# Meadows R1 Neg vs HWL IC

# 1NC

### 1

#### **Interp – “medicines” treat or cure, whereas vaccines prevent – o/w on specificity since it’s about the COVID vaccine**

Vecchio 7/22 (Christopher Vecchio, [CFA, Senior Strategist,], 7-22-2021, “Delta Variant Concerns Won't Cripple Markets, US Economy“, DailyFX, accessed: 8-9-2021, https://www.dailyfx.com/forex/video/daily\_news\_report/2021/07/22/market-minutes-delta-variant-concerns-wont-cripple-markets-us-economy.html) ajs

Let’s stick to the facts. The COVID-19 vaccines are not medicines, which by definition “treat or cure diseases.” Vaccines “help prevent diseases,” an important distinction. Why does this matter? Because data coming out of some of the world’s developed economies with high adult vaccination rates suggest that the vaccines are working as intended: tail-risks have been reduced, with hospitalizations and deaths falling relative to the recent spike in infections (which have been occurring primarily among the unvaccinated at this point). Put another way, vaccines are like a Kevlar vest for the immune system; while they don’t make you bulletproof, they dramatically increase the odds of surviving an adverse event.

#### Vaccines are medical interventions – not medicines

Elbe 10 (Stefan Elbe, [director of the Centre for Global Health Policy and a professor of international relations at the University of Sussex. He is the author of Strategic Implications of HIV/AIDS, Security and Global Health, and Virus Alert: Security, Governmentality, and the AIDS Pandemic.], 5-3-2010, “Security and Global Health” Polity Press, accessed: 8-9-2021, https://books.google.com/books?id=PKMoMJrSsksC) ajs

Yet here too we must be careful not to overlook other types of medical intervention simultaneously pursued by the 'social' arm of modern medicine at the population level. Vaccines in particular continue to be particularly important medical interventions that repeatedly surface in a variety of different health security delib- erations. Strictly speaking, vaccines are not medicines because they consist of small concentrations of disease-causing microbes (or their derivatives) used to enhance a person's immuno-response to a future infection. As a public health measure, vaccines have therefore also been largely sidelined in the existing medicalization literature. Yet, generally speaking, vaccines too can be considered as medical inter- ventions. That is certainly how the World Health Organization views them, pointing out that 'vaccines are among the most important medical interventions for reducing illness and deaths' available today (WHO 2009a). Whereas pills and other therapies mark the tools of clinical medicine, vaccines play a crucial part in the arsenal of 'social' medicine and public health. Developing and rolling out of new vaccines against a range of current (and future) diseases therefore represents further evidence of how the rise of health security is also encouraging security to be practised through the introduction of new medical interventions in society.

#### Violation – they violate or don’t solve

#### Negate –

#### Limits – expanding the topic to preventative treatment or medical interventions allows anything from surgery to medical devices to education strategies or mosquito repellent to prevent malaria. Destroys core generics like innovation which are exclusive to disease curing – core of the topic is about proprietary information.

### 2

#### CP: The People’s Republic of China should:

#### - Substantially increase innovation funding, production and global distribution of COVID-19 Vaccines for all current and future waves of the pandemic

- includes Sinovac, sionpharm, and any future vaccines

#### - cooperate with allies to achieve increased production and global distribution of the COVID-19 Vaccine.

#### The Republic of China should:

#### End domestic production of all Covid Vaccine 19s

#### Cancel all future purchases of vaccines from any nation other than the People’s Republic of China

Taiwan planks solve adv 1

#### Solves case – China vaccinates the world.

Mallapaty 6-9 Smriti Mallapaty 6-9-2021 "China is vaccinating a staggering 20 million people a day" <https://www.nature.com/articles/d41586-021-01545-3> (She has a master of science degree in environmental technology from Imperial College London.)//Elmer

For more than a week, an average of about **20 million people** have been vaccinated against COVID-19 **every day in China**. At this rate, the nation would have fully vaccinated the entire UK population in **little more than six days**. China now accounts for more than half of the 35 million or so people around the world receiving a COVID-19 shot each day. Zoltán Kis, a chemical engineer in the Future Vaccine Manufacturing Research Hub at Imperial College London, doesn’t know of “anything **even close to those production scales**” for a vaccine. “The manufacturing efforts required in China to reach this high production throughput are tremendous,” he says. The majority of doses are of one of two vaccines, both of which have been approved for emergency use worldwide by the World Health Organization (WHO). CoronaVac — produced by Beijing-based company Sinovac — showed an efficacy of 51% against symptoms of COVID-19 in clinical trials, and much higher protection against severe disease and death. The second jab was developed in Beijing by state-owned firm Sinopharm and has demonstrated an efficacy of 79% against symptomatic disease and hospitalization. Supplying vaccines to the world China’s current vaccine production rate could potentially **make a significant dent in global demand**, says Kis; that would be “**a huge step in reducing the health-care and economic burden of the COVID-19 pandemic**”. China has already supplied 350 million doses of the two vaccines to more than 75 nations, and WHO approval should now trigger the further distribution of both vaccines to low-income countries. “China’s vaccination campaign got off to a slow start, but has rapidly picked up pace,” says Rongjun Chen, a biomaterials scientist also at the Future Vaccine Manufacturing Research Hub. As recently as mid-April, China was administering only about five million doses a day. According to an official at China’s National Health Commission, the nation aims to produce some three billion doses of COVID-19 vaccines in 2021 — and up to **five billion per year after that**. To achieve such high production rates, many things need to go according to plan across the entire production and distribution chain, from sourcing raw materials to manufacturing active ingredients, filling vials and distributing doses to vaccination centres, says Kis. “It is crucial that everything arrives at the right location at the right time.”

#### China’s using absence of vaccine alternates to assert influence.

Zhao 4-29 Suisheng Zhao 4-29-2021 "Why China’s vaccine diplomacy is winning" <https://www.eastasiaforum.org/2021/04/29/why-chinas-vaccine-diplomacy-is-winning/> (Professor and Director of the Center for China–US Cooperation at the Josef Korbel School of International Studies, University of Denver)//Elmer

Chinese COVID-19 vaccines have been shipped to more than **80 countries** for market or emergency use. Among them, 53 countries received vaccines for free (including developing countries in Africa and some strategically important Asian countries such as the Philippines and Pakistan) and 27 middle-income countries paid for doses. Rolling out of vaccines to developing countries, Beijing has framed itself as **a solution to the pandemic** rather than the origin of the coronavirus. China’s advanced vaccine diplomacy stands in contrast **to the ‘me first policies’** of the **United States and the European Union**. With a shortfall in supplies, US and EU leaders have faced high infection rates and death tolls at home and feel the need to inoculate their domestic populations first. This has left the world’s poorest and most vulnerable people without vaccine supply and at risk. China has not faced these problems and can afford to send vaccines abroad. Just by showing up and helping plug gaps in the global supply of vaccines, China has g**ained ground** in vaccine diplomacy. President Xi Jinping pledged that Chinese vaccines would be provided as a global public good. But a large portion of Chinese vaccines are not free — some countries have paid Chinese vaccine makers. Still the absence of the United States and European Union from vaccine diplomacy **is not lost** on countries struggling to put shots in people’s arms. Many countries would prefer US or EU-made Pfizer and Moderna vaccines over China’s vaccines if given the choice, **yet they cannot access them**. These countries are desperate and have jumped at the opportunity to receive Chinese vaccines. Chinese companies are also more willing than their western counterparts **to strike licensing deals** to produce vaccines in foreign countries. For example, Indonesia has become a regional hub for Sinovac’s CoronaVac through its state pharmaceuticals company Bio Farma. The United Arab Emirates (UAE) chose Sinopharm because it was willing to conduct phase three clinical trials in the UAE and build native vaccine production capabilities. Sinopharm also arranged to manufacture its vaccine in the UAE for regional distribution. Beijing’s vaccine diplomacy involves propaganda to boost **perceptions of China as a generous and responsible power**. Chinese media has covered every delivery of vaccine shipment. The scene is set by a standard script. When a cargo plane lands, it is greeted by senior local leaders accompanied by Chinese ambassadors fawning over the vaccine cargo. Vaccine diplomacy has helped **increase China’s influence** and enabled it to capitalise **on new opportunities**. China has rolled vaccines out to participants of its Belt and Road Initiative (**BRI**) **and enhanced preferential access to jabs alongside investments in infrastructure and connectivity projects**. According to an April Think Global Health report, of the 56 countries to which China pledged doses, all but one were participants in its BRI. Naming it the Health Silk Road, vaccine diplomacy has provided a foothold for China’s pharmaceutical industry that has been plagued by scandals and low levels of trust at home and abroad. Making Sinovac and Sinopharm household names in foreign countries, China may change these perceptions. Although Chinese vaccine makers were among the earliest in the world to begin clinical trials and self-reported some key results, many have not published complete data in peer-reviewed journals. This has fuelled scepticism about their safety and effectiveness. Gao Fu, director of China’s Centre for Disease Control and Prevention, noted in April that Chinese vaccines were not as effective as hoped and mixing them was among the strategies being considered to boost their effectiveness. Some countries have been reluctant to greenlight Chinese vaccines. Singapore received its first shipment of Sinovac vaccines in February, but Singaporean regulators have not approved its use, moving ahead with using Pfizer and Moderna vaccines. Polish President Andrzej Duda spoke with President Xi about buying Chinese jabs in March. Yet Poland’s health authorities have recommended against using Chinese vaccines because of a lack of data. Concerns have also arisen about whether China’s production capacity is able to keep pace with an ever-expanding list of overseas customers and its domestic vaccination campaign. The Turkish government ordered 20 million doses of China’s Sinovac vaccine. But delayed shipments forced the government to repeatedly revise its vaccination timetable. Egypt purchased a total of 40 million doses of the vaccine from Sinopharm in January but had received only a tiny percentage of its vaccine order from China by the middle of April. This tension will intensify as China’s domestic demand for vaccines increases. China has continued with vaccine diplomacy in the absence of the United States and other Western countries. These countries should compete and cooperate with China to overcome bottlenecks in the global distribution of vaccines and ensure that all nations, particularly developing countries, receive the vaccines they need to finally beat COVID-19.

#### Waivers are a critical issue in the perceptual ineptness of America and the West.

Pratt and Levin 4-29 Simon Frankel Pratt and Jamie Levin 4-29-2021 "Vaccines Will Shape the New Geopolitical Order" <https://archive.is/OgDcA#selection-847.23-857.11> (Simon Frankel Pratt is a lecturer in the School of Sociology, Politics, and International Studies at the University of Bristol. Jamie Levin is an assistant professor of political science at St. Francis Xavier University in Canada.)//Elmer

While home to vaccines produced by the likes of Pfizer, Moderna, AstraZeneca, and Johnson & Johnson—all now household names and whose vaccines are considered more efficacious—governments of these states have demonstrated a **reluctance to supply doses** to much of the rest of the world at the expense of domestic vaccination rates. The United States and the U.K. have exported almost none, and the EU is clamping down. They have similarly been **unwilling to waive patents**, allowing for production of these vaccines where they are most needed. This suggests that the United States and the EU are **slow to fully exploit the geopolitical opportunities** of vaccine diplomacy or at least are not willing to do so with the same alacrity and **enthusiasm as other states**. That may change as time goes on, however, and the result will be worsened inequities within already inequitable trade relationships between these countries and the global south.

#### Chinese leadership solves existential threats.

Yamei 18 Shen Yamei 18, Deputy Director and Associate Research Fellow of Department for American Studies, China Institute of International Studies, 1-9-2018, "Probing into the “Chinese Solution” for the Transformation of Global Governance," CAIFC, <http://www.caifc.org.cn/en/content.aspx?id=4491>

As the world is in a period of great development, transformation and adjustment, the international power comparison is undergoing profound changes, global governance is reshuffling and traditional governance concepts and models are confronted with challenges. The international community is expecting China to play a bigger role in global governance, which has given birth to the Chinese solution. A. To Lead the Transformation of the Global Governance System. The “shortcomings” of the existing global governance system are prominent, which can hardly ensure global development. First, the traditional dominant forces are seriously imbalanced*.* The US and Europe that used to dominate the global governance system have been beset with structural problems, with their economic development stalling, social contradictions intensifying, populism and secessionism rising, and states trapped in internal strife and differentiation. These countries have not fully reformed and adjusted themselves well, but rather pointed their fingers at globalization and resorted to retreat for self-insurance or were busy with their own affairs without any wish or ability to participate in global governance, which has encouraged the growth of “anti-globalization” trend into an interference factor to global governance. Second, the global governance mechanism is relatively lagging behind. Over the years of development, the strength of emerging economies has increased dramatically, which has substantially upset the international power structure, as the developing countries as a whole have made 80 percent of the contributions to global economic growth. These countries have expressed their appeal for new governance and begun policy coordination among themselves, which has initiated the transition of global governance form “Western governance” to “East-West joint governance”, but the traditional governance mechanisms such as the World Bank, IMF and G7 failed to reflect the demand of the new pattern, in addition to their lack of representation and inclusiveness. Third, the global governance rules are developing in a fragmented way, with governance deficits existing in some key areas. With the diversification and in-depth integration of international interests, the domain of global governance has continued to expand, with actors multiplying by folds and action intentions becoming complicated. As relevant efforts are usually temporary and limited to specific partners or issues, global governance driven by requests of “diversified governance” lacks systematic and comprehensive solutions. Since the beginning of this year, there have been risks of running into an acephalous statein such key areas as global economic governance and climate change*.* Such emerging issues as nuclear security and international terrorism have suffered injustice because of power politics*.* The governance areas in deficit, such as cyber security, polar region and oceans, have “reversely forced” certain countries and organizations to respond hastily*.* All of these have made the global governance system trapped in a dilemma and call urgently for a clear direction of advancement. B. To Innovate and Perfect the International Order. Currently, whether the developing countries or the Western countries of Europe and the US are greatly discontent with the existing international order as well as their appeals and motivation for changing the order are unprecedentedly strong. The US is the major creator and beneficiary of the existing hegemonic order, but it is now doubtful that it has gained much less than lost from the existing order, faced with the difficulties of global economic transformation and obsessed with economic despair and political dejection. Although the developing countries as represented by China acknowledge the positive role played by the post-war international order in safeguarding peace, boosting prosperity and promoting globalization, they criticize the existing order for lack of inclusiveness in politics and equality in economy, as well as double standard in security, believing it has failed to reflect the multi-polarization trend of the world and is an exclusive “circle club”. Therefore, there is much room for improvement. For China, to lead the transformation of the global governance system and international order not only supports the efforts of the developing countries to uphold multilateralism rather than unilateralism, advocate the rule of law rather than the law of the jungle and practice democracy rather than power politics in international relations, but also is an important subject concerning whether China could gain the discourse power and development space corresponding to its own strength and interests in the process of innovating and perfecting the framework of international order. C. To Promote Integration of the Eastern and Western Civilizations. Dialog among civilizations, which is the popular foundation for any country’s diplomatic proposals, runs like a trickle moistening things silently. Nevertheless, in the existing international system guided by the “Western-Centrism”, the Western civilization has always had the self-righteous superiority, conflicting with the interests and mentality of other countries and having failed to find the path to co-existing peacefully and harmoniously with other *civilizations.* So to speak, many problems of today, including the growing gap in economic development between the developed and developing countries against the background of globalization, the Middle East trapped in chaos and disorder, the failure of Russia and Turkey to “integrate into the West”, etc., can be directly attributed to lack of exchanges, communication and integration among civilizations. Since the 18th National Congress of CPC, Xi Jinping has raised the concept of “Chinese Dream” that reflects both Chinese values and China’s pursuit, re-introducing to the world the idea of “all living creatures grow together without harming one another and ways run parallel without interfering with one another”, which is the highest ideal in Chinese traditional culture, and striving to shape China into a force that counter-balance the Western civilization. He has also made solemn commitment that “we respect the diversity of civilizations …… cannot be puffed up with pride and depreciate other civilizations and nations”; “facing the people deeply trapped in misery and wars, we should have not only compassion and sympathy, but also responsibility and action …… do whatever we can to extend assistance to those people caught in predicament”, etc. China will rebalance the international pattern from a more inclusive civilization perspective and with more far-sighted strategic mindset, or at least correct the bisected or predominated world order so as to promote the parallel development of the Eastern and Western civilizations through mutual learning, integration and encouragement. D. To Pass on China’s Confidence. Only a short while ago, some Western countries had called for “China’s responsibility” and made it an inhibition to “regulate” China’s development orientation. Today, China has become a source of stability in an international situation full of uncertainties. Over the past 5 years, China has made outstanding contributions to the recovery of world economy under relatively great pressure of its own economic downturn. Encouraged by the “four confidences”, the whole of the Chinese society has burst out innovation vitality and produced innovation achievements, making people have more sense of gain and more optimistic about the national development prospect. It is the heroism of the ordinary Chinese to overcome difficulties and realize the ideal destiny that best explains China’s confidence. When this confidence is passed on in the field of diplomacy, it is expressed as: first, China’s posture is seen as more forging ahead and courageous to undertake responsibilities ---- proactively shaping the international agendas rather than passively accepting them; having clear-cut attitudes on international disputes rather than being equivocal; and extending international cooperation to comprehensive and dimensional development rather than based on the theory of “economy only”. In sum, China will actively seek understanding and support from other countries rather than imposing its will on others with clear-cut Chinese characteristics, Chinese style and Chinese manner. Second, China’s discourse is featured as a combination of inflexibility and yielding as well as magnanimous ---- combining the internationally recognized diplomatic principles with the excellent Chinese cultural traditions through digesting the Chinese and foreign humanistic classics assisted with philosophical speculations to make “China Brand, Chinese Voice and China’s Image get more and more recognized”. Third, the Chinese solution is more practical and intimate to people as well as emphasizes inclusive cooperation, as China is full of confidence to break the monopoly of the Western model on global development, “offering mankind a Chinese solution to explore a better social system”, and “providing a brand new option for the nations and peoples who are hoping both to speed up development and maintain independence”. II.Path Searching of the “Chinese Solution” for Global Governance Over the past years’ efforts, China has the ability to transform itself from “grasping the opportunity” for development to “creating opportunity” and “sharing opportunity” for common development, hoping to pass on the longing of the Chinese people for a better life to the people of other countries and promoting the development of the global governance system toward a more just and rational end. It has become the major power’s conscious commitment of China to lead the transformation of the global governance system in a profound way. A. To Construct the Theoretical System for Global Governance. The theoretical system of global governance has been the focus of the party central committee’s diplomatic theory innovation since the 18th National Congress of CPC as well as an important component of the theory of socialism with Chinese characteristics for a new era, which is not only the sublimation of China’s interaction with the world from “absorbing and learning” to “cooperation and mutual learning”, but also the cause why so many developing countries have turned from “learning from the West” to “exploring for treasures in the East”. In the past 5 years, the party central committee, based on precise interpretation of the world pattern today and serious reflection on the future development of mankind, has made a sincere call to the world for promoting the development of global governance system toward a more just and rational end, and proposed a series of new concepts and new strategies including engaging in major power diplomacy with Chinese characteristics, creating the human community with common destiny, promoting the construction of new international relationship rooted in the principle of cooperation and win-win, enriching the strategic thinking of peaceful development, sticking to the correct benefit view, formulating the partnership network the world over, advancing the global economic governance in a way of mutual consultation, joint construction and co-sharing, advocating the joint, comprehensive, cooperative and sustainable security concept, and launching the grand “Belt and Road” initiative. The Chinese solution composed of these contents, not only fundamentally different from the old roads of industrial revolution and colonial expansion in history, but also different from the market-driven neo-liberalism model currently advocated by Western countries and international organizations, stands at the height of the world and even mankind, seeking for global common development and having widened the road for the developing countries to modernization, which is widely welcomed by the international community. B. To Supplement and Perfect the Global Governance System. Currently, the international political practice in global governance is mostly problem-driven without creating a set of relatively independent, centralized and integral power structures, resulting in the existing global governance systemcharacterized as both extensive and unbalanced**.** China has been engaged in reform and innovation, while maintaining and constructing the existing systems, producing some thinking and method with Chinese characteristics. First, China sees the UN as a mirror that reflects the status quo of global governance, which should act as the leader of global governance, and actively safeguards the global governance system with the UN at the core. Second, China is actively promoting the transforming process of such recently emerged international mechanisms as G20, BRICS and SCO, perfecting them through practice, and boosting Asia-Pacific regional cooperation and the development of economic globalization. China is also promoting the construction of regional security mechanism through the Six-Party Talks on Korean Peninsula nuclear issue, Boao Forum for Asia, CICA and multilateral security dialog mechanisms led by ASEAN so as to lay the foundation for the future regional security framework. Third, China has initiated the establishment of AIIB and the New Development Bank of BRICS, creating a precedent for developing countries to set up multilateral financial institutions. The core of the new relationship between China and them lies in “boosting rather than controlling” and “public rather than private”, which is much different from the management and operation model of the World Bank, manifesting the increasing global governance ability of China and the developing countries as well as exerting pressure on the international economic and financial institution to speed up reforms. Thus, in leading the transformation of the global governance system, China has not overthrown the existing systems and started all over again, but been engaged in innovating and perfecting; China has proactively undertaken international responsibilities, but has to do everything in its power and act according to its ability. C. To Reform the Global Governance Rules. Many of the problems facing global governance today are deeply rooted in such a cause that the dominant power of the existing governance system has taken it as the tool to realize its own national interests first and a platform to pursue its political goals. Since the beginning of this year, the US has for several times requested the World Bank, IMF and G20 to make efforts to mitigate the so-called global imbalance, abandoned its commitment to support trade openness, cut down investment projects to the middle-income countries, and deleted commitment to support the efforts to deal with climate change financially, which has made the international systems accessories of the US domestic economic agendas, dealing a heavy blow to the global governance system. On the contrary, the interests and agendas of China, as a major power of the world, are open to the whole world, and China in the future “will provide the world with broader market, more sufficient capital, more abundant goods and more precious opportunities for cooperation”, while having the ability to make the world listen to its voice more attentively. With regard to the subject of global governance, China has advocated that what global governance system is better cannot be decided upon by any single country, as the destiny of the world should be in the hands of the people of all countries. In principle, all the parties should stick to the principle of mutual consultation, joint construction and co-sharing, resolve disputes through dialog and differences through consultation. Regarding the critical areas, opening to the outer world does not mean building one’s own backyard, but building the spring garden for co-sharing; the “Belt and Road” initiative is not China’s solo, but a chorus participated in by all countries concerned. China has also proposed international public security views on nuclear security, maritime cooperation and cyber space order, calling for efforts to make the global village into a “grand stage for seeking common development” rather than a “wrestling arena”; we cannot “set up a stage here, while pulling away a prop there”, but “complement each other to put on a grand show”. From the orientation of reforms, efforts should be made to better safeguard and expand the legitimate interests of the developing countries and increase the influence of the emerging economies on global governance. Over the past 5 years, China has attached importance to full court diplomacy, gradually coming to the center stage of international politics and proactively establishing principles for global governance. By hosting such important events as IAELM, CICA Summit, G20 Summit, the Belt and Road International Cooperation Forum and BRICS Summit, China has used theseplatforms to elaborate the Asia-Pacific Dream for the first time to the world, expressing China’s views on Asian security and global economic governance, discussing with the countries concerned with the Belt and Road about the synergy of their future development strategies and setting off the “BRICS plus” capacity expansion mechanism, in which China not only contributes its solution and shows its style, but also participates in the shaping of international principles through practice. On promoting the resolution of hot international issues, China abides by the norms governing international relations based on the purposes and principles of the UN Charter, and insists on justice, playing a constructive role as a responsible major power in actively promoting the political accommodation in Afghanistan, mediating the Djibouti-Eritrea dispute, promoting peace talks in the Middle East, devoting itself to the peaceful resolution of the South China Sea dispute through negotiations. In addition, China’s responsibility and quick response to international crises have gained widespread praises, as seen in such cases as assisting Africa in its fight against the Ebola epidemic, sending emergency fresh water to the capital of Maldives and buying rice from Cambodia to help relieve its financial squeeze, which has shown the simple feelings of the Chinese people to share the same breath and fate with the people of other countries. D. To Support the Increase of the Developing Countries’ Voice. The developing countries, especially the emerging powers, are not only the important participants of the globalization process, but also the important direction to which the international power system is transferring. With the accelerating shift of global economic center to emerging markets and developing economies, the will and ability of the developing countries to participate in global governance have been correspondingly strengthened. As the biggest developing country and fast growing major power, China has the same appeal and proposal for governance as other developing countries and already began policy coordination with them, as China should comply with historical tide and continue to support the increase of the developing countries’ voice in the global governance system. To this end, China has pursued the policy of “dialog but not confrontation, partnership but not alliance”, attaching importance to the construction of new type of major power relationship and global partnership network, while making a series proposals in the practice of global governance that could represent the legitimate interests of the developing countries and be conducive to safeguarding global justice, including supporting an open, inclusive, universal, balanced and win-win economic globalization; promoting the reforms on share and voting mechanism of IMF to increase the voting rights and representation of the emerging market economies; financing the infrastructure construction and industrial upgrading of other developing countries through various bilateral or regional funds; and helping other developing countries to respond to such challenges as famine, refugees, climate change and public hygiene by debt forgiveness and assistance.

#### Condo’s good – a) prep skew – they’re more familiar with the aff so I need to be able to leverage multiple forms of prep, b) reciprocity – no condo means every perm becomes a no risk issue which creates NIBs to ballot access

### Case

#### WTO not key – gut check

#### Trade wars don’t go to hot wars

**Dayen 17**, New Republic contributor (David “Trump Is Signaling a Trade War, but It’s Not as Disastrous as You May Think”, https://www.thenation.com/article/trump-is-signaling-a-trade-war-but-its-not-as-disastrous-as-you-may-think/)

Can Trump enact tariffs on his own? Though it would appear to contradict the Origination Clause of the Constitution, Congress has delegated that authority in enough pieces of legislation that Trump could probably raise import duties unilaterally. But what would be the practical effect? Hard-core free traders paint a picture of cataclysm. Tariffs will launch trade wars, increase prices, and destroy the economy. This is all hard-wired into the pro-globalization worldview. Thomas Friedman once famously admitted that he wrote a column supporting a free-trade agreement with Central America without knowing a thing about it: “I just knew two words: free trade,” he told an audience. Presumably the opposite is true for Friedman: He sees one word, “tariff,” and immediately screams in horror. Oddly, many of those same proponents of free trade favor a policy that looks very much like a tariff. The Republican corporate-tax revamp includes something called a border-adjustment tax, which would impose a 20 percent tax on imports while eliminating a tax on exports. Like with tariffs, the goal appears to be to encourage domestic production. In fact, the tax would be much higher than the 5-10 percent tariff being floated. (It also might be illegal under the current global trade regime.) Supporters of border adjustment, particularly economists, argue that it will end up trade neutral, because the exchange rate will fluctuate in response to the tax. In other words, though the tax would make American-made goods more attractive, the value of the dollar would increase, leveling that out. Few of these economists seem to carry over the same analysis to the effects of a tariff. I don’t understand why. There’s no reason to doubt the fact that, if Trump imposed an across-the-board tariff, the dollar would strengthen, thus nullifying the desired effect. Indeed, before Trump has even taken office, the dollar has risen to a 14-year high, in anticipation of a more protectionist stance. Incidentally, for all the one-off announcements by Trump (however factually challenged) about hundreds of jobs he has allegedly rescued here or there, this one development—the rise in the dollar—has likely caused the loss of hundreds of thousands of manufacturing jobs, under standard economic theory. Looked at this way, higher tariffs wouldn’t cause a recession (as Paul Krugman has acknowledged), but would be somewhat pointless, with currency exchanges shifting to account for any changes. Trade wars might temporarily reduce efficiency, as domestic supply chains would have to be rebuilt, but they’re unlikely to radically alter the balance of trade on their own. There are other variables here. Importers and exporters who have lived in a world of floating exchange rates for decades may be fairly nimble in adjusting to them. On the downside, Krugman explains that raising tariffs could inhibit capital flows, meaning that investors will place less money into US markets. You can see how that might reduce economic growth. But Jeff Spross points out that America currently has a problem with too much foreign money flowing in; reducing the flow could arguably make the economy more stable. Trump could also seek to prevent unlawful currency manipulation (not necessarily from China, but from other Asian nations) that artificially disadvantages US manufacturing. The real unknown here is what Trump would do with all that tariff revenue. The border adjustment tax at 20 percent is assumed to bring in $1 trillion over the 10-year budget window. So a tariff of even one-quarter or one-half that size would draw significant funds. What’s the plan for it? Would it get plowed into job-creating investments? Tax cuts for the wealthy? That’s a significant variable as well. We do know that the same pundits who confidently predicted that globalization would be a win-win policy for America repeatedly got it wrong. Those on the losing side saw their jobs shipped out and factories closed down, and weren’t given the kind of assistance needed to offset the disruption. So it’s worth being a little skeptical of the warnings coming from the same corners now. I don’t have a ton of faith in the Trump team to necessarily make their trade agenda work (especially as corporate interests will seek to co-opt the redesigned policies in ways even friendlier to their bottom line). And I think there are smarter ways to balance our trade deficit than a tariff strategy which will just run up against currency exchange rates. But the hysteria accompanying these tariffs (which wasn’t at all present when President Obama imposed his own tariffs on Chinese tires and steel) seems far beyond what little we can assume about the actual results of such a strategy.

#### Declining trade increases cooperation.

Christina L. **Davis &** Krzysztof J. **Pelc 17**, Christina L. Davis is a Professor of Politics and International Affairs at Princeton; Krzysztof J. Pelc is an Associate Professor of Political Science at McGill University, “Cooperation in Hard Times: Self-restraint of Trade Protection,” Journal of Conflict Resolution, 61(2): 398-429

Conclusion Political economy theory would lead us to expect rising trade protection during hard times. Yet empirical evidence on this count has been mixed. Some studies find a correlation between poor macroeconomic conditions and protection, but the worst recession since the Great Depression has generated surprisingly moderate levels of protection. We explain this apparent contradiction. Our statistical findings show that under conditions of pervasive economic crisis at the international level, states exercise more restraint than they would when facing crisis alone. These results throw light on behavior not only during the crisis, but throughout the WTO period, from 1995 to the present. One concern may be that the restraint we observe during widespread crises is actually the result of a decrease in aggregate demand and that domestic pressure for import relief is lessened by the decline of world trade. By controlling for product-level imports, we show that the restraint on remedy use is not a byproduct of declining imports. We also take into account the ability of some countries to manipulate their currency and demonstrate that the relationship between crisis and trade protection holds independent of exchange rate policies. Government decisions to impose costs on their trade partners by taking advantage of their legal right to use flexibility measures are driven not only by the domestic situation but also by circumstances abroad. This can give rise to an individual incentive for strategic self-restraint toward trade partners in similar economic trouble. Under conditions of widespread crisis, government leaders fear the repercussions that their own use of trade protection may have on the behavior of trade partners at a time when they cannot afford the economic cost of a trade war. Institutions provide monitoring and a venue for leader interaction that facilitates coordination among states. Here the key function is to reinforce expectations that any move to protect industries will trigger similar moves in other countries. Such coordination often draws on shared historical analogies, such as the Smoot–Hawley lesson, which form a focal point to shape beliefs about appropriate state behavior. Much of the literature has focused on the more visible action of legal enforcement through dispute settlement, but this only captures part of the story. Our research suggests that tools of informal governance such as leader pledges, guidance from the Director General, trade policy reviews, and plenary meetings play a real role within the trade regime. In the absence of sufficiently stringent rules over flexibility measures, compliance alone is insufficient during a global economic crisis. These circumstances trigger informal mechanisms that complement legal rules to support cooperation. During widespread crisis, legal enforcement would be inadequate, and informal governance helps to bolster the system. Informal coordination is by nature difficult to observe, and we are unable to directly measure this process. Instead, we examine the variation in responses across crises of varying severity, within the context of the same formal setting of the WTO. Yet by focusing on discretionary tools of protection—trade remedies and tariff hikes within the bound rate—we can offer conclusions about how systemic crises shape country restraint independent of formal institutional constraints. Insofar as institutions are generating such restraint, we offer that it is by facilitating informal coordination, since all these instruments of trade protection fall within the letter of the law. Future research should explore trade policy at the micro level to identify which pathway is the most important for coordination. Research at a more macro-historical scope could compare how countries respond to crises under fundamentally different institutional contexts. In sum, the determinants of protection include economic downturns not only at home but also abroad. Rather than reinforcing pressure for protection, pervasive crisis in the global economy is shown to generate countervailing pressure for restraint in response to domestic crisis. In some cases, hard times bring more, not less, international cooperation.

#### Carbon border tax coming now and key to solving warming.

Kellard 1/28 Neil Kellard [Dean, Professor in Finance, Essex Business School, University of Essex] “Why the EU’s proposed carbon border levy is an important test for global action on climate change” January 28, 2021 <https://theconversation.com/why-the-eus-proposed-carbon-border-levy-is-an-important-test-for-global-action-on-climate-change-154041> SM

In the more than two decades since the Kyoto Protocol was adopted, national policies on climate change have had dangerously and disappointingly little effect on global emissions.

Within the current economic system, perhaps the most ambitious attempt to reduce emissions has been the EU’s emissions trading system (or ETS). In operation since 2005, the ETS covers more than 11,000 heavy-energy-using power stations, factories and airlines, representing around 40% of the EU’s greenhouse gas emissions. The scheme operates via a cap-and-trade principle where an EU-wide cap on emissions means that firms must buy allowances, essentially paying for their polluting activities.

Yet although the ETS has had some success in reducing emissions, finance professor Panayiotis Andreou and I recently showed that the scheme is under-penalising those who pollute the most – primarily because the price of allowances has typically been too low.

The current price of an allowance to emit greenhouse gases is around €33 per tonne, a price already much higher than the average over the life of the ETS. However, to meet EU climate change targets, this price will need to be more like €40 by 2030 and close to €250 in 2050. Given the substantial costs this will impose on EU firms, either to pay for allowances or to invest in low carbon technologies, companies based outside the EU will have a hefty competitive advantage unless they face similar regulatory controls in their own countries.

This is why the European Commission, the EU’s executive branch, plans to present its carbon border levy in June 2021 as part of its Green Deal planning. Frans Timmermans, the first vice-president of the European Commission, recently stressed that:

It’s a matter of survival of our industry. So, if others will not move in the same direction, we will have to protect the European Union against distortion of competition and against the risk of carbon leakage.

Although its details are still undecided, the carbon border levy is expected to charge imports into the EU at an amount related to the emissions trading system price. As commission official Benjamin Angel notes, this could mean setting a carbon amount per product and multiplying it by the ETS price. For example, given production of each tonne of steel typically generates around 1.9 tonnes of CO₂ emissions, if we assume an ETS price of €30 then a firm would pay €57 extra to import it.

Having such a levy in place would send a strong signal to EU firms that potentially expensive investments in environmentally beneficial technologies would not result in undercutting, either by non-EU rivals that enjoy looser regulations, or by firms relocating to outside the EU – the so called “carbon leakage” that Frans Timmermans mentions.

Combining the EU ETS with a border levy is a sensible and workable strategy, providing a long-term context for firms that encourages the reduction of emissions by pricing in the pollution they produce. The benefits of a border levy may also spill over to outside the EU in at least one of two ways. First, and most obviously, non-EU firms that wish to export into Europe will be encouraged to reduce emissions to limit their charge. Secondly, other governments and regulatory authorities will be watching closely to see if the approach is workable and this could see the spread of cap-and-trade agreements more globally.

#### Lack of WTO legitimacy is key – the threat of disputes deters action.

Ashurst 7/16 Ashurst [A progressive global law firm] Proposed EU Regulation on CBAM, July 16 2021, <https://www.ashurst.com/en/news-and-insights/legal-updates/proposed-eu-regulation-of-cbam-published/> SM

Next steps for the Commission's proposal

Following publication of the detailed proposal for the CBAM, it will need to go through the ordinary legislative procedure, which involves being reviewed and modified by the European Parliament and the Council. This process will provide Member States with the opportunity to introduce significant changes.

Future developments

While only a proposal, the draft CBAM regulation also contains a reporting and review mechanism. Here, the draft CBAM regulation obliges the Commission to report before the end of the transitional period on the application of the CBAM, with a view to extending the scope of CBAM to indirect emissions and goods other than those listed in Annex I.

How might the proposal be challenged?

The CBAM is controversial outside the EU. Commentators have already started to map out potential challenges to it. In principle, these challenges follow two distinct routes:

that the CBAM breaches international obligations; and/or

that the CBAM breaches EU domestic law.

The main international route would be a WTO challenge by another WTO member government. As the WTO dispute settlement process is a government-to-government process, business would need to either lobby a government to bring a WTO Dispute Settlement Understanding (DSU) case, or, in certain jurisdictions, use formal processes (e.g. section 301 of the U.S. Trade Act of 1974) to stimulate a government to bring a case that it would not otherwise bring.

The obvious candidates are countries such as Brazil, India, Australia, China and Russia, all of which will be affected by the CBAM.

The WTO DSU process is currently functioning poorly since the US has refused to appoint new Appellate Body (AB) members, so the AB cannot function. This may have influenced the EU's decision to publish the draft regulation at this time, and until new AB members are appointed the prospect of the CBAM being held, definitively, to be incompatible with WTO obligations appears slim.

#### Otherwise, countries dispute through the WTO

Brooks 7/21 “Trade experts positive on EU’s CBAM, despite risk of rich nation-poor nation rift”, July 21 2021 Cristina Brooks [Senior Journalist, Climate & Sustainability, IHS Markit] <https://ihsmarkit.com/research-analysis/--trade-experts-positive-on-eus-cbam-despite-risk-of-rich-nati.html> SM

In addition to EU due process, the CBAM will face international challenges. World Trade Organization (WTO) rules were not drafted to accommodate climate change policies, so countries slapped with new charges on exports may challenge the CBAM via a WTO dispute settlement case.

Stephen Woolcock, a lecturer in international political economy at the London School of Economics, told Net-Zero Business Daily there are several ways of challenging the CBAM. "If the EU were to introduce the measure, other countries would challenge this, and you then go through a dispute settlement mechanism. The WTO appellate body, if you like 'the international trade court,' would then rule on whether this is complying with the WTO rules," he said.

However, he said it seems likely countries will discuss it in other forums since the US under the Trump administration blocked appointees to the WTO's appellate body. "So, we don't have a functioning appellate body in the WTO at the moment," said Woolcock.

#### Short-term action to mitigate climate change solves extinction and nuclear war

**Pester 8/30/21** (Patrick, staff writer for Live Science. His background is in wildlife conservation and he has worked with endangered species around the world. Patrick holds a master's degree in international journalism from Cardiff University in the U.K. and is currently finishing a second master's degree in biodiversity, evolution and conservation in action at Middlesex University London. Citing **Luke Kemp, a research associate at the Centre for the Study of Existential Risk at the University of Cambridg**e in the United Kingdom AND **Michael Mann, PhD, distinguished professor of atmospheric science at Penn State**. “Could climate change make humans go extinct?” [https://www.livescience.com/climate-change-humans-extinct.html August 30](https://www.livescience.com/climate-change-humans-extinct.html%20August%2030), 2021)DR 21

According to Mann, a global temperature increase of 5.4 degrees Fahrenheit (3 degrees Celsius) or more could lead to a collapse of our societal infrastructure and massive unrest and conflict, which, in turn, could lead to a future that resembles some Hollywood dystopian films.

One way climate change could trigger a societal collapse is by creating food insecurity. Warming the planet has a range of negative impacts on food production, including increasing the water deficit and thereby reducing food harvests, [Live Science previously reported](https://www.livescience.com/58891-why-2-degrees-celsius-increase-matters.html). Food production losses can increase human deaths and drive economic loss and socio-political instability, among other factors, that may trigger a breakdown of our institutions and increase the risk of a societal collapse, according to a study published Feb. 21 in the journal [Climatic Change](https://go.redirectingat.com/?id=92X1590019&xcust=livescience_us_1191050396230939400&xs=1&url=https%3A%2F%2Flink.springer.com%2Farticle%2F10.1007%2Fs10584-021-02957-w&sref=https%3A%2F%2Fwww.livescience.com%2Fclimate-change-humans-extinct.html).

Related: [Has the Earth ever been this hot before?](https://www.livescience.com/65927-has-earth-been-this-hot-before.html)

Past extinctions and collapses

Kemp studies previous civilization collapses and the risk of climate change. Extinctions and catastrophes almost always involve multiple factors, he said, but he thinks if humans were to go extinct, climate change would likely be the main culprit.

"If I'm to say, what do I think is the biggest contributor to the potential for human extinction going towards the future? Then climate change, no doubt," Kemp told Live Science.

All of the major [mass-extinction events](https://www.livescience.com/mass-extinction-events-that-shaped-Earth.html) in Earth's history have involved some kind of climatic change, according to Kemp. These events include cooling during the Ordovician-[Silurian](https://www.livescience.com/43514-silurian-period.html) extinction about 440 million years ago that wiped out 85% of species, and warming during the [Triassic](https://www.livescience.com/43295-triassic-period.html)-[Jurassic](https://www.livescience.com/28739-jurassic-period.html) extinction about 200 million years ago that killed 80% of species, Live Science previously reported. And more recently, climate change affected the fate of early human relatives.

While [Homo sapiens](https://www.livescience.com/homo-sapiens.html) are obviously not extinct, "we do have a track record of other hominid species going extinct, such as [Neanderthals](https://www.livescience.com/28036-neanderthals-facts-about-our-extinct-human-relatives.html)," Kemp said. "And in each of these cases, it appears that again, climatic change plays some kind of role."

Scientists don't know why Neanderthals went extinct about 40,000 years ago, but climatic fluctuations seem to have broken their population up into smaller, fragmented groups, and severe changes in temperature affected the plants and animals they relied on for food, according to the [Natural History Museum](https://www.nhm.ac.uk/discover/who-were-the-neanderthals.html) in London. Food loss, driven by climate change, may have also led to a tiny drop in Neanderthal fertility rates, contributing to their extinction, [Live Science previously reported](https://www.livescience.com/65594-neanderthal-fertility-led-to-extinction.html).

Climate change has also played a role in the collapse of past human civilizations. A [300-year-long drought](https://www.livescience.com/38893-drought-caused-ancient-mediterranean-collapse.html), for example, contributed to the downfall of ancient Greece about 3,200 years ago. But Neanderthals disappearing and civilizations collapsing do not equal human extinction. After all, humans have survived climate fluctuations in the past and currently live all over the world despite the rise and fall of numerous civilizations.

Homo sapiens have proven themselves to be highly adaptable and able to cope with many different climates, be they hot, cold, dry or wet. We can use resources from many different plants and animals and share those resources, along with information, to help us survive in a changing world, according to the [Smithsonian’s National Museum of Natural History](https://humanorigins.si.edu/research/climate-and-human-evolution/climate-effects-human-evolution).

Related: [How would just 2 degrees of warming change the planet?](https://www.livescience.com/58891-why-2-degrees-celsius-increase-matters.html)

Today, we live in a global, interconnected civilization, but there's reason to believe our species could survive its collapse. A study published on July 21 in the journal [Sustainability](https://www.mdpi.com/2071-1050/13/15/8161/htm) identified countries most likely to survive a global societal collapse and maintain their complex way of life. Five island countries, including New Zealand and Ireland, were chosen as they could remain habitable through agriculture, thanks to their relatively cool temperatures, low weather variability and other factors that make them more resilient to climate change.

New Zealand would be expected to hold up the best with other favorable conditions, including a low population, large amounts of good quality agricultural land and reliable, domestic energy. So, even if climate change triggers a global civilization collapse, humans will likely be able to keep going, at least in some areas.

Turning on ourselves

The last scenario to consider is climate-driven conflict. Kemp explained that in the future, a scarcity of resources that diminish because of **climate change could** potentially create conditions for wars that threaten humanity. "There's reasons to be concerned that as water resources dry up and scarcity becomes worse, and the general conditions of living today become much, much worse, then suddenly, the threat of potential nuclear war becomes much higher," Kemp said.

Put another way, climate change impacts might not directly cause humans to go extinct, but it could lead to events that seriously endanger hundreds of millions, if not billions, of lives. A 2019 study published in the journal [Science Advances](https://advances.sciencemag.org/content/5/10/eaay5478) found that a nuclear conflict between just India and Pakistan, with a small fraction of the world's nuclear weapons, could kill 50 million to 125 million people in those two countries alone. Nuclear war would also change the climate, such as through temperature drops as burning cities fill the atmosphere with smoke, threatening food production worldwide and potentially causing mass starvation.

What's next?

While avoiding complete extinction doesn't sound like much of a climate change silver lining, there is reason for hope. Experts say it isn't too late to avoid the worst-case scenarios with significant cuts to greenhouse gas emissions.

"It is up to us," Mann said. "If we fail to reduce carbon emissions substantially in the decade ahead, we are likely committed to a worsening of already dangerous extreme weather events, inundation of coastlines around the world due to melting ice and rising sea level, more pressure on limited resources as a growing global population competes for less food, water and space due to climate change impacts. If we act boldly now, we can avoid the worst impacts."

#### WTO legitimacy trades off with the efficacy and legitimacy of regional trade agreements.

Kwak and Marceau 16 “Overlaps and Conflicts of Jurisdiction between the World Trade Organization and Regional Trade Agreements,” Kyung Kwak [Kyung Kwak is an associate of a law firm, Ashurst, in Brussel] and Gabrielle Marceau [Gabrielle Marceau, Ph.D., is counsellor in the Légal Affairs Division of the Secretariat to the World Trade Organization] Published online by Cambridge University Press: 09 March 2016 <https://www.cambridge.org/core/journals/canadian-yearbook-of-international-law-annuaire-canadien-de-droit-international/article/abs/overlaps-and-conflicts-of-jurisdiction-between-the-world-trade-organization-and-regional-trade-agreements/6C0C9CA77BED3390A38226F9E01EB44D> SM

The relationship between the dispute settlement mechanism of the World Trade Organization (WTO) and that of regional trade agreements (RTAs) demonstrates the difficulties surrounding the issues of overlaps/conflicts of Jurisdiction and of hierarchy of norms in international law.1 Jurisdiction is often defined in terms of either legislative or judicial Jurisdiction — that is, the authority to legislate or to adjudicate on a matter. Jurisdiction may be analyzed from horizontal points of view (the allocation of Jurisdiction among states or among international organizations) and from a vertical point of view (the allocation of jurisdiction between states and international organizations) . 2

This article addresses the issue of horizontal allocation of judicial jurisdiction between RTAs and the WTO, as expressed in the dispute settlement provisions of each treaty. The choice of a dispute settlement forum is often an expression of the importance that states give to the System of norms that may be enforced by the related dispute settlement mechanism. For instance, if the same states — which are parties to two treaties A and B that contain similar obligations — provide that priority or exclusivity is given to the dispute settlement mechanism of A over that of B, it may be that the states are expressing their choice to favour the enforcement of treaty A over treaty B.

In the case of RTAs, the situation is further complicated because the General Agreement on Tariffs and Trade (GATT)3 authorizes WTO members to form regional trade agreements. The WTO jurisprudence has made it clear that members have a "right" to form preferential trade agreements. This right is however conditional. In the context of an RTA, Article XXIV may justify a measure that is inconsistent with certain other GATT provisions. However, in a case involving the formation of a customs union, this RTA "defence" is available only when two conditions are fulfilled. First, the party claiming the benefit of this defence must demonstrate that the measure at issue is introduced upon the formation of a customs union that fully meets the requirements of sub-paragraphs 8 (a) and 5 (a) of Article XXIV. Second, this party must demonstrate that the formation of the customs union would be prevented if it were not allowed to introduce the measure at issue. Again, both of these conditions must be met to have the benefit of the defence under Article XXIV of GATT.4

Many RTAs include (substantive) rights and obligations that are parallel to those of the Marrakesh Agreement Establishing the World Trade Organization (WTO Agreement).5 Generally, these RTAs may provide for their own dispute settlement mechanism, which makes it possible for the states to resort to different but parallel dispute settlement mechanisms for parallel or even similar obligations. This situation is not unique as states are often bound by multiple treaties, and the dispute settlement Systems of these treaties operate in a parallel manner.6 At the same time, the WTO dispute settlement System claims to be compulsory and exclusive. Article 23 of the Understanding on Rules and Procedures Governing the Settlement of Disputes (DSU)7 mandates exclusive jurisdiction in favour of the DSU for WTO violations. By simply alleging that a measure affects or impairs its trade benefits, a WTO member is entitled to trigger the quasi-automatic, rapid, and powerful WTO dispute settlement mechanism, excluding thereby the competence of any other mechanism to examine WTO law violations. The challenging member does not need to prove any specific economic or legal interest nor provide any evidence of the trade impact of the challenged measure in order to initiale the DSU mechanism.8 The WTO will thus often "attract" jurisdiction over disputes with (potential) trade effects even if such disputes could also be handled in fora other than that of the WTO.

OVERLAPS OF JURISDICTION BETWEEN RTAs AND THE WTO

Overlaps of jurisdiction in dispute settlement can be defined as situations where the same dispute or related aspects of the same dispute could be brought to two distinct institutions or two different dispute settlement Systems. Under certain circumstances, this occurrence may lead to difficulties relating to "forum-shopping," whereby disputing entities would have a choice between two adjudicating bodies or between two different jurisdictions for the same facts. When the dispute settlement mechanisms of two agreements are triggered in parallel or in sequence, there are problems on two levels: first, the two tribunals may claim final jurisdiction (supremacy) over the matter and, second, they may reach different, or even opposite, results.9

Various types of overlaps of jurisdiction may occur. For the purpose of the present discussion, an overlap of jurisdiction occurs: ( i ) when two fora claim to have exclusive jurisdiction over the matter; (2) when one forum claims to have exclusive jurisdiction and the other one offers jurisdiction, on a permissive basis, for dealing with the same matter or a related one; or (3) when the dispute settlement mechanisms of two different fora are available (on a non-mandatory basis) to examine the same or similar matters. Conflicts are possible in any of these three situations. All of the RTAs examined in Table i at the end of this article have dispute settlement mechanisms with jurisdiction that may potentially overlap with that of the WTO Agreement.

#### Regional trade integration is key to the African economy.

Gammadigbe 21 IMF Working Paper Strategy, Policy, & Review “Is Regional Trade Integration a Growth and Convergence Engine in Africa?” Prepared by Vigninou Gammadigbe [Research Fellow at Banque Centrale des Etats de l'Afrique de l'Ouest Authorized for distribution by Johannes Wiegand January 2021 <https://www.imf.org/en/Publications/WP/Issues/2021/01/29/Is-Regional-Trade-Integration-a-Growth-and-Convergence-Engine-in-Africa-50040> SM

\*REC = Regional Economic Communities (for example, FTAs, unions, etc.)

It has been argued in the literature that regional integration promotes shared economic growth and income convergence among member countries through direct and indirect channels of increased intra-regional trade, economies of scale, dissemination of knowledge and technology, and structural transformation. This paper contributes to this literature in Africa and African RECs. Its main objective was to analyses the effects of RTI on growth and income convergence in Africa and its different RECs. The study examines whether regional integration has played an important role in economic growth and income convergence of member countries in African major RECs in order to draw lessons for the process of establishing the African Continental Free Trade Area (AfCFTA). To this end, the study estimated two models, one for economic growth and the other for income convergence in the African sample and in the African major RECs over the period 1989 to 2018 using the instrumental variable method and the panel fixed-effects model.

The baseline results as well as the results of the multiple robustness tests indicate that RTI promotes economic growth in the participating countries. However, econometric evidence shows that it fuels divergence rather than income convergence across the continent implying that the positive effect on economic growth is mostly captured by the relatively more developed economies on the continent. These results are robust to the use of alternative indicators of trade integration, to the time frame of the analysis and to the estimation method particularly for the sample of Africa and in large RECs including COMESA, SADC, ECOWAS, WAEMU and SADC. For these RECs and in the context of the African continental free trade project, these results show how necessary it is to design specific programs (social programs and training programs) to support the most vulnerable economies in order to protect their sectors that will suffer negative shocks when the African Continental Free Trade Area (AfCFTA) will be in force. The results also show that regional integration offers substantial gains, whose full absorption is conditional on the implementation of comprehensive structural reforms aimed at diversifying economies and increasing their productivity. The positive effect of regional integration on growth suggests that the process of African trade integration would be beneficial to the continent’s economic growth. Therefore, the study recommends the elimination of non-tariff barriers in order to increase its effectiveness. Furthermore, regarding the positive effect on income divergence, the study recommends that RTI, beyond its traditional role as an instrument for trade promotion, should also be used as an instrument for providing essential infrastructure, improving the quality of institutions, building human capacity and strengthening the physical capital stock.

#### That’s key to preventing terror.

Ray 1/11 “Does Africa Matter to the United States?” Charles A. Ray [a member of the Board of Trustees and Chair of the Africa Program at the Foreign Policy Research Institute, served as U.S. Ambassador to the Kingdom of Cambodia and the Republic of Zimbabwe] January 11, 2021 <https://www.fpri.org/article/2021/01/does-africa-matter-to-the-united-states/> SM

The population of African countries is also overwhelmingly young. Approximately 40% of Africans are under 15, and, in some countries, over 50% is under 25. By 2050, two of every five children born in the world will be in Africa, and the continent’s population is expected to triple. These developments have positive and negative potential impacts on the United States and the rest of the world. Young Africans have, for the most part, completely skipped the analog age and gone directly digital. Comfortable with technology, they form a huge potential consumer and labor market. If, on the other hand, the countries of Africa fail to develop economically and do not create gainful employment for this young population, then there is the risk that they will become a huge potential source of recruits to extremist and terrorist movements, which currently target disadvantaged and disenchanted youth.

Lack of economic opportunity, increased urbanization, and climate-fueled disasters will also contribute to movement of people seeking better lives, which will impact economies and security not only on the continent of Africa, but also the economic and security situations around the world. Nations, lacking adequate critical infrastructure, education, and job opportunities are ripe for internal unrest and radicalization. In particular, inadequate health delivery systems, when coupled with natural disasters, such as droughts or floods that limit food production, cause famine and mass movements of populations.

The Challenges for U.S. Policy

Prior to World War II, the U.S. policy towards Africa was not as active as it was toward Europe, Asia, or Latin America. During the Cold War, Africa policy was primarily viewed from a perspective of super-power competition. The end of the Cold War and the rise of international terrorism introduced this as a major component in U.S. Africa policy along with competition with a rising China and increased Chinese engagement in Africa.

Before his first official trip to Kenya, U.S. President Barack Obama said, “Africa had become an idea more than an actual place . . . with the benefit of distance, we engaged Africa in a selective embrace.” This is probably an apt description of U.S. policy towards African nations despite the bipartisan nature of that policy. The United States, with the many domestic and international issues it has to cope with, can ill afford to continue to ignore Africa. Going forward, U.S. policy must include a hard-headed look at where Africa fits in policy priorities.

The incoming Biden administration will face a number of important issues and challenges as it develops its Africa policy. The most pressing issues are the following:

Climate Change: Climate change is an existential problem that affects the entire globe, but Africa has probably suffered more from the effects of climate change than other continents—and the problem will only get worse with time. In an October 2020 article, World Meteorological Organization (WMO) Secretary-General Petteri Taalas said,

Climate change is having a growing impact on the African continent, hitting the most vulnerable hardest, and contributing to food insecurity, population displacement and stress on water resources. In recent months we have seen devastating floods, an invasion of desert locusts and now face the looming specter of drought because of a La Nina event. The human and economic toll has been aggravated by the COVID-19 pandemic.

Climate change impacts water quality and availability, and millions in Africa will likely face persistent increased water stress due to these impacts. A multi-year drought in parts of South Africa, for instance, threatened total water failure in several small towns and had livestock farmers facing financial ruin. Another pressing climate-change issue is the need for protection of the Congo Basin rainforest. This 178-million-hectare rainforest is the world’s second largest after the Amazon and is currently threatened by agricultural activities in Cameroon, Central African Republic, Democratic Republic of Congo, Republic of the Congo, Equatorial Guinea, and Gabon. Countries in the Congo Basin need to address the preservation issue, while also enabling sustainable agricultural activities to ensure food security for the region’s population. In addition to the impact on global climate caused by destruction of the rainforest, such destruction also brings human populations into closer contact with the region’s animals, creating the risk of future animal-to-human transmission of new and possibly more virulent viruses similar to COVID-19, which will have a global impact. In a January 2021 CNN report, Dr. Jean-Jacques Muyembe Tamfum, who as a researcher helped discover the Ebola virus in 1976, warned of possible new pathogens that could be as infectious as COVID-19 and as virulent as Ebola.

Rule of Law/Mitigation of Corruption: A key to African development, given the increasing urbanization, population increases, and youthfulness of the continent’s population, will be an increase in domestic and international investment to build the industries that can provide meaningful employment and improved standards of living. In order for this to be successful, African nations will need to address the issues of rule of law and corruption. Investors will not risk money if the business climate comes with a level of political risk that is too high. Government leaders throughout Africa need to establish legislation that provides an acceptable level of security for investments and take action to curb the endemic corruption that currently discourages investment. Corruption in Africa ranges from wholesale political corruption on the scale of General Sani Abachi’s looting of $3-5 billion of state money during his five years as Nigeria’s military ruler to the bribes paid by businessmen to police and customs officials. The “tradition” of having to pay bribes, or “sweeteners,” drives away domestic investment and scares away foreign investment, leaving many countries mired in poverty.

Violent Extremism and Terrorism: A number of African nations are currently plagued with rising extremist movements. While primarily a domestic issue, the mass movement of people fleeing violence and the disruption of economic activity have the potential to negatively impact the rest of the world. African nations need regional responses to curb extremist and terrorist organizations, many of which are supported by international terrorist organizations, such as ISIS and al Qaeda. In addition, the underlying conditions that helped to create these movements must be addressed. Terrorist groups in Africa range from relatively large and dangerous groups, such as Boko Haram, a group in Nigeria that has received support from al Qaeda and that aims to implement sharia law in the country; Al-Shabab, an al Qaeda affiliate aiming to overthrow the government in Somalia and to punish neighboring countries for their support of the Somali regime; and Uganda’s Lord’s Resistance Army, a fundamentalist Christian group. Terrorist groups in the fragile political climate of Libya also pose a threat to sub-Saharan Africa.

#### Causes terrorist CBW usage.

Fyanka 20 Bernard B. Fyanka (epartment of History and International Studies, Redeemer’s University) (2020): Chemical, biological, radiological and nuclear (CBRN) terrorism: Rethinking Nigeria’s counterterrorism strategy, African Security Review, DOI: 10.1080/10246029.2019.1698441 (SGK)

The most commonly used non-conventional weapons are chemical or biological in nature. The long history of chemical and biological weapons usage dates as far back as 600 BC when, during a siege, Solon of Athens poisoned the drinking water of the city of Kirrha.44 More recently – starting with the use of mustard gas during the First World War – nations have acquired chemical and biological weapons easily, deploying them against enemies and their own citizens alike. For terrorist groups like Boko Haram, chemical and biological weapons are uniquely suited to their agenda and as such present very attractive alternatives to nuclear; they are extremely difficult to detect, cost effective and easy to deploy. Aerosols of biological agents are invisible to the naked eye, silent, odourless, tasteless and relatively easily dispersed. Most importantly they are 600 to 2000 times cheaper than other WMDs. Recent esti- mates place the cost of biological weapons at about 0.05% of the cost of a conventional weapon which could produce similar numbers of mass casualties per square kilometre. 45 The proliferation of chemical and biological weapons has proved to be very fluid over the past century due to advancements in technology. Production is comparatively easy via the commonplace technology that is used in the manufacturing of antibiotics, vaccines, foods and beverages, while delivery systems such as spray devices deployed from airplane, boat or car are widely available. Another advantage of biological agents is the natural lead time pro- vided by the organism’s incubation period (three to seven days in most cases), allowing the ter- rorists to deploy the agent and then escape before an investigation by law enforcement and intelligence agencies can even begin. Furthermore, not only would the use of an endemic infec- tious agent likely cause initial confusion because of the difficulty of differentiating between a biological warfare attack and a natural epidemic, but with some agents the potential also exists 46 for secondary or tertiary transmission from person to person or via natural vectors. Unlike their nuclear and radiological counterparts, biological and chemical weapons have been used for terrorism by both state and non-state actors. The challenges faced in preventing the use of these weapons through international control mechanisms include the increasing availability of larger quantities of substances, ease of use and most especially advanced tech- nological deployment facilities that portend a high risk factor to larger populations. Table 1 catalogues the use of biochemical weapons in warfare and by terrorists and other groups or individuals over the past century, offering concrete historical precedent and empirical grounds for the potential future actions of Boko Haram. The data shows consistent recourse to the use of these weapons, in spite of the chemical and biological weapons conventions out- lawing them. It can be seen that from the 1970s onwards there has been an increase in the use of biochemical weapons by religious cults and terrorist groups in pursuit of their agendas. The rise of Boko Haram and its ISIS affiliation could lead to a future where the use of biochemical weapons is the norm rather than the exception.

#### COVID incentivizes engineered bioterror- extinction

Walsh, 20 -- Axios Future correspondent [Bryan Walsh, "The coronavirus pandemic reawakens bioweapon fears," Axios, 5-14-2020, https://www.axios.com/coronavirus-pandemic-pathogen-bioweapon-45417c86-52aa-41b1-8a99-44a6e597d3a8.html, accessed 9-7-2020]

The coronavirus pandemic reawakens bioweapon fears

The immense human and economic toll of the COVID-19 pandemic only underscores the threat posed by pathogens that could be deliberately engineered and released.

Why it matters: New technology like gene editing and DNA synthesis has made the creation of more virulent pathogens easier. Yet security and regulation efforts haven't kept pace with the science.

What's happening: Despite some claims by the White House, overwhelming scientific evidence indicates that the novel coronavirus was not accidentally released from a lab or deliberately engineered, but naturally spilled over from an animal source.

That doesn't mean the threat from bioweapons isn't dire. Along with AI, engineered pandemics are widely considered the biggest existential risk facing humanity.

That's in part because a pathogen could be engineered in a lab for maximum contagiousness and virulence, well beyond what would arise through natural selection.

Case in point: a 2018 pandemic simulation put on by the Johns Hopkins Center for Health Security featured a fictional engineered virus called Clade X that combined the contagiousness of the common cold with the virulence of the real-life Nipah virus, which has a mortality rate of 40-75%. The resulting simulated global outbreak killed 150 million people.

COVID-19 isn't anywhere near that fatal, but the pandemic has shown the vulnerability of the U.S. and the world to biological threats both natural and manmade.

"Potential adversaries are of course seeing the same things we’re seeing," says Richard Pilch of the Middlebury Institute of International Studies. "Anyone looking for a radical leveling approach — whether a state actor like North Korea or a motivated terrorist organization — may be influenced by COVID-19 to consider pursuing a biological weapons capability."

Background: Bioweapons were officially banned by the Biological Weapons Convention in 1975, though North Korea is suspected of maintaining an offensive bioweapons program.

A particular concern about biowarfare and bioterror, though, is that many of the tools and methods that could be used to create a weaponized virus are largely indistinguishable from those used in the course of legitimate scientific research. This makes biotechnology "dual-use" — and that much more difficult to safely regulate without cutting off research that could be vitally important.

While earlier bioweapons fears focused on the possibility that a state or terror group could try to weaponize a known dangerous agent like smallpox — which would require somehow obtaining restricted pathogens — new technology means that someone could obtain the genetic sequence of a germ online and synthesize it in the lab.

"If you've been trained in a relevant technical discipline, that means you can make almost any potentially harmful agent that you're aware of," says Kevin Esvelt, a biologist at the MIT Media Lab and a member of the CDC's Biological Agent Containment Working Group. That would include the novel coronavirus that causes COVID-19, which was recently synthesized from its genetic sequence in a study published in Nature.

How it works: Currently, synthetic DNA is ordered through commercial suppliers. But while most suppliers screen DNA orders for the sequences of dangerous pathogens, they're not required to — and not all do, which means safety efforts are "incomplete, inaccurate, and insecure," says Esvelt.

Screening efforts that look for the genetic sequences of known pathogens also wouldn't necessarily be able to detect when synthetic DNA was being used to make something entirely novel and dangerous.

In the near future, desktop DNA synthesizers may be able to generate synthetic DNA in the lab, cutting out the need for commercial suppliers — and potential security screenings.

The democratization of biotechnology could unleash a wave of creativity and innovation, just as the democratization of personal computing did. But it also increases the number of people who could potentially make a dangerous engineered virus, whether deliberately or by accident.

#### US-China war is structurally inevitable --- China delays it to buy time to modernize

Kazianis 18

Harry J. Kazianis. Harry J. Kazianis is director of defense studies at the [Center for the National Interest](https://cftni.org/), founded by former President Richard M. Nixon, “A US-China trade war is coming, but here's how to stop it.” Fox News. April 6, 2018. http://www.foxnews.com/opinion/2018/04/06/us-china-trade-war-is-coming-but-heres-how-to-stop-it.html

But even if a deal is struck to prevent most of the new tariffs from taking effect, we have crossed an important milestone in the U.S.-China relationship. Both sides now realize the nature of their ongoing geopolitical struggle. It is not out of the question to wonder whether ties between these countries with the two largest economies in the world are entering a heated, almost Cold War atmosphere.

[As I noted](http://www.foxnews.com/opinion/2018/04/04/china-is-no-friend-to-us-trump-is-right-to-take-them-on.html) in an op-ed for Fox News this week, clearly China is no friend of America. Our two nations have very different trade as well as diplomatic, economic and geopolitical goals that will naturally create tensions for perhaps decades to come. And as President Trump pointed out Thursday, each nation is understandably seeking to come out on top in any deal the two work out.

What’s needed now are tough and serious negotiations between China and the U.S. to reach a reasonable and fair compromise that gives each nation some of what it wants. But this is now a matter for diplomacy – not tweets or off-the-cuff comments. It would be a strategic mistake for the U.S. and China to engage in a tit-for-tat war of words in the media, simply adding gasoline to the fire of their trade dispute.

This is especially true because there are some indications that Beijing may be ready to blink – for strategic reasons.

Thursday night I spoke with several top-tier Chinese academics, scholars, and economists – all close to the government, all with good insights into Beijing’s thinking on escalating trade tensions with Washington. They all echoed a very similar opinion: there is a possibility of a deal with America, [even despite Beijing’s comments that no negotiations are likely](https://www.reuters.com/article/us-usa-trade-china/trump-threatens-tariffs-on-100-billion-more-china-goods-beijing-ready-to-strike-back-idUSKCN1HD0NW), for very clear reasons.

The experts I spoke with talked to me on the condition that I not identify them by name, so they could speak candidly.

“China was not ready for the sheer magnitude of President Trump coming after us on the so-called trade imbalance,” a senior Chinese economist with close ties to the government told me. “However, there is a deal that could be struck, as both sides have a lot to lose, especially China, as we are not ready for economic warfare with such a big power as America.”

The economist continued: “What scares me, and many government officials, is the rhetoric is heating up very quickly, leaving both sides very little room to work out a deal. Both sides are making a big mistake, as trying to score quick points for their own domestic political audiences is a big error. Now is the time to get both sides in a room, lock the doors, and work towards a deal that is fair to everyone.”

A Chinese scholar, also with close ties to the Beijing government, agreed with that sentiment, but with a twist.

“Chinese officials will likely offer some strong concessions to make sure we avoid a trade battle with Washington,” the scholar told me. “At the moment, we aren’t fully ready to take America on, and must continue to grow our economic and military power. This confrontation is not in our interest, and must be, at least for the moment delayed, until we are in a more powerful position.”

This scholar explained that it might even be in China’s interest to “fold” on this issue, because Beijing has much bigger issues that it must confront in the coming years.

“China must think correctly on all of this trade discussion,” the scholar said. “Our goal is to ensure our rise is not halted. We have greater strategic goals in mind. Winning a trade skirmish with America could come at the highest of prices – and turning America into an enemy that we can’t hope to defeat, at least not yet. We must delay that day for as long as we can.”

A White House official, who spoke to me Friday on condition that I not name him, also expressed hope that a deal could be worked.

“President Trump has always said he was willing to negotiate with Beijing, that is nothing new,” the U.S. official said. “But we are done being suckers to China. We want fair, reciprocal trade. I think we can get there.” However, the official expressed some caution, stating quite clearly that “the ball is now in China’s court.”

What happens now is really anyone’s guess. I would argue that a deal is most likely possible, with both sides making some concessions, especially China on intellectual property and access for U.S. products to its massive domestic markets in the years ahead.

But, at the same time, we should be cautious. The Trump administration has invested precious political capital in making sure China not only understands our intent but understands that we will defend our interests – even if that requires America to take an economic hit.

The U.S. must make sure that any agreement protects American workers, our technological base and other vital national priorities. Such a negotiation could take some time and cause us some economic pain, but would protect our long-term economic interests.

There is, however, a much bigger challenge looming just over the horizon: China’s changing strategic outlook.

Beijing is adjusting its gaze across the globe, seeing America as a very real strategic threat – and posing an increasing threat to America. Just this week, Chinese defense officials offered words of support to Russia[, forging ties that are looking more and more like a straight-up alliance](http://www.foxnews.com/world/2018/04/05/russia-china-hail-burgeoning-ties.html).

Washington must be prepared for the long haul and be ready to confront Chinese power in the months and years to come.

A Chinese economist, based out of Hong Kong, who I have known for a long time now, put it bluntly: “Washington and Beijing are set to clash. It’s just a matter of when and how.”

#### US wins now, but by 2025 A2/AD makes it game over --- strikes stay conventional and neutralize military targets

Majumdar 16

Dave Majumdar, Defense Editor of the National Interest, “New Report Details Why a War between China and America Would be Catastrophic.” The National Interest. August 1, 2016. <https://nationalinterest.org/blog/the-buzz/new-report-details-why-war-between-china-america-would-be-17210?page=0%2C1>

A war between the United States and China would cause severe losses on both sides, but—today at least—Beijing would bear the brunt of the casualties. However, as China’s anti-access/area denial (A2/AD) capabilities continue to improve—the balance of losses would shift more towards Beijing’s favor by 2025. Nonetheless, China would still suffer more losses than Washington even at that stage—according to a new report from [the RAND Corporation](http://www.rand.org/pubs/research_reports/RR1140.html#relatedProducts). Victory for either side might prove to be elusive as the conflict could degenerate into inconclusive bloodletting.

“As its military advantage declines, the United States will be less confident that a war with China will conform to its plans,” reads the new report by [David C. Gompert](http://www.rand.org/about/people/g/gompert_david_c.html), [Astrid Cevallos](http://www.rand.org/pubs/authors/c/cevallos_astrid.html)and [Cristina L. Garafola](http://www.rand.org/about/people/g/garafola_cristina_l.html). “China’s improved military capabilities, particularly for anti-access and area denial (A2AD), mean that the United States cannot count on gaining operational control, destroying China’s defenses, and achieving decisive victory if a war occurred.”

A war with China—now and in the future—would likely be fought at sea and in the air, but cyber and space capabilities would play a significant role, according to the report. But the RAND researchers expect that should a war breakout, it would remain a conventional fight. “Each side’s increasingly far-flung disposition of forces and growing ability to track and attack opposing forces could turn much of the Western Pacific into a ‘war zone,’ with grave economic consequences,” reads the report. “It is unlikely that nuclear weapons would be used: Even in an intensely violent conventional conflict, neither side would regard its losses as so serious, its prospects so dire, or the stakes so vital that it would run the risk of devastating nuclear retaliation by using nuclear weapons first.”

Moreover, while the RAND study postulates that the United States would strike heavily at the Chinese mainland, the researchers don’t believe that Beijing would strike at the U.S. homeland except via cyber attacks. “We also assume that China would not attack the U.S. homeland, except via cyberspace, given its minimal capability to do so with conventional weapons,” the report states. “In contrast, U.S. nonnuclear attacks against military targets in China could be extensive.”

A Sino-American war could develop in a number of ways—including short bloody war or a long and devastating war. Moreover, modern technologies incentivize either side to launch a preemptive attack first. “Sensors, weapon guidance, digital networking, and other information technologies used to target opposing forces have advanced to the point where both U.S. and Chinese military forces seriously threaten each other,” the report reads. “This creates the means as well as the incentive to strike enemy forces before they strike one’s own. In turn, this creates a bias toward sharp, reciprocal strikes from the outset of a war, yet with neither side able to gain control and both having ample capacity to keep fighting, even as military losses and economic costs mount.”

In the case of a brief war fought today, American losses would be significant, but Chinese losses might be catastrophic. “If either U.S. or Chinese political leaders authorize their military commanders to carry out plans for sharp strikes on enemy forces, a severely violent war would erupt,” the report reads. “As of 2015, U.S. losses of surface naval and air forces, including disabled aircraft carriers and regional air bases, could be significant, but Chinese losses, including to homeland-based A2AD systems, would be much greater. Within days, it would be apparent to both sides that the early gap in losses favoring the United States would widen if fighting continued.”

By 2025, however, China’s military capabilities are likely to have expanded to a point where it will not sustain as many losses. “By 2025, though, U.S. losses would increase because of enhanced Chinese A2AD. This, in turn, could limit Chinese losses, though these would still be greater than U.S. ones,” the report reads. “It could be unclear then whether continued fighting would result in victory for either side.”

A longer war would be far more devastating—and could leave both military forces in shambles. “As of 2015, the longer a severe war dragged on, the worse the results and prospects would be for China,” the report states. “By 2025, however, inconclusive results in early fighting could motivate both sides to fight on despite heavy losses incurred and still expected. Although prospects for U.S. military victory then would be worse than they are today, this would not necessarily imply Chinese victory.”

#### Continued modernization causes China to MIRV ICBMs

Killalea 17

Debra Killalea, Writer for AU News, “China: New missile, DF-41, expected to be deployed next year.” AU News. December 1, 2017. <https://www.news.com.au/world/asia/china-new-missile-df41-expected-to-be-deployed-next-year/news-story/5f0989eb732ab8f4c6b6a00db3eecae5>

CHINA has unveiled its most powerful weapon yet and its new intercontinental ballistic missile is a force to be reckoned with.

The DF-41 ICBM can carry up to 10 manoeuverable warheads ranging from 100 to 200 kilotonnes to megaton size and has a range of between 12,000kms and 15,000kms.

In comparison, North Korea’s Hwasong-15, which was launched yesterday, has an estimated range of 13,000km.

China’s[People Daily](http://en.people.cn/n3/2017/1128/c90000-9297997.html?mkt_tok=eyJpIjoiTnpkaFpUSTBOR00wWTJNNSIsInQiOiJuWmYrSTNYR0RzRlNnU2k2a3dQZTk5WUxYUlowSGQyZnBcL0xpbFV1ck9ISDNIVzFzN1dGb1BZQ3FDbUJ1NGpqcExMTHZcL0ZsWWhrczU0d0c1YXh6TUF4T0l4R1FOTTVCR1JUYWNaQUtSbW83TXl4cmJLandrMHhrcDkrZ1kyUkFtIn0%3D)newspaper revealed the DF-41 could enter service as early as the first half of next year.

Military expert Yang Chengjun told a TV program broadcasted on China Central Television (CCTV) earlier this week the DF-41 is China’s latest strategic missile and was quick, mobile and precise.

“The missile can hit every corner of the earth, allowing China to counter a nuclear strike on the country,” Mr Yang said.

According to the newspaper, the test launches have had a 100 per cent success rate.

Dr Malcolm Davis, a senior analyst in defence strategy and capability at the Australian Strategic Policy Institute, said this was China’s most advanced ICBM.

“It’s a road-mobile, solid fuelled ICBM with the range to cover all targets in the continental United States,” Dr Davis said.

“Its MIRVed — MIRV standing for multiple independently targeted re-entry vehicles.

“This means the missile can carry multiple nuclear warheads — up to 10 warheads each with yields of around 150 kilotons (150,000 tons TNT equivalent) — or a single warhead with a yield up to 3 megatons (millions of tons of TNT).”

Dr Davis said 24 of these missiles could deliver between 240 warheads against the US.

“The North Korean Hwasong-15 would by contrast carry a single warhead,” he said.

“It would also carry penetration aids (‘penaids’) designed to confuse US missiles defences.”

Dr Davis said China is also developing ‘MARVs’ — manoeuvring re-entry vehicles — that would give them the ability to further defeat US missile defence, and potentially, attack mobile targets.

“They are also developing hypersonic glide vehicles which would carry individual warheads and glide at up to Mach 20 at very high altitude on a highly evasive trajectory, with the hypersonic glide vehicle (called a ‘DZ-ZF’) being launched atop the DF-41 in place of the regular payload of warheads,” he said.

Beijing’s overall objective is to ensure Chinese ICBMs like the DF-41 can defeat US missile defence systems, Dr Davis said.

ULTIMATE WEAPON

Nuclear disarmament campaigner John Hallam said the DF-41 was simply the most powerful nuclear missile in the world and was the “ultimate doomsday weapon”.

“It’s a whopper, comparable to the biggest Russian missiles, which it resembles, including the recently tested Sarma,” Mr Hallam said.

He said there have been rumours and claimed sightings of this missile for some time and that it has been tested before.

“The backbone of China’s strategic force has always been the somewhat ancient DF-5 missile, each with a single 5 megaton warhead (by far) the biggest warhead in actual military use,” Mr Hallam said.

“For a long time there were just 20 of these things, but a few years back the Chinese started to upgrade, update, and add to the DF5’s, so there might be 30 now, and they started to deploy something called the DF-41 — the same designation as this one.”

The missile also could have a deadly impact if used in conflict.

“Just one of these missiles, with 10 warheads each of 100kt plus range, could essentially destroy either the major cities or the significant military capacity of the United States, especially if command and control nodes are prioritised,” Mr Hallam said.

“The DF-41 with multiple big warheads and probably a middling accuracy is ideally suited for incinerating cities, and its being mounted on a TEL (Transporter-Erector-Launcher), is consistent with that — it moves around so it can’t easily be targeted like a silo.

#### US missile defense ensures deployment – competition draws in India and escalates

Kristensen, director of the Nuclear Information Project at the Federation of American Scientists, ‘15

(Hans M., “Pentagon Report: China Deploys MIRV Missile,” May 11, https://fas.org/blogs/security/2015/05/china-mirv/)

**Why Chinese MIRV?**

The big question is why the Chinese leadership has decided to deploy MIRV on the silo-based, liquid-fuel DF-5A.

Chinese officials have for many years warned, **and US officials have predicted**, that advanced US non-nuclear capabilities such as missile defense systems could cause China to deploy MIRV **on some of its missiles.** The Pentagon report **repeats this analysis** by stating that China’s “new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of China’s strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic ISR, precision strike, and **missile defense capabilities**.”

Conclusions

**Chinese MIRV on the DF-5 ICBM is a** bad day for nuclear constraint.

Seen in the context of China’s other ongoing nuclear modernization programs – deployment of several types of mobile ICBMs and a new class of sea-launched ballistic missile submarines – the deployment of a MIRVed version of the DF-5 ICBM reported by the Pentagon’s annual report **strains the credibility of China’s official assurance** that it only wants a minimum nuclear deterrent and is not part of a nuclear arms race.

MIRV on Chinese ICBMs changes the calculus that other nuclear-armed states will make about China’s nuclear intensions and capacity. Essentially, **MIRV allows a much more rapid increase of a nuclear arsenal than single-warhead missile.** If China also develops MIRV for a mobile ICBM, then it would further deepen that problem.

To its credit, the Chinese nuclear arsenal is still much smaller than that of Russia and the United States. So this is not about a massive Chinese nuclear buildup. Yet the development underscores that a technological nuclear competition among the nuclear-armed states is in full swing – one that China also contributes to.

Although it is still unclear what has officially motivated China to deploy a MIRVed version of the DF-5 ICBM now, previous Chinese statements and US intelligence assessments **indicate that it may be a** reaction to the US development and deployment of missile defense systems **that can threaten China’s ability to retaliate with nuclear weapons.**

If so, **how ironic that the US missile defense system** – intended to reduce the threat to the United States – instead **would seem to have increased the threat by triggering development of MIRV** on Chinese ballistic missiles that could destroy more US cities in a potential war.

The deployment of a MIRVed DF-5 also raises serious questions about China’s strategic relationship with India. The Pentagon report states that in addition to US missile defense capabilities, “India’s nuclear force is an additional driver behind China’s nuclear force modernization.” **There is little doubt that Chinese MIRV has the potential to** nudge India into the MIRV club as well.

Indian weapons designers have already hinted that India may be working on its own MIRV system and the US Defense Intelligence Agency recently stated that “India will continue developing an ICBM, the Agni-VI, which will reportedly carry multiple warheads.”

**If** Chinese MIRV triggers Indian MIRV **it would** deepen nuclear competition **between the two Asian nuclear powers and reduce security for both**. This calls for both countries to show constraint but it also requires the other MIRVed nuclear-armed states (Britain, France, Russia and the United States) to limit their MIRV and offensive nuclear warfighting strategies.

#### 1] War’s inevitable, which means only our offense---if we need to have it, better now than later when China modernizes

#### 2] No escalation --- we’d use counterforce strikes

Lieber and Press 16

Keir A. Lieber and Daryl G. Press. Keir A. Lieber is Director of the Security Studies Program and Associate Professor in the Edmund A. Walsh School of Foreign Service at Georgetown University. Daryl G. Press is Associate Professor in the Department of Government at Dartmouth College. “The New Era of Nuclear Weapons, Deterrence, and Conflict.” Strategic Studies Quarterly. Vol. 10, No. 5. 2016.

https://www.jstor.org/stable/pdf/26271621.pdf?refreqid=excelsior%3A928c663c72c835e2ad1bf2512a0f4eb3

“The United States is not seeking to neutralize adversary deterrent forces.”

Some critics argue that the United States is not seeking strategic primacy. They reject any intent behind the emergence of US nuclear primacy and downplay the effort to neutralize adversary deterrent forces in US military strategy. Instead of the United States bolstering its counterforce capabilities, critics emphasize how it is minimizing the role of nuclear weapons in national security strategy—as only this is consistent with international arms control and nonproliferation efforts aimed at convincing other states to forego strategic weapons, reduce existing arsenals, or cancel modernization programs. The implication is that we have mistakenly imputed sinister motives to US defense programs and planning.

Disavowal of the US pursuit of strategic primacy comes most frequently from those who work inside or outside the government on arms control and nonproliferation policy. Yet, those who work on US regional war plans and counterproliferation policy typically see nothing controversial in our claim that the United States seeks the ability to neutralize adversary strategic weapons. In fact, this effort appears to be official US policy. As a simple Internet search shows, the US government does not hide the wide range of research and planning efforts underway that fall under the rubric of “defeat WMD” or “combatting WMD.” And the underlying logic behind those efforts is simple: deterrence may fail, especially during conventional wars, and therefore the United States needs the ability to defend US forces, allies, and the US homeland from enemy WMD using, depending on the circumstances, conventional strikes, missile defenses, special operations, offensive cyber attacks, and in extreme cases nuclear strikes. In short, “defeating WMD” and “seeking strategic primacy” are essentially synonymous: protecting oneself from others’ strategic weapons (which sounds reasonable) and neutralizing others’ strategic deterrent forces (which sounds more malicious) are simply two phrases describing the same behavior.

**That kills 700 max**

**Lieber 17**

Keir A. Lieber, Associate Professor in the Edmund A. Walsh School of Foreign Service and the Department of Government at Georgetown University, and Daryl G. Press, Associate Professor in the Department of Government at Dartmouth College, The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence, Volume 41, Number 4, Spring 2017

Third, the emergence of a new era of counterforce raises the question of whether it is wise, for the United States in particular, to continue improving nuclear and nonnuclear counterforce capabilities. On the one hand, improved **counterforce capabilities** could be invaluable in a range of plausible scenarios.11 Improved offensive capabilities could help the United States **deter** weak countries from **initiating conventional conflicts** or from **escalating** in the midst of war. Enhanced counterforce capabilities could also help **protect U.S. forces, allies, and the U.S. homeland from nuclear attack if a conventional war did escalate**. On the other hand, better counterforce could be a source of danger: not only might improved disarming strike capabilities—in any country's hands—increase the temptation to attack, but also potential victims of disarming strikes will seek to escape their vulnerability, thereby possibly triggering arms racing and incentives to strike preemptively.12 Both views may be correct. The net benefit of decisions to enhance counter-force capabilities will therefore depend on the particular case. For countries that perceive a highly malign threat environment, face aggressive nuclear [End Page 12] armed adversaries, or have ambitious foreign policy goals, the benefits of developing advanced counterforce capabilities may outweigh the costs. For those countries that face a benign environment and have more modest goals, however, the secondary costs of enhancing counterforce may be too great. In any case, these contentious issues have not received sufficient attention; analysts and policymakers have largely overlooked the ways that rapidly changing technologies are eroding the foundation of deterrence. The remainder of this article is organized as follows. We first discuss the key role that arsenal survivability plays in nuclear deterrence theory. Second, we describe the main strategies that planners employ to ensure arsenal survivability in practice. Next, we explore one of the major technological trends eroding survivability, the **great leap in weapons accuracy**, and illustrate how improved accuracy creates new possibilities for counterforce strikes. We then focus on the second major trend, **dramatic improvements in remote sensing**, and how the resulting increase in transparency threatens **concealed and mobile nuclear forces**. We conclude with a summary of our findings and their implications for international politics and U.S. national security. Nuclear Survivability in Theory At its core, nuclear deterrence theory rests on two simple propositions. First, countries will not attack their adversaries if they expect the costs to exceed the benefits. Second, nuclear weapons allow countries, even relatively weak ones, to inflict unprecedented levels of damage on those who attack them. Taken together, these propositions suggest that nuclear weapons are the ultimate instruments of deterrence: no conceivable benefit of attacking a nuclear-armed state could be worth the cost of getting hit with nuclear weapons in retaliation. As long as nuclear arsenals are survivable, that is, able to withstand an enemy's first strike and retaliate, nuclear weapons are a tremendous force for peace. The theory of the nuclear revolution builds on the logic of deterrence theory and extends its implications. Because nuclear weapons make countries fundamentally secure, countries can escape the most pernicious consequences of anarchy. According to the theory of the nuclear revolution, once countries deploy survivable arsenals they no longer need to fear conquest.13 As a result, they [End Page 13] can stop worrying about the relative balance of power;14 engaging in arms races;15 or competing for alliance partners and strategic territory.16 Proponents of the theory of the nuclear revolution have always recognized the discrepancy between their theory's predictions and the actual behavior of countries in the nuclear era. The Cold War competition between the United States and the Soviet Union, in particular, is filled with empirical anomalies: extensive arms racing, intense concerns about relative power gains and losses, and competition for allies and control of strategic territory—all occurring at a time when the main adversaries appeared to be invulnerable to disarming strikes.17 World War III was averted, as nuclear deterrence theory would predict, [End Page 14] but the transformation of international politics that advocates of the theory of the nuclear revolution anticipated never materialized. Today, nuclear powers still eye each other's economic power and military capabilities warily; strive for superiority over their adversaries in conventional and nuclear armaments; aim to control strategically relevant areas of land, air, sea, and space; seek to build and maintain alliances; and prepare for war. The discrepancy between the theory of the nuclear revolution and the behavior of states stems from the theory's misplaced confidence in the survivability of nuclear arsenals.18 Proponents of the theory believe that nuclear weapons deployed in even moderate numbers are inherently survivable.19 Moreover, according to the argument, survivability is a one-way street: once a country deploys a survivable arsenal, it will remain that way. Yet, what if survivability is reversible? If arsenal survivability depends on the uncertain course of technological change and the efforts of adversaries to develop new technologies, states will feel compelled to arms race to ensure that their deterrent forces remain survivable in the face of adversary advances. They will worry about relative gains, because a rich and powerful adversary will have more resources to invest in technology and military forces. They will value allies, which help contribute resources and valuable territory. Moreover, states may be enticed to develop their own counterforce capabilities in order to disarm their adversaries or limit the damage those adversaries can inflict in case of war. In short, if nuclear stalemate can be broken, one should expect countries to act as they always have when faced with military threats: by trying to exploit new technologies [End Page 15] and strategies for destroying adversary capabilities. If arsenals have been more vulnerable than theorists assume, or if survivability and stalemate are reversible, then the central puzzle of the nuclear era—continued geopolitical competition—is no longer a puzzle. We argue not only that stalemate is reversible in principal, but also that changes in technology occurring today are making all countries' arsenals less survivable than they were in the past. The fear of suffering devastating retaliation will still do much to deter counterforce attacks, but countries will increasingly worry that their adversaries are trying to escape stalemate, and they will feel pressure to do the same. Deterrence will weaken as arsenals become more vulnerable. In extreme circumstances—for example, if an adversary threatens escalation (or begins to escalate) during a conventional war—the temptation to launch a disarming strike may be powerful.20 In short, in stark contrast to the expectations of the theory of the nuclear revolution, security competition has not only endured, but also will intensify as enhanced counterforce capabilities proliferate. Nuclear Survivability in Practice The survivability of retaliatory arsenals has long been a crucial objective of real-world military planning, not just a fertile topic of theoretical analysis. Military planners have employed three basic approaches to protect their countries' nuclear forces from attack: hardening, concealment, and redundancy. In terms of hardening, planners deploy missiles in reinforced silos designed to resist blast, heat, ground shock, and the other effects of nuclear detonations; place aircraft in hardened shelters; create protective sites for patrolling mobile missile launchers; and bury command and control sites, as well as the secure means used to communicate launch orders. Nuclear planners also rely heavily on concealment. Concealment is the foundation of survivability for mobile delivery systems, such as ballistic missile submarines (SSBNs) or mobile missile launchers (known as "transporter erector launchers," or TELs), both of which hide in vast deployment areas. Aircraft are harder to hide because they require airfields for takeoff and landing, but they too can employ concealment by dispersing to alternate airfields or remaining [End Page 16] airborne during alerts. Even the most difficult facilities to hide, hardened missile silos or command bunkers, can be concealed using camouflage and decoys. Finally, redundancy is used to bolster every aspect of the nuclear mission, especially force survivability. Most nuclear-armed states use multiple types of delivery systems and warheads to complicate enemy strike plans and protect against warhead design flaws. They spread their forces and warheads across multiple bases. Moreover, the most powerful nuclear-weapon states employ redundant communication networks, command and control arrangements, and early warning systems. No single strategy of survivability is ideal, because each entails important trade-offs. Hardening is attractive, but it comes at the price of concealment: for example, it is difficult to hide the major construction entailed in building a nuclear silo. Also, hardened sites are not mobile; once discovered, they remain so.21 Similarly, concealment comes at the price of hardening. If mobile forces are discovered, they tend to be easy to destroy. Concealment has another significant drawback: it is a "fail deadly" strategy, meaning that if an adversary develops a way to locate one's forces, one's arsenal might go from highly survivable to completely vulnerable almost overnight. Even worse, one might not know that the nuclear balance has shifted in such a calamitous manner.22 Some countries have adopted operating doctrines that attempt to capitalize on the advantages of both hardening and concealment: China today, for example, appears to plan to disperse its mobile missiles in a nuclear crisis from its peacetime garrisons to remote protective sites.23 Such approaches capture the [End Page 17] benefits of both strategies, but they also pay the costs. For example, China's strategy **leaves its forces vulnerable if an attacker has identified its dispersal sites** or detects mobile missiles in transit.24 Major technological trends are **directly undermining** these strategies of survivability. Leaps in weapons accuracy threaten nuclear forces that rely on hardening, while an unfolding revolution in remote sensing threatens nuclear forces that depend on concealment. (Another major change since the end of the Cold War, **far smaller nuclear arsenals** among potential adversaries, weakens the third strategy of survivability: redundancy.)25 Developing survivable forces is not impossible, but **a new age of vulnerability has begun**. Counterforce in the Age of Accuracy For most of the nuclear age, neither bombers nor ballistic missiles could deliver weapons accurately enough to reliably destroy hardened targets. Too many variables affected the impact point of a bomb—such as the aircraft's speed and altitude; the air defense environment; and atmospheric conditions including wind, temperature, and humidity—for even highly skilled crews to deliver bombs precisely.26 Long-range ballistic missiles were even less accurate. Although their initial deployment conjured fears of "bolt-from-the-blue" disarming strikes, throughout the 1970s long-range missiles were not accurate enough to destroy fields of hardened silos.27 **Technological improvements chipped away** at the sources of inaccuracy, however. Leaps in navigation and guidance, including advanced inertial sensors [End Page 18] with stellar updates, improved the ability of missiles to precisely determine their position in flight and guide themselves, as needed, back on course. Other breakthroughs allowed mobile delivery systems, such as submarines and mobile land-based launchers, to accurately determine their own position prior to launch, greatly improving their accuracy.28 As a result of these innovations, new missiles emerged in the mid-1980s with far better accuracy than their predecessors, rendering hardened targets vulnerable as never before. For bombers, onboard computers now continuously measure the variables that previously confounded bombardiers. Data on aircraft speed and location are uploaded from the aircraft into the computers of "smart" bombs and cruise missiles, which in turn automatically plot a flight path from the release location to the target. The weapons adjust their trajectory as they fly to remain on course.29 **As a result, bombs and missiles can achieve levels of accuracy unimaginable at the start of the nuclear age.** The leap in munitions accuracy has been showcased repeatedly during conventional wars: videos of missiles and bombs guiding themselves directly to designated targets now appear mundane. Although the effects of the accuracy revolution on nuclear delivery systems are equally dramatic, they have received far less attention, despite huge implications for the survivability of hardened targets. IMPROVED MISSILE ACCURACY Figure 1 illustrates one consequence of the accuracy revolution, as applied to nuclear forces, by comparing the effectiveness of U.S. ballistic missiles in 1985 to those in the current U.S. arsenal.30 We use formulas, employed by nuclear analysts for decades, to estimate the effectiveness of missile strikes against a [End Page 19] Figure 1. The Growing Vulnerability of Hard Targets, 1985–2017 NOTE: The calculations underlying this figure assume targets hardened to withstand 3,000 pounds per square inch (psi). Data for 1985 are based on the most capable U.S. land-based intercontinental ballistic missile (ICBM) and submarine-launched ballistic missile (SLBM) at the time: the Minuteman III ICBM armed with a W78 warhead and the Trident I C-4 SLBM armed with a W76 warhead. The 2017 ICBM data are based on the same Minuteman III / W78, with an improved guidance system. The 2017 SLBM data show both contemporary configurations of the Trident II D-5 missile: one version armed with the W76 and the other with higher-yield W88 warheads. The data and sources for U.S. weapon systems are in the online appendix, , table A1. Click for larger view View full resolution Figure 1. The Growing Vulnerability of Hard Targets, 1985–2017 NOTE: The calculations underlying this figure assume targets hardened to withstand 3,000 pounds per square inch (psi). Data for 1985 are based on the most capable U.S. land-based intercontinental ballistic missile (ICBM) and submarine-launched ballistic missile (SLBM) at the time: the Minuteman III ICBM armed with a W78 warhead and the Trident I C-4 SLBM armed with a W76 warhead. The 2017 ICBM data are based on the same Minuteman III / W78, with an improved guidance system. The 2017 SLBM data show both contemporary configurations of the Trident II D-5 missile: one version armed with the W76 and the other with higher-yield W88 warheads. The data and sources for U.S. weapon systems are in the online appendix, http://dx.doi:10.7910/DVN/NKZJVT, table A1. typical hardened silo.31 The figure distinguishes three potential outcomes of a missile strike: hit, miss, and fail. "Hit" means that the warhead detonates within the lethal radius (LR) of the aimpoint, thus destroying the target. "Miss" means that the warhead detonates outside the LR, leaving the target undamaged. "Fail" means that some element of the attacking missile system malfunctioned, leaving the target undamaged. [End Page 20] Figure 1 shows that the accuracy improvements of the past three decades have led to substantial leaps in counterforce capabilities. In 1985 a U.S. intercontinental ballistic missile (ICBM) had only about a 54 percent chance of destroying a missile silo hardened to withstand 3,000 pounds per square inch (psi) overpressure. In 2017 that figure exceeds 74 percent. The improvement in submarine-launched weapons is starker: from 9 percent to 80 percent (using the larger-yield W88 warhead). Figure 1 also suggests, however, that despite vast improvements in missile accuracy, the weapons still are not effective enough to be employed individually against hardened targets. Even modern ballistic missiles are expected to miss or fail 20–30 percent of the time. The simple solution to that problem, striking each target multiple times, has never been a feasible option because of the problem of fratricide: the danger that incoming weapons might destroy or deflect each other.32 The accuracy revolution, however, also offers a solution to the **fratricide**

**problem**, opening the door to assigning **multiple warheads against a single target**, and thus paving the way to **disarming counterforce strikes**. THE FADING PROBLEM OF FRATRICIDE One type of fratricide occurs when the prompt effects of nuclear detonations—radiation, heat, and overpressure—destroy or deflect nearby warheads. To protect those warheads, targeters must separate the incoming weapons by at least 3–5 seconds.33 A second source of fratricide is harder to overcome. Destroying hard targets typically requires low-altitude detonations (so-called ground bursts), which vaporize material on the ground. When the debris begins to cool, 6–8 seconds after the detonation, it solidifies and forms a dust cloud that envelops the target. Even small dust particles can be lethal to incoming warheads speeding through the cloud to the target. Particles in the debris cloud take approximately 20 minutes to settle back to ground.34 For decades, these two sources of fratricide, acting together, posed a major [End Page 21] problem for nuclear planners.35 Multiple warheads could be aimed at a single target if they were separated by at least 3–5 seconds (to avoid interfering with each other); yet, all inbound warheads had to arrive within 6–8 seconds of the first (before the dust cloud formed). As a result, assigning more than two weapons to each target would produce only marginal gains: if the first one resulted in a miss, the target would likely be shielded when the third or fourth warhead arrived.36 Improvements in accuracy, however, have greatly mitigated the problem of fratricide. As figure 1 shows, the proportion of misses—the main culprit of fratricide—compared to hits is fading. To be clear, some weapons will still fail; that is, they will be prevented from destroying their targets because of malfunctioning missile boosters, faulty guidance systems, or defective warheads. Those kinds of failures, however, do not generally cause fratricide, because the warheads do not detonate near the target. Only those that miss—that is, those that travel to the target area and detonate outside the LR—will create a dust cloud that shields the target from other incoming weapons. In short, leaps in accuracy are essentially reducing the set of three outcomes (hit, fail, or miss) to just two: hit or fail. The "miss" category, the key cause of fratricide, has **virtually disappeared**.37 THE CUMULATIVE CONSEQUENCES FOR COUNTERFORCE The end of fratricide is just one development that has helped negate hardening and increased the vulnerability of nuclear arsenals. The computer revolution has led to other improvements that, taken together, **significantly increase counterforce capabilities**. First, improved accuracy has transformed the role of ballistic missile submarines, turning these instruments of retaliation against population centers into potent counterforce weapons. Recall (from figure 1 above) that a 1985 submarine-launched ballistic missile (SLBM) had only a 9 percent chance of destroying a hardened target. This meant that although ballistic missile submarines could destroy "soft" targets (e.g., cities), they could not destroy the hardened sites that would be a key focus of a disarming attack. Increased [End Page 22] SLBM accuracy has added hundreds of SLBM warheads to the counterforce arsenal; it has also unlocked other advantages that submarines possess over land-based missiles. For example, submarines have flexibility in firing location, allowing them to strike targets that are out of range of ICBMs or that are deployed in locations that ICBMs cannot hit.38 Submarines also permit strikes from close range, reducing an adversary's response time. And because submarines can fire from unpredictable locations, SLBM launches are more difficult to detect than ICBM attacks, further reducing adversary response time before impact. Second, upgraded fuses are making ballistic missiles even more capable than figure 1 reports. In a compelling new analysis, Theodore Postol explores the implications of new "compensating" fuses that exist on most U.S. SLBMs and that will soon be deployed on the entire force.39 Reentry vehicles equipped with this fusing system use an altimeter to measure the difference between the actual and expected trajectory of the reentry vehicle, and then compensate for inaccuracies by adjusting the warhead's height of burst.40 Specifically, if the altimeter reveals that the warhead is off track and will detonate "short" of the target, the fusing system lowers the height of burst, allowing the weapon to travel farther (hence, closer to the aimpoint) before detonation. Alternatively, if the reentry vehicle is going to detonate beyond the target, the height of burst is adjusted upward to allow the weapon to detonate before it travels too far.41 Without this technology, as figure 1 shows, the lower-yield W76 warheads are much less effective against hardened targets than their higher-yield cousins, the W88s. The improved fuse cuts the effectiveness gap roughly in half, making the hundreds of W76s in the U.S. arsenal potent counterforce weapons for the first time.42 **The consequences** of the new fuse [End Page 23] **are**, therefore, **profound**, essentially **tripling the size of the U.S. submarine-based arsenal against hard targets**.43 More broadly, the technology at the core of compensating fuses is available to any state capable of building modern multistage ballistic missiles.44 A third key improvement, rapid missile retargeting, increases the effectiveness of ballistic missiles by reducing the consequence of malfunctions. As figure 1 illustrates, when accuracy increases, missile reliability becomes the main hurdle to attacks on hardened targets. For decades analysts have recognized a solution to this problem: if missile failures can be detected, the targets assigned to the malfunctioning missiles can be rapidly reassigned to other missiles held in reserve.45 The capability to retarget missiles in a matter of minutes was installed at U.S. ICBM launch control centers in the 1990s and on U.S. submarines in the early 2000s, and both systems have since been upgraded.46 We do not know if the United States has adopted war plans that fully exploit rapid reprogramming to minimize the effects of missile failures.47 Nevertheless, such a targeting approach is within the technical capabilities of the United States and other major nuclear powers and may already be incorporated into war plans.48 [End Page 24] Table 1 illustrates the consequences of these improvements against two hypothetical target sets: 100 moderately hard mobile missile shelters and 200 hardened missile silos.49 Row 1 shows the approximate counterforce capabilities of a 1985-era U.S. Minuteman III ICBM strike; a 2-on-1 attack would have been expected to leave 8 mobile missile shelters intact. A strike against 200 hardened silos would fare worse, with 42 targets expected to survive. The remaining rows in table 1 highlight the implications of the changes that have occurred from 1985 to 2017. Row 2 illustrates the impact of improved Minuteman III guidance, which reportedly reduced circular error probable (CEP) from 183 to 120 meters. Row 3 employs the most capable missile and warhead combination in the current U.S. arsenal: the Trident II armed with a high-yield W88 warhead. As the results in both rows show, upgraded missiles perform better than their predecessor, but not well enough to conduct effective disarming strikes against large target sets. Rows 4–7 demonstrate how the various improvements in missile technology have combined to create transformative counterforce capabilities. In row 4, we use a more realistic figure for missile system reliability. Although 80 percent missile reliability is traditionally used as a baseline, **much evidence suggests that the actual reliability of modern missiles exceeds 90 percent**.50 Row 4 shows attack outcomes for a Trident II/W88 with 90 percent reliability. Row 5 shows the consequences if the United States can reprogram its missiles [End Page 25] Table 1. The Demise of Hard Target Survivability NOTE: Results are displayed for 100 mobile missile shelters hardened to withstand up to 1,000 pounds per square inch (psi) or 200 missile silos hardened to 3,000 psi. Yield is in kilotons and circular error probable (CEP) is in meters. The column "Attack Plan" indicates the number of warheads assigned to each target; "R" (for reprogramming) means that the attacker uses reserve missiles to replace boost phase malfunctions. The columns titled "p(K)" list the probability that each individual target is destroyed, and "Survives" is the expected number of targets surviving the attack. The designation of "0.99+" under p(K) indicates 99.9 percent or greater chance of destroying each individual target. Light shaded cells indicate successful disarming attacks; darker cells indicate very successful strikes. Note that a single surviving mobile missile shelter does not necessarily imply that a mobile missile survived, whereas a surviving silo suggests a surviving missile. Click for larger view View full resolution Table 1. The Demise of Hard Target Survivability NOTE: Results are displayed for 100 mobile missile shelters hardened to withstand up to 1,000 pounds per square inch (psi) or 200 missile silos hardened to 3,000 psi. Yield is in kilotons and circular error probable (CEP) is in meters. The column "Attack Plan" indicates the number of warheads assigned to each target; "R" (for reprogramming) means that the attacker uses reserve missiles to replace boost phase malfunctions. 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This row, unlike the others, employs the lower-yield warhead on the Trident II missiles (the W76). With the compensating fuse, a 2-on-1 attack using W76s would be expected to destroy all the mobile missile shelters and all but one of the hardened silos. (An attack that mixed W88s and W76s could destroy the entire hardened silo force.) The results in table 1 are simply the output of a model. In the real world, the effectiveness of any strike would depend on many factors not modeled here, including the skill of the attacking forces, the accuracy of target intelligence, the ability of the targeted country to detect an inbound strike and "launch on warning," and other factors that depend on the political and strategic context. As a result, these calculations tell us less about the precise vulnerability of a given arsenal at a given time—though one can reach arresting conclusions based on the evidence—and more about trends in how technology is undermining survivability.51 One crucial consequence of the accuracy revolution is not captured in the above results. Yet, its impact on the vulnerability of nuclear arsenals may be just as profound. The accuracy revolution has rendered **low-casualty counter-force attacks** plausible for the **first time**. THE DAWN OF LOW-CASUALTY COUNTERFORCE In nuclear deterrence theory, the primary factor preventing nuclear attack is the attacker's fear of retaliation. In reality, however, additional sources of inhibition exist, including the terrible civilian consequences of an attempted counterforce strike. If a leader contemplating a disarming strike knows that such an attack will inflict massive casualties on the enemy, that leader will also understand that the failure to disarm the enemy will provoke a massive punitive response, foreclosing the possibility of a limited nuclear exchange. Furthermore, if a disarming strike would cause enormous civilian casualties in the target country, but also possibly in allied and neutral neighboring countries, leaders who value human life or the fate of allies would contemplate such an [End Page 27] attack in only the direst circumstances. The link between civilian casualties and nuclear inhibition explains why many arms control advocates oppose the development of less destructive nuclear weapons; they worry that such weapons are more "usable."52 Counterforce was tantamount to mass casualties throughout the nuclear age, **but the accuracy revolution is severing that link**. In the past, the main impediment to low-casualty nuclear counterforce strikes has been **radioactive fallout**. Targeters would have had to rely on ground bursts to maximize destructive effects against hardened facilities such as silos and storage sites. Detonations close to the ground have a major drawback, however: debris is sucked up into the fireball, where it mixes with radioactive material, spreading radiation wherever it settles. Although the other effects of nuclear detonations (e.g., blast and fire) can have large-scale consequences for civilians, in many circumstances those effects can be minimized.53 If a strike produces fallout, however, the consequences are potentially vast and difficult to predict.54 In theory, it has always been possible to employ nuclear weapons without creating much fallout. If weapons are detonated at high altitude (above the "fallout threshold"), very little debris from the ground will be drawn up into the fireball, greatly reducing fallout.55 In practice, however, this targeting strategy has never been feasible against hardened sites. The problem is that any high-yield weapon that detonates low enough to destroy a hardened target will also be low enough to create fallout. Low-yield weapons could do the job and remain above the fallout threshold, but that has always been impractical because low-yield weapons would need to be delivered with great precision to destroy hardened sites, which was previously impossible.56 [End Page 28] Figure 2. The Potential for Low-Fallout Nuclear Counterforce NOTE: "Target hardness" (the horizontal axis) is measured in pounds per square inch (psi), with a typical range of psi for hardened mobile missile shelters and missile silos noted. "Yield" (the vertical axis) is measured in kilotons and plotted on a logarithmic scale. The curve depicts the maximum weapon yield that can destroy a given target from above the fallout threshold. Any weapon yield/target hardness combination above the line that is effective enough to destroy the target will necessarily result in fallout. Points below the line indicate that weapons can be detonated at an altitude that will destroy the target yet produce little or no fallout. See the online appendix for calculations. Click for larger view View full resolution Figure 2. The Potential for Low-Fallout Nuclear Counterforce NOTE: "Target hardness" (the horizontal axis) is measured in pounds per square inch (psi), with a typical range of psi for hardened mobile missile shelters and missile silos noted. "Yield" (the vertical axis) is measured in kilotons and plotted on a logarithmic scale. The curve depicts the maximum weapon yield that can destroy a given target from above the fallout threshold. Any weapon yield/target hardness combination above the line that is effective enough to destroy the target will necessarily result in fallout. Points below the line indicate that weapons can be detonated at an altitude that will destroy the target yet produce little or no fallout. See the online appendix for calculations. Figure 2 illustrates why high-yield strikes against hard targets inevitably create fallout, and it highlights the potential low-yield solution to the fallout problem. The vertical axis reflects weapon yield, and the horizontal axis depicts the hardness of potential targets—with the approximate values for mobile missile shelters and missile silos indicated. The solid black line shows the maximum yield of a weapon that can generate enough overpressure to destroy a target from above the fallout threshold. For example, figure 2 shows that for a 3,000 psi target, the highest-yield weapon that can destroy it while remaining above the fallout threshold is 0.35 kilotons. A larger-yield weapon will necessarily cause fallout if it destroys the target. A low-fallout strike against a 1,000 psi mobile missile shelter would require a weapon with 50 kilo [End Page 29] tons yield, or less. In short, low-fatality nuclear counterforce is possible, but it requires low-yield weapons, and hence very accurate delivery. The accuracy of nuclear delivery systems is now to the point that low-casualty disarming strikes are possible. For example, a 0.3 kiloton bomb would require a CEP of 10–15 meters to be highly effective against hard targets;57 that level of accuracy is likely within the reach of the new guided B61-12, which is slated to replace all nuclear gravity bombs in the U.S. arsenal.58 Similarly, a 5-kiloton missile warhead, which may approximate the yield of the fission primary on many existing ballistic missiles, could destroy a hardened target if its CEP was approximately 50 meters.59 That level of accuracy was implausible for most of the Cold War, yet it is within reach of many countries today.60 By detonating weapons above the fallout threshold, targeters can greatly reduce fallout relative to ground bursts. But how significant are these reductions? How many fewer deaths would be caused in comparison with ground burst strikes? To compare the fallout and potential fatalities from high-yield and low-yield counterforce operations, we used unclassified U.S. Defense Department software, called Hazard Prediction and Assessment Capability (HPAC).61 We modeled two different counterforce strikes, one using a "traditional" high-yield approach and one employing low-yield airbursts, against five hardened targets in North Korea (e.g., nuclear storage sites or hardened mobile missile shelters). Because there is no available unclassified information about the location of North Korea's nuclear storage sites, we modeled strikes against notional locations around the DPRK's periphery. [End Page 30] Figure 3. Low-Fallout Counterforce Option against North Korea NOTE: The figure illustrates the potential fallout consequences of two alternative counter-force strikes against five notional North Korean hardened nuclear sites. In both strike options, each target is destroyed with **greater than 95 percent probability**. The high-yield attack employs ten W88 warheads (455-kiloton yield), with two warheads against each target. Because high-yield weapons cannot destroy hardened sites from above the fallout threshold, the W88s are ground bursts. The low-yield attack uses twenty B61 bombs (0.3-kiloton yield), set to detonate at an altitude that maximizes effectiveness while minimizing fallout. The fallout patterns and casualty figures were generated using unclassified U.S. Defense Department software, called Hazard Prediction and Assessment Capability. Click for larger view View full resolution Figure 3. Low-Fallout Counterforce Option against North Korea NOTE: The figure illustrates the potential fallout consequences of two alternative counter-force strikes against five notional North Korean hardened nuclear sites. In both strike options, each target is destroyed with greater than 95 percent probability. 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As long as the targets were located outside North Korean cities, the number of Korean fatalities from a low-yield strike would be comparable to the human losses from conventional operations. In fact, the fallout contours that are visible in figure 3 for the low-yield scenario correspond to annual radiation levels deemed acceptable by the U.S. Occupational Safety and Health Administration. The precise results of the HPAC simulation should be treated with skepticism: wind speed and direction change constantly, altering fallout patterns. The amount of fallout generated in the low-yield scenario is so low, however, that the results of figure 3 are robust regardless of which way the wind blows: [End Page 31] few people located away from the actual targets would be killed. The point of figure 3 is not to predict the outcome of a counterforce strike on North Korea, but to reveal the relationship between accuracy and fallout. When accuracy was poor, the only approach to nuclear counterforce was high-yield strikes, which would create catastrophic results such as the one depicted above. The accuracy revolution has **changed the calculus**, however; **low-fatality nuclear strikes are now possible**.62 The accuracy revolution is ongoing. As accuracy continues to improve, the effectiveness of conventional attacks on hard targets will continue to increase. Today, low-yield nuclear weapons can destroy targets that once required very large yield detonations. In the future, many of those targets will be vulnerable to conventional attacks. In sum, from the start of the nuclear age to the present, force planners have relied on hardening as a key strategy for ensuring the survivability of their arsenals. That strategy made sense, and until recently ensured that disarming strikes would not only fail, but also kill millions of civilians in the process. Technology never stands still, however, and the technical foundations of deterrence, particularly for the strategy of hardening, have been greatly undermined by leaps in accuracy. Counterforce in the Age of Transparency While advances in accuracy are negating hardening as a strategy for protecting nuclear forces, leaps in remote sensing are undermining the other main approach: concealment. Finding concealed forces, particularly mobile ones, remains a major challenge. Trends in technology, however, are eroding the security that mobility once provided. In the ongoing competition between "hiders" and "seekers," waged by ballistic missile submarines, mobile land-based missiles, and the forces that seek to track them, the hider's job is growing more difficult than ever before. Five trends are ushering in an age of unprecedented transparency.63 First, [End Page 32] sensor platforms have become more diverse. The mainstays of Cold War technical intelligence—satellites, submarines, and piloted aircraft—continue to play a vital role, and they are being supplemented by new platforms. For example, remotely piloted aircraft and underwater drones now gather intelligence during peacetime and war. Autonomous sensors, hidden on the ground or tethered to the seabed, monitor adversary facilities, forces, and operations. Additionally, the past two decades have witnessed the development of a new "virtual" sensing platform: cyberspying.64 Second, sensors are collecting a widening array of signals for analysis using a growing list of techniques. Early Cold War strategic intelligence relied heavily on photoreconnaissance, underwater acoustics, and the collection of adversary communications—all of which remain important. Now, modern sensors gather data from across the entire electromagnetic spectrum; they employ seismic and acoustic sensors in tandem; and they emit radar at various frequencies depending on their purpose, for example, to maximize resolution or to penetrate foliage. Modern remote sensing exploits an increasing number of analytic techniques, including spectroscopy to identify the vapors leaking from faraway facilities, interferometry to discover underground structures, and signals processing techniques (such as those underpinning synthetic aperture radars) that allow radars to perform better than their antenna size would seem to permit.65 Third, remote sensing platforms increasingly provide persistent observation. At the beginning of the Cold War, strategic intelligence was hobbled by sensors that collected snapshots rather than streams of data. Spy planes sprinted past targets, and satellites passed overhead and then disappeared over the horizon. Over time those sensors were supplemented with platforms that remained in place and soaked up data, such as signals intelligence antennas, undersea hydrophones, and geostationary satellites. The trend toward persistence is continuing. Today, remotely piloted vehicles can loiter near enemy targets, and autonomous sensors can monitor critical road junctures for months or years. Persistent observation is essential if the goal is not merely to count enemy weapons, but also to track their movement. [End Page 33] The fourth factor in the ongoing remote sensing revolution is the steady improvement in sensor resolution. In every field that employs remote sensing technology, including medicine, geology, and astronomy, improved sensors and advanced data processing are permitting more accurate measures and fainter signals to be discerned from background noise. The leap in satellite image resolution is but one example: the first U.S. reconnaissance satellite (Corona) could detect objects as small as 25 feet across. Today, even commercial satellites (e.g., DigitalGlobe's WorldView-3 and WorldView-4) can collect images with 1-foot resolution, and U.S. spy satellites are reportedly capable of resolutions less than 4 inches.66 Advances in resolution are not merely transforming optical remote sensing systems; they are extending what can be seen by infrared sensors, advanced radars, interferometers and spectrographs, and many other sensors. The fifth key trend is the huge increase in data transmission speed. During the first decades of the Cold War, it took days or longer to transmit information from sensors to analysts. At least a full day passed before the photographs snapped by U-2 aircraft were developed and analyzed. Early satellites were slower: the satellite had to finish its roll of film, and then eject the canister, which would be caught midair and flown to a facility for development and analysis. All told, images collected at the beginning of a satellite mission might take weeks before they arrived at an analyst's desk. Today, by contrast, intelligence gathered by aircraft, satellites, and drones can be transmitted in nearly real time. The data can be transmitted to intelligence analysts, political leaders, and in some cases directly to military commanders conducting operations. None of these technological trends alone is transformative. Taken together, however, they are creating a degree of transparency that was unimaginable even two decades ago. These new remote sensing technologies are not proliferating around the world evenly; the United States, for example, seems to have exploited new sensing technologies more intensively than other countries. Many countries are developing expertise in advanced sensing, however. The sensing revolution is a global phenomenon, with implications for the survivability of all countries' nuclear arsenals. Remote sensing technologies have improved greatly, but the crucial question is whether these advances have meaningfully increased the vulnerability of the two most elusive types of nuclear delivery systems: SSBNs and mobile land-based missiles. If the ability to track submarines at sea or mobile missiles [End Page 34] on patrol remains out of reach, then the counterforce improvements we identify are less significant, at least for now. In fact, SSBNs have never been as invulnerable as analysts typically assume, and advances in remote sensing appear to be reducing the survivability of both submarines and mobile missiles. REMOTE SENSING AND TRACKING SUBMARINES During the Cold War, the competition between submariners and antisubmarine warfare operators was shrouded in secrecy, but that history is finally being revealed. We now know that the United States was able to locate, and even track, Soviet SSBNs during extended periods of the Cold War.67 The core of U.S. ASW efforts against the Soviet Union lay in a series of breakthroughs in passive sonar and signals processing, as well as doctrine and tactics to exploit those advances. Starting in the 1950s, the United States deployed an expanding network of underwater hydrophones designed to identify and locate adversary submarines. Data from the hydrophones were transmitted across undersea cables to onshore computing facilities, where powerful computers discerned the faint sounds of submarines from ocean noise. Potential targets were then passed along to aircraft and attack submarines (SSNs) for further location and tracking. U.S. capabilities to track Soviet submarines leapt forward in the late 1960s and 1970s, as the United States deployed new attack submarines, which were equipped with powerful sonars in their bows, towed sonar arrays, and improved on-ship computing power, giving U.S. SSNs an unprecedented combination of acoustic gathering and data processing capabilities.68 The competition between Soviet SSBNs and the pack of U.S. submarines, aircraft, and surface ships hunting them varied throughout the Cold War. There were periods in which U.S. forces were winning, trailing every Soviet SSBN on patrol, from port to sea and back. In later periods, after discovering their vulnerability, the Russians pulled their forces into protected "bastions" near Soviet territory to counter the U.S. ASW strategy. The United States did not give up, and worked until the end of the Cold War (and beyond) to regain undersea superiority. [End Page 35] The duration of U.S. Cold War ASW superiority cannot be accurately assessed today because of enduring classification constraints. But for periods of the superpower competition, U.S. naval leaders believed they had the ASW problem well in hand. As the former commander of the U.S. Pacific Fleet in the mid-1980s remarked, the United States was able to "identify by hull number the identity of Soviet subs…and know exactly where they were. In port or at sea. If they were at sea, N3 [director for operations] had an SSN [on them]."69 There are three key lessons to draw from the Cold War ASW competition. First, previous advances in remote sensing greatly increased the vulnerability of deployed submarines.70 Second, escaping vulnerability was no easy task. In the late 1960s, the Soviet Union learned that its submarines were vulnerable. But despite Moscow's significant economic and technological resources, it took the Soviet navy more than a decade to develop good countermeasures against the evolving U.S. ASW capabilities.71 Third, and most broadly, the Cold War ASW competition demonstrates that the deployment of ballistic missile submarines neither ended the Cold War nuclear competition nor negated hopes on either side of attaining military superiority. The United States led the undersea competition for a time because of its superior technology and tactics; the Soviet Union developed countermeasures because it discovered its vulnerabilities and innovated. This back-and-forth struggle between hiders and seekers looks more like a traditional struggle for naval superiority than the common depiction of invulnerable submarines. Today's technological advances in remote sensing, data processing, and communication are occurring at a rapid pace, and their ultimate impact on the submarine competition is too uncertain to predict with confidence (especially given the tight controls over information on contemporary ASW capabilities). Yet, there are good reasons to suspect that the dramatic leaps in remote sensing are increasing the transparency of the seas and undermining the ability of submarines to remain concealed.72 Some of the promising new anti-submarine [End Page 36] technologies include improved acoustic sensors (including low-frequency active sonars and new networks of seabed passive sonars); non-acoustic techniques (such as laser detection); sophisticated "big data" analysis (which exploits leaps in processor speed to sift vast quantities of sensor data); and a variety of unmanned and autonomous undersea vehicles (including those designed to find and shadow adversary submarines for weeks or months).73 The point is not that submarines are now easy to locate or that the challenges of ASW have been solved. Locating technologically sophisticated, well-operated submarines in vast ocean sanctuaries remains a substantial challenge. Rather, the key point is that even the nuclear delivery system sometimes touted as the most survivable has been vulnerable in the past and appears to be increasingly vulnerable today, as ASW efforts and capabilities rapidly improve. What about mobile land-based missiles? Are breakthroughs in sensing technology increasing their vulnerability as well? REMOTE SENSING AND HUNTING MOBILE MISSILES We illustrate the impact of two advanced surveillance systems, radar satellites and remotely piloted aircraft, on the survivability of mobile land-based nuclear missiles. The effectiveness of sensing systems depends on the characteristics of the target country—for example, its size, location, topography, and defenses. As such, their impact is difficult to quantify in the abstract. Instead, we explore the potential contributions of two advanced sensor systems in a hypothetical case: a U.S.-led operation to destroy a small arsenal of North Korean nuclear-tipped mobile missiles.74 We assume that North Korea's TELs are postured like most other countries' mobile missiles; they remain in hardened shelters during peacetime, with plans to disperse a portion of the force during a conflict.75 U.S. and allied strategic intelligence would have at least three critical roles in [End Page 37] support of a military operation against North Korean TELs. The first, a peacetime mission called "intelligence preparation of the battlefield" (IPB), involves locating North Korea's nuclear and missile facilities, identifying the patrol routes utilized by its missile forces, learning its organizational routines, and mapping its command and communication network. The other two roles are principally wartime missions. "Detection" refers to sensing possible targets; it typically involves sensors that can monitor large areas, but that have inadequate resolution for positive identification or targeting. "Identification" is the next step; once a possible target is detected, other platforms (often with higher-resolution sensors) are cued to identify and precisely locate the target.76 SATELLITES/SAR SENSORS A core element of U.S. surveillance capabilities lies in a constellation of satellites that use synthetic aperture radar to image targets on the ground. Satellites provide a unique capability to peer deep into adversary territory, and they are especially useful for missions that require frequent observations of critical facilities. Whereas manned aircraft and unmanned aerial vehicles (UAVs) are often restricted from adversary airspace, satellites routinely overfly adversary territory. Moreover, unlike satellites with optical or infrared sensors, radar satellites can image targets at night and through cloudy weather. Until recently, the type of radar employed on most satellites—synthetic aperture radar (SAR)—could not image moving targets, limiting the effectiveness of space-based sensors for hunting mobile missiles.77 But over the past two decades, engineers have developed data-processing techniques that enable SAR systems to detect moving targets and determine their speed and direction of travel.78 Although the precise capabilities of intelligence satellites are classified, [End Page 38] civilian radar satellites can scan approximately 150-kilometer-wide swaths along the ground as they pass overhead with sufficient resolution to detect truck-sized moving vehicles.79 New techniques are being developed that may soon double or triple the width of the swath that can be scanned on each pass.80 SAR-equipped satellites, now able to find mobile targets, have the potential to transform counter-TEL operations. If U.S. intelligence satellites can detect moving vehicles within a 150-kilometer-wide swath along the ground, a conservative assumption given that a civilian satellite launched nearly a decade ago can do so, then centering the radar on a mobile missile garrison would put all the roads within two hours' drive-time of that facility within the radar's swath width.81 A single satellite can generate up to twelve 150 kilometer x 150 kilometer swaths in a single pass over North Korea, enough to image all the country's roads more than once—and key sections multiple times—before passing over the horizon.82 Although SAR satellites have become powerful tools for hunting TELs, they have important limitations. Surveillance satellites provide only intermittent coverage of key areas, passing overhead and then descending over the horizon. Thus, even if a constellation of satellites could image the entire road network in North Korea every hour, North Korean TELs might be able to disperse without being observed, by seeking shelter whenever a satellite approaches. Furthermore, if many of North Korea's critical facilities are located in its mountainous regions, topography may block the satellite's line-of-sight, which would allow targets within the swath to be hidden from the radar. The potential effectiveness of radar satellites for hunting mobile missiles, therefore, depends [End Page 39] on two key factors: the time interval between satellite passes and the percentage of road network that is observable in a given pass.83 To assess the effectiveness of SAR satellites for hunting North Korean mobile missiles, we conducted an analysis with three key steps. First, we created a digital map of North Korea's roads. Second, we used geospatial analysis software to determine the visible portion of those roads as a function of a satellite's position. Third, we calculated the frequency with which satellites pass within an orbital band that provides high levels of visibility of the road network.84 Our analysis of satellite orbits and North Korean topography reveals that satellites passing through an orbital band that stretches as far as 1,500-kilometer lateral distance from the Korean Peninsula can view, on average, 90 percent of North Korean roads. A typical radar satellite (which operates in low earth orbit) will pass through such a band, what we call a "usable pass," roughly 2.5 times per day. The total number of usable passes per day thus depends on the number of SAR satellites in orbit that are available for hunting mobile missiles. The number of available satellites, in turn, depends on the willingness of the United States and its close allies to share sensitive satellite imagery, the technical preparations that have been undertaken to facilitate that sharing, and the precise technical capabilities of the satellites. Table 2 shows the implications of different assumptions about those uncertainties. If the United States and key allies create the political and technical arrangements to share satellite data during wartime, North Korean TEL commanders would have little time between passes—specifically, as few as 24 minutes.85 Twenty-four minutes between satellite passes could provide enough time for TELs or other vehicles to move quickly from shelter to shelter, but that strategy requires precise information on satellite orbits, and the short time interval between passes leaves little margin for error for vehicles racing for cover. Moreover, the challenge for TEL operators is more serious than the data suggest. The analysis here focuses on the twenty military and intelligence SAR [End Page 40] satellites, not the half dozen or more U.S. and allied civilian platforms that might be pressed into service in wartime.86 Nor does the analysis count the optical and infrared satellites that supplement SAR coverage. Finally, the number and capability of radar satellites available to the United States is growing.87 As that number increases, the window for mobile missiles to scoot away without being observed will narrow further. Table 2. Synthetic Aperture Radar (SAR) Satellites and Frequency of Usable Passes NOTE: The category "Number of SAR Satellites" counts major military and intelligence SAR satellites operated by the United States and key allies. The other columns are cumulative and show how satellite coverage grows when one adds the assets of various U.S. partners. "Usable Passes per Day" indicates the daily satellite overflights that pass through an orbital band that offers, on average, 90 percent coverage of North Korean roads. Click for larger view View full resolution Table 2. Synthetic Aperture Radar (SAR) Satellites and Frequency of Usable Passes NOTE: The category "Number of SAR Satellites" counts major military and intelligence SAR satellites operated by the United States and key allies. The other columns are cumulative and show how satellite coverage grows when one adds the assets of various U.S. partners. "Usable Passes per Day" indicates the daily satellite overflights that pass through an orbital band that offers, on average, 90 percent coverage of North Korean roads. SAR satellites do not solve the problem of locating mobile targets. For one thing, Russia and China are improving their ASAT capabilities, partly in response to U.S. capabilities.88 Furthermore, adversaries will seek to place missile garrisons and conduct deterrent patrols in locations that are difficult to observe.89 Those choices, however, force adversaries into ever-narrower zones, which then become the focus of other surveillance tools—for example, stealthy penetrating UAVs and unattended ground sensors. [End Page 41] In terms of the three key sensing missions (IPB, detection, and identification), SAR-equipped satellites offer a high level of capability for the IPB mission, because they can repeatedly image stationary or moving targets in peacetime. They also contribute a high level of capability to detection, by offering frequent wide-area coverage of North Korean roads. Finally, SAR satellites offer fairly good capability for the identification mission: they can produce high-resolution images of stationary TELs and enough resolution of moving vehicles to determine that a target is "truck-sized."90 UAVS/SAR SENSORS A second set of sensing capabilities lies in a fleet of aircraft, including manned and remotely piloted vehicles, that use powerful radars to scan adversary territory. These aircraft carry SARs, and many are equipped with Ground Moving Target Indicator (GMTI) radars, allowing them to create high-resolution images of stationary targets or track a large number of moving vehicles. Most surveillance aircraft must operate from "standoff" distances to reduce their vulnerability to air defenses. Some drones, however, are stealthy and can penetrate adversary airspace. Below we illustrate the capabilities of standoff SAR/GMTI platforms and penetrating UAVs in the context of a U.S. and allied operation against North Korean mobile missiles. The United States uses several types of aircraft for standoff radar-reconnaissance missions; we base our model on one of them: the remotely piloted RQ-4 Global Hawk. We explore the potential effectiveness of radar surveillance from four continuous orbits 80 kilometers outside North Korean territory.91 ArcGIS software allows us to identify orbital locations that maximize coverage of North Korean roads, as well as calculate the visible percentage of the road network from those locations.92 Figure 4 shows the results. Figure 4 reveals that even against a small country such as North Korea, standoff airborne radars cannot, by themselves, provide complete coverage of key roads and regions. Four orbits can observe 54 percent of North Korea's roads; the remainder is out of sensor range or shielded by mountainous terrain. These results also suggest, however, that standoff UAVs could play a crucial role in a sensing operation; that is, the ability to continuously monitor [End Page 42] roughly half of North Korea's road network during a conflict would compel North Korea to constrain its mobile missile operations to the north-central region of the peninsula. Figure 4. Coverage of North Korea with Standoff Unmanned Aerial Vehicles (UAVs) NOTE: The white circles depict potential orbital locations for four UAVs; the locations were selected to maximize surveillance of North Korea's road network. The orbits are located 80 kilometers from North Korea's territory at an altitude of 60,000 feet, which reflect plausible operations for RQ-4 Global Hawks. White road segments are observable from at least one of the locations. For additional discussion of the underlying analysis, see the online appendix at . The image was created using ArcGIS and road data from OpenStreetMap and DIVA-GIS. Click for larger view View full resolution Figure 4. Coverage of North Korea with Standoff Unmanned Aerial Vehicles (UAVs) NOTE: The white circles depict potential orbital locations for four UAVs; the locations were selected to maximize surveillance of North Korea's road network. The orbits are located 80 kilometers from North Korea's territory at an altitude of 60,000 feet, which reflect plausible operations for RQ-4 Global Hawks. White road segments are observable from at least one of the locations. For additional discussion of the underlying analysis, see the online appendix at http://dx.doi:10.7910/DVN/NKZJVT. The image was created using ArcGIS and road data from OpenStreetMap and DIVA-GIS. In addition to standoff UAVs, the United States has developed drones for so-called penetrating operations.93 These UAVs reduce their visibility to enemy radar [End Page 43] by utilizing stealth technologies and a combination of passive sensors and "low-probability of intercept" (LPI) radars to observe targets on the ground.94 Even sophisticated, stealthy UAVs are vulnerable to air defenses. To some extent their vulnerability depends on technical questions, for example, the state of competition between radar engineers and designers of stealth technology. The vulnerability of penetrating drones, however, depends greatly on their mission. Of the two critical wartime missions, "detection" is likely more dangerous than "identification." The detection mission—continuously monitoring a large area to detect possible targets—would require a drone to remain within the line-of-sight of a large portion of adversary territory. The mission would, therefore, require the drone to fly at high altitude (to maximize line-of-sight) and possibly use active sensors (to maximize the drone's sensor range). The identification mission, on the other hand, would allow penetrating drones to protect themselves better: to operate at lower altitude so that terrain would shield them from enemy sensors, and fly (when cued by detection systems) to investigate a possible TEL. Only then would the penetrating UAV employ LPI or passive sensors to examine the potential target. We used ArcGIS to explore the potential capability of penetrating drones in the identification mission by determining the percentage of the North Korean road network that would be visible using four UAV orbits. Because the penetrating UAVs would need to rapidly identify the vehicles detected by other sensors, we restricted the UAVs to 5 minutes of flight time to maneuver into position to observe the suspected TEL.95 Furthermore, because LPI radars and passive sensors have shorter range than the powerful radars on standoff platforms, we limit the sensor range to 50 kilometers.96 Our analysis reveals that four penetrating drones, operating as we describe above, can identify targets along 84 percent of North Korea's roads.97 As figure 5 [End Page 44] shows, penetrating and standoff systems would be particularly effective in combination, increasing the road network coverage to 97 percent. Assuming that penetrating UAVs can be cued by other reconnaissance systems, such as satellites, unattended ground sensors, or (near the coast) standoff drones, North Korean TEL operators would have great difficulty moving safely along the country's road network without being detected. If U.S. and South Korean intelligence had identified mobile missile garrisons and operating areas before the conflict, the regions surrounding those zones might be fully covered by only one or two drone orbits.98 Figure 5. Coverage of N. Korea with Standoff and Penetrating Unmanned Aerial Vehicles NOTE: The white circles depict potential orbital locations for four UAVs operating 80 kilometers outside North Korea's territory. The black circles depict the area over North Korea that four penetrating UAVs can overfly within five minutes of flight time starting from the center of each circle. Road segments are coded as visible (white) if they are observable from either a standoff or penetrating UAV. For discussion of the underlying analysis, see the online appendix at . The image was created using ArcGIS and road data from OpenStreetMap and DIVA-GIS. Click for larger view View full resolution Figure 5. Coverage of N. Korea with Standoff and Penetrating Unmanned Aerial Vehicles NOTE: The white circles depict potential orbital locations for four UAVs operating 80 kilometers outside North Korea's territory. The black circles depict the area over North Korea that four penetrating UAVs can overfly within five minutes of flight time starting from the center of each circle. Road segments are coded as visible (white) if they are observable from either a standoff or penetrating UAV. For discussion of the underlying analysis, see the online appendix at http://dx.doi:10.7910/DVN/NKZJVT. The image was created using ArcGIS and road data from OpenStreetMap and DIVA-GIS. [End Page 45] Each of the sensing systems explored here has important limitations. For example, radar satellites provide wide-area coverage, but do so intermittently and at only moderate resolution. Standoff drones provide persistent coverage, but only near the coast. Penetrating drones can provide persistent coverage inland (at the cost of increased risk to the aircraft) or intermittent inland coverage at lower risk. In many cases, however, the capabilities of one system can offset the limits of another. Moreover, this analysis merely scratches the surface in terms of new sensing platforms (e.g., unattended ground and seabed systems), signals (e.g., high-resolution spectroscopy), and approaches (e.g., cyber intrusions), many of which would be employed together for the same mission. Old assumptions about the survivability of mobile forces need to be revised in light of new sensing technologies and capabilities. Concealment is not impossible, of course. An adversary's mobile delivery systems can remain secure if its air defenses can keep UAVs at bay, its navy can keep enemy ASW forces from its coastal waters, and anti-satellite technology can blind satellites. But in this new era of transparency, whether concealed forces are survivable or not depends on the state of competition between opposing intelligence and military organizations. Survivability through concealment can no longer be assumed. What About Countermeasures? Countries will surely address the growing vulnerability of their nuclear arsenals by trying to develop countermeasures to thwart advanced sensor and strike systems. They will seek to deploy radar jammers, anti-satellite weapons, and decoys. They will try to adapt mobile missile doctrines to reduce vulnerability, for example, by timing movements to elude satellites and minimizing communications to thwart signals intelligence efforts. The new era of counter-force will not be static; it will be characterized by vigorous efforts to develop countermeasures, as well as equally vigorous efforts to overcome them. Yet, there are good reasons to expect that the net result of these efforts will leave nuclear delivery systems more vulnerable than they have been in the recent past. First, hunters are poised to do well in the back-and-forth battle of countermeasures. Counterforce is the domain of the powerful; those that are seeking to track enemy nuclear forces typically have greater resources than their rivals.99 Additionally, the countries that are leaders in sensing technology [End Page 46] have an advantage in the race to build (and thwart) countermeasures. As Brendan Green and Austin Long observe about the Cold War ASW competition, U.S. superiority in passive acoustics helped the United States quiet its own SSBNs, which in turn allowed it to practice and hone its tracking capabilities.100 Expertise in sensors and countermeasures go hand in hand. Perhaps most importantly, many countermeasures reduce one vulnerability at the cost of exacerbating others. For example, limiting communications between mobile missiles or submarines and their command authorities reduces vulnerability to signals intercepts, but it increases vulnerability to attacks designed to sever (or simulate) their command and control.101 Avoiding coastal roads neutralizes offshore sensors, but it channels forces into a smaller zone, easing the search problem. Even the simplest countermeasures, such as increasing security near sensitive facilities to prevent the emplacement of unattended ground sensors or improving air defenses around key sites to thwart UAVs, may cue hunters to the presence of high-value sites. Second, the potential targets of disarming strikes cannot merely respond to a single counterforce technology; they must respond to a daunting list of them. The revolutions in accuracy and sensing have had multiple, synergistic effects in bolstering counterforce. The task for hiders is not simply to thwart a single platform, such as SAR satellites, but rather to develop countermeasures to the entire array of (known) capabilities deployed by the hunters. For example, North Korea may find ways to interfere with U.S. radar satellites, but that still leaves its missiles vulnerable to detection by optical satellites; UAVs; unattended ground sensors; and a variety of tagging, tracking, and locating capabilities. Third, some vulnerabilities are difficult to fix. In the late 1960s, the Soviet Union learned that its SSBNs were being tracked by the United States, but it took more than a decade to counter this U.S. capability. Consider the challenge faced by China today in building a survivable ballistic missile submarine force; China deployed its first submarines in the 1960s, but more than half a century later Chinese submarines are still so noisy that experts predict it will be decades before Beijing can field survivable submarines.102 [End Page 47] The battle between countermeasures and corresponding attempts to defeat them is under way, and its outcome will likely depend on the strategic context. Rich countries with advanced research and development infrastructure are developing technology and doctrine to protect their nuclear forces in the face of improvements in weapons accuracy and remote sensing. Weaker countries with modest resources, however, will be hard pressed to develop effective countermeasures to the full spectrum of emerging means of counterforce. Conclusion For most of the nuclear age, there were many impediments to effective counterforce. Weapons were too inaccurate to reliably destroy hardened targets; fratricide prevented many-on-one targeting; the number of targets to strike was huge; target intelligence was poor; conventional weapons were of limited use; and any attempt at disarming an adversary would be expected to kill vast numbers of people. Today, in stark contrast, highly accurate weapons aim at shrinking enemy target sets. The fratricide problem has been swept away. Conventional weapons can destroy most types of counterforce targets, and low-fatality nuclear strikes can be employed against others. Target intelligence, especially against mobile targets, remains the biggest obstacle to effective counterforce, but the technological changes under way in that domain are revolutionary. Of the two key strategies that countries have employed since the start of the nuclear age to keep their arsenals safe, hardening has been negated, and concealment is under great duress. The new era of counterforce helps solve one of the enduring theoretical puzzles of the nuclear age. For decades, scholars of the theory of the nuclear revolution wondered why leaders seemed to be ignoring the profound implications of nuclear weapons for international politics. In theory, nuclear weapons make states that possess them so secure that they need not engage in traditional forms of competition with adversaries, such as arms racing, alliance building, relative gains competition, and rivalry over strategic territory. In practice, all those behaviors have endured. Scholars blame the persistent discrepancy between theory and practice on misperception, illogic, or other decisionmaking pathologies. The new era of counterforce suggests, however, that leaders have been correct to perceive that stalemate can be broken, and that the nuclear balance can vary dramatically across cases. If today's secure arsenal can become tomorrow's first-strike target, then there is little reason to expect [End Page 48] the geopolitical competition between countries to end with the deployment of seemingly secure nuclear weapons. **The policy implications of the new era of counterforce are** also **important**. First, if nuclear forces are becoming increasingly vulnerable to counterforce, then states need to improve their retaliatory arsenals just to maintain the same level of deterrence. Given that nuclear delivery systems are expensive and must last for decades, the challenge for force planners is extraordinary: deploy weapon systems that will remain survivable for multiple generations, even as technology improves at an ever-increasing pace. Second, the growing threat to nuclear arsenals (from nuclear strikes, conventional attacks, missile defenses, ASW, and cyber operations) raises major questions about the wisdom of cutting the size of nuclear arsenals. In the past, many arms control advocates believed that arms cuts reduced the incentives for disarming strikes; whether right or wrong in the past, that assumption is **increasingly dubious** as a recipe for **deterrence stability** today. Finally, leaps in accuracy and remote sensing should **reopen** debates in the United States about **the wisdom of** pursuing effective **counterforce** systems. Fielding those capabilities—nuclear, conventional, and other—may prove invaluable: enhancing deterrence during conventional wars and, if deterrence fails, allowing the United States to defend itself and its allies. Enhancing counterforce capabilities, however, may trigger arms races and other dynamics that exacerbate political and military conditions. In the past, technological conditions bolstered those who favored restraint: disarming strikes seemed impossible, so enhancing counterforce would likely trigger arms racing without much strategic benefit. Today, technological trends appear to **validate the advocates of counterforce**: remote sensing, conventional strike capabilities, ASW, and cyberattack techniques will continue to improve and increasingly threaten strategic forces **whether or not** the United States seeks to maximize its counter-force capabilities. In this new era of counterforce, technological **arms racing seems inevitable**, so exercising restraint may **limit options** **without yielding much benefit**. Nuclear deterrence can be robust, but **nothing about it is automatic** or everlasting. Nuclear stalemate might endure among some pairs of states, and technology could someday reestablish the ease of deploying survivable arsenals. Today, however, **survivability is eroding**, and **it will continue to do so** in the foreseeable future. Weapons will grow even more accurate. Sensors will improve. The new era of counterforce will likely yield benefits to those countries that best adapt to the new landscape, and costs to those that fall behind. The first step in understanding these dynamics is to recognize the new strategic reality confronting nuclear powers today.

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