## T -- Reduce

#### Interpretation: Reduce means unconditional and permanent – the aff is a suspension.

Reynolds 59 – Judge (In the Matter of Doris A. Montesani, Petitioner, v. Arthur Levitt, as Comptroller of the State of New York, et al., Respondents [NO NUMBER IN ORIGINAL] Supreme Court of New York, Appellate Division, Third Department 9 A.D.2d 51; 189 N.Y.S.2d 695; 1959 N.Y. App. Div. LEXIS 7391 August 13, 1959, lexis)

Section 83's counterpart with regard to nondisability pensioners, section 84, prescribes a reduction only if the pensioner should again take a public job. The disability pensioner is penalized if he takes any type of employment. The reason for the difference, of course, is that in one case the only reason pension benefits are available is because the pensioner is considered incapable of gainful employment, while in the other he has fully completed his "tour" and is considered as having earned his reward with almost no strings attached. It would be manifestly unfair to the ordinary retiree to accord the disability retiree the benefits of the System to which they both belong when the latter is otherwise capable of earning a living and had not fulfilled his service obligation. If it were to be held that withholdings under section 83 were payable whenever the pensioner died or stopped his other employment the whole purpose of the provision would be defeated, i.e., the System might just as well have continued payments during the other employment since it must later pay it anyway.  [\*\*\*13]  The section says "reduced", does not say that monthly payments shall be temporarily suspended; it says that the pension itself shall be reduced. The plain dictionary meaning of the word is to diminish, lower or degrade. The word "reduce" seems adequately to indicate permanency.

#### Violation – the plan advocates a delay in enforcement, their own sovelncy advocates prove they leverage offense from the fact that they still grant cannabis patents they just do it later

#### Vote neg:

#### 1] Precision – Our definition is most precise which is the biggest internal link to predictability - anything else justifies the aff arbitrarily jettisoning words in the resolution which is the only stasis point we know before the round.

#### 2] Limits and ground– their model allows affs to defend anything from pandemics to Biden’s presidency— there's no universal DA since it’s impossible to know the timeframe when there won’t be IP— that explodes neg prep and leads to random timeframe of the week affs which makes cutting stable neg links impossible — limits key to reciprocal engagement since they create a caselist for neg prep (innovation, collaboration, econ, ptx: all core neg literature thrown away) – controls the internal link to iterative testing and argument refinement

#### 3] TVA solves all of their offense – defend your advantage with a plan text of permanently reducing ip protections for cannabis.

#### DTD on T bc it skewed the entire round – it’s a question of whether or not the aff should have been read in the first place.

#### No RVIs – they’re illogical, you don’t win for being topical

#### Competing interpretations – reasonability is arbitrary and causes judge intervention, leads to a race to the bottom where debaters push the boundaries of what is reasonable in order to justify infinite abuse

## HIF CP

#### Counterplan text: the member nations of the World Trade Organization should implement and fund a Health Impact Fund as per the Hollis and Pogge 08 card

#### The Health Impact Fund would guarantee patent rights and increase profits, while also equalizing the cost of medicines

Hollis & Pogge ’08 - Aidan Hollis [Associate Professor of Economics, the University of Calgary] and Thomas Pogge [Leitner Professor of Philosophy and International Affairs, Yale University], “The Health Impact Fund Making New Medicines Accessible for All,” *Incentives for Global Health* (2008) AT

We propose the Health Impact Fund as the most sensible solution that comprehensively addresses the problems. Financed by governments, the HIF would offer patentees the option to forgo monopoly pricing in exchange for a reward based on the global health impact of their new medicine. By registering a patented medicine with the HIF, a company would agree to sell it globally at cost. In exchange, the company would receive, for a fixed time, payments based on the product’s assessed global health impact. The arrangement would be optional and it wouldn’t diminish patent rights.¶ The HIF has the potential to be an institution that benefits everyone: patients, rich and poor alike, along with their caregivers; pharmaceutical companies and their shareholders; and taxpayers.¶ HOW THE HEALTH IMPACT FUND WORKS FOR PATIENTS¶ The HIF increases the incentives to invest in developing medicines that have high health impact. It directs research toward the medicines that can do the most good. It can also reward the development of new products, and the discovery of new uses for existing products, which the patent system alone can’t stimulate because of inadequate protection from imitation. All patients, rich and poor, would benefit from refocusing the innovation and marketing priorities of pharmaceutical companies toward health impact.¶ Any new medicines and new uses of existing medicines registered for health impact rewards would be available everywhere at marginal cost from the start. Many patients – especially in poor countries, but increasingly in wealthy ones too – are unable to afford the best treatment because it is too expensive. Even if fully insured, patients oft en lack access to medicines because their insurer deems them too expensive to reimburse. The HIF simply and directly solves this problem for registered drugs by setting their prices at marginal cost.¶ HOW THE HEALTH IMPACT FUND WORKS FOR PHARMACEUTICAL COMPANIES¶ Most proposals for increasing access to medicines would reduce the profits of pharmaceutical companies and hence their ability to fund research. The HIF, however, leaves the existing options of pharmaceutical firms untouched. It merely gives them the opportunity to make additional profits by developing new high-impact medicines that would be unprofitable or less profitable under monopoly pricing. Selling such registered medicines at cost, firms won’t be forced to defend a policy of charging high prices to poor people and they won’t be pressured to make charitable donations. With HIF-registered medicines they can instead “do well by doing good”: bring real benefit to patients in a profitable way. Research scientists of these firms will be encouraged to focus on addressing the most important diseases, not merely those that can support high prices.¶ HOW THE HEALTH IMPACT FUND WORKS FOR TAXPAYERS¶ The HIF will be supported mainly by governments, which are supported by the taxes they collect. Taxpayers want value for their money, and the HIF provides exactly that. Because the HIF is a more efficient way of incentivizing the pharmaceutical R&D we all want, total expenditures on medicines need not increase. However, if they do, the reason is that new medicines that would not have existed without the HIF are being developed. The HIF mechanism is designed to ensure that taxpayers always obtain value for money in the sense that any product regis-tered with the HIF will have a lower cost for a given amount of health impact than products outside the HIF. Taxpayers may also benefit from a reduction in risks of pandemics and other health problems that easily cross national borders.

## Innovation DA

#### The pharma industry is strong now but patents are key for continued economic growth. Batell and PhRMA 14:

Batell and PhRMA {Battelle is the world’s largest nonprofit independent research and development organization, providing innovative solutions to the world’s most pressing needs through its four global businesses: Laboratory Management, National Security, Energy, Environment and Material Sciences, and Health and Life Sciences. The Pharmaceutical Research and Manufacturers of America (PhRMA) represents the country’s leading pharmaceutical research and biotechnology companies, which are devoted to inventing medicines that allow patients to live longer, healthier, and more productive lives.}, 14 – “The U.S. Biopharmaceutical Industry: Perspectives on Future Growth and The Factors That Will Drive It,” http://phrma-docs.phrma.org/sites/default/files/pdf/2014-economic-futures-report.pdf//marlborough-wr//

Compared to other capital-intensive, advanced manufacturing industries in the U.S., the biopharmaceutical industry is a leader in R&D investment, IP generation, venture capital investment, and R&D employment. Policies and infrastructure that helped foster these innovative activities have allowed the U.S. to seize global leadership in biopharmaceutical R&D over the past 30 years. However, as this report details, other countries are seeking to compete with the U.S. by borrowing and building upon some of these pro-innovation policies to improve their own operating environment and become more favorable to biopharmaceutical companies making decisions about where to locate their R&D and manufacturing activities. A unique contribution of this report was the inclusion of the perspective of senior-level strategic planning executives of biopharmaceutical companies regarding what policy areas they see as most likely to impact the favorability of the U.S. business operating environment. The executives cited the following factors as having the most impact on the favorability of the operating environment and hence, potential growth of the innovative biopharmaceutical industry in the U.S.: • Coverage and payment policies that support and encourage medical innovation • A well-functioning, science-based regulatory system • Strong IP protection and enforcement in the U.S. and abroad The top sub-attribute identified as driving future biopharmaceutical industry growth in the U.S. cited by executives was a domestic IP system that provides adequate patent rights and data protection. Collectively, these factors underscore the need to reduce uncertainties and ensure adequate incentives for the lengthy, costly, and risky R&D investments necessary to develop new treatments needed by patients and society to address our most costly and challenging diseases. With more than 300,000 jobs at stake between the two scenarios, the continued growth and leadership of the U.S. innovative biopharmaceutical industry cannot be taken for granted. Continued innovation is fundamental to U.S. economic well-being and the nation’s ability to compete effectively in a globalized economy and to take advantage of the expected growth in demand for new medicines around the world. Just as other countries have drawn lessons from the growth of the U.S. biopharmaceutical sector, the U.S. needs to assess how it can improve the environment for innovation and continue to boost job creation by increasing R&D investment, fostering a robust talent pool, enhancing economic growth and sustainability, and continuing to bring new medicines to patients.

#### COVID has kept patents and innovation strong, but continued protection is key to innovation by incentivizing biomedical research – it’s also crucial to preventing counterfeit medicines, economic collapse, and fatal diseases, which independently turns case. Macdole and Ezell 4-29:

Jaci Mcdole and Stephen Ezell {Jaci McDole is a senior policy analyst covering intellectual property (IP) and innovation policy at the Information Technology and Innovation Foundation (ITIF). She focuses on IP and its correlations to global innovation and trade. McDole holds a double BA in Music Business and Radio-Television with a minor in Marketing, an MS in Education, and a JD with a specialization in intellectual property (Southern Illinois University Carbondale). McDole comes to ITIF from the Institute for Intellectual Property Research, an organization she co-founded to study and further robust global IP policies. Stephen Ezell is vice president, global innovation policy, at the Information Technology and Innovation Foundation (ITIF). He comes to ITIF from Peer Insight, an innovation research and consulting firm he cofounded in 2003 to study the practice of innovation in service industries. At Peer Insight, Ezell led the Global Service Innovation Consortium, published multiple research papers on service innovation, and researched national service innovation policies being implemented by governments worldwide. Prior to forming Peer Insight, Ezell worked in the New Service Development group at the NASDAQ Stock Market, where he spearheaded the creation of the NASDAQ Market Intelligence Desk and the NASDAQ Corporate Services Network, services for NASDAQ-listed corporations. Previously, Ezell cofounded two successful innovation ventures, the high-tech services firm Brivo Systems and Lynx Capital, a boutique investment bank. Ezell holds a B.S. from the School of Foreign Service at Georgetown University, with an honors certificate from Georgetown’s Landegger International Business Diplomacy program.}, 21 - ("Ten Ways Ip Has Enabled Innovations That Have Helped Sustain The World Through The Pandemic," Information Technology & Innovation Foundation, 4-29-2021, https://itif.org/publications/2021/04/29/ten-ways-ip-has-enabled-innovations-have-helped-sustain-world-through)//marlborough-wr/

To better understand the role of IP in enabling solutions related to COVID-19 challenges, this report relies on 10 case studies drawn from a variety of nations, technical fields, and firm sizes. This is but a handful of the thousands of IP-enabled innovations that have sprung forth over the past year in an effort to meet the tremendous challenges brought on by COVID-19 globally. From a paramedic in Mexico to a veteran vaccine manufacturing company in India and a tech start-up in Estonia to a U.S.-based company offering workplace Internet of Things (IoT) services, small and large organizations alike are working to combat the pandemic. Some have adapted existing innovations, while others have developed novel solutions. All are working to take the world out of the pandemic and into the future. The case studies are: Bharat Biotech: Covaxin Gilead: Remdesivir LumiraDX: SARS-COV-2 Antigen POC Test Teal Bio: Teal Bio Respirator XE Ingeniería Médica: CápsulaXE Surgical Theater: Precision VR Tombot: Jennie Starship Technologies: Autonomous Delivery Robots Triax Technologies: Proximity Trace Zoom: Video Conferencing As the case studies show, IP is critical to enabling innovation. Policymakers around the world need to ensure robust IP protections are—and remain—in place if they wish their citizens to have safe and innovative solutions to health care, workplace, and societal challenges in the future. THE ROLE OF INTELLECTUAL PROPERTY IN R&D-INTENSIVE INDUSTRIES Intangible assets, such as IP rights, comprised approximately 84 percent of the corporate value of S&P 500 companies in 2018.4 For start-ups, this means much of the capital needed to operate is directly related to IP (see Teal Bio case study for more on this). IP also plays an especially important role for R&D-intensive industries.5 To take the example of the biopharmaceutical industry, it is characterized by high-risk, time-consuming, and expensive processes including basic research, drug discovery, pre-clinical trials, three stages of human clinical trials, regulatory review, and post-approval research and safety monitoring. The drug development process spans an average of 11.5 to 15 years.6 For every 5,000 to 10,000 compounds screened on average during the basic research and drug discovery phases, approximately 250 molecular compounds, or 2.5 to 5 percent, make it to preclinical testing. Out of those 250 molecular compounds, approximately 5 make it to clinical testing. That is, 0.05 to 0.1 percent of drugs make it from basic research into clinical trials. Of those rare few which make it to clinical testing, less than 12 percent are ultimately approved for use by the U.S. Food and Drug Administration (FDA).7 In addition to high risks, drug development is costly, and the expenses associated with it are increasing. A 2019 report by the Deloitte Center for Health Solutions concluded that since 2010 the average cost of bringing a new drug to market increased by 67 percent.8 Numerous studies have examined the substantial cost of biopharmaceutical R&D, and most confirm investing in new drug development requires $1.7 billion to $3.2 billion up front on average.9 A 2018 study by the Coalition for Epidemic Preparedness found similar risks and figures for vaccines, stating, “In general, vaccine development from discovery to licensure can cost billions of dollars, can take over 10 years to complete, and has an average 94 percent chance of failure.”10 Yet, a 2010 study found that 80 percent of new drugs—that is, the less than 12 percent ultimately approved by the FDA—made less than their capitalized R&D costs.11 Another study found that only 1 percent (maybe three new drugs each year) of the most successful 10 percent of FDA approved drugs generate half of the profits of the entire drug industry.12 To say the least, biopharmaceutical R&D represents a high-stakes, long-term endeavor with precarious returns. Without IP protection, biopharmaceutical manufacturers have little incentive to take the risks necessary to engage in the R&D process because they would be unable to recoup even a fraction of the costs incurred. Diminished revenues also result in reduced investments in R&D which means less research into cancer drugs, Alzheimer cures, vaccines, and more. IP rights give life-sciences enterprises the confidence needed to undertake the difficult, risky, and expensive process of life-sciences innovation secure in the knowledge they can capture a share of the gains from their innovations, which is indispensable not only to recouping the up-front R&D costs of a given drug, but which can generate sufficient profits to enable investment in future generations of biomedical innovation and thus perpetuate the enterprises into the future.13 THE IMPORTANCE OF INTELLECTUAL PROPERTY TO INNOVATION Although anti-IP proponents have attacked biopharmaceutical manufacturers particularly hard, the reality is all IP-protected innovations are at risk if these rights are ignored, or vitiated. Certain arguments have shown a desire for the term “COVID-19 innovations” to include everything from vaccines, therapeutics, diagnostics, and PPE to biotechnology, AI-related data, and educational materials.14 This could potentially open the floodgates to invalidate IP protection on many of the innovations highlighted in this report. However, much of the current discussion concerning IP focuses almost entirely on litigation fears or R&D incentives. Although R&D is an important aspect of IP, as previously mentioned, these discussions ignore the fact that IP protection can be—and often is—used for other purposes, including generating initial capital to create a company and begin manufacturing and, more importantly, using licensing agreements and IP to track the supply chain and ensure quality control of products. This report highlights but a handful of the thousands of IP-enabled innovations that have sprung forth over the past year in an effort to meet the tremendous challenges brought on by COVID-19 globally. In 2018, Forbes identified counterfeiting as the largest criminal enterprise in the world.15 The global struggle against counterfeit and non-regulated products, which has hit Latin America particularly hard during the pandemic, proves the need for safety and quality assurance in supply chains.16 Some communities already ravaged by COVID-19 are seeing higher mortality rates related to counterfeit vaccines, therapeutics, PPE, and cleaning and sanitizing products.17 Polish authorities discovered vials of antiwrinkle treatment labeled as COVID-19 vaccines. 18 In Mexico, fake vaccines sold for approximately $1,000 per dose.19 Chinese and South African police seized thousands of counterfeit vaccine doses from warehouses and manufacturing plants.20 Meanwhile, dozens of websites worldwide claiming to sell vaccines or be affiliated with vaccine manufacturers have been taken down.21 But the problem is not limited to biopharmaceuticals. The National Intellectual Property Rights Coordination Center has recovered $48 million worth of counterfeit PPE and other products.22 Collaborative efforts between law enforcement and manufacturers have kept numerous counterfeits from reaching the population. In countries with strong IP protection, the chances of counterfeit products reaching the market are significantly lower. This is largely because counterfeiting tends to be an IP-related issue, and these countries generally provide superior means of tracking the supply chain through trademarks, trade secrets, and licensing agreements. This enables greater quality control and helps manufacturers maintain a level of public confidence in their products. By controlling the flow of knowledge associated with IP, voluntary licensing agreements provide innovators with opportunities to collaborate, while ensuring their partners are properly equipped and capable of producing quality products. Throughout this difficult time, the world has seen unexpected collaborations, especially between biopharmaceutical companies worldwide such as Gilead and Eva Pharma or Bharat Biotech and Ocugen, Inc. Throughout history, and most significantly in the nineteenth century through the widespread development of patent systems and the ensuing Industrial Revolution, IP has contributed toward greater economic growth.23 This is promising news as the world struggles for economic recovery. A 2021 joint study by the EU Intellectual Property Office (EUIPO) and European Patent Office (EPO) shows a strong, positive correlation between IP rights and economic performance.24 It states that “IP-owning firms represent a significantly larger proportion of economic activity and employment across Europe,” with IP-intensive industries contributing to 45 percent of gross domestic product (GDP) (€6.6 trillion; US$7.9 trillion).25 The study also shows 38.9 percent of employment is directly or indirectly attributed to IP-intensive industries, and IP generates higher wages and greater revenue per employee, especially for small-to-medium-sized enterprises.26 That concords with the United States, where the Department of Commerce estimated that IP-intensive industries support at least 45 million jobs and contribute more than $6 trillion dollars to, or 38.2 percent of, GDP.27 In 2020, global patent filings through the World Intellectual Property Organization’s (WIPO) Patent Cooperation Treaty (PCT) system reached a record 275,900 filings amidst the pandemic, growing 4 percent from 2019.28 The top-four nations, which accounted for 180,530 of the patent applications, were China, the United States, Japan, and Korea, respectively.29 While several countries saw an increase in patent filings, Saudi Arabia and Malaysia both saw significant increases in the number of annual applications, with the top two filing growths of 73 percent and 26 percent, respectively.30 The COVID-19 pandemic slowed a lot of things, but it certainly couldn’t stop innovation. There are at least five principal benefits strong IP rights can generate, for both developing and developed countries alike.31 First, stronger IP protection spurs the virtuous cycle of innovation by increasing the appropriability of returns, enabling economic gain and catalyzing economic growth. Second, through patents—which require innovators to disclose certain knowledge as a condition of protection—knowledge spillovers build a platform of knowledge that enables other innovators. For instance, studies have found that the rate of return to society from corporate R&D and innovation activities is at least twice the estimated returns that each company itself receives.32 Third, countries with robust IP can operate more efficiently and productively by using IP to determine product quality and reduce transaction costs. Fourth, trade and foreign direct investment enabled and encouraged by strong IP protection offered to enterprises from foreign countries facilitates an accumulation of knowledge capital within the destination economy. That matters when foreign sources of technology account for over 90 percent of productivity growth in most countries.33 There’s also evidence suggesting that developing nations with stronger IP protections enjoy the earlier introduction of innovative new medicines.34 And fifth, strong IP boosts exports, including in developing countries.35 Research shows a positive correlation between stronger IP protection and exports from developing countries as well as faster growth rates of certain industries.36 The following case studies illustrate these benefits of IP and how they’ve enabled innovative solutions to help global society navigate the COVID-19 pandemic.

#### Cannabis is an especially expensive industry to enter

Kathryn Hardison {reporter}, 19 - ("With marijuana startups, a green thumb comes at a cost," Springfield Business Journal, 11-4-2019, https://sbj.net/stories/with-marijuana-startups-a-green-thumb-comes-at-a-cost,66297)//marlborough-wr/

Vying for a spot in the medical marijuana industry comes with a large buy-in.¶ Before a state application can be considered, these entrepreneurs must secure a location, assemble investors – because they can’t get a business loan – develop a medical team, hire an architect to create renderings of their potential business, determine a security plan for the high-dollar products and complete the application paperwork – or hire someone else to do it. That alone could cost $60,000-$100,000 a pop.¶ Then, they pay the $6,000-$10,000 application fee, depending on the license sought: dispensary, cultivation or infused-product manufacturing.¶ And that’s just the beginning.¶ Though medical marijuana may be a lucrative business, those with their eyes on the Springfield market know the return on investment is slow and the profit margins of 10%-20% is less than some expect.¶ Jamie Tillman, owner of CBD operator CannaBliss LLC, hopes to open three medical marijuana dispensaries in 2020. After her dispensary is built at 1109 E. Battlefield Road, Tillman will have invested $1 million along with her two silent partners in the application process.¶ Tillman says she expects her profit margin to be about 20% after the many factors she anticipates taking their piece of the pie.¶ So, what are the financials behind a medical marijuana business?¶ Operating costs¶ A medical marijuana business, like a dispensary, incurs similar operating costs as other companies – just on a larger scale, said Marshall Marquardt, chief operations officer of Colorado-based Apothecary Farms. The company applied for 11 licenses in Missouri, according to past Springfield Business Journal reporting.¶ Marquardt said labor for an Apothecary Farms dispensary costs over $250,000. That covers 10-15 employees, an assistant manager and manager, he said.¶ Tillman said the Missouri application required her to have a medical team in place outside of her planned employees.¶ “You have to have a pharmacist, a medical director, a security adviser, and then anything else you can round up is perks,” Tillman said. “Usually, to get these people on your team, you have to give them a percentage of your business, which is what a lot of people have done – or you pay them.”¶ Marquardt said another large portion of the company’s operating cost goes to the security systems, noting each dispensary has over 100 security cameras, running off Wi-Fi. He cited security costs of over $100,000 per site.¶ “There’s a lot of other industries that will be positively impacted by cannabis,” Marquardt said, citing security and power companies.¶ Wendy Coy, chief operations manager at Midwest Security Inc. in Springfield, expects the burgeoning industry to be good for business. She said at least a dozen applicants have asked for a quote from Midwest Security for a 24-hour security guard. Many of these entrepreneurs are hopeful to open multiple locations across the state, Coy said.¶ “Most of the applicants will need one guard at a time, depending on the alarm systems that they will have in place,” Coy said. “Figuring 24-hour shifts, it would be around $219,000 a year per location.”¶ Then, there’s the product.¶ If she receives a license, Tillman said she’s budgeted close to $400,000 in furnishings, like display cabinets, and expects the initial marijuana product to cost $350,000 per dispensary location. She said it’s likely that her budget will change once product is grown in the state.¶ “No one knows what the going rate will be, because no one knows what our surplus will be because cultivators aren’t here,” Tillman said. “This is just throwing a dart at the board.”¶ Cultivators also have to fund the laboratory setting required by the state. According to past SBJ reporting, it could cost organizers of Springfield-based The Wholesome Bud Co. LLC about $70 per square foot of a cultivation building to create the laboratory – including lights, tables and HVAC. They’ll also need video cameras with two views on every plant.¶ The Wholesome Bud team projects an investment of $3 million-$5 million by the end of 2020 with help from angel investors to meet their business plan.¶ Banking and marijuana¶ As to how and where the marijuana business income will be processed, Tillman has to laugh: “That’s to be decided.”¶ That’s because it’s technically illegal for a bank to do business with a company that sells a Schedule I drug, said Shaun Burke, president and CEO of Guaranty Federal Bancshares Inc. (Nasdaq: GFED). It signals money laundering, he said.¶ There could be regulatory relief soon, however. The U.S. House of Representatives recently passed the Secure and Fair Enforcement Act, which would help regulate relationships between banks and marijuana-related businesses. It’s now awaiting approval from the Senate.¶ Until then, most Federal Deposit Insurance Corp. insured banks won’t do business with marijuana companies, Burke said. The few that do, however, can name their price.¶ “The reality is that some banks are banking (marijuana-related businesses), and they’re just not saying it,” Burke said, drawing on his experience as past chairman of the Missouri Bankers Association. “There are banks choosing to do it because right now they can charge anything they want to.”¶ Marquardt said it can cost $5,000-$15,000 to open a checking account with a bank in Colorado. Burke said he’s heard of other banks charging upwards of $10,000.¶ On top of that, Marquardt said Apothecary Farms is charged $2,500 a month just to keep an account open.¶ The limited access to banking also means many state-legal marijuana businesses nationwide are having to operate as a cash-only enterprise. Marquardt said that requires businesses to hire armed car services to transport money, which could cost as much as $100,000 a year, based on frequency.

#### Biotech collapse wrecks the economy

Carlson 16, Robert Carlson is the managing Director at Bioeconomy Capital, “Estimating the biotech sector's contribution to the US economy”, Nature Biotechnology 34, 247–255 (2016), http://www.nature.com/nbt/journal/v34/n3/full/nbt.3491.html?WT.feed\_name=subjects\_business&foxtrotcallback=true#author-information

Biotech is now a major contributor to the US economy. When considered as an industry in itself, biotech and its economic impact rivals mining, utilities, chemicals and computing and electronics. Internationally, at least 20 countries have articulated strategies that explicitly identify biotech as critical to their future economic and employment growth1. Given this focus on economic development, it is crucial to better define the current systemic role of biotech. Moreover, ongoing discussions of funding and investment, benefit and risk, and opportunity and threat all would benefit from a more detailed understanding of where biotech is and where it is headed. In this article, I use data collected from a variety of public and private sources to assemble an initial economic assessment of biotech in the United States as a test case for an analysis at the global level. What emerges is a picture of a sector already making a remarkable and accelerating transformation of the US economy. By my estimate, total domestic US revenues generated by biotech in 2012 reached at least $324 billion—the equivalent of >2% of gross domestic product (GDP; for comparison, see Supplementary Table 1 for a list of selected industries and their contributions to US GDP). The estimate is intended to be conservative; the actual total could be 10–20% higher. Total revenues comprise three biotech subsectors: biologics (drugs), at $91 billion; crops (and seeds), at $128 billion; and industrial products (biofuels, enzymes, biomaterials and biochemicals), at >$105 billion. Over the past decade, aggregate revenues have grown on average at annual rates >10%, much faster than the economy as a whole. Remarkably, biotech revenue growth was the equivalent of >5% of annual US GDP growth every year between 2007 and 2012. It is difficult to project exactly how large the biotech sector might ultimately become, but the trends indicate that biological technologies are likely to generate an increasing share of both GDP and annual GDP growth. What is biotech, and how can it be measured? Current understanding of the biotech sector is hampered by inconsistencies in usage and definition of 'biotechnology' and 'bioeconomy' in public discussion and in print. These words may be used in reference only to pharmaceuticals (or biopharmaceuticals or biologics, depending on one's definition), genetically modified (GM) crops, or public companies whose primary revenues rely on biological technologies, thereby muddling an integrated description of the industry (Box 1). Beyond linguistic imprecision, a lack of data resulting from inadequate characterization of the economy hampers any assessment of the economic size and scope of biotech. Even in the United States, the country with the largest biotech sector, there is no official mechanism to distinguish between products made through biology and products manufactured through other technologies. At present, for example, a chemical manufactured through biological technologies is treated identically to one derived from fossil petroleum. The biological product may displace the petroleum product from the market on the basis of price or preference, yet revenues now accrue to a category that includes petrochemicals. Under the current classification system, even revenues from novel biomolecules, including those that may outperform petroleum products, will be misattributed to fossil sources. The approach I take here differs from the frequently employed tactic of describing 'biotech industry' revenues on the basis only of financial reporting from public companies. For example, this journal's 'What's Fueling the Biotech Engine' series2 focuses exclusively on the metric of domestic US sales of drug products. Another annual Feature, 'Public Biotech by the Numbers'3, defines the biotech industry as including only the companies whose revenues are derived primarily from sales of biotech products, an approach similar to that of the annual 'Beyond Borders' reports by consultants Ernst and Young (New York). Defining the biotech sector on the basis of financial reporting of qualifying companies works only as long as those companies fit the scope of that definition. If a biotech company is acquired by a company outside the biotech sector (e.g., a big pharma or a chemical company), the relevant revenues from the biotech company's products 'disappear' from estimates based on companies in the industry—for example, in these analyses, product revenues from Genentech (S. San Francisco, CA, USA) are no longer counted toward the biotech industry because Genentech is now part of Roche (Basel, Switzerland), which is classified as a large pharmaceutical company. More broadly, the above industry analyses often focus predominantly on biotech enterprises engaged in biomedical markets; companies involved in crops (and seeds) or industrial bioproducts are often given comparatively scant attention. Quantifying biotech's economic contribution The economic impact of an industry is often based on its contribution to GDP (Supplementary Table 1). GDP is a national measure of economic output, which in the United States is calculated by the government using survey and census data. According to the US Census Bureau, “the North American Industrial Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the US business economy” (http://www.census.gov/eos/www/naics/index.html). The NAICS is used to segment the economy according to a list of six-digit codes that are reevaluated every five years. The resulting data serve as the basis for constructing GDP in one of three ways: the value added to the economy for each industry, total domestic income earned and final sales of domestic products to purchasers. The algorithms used to calculate GDP are adjusted over time, with refinements intended to sharpen understanding of how goods and services are exchanged to create value. In principle, then, biotech innovations can, like any other component of the US economy, be assessed through changes in the NAICS and GDP calculations. However, there is at present no means to calculate the contribution of biotech to GDP on the basis of the value added, total income or final sales methods. Despite the intention that “producing units that use the same or similar production processes are grouped together in NAICS,” the only NAICS code for biotech-related businesses is specifically meant to identify research and development entities, and it is associated with a very broad definition of biotech (Box 2 and http://www.census.gov/eos/www/naics/reference\_files\_tools/NAICS\_Update\_Process\_Fact\_Sheet.pdf). The only code associated with biological manufacturing of any kind is a subset of pharmaceutical production. Although biotech may nominally be used in various industries that do not obviously overlap (e.g., in the production of fuels or drugs), it comprises a coherent set of tools, skills and practices that together constitute similar production processes that are very different from synthetic chemistry or resource mining. At present, the vast majority of biotech product and service revenues are evidently collected into generic categories such as chemicals, agriculture and pharmaceuticals. Consequently, among other shortcomings, in the NAICS system, what is identified as 'biochemicals' (Fig. 1) conflates chemicals produced largely via fermentation with chemicals produced from petroleum or mining. This is but one example of misaggregation of biotech revenues with those generated from entirely unrelated production processes. n lieu of standardized data classified via the NAICS, how might one estimate the contribution of biotech to GDP? One starting point is industry revenue, corrected as is feasible to remove double counting (Box 1 and Supplementary Methods). For the present analysis, I relied largely on data from the following sources: corporate financial reporting, US Department of Agriculture (USDA) crop price and GM seed usage reporting, and private consulting firms. Because these data are of varying quality and quantity, I combined available hard data with trends and anecdotes to develop estimates. I argue here that the result is a reasonable approximation of the contribution of biotech to GDP. US biotech revenues The quantitative data used were derived primarily from financial reporting and market prices, and the estimates primarily from surveys, private consulting reports and numerical interpolation of sparse time series data (sources of uncertainty are detailed in Box 3). Because of differences in the regulatory structure and financing and, consequently, the pace of innovation across the industry, the biotech sector naturally breaks down into three subsectors: biologics (biotech drugs), GM crops or seeds and industrial biotech. Although biologics development is said to run faster than small-molecule pharmaceuticals, the cost for each is frequently estimated to be >$1 billion per drug, spent over 10 years of development and clinical trials4. GM crops may cost between $500 million and $700 million to develop, with field trials running 3–5 years, depending on whether those trials are conducted simultaneously in the southern and northern hemispheres4. Finally, industrial products may cost anywhere from tens to hundreds of millions of dollars to develop—depending in part on whether the physical infrastructure (i.e., 'steel in the ground') is included in the costs—and US regulatory barriers may be so low that only a notification letter to relevant authorities is required, meaning products can be marketed as soon as they are produced4, 5. Biologics. For this analysis, I define biologics as drugs produced using GM organisms; I explicitly exclude drugs purified from nonmodified organisms. On the basis of reporting from publicly traded companies, global 2012 revenues from biologics reached at least $125 billion; McKinsey and Company (New York) estimated that 2012 global biopharmaceuticals revenues may have been as high $168 billion6 (http://www.mckinsey.com/insights/health\_systems\_and\_services/rapid\_growth\_in\_biopharma) (Supplementary Table 2). Of that total, domestic US revenues from biologics reached $91 billion. This figure includes ~$28 billion in revenues accruing to such companies as Genentech and Genzyme (Cambridge, MA, USA) that are now wholly owned by overseas entities—Roche and Sanofi (Paris), respectively. Domestic US clinical sales of biologics rose >18%, reaching $63.6 billion in 2012 (ref. 2). Beyond drugs that are produced biologically, the contemporary development and testing of virtually all small-molecule prescription drugs is highly dependent on biotech. Of the ~$337 billion in total 2012 US pharmaceutical revenues, a large fraction of the small-molecule revenues relied heavily on biotechnologies used in discovery, validation and trials7. Further complicating this estimate is the challenge of accounting for the potential double-counting of 'biologics feedstocks' produced in the United States, as some fraction of those revenues is produced from exports, and ~75% of pharmaceutical ingredients used in the United States are imported from China8. Consequently, in the interest of simplicity and of using data that are relatively easy to come by, I have chosen to include here only 'nameplate' biologics revenues that are directly attributable to biological production, even though this probably underestimates the total relevant revenues by a substantial amount. GM crops. Global planting of GM crops increased by 6% in 2012, reaching a total of 170 million hectares9. In the United States, where farmers planted 40% of the total global GM crop area, GM corn, cotton and soy continued to have ~90% penetration, with GM sugar beets at 95%. Using average crop revenue figures and the fractions of crops planted in GM seed as compiled by the USDA, I estimate that the sum of farm-scale domestic US revenues, seeds and licensing revenues reached $128 billion (Fig. 2 and Supplementary Table 3). On the basis of the global acreage of GM crops as reported by the International Service for the Acquisition of Agri-biotech Applications, and assuming approximately uniform global prices, I estimate that 2012 global farm-scale revenues for GM crops were at least $300 billion9. How should the biotechnological contribution to GM crop revenues be valued? Until 2009, revenues from GM seeds alone were widely misreported as total “revenues from GM crops”10. Seeds, however, grow into larger organisms with greater value. Some of that value would be realized without the GM component. The US National Research Council (NRC) estimates that by planting GM crops, US farmers receive an additional economic benefit that ranges between 6% and 20% of total crop revenues, depending on the crop, where it is planted and how closely farmers follow recommended practices11. Cumulative 2000–2012 GM crop and seed revenues (Fig. 3) amount to $802 billion, suggesting that US farmers received between $50 billion and $160 billion in additional economic benefit over those years. These figures substantially exceed the benefits estimated by Brookes and Barfoot12 for 1996–2011. This difference highlights the complexity of the analysis and the need to develop standards and consistency. For example, a fraction of the economic benefit estimated by the NRC is indirect, in that farmers who plant GM crops are able to spend less time tending to those crops. That time can be used in other pursuits, including earning additional income, a factor that Brooks and Barfoot intentionally exclude owing to the complexity of gathering and analyzing such data in a global context12. More recently, Klümper and Qaim found that “on average, GM technology adoption has reduced chemical pesticide use by 37%, increased crop yields by 22%, and increased farmer profits by 68%”13. Beyond the direct benefits to farmers planting GM crops, there are benefits to conventional crops in proximity to GM crops. Multiple lines of evidence demonstrate that insect-resistant crops produce area-wide pest suppression—also known as the 'halo effect'—reducing losses in nearby conventional crops. This effect both reduces pesticide requirements for conventional crops and increases their yield; consequently, by one estimate, more than 70% of the cumulative benefits of Bt corn adoption over a period of 14 years accrued to nonadopters in the US Midwest14. The economic benefits of GM crops to nonadopting farmers are difficult to assess broadly, but they should be attributed in some way to the total economic contribution GM crops. I do not attempt to include this value in the present revenue estimate. Going forward, a more thorough accounting of what revenues are produced by which crops might provide a mechanism to include only the fraction of revenues attributable to GM traits. This metric should include the value provided by nearby GM crops to farmers of conventional crops and would thereby contribute to solidifying conversations about the utility and value of various integrated pest-management approaches. This accounting strategy could be the product of work in the public or private sector, but it should be adopted at the federal level to facilitate data gathering and analysis. For simplicity, here I use the total farm-scale revenues from GM crops and seeds. This may well constitute an overestimate of GM crop revenues, but its contribution to estimated total biotech revenues is arguably offset by my use of only 'nameplate' biologics revenues, described above. Industrial biotech. The industrial subsector appears to be the fastest-growing portion of the biotech sector (Fig. 3), and the lack of resolution of this component at the level of the NAICS masks a large and accelerating shift in the US economy. US revenues from industrial biotech reached at least $105 billion in 2012. The accuracy of the industrial revenue estimate continues to suffer in comparison to estimates for biologics and GM crops, owing to the quantity and quality of available data (Fig. 3). My previous efforts have required reverse engineering of reports from private consulting firms who rarely describe data sources and methods4. For the present set of estimates, I first excluded the value of corn from annual US ethanol revenues, which I then used as a lower bound for total US revenues. To these figures I added a conservatively scaled fraction of the international industrial biotech revenue figures reported by consulting firms (Box 1 and Supplementary Table 4). For the 2012 data, I relied on data provided by by Agilent Technologies (Santa Clara, CA, USA), of $125 billion15. Although it would be preferable to categorize industrial biotech products under biofuels, enzymes, biomaterials and biochemicals (biologically derived chemicals), the Agilent report categorizes revenues differently. Its internal breakdown of the $125 billion in business-to-business sales for 2012 was as follows: $66 billion in biochemicals, $30 billion in biofuels, $16 billion in biologics feedstocks (active pharmaceutical ingredients), $12 billion in food and agricultural applications (including enzymes) and $1 billion in new markets. Darlene Solomon, senior vice-president and CTO of Agilent, later clarified that the “industrial biotechnology market analysis was developed via analysis of corporate financial reports, equity analyst reports, private consulting firms reports, and third party market research reports” (personal communication).No further information is available at present. For the revenue estimate reported here, I have scaled the 2012 Agilent biofuels revenues to avoid double counting the substantial contribution of corn feedstocks (on average, ~68% of the wholesale cost of ethanol) (Supplementary Table 4). This reduces the 2012 value added of biofuels production to no more than $10 billion. Notably, biochemicals have eclipsed fuels as the largest component of industrial biotech revenues. The magnitude of the disparity between biofuel and biochemical revenues is informative for understanding the state of the bioeconomy and may inform ongoing policy debates about the relative levels of federal support received by each type of product. The estimates presented here suggest that biochemicals may already generate the equivalent of ~0.4% of the US GDP (compared with ~3% for petrochemicals; see below and Supplementary Table 4). Last, the ultimate contribution of industrial biotech to GDP could be 10–15% larger than that quoted here, depending on the actual retail margin and value added for consumers by biotech beyond business-to-business transactions. The total 2012 impact on the US economy could therefore have been as much as $155 billion, which would bring the total 2012 biotech revenues to >$374 billion. Contribution to US GDP To what extent is it sensible to refer to a 'biotech industry' and its contribution to GDP? Just as cell culture and fermentation are quite different from mining or petroleum refining, so are they different from agriculture. But biological production methods, and their underlying bioengineering techniques and tools, are similar in many ways, particularly when contrasted with mining and refining. These distinctions are likely to be of increasing importance in policy discussions around renewable biological manufacturing and its potential to replace processes and manufacturing based on fossil energy and materials. Moreover, aggregate revenues from GM organisms are now a large and rapidly growing contribution to the US economy (Fig. 3). How well does the sum of biotech revenues in Figure 3 approximate the contribution of biotech to GDP? The overall quality of the data available supports treating any aggregate as only an estimate. As argued above, 'nameplate' biologics revenues are probably a substantial underestimate of subsector revenues. Similarly, although use of total GM crop revenues overestimates the value added to these crops by genetic modification, the total impact is probably underestimated, owing to the direct benefits for conventional crops via the halo effect. Historically, industrial revenues are the least precise owing to the quantity and quality of data, although I eliminated obvious double counting where feasible. In all three cases I sought to produce conservative estimates whenever possible. Taken together, until better data are available, the resulting revenue figure is a reasonable proxy for a direct measure of 'GM domestic product' (GMDP). Therefore, it is arguably both useful and approximately correct to aggregate the revenues from GM organisms as the GMDP to assess the economic impact of biotech. With this approximation in hand, the interpolation in Figure 3 enables a direct historical comparison of biotech revenues to GDP and GDP growth in the United States over the past three decades. This comparison reveals that the US economy, and in particular annual US GDP growth, is becoming increasingly dependent on biotech. Biotech revenues have increased as a fraction of GDP gradually since 1980, reaching the equivalent of at least 2% in 2012. This development is driven by annual increases in biotech revenues that, by 2012, contributed the equivalent of at least 5.4% of annual GDP growth. The apparent peak between 2007 and 2011 is due to the poor overall performance of the US economy rather than any particular trend in biotech. This phenomenon, also visible in 1991 and 2001–2003, suggests that biotech as a sector is relatively robust in the face of general economic downturn. Now, as the broader economy recovers, the annual biotech revenue growth contribution appears to be realigning with the multidecadal trend; several more years may yet be required to resolve the actual annual rate. The model is sensitive to the size of the 2012 industrial biotech revenues; using a biotech revenue estimate of $350 billion would raise the contribution of biotech to GDP to 2.26% and the 2012 contribution to GDP growth to 8.6% (data not shown). The code used to generate historical estimates can also be used to project future revenues. However, because of both the uncertainty in the size of 2012 biotech revenues (between $324 billion and $374 billion) and the sensitivity of the revenue interpolation and growth rates to the size of 2012 industrial revenues, I will not speculate on the magnitude of more recent revenues or quantitatively predict future performance. The code used to generate Figures 3 and 4 is available is available from Biodesic (http://www.biodesic.com). Better tracking of the bio-based economy Box 2 summarizes how NAICS could be used to track biotech products and revenues. Looking forward, one necessary change to the NAICS would be to institute a 'nonpharmaceutical, cell-based manufacturing' code. This code would capture the majority of industrial biotech revenues, which even at the business-to-business 2012 total of $105 billion exceeded the $101 billion in direct contribution to GDP claimed by the mining industry (Supplementary Table 4 compares the contributions to GDP of biotech and selected manufacturing and extractive industries)16. An additional code could be used to specify cell-based manufacturing that relies on modified genomes. These updates for biotech would not constitute a departure from previous practices; indeed, there is precedent to fine grain the measurement of any industry, and there are multiple NAICS codes to characterize aspects of mining and mineral processing, as well as related services and equipment manufacturing. The US government should examine the bioeconomy at a similar resolution. The current NAICS codes either miss substantial biotech revenues and employment or misaggregate them with entirely dissimilar means of production. Of more general concern, the misattribution of sector revenues obscures the broader raw economic contribution of biotech. The resulting ignorance impedes quantitative assessment of key features of sector growth and health, such as the number of firms, the rate of firm creation and destruction, firm longevity, employment and returns on public and private sector investment. I hope that, by calling attention to these and other shortcomings, this analysis will encourage private and public sector efforts to gather and share data that support a more detailed understanding of the biotech sector and its contributions to innovation and physical and economic security. The NAICS is under review for an update in 2017. New codes specifically designed to elicit information about biological production would address serious shortcomings in the way the US government assesses its economy. The continued use of NAICS codes adopted in previous years will explicitly confuse chemicals directly produced through biological systems with those refined from fossil sources and ores. For example, a recent attempt by the Battelle Memorial Institute (Columbus, OH, USA) to use the NAICS to define 'bioscience-related' employment was hampered by antiquated industrial groupings that not only excluded many companies that derive revenue from biotech products (including GM seeds, nonagricultural industrial chemicals and industrial enzymes) but also included companies that manufacture farm equipment and irradiation instruments that are clearly not biotech related17. Consequently, using the current NAICS to estimate biotech employment is a difficult proposition, because the current codes do not map well onto existing and emerging bioproduction methods18. Modernizing the NAICS must be a priority of both the public and private sectors to enable accurate economic analyses, employment measurements and appropriate marshaling and allocation of resources. The mechanisms to better characterize the bioeconomy throughout North America appear to exist in the form of NAICS and the North American Product Classification System (NAPCS). Ongoing revisions to industrial coding and classification provide opportunities to untangle biotech revenues from other industries and to clarify the contribution of biological production to the economy. The broader bioeconomy The estimates of the economic contribution of the biotech sector provided here are relatively inaccurate compared with those describing other parts of the US economy. Not only are there whole areas of biotech activity for which no data are collected, there is also a lack of detail for biotech products where data are available. A critical question for any analysis of the 'biotech sector' is that of what falls within the scope of biotech. For example, in excess of the biologics estimate provided here, there are almost certainly additional billions of dollars in revenues attributable to the creation, maintenance and production of GM model animals, such as knockout microbes and rodents, which are increasingly sold as services to industry and academia. Similarly, companies produce many types of modified cells and antibodies for sale, and vaccines are increasingly produced via biotechnological techniques such as reverse genetics. Marketing reports for sale on the Internet suggest that sales of chemically synthesized peptides, oligonucleotides and genes generate between hundreds of millions and several billion dollars annually. Other reports (http://www.bccresearch.com/market-research/biotechnology/synthetic-biology-bio066c.html; http://www.transparencymarketresearch.com/synthetic-biology-market.html) define a new category of 'synthetic biology' that is putatively already worth several billion dollars a year and that will purportedly climb to tens of billions by 2020. In principle, all of these contributions could be tracked with appropriate NAICS codes, because the value provided by biotech tools should be reflected in their price and thus in the revenues of the vending companies. Properly accounting for these contributions could add tens of billions of dollars in additional revenue to the biotech tally provided here, but such a calculation is not obviously feasible with current data. Clearly defined metrics are critical for formulating policy and allocating resources for research, development and market incentives. For example, policy discussions about alternatives to fossil fuels and reducing carbon emissions should consider metrics not only on biofuels but also on the contribution of biochemicals to plastics and solvents, given that ~15% of a barrel of petroleum is processed into such materials (http://www.eia.gov/energyexplained/index.cfm?page=oil\_refining and http://www.eia.gov/dnav/pet/PET\_PNP\_PCT\_DC\_NUS\_PCT\_A.htm). In other words, although the energy content of petroleum might be replaced by many sources, more consideration should be given to replacing the atoms in petroleum, given their crucial role as materials in the existing economy. Addressing the shortcomings of present data through better measurement would benefit strategy development and policy-making across the public and private sectors. For example, adequate planning to educate an appropriate labor force requires understanding the current skill base and overall sector employment. More broadly, accurate and precise historical revenue estimates would facilitate efforts to understand the long-term return on public and private investments in the bioeconomy and would benefit conversations both practical and political. Beyond the United States, better data would help governments assess biotech's contributions to their own economies. Yet assessing the specific economic roles of modified DNA and biomanufacturing should be undertaken as part of a larger effort. It is often said that this is the century of biology and that biology is the technology of the twenty-first century. Private investments continue to flow into biotech, motivated by hopes of developing new medical treatments, crops, chemicals and production processes.Public investments seek the same returns, with additional expectations for education, employment and economic development. How can the returns from these investments be tallied, and how should this tally be used to assess the contribution of biology to the larger economy? It is well past time for governments around the world to collaborate in developing a standardized and comprehensive understanding of the role of biology in their economies. Standardized data would be invaluable in an assessment of the economic importance of biotech and would enable a direct comparison with GDP. In the long term, it would be ideal to have an industry-wide reference metric that is comparable to GDP. Some governments track—to varying degrees—healthcare, domestic agricultural productivity and biofuels production, but data collection and analytical standards are far from uniform (e.g., see the variable quality and quantity of data in the European Commission's Bioeconomy Observatory (http://biobs.jrc.ec.europa.eu/)). As a step toward clarity, nascent efforts are under way to assemble a unified picture of the value provided by biological goods and services in the form of the biobased economy. The definition of 'biobased economy' varies internationally. In the United States, it is typically defined as “economic activity and jobs generated by the use and conversion of agricultural feedstocks to higher value products; the use of microbes and industrial enzymes as transformation agents or for process changes; and the production of bio-based products and biofuels”19. Responding to a mandate from the US Congress, the USDA has elaborated a list of potential “biobased economy indicators” and also described the difficulties in fleshing out those metrics20. Yet even in the current data-poor environment, the biobased economy was recently valued at an estimated $1.25 trillion in the United States for 2012, the equivalent of about 7% of the GDP21. As impressive as these numbers are, they may still exclude a wide variety of economically important biological goods and services. The preceding definition of biobased economy, and the one used by the USDA, omit fisheries, forestry and agriculture20. Depending on who is counting, those industries generate between $300 billion and $800 billion in revenue annually, bringing even a conservative estimate of the total size of the broader US bioeconomy to nearly 10% of GDP4. For comparison, a recent estimate of the European Union's bioeconomy sectors that included all biobased activity put the total at >$2 trillion and 9% of GDP22. Yet even if a more detailed and thorough accounting were to raise the total bioeconomy to 15% or 20% of GDP, that number would underestimate the larger importance of biological systems in supporting countries and their economies. Without biological production in the form of food, water, oxygen and raw materials, the rest of the economy would be worthless. Precisely because the biobased economy is intertwined with, and depends on, agriculture and natural resources, a thorough understanding of the relationship between biological systems and the economy requires a broader systematic accounting that extends across land and water resources, agriculture, food, textiles and paper, to cutting-edge products of metabolic engineering. Simply put, we should measure everything better.

#### Economic decline causes nuclear war – collapses faith in deterrence

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

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 inter-dependent 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.

The best way to enhance global peace is no doubt to multiply the factors protecting it: build a Pacific security community by topping up economic interdependence with political rapprochement and trust, institutionalized cooperation, and shared international norms. Yet even without such accomplishments, the combination of deterrence and economic interdependence may be enough to prevent war among the major powers. Because the leaders of nuclear armed nations are fearful of getting into a situation where peace relies uniquely on nuclear deterrence, and because they know that their adversaries have the same fear, they may accept the risks entailed by depending economically on others. And then there will be neither trade wars nor shooting wars, just disputes and diplomacy.

## Case

#### No aff solvency---only a short term delay in patents so monopolies will still happen after patents come into effect

### 1NC -- No Marijuana I/L

#### Cartels have already switched to opium for profits-turns the case because cartel violence increased with partial marijuana legalization

Agren 18 (David Agren covers Mexico as a freelance correspondent for The Guardian, and his writing also regularly appears in The Washington Post, USA Today, Maclean's and Catholic News Service, and resides in Mexico city, 2-24-18, "Mexican cartels pushing more heroin after U.S. states relax marijuana laws," USA TODAY, <https://www.usatoday.com/story/news/world/2018/02/20/mexican-cartels-switch-gears-after-u-s-states-relax-u-s-states-legalize-marijuana-mexicos-cartels-sw/343389002/>, MX)

As more U.S. states legalize the use of marijuana, Mexico's violent drug cartels are turning to the basic law of supply and demand. That means small farmers, or campesinos, in this border state's rugged Sierra Madre who long planted marijuana to be smuggled into the United States are switching to opium poppies, which bring a higher price. The opium gum harvested is processed into heroin to feed the ravaging U.S. opioid crisis. “Marijuana isn’t as valuable, so they switched to a more profitable product,” said Javier Ávila, a Jesuit priest in this region rife with drug cartel activities. Laws allowing marijuana in states like Colorado, Washington and California are causing shifts in the Mexican underworld that have also led to increased violence as the cartels move away from its cash cow of marijuana to traffic more heroin and methamphetamines. U.S. Customs and Border Protection statistics show that marijuana seizures fell by more than half since 2012, while heroin and methamphetamine seizures have held steady or markedly increased. The switch in illegal drugs coincides with Mexico hitting a record 29,168 murders in 2017, the most since the country started keeping homicide statistics in 1997. The jump in violence stems from several factors: cartels splintering into smaller factions, power struggles within the formidable Sinaloa Cartel after leader Joaquín “El Chapo” Guzmán was arrested and extradited to the U.S., plus the rise of the violent Jalisco New Generation Cartel, which expanded nationally and moved in on El Chapo’s turf. Few attribute Mexico's rising violence just to legalized marijuana north of the border or the increasing opioid crisis, but those changes in the U.S. are causing problems here. In Chihuahua, state prosecutor César Peniche said criminal groups on Mexico’s Pacific Coast used to traffic marijuana to California. Now those groups are “looking for other routes to continue their trafficking” by usingborder crossings farther inland, he said. “Criminal groups … enter the state of Chihuahua, and this causes confrontations,” Peniche explained. “It’s creating conflicts between criminal organizations to win control of the routes because some markets have closed, but others have stayed open. This sparks violence.” In Mexico’s heroin-producing heartland of southern Guerrero state, the violence is so bad that the morgues are full and unable to handle all the bodies brought in for autopsies. The U.S. government recently toughened its travel warning to Americans against visiting Guerrero, which includes the tourist resorts of Acapulco and Ixtapa, in addition to remote villages that rely on planting opium poppies. Growers in Guerrero, like those in northwest Mexico, also moved away from marijuana to focus on opium poppies. And they have no problem selling their harvests. “In talking with middlemen and others (selling illegal drugs), the U.S. has an almost insatiable demand. ... The cartels are never sitting on product,” said Myles Estey, producer of the Showtime series The Trade, which filmed in Guerrero. He said the cartels “saw a lot more demand for heroin (in the United States) and responded.”

### 1NC -- Cartels Dead

#### Cartels are dead inevitably

Stewart 17 (Scott, Stratfor analyst of terrorism and security issues “Mexico's Cartels Will Continue to Splinter in 2017”, https://worldview.stratfor.com/article/mexicos-cartels-will-continue-splinter-2017)

Stratfor has tracked Mexico's drug cartels for over a decade. For most of that time, our annual forecasts focused on the fortunes and prospects of each trafficking organization. But as Mexican organized crime groups have gradually fractured and fallen apart — a process we refer to as balkanization — we have had to refine the way we think about them. The cartels are no longer a handful of large groups carving out territory across Mexico, but a collection of many different smaller, regionally based networks. So, rather than exploring the outlook of every individual faction, we now take them as loose gatherings centered on certain core areas of operation: Tamaulipas, Tierra Caliente and Sinaloa.

### ~~1NC – Defense -- Terror~~

#### ~~No impact to cartels~~

~~Barry 13 (Tom, January 9, 2013, Director for the TransBorder project at the Center for International Policy in Wash. DC. “With the Resurrection of Immigration Reform We'll Hear a Lot About Securing Our Borders, But What Does It Really Mean?” http://www.alternet.org/immigration/resurrection-immigration-reform-well-hear-lot-about-securing-our-borders-what-does-it)~~

~~One likely reason the Border Patrol does not address its counterterrorism in any detail is that the agency’s border security buildup on the southwestern border has not resulted in the apprehension of members of foreign terrorist organizations, as identified by the State Department.~~

~~Experts in counterterrorism agree there is little risk that foreign terrorist organizations would rely on illegal border crossings – particularly across the U.S.-Mexico border – for entry into the United States. While the fear that foreign terrorists would illegally cross U.S. land borders drove much of the early build-up in border security programs under the newly created homeland security department, counterterrorism seems to have dropped off the actual and rhetorical focus of today’s border security operations.~~

**~~No terror threat~~**

~~Mark~~ **~~Sullivan 13~~**~~, Specialist in Latin American Affairs for the Congressional Research Service, “Latin America: Terrorism Issues”, 4/5/13, Congressional Research Service, http://fas.org/sgp/crs/terror/RS21049.pdf~~

~~For most countries in Latin America and the Caribbean,~~ **~~threats emanating from terrorism are low~~**~~. Terrorism in the region is largely perpetrated by groups in Colombia and by the remnants of radical leftist Andean groups. According to the Department of State, most governments in the region have good records of cooperation with the United States on anti-terrorism issues, although progress in the region on improving counterterrorism capabilities is limited by several factors, including corruption, weak governmental institutions, weak or non-existent legislation, and reluctance to allocate sufficient resources. Both Cuba and Venezuela are on the State Department’s list of countries determined to be not cooperating fully with U.S. antiterrorism efforts, and Cuba has remained on the State Department’s list of state sponsors of terrorism since 1982. U.S. officials and some Members of Congress have expressed concern over the past several years about Venezuela’s relations with Iran, with concerns centered on efforts by Iran to circumvent U.N. and U.S. sanctions and on Iran’s ties to Hezbollah, alleged to be linked to two bombings in Argentina in the 1990s. There is disagreement, however, over the extent and significance of Iran’s activities in Latin America. The State Department maintains that there are~~ **~~no known operational cells of either Al Qaeda or Hezbollah-related groups in the hemisphere~~**~~, although it notes that ideological sympathizers continue to provide financial and moral support to these and other terrorist groups in the Middle East and South Asia.~~

**~~Border smuggling only happens if drug revenue decreases~~**

**~~Altman 14~~**~~—Tampa Tribune~~

~~(Howard, “Cartel, terrorist ties are up for debate”,~~ [~~http://tbo.com/list/military-news/cartel-terrorist-ties-are-up-for-debate-20141020/~~](http://tbo.com/list/military-news/cartel-terrorist-ties-are-up-for-debate-20141020/)~~, dml)~~

~~There is a lot of concern these days about the possibility that members of Islamic State or other jihadi organizations may take advantage of our porous southern border to smuggle bad guys or weapons into the United States. But one recently former CIA analyst, who was responsible for reporting on the activities of the Mexican cartels, says that concern is largely overstated. The reason? The cartels, says Scott Schlimmer, make so much money from selling cocaine, heroin, marijuana and from human trafficking that they don’t want to risk the blowback from U.S. authorities should a jihadi or weapon of mass destruction wind up crossing the border and creating havoc in the U.S. “They have the capability,” says Schlimmer. “But not the desire.” There are many threats to the homeland, says Schlimmer, but cartels smuggling in jihadis “is one of the less risky threats. “It is almost ironic,” says Schlimmer, “but because of this fear of blowback, the cartels are actually protecting us from terrorists.” Schlimmer, 32, worked for the CIA for seven years, leaving in July. During his time with the agency’s directorate of intelligence, he provided, among other things, analysis to senior policymakers and law enforcement officials on the risk of jihadis crossing the border. He eventually found his way to Tampa, where he is now an adviser for the government and private firms, including Wittenberg Weiner Consulting. He is quick to point out that he speaks for himself, not the agency. I have been tracking the nexus between jihadis and cartels for years, including the curious case of airplanes sold out of the St. Pete-Clearwater Airport. One of the planes crashed in Mexico with nearly four tons of cocaine on board, another was seized in Mexico with more than five tons on board. Both, and many more, at one point wound up in the hands of Walid Makled, who a prosecutor called a king among kingpins. Makled, now jailed in Venezuela, claims that he was working with Iranians and jihadi groups in Venezuela to smuggle drugs. Years of research leads me to believe that there is a close financial connection between jihadis and drug organizations, which is especially strong in West Africa, where drugs flown in from South America are then smuggled under the auspices of al-Qaida and other jihadi groups. I count myself among those concerned that the southern border is vulnerable to jihadi machinations. So when I found out that Schlimmer had been tracking this nexus for the CIA, I was naturally curious about his take. “I really don’t think there is much risk of (jihadis or weapons being smuggled) through the U.S.-Mexico border,” says Schlimmer. “The cartel senior leaders wouldn’t go for it.” That’s because, combined, the Sinaloa, Zetas, Gulf and La Familia cartels, among others, make billions every year.~~

### 1NC -- Defense -- Mexican State Collapse

#### No spillover – if it does the impact is tiny

Phil Williams and Vanda Felbab-Brown April 2012 (PHIL WILLIAMS is the Wesley W. Posvar Professor ¶ and Director of the Matthew B. Ridgway Center for ¶ International Security Studies at the University of ¶ Pittsburgh. His previous assignments included Visiting Professor at the Strategic Studies Institute, U.S. ¶ Army War College; and Visiting Scientist at CERT ¶ Carnegie Mellon University, where he worked on cyber-crime and infrastructure protection. Dr. Williams ¶ has worked extensively on transnational criminal networks, terrorist networks, terrorist finances, and has ¶ focused most recently on the rise of drug trafficking ¶ violence in Mexico, VANDA FELBAB-BROWN is a Fellow in the Latin ¶ America Initiative and in the 21st Century Defense ¶ Initiative in Foreign Policy at the Brookings Institution.upitt strategic studies institute, “DRUG TRAFFICKING, VIOLENCE, AND INSTABILITY” http://www.strategicstudiesinstitute.army.mil/pdffiles/pub1101.pdf)

Drug trafficking organizations in Mexico pose ¶ perhaps the second greatest threat to U.S. security on ¶ the part of today’s actors involved in the global drug ¶ trade. Unlike jihadi terrorist groups in Afghanistan ¶ and Pakistan, they do not seek to target the U.S. homeland or intend to conduct a deadly terrorism campaign ¶ against the United States. Nor do they have the capac-ity or desire to overthrow the Mexican government. ¶ Mexico is not a failing state. But any spillover of the ¶ drug war from Mexico could threaten public safety in ¶ certain U.S. localities, including substantial increases ¶ in murder rates, kidnapping,

~~and other violent crime.~~

**~~No Mexican state collapse---crime and violence are effects of failed states, not causes~~**

~~Neil Couch 12, Brigadier in the British Army, July 2012, “’Mexico in Danger of Rapid Collapse’: Reality or Exaggeration?” http://www.da.mod.uk/colleges/rcds/publications/seaford-house-papers/2012-seaford-house-papers/SHP-2012-Couch.pdf/view~~

~~A ‘collapsed’ state, however, as postulated in the Pentagon JOE paper, suggests ‘a total vacuum of authority’, the state having become a ‘mere geographical expression’.16 Such an extreme hypothesis of Mexico disappearing like those earlier European states seems implausible for a country that currently has the world’s 14th largest economy and higher predicted growth than either the UK, Germany or the USA; that has no external threat from aggressive neighbours, which was the ‘one constant’ in the European experience according to Tilly; and does not suffer the ‘disharmony between communities’ that Rotberg says is a feature common amongst failed states.17,18¶ A review of the literature does not reveal why the JOE paper might have suggested criminal gangs and drug cartels as direct causes leading to state collapse. Crime and corruption tend to be described not as causes but as symptoms demonstrating failure. For example, a study for Defense Research and Development Canada attempting to build a predictive model for proximates of state failure barely mentions either.19 One of the principal scholars on the subject, Rotberg, says that in failed states, ‘corruption flourishes’ and ‘gangs and criminal syndicates assume control of the streets’, but again as~~ **~~effect rather than trigger~~**~~.20 The Fund for Peace Failed States Index, does not use either of them as a ‘headline’ indicator, though both are used as contributory factors.¶ This absence may reflect an assessment that numerous states suffer high levels of organised crime and corruption and nevertheless do not fail. Mandel describes the corruption and extreme violence of the Chinese Triads, Italian Mafia, Japanese Yakuza and the Russian Mob that, in some cases, has continued for centuries.21 Yet none of these countries were singled out as potential collapsed or failed states in the Pentagon’s paper. Indeed, thousands of Americans were killed in gang warfare during Prohibition and many people ‘knew or at least suspected that politicians, judges, lawyers, bankers and business concerns collected many millions of dollars from frauds, bribes and various forms of extortion’.22 Organised crime and corruption were the norm in the political, business, and judicial systems and police forces ran their own ‘rackets’ rather than enforcing the law.23 Neither the violence nor the corruption led to state failure.~~

### ~~1NC -- Defense -- Latin America Instability~~

#### ~~No Latin American instability --- democracy consolidation, macroeconomic stability, and international law.~~

~~Feinberg et al. 15—Richard Feinberg is a professor of international political economy at the Graduate School of IR and Pacific Studies, UC San Diego [Richard, “Better Than You Think: Reframing Inter-American Relations; Harold Trinkunas is a senior fellow and director of Brooking’s Latin America Initiative am; Emily Miller is a Research Assistant at Brooking’s Latin America Initiative [“Better Than You Think: Reframing Inter-American Relations,”~~ *~~Latin America Initiative in Foreign Policy at Brookings~~*~~, March,~~ [~~https://www.brookings.edu/wp-content/uploads/2016/06/Better-Than-You-Think-Reframing-InterAmerican-Relations.pdf~~](https://www.brookings.edu/wp-content/uploads/2016/06/Better-Than-You-Think-Reframing-InterAmerican-Relations.pdf)~~]~~

~~Much of the contemporary U.S. policy toward the hemisphere has its roots in the 1990s. In the wake of the end of the Cold War, the regional agenda became crowded with new initiatives and institutions: the Summit of the Americas, the Free Trade Area of the Americas (FTAA), the Conference of Defense Ministers of the Americas, a reoriented Organization of American States (OAS) focused on democracy promotion and a reinvigorated Inter-American Court of Human Rights. At its core, this agenda was intended to consolidate and give regional institutional weight to core U.S. interests in the region, namely free elections, free markets, free trade and cooperative security. In the wake of the 9/11 attacks, the United States redoubled efforts to secure regional cooperation on combating terrorism and controlling the proliferation of weapons of mass destruction.~~

~~Even if some specific initiatives have run aground, such as the FTAA, or have been troubled, such as recent Summits, the hemispheric agenda of the United States has by and large been achieved. In country after country, international and domestic actors have aligned to produce the triumph of democracy and sustainable market-based economies, leading a wave of democratization and liberalization that has swept the globe since the 1970s. The region experienced its last (brief) interstate conflict between Ecuador and Peru in 1995, and the probability of war in Latin America is vanishingly small, an astounding achievement when compared to present troubles in Europe, Asia and the Middle East. In addition, although international terrorism and proliferation have not vanished from the region, Latin America is far better off than any other part of the world on this security dimension.22~~

~~In contrast to 1980, democracy is now by and large consolidated, with only a few exceptions of backsliding (shown in Figure 5),23 and military coups have become increasingly rare. Latin American democracies have pioneered new forms of political and social inclusion, such as participatory budgeting and conditional cash transfer programs. Civil society has flourished across much of the region, and there is a vibrant media in many countries.~~

~~Across Latin America, we have generally witnessed stronger economic growth and better macroeconomic management during the past decade than in the previous two. In the wake of the 1980s debt crisis, bouts of hyperinflation and financial crises in the 1990s, regional political and economic leaders have been much more cautious, accumulating substantial international reserves and keeping close watch on inflation. By 2011, the nine largest economies in Latin America had, on average, accumulated reserves equivalent to 16 percent of GDP.24 At the end of 2013, Brazil was sitting on $376 billion and Mexico on $177 billion (Figure 6). Inflation has fallen dramatically from over 200 percent between 1990 and 1995 to an average of six percent since 2010.25~~

~~This improved macroeconomic management has produced significant reductions in poverty and improvements in social inclusion. The size of the middle class in Latin America has also nearly doubled since 2002,26 contributing to economic growth and new demands for improved governance. Figure 727 illustrates the sustained GDP per capita growth and poverty reduction beginning in 2003, which contrast with the income stagnation of the 1980s and modest improvements of the 1990s. Similarly, Figure 8 demonstrates consistent downward trends in inequality in some of the region’s largest economies.28 While Latin America remains the most unequal region of the world,29 it is clear that sound macroeconomic policies have contributed to improved social equity, either directly through broad-based growth, or indirectly through enabling states to finance targeted redistributive policies. The region’s rapid recovery from the 2008 global financial crisis is evidence of the strength of the macroeconomic policies and institutions that have prevailed thus far. This has meant that much of the region has needed fewer loans and external assistance, and also that Latin American leaders have less need to adhere to external conditions for financial support. For example, in 2014 the Brazilian economy slowed down but its external reserves are so large that it does not need to revert to the multilateral institutions for funds or advice. Rather, international markets and competitive pressures are tilting the internal debate in Brazil toward more market-friendly policies, as signaled by the recent appointments of a more orthodox finance minister, Joaquim Levy, and market-oriented politicians to the agriculture and industry portfolios.~~

~~Latin America has also expanded its participation in global trade and its range of trading partners. In conjunction with a fall in average tariffs from 39 percent in 1985 to 10 percent in 2005, Latin America’s export volume quadrupled.30 There is now a broad array of free trade agreements in place across the region, not only among Latin American states but also with China, Europe and the United States. This tangible multi-polarity offers nations more options for economic development and export-led growth. For example, growing commodity exports toward China during the 2000s (Figure 9) reflects rising demand relative to traditional Latin American export markets such as Europe and the United States. Latin America’s diversified trade is not the “fault” of U.S. policy inattention but rather a reflection of structural shifts in the global economy. For Latin America, this is a healthy development because it reduces the risks of being tied to the economic prospects of any one region of the world; vulnerabilities of course remain, as South America depends heavily on commodity exports and Central America and Mexico are subject to the ups and downs of the U.S. economy.~~

~~Inter-state peace in Latin America has become the status quo. States in the region rarely militarize disputes, and civil conflicts have declined as well; Figure 10 plots civil and international conflicts as measured by magnitude scores that reflect “societal-systemic impact.”31 According to Figure 10, the only nations currently plagued by major episodes of civil violence are Colombia and Mexico, both drug-fueled conflicts.32 Even though most states in the region continue to share some disputed borders, such sources of friction are by and large the province of diplomats and lawyers arguing cases at the International Court of Justice in The Hague rather than of armies.33 Latin America has in place a nuclear-weapon-free zone, and the two leading nuclear technology powers, Argentina and Brazil, have a longstanding non-proliferation institution, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), that monitors their mutual rejection of the pursuit of nuclear weapons.34 While fears about international terrorism in the region have occasionally made headlines in the United States post 9/11, the last major incidents occurred in 1992 and 1994 when Hezbollah agents attacked the Israeli Embassy and Jewish Cultural Center in Buenos Aires. In its most recent report on terrorism in the region, the U.S. State Department maintained that the majority of terrorist attacks in Latin America were committed by the Revolutionary Armed Forces of Colombia (FARC). However such tactics by transnational criminal organizations and insurgents in the hemisphere are largely aimed at domestic audiences rather than linked to international terrorist networks.35~~

~~The bottom line is that since the end of the Cold War, Latin America has advanced far and fast along a number of political, security, economic and social dimensions. It is impossible to untangle the relative weight of the external and internal factors contributing to this felicitous outcome, but it is safe to say that Latin American countries have made themselves much more democratic, peaceful and prosperous, and that past instruments of U.S. influence, when smartly deployed, have largely worked themselves out of a job. These achievements are deeply compatible with longrange core U.S. interests in regional peace, democracy and human rights, market-based economies and free trade. As such, a return to a mid-20th century interventionist foreign policy is neither feasible nor desirable.~~