell.edu/blog/2019/06/gene-editing-save-ghanas-cocoa-extinction-scientists-say.

A new study warns that climate change could drive Ghana’s cocoa (cacao) industry to extinction — a fate that scientists say could be reversed through gene editing. A study by the Climate Change Unit of Ghana’s Environmental Protection Agency (EPA) and the Cocoa Research Institute of Ghana is predicting the country’s environment will no longer be conducive to growing cocoa by 2080 if current climate change trends continue. The study supports a 2017 prediction by scientists that cocoa could go extinct across the world in 40 years. Ghana is the world’s second largest producer of cocoa, which is the main ingredient in the production of chocolate. Cocoa is the primary ingredient in chocolate. The Ghana study found that the reduced rainfall and increased temperatures resulting from climate change will make the country’s cocoa belt unsuitable for production of the crop by 2080, Angelina Mensah, public affairs director of Ghana’s Environmental Protection Agency, told a Ghana newspaper. “In the study, it was identified that due to warm temperature conditions being experienced currently in the country, the dry season, which spans from September to March, has exacerbated. This means cocoa, which is very sensitive to drought, in terms of growth and yields, would be affected,” she explained. “(Soil) moisture level in the years ahead will not be adequate for profitable cocoa production. Unless immediate interventions are rolled out to tackle climate change, cocoa would only be in the history books for the next generation to read.” If such interventions are not forthcoming, gene editing could be the solution to breeding new cocoa varieties that can survive the changing conditions. “Gene editing has the potential to accelerate the breeding of new cocoa varieties with resistance to climate stress and pests and diseases,” said Mark Guiltinan, professor of molecular biology at Pennsylvania State University, in an interview with the Alliance for Science. He noted that gene editing has already been used to develop other crops with improved resistance to some of the same climate-related stresses that cocoa is facing. “A key advantage of this approach is that it could be used to edit varieties with special characteristics and locally adapted to environmental conditions, which will avoid the very time-consuming process of moving traits from one access into another, which could take decades,” Guiltinan added. Ongoing work with CRISPR Guiltinan is leading a research project at Penn State that will help produce better cocoa plants using the CRISPR-Cas9 gene editing tool. CRISPR (clustered regularly interspaced short palindromic repeats) is a DNA sequence found in single-celled organisms. It can be used to introduce an enzyme called Cas9 in organisms to precisely edit their genomes and delete, silence or replace specific DNA regions. The researchers have used CRISPR-Cas9 to knock out a cocoa gene called TcNPR3 that suppresses the plant’s disease response. The researchers also created gene-edited cocoa embryos which they hope will grow into mature trees to test the effectiveness of this approach at a whole plant level. “We have regenerated some CRISPR-mediated gene-edited plants with mutations in a repressor of the pathogen defense system,” Guiltinan said. “These plants show strong resistance in lab tests. The plants are now about 2 feet tall and growing fast. Soon we will be able to perform further testing.” Low cocoa productivity in Africa In addition to climate change, cocoa growers in developing nations are facing other challenges, including lack of irrigation and the inability to purchase inputs like pesticides and fertilizers. In Ghana, cocoa orchards are also being displaced by more profitable rubber plantations. An estimated 30 percent of all cocoa produced in West Africa is destroyed by disease before it can get off the farm, which creates an enormous financial burden for farmers. In Ghana, the world’s second-largest cocoa producing country, state regulator COCOBOD revised the expected cocoa output for 2019 downward earlier this year because of an increase in pest attacks and disease. The increased pest and disease attacks have have been exacerbated partly by climate change, which encourages the rampant spread of disease-causing organisms that become more active in warmer weather. The Cocoa Swollen Shoot Virus (CSSV) disease, for example, has destroyed more than 200 million cocoa trees in West Africa and continues to spread on farms in the sub-region. Although it will take some time, Guiltinan is confident that gene editing technology will in due course be able to help farmers deal with diseases on cocoa farms. “The cocoa farmers around the world should know that it will be many years before these efforts find their way to their fields because on top of the technical challenges, there are also legal regulations and the public acceptance of these products that need to be addressed as well,” he said. “In the meantime, we are working to develop transgene-free gene editing in cacao and we are targeting several other genes for traits of interest, such as disease-resistance and quality traits. One trait of special interest for West Africa is CSSV resistance.” If all goes well, Guiltinan said, “I see a strong possibility of the first gene-edited cacao being ready for farmers in about five to 10 years.”

#### Destroys Ghana’s rainforest biodiversity

Omponsah and Tayki 20 Amponsah, Owusu [ Senior Lecturer, Department of planning, Kwame Nkrumah University of Science and Technology (KNUST) ] and Stephen Appiah Takyi [ Lecturer, Planning, Kwame Nkrumah University of Science and Technology (KNUST) ]. "Ghana's cocoa production relies on the environment, which needs better protection." Conversation, April 5, 2020, theconversation.com/ghanas-cocoa-production-relies-on-the-environment-which-needs-better-protection-134557.

Cocoa production has been the backbone of Ghana’s economy since the 1870s. It dominates the agricultural sector and contributes about 30% of the country’s export earnings. Cocoa employs about 800,000 farmers directly. It also supports the livelihoods of others in the commerce, service and industrial sectors of the Ghanaian economy. This makes it an important generator of revenue. Most studies of cocoa production have focused on its economic benefits. Less attention has been paid to its environmental impacts. But cocoa farming has enormous environmental consequences. This is because it can only take place in Ghana’s forest agro-ecological zone. In this zone, the rainfall is ideal for cocoa at 1500-2000mm, with a dry season of about four months. Also, cocoa trees thrive under shade. But with rising demand for cocoa on the world market, large areas of forest cover have been lost to its cultivation. The expansion and cultivation of new parcels of forest land, the replacement of old cocoa trees and the abandonment of old cocoa farmlands due to loss of soil fertility, have depleted the country’s forest cover. Between 2010 and 2015, 117,240 hectares of forest were cleared. Do experts have something to add to public debate? This loss is a threat to the very industry that is causing it. Over the years researchers, policy makers and practitioners in Ghana’s agricultural and environmental sectors have underestimated the environmental impacts of agricultural activities such as cocoa production. The link between low productivity in the cocoa sector and environmental impacts is contributing to uncertainty in the sector’s long-term sustainability. There is, therefore, an urgent need for more research, policies and strategies that will help minimise the environmental impacts of cocoa production. We undertook a study to assess these environmental impacts. We focused particularly on practices such as the clearing of cocoa farms and the use of insecticides and fertilisers.

**Key to prevent extinction**

**Owusu-Afriyie, 2 ---** Aburi Botanic Gardens staff

(George, "The Potential Role of African Botanic Gardens in Environmental Awareness Programmes and the Need to be Involved," 10-1-2, www.bgci.org/education/1703/, accessed 1-15-12)

Today some of the 60 botanic gardens and arboreta in Africa are among those botanic gardens that are leading the worldwide fight to save plant diversity, as well as creating an understanding and awareness for the promotion of methods of conservation and development of plant resources. Despite financial constraints, a number of African botanic gardens are implementing major reforms under the auspices of Botanic Gardens Conservation International, to enable them play a more purposeful role in conservation. The Creation of Environmental Awareness Among the Populace **African's biological diversity is** not only of continental economic importance but is also **of global significance**. Unfortunately, existing arrangements for the utilization of the continent's biodiversity cannot be considered sustainable and this is having serious repercussions on development programmes in Africa. The rich plant diversity in Africa is indiscriminately harvested for a number of purposes including: cultivation and production of food and cash crops for domestic and external interests herbal medicine construction. Luckily, in spite of their continued exploitation, botanic gardens and other habitats still contain some of the **richest assemblages of plant life known on this planet.** Thus African gardens are appropriate institutions with the necessary capacities and plant diversities for use in environmental awareness programmes. The success of environmental awareness programmes will largely depend upon the communities' understanding of the functioning of the environment, the problems it presents, and their expected contribution to its protection and improvement. The pursuit of conservation-oriented practices to halt the degradation and extinction of plant resources will depend not only on their acceptability, but also on the active support and involvement of the populace at large. In addition, people need to be well informed, sensitized and motivated towards adopting specific plant conservation practices and the sustainable use of plant resources. It is well known that plants are the **key to life on Earth** and the **prime element in biodiversity**. They dominate our landscape, providing the framework of natural ecosystems that provide the habitats for animal species and **make life on earth possible for humans** as well as other living beings. Yet in spite of this common knowledge of the importance of plants in human survival, plant life is being lost at an increasing rate not only in Africa, but also throughout the whole world. This is the result of economic pressure on the developing countries and careless human activities. Until unfair transactions, particularly in trading systems, are addressed and humans made the centre of attention, only a limited impact will be made in our effort to control the excessive utilization of resources and the regenerability of the various life-sustaining systems on the Earth.

**Ghana and each country of Africa is key- its key to prevent extinction- key region and species to global life-support systems**

**Richard, 10** -- science and technology editor

(Michael Graham, "The True Size and Importance of Africa," 10-13-10, www.treehugger.com/clean-technology/the-true-size-and-importance-of-africa-map.html, accessed 1-16-12)

Don't Overlook Africa! Because of the way flat maps distort the size of countries (the closer they are to the poles, the more distorted they are), most people don't really know just how big the African continent is. This leads many people - and the smart and powerful aren't immune to this - to underestimate Africa's importance. The map above shows just how wrong our perception can be (unless we've already seen a map like this before). It shows that you could fit the whole USA, China, India, Spain, France, Germany, the UK, Italy, Switzerland, Japan, and Eastern Europe, inside of Africa and still have some room left. We're All Inter-Connected Africa matters a lot because of the number of people who live there (about 1 billion as of 2005, with projections of 2 billion by 2050), but also because of the **number of indigenous animal and plant species**, because of the vast expanses of land that aren't being protected, because of the huge ecosystems that are uniquely found there, because of the impact that it can have on the global climate (especially deforestation and desertification), because of all the solar power potential and other natural resources, etc. It is one of the **key regions** that needs to improve on many levels for the welfare of its people and **to safeguard the integrity of our planet's life-support systems.** Africa is too often the forgotten continent, but it shouldn't be, and humanitarian problems should make us forget environmental issues because both go hand in hand. The degradation of the environment will affect the most vulnerable people there.

#### CRISPR causes agricultural gene drives – wrecks ag

Montenegro 19 Maywa Montenegro, Human Ecology, University of California Davi Maywa Montenegro de Wit (2019) Gene driving the farm: who decides, who owns, and who benefits?, Agroecology and Sustainable Food Systems, 43:9, 1054-1074, DOI: 10.1080/21683565.2019.1591566. [Note – Driving is short for “gene driving”, the process of using gene editing tech like CRISPR to release new strains of plants or animals into the wild]

Does driving genes through wild populations resonate with biologically diversified farming? Does it seek to control and simplify agroecosystems rather than cope with organisms (like pests) that may not always behave as we want but that serve important roles in complex ecological webs? While most current drive experiments are confined to laboratory settings, with sophisticated biosecur- ity protocols in place, the entire point of drive is to eventually introduce genes into wild populations to propagate virally. We need ecologists and agroecologists to help us better understand what the effects of such releases might be. If, for example, we successfully wipe out a problematic pest, what happens to the beneficial insects or birds that used to rely on them for food? Or what happens if collapsing one population opens up food resources or habitats for new types of pests to move in? In what ways –if we can even count them –will gene drive ripple across the food web in ecosystems in and around the farm? What are the risks –ecological and social –of ecosystem engineering and are they being seriously appraised? The idea implicit in gene drive is that scientists can know the risks and can steer the trajectory of drives, stopping them from spreading or running amok. But gene drive researchers themselves acknowledge great uncertainties in the scope, durability, and control of drives. For example, Kevin Esvelt, 1062 M. MONTENEGRO a prominent drive expert at MIT, has become something of a maverick in his field for publicly criticizing the hubris of many biotechnologists. When the first UC Irvine demonstration of drive was published in 2015, Esvelt told MIT Technology Review that, in his opinion, the California researchers had not used strict enough safety measures. Locked doors and closed cages are not enough, he said. Instead, they could be installing a genetic “reversal drive”so the change can be undone, if necessary (Regalado 2015). Similarly, Hank Greely, a bioethics law specialist at Stanford, says environ- mental uses are more worrisome than a few modified people. “The possibility of remaking the biosphere is enormously significant, and a lot closer to realization,”he told the Technology Review (Regalado 2015). More recently, scientists have gone even further to say that gene drives are too risky for field trials (Zimmer 2017). In 2017, a team of Harvard and MIT researchers created a detailed mathematical model to describe what happens following the release of gene drive organisms. In a paper published on the preprint bioRxiv server, they discovered unacceptable risk: “Current CRISPR gene drive systems,”they said, “are likely to be highly invasive in wild populations”(Noble et al. 2017). In other words, in the name of conservation a drive might spread to places where the species isn’t invasive at all, but is part of a well-established ecosystem. What does this mean for agriculture? Can we expect that releasing gene drives to eliminate invasive insects or plants in one territory will not spread into agroecosystems that depend on a variety of “unplanned”pollinators, predators, habitats, and food-providers? Can we be confident that drives will preserve the integrity of agrobiodiversity, especially in Indigenous and tradi- tional cropping systems where boundaries between “wild”and “domesti- cated”are porous and intentionally traversed? Championing the notion of releasing drives into nature, Esvelt admitted in 2017 was “an embarrassing mistake”(Zimmer 2017). While other scientists express similar precautions about gene driving wild ecosystems, agriculture, as a “human-dominated”system, is a likely space for more aggressive inter- ventions to seem acceptable. Thus, it is here especially that we need agroe- cologists to help us understand the complex dynamics of patchy landscapes, where conservation and agriculture, cultivated and noncultivated converge (Perfecto and Vandermeer 2010). And we need geneticists like Esvelt to own up to the limits of certainty –and the known and unknown risks of what gene drive can do.

#### Agricultural genetic diversity collapse – extinction!

Fowler Moonet 90. Cary Fowler and Pat Mooney, Rural Advancement Fund International, Shattering: Food, Politics, and the Loss of Genetic Diversity, 1990, p. ix

While many may ponder the consequences of global warming, perhaps the biggest single environmental catastrophe in human history is unfolding in the garden. While all are rightly concerned about the possibility of nuclear war, an equally devastating time bomb is ticking away in the fields of farmers all over the world. Loss of genetic diversity in agriculture—silent, rapid, inexorable—is leading us to a rendezvous with extinction—to the doorstep of hunger on a scale we refuse to imagine. To simplify the environment as we have done with agriculture is to destroy the complex interrelationships that hold the natural world together. Reducing the diversity of life, we narrow our options for the future and render our own survival more precarious. It is life at the end of the limb. That is the subject of this book. Agronomists in the Philippines warned of what became known as southern corn leaf blight in 1061.' The disease was reported in Mexico not long after. In the summer of 1968, the first faint hint that the blight was in the United States came from seed growers in the Midwest. The danger was ignored. By the spring of 19701 the disease had taken hold in the Florida corn crop. But it was not until corn prices leapt thirty cents a bushel on the Chicago Board of Trade that the world took notice; by then it was August—and too late. By the close of the year, Americans had lost fifteen percent of their most important crop—more than a billion bushels. Some southern states lost half their harvest and many of their farmers. While consumers suffered in the grocery stores, producers were out a billion dollars in lost yield. And the disaster was not solely domestic. U.S. seed exports may have spread the blight to Africa, Latin America and Asia.

#### Gene editing wrecks genetic human diversity – extinction

Christian Wolfe 9, Associate Editor for American Association of Inside Sales Professionals, "Human Genetic Diversity and the Threat to the Survivability of Human Populations", https://www.ohio.edu/ethics/2003-conferences/human-genetic-diversity-and-the-threat-to-the-survivability-of-human-populations/

Through advances in reproductive technologies humans will eventually have the ability to utilize nearly fully artificial selection on human populations. These technologies raise many ethical and theological concerns. I will address one of the pragmatic ethical concerns, the potential loss of genetic diversity. Genetic diversity has a direct relation to the fitness and survivability of various species and populations; as genetic diversity decreases within a population, so does the fitness and survivability of that population. An examination of the genetic diversity argument (GDA) reveals that there is not strongly persuasive evidence regarding the effects on genetic diversity of the reproductive technologies on human populations. The only method available to produce the required evidence is through a very complex form of human experimentation. The type of human experiment that would produce the evidence is incompatible with present ethical codes of conduct. Therefore, any implementation of these technologies on human populations should be banned. There are many emerging technologies that could potentially affect genetic diversity. These include genetic testing and screening, selective breeding, population control, sterilization, selective abortion, embryo testing and selection, sperm donation, egg donation, embryo donation, surrogate pregnancy, fertility drugs, contraception, cloning embryos, and germ line or somatic cell manipulation (Resnik 2000, 454). Each of these reproductive technologies affects the composition of the human gene pool by increasing or decreasing the frequency of different genotypes or combinations of genotypes (Resnik 2000, 454). The germ-cell line, or just germ-line, constitutes a cell line through which genes are passed from generation to generation (World of Genetics 322). Germ-line therapy is often differentiated from somatic cell therapy, which is the alteration of non-reproductive cells. This distinction is not as clear as much of the literature supposes, but the problems with the germ-line/somatic cell distinction are beyond the scope of this paper. The focus of this paper includes the screening of embryos with the possibility of destruction of certain embryos, the modification of DNA (deoxyribonucleic acid) of early stage embryos through in-vitro fertilization (IVF), and the modification of parent gametes (Zimmerman 594-5). These technologies pose the clearest threat to genetic diversity of human populations. Genetic testing and screening examines the genetic information contained in a person’s cells to determine whether that person has or will develop a certain disease, is more susceptible to certain environmental risks, or could pass a disease on to his or her offspring (World 305). Parents could subject themselves to testing to determine whether or not to reproduce based on the likelihood of their potential children inheriting their genetic maladies. Also, embryos can be subjected to testing and screening to determine the likelihood that the future individual will develop a genetic disease. From that information, parents can decide to destroy the embryo, alter the embryo, or leave the embryo unmodified and risk that the child will develop a genetic disease. Germ-line gene therapy (GLGT) is germ-line manipulation on the genetic level in order to prevent genetic diseases in future persons (Richter and Bacchetta 304). The goal of GLGT is to treat human diseases by correcting the genetic defects that underlie the genetic disorders (Anderson and Friedmann 907). Therapy presents an alternative to destroying embryos likely to develop genetic disease by actually correcting genetic defects. Also available is the alteration of parent gametes in order to eliminate the possibility of passing on genetic disease to their offspring. GLGT allows for the alteration of either the early stage embryo or the parent gametes to prevent genetic disease. By either eliminating those genotypes that are likely to produce genetic disease or by altering the genome to actually prevent the genetic disease from developing, these technologies have great potential to affect the genetic diversity of a population. Genetic diversity is the variety and frequency of different genotypes or combinations of different genotypes within a population. A population is a geographically, socially, or culturally linked group whose reproductive decisions affect those within the group. Genetic diversity is measured by genetic variability, which diminishes in a population when the number of different phenotypes or the number of different combinations of genotypes decreases. Since populations are composed of individuals that carry genotypes, individual reproductive outcomes affect the genetic variability within specific populations (Resnik 2000, 452). Genetic diversity provides the resource for phenotypic variation that is integral in determining the rate of evolutionary change in an environment. A population that lacks genetic diversity will be poorly equipped to meet environmental changes and demands (Resnik 2000, 452). The importance of genetic diversity is undeniable; the survivability of a population is directly related to genetic diversity. While genetic diversity has no intrinsic value, genetic diversity has a clear instrumental value. Humans place positive value in genetic diversity as it promotes the extrinsic value of survivability. There is an ethical duty to prevent decreases in the genetic diversity of populations because of its importance in the survivability of those populations. Decreases in genetic diversity in populations are ethically undesirable because actions that reduce the survivability of the population are unethical. The genetic diversity argument (GDA) starts from the fact that scientific and technological developments in the realm of genetics and human reproduction will greatly affect the genetic diversity of human populations. There are both pessimistic and optimistic versions of the argument. I will briefly describe both versions of the GDA. The pessimistic version of the argument contends that the increased ability to control human reproduction will result in a loss of genetic diversity that will threaten the health and survivability of human populations (Resnik 2000, 451). This threat to health and survivability is due to a decrease in the populations’ ability to adapt to environmental changes and demands. In effect, these technologies have the potential to make the pool of available phenotypic traits limited enough so that human populations will not be able to respond to changes in environmental demand. This version of the GDA warns that germ-line altering reproductive technologies will reduce populations’ gene pools and eliminate potentially useful genes. Genetic diversity provides a resource of these useful genes. Evolutionary change is blind and has no way to know which genes are useful, therefore it is potentially damaging to population survivability to eliminate genes of any sort. As Glenn McGee notes, “The point of the GDA is that human beings also have no way of knowing which genes will be useful in the future or in different environments” (cited in Resnik 2000, 456). For instance, genetically homogenous populations of corn face problems with blight due to lack of genetic diversity. Although human populations have an ever-increasing level of control over the environment, the pessimistic response still turns on the inability to determine which genes will be useful in the future. The optimistic version of the genetic diversity argument contends that these reproductive technologies could lead to increases in human health and survivability resulting in an improvement of the well being of populations (Resnik 2000, 457). The basis for this response rests on the historical fact that advances in technology increase humans’ ability to control nature. The ability to control nature often leads to positive changes in the adaptability and survivability of human populations. The optimistic GDA relies on this historical fact and the seemingly obvious inference that the above technologies will increase the ability to affect the genetic diversity of human populations (Resnik 2000, 457). A commonly cited example of how genetic diversity can be increased with the implementation of such technologies is the incredible diversity of canines. Of course, there are important dissimilarities such as the explicit intention to increase phenotypic diversity. A major factor in whether these reproductive technologies will increase or decrease genetic diversity is what model they are implemented under, free market or state control. Each model addresses the concerns and motivations of those affected differently. The free market model is based upon the reproductive decisions of a diverse group of potential parents with separate interests, motivations, and means. The free market is the method by which many consumer decisions are made in the United States. This model is fundamentally based on the interaction between supply and demand. If a market demands diversity of a product, then the market will often supply the desired diversity. If the market demands the standardization of goods, such as building supplies, then that homogeneity is likely to be supplied. Also, markets create new preferences and demands by introducing new goods and services to the market. Most often, advancements in technology increase market variability, except of course if that development results in the formation of a monopoly. The diversity of goods in the free market system of America seemingly justifies the inference that a free market model for reproductive technologies would lead to increases, not decreases, in the genetic diversity of human populations. Both J. Glover and W. Gardner’s individual studies conclude, “Increases in our ability to control human reproduction will result in more genetic diversity in the human population because parents will have a variety of preferences and values that they can use in selecting offspring” (cited in Resnik 2000, 458). Just as technological advancements have increased the availability of diverse consumer products, germ-line altering technologies could increase the available options in reproduction and therefore increase the diversity of human populations. Nevertheless, confounding factors such homogeneity of desirable characteristics makes the above inference much more dubious than it first appears. The major problem with the free market model is the potential emergence of the homogeneity of desirable characteristics. Many characteristics such as intelligence, athleticism, and health, are almost universally accepted as desirable. Other characteristics such as height, eye color, and hair color, also have particular value attached to them. Genetic homogeneity could arise if the consumers of reproductive technologies have similar preferences for traits. As Resnik states, “If most people want tall, intelligent, healthy children with blonde hair and blue eyes, then parental choices could produce a phenotypically and genetically homogeneous population” (2000, 459). This problem is only exacerbated when one considers the phenomenon of fads. Societal pressures and obligations may also produce conformity. While these social effects may not take hold immediately, it seems possible, if not probable that these pressures would eventually affect reproductive decisions. Genetic homogeneity may be an unintended consequence of a population sharing common values (Resnik 2000, 459). If most people within a population have similar characteristic preferences and a desire to conform, genetic homogeneity is almost inevitable. Of course much of this line of reasoning depends on genetic determinism, which is incredibly naïve and misinformed. Environmental factors often play a decisive role in which phenotypes are displayed. If certain desirable traits, such as intelligence or health, were strongly linked to environmental factors regardless of genotype, then the inference from individual choices to phenotypic characteristics would be dramatically weakened (Resnik 2000, 465). On the other hand, if certain genes or series of genes are linked to a trait, and that genotype is most frequently selected, it would still poses the potential threat of a genetically homogeneous population, although not phenotypically homogeneous. There are good reasons to believe that the free market system will create greater genetic diversity within human populations. On the other hand, the influences of societal pressures and expectations should not be underestimated or ignored (Resnik 2000, 459). State control involves the local or federal government dictating the standards of practice in certain industries, such as the power industry, education, and mass transit. This model of control in implementing genetic technologies appears likely to lead to decreases in genetic diversity within a population. It is imaginable that the government would develop specific standards to which all human beings produced in that state would be subject. The effects of state control of reproductive technologies are not clearly predictable. A state controlled system could lead to a genetic caste system. For instance, if the state determined that all people should be a certain height, weight, IQ, color, sexual orientation, etc., then those who diverge from those state determined standards could be forced into different strata of the genetic caste system. Such scenarios are certainly plausible, if not likely under state controlled conditions. Under free market conditions, reproductive technologies could lead to increases or decreases genetic diversity. On the other hand, state control would almost inevitably lead to decreases in genetic diversity, but the extent of such effects is not clear. As David Resnik claims, “the consequences of not exerting social or governmental control over human genetics may be just as troubling, since parents will in all likelihood attempt to provide their children with genetic advantages, and the long-term results of parental control over human genetics may further exacerbate existing social and economic inequalities and create a genetic caste system” (1997, 428). The inability to produce definitive evidence of the effects of reproductive technologies under either control model points to urgency of the issue and the minimal knowledge of these technologies’ implications for the future of humanity. Each version of the GDA provides ground for arguments that could support or undermine the utilization of germ-line altering reproductive technologies. The most obvious conclusion from examining both versions is that there is no definitive evidence that implementing the above technologies will have positive or negative consequences for the survivability of human populations. Furthermore, an examination of the two most plausible options for methods of implementing the technologies within a population does not produce strong evidence that implementation will result in either increases or decreases in genetic diversity. This leaves medical science at an ethical crossroads between either continuing with the technologies and dealing with the results afterwards, or abstaining from research, or at least clinical trials, until such evidence arises. Neither of these paths seems to be positive, or even tenable. The only method for producing clear evidence about the potential threat to survivability that these reproductive technologies pose would be to continue research and perform a massive clinical trial. Animal experimentation is not a viable alternative to human experimentation because it completely eliminates many of the confounding factors such as social influences. Since the arguments on either side of the GDA cannot produce conclusive results, and given the potential harm done to populations if the reproductive technologies are implemented and genetic diversity does decrease, some form of human experimentation seems necessary before the technologies should be implemented. Of course, there are many questions that arise in response to such a claim, including the justification of the inference to the necessity of human experimentation. I will discuss these concerns below. To clarify the inference, one should be reminded of what is at stake with respect to genetic diversity. The cautionary tales of the GDA describe potentially analogous situations, such as the effects of artificial selection on the survivability of maize and the variety of canines that have been produced by artificial selection. It is not at all clear what effects the above reproductive technologies will have on a population’s genetic diversity. Their implementation could result in increases in disease susceptibility like the result of artificial selection on maize, or it could result in populations with incredible arrays of genetically distinct individuals, such as in the canine example. What is clear though is that genetic diversity has an inverse relationship with the adaptability and survivability of populations. Since human populations value their own survivability, it is clear that technologies that pose a great potential threat to genetic diversity should be closely examined before being implemented. Due to the great potential threat these technologies present to humans, it is necessary to produce very strong, if not definitive, evidence about the effects of these technologies on genetic diversity. The only way to produce such evidence is human experimentation. There are many factors that must be accounted for in a human experiment that would produce definitive evidence. The number and diversity of subjects would have to emulate a population that would be affected by the technologies. The experiment would have to be extensive enough to determine the effects on future generations. To account for potential homogeneity of desirable characteristics, the experiment should account for both diverse cultural and societal pressures. Furthermore, the experiment should be carried out under the two control models mentioned above, free market and state control. Also, there would have to be a method of curtailing influences from the non-experimental population. Finally, in the event that something goes awry with the experiment, there must be a method of destroying the test subjects. Given present ethical standards concerning human experimentation, the ethics of such an experiment are, at best, deeply problematic. While ethical norms can dramatically change with time through changes in societal norms and beliefs, the means necessary to employ such an experiment are almost incomprehensible. For instance, it is not at all clear how the experiment would quarantine the subjects or how to handle the necessity of multiple generations of researchers. The role of informed consent is unclear with such an experiment. In the proposed experiment, an unethical researcher could use informed consent in a manner to produce the results that the researcher desires and undermine the purpose of the experiment. Additionally, an integral part of informed consent is the ability to withdraw from the experiment at any time. This element could pose a serious problem for this type of research. Therefore informed consent must either be eliminated or be drastically altered. Under present ethical norms it is clear that the kind of experiment necessary to provide strongly persuasive evidence of the effects of germ-line altering reproductive technologies would be unethical. Ethical considerations aside, the pragmatics of such an experiment are daunting to say the least. The use of germ-line altering technologies should not be implemented until strongly persuasive evidence regarding the effects on genetic diversity is concretely established. Decreases in the genetic diversity of a population would put at risk the survivability of that population. Humans place a clear value in the survivability of populations. Therefore anything that threatens the survivability of populations is unethical. Germ-line altering reproductive technologies may potentially decrease genetic diversity within a population. Until there is concrete evidence demonstrating that such technologies will not lead to decreases in a population’s genetic diversity, those technologies should not be utilized. The only method of assessment to produce such evidence is through human experimentation. The nature of the necessary experimentation involves unacceptable ethical violations and unavoidable pragmatic difficulties. Without strong proof that such technologies do not pose a threat to genetic diversity, and therefore population survivability, those technologies should not be implemented. Due to the fact that such evidence is not possible, germ-line altering technologies should be banned.

### NC – WTO

**Collapse is inevitable**

Kallis '18 [Giorgos; 5/31/18; ICREA Research Professor at Universitat Autònoma de Barcelona, environmental scientist working on ecological economics and political ecology, formerly Marie Curie International Fellow at the Energy and Resources Group of the University of California at Berkeley, PhD in Environmental Policy and Planning from the University of the Aegean in Greece, et al.; "Annual Review of Environment and Resources: Research On Degrowth," Annual Review of Environment and Resources, Vol. 43, p. 296-29]//GJ

3. ECOLOGICAL ECONOMICS: THE LIMITS OF GREEN GROWTH

Although driven by political, institutional, and discursive processes, growth is also **biophysical**. The economic process converts energy, resources, and matter to goods, services, and **waste** (34). In theory, it seems possible to decouple material throughput from economic output by improving the resource efficiency of production. Ecological economists, however, argue that in practice **absolute decoupling is unlikely**, even though relative decoupling is common (34). **Efficiency should not be confused with scale** (35): The more efficiently we use resources, the lower they cost, and **the more of them we end up using** (36). This is, in essence, growth. Just as increases in labor productivity lead to growth and new jobs, not to less employment, increases in resource productivity increase output and **resource use** (37). Capitalist economies grow by using more resources and more people, more intensively. Accelerating this is unlikely to spare resources.

Growth can become “cleaner” or “greener” by substituting, for example, fossil fuels with solar power, or scarce, environmentally intensive metals with more abundant and less intensive metals. But new substitutes have resource requirements, and life-cycle impacts that cross space and time. Energy is a vital source of useful work (38); growth has been possible because fossil fuels did things human labor alone could not do. Ending the use of fossil fuels is likely to reduce labor productivity and limit output (34). Solar and wind power are constrained only by their rate of flow, but unlike fossil fuels, they are **diffuse**—more like rain than a lake (3). To collect and concentrate a diffuse flow of energy, **more energy is necessary and more land is required**. The EROIs (energy returns on energy investment) of renewable energies are between 10:1 and 20:1, compared to more than 50:1 for earlier deposits of oil and coal (39). An economy powered by a diffuse energy flow is then likely to be an economy of lower net energy and lower output than one powered by concentrated stocks (3). Land use for solar or wind also competes with the use of land for **food production**, and **rare materials** are necessary for infrastructures and batteries that store their intermittent flows, **with significant environmental effects**.

Historical data corroborate ecological economic theory (40). Ayres & Warr (38) find that the use of net energy after conversion losses explains a big portion of the **U**nited **S**tates’ total factor productivity and economic growth. At the global level, GDP and material use have increased approximately 1:1. Carbon emissions have increased somewhat slower than GDP, but still have **increased** (34). **This is unlikely to be a coincidence**. Exceptions may exist, but cross-panel data analysis shows that overall, 1% growth of a national economy is associated with 0.6% to 0.8% increase in its carbon emissions (41) and 0.8% growth in its resource use (42).

Global resource use follows currently the “**collapse by 2050**” scenario foreseen in the “Limits to Growth” 1971 report (43–45). Domestic material use in some developed OECD economies has reached a plateau, but this is because of globalization and trade. If we take into account **imported goods**, then the material requirements of products and services consumed in OECD countries have grown hand in hand with GDP, with **no decoupling** (46). For **water use**, the effects of growth overwhelm any realistic savings from technologies and efficiency (47); water footprints have increased even in regions such as California where water withdrawals were stabilized (40).

Carbon emissions in some EU (European Union) countries have been declining, even after trade is taken into account, suggesting some substitution of fossil fuels by cleaner energies. [Although recession also played a role (34).] These declines are nowhere near the 8–10%, year-after-year reductions in carbon emissions required for developed nations under scenarios compatible with a **50% chance** of limiting warming to 2◦C (48). Further reductions will be harder to sustain once **one-off substitutions** of oil or coal with natural gas are exhausted (34).

Resource use or carbon emissions are a product of the scale of the economy (GDP) times its resource or carbon intensity (kg/GDP or kgCO2/GDP). With 1.5% annual increase in global income per capita, carbon intensity has to decline 4.4% each year for staying within 2◦C; with 0% growth, carbon intensity has to fall 2.9% each year (49). In the period 1970–2013, the average annual reduction rate for carbon intensity was less than 1.5%—and this gets harder to sustain as the share of carbon-intensive economies in global output increases (49). As Jackson (50) showed in his seminal work, **it is practically impossible to envisage viable climate mitigation scenarios that involve growth**. This calls for research on managing, or prospering, **without growth** (50, 51).

Some scenarios deem possible meeting climate targets while sustaining growth, but these generally assume after 2050 some sort of “negative emissions technology,” geo-engineering or otherwise. According to a recent Nature editorial, these technologies remain currently “**magical thinking**” (52). Clean energy investments can stimulate the economy in the short run, but in the **long run** growth may be limited by their **low EROIs**. Studies suggest that economic growth requires a minimum EROI of close to 11:1 (53). Less EROI means less labor productivity, and hence less growth. Indeed, “Limits to Growth” scenarios do not predict growth ending when resources are exhausted but, rather, when the quality of resources declines to such an extent that further extraction diverts more and more investment away from productive industry (44).

Degrowth is defined by ecological economists as an equitable downscaling of throughput, with a concomitant securing of wellbeing. If there is a fundamental coupling of economic activity and resource use, as ecological economics suggests there is, then serious environmental or climate policies will slow down the economy. Vice versa, a slower economy will use less resources and emit less carbon (40). This is not the same as saying that the degrowth goal is to reduce GDP (54); slowing down the economy is not an end but a likely outcome in a transition toward equitable wellbeing and environmental sustainability.

Advancing a position of “a-growth,” van den Bergh (54) proposes ignoring GDP and implementing a global carbon price, indifferent to what its effect on growth turns out to be. Ignoring GDP is a normative position—but at the end, the economy will either grow or not, and if it does not, then there should be plans for managing without growth. Given how entrenched GDP growth is in existing institutional and political structures, a-growth approaches must be advanced as part of broader systemic change (55).

Is it possible to secure a decent standard of living for all while throughput and output degrow? Substantive evidence indicates that **prosperity does not depend on high levels of production** and consumption. Kubiszewski et al. (56) find that the Genuine Progress Indicator, an indicator that includes environmental and social costs alongside output, peaked in 1978, despite subsequent global growth. A similar indicator, the Index of Sustainable Economic Welfare, has stayed at the same levels in the United States since 1950, despite a threefold growth of GDP (57).

Wealthier countries on average have higher levels of life expectancy and education than poorer ones, but above a certain level of GDP, income does not make a difference in wellbeing—**equality** does. Satisfactory levels of wellbeing are achieved by countries such as Vietnam or Costa Rica at a fraction (one-third or less) of the output, energy, or resource use of countries such as the **U**nited **S**tates. Even the lower levels of resource use of mid-income countries, however, would not be sustainable if they were to be generalized to the planet as a whole. No country currently satisfies social wellbeing standards while staying within its share of planetary boundaries, suggesting that radical changes in provisioning systems are necessary (58).

Wealthier people within a country are on average happier than others, but in the long run, overall happiness does not increase as a country’s income rises (59). Nuances of this income-happiness paradox depend on the sample of countries included and how one defines and asks about happiness. Within societies, individuals with higher incomes evaluate their lives as better than others, but do not enjoy better emotional wellbeing (60). Income determines social rank, and rank affects individuals’ assessments of their lives. Growth does not change relative rank or relative access to positional goods (those signifying position) but it does inflate expectations and prices of material goods, **increasing frustration** (61). Relative comparisons matter for personal wellbeing in low-income and high-income countries; for both, the more equally income is distributed, the happier people are (62). **Pro-environmental behaviors** and sharing are also strongly associated with personal wellbeing (63). This suggests that an economic contraction may not impact wellbeing negatively if accompanied by redistribution, sharing, and value shifts (34).

**Growth ensures extinction:**

**Phosphorous depletion**

Charly **Faradji 16**, Doctor of Philosophy Student, Chemistry, University of Bristol, “How the great phosphorus shortage could leave us short of food,” 2/17/16, https://phys.org/news/2016-02-great-phosphorus-shortage-short-food.html

It's not as well-known as the other issues, but phosphorus depletion is no less significant. After all, we could live without cars or unusual species, but if phosphorus ran out we'd have to **live without food**.

Phosphorus is an **essential nutrient for all forms of life**. It is a key element in our DNA and all living organisms require daily phosphorus intake to produce energy. It cannot be replaced and there is no synthetic substitute: without phosphorus, there is no life.

Our dependence began in the mid-19th century, after farmers noticed spreading phosphorus-rich guano (bird excrement) on their fields led to impressive improvements in crop yields. Soon after, mines opened up in the US and China to extract phosphate ore – rocks which contain the useful mineral. This triggered the current use of mineral fertilisers and, without this industrial breakthrough, humanity could only produce half the food that it does today.

Fertiliser use has quadrupled over the past half century and will **continue rising** as the population expands. The **growing wealth of developing countries** allows people to afford more meat which has a "phosphorus footprint" 50 times higher than most vegetables. This, together with the increasing usage of biofuels, is estimated to double the demand for phosphorus fertilisers by 2050.

Today phosphorus is also used in pharmaceuticals, personal care products, flame retardants, catalysts for chemical industries, building materials, cleaners, detergents and food preservatives.

Phosphorus is not a renewable resource

Reserves are limited and not equally spread over the planet. The only large mines are located in Morocco, Russia, China and the US. Depending on which scientists you ask, the world's phosphate rock reserves will last for another 35 to 400 years – though the more optimistic assessments rely on the discovery of new deposits.

It's a big concern for the EU and other countries without their own reserves, and phosphorus depletion could lead to **geopolitical tensions**. Back in 2008, when fertiliser prices sharply increased by 600% and directly influenced food prices, there were **violent riots** in 40 different developing countries.

Phosphorus also harms the environment. Excessive fertiliser use means it leaches from agricultural lands into rivers and eventually the sea, leading to so-called dead zones where most fish can't survive. Uninhibited algae growth caused by high levels of phosphorus in water has already created more than 400 coastal death zones worldwide. Related human poisoning costs US$2.2 billion dollars annually in the US alone.

With the increasing demand for phosphorus leading to massive social and environmental issues, it's time we looked towards more sustainable and responsible use.

There is still hope

In the past, the phosphorus cycle was closed: crops were eaten by humans and livestock while their faeces were used as natural fertilisers to grow crops again.

These days, the cycle is broken. Each year 220m tonnes of phosphate rocks are mined, but only a negligible amount makes it back into the soil. Crops are transported to cities and the waste is not returned to the fields but to the sewage system, which mainly ends up in the sea. A cycle has become a linear process.

We could reinvent a modern phosphorus cycle simply by **dramatically reducing our consumption**. After all, less than a third of the phosphorus in fertilisers is actually taken up by plants; the rest accumulates in the soil or is washed away. To take one example, in the Netherlands there is enough phosphorus in the soil today to supply the country with fertiliser for the next 40 years.

**Growth makes war inevitable**

Manuchehr **Irandoust 17**, Department of Economics and Finance, School of Business Studies, Kristianstad University, “Militarism and globalization: Is there an empirical link?” *Quality and quantity*, June 16, 2017, Springer Open Access

[GLOB = globalization index, MIS = militarized spending]

The results of the bootstrap panel Granger causality test are shown in Table 2. The findings show that **GLOB and MIS are causally related** in most of the countries under review. There is a bi-directional causality in UK, US, Saudi Arabia, and Russia. The causality is unidirectional running from GLOB to MIS in Australia, Brazil, India, and China, and running from MIS to GLOB in Turkey. The degree of significance level varies from country to country. There is no any causal relationship between military spending and globalization in France, Italy, South Korea, Germany, and Japan. Overall, this evidence shows a **relatively robust association** between changes in globalization and changes in military expenditure. In other words, countries experiencing greater globalization have relatively **large increases in militarization** over the past 20 years.

However, it has been shown that globalization may not lead to more peaceful relations or demilitarization. As we discussed in Sect. 2, bilateral trade increases the opportunity cost of bilateral war and may hinder bilateral war. Globalization (equivalent to multilateral economic openness) **reduces this opportunity cost with any given country** and devitalize the incentive to make concessions during negotiations, and, therefore, **increases the probability of war** between any given pair of country. Thus, an increase in trade or openness between two countries may restore peace between those but may increase the probability of conflict with third countries.

6 Conclusion

While previous studies mostly focused on the causal nexus between military expenditure and economic growth, those studies have not considered the role of globalization. This study uses data from the top 15 military expenditure spenders over the period 1990–2012 to examine the relationship between militarism and globalization. The bootstrap panel Granger causality that accounts for both cross-sectional dependence and heterogeneity across countries is utilized to detect the direction of causality. The results show that military expenditures and globalization are causally related in most of the countries under review. Despite the increasing role of globalization, the results show that **military expenditures are growing** and pointing to a strengthening in nationalist sentiments and militarism. This paper suggests that changes in domestic political and economic conditions might hinder the process of globalization. The results are consistent with those of Acemoglu and Yared (2010) who conclude that high military spending endangers globalization. This study also supports the results of Martin et al. (2008) who find that an increase in multilateral trade raises the chance of conflict between states. The policy implication of the findings is that greater military spending by a country increases the likelihood of military conflict in the future, the anticipation of which discourages globalization.

#### Trade causes proliferation—results in the spread of dual-use technology

Kassenova 1/25/12 (Togzhan Kassenove- associate in the Nuclear Policy Program at the Carnegie Endowment and a Stanton Nuclear Security Fellow. She specializes in weapons of mass destruction nonproliferation issues, with a regional focus on Central Asia and Southeast Asia; nuclear security; strategic trade management; and civilian nuclear energy programs, January 25, “Preventing WMD Proliferation Myths and Realities of Strategic Trade Controls”, <http://carnegieendowment.org/files/wmd_proliferation_Togzhan_Jan_25_2012.pdf>)

WMD-relevant technology and materials are all around us. Semiconductors, for instance, are indispensable in the advanced electronics we use every day (including computers), but they can also be utilized in a variety of military equipment, such as satellites, infrared imaging products, and transistors. Freezedrying technology used to make instant coffee or instant noodles can also be used in biological-warfare research. Encryption technology has many civilian applications—for instance, in train-signaling systems—but malicious actors can also use it to communicate without being detected by law enforcement agencies. Similarly, satellite technology may have civilian applications, weather monitoring for example, or military ones, such as missile guidance. The broad applications for dual-use goods and technology in everyday life result in constant flows of proliferation-sensitive items across borders. And this poses a real danger. Gradual acquisition of components and technology from various sources that can enable a nonstate or state actor to build a WMD program is a more likely proliferation threat than an actor acquiring an already-built weapon from an external source. The best illustration of how real this threat is in the nuclear realm is the story of the A. Q. Khan network. Pakistani scientist A. Q. Khan and his associates successfully exploited gaps in controls of nuclear exports in Pakistan and beyond during the 1980s and 1990s. The network assisted Iran, North Korea, and Libya in acquiring a whole range of nuclear weapons–relevant items. 1 According to a recent report by nonproliferation expert Joshua Pollack, India, surprisingly, was the fourth customer of the Khan network, procuring uraniumenrichment technology. 2 Unfortunately for the proliferation outlook, progress in high-tech industries, especially in the fields of electronics and biotechnology, as well as the expansion of nuclear power and the globalization of trade, further exacerbate the challenge of firewalling international trade from WMD proliferation.

#### Free trade results in deregulation which makes nuclear materials easier to access

Jackson 11/10/11 (Beckett Jackson, Master’s Candidate at Georgetown University’s Security Studies Program and works as a Security and Military Intelligence Analyst within IHS Jane’s A&D Consulting Practice, “Proliferation Networks Capitalize on Limited Oversight of Service-Based Economies”, <http://journal.georgetown.edu/2011/11/10/proliferation-networks-capitalize-on-limited-oversight-of-service-based-economies/>)

Despite all of the benefits of an increasingly globalized economy, certain authoritarian governments have shunned the system. While these states attempt to limit their societies’ exposure to an increasingly interconnected world, they still use the global economic system for their own benefits. Increasingly, globalization and technological advancement have created a security risk for the United States. High-strength aluminum alloys used in aerospace components also have applications in the production of uranium enrichment equipment. Non-destructive testing machines designed to identify anomalies in automobile parts can be used in the production of solid rocket motors for ballistic missiles. Despite the enactment of sanctions against regimes involved in the proliferation of weapons of mass destruction (WMD), states have exploited a fundamental characteristic of the global trade system to access dual-use equipment and materials used in the fabrication of WMD. In a global economy where the customers, manufacturers and suppliers of a product span multiple continents, delivery times and shipping costs are a priority for commercial enterprises. As a result, financial and transit hubs, such as Hong Kong, Dubai and Singapore, rely on the speed of customs clearance, minimal financial regulations and favorable business policies for consistent GDP growth. However, these services also create a proliferation security challenge. For instance, in Hong Kong, the ease and minimal oversight involved in establishing a business provides a favorable environment for proliferation networks. In 2011, the South China Morning Post reported, “the sheer volume of goods passing through Hong Kong…attracts businesses looking to slip through the cracks.” The U.S.-China Economic Security Review Commission, which provides annual congressional reports on security issues related to trade with China, has identified a single address in Hong Kong out of which 30 Chinese front companies operate. This example illustrates the lack of oversight in Hong Kong and is a symptom of the imbalance between trade facilitation and security in service-based economies.

#### Nuclear war

**Kroenig 15** (Matthew, Associate Professor and International Relations Field Chair in the Department of Government and School of Foreign Service at Georgetown University, 2015. “The History of Proliferation Optimism: Does It Have a Future?” *Journal of Strategic Studies*, Volume 38, Issue 1-2, 2015)

The spread of nuclear weapons poses at least six severe threats to international peace and security including: nuclear war, nuclear terrorism, global and regional instability, constrained US freedom of action, weakened alliances, and further nuclear proliferation. Each of these threats has received extensive treatment elsewhere and this review is not intended to replicate or even necessarily to improve upon these previous efforts. Rather the goals of this section are more modest: to usefully bring together and recap the many reasons why we should be pessimistic about the likely consequences of nuclear proliferation. Many of these threats will be illuminated with a discussion of a case of much contemporary concern: Iran’s advanced nuclear program. Nuclear War The greatest threat posed by the spread of nuclear weapons is nuclear war. The more states in possession of nuclear weapons, the greater the probability that somewhere, someday, there will be a catastrophic nuclear war. To date, nuclear weapons have only been used in warfare once. In 1945, the United States used nuclear weapons on Hiroshima and Nagasaki, bringing World War II to a close. Many analysts point to the 65-plus-year tradition of nuclear non-use as evidence that nuclear weapons are unusable, but it would be naïve to think that nuclear weapons will never be used again simply because they have not been used for some time. After all, analysts in the 1990s argued that worldwide economic downturns like the Great Depression were a thing of the past, only to be surprised by the dot-com bubble bursting later in the decade and the Great Recession of the late 2000s.48 This author, for one, would be surprised if nuclear weapons are not used again sometime in his lifetime. Before reaching a state of MAD, new nuclear states go through a transition period in which they lack a secure-second strike capability. In this context, one or both states might believe that it has an incentive to use nuclear weapons first. For example, if Iran acquires nuclear weapons, neither Iran, nor its nuclear-armed rival, Israel, will have a secure, second-strike capability. Even though it is believed to have a large arsenal, given its small size and lack of strategic depth, Israel might not be confident that it could absorb a nuclear strike and respond with a devastating counterstrike. Similarly, Iran might eventually be able to build a large and survivable nuclear arsenal, but, when it first crosses the nuclear threshold, Tehran will have a small and vulnerable nuclear force. In these pre-MAD situations, there are at least three ways that nuclear war could occur. First, the state with the nuclear advantage might believe it has a splendid first strike capability. In a crisis, Israel might, therefore, decide to launch a preventive nuclear strike to disarm Iran’s nuclear capabilities. Indeed, this incentive might be further increased by Israel’s aggressive strategic culture that emphasizes preemptive action. Second, the state with a small and vulnerable nuclear arsenal, in this case Iran, might feel use them or lose them pressures. That is, in a crisis, Iran might decide to strike first rather than risk having its entire nuclear arsenal destroyed. Third, as Thomas Schelling has argued, nuclear war could result due to the reciprocal fear of surprise attack.49 If there are advantages to striking first, one state might start a nuclear war in the belief that war is inevitable and that it would be better to go first than to go second. Fortunately, there is no historic evidence of this dynamic occurring in a nuclear context, but it is still possible. In an Israeli–Iranian crisis, for example, Israel and Iran might both prefer to avoid a nuclear war, but decide to strike first rather than suffer a devastating first attack from an opponent. Even in a world of MAD, however, when both sides have secure, second-strike capabilities, there is still a risk of nuclear war. Rational deterrence theory assumes nuclear-armed states are governed by rational leaders who would not intentionally launch a suicidal nuclear war. This assumption appears to have applied to past and current nuclear powers, but there is no guarantee that it will continue to hold in the future. Iran’s theocratic government, despite its inflammatory rhetoric, has followed a fairly pragmatic foreign policy since 1979, but it contains leaders who hold millenarian religious worldviews and could one day ascend to power. We cannot rule out the possibility that, as nuclear weapons continue to spread, some leader somewhere will choose to launch a nuclear war, knowing full well that it could result in self-destruction. One does not need to resort to irrationality, however, to imagine nuclear war under MAD. Nuclear weapons may deter leaders from intentionally launching full-scale wars, but they do not mean the end of international politics. As was discussed above, nuclear-armed states still have conflicts of interest and leaders still seek to coerce nuclear-armed adversaries. Leaders might, therefore, choose to launch a limited nuclear war.50 This strategy might be especially attractive to states in a position of conventional inferiority that might have an incentive to escalate a crisis quickly to the nuclear level. During the Cold War, the United States planned to use nuclear weapons first to stop a Soviet invasion of Western Europe given NATO’s conventional inferiority.51 As Russia’s conventional power has deteriorated since the end of the Cold War, Moscow has come to rely more heavily on nuclear weapons in its military doctrine. Indeed, Russian strategy calls for the use of nuclear weapons early in a conflict (something that most Western strategists would consider to be escalatory) as a way to de-escalate a crisis. Similarly, Pakistan’s military plans for nuclear use in the event of an invasion from conventionally stronger India. And finally, Chinese generals openly talk about the possibility of nuclear use against a US superpower in a possible East Asia contingency. Second, as was also discussed above, leaders can make a ‘threat that leaves something to chance’.52 They can initiate a nuclear crisis. By playing these risky games of nuclear brinkmanship, states can increase the risk of nuclear war in an attempt to force a less resolved adversary to back down. Historical crises have not resulted in nuclear war, but many of them, including the 1962 Cuban Missile Crisis, have come close. And scholars have documented historical incidents when accidents nearly led to war.53 When we think about future nuclear crisis dyads, such as Iran and Israel, with fewer sources of stability than existed during the Cold War, we can see that there is a real risk that a future crisis could result in a devastating nuclear exchange. Nuclear Terrorism The spread of nuclear weapons also increases the risk of nuclear terrorism.54 While September 11th was one of the greatest tragedies in American history, it would have been much worse had Osama Bin Laden possessed nuclear weapons. Bin Laden declared it a ‘religious duty’ for Al- Qa’eda to acquire nuclear weapons and radical clerics have issued fatwas declaring it permissible to use nuclear weapons in Jihad against the West.55 Unlike states, which can be more easily deterred, there is little doubt that if terrorists acquired nuclear weapons, they would use them.56 Indeed, in recent years, many US politicians and security analysts have argued that nuclear terrorism poses the greatest threat to US national security.57 Analysts have pointed out the tremendous hurdles that terrorists would have to overcome in order to acquire nuclear weapons.58 Nevertheless, as nuclear weapons spread, the possibility that they will eventually fall into terrorist hands increases. States could intentionally transfer nuclear weapons, or the fissile material required to build them, to terrorist groups. There are good reasons why a state might be reluctant to transfer nuclear weapons to terrorists, but, as nuclear weapons spread, the probability that a leader might someday purposely arm a terrorist group increases. Some fear, for example, that Iran, with its close ties to Hamas and Hizballah, might be at a heightened risk of transferring nuclear weapons to terrorists. Moreover, even if no state would ever intentionally transfer nuclear capabilities to terrorists, a new nuclear state, with underdeveloped security procedures, might be vulnerable to theft, allowing terrorist groups or corrupt or ideologically-motivated insiders to transfer dangerous material to terrorists. There is evidence, for example, that representatives from Pakistan’s atomic energy establishment met with Al-Qa’eda members to discuss a possible nuclear deal.59 Finally, a nuclear-armed state could collapse, resulting in a breakdown of law and order and a loose nukes problem. US officials are currently very concerned about what would happen to Pakistan’s nuclear weapons if the government were to fall. As nuclear weapons spread, this problem is only further amplified. Iran is a country with a history of revolutions and a government with a tenuous hold on power. The regime change that Washington has long dreamed about in Tehran could actually become a nightmare if a nuclear-armed Iran suffered a breakdown in authority, forcing us to worry about the fate of Iran’s nuclear arsenal. Regional Instability The spread of nuclear weapons also emboldens nuclear powers, contributing to regional instability. States that lack nuclear weapons need to fear direct military attack from other states, but states with nuclear weapons can be confident that they can deter an intentional military attack, giving them an incentive to be more aggressive in the conduct of their foreign policy. In this way, nuclear weapons provide a shield under which states can feel free to engage in lower-level aggression. Indeed, international relations theories about the ‘stability-instability paradox’ maintain that stability at the nuclear level contributes to conventional instability.60 Historically, we have seen that the spread of nuclear weapons has emboldened their possessors and contributed to regional instability. Recent scholarly analyses have demonstrated that, after controlling for other relevant factors, nuclear-weapon states are more likely to engage in conflict than nonnuclear-weapon states and that this aggressiveness is more pronounced in new nuclear states that have less experience with nuclear diplomacy.61 Similarly, research on internal decision-making in Pakistan reveals that Pakistani foreign policymakers may have been emboldened by the acquisition of nuclear weapons, which encouraged them to initiate militarized disputes against India.62 Currently, Iran restrains its foreign policy because it fears major military retaliation from the United States or Israel, but with nuclear weapons it could feel free to push harder. A nuclear-armed Iran would likely step up support to terrorist and proxy groups and engage in more aggressive coercive diplomacy. With a nuclear-armed Iran increasingly throwing its weight around in the region, we could witness an even more crisis prone Middle East. And in a poly-nuclear Middle East with Israel, Iran, and, in the future, possibly other states, armed with nuclear weapons, any one of those crises could result in a catastrophic nuclear exchange.

#### No econ impact

Walt 20 — (Stephen M. Walt, Robert and Renée Belfer professor of international relations at Harvard University., “Will a Global Depression Trigger Another World War?“, Foreign Policy, 5-13-20, Available Online at https://foreignpolicy.com/2020/05/13/coronavirus-pandemic-depression-economy-world-war/, accessed 11-5-2020, HKR-AR)

One familiar argument is the so-called diversionary (or “scapegoat”) theory of war. It suggests that leaders who are worried about their popularity at home will try to divert attention from their failures by provoking a crisis with a foreign power and maybe even using force against it. Drawing on this logic, some Americans now worry that President Donald Trump will decide to attack a country like Iran or Venezuela in the run-up to the presidential election and especially if he thinks he’s likely to lose.

This outcome strikes me as unlikely, even if one ignores the logical and empirical flaws in the theory itself. War is always a gamble, and should things go badly—even a little bit—it would hammer the last nail in the coffin of Trump’s declining fortunes. Moreover, none of the countries Trump might consider going after pose an imminent threat to U.S. security, and even his staunchest supporters may wonder why he is wasting time and money going after Iran or Venezuela at a moment when thousands of Americans are dying preventable deaths at home. Even a successful military action won’t put Americans back to work, create the sort of testing-and-tracing regime that competent governments around the world have been able to implement already, or hasten the development of a vaccine. The same logic is likely to guide the decisions of other world leaders too.

Another familiar folk theory is “military Keynesianism.” War generates a lot of economic demand, and it can sometimes lift depressed economies out of the doldrums and back toward prosperity and full employment. The obvious case in point here is World War II, which did help the U.S economy finally escape the quicksand of the Great Depression. Those who are convinced that great powers go to war primarily to keep Big Business (or the arms industry) happy are naturally drawn to this sort of argument, and they might worry that governments looking at bleak economic forecasts will try to restart their economies through some sort of military adventure.

I doubt it. It takes a really big war to generate a significant stimulus, and it is hard to imagine any country launching a large-scale war—with all its attendant risks—at a moment when debt levels are already soaring. More importantly, there are lots of easier and more direct ways to stimulate the economy—infrastructure spending, unemployment insurance, even “helicopter payments”—and launching a war has to be one of the least efficient methods available. The threat of war usually spooks investors too, which any politician with their eye on the stock market would be loath to do.

Economic downturns can encourage war in some special circumstances, especially when a war would enable a country facing severe hardships to capture something of immediate and significant value. Saddam Hussein’s decision to seize Kuwait in 1990 fits this model perfectly: The Iraqi economy was in terrible shape after its long war with Iran; unemployment was threatening Saddam’s domestic position; Kuwait’s vast oil riches were a considerable prize; and seizing the lightly armed emirate was exceedingly easy to do. Iraq also owed Kuwait a lot of money, and a hostile takeover by Baghdad would wipe those debts off the books overnight. In this case, Iraq’s parlous economic condition clearly made war more likely.

Yet I cannot think of any country in similar circumstances today. Now is hardly the time for Russia to try to grab more of Ukraine—if it even wanted to—or for China to make a play for Taiwan, because the costs of doing so would clearly outweigh the economic benefits. Even conquering an oil-rich country—the sort of greedy acquisitiveness that Trump occasionally hints at—doesn’t look attractive when there’s a vast glut on the market. I might be worried if some weak and defenseless country somehow came to possess the entire global stock of a successful coronavirus vaccine, but that scenario is not even remotely possible.

If one takes a longer-term perspective, however, a sustained economic depression could make war more likely by strengthening fascist or xenophobic political movements, fueling protectionism and hypernationalism, and making it more difficult for countries to reach mutually acceptable bargains with each other. The history of the 1930s shows where such trends can lead, although the economic effects of the Depression are hardly the only reason world politics took such a deadly turn in the 1930s. Nationalism, xenophobia, and authoritarian rule were making a comeback well before COVID-19 struck, but the economic misery now occurring in every corner of the world could intensify these trends and leave us in a more war-prone condition when fear of the virus has diminished.

On balance, however, I do not think that even the extraordinary economic conditions we are witnessing today are going to have much impact on the likelihood of war. Why? First of all, if depressions were a powerful cause of war, there would be a lot more of the latter. To take one example, the United States has suffered 40 or more recessions since the country was founded, yet it has fought perhaps 20 interstate wars, most of them unrelated to the state of the economy. To paraphrase the economist Paul Samuelson’s famous quip about the stock market, if recessions were a powerful cause of war, they would have predicted “nine out of the last five (or fewer).”

Second, states do not start wars unless they believe they will win a quick and relatively cheap victory. As John Mearsheimer showed in his classic book Conventional Deterrence, national leaders avoid war when they are convinced it will be long, bloody, costly, and uncertain. To choose war, political leaders have to convince themselves they can either win a quick, cheap, and decisive victory or achieve some limited objective at low cost. Europe went to war in 1914 with each side believing it would win a rapid and easy victory, and Nazi Germany developed the strategy of blitzkrieg in order to subdue its foes as quickly and cheaply as possible. Iraq attacked Iran in 1980 because Saddam believed the Islamic Republic was in disarray and would be easy to defeat, and George W. Bush invaded Iraq in 2003 convinced the war would be short, successful, and pay for itself.

#### Tonneson says unbalanced trade can increase conflict—the examples it cites are the U.S. and China who have extremely unbalanced trade ties and are currently suing each other over steel and other goods in the WTO.

Stein Tønnesson 15, Research Professor, Peace Research Institute Oslo; Leader of East Asia Peace program, Uppsala University, 2015, “Deterrence, interdependence and Sino–US peace,” International Area Studies Review, Vol. 18, No. 3, p. 297-311

Several recent works on China and Sino–US relations have made substantial contributions to the current understanding of how and under what circumstances a combination of nuclear deterrence and economic interdependence may reduce the risk of war between major powers. At least four conclusions can be drawn from the review above: first, those who say that interdependence may both inhibit and drive conflict are right. Interdependence raises the cost of conflict for all sides but asymmetrical or unbalanced dependencies and negative trade expectations may generate tensions leading to trade wars among interdependent states that in turn increase the risk of military conflict (Copeland, 2015: 1, 14, 437; Roach, 2014). The risk may increase if one of the interdependent countries is governed by an inward-looking socio-economic coalition (Solingen, 2015); second, the risk of war between China and the US should not just be analysed bilaterally but include their allies and partners. Third party countries could drag China or the US into confrontation; third, in this context it is of some comfort that the three main economic powers in Northeast Asia (China, Japan and South Korea) are all deeply integrated economically through production networks within a global system of trade and finance (Ravenhill, 2014; Yoshimatsu, 2014: 576); and fourth, decisions for war and peace are taken by very few people, who act on the basis of their future expectations. International relations theory must be supplemented by foreign policy analysis in order to assess the value attributed by national decision-makers to economic development and their assessments of risks and opportunities. If leaders on either side of the Atlantic begin to seriously fear or anticipate their own nation’s decline then they may blame this on external dependence, appeal to anti-foreign sentiments, contemplate the use of force to gain respect or credibility, adopt protectionist policies, and ultimately refuse to be deterred by either nuclear arms or prospects of socioeconomic calamities. Such a dangerous shift could happen abruptly, i.e. under the instigation of actions by a third party – or against a third party.

Yet as long as there is both nuclear deterrence and interdependence, the tensions in East Asia are unlikely to escalate to war. As Chan (2013) says, all states in the region are aware that they cannot count on support from either China or the US if they make provocative moves. The greatest risk is not that a territorial dispute leads to war under present circumstances but that changes in the world economy alter those circumstances in ways that render inter-state peace more precarious. If China and the US fail to rebalance their financial and trading relations (Roach, 2014) then a trade war could result, interrupting transnational production networks, provoking social distress, and exacerbating nationalist emotions. This could have unforeseen consequences in the field of security, with nuclear deterrence remaining the only factor to protect the world from Armageddon, and unreliably so. Deterrence could lose its credibility: one of the two great powers might gamble that the other yield in a cyber-war or conventional limited war, or third party countries might engage in conflict with each other, with a view to obliging Washington or Beijing to intervene.

**Economic decline decreases emissions – emissions are driven by growth and it’s empirically proven by the recession**

Kuishuang **Feng 15**, Ph.D. in Ecological Economics from the University of Leeds, Associate Professor at University of Maryland, 7/21/15, “Drivers of the US CO2 emissions 1997–2013,” Nature Communications, Volume 6, Article 7714, p. 2-3

Abstract

Fossil fuel CO2 emissions in the **U**nited **S**tates decreased by ∼11% between 2007 and 2013, from 6,023 to 5,377 Mt. This decline has been widely attributed to a shift from the use of coal to natural gas in US electricity production. However, the factors driving the decline have not been **quantitatively evaluated**; the role of natural gas in the decline therefore remains **speculative**. Here we analyse the factors affecting US emissions from 1997 to 2013. Before 2007, rising emissions were **primarily driven by economic growth**. After 2007, **decreasing emissions were largely a result of economic recession** with changes in fuel mix (for example, substitution of natural gas for coal) playing a comparatively **minor role**. Energy–climate policies may, therefore, be necessary to lock-in the recent emissions reductions and drive further decarbonization of the energy system as the US economy recovers and grows.

Introduction

The CO2 emissions from the burning of fossil fuels are the primary cause of anthropogenic climate change1, and the United States emits more CO2 each year than any other country except China. In the decade before 2007, US CO2 emissions grew by an average 0.7% per year. However, beginning in 2007, US emissions decreased, reaching a minimum of 5,284 Mt CO2 in 2012—12% lower than 2007 levels and 5% lower than 1997 levels2. This recent decline is good news and is consistent with the Obama administration’s stated goal of reducing CO2 emissions by 17% in 2020 and 83% in 2050 relative to 2005 levels3. Assuming no change in emissions outside the power sector, the new rules proposed by the US Environmental Protection Agency in June 2014 to limit CO2 emissions from power plants will require US emissions to decrease to 4,200 Mt CO2 in 2030—a further 20% reduction from 2013 levels4.

Coinciding with the post-2007 decline in emissions, innovations in hydraulic fracturing technology have dramatically increased domestic supplies of gas5,6. Commentators in the scientific community and media have linked the two trends, celebrating the climate benefits of the gas boom7,8,9. Recently, the Third National Climate Assessment of the United States Global Change Research Program also adopted this conclusion, stating that the decrease in US CO2 emissions was ‘…largely due to a shift from coal to less CO2-intensive natural gas for electricity production’10. Yet, despite potentially significant implications for US climate and energy policy, there has been **no quantitative analysis** of whether the gas boom and changes in the fuel mix of the power sector are indeed driving the decrease in US CO2 emissions.

Here, we use input–output structural decomposition analysis (SDA) to assess sources of change in US CO2 emissions over a decade of mostly increasing emissions, 1997–2007, and then over the period of mostly decreasing emissions, 2007–2013. Our analysis quantifies the contribution of six different factors to changes in US emissions. These factors are: population growth; changes in consumption volume caused exclusively by changes in per capita consumption of goods and services; shifts in consumption patterns or the types of goods and services being consumed; adjustments in production structure or the mix of inputs (for example, labour, domestic and imported materials) required to produce US goods and services; changes in fuel mix as reflected by the CO2 emitted per unit of energy used; and changes in energy intensity or the energy used per inflation-adjusted unit of economic output. The SDA in this research is based on the additive decomposition of the changes in emission determined by six multiplicative factors acting as accelerators or retardants of the emission dynamics. Each term in the decomposition is a product of the change in one explicative factor and the level values of the other five factors, and thus represents the contribution of one explicative factor to the total change in emission. For example, in the term where population is the explicative factor, the values of consumption volume, production structure, consumption patterns, energy intensity and fuel mix are held unchanged and only population varies. In this way, the SDA method allows us to quantify the contribution of each of the assessed factors to the trend in emissions. Details of our methodology and data sources are in the Methods section (including Supplementary Methods). We find that before 2007, rising **emissions were driven by economic growth**: 71% of the increase between 1997 and 2007 was due to increases in US **consumption** of goods and services, with the remainder of the increase due to population growth. Concurrent with the **global economic recession**, 83% of the decrease during 2007–2009 was due to **decreased consumption** and changes in the production structure of the US economy, with just 17% related to changes in the fuel mix. During the economic recovery, 2009–2013, the decrease in US emissions has been small (<1%), with nearly equal contributions from changes in the fuel mix, decreases in energy use per unit of GDP, changes in US production structure, and changes in consumption patterns. We conclude that **substitution of gas for coal has had a relatively minor role in the emissions reduction of US CO2 emissions since 2007**.

Results

Growing emissions from 1997 to 2007

Between 1997 and 2007, US emissions increased by 7.3% (Fig. 1, black curve). Our analysis shows that the main factor behind this increase was an increase in consumption volume caused by growth in per capita consumption of goods and services in the United States. Indeed, increases in such consumption volume correspond to a contribution of a 21.8% increase in emissions over this decade (Fig. 1, red curve). The next most important factor influencing CO2 emissions over the same period was population growth. Immigration and natural growth have resulted in steady population growth at a rate of ∼1% per year since 1997. These population gains contributed to an 8.9% increase in emissions between 1997 and 2007 (Fig. 1, yellow curve).

However, other factors slowed the growth of emissions between 1997 and 2007: decreases in the energy intensity of GDP; changes in the consumption patterns of US consumers; shifts in production structure; and decreases in the use of coal as an energy source. For instance, over this period, the energy used per dollar of economic output decreased by 17% (Fig. 2a, black curve), the share of consumer spending on manufactured goods decreased by ∼4% (Fig. 2b), the share of imported inputs to the US industry sectors increased (for example, imports to petroleum and coal products sector increased by 6.7%, and imports to the chemical products, primary metals and textile sectors increased by 2.7%, 2.5% and 2.1%, respectively)11, and the share of US electricity generated from coal decreased by ∼5% while the share generated from natural gas increased by 8% (Fig. 2c). All of these trends exerted a downward influence on emissions. Between 1997 and 2007, changes in energy intensity, consumption patterns, production structure and fuel mix contributed to retarding emissions of 7.4, 6.9, 4.9 and 3.6%, respectively (Fig. 1, purple, green, blue and orange curves, respectively).

Declining emissions from 2007 to 2013

US CO2 emissions stopped growing in 2007, and decreased by ∼11% between 2007 and 2013 (Fig. 1, black curve). Looking at this time period in aggregate, the only factor which acted to increase emissions over the period was continued and steady population growth (+3.7%) (Fig. 1, yellow curve). However, the upward influence of population growth was overwhelmed by the downward influence of changes in production structure (−6.1%), fuel mix (−4.4%), consumption volumes triggered by per capita consumption (−3.9%), energy intensity of GDP (−0.5%) and changing consumption patterns (−0.4%; Fig. 1, blue, orange, red, purple and green curves, respectively).

Although all of the analysed factors except population contributed to the decrease in emissions during 2007–2013, different factors dominated over shorter periods. Figure 3 subdivides 2007-2013 into 2-year periods, showing that emissions fell by 9.9% from 2007 to 2009, increased by 1.3% between 2009 to 2011 and decreased again by 2.1% between 2011 and 2013.

More than half (53%) of the initial and **most substantial decrease** in emissions, b

etween 2007 and 2009, was due to a **sharp drop in the volume of consumed goods** as a result of reduction in per capita consumption during the global economic recession (Fig. 3, red bar). In particular, Fig. 4 shows that sharp decreases in the volume of capital expenditures and exported goods between 2007 and 2009 drove down associated emissions by 25% and 18%, respectively. Changes in the production structure of the US economy (that is, the volume and type of intermediate goods demanded) and the fuel mix of the energy sector contributed 30% and 17% of the initial (2007–2009) decrease in emissions, respectively, while increases in the energy intensity of the US economy and changing consumption patterns exerted modest upward influences on emissions during the same period.

### NC – Warming

#### No tech miracles for warming – they delay effective responses and offset real reductions in emissions

Science Daily 20 [Science Daily. "Why relying on new technology won't save the planet." https://www.sciencedaily.com/releases/2020/04/200420125510.htm]

Overreliance on promises of new technology to solve climate change is enabling delay, say researchers from Lancaster University.

Their research published in Nature Climate Change calls for an end to a longstanding cycle of technological promises and reframed climate change targets.

Contemporary technological proposals for responding to climate change include nuclear fusion power, giant carbon sucking machines, ice-restoration using millions of wind-powered pumps, and spraying particulates in the stratosphere.

Researchers Duncan McLaren and Nils Markusson from Lancaster Environment Centre say that: "For forty years, climate action has been delayed by technological promises. Contemporary promises are equally dangerous. Our work exposes how such promises have raised expectations of more effective policy options becoming available in the future, and thereby enabled a continued politics of prevarication and inadequate action.

"Prevarication is not necessarily intentional, but such promises can feed systemic 'moral corruption', in which current elites are enabled to pursue self-serving pathways, while passing off risk onto vulnerable people in the future and in the global South.

The article describes a history of such promises, showing how the overarching international goal of 'avoiding dangerous climate change' has been reinterpreted and differently represented in the light of new modelling methods, scenarios and technological promises.

The researchers argue that the targets, models and technologies have co-evolved in ways that enable delay: "Each novel promise not only competes with existing ideas, but also downplays any sense of urgency, enabling the repeated deferral of political deadlines for climate action and undermining societal commitment to meaningful responses.

#### No extinction – assumes 45 degrees celcius

Alexey Turchin 19, Researcher at the Foundation Science for Life Extension in Moscow, Brian P. Green, director of technology ethics at the Markkula Center for Applied Ethics at Santa Clara University, 3/11/19, “Islands as refuges for surviving global catastrophes,” https://www.emerald.com/insight/content/doi/10.1108/FS-04-2018-0031/full/html

Different types of possible catastrophes suggest different scenarios for how survival could happen on an island. What is important is that the island should have properties which protect against the specific dangers of particular global catastrophic risks. Specifically different islands will provide protection against different risks, and their natural diversity will contribute to a higher total level of protection:

- Quarantined island survives pandemic. An island could impose effective quarantine if it is sufficiently remote and simultaneously able to protect itself, possibly using military ships and air defense.

- Far northern aboriginal people survive an ice age. Many far northern people have adapted to survive in extremely cold and dangerous environments, and under the right circumstances could potentially survive the return of an ice age. However, their cultures are endangered by globalization. If these people become dependent on the products of modern civilization, such as rifles and motor boats, and lose their native survival skills, then their likelihood of surviving the collapse of the outside world would decrease. Therefore, preservation of their survival skills may be important as a defense against the risks connected with extreme cooling.

- Remote polar island with high mountains survives brief global warming of median surface temperatures, up to 50˚C. There is a theory that the climates of planets similar to the Earth could have several semi-stable temperature levels (Popp et al., 2016). If so, because of climate change, the Earth could transition to a second semi-stable state with a median global temperature of around 330 K, about 60˚C, or about 45˚C above current global mean temperatures. But even in this climate, some regions of Earth could still be survivable for humans, such as the Himalayan plateau at elevations above 4,000 m, but below 6,000 (where oxygen deficiency becomes a problem), or on polar islands with mountains (however, global warming affects polar regions more than equatorial regions, and northern island will experience more effects of climate change, including thawing permafrost and possible landslides because of wetter weather). In the tropics, the combination of increased humidity and temperature may increase the wet bulb temperature above 36˚C, especially on islands, where sea moisture is readily available. In such conditions, proper human perspiration becomes impossible (Sherwood and Huber, 2010), and there will likely be increased mortality and morbidity because of tropical diseases. If temperatures later returned to normal – either naturally or through climate engineering – the rest of the Earth could be repopulated.

#### CRISPR is environmentally dangerous, unpredictable, and ev that it solves environment is speculative and over-optimistic

Mackelprang 19 [Becky, plant biologist and science communicator. “Can the gene editing technology CRISPR help reduce biodiversity loss worldwide?” https://www.greenbiz.com/article/can-gene-editing-technology-crispr-help-reduce-biodiversity-loss-worldwide]

While many scientists are eager to discuss the possibilities of using CRISPR to preserve biodiversity, they are also cautious. The effects of human interventions are not always predictable, and once a gene-edited species is released into the wild, controlling any negative effects will be difficult. Toni Piaggio, a research scientist at the U.S. Department of Agriculture (USDA) National Wildlife Research Center, says researchers should “never entirely sip the Kool-Aid” when it comes to CRISPR. Instead, she says, they should “spend a lot of research time and intellectual energy” questioning themselves and their work. Posing the right questions to the right stakeholders — including communities that would be affected by the application of gene editing — might help to avoid the unintended consequences that so often accompany human solutions to ecosystem challenges.

#### Off-target mistakes ensure it can’t solve climate or biod

Cohen 19 [Jon, staff writer for Science. “CRISPR offshoot still makes mistakes editing DNA, raising concerns about its medical use” https://www.science.org/content/article/crispr-offshoot-still-makes-mistakes-editing-dna-raising-concerns-about-its-medical-use]

Variations of the genome editor CRISPR have wowed biology labs around the world over the past few years because they can precisely change single DNA bases, promising deft repairs for genetic diseases and improvements in crop and livestock genomes. But such "base editors" can have a serious weakness. A pair of studies published online in Science this week shows that one kind of base editor causes many unwanted—and potentially dangerous—"off-target" genetic changes.

The mistakes are still rare overall, says David Liu, a chemist at Harvard University whose team developed the first generation of base editors, and are unlikely to interfere with laboratory uses of the technology. But they are enough to concern anyone contemplating use of the technology in patients, Liu and others say. "The two papers are very interesting and important," says Jin-Soo Kim, a CRISPR researcher at Seoul National University. "It is now important to determine which component is responsible for the collateral mutations and how to reduce or avoid them."

In its original form, CRISPR uses an RNA strand to guide an enzyme known as Cas9 to a specific place in a genome. The Cas9 acts as a molecular scissors on the DNA, cutting both of its strands, and the cell's attempts to repair the brake can disable the gene. Or researchers can use the cut to insert a new sequence of DNA. Base editors instead couple the guide RNA to a Cas9 that only cuts one DNA strand. This molecular complex also includes an enzyme, called a deaminase, that can chemically change one base into another. Because such editors have more control over the specific changes than CRISPR itself, researchers did not expect them to cause off-target errors.

### NC – Disease

#### No way CRISPR solves all disease - lifestyle factors, mistakes

Radcliffe 17 Radcliffe, Shawn. Shawn Radcliffe is a science writer and yoga teacher in Ontario, Canada. "Will Gene Editing Allow Us to Rid the World of Diseases?" Healthline, 26 Aug. 2017, www.healthline.com/health-news/will-gene-editing-allow-us-to-rid-world-of-diseases.

CRISPR-Cas9 is a powerful tool, but it also raises several concerns. “There’s a lot of discussion right now about how best to detect so-called ‘off-target effects,’” said Hochstrasser. “This is what happens when the [Cas9] protein cuts somewhere similar to where you want it to cut.” Off-target cuts could lead to unexpected genetic problems that cause an embryo to die. An edit in the wrong gene could also create an entirely new genetic disease that would be passed onto future generations. Even using CRISPR-Cas9 to modify mosquitoes and other insects raises safety concerns — like what happens when you make large-scale changes to an ecosystem or a trait in a population that gets out of control. There are also many ethical issues that come with modifying human embryos. So will CRISPR-Cas9 help rid the world of disease? There’s no doubt that it will make a sizeable dent in many diseases, but it’s unlikely to cure all of them any time soon. We already have tools for avoiding genetic diseases — like early genetic screening of fetuses and embryos — but these are not universally used. “We still don’t avoid tons of genetic diseases, because a lot of people don’t know that they harbor mutations that can be inherited,” said Hochstrasser. Some genetic mutations also happen spontaneously. This is the case with many cancers that result from environmental factorsTrusted Source such as UV rays, tobacco smoke, and certain chemicals. People also make choices that increase their risk of heart disease, stroke, obesity, and diabetes. So unless scientists can use CRISPR-Cas9 to find treatments for these lifestyle diseases — or genetically engineer people to stop smoking and start biking to work — these diseases will linger in human society. “Things like that are always going to need to be treated,” said Hochstrasser. “I don’t think it’s realistic to think we would ever prevent every disease from happening in a human.”

#### No extinction from pandemics

* Death rates as high as 50% didn’t collapse civilization
* Fossil fuel record caps risk at .1% per century
* health, sanitation, medicine, science, public health bodies, solve
* viruses can’t survive in all locations
* refugee populations like tribes, remote researchers, submarine crews, solve

Ord 20 Ord, Toby. Toby David Godfrey Ord (born 18 July 1979) is an Australian philosopher. He founded Giving What We Can, an international society whose members pledge to donate at least 10% of their income to effective charities and is a key figure in the effective altruism movement, which promotes using reason and evidence to help the lives of others as much as possible.[3] He is a Senior Research Fellow at the University of Oxford's Future of Humanity Institute, where his work is focused on existential risk. BA in Phil and Comp Sci from Melbourne, BPhil in Phil from Oxford, PhD in Phil from Oxford. The precipice: existential risk and the future of humanity. Hachette Books, 2020.

Are we safe now from events like this? Or are we more vulnerable? Could a pandemic threaten humanity’s future?10 The Black Death was not the only biological disaster to scar human history. It was not even the only great bubonic plague. In 541 CE the Plague of Justinian struck the Byzantine Empire. Over three years it took the lives of roughly 3 percent of the world’s people.11 When Europeans reached the Americas in 1492, the two populations exposed each other to completely novel diseases. Over thousands of years each population had built up resistance to their own set of diseases, but were extremely susceptible to the others. The American peoples got by far the worse end of exchange, through diseases such as measles, influenza and especially smallpox. During the next hundred years a combination of invasion and disease took an immense toll—one whose scale may never be known, due to great uncertainty about the size of the pre-existing population. We can’t rule out the loss of more than 90 percent of the population of the Americas during that century, though the number could also be much lower.12 And it is very difficult to tease out how much of this should be attributed to war and occupation, rather than disease. As a rough upper bound, the Columbian exchange may have killed as many as 10 percent of the world’s people.13 Centuries later, the world had become so interconnected that a truly global pandemic was possible. Near the end of the First World War, a devastating strain of influenza (known as the 1918 flu or Spanish Flu) spread to six continents, and even remote Pacific islands. At least a third of the world’s population were infected and 3 to 6 percent were killed.14 This death toll outstripped that of the First World War, and possibly both World Wars combined. Yet even events like these fall short of being a threat to humanity’s longterm potential.15 In the great bubonic plagues we saw civilization in the affected areas falter, but recover. The regional 25 to 50 percent death rate was not enough to precipitate a continent-wide collapse of civilization. It changed the relative fortunes of empires, and may have altered the course of history substantially, but if anything, it gives us reason to believe that human civilization is likely to make it through future events with similar death rates, even if they were global in scale. The 1918 flu pandemic was remarkable in having very little apparent effect on the world’s development despite its global reach. It looks like it was lost in the wake of the First World War, which despite a smaller death toll, seems to have had a much larger effect on the course of history.16 It is less clear what lesson to draw from the Columbian exchange due to our lack of good records and its mix of causes. Pandemics were clearly a part of what led to a regional collapse of civilization, but we don’t know whether this would have occurred had it not been for the accompanying violence and imperial rule. The strongest case against existential risk from natural pandemics is the fossil record argument from Chapter 3. Extinction risk from natural causes above 0.1 percent per century is incompatible with the evidence of how long humanity and similar species have lasted. But this argument only works where the risk to humanity now is similar or lower than the longterm levels. For most risks this is clearly true, but not for pandemics. We have done many things to exacerbate the risk: some that could make pandemics more likely to occur, and some that could increase their damage. Thus even “natural” pandemics should be seen as a partly anthropogenic risk. Our population now is a thousand times greater than over most of human history, so there are vastly more opportunities for new human diseases to originate.17 And our farming practices have created vast numbers of animals living in unhealthy conditions within close proximity to humans. This increases the risk, as many major diseases originate in animals before crossing over to humans. Examples include HIV (chimpanzees), Ebola (bats), SARS (probably bats) and influenza (usually pigs or birds).18 Evidence suggests that diseases are crossing over into human populations from animals at an increasing rate.19 Modern civilization may also make it much easier for a pandemic to spread. The higher density of people living together in cities increases the number of people each of us may infect. Rapid long-distance transport greatly increases the distance pathogens can spread, reducing the degrees of separation between any two people. Moreover, we are no longer divided into isolated populations as we were for most of the last 10,000 years.20 Together these effects suggest that we might expect more new pandemics, for them to spread more quickly, and to reach a higher percentage of the world’s people. But we have also changed the world in ways that offer protection. We have a healthier population; improved sanitation and hygiene; preventative and curative medicine; and a scientific understanding of disease. Perhaps most importantly, we have public health bodies to facilitate global communication and coordination in the face of new outbreaks. We have seen the benefits of this protection through the dramatic decline of endemic infectious disease over the last century (though we can’t be sure pandemics will obey the same trend). Finally, we have spread to a range of locations and environments unprecedented for any mammalian species. This offers special protection from extinction events, because it requires the pathogen to be able to flourish in a vast range of environments and to reach exceptionally isolated populations such as uncontacted tribes, Antarctic researchers and nuclear submarine crews. 21 It is hard to know whether these combined effects have increased or decreased the existential risk from pandemics. This uncertainty is ultimately bad news: we were previously sitting on a powerful argument that the risk was tiny; now we are not. But note that we are not merely interested in the direction of the change, but also in the size of the change. If we take the fossil record as evidence that the risk was less than one in 2,000 per century, then to reach 1 percent per century the pandemic risk would need to be at least 20 times larger. This seems unlikely. In my view, the fossil record still provides a strong case against there being a high extinction risk from “natural” pandemics. So most of the remaining existential risk would come from the threat of permanent collapse: a pandemic severe enough to collapse civilization globally, combined with civilization turning out to be hard to re-establish or bad luck in our attempts to do so.

#### Humans are too dispersed and disease trends against lethality

Sebastian Farquhar 17, director at Oxford's Global Priorities Project, Owen Cotton-Barratt, a Lecturer in Mathematics at St Hugh’s College, Oxford, John Halstead, Stefan Schubert, Haydn Belfield, Andrew Snyder-Beattie, "Existential Risk Diplomacy and Governance", GLOBAL PRIORITIES PROJECT 2017, 1/23/2017, https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf

1.1.3 Engineered pandemics For most of human history, natural pandemics have posed the greatest risk of mass global fatalities.37 However, there are some reasons to believe that natural pandemics are very unlikely to cause human extinction. Analysis of the International Union for Conservation of Nature (IUCN) red list database has shown that of the 833 recorded plant and animal species extinctions known to have occurred since 1500, less than 4% (31 species) were ascribed to infectious disease.38 None of the mammals and amphibians on this list were globally dispersed, and other factors aside from infectious disease also contributed to their extinction. It therefore seems that our own species, which is very numerous, globally dispersed, and capable of a rational response to problems, is very unlikely to be killed off by a natural pandemic. One underlying explanation for this is that highly lethal pathogens can kill their hosts before they have a chance to spread, so there is a selective pressure for pathogens not to be highly lethal. Therefore, pathogens are likely to co-evolve with their hosts rather than kill all possible hosts.39

#### Containment solves---it’s more effective than vaccination

Bryan **Walsh 17**, Bryan Walsh is a contributor to TIME. Previously, he was TIME’s International Editor, its energy and environmental correspondent and was the Tokyo bureau chief in 2006 and 2007. 5-4-2017, "The Next Global Security Threat Isn’t What You Think," Time, http://time.com/4766624/next-global-security/

No disease better illustrates the need for a next-gen vaccine than influenza. "We need to do better with flu vaccine," says Dr. Anthony Fauci, director of the NIH National Institute of Allergy and Infectious Diseases. A healthy market exists for the seasonal-flu vaccine, but because the influenza virus constantly mutates, a new version has to be made each year, a process that takes months. That lag could be deadly during a severe influenza pandemic. Humans have little to no immune protection against new flu strains, which then spread rapidly around the world and--sometimes--cause severe disease. And though the flu usually isn't deadly for otherwise healthy people, it can be, as the 1918 pandemic showed. While flu vaccines didn't exist in 1918, they did in 2009, when a new flu strain jumped from pigs to people and ultimately killed an estimated 203,000 people around the world, a majority of them under the age of 65. Efforts were made to fast-track a vaccine, but the first doses weren't available for 26 weeks, and it would have taken a year to produce vaccines for every American. Since it can require years of testing and well over $1 billion to successfully develop a single vaccine against a single pathogen, drug companies have increasingly shied away from the business. "There's just no incentive for any company to make pandemic vaccine to store on shelves," says Dr. Trevor Mundel, president of the global health division at the Bill and Melinda Gates Foundation. That's why most infectious-disease experts aren't hanging their hopes solely on new treatments or vaccines. After all, that's not what ultimately contained the most recent lethal outbreak of Ebola. It chiefly fell to health workers on the ground and to Frieden, director of the CDC for eight years under President Obama. And on no day did that effort come closer to failure than on July 23, 2014. That was the day Frieden received news that Ebola had arrived in the Nigerian megacity of Lagos. The virus had been killing people for months in Guinea, Liberia and Sierra Leone, but Ebola in Lagos--the biggest city on the African continent, with a metro population of 21 million--represented a threat of an entirely different magnitude. "If it got out of control in Lagos, it could spread through Nigeria and the rest of Africa," says Frieden. "It could still be going on today." But it isn't, thanks largely to the herculean efforts of thousands of expert health workers--U.S. staff from the CDC and Nigerian officials who had been trained in the international effort to stop polio--who were quickly diverted to fight Ebola. This is why Frieden, Gates and others are so bullish about investing in science and foreign aid. Without aid, Nigeria would not have been able to stem the spread of Ebola. And without the next-generation science that helped track the outbreak, far more people would have died. "It's very important that this kind of work continues," says Frieden, "or America is going to be less safe." Make no mistake: for all our high-tech isolation units, top-tier doctors and world-class scientists, the U.S. health care system is not ready for the stresses of a major pandemic. As the infectious-disease expert Osterholm notes, a pandemic is not like other natural disasters, which tend to be confined to a single location or region. Disease can strike everywhere at once. In the event of a pandemic, even the best hospitals could rapidly run out of beds and mechanical ventilators.