Strategic Studies Quarterly

Revealed Preference and the Minimum Requirements of Nuclear Deterrence

Dallas Boyd

Abstract

US national security policy features a striking inconsistency in its leaders' tolerance for the risk of nuclear terrorism and nuclear war respectively. Policies concerning the former suggest an overwhelming aversion to the risk of a nuclear attack. By contrast, US offensive nuclear capabilities, which are configured for preemptive counterforce strikes, imply at least some tolerance for the risk of nuclear retaliation. Yet this retaliation could be many times more severe than an act of nuclear terrorism—an event that American leaders suggest is intolerable. A further inconsistency is that the conventional criteria for a successful first strike only account for an enemy's constituted nuclear weapons. This differs from the standard that governs US counterterrorism policy, which holds that the mere possession of fissile material constitutes a nuclear capability. A more consistent nuclear doctrine would consider that any state capable of engineering a single nuclear detonation on American soil may be able to deter the United States. If internalized uniformly, this low damage tolerance could preclude many scenarios involving preemptive attacks, which in turn may cast doubt on the United States' ability to exercise nuclear coercion.

✳ ✳ ✳ ✳ ✳

More than 40 years ago, National Security Advisor McGeorge Bundy noted the existence of "an enormous gulf between what political leaders really think about nuclear weapons and what is assumed in complex calculations of relative 'advantage' in simulated strategic warfare." He considered analysts who spoke of "acceptable" damage running into the tens of millions of lives to inhabit an "unreal world." In reality, Bundy believed "a decision that would bring even one hydrogen bomb on one city

Dallas Boyd is a senior policy analyst, addressing nuclear weapons policy and counterterrorism. His writings have appeared in *The Nonproliferation Review*, *The Washington Quarterly*, *The Bulletin of the Atomic Scientists*, and *Studies in Conflict and Terrorism*. He earned a master of public policy degree from Harvard's JFK School of Government.

of one's own country would be recognized in advance as a catastrophic blunder."[1] Yet, at the time of his writing, the United States and the Soviet Union were still fearful of falling victim to the other's first-strike superiority, and at the end of the Cold War, more than 20 years later, each side continued to deploy more than 10,000 strategic weapons.[2]

The gulf that Bundy described persists in the present day, even as the number of warheads in the major powers' arsenals has sharply receded. However, the veil shrouding what American leaders really think about nuclear weapons has partly lifted, exposing a vast divergence between their apparent views and US nuclear doctrine. Nowhere is this divide more striking than in these leaders' attitudes toward the risk of nuclear terrorism and the risk of nuclear war. If the rhetoric of many US officials is to be believed, a terrorist nuclear attack would represent an almost inconceivable calamity. "Just one nuclear weapon exploded in a city," Pres. Barack Obama has argued, would devastate "our very way of life" and constitute nothing less than "a catastrophe for the world."[3]

Together with the range of defenses against this threat, these statements suggest a pronounced aversion to the risk of a nuclear attack. By contrast, the US nuclear posture features substantial offensive nuclear capabilities, implicitly accepting the risks that would attend a nuclear attack *initiated by the United States*. Indeed, some analysts have asserted that the United States is intentionally pursuing "nuclear primacy"—the ability to eliminate an enemy's nuclear forces entirely in a first strike.[4] Yet, the exercise of this advantage would expose the nation to the risk of retaliation far more severe than a terrorist nuclear attack—an outcome that its leaders suggest is intolerable. What explains this contradiction?

There are two principal explanations. One is that these differing risk tolerances are highly circumstantial and thus cannot be compared. According to this logic, the offensive use of nuclear weapons would be considered only in defense of a truly vital national interest, which would naturally require a higher tolerance for risk than would be operative in peacetime.[5] The risk of nuclear terrorism, by contrast, does not shift dramatically in response to US actions, nor would a decision that increases this risk be offset by a potential reward. This distinction argues against a uniform risk tolerance, even if both scenarios may involve a nuclear detonation on American soil. However, it strains credulity to believe that such wildly divergent attitudes toward a nuclear attack could consciously coexist in decision makers' minds. Far more likely is the second

explanation: that one of these attitudes is insincere. Either US leaders are less fearful of a terrorist nuclear attack than their policies and rhetoric imply or they retain offensive capabilities that their appetite for risk should never allow them to employ.

Ascertaining their true risk tolerance borrows from the economic theory of "revealed preference," which holds that consumer tastes are discernible from purchasing behavior.[6] Various US security policies serve a similar function, telegraphing American leaders' aversion to the risk of a nuclear attack. The most obvious of these policies are countermeasures against nuclear terrorism, such as programs to secure fissile material abroad and scan for radiation at maritime ports. Other signals include US nonproliferation and counterproliferation efforts, the doctrine of preventive war, and the pursuit of ballistic missile defenses. Each of these policies shares a common denominator in the belief that even one bomb in the hands of an enemy that cannot be deterred poses an unacceptable threat.

This commonality has a profound but overlooked implication for the offensive use of nuclear weapons. Because a nation subjected to a first strike may no longer have reason to be deterred, its leadership might fairly be considered "undeterrable" as well. Furthermore, by the standard of US counterterrorism policy, which considers the mere possession of fissile material to equal a nuclear capability, even a first strike that eliminated an enemy's nuclear weapons completely would not neutralize its ability to retaliate. It follows logically that the United States' risk aversion concerning terrorists and pariah states should inform its stance toward *any* adversary with a nuclear capability.

This article therefore has two objectives. The first is to contend that US leaders' aversion to the risk of nuclear terrorism reflects their fundamental view of a nuclear attack. The second is to scrutinize the notion that an enemy's capacity for nuclear retaliation can be neutralized with such confidence as to overcome this extreme intolerance for risk. This exercise sheds light on a question that has been debated since the beginning of the nuclear age: What is the minimum number of nuclear weapons that is necessary to deter? In the case of the United States, the answer is clear. Any state that can engineer a single detonation in an American city may be able to immunize itself from nuclear coercion, much less nuclear attack. This conclusion calls into question virtually every function of the US nuclear arsenal save its most basic—deterring a nuclear

attack on the United States. Any use of US nuclear weapons beyond this limited purpose requires the resolve to risk nuclear retaliation—a resolve American leaders do not appear to possess.

The case for this proposition begins by cataloging the policies that reveal US leaders' abhorrence of the prospect of a nuclear attack. It then examines the evidence that US nuclear forces and related capabilities are oriented toward preemptive counterforce strikes and questions the belief that such an attack can be conducted with acceptable risk. The analysis draws on the concept of delayed retaliation using unconventional delivery means, such as those commonly associated with nuclear terrorism. Because these modes of attack are no less useful to governments than terrorists, they may provide a second-strike capability that fulfills the basic requirements of deterrence. The analysis also considers the circumstances in which a nuclear-capable state might be self-deterred from retaliating after a nuclear attack. Finally, it discusses implications for the US nuclear posture.

Revealed Preference in US National Security Policies

That a consensus exists on the unacceptability of a nuclear attack is perhaps unremarkable. Yet, the breadth of policies that reflect this view is so wide, and their influence on the United States' strategic conduct so profound, they cannot but reveal an utter intolerance for this risk. Among these policies is the wide-ranging effort to slow the spread of nuclear weapons, which has led successive administrations to confront North Korea, Iraq, Iran, Libya, and others over their illicit nuclear programs. Several of these countries have also figured in the decades-long pursuit of ballistic missile defenses. Most tellingly, the United States led the overthrow of Saddam Hussein's regime in part over concerns the Iraqi dictator had resumed his pursuit of nuclear arms.

Underlying these diverse policies is the concern that the threat of punishment alone might not deter an attack on the United States—a fear that continues to animate the US response to Iran's nuclear ambitions. Because deterrence may not afford the same protection against certain adversaries as it does against the established nuclear powers, the United States expends enormous effort on alternative means to cope with these problem states.[7] The fear of undeterrable actors is especially palpable in regard to would-be nuclear terrorists, and nowhere is the fear of these

weapons more plainly revealed than in US leaders' distress over the terrorist threat.

Nonproliferation, Counterproliferation, and Preventive War

The United States' two major political parties share the belief that a nuclear detonation on US soil would radically alter the American way of life. However, the preferred responses to this threat diverge sharply. The left has tended to favor the nuclear nonproliferation regime, while the right has emphasized counterproliferation policies. Ironically, both approaches have partly been necessitated by earlier US policies that enabled the spread of nuclear technology. In the 1950s, the United States launched the Atoms for Peace program to supply nuclear reactors, fuel, and scientific training to developing countries pursuing nuclear energy.[8] Indeed, this policy enabled the early nuclear programs of Iran, India, and Pakistan—three countries that have presented perennial challenges to the nonproliferation regime.[9] Following India's 1974 detonation of a "peaceful nuclear explosion," which illustrated the inadequacy of the Atoms for Peace program's nonproliferation safeguards, the United States began to reverse course and has sought to control access to nuclear technology and materials ever since.[10]

On the extreme end of the containment spectrum is the doctrine of preventive war, under which a state reserves the right to eliminate a catastrophic threat before it materializes. Pres. George W. Bush pressed for the invasion of Iraq on this basis, declaring that the United States could not wait for proof of Iraq's nuclear program to come "in the form of a mushroom cloud."[11] While the fear of an unprovoked nuclear strike helps explain these policies, there is an additional explanation: US leaders are concerned that nuclear weapons in the hands of pariah states would impose unacceptable constraints on American freedom of action abroad. As Bruce Blair and Chen Yali argue, these policies reflect an understanding that the United States can be deterred with even the most "primitive and diminutive of nuclear arsenals." This recognition explains why the United States "goes to such extraordinary lengths to prevent adversaries from acquiring even one solitary bomb in the first place."[12]

Ballistic Missile Defense

Failing efforts to stop the spread of nuclear weapons, the United States has pursued another countermeasure in the form of ballistic missile defenses. The debate over this system, while intensely partisan, features a revealing intersection of belief between opponents and advocates. Proponents such as Richard Perle contend that without missile defenses, "we are vulnerable to any country or movement that manages to obtain even a single missile capable of reaching the United States."[13] Skeptics counter that the system could easily be circumvented and that no responsible leader would ever gamble a single city on the failure of alternative means of attack. As Charles L. Glaser and Steve Fetter argue, "even a small probability of having one US or allied city destroyed by a rogue nuclear weapon would be too large to warrant . . . overthrowing a rogue leader."[14] Thus, the debate is illuminating not for its insight into the system's reliability but for making explicit US leaders' maximum damage tolerance—a single nuclear detonation on American soil. If any confirmation of this conviction were needed, it emerged in the widespread anxiety over nuclear terrorism in the post-9/11 era.

Nuclear Terrorism

After the terrorist attacks on the US homeland, the fear of an even greater catastrophe consumed policy makers and the public alike. Expert commentary on the probability of a terrorist nuclear attack and ever more lurid descriptions of its effects flamed this dread. One widely cited study estimated that a single 10–kiloton device detonated in New York City would kill as many as 500,000 people.[15] Assessments of this sort led to a rare convergence of opinion among US leaders, which Pres. Barack Obama captured in his description of nuclear terrorism as "the single biggest threat to US security."[16] Accordingly, preventing nuclear proliferation and nuclear terrorism figured prominently in the president's 2009 Prague speech, and these objectives were first among the five priorities listed in the 2010 *Nuclear Posture Review*.[17]

While such messaging conveys an unmistakable horror of nuclear terrorism, the true measure of how seriously leaders take this threat lies in the policies they have enacted to guard against it. Foremost on this list are efforts to place nuclear materials beyond the reach of terrorists, a practice that had its origins in the Cooperative Threat Reduction program to

secure nuclear weapons and materials in the former Soviet Union. Later policies would expand on this model, including programs to consolidate separated plutonium in secure locations and convert civilian research reactors to low-enriched uranium fuels. The United States also operates an array of programs to detect the smuggling of nuclear weapons and materials around the world. Under the Second Line of Defense, for example, radiation detectors have been installed at nearly 500 border crossings and airports in the former Soviet Union. The Megaports Initiative operates detectors at ports in more than a dozen countries in Europe, South America, Southeast Asia, and the Caribbean, while the Secure Freight Initiative conducts scanning at ports in Pakistan, Honduras, Singapore, South Korea, Oman, and the United Kingdom. Likewise, some 1,400 radiation portals have been installed at US ports, which complement various domestic tools to detect nuclear devices. Finally, the United States maintains a global intelligence network to monitor for materials trafficking and terrorist activity relating to nuclear weapons.

The breadth and expense of this architecture should underscore the United States' consummate fear of a nuclear attack. However, the implications of this fear are not limited to terrorists and pariah states. It may also have powerful but underrecognized effects on the outcomes of crises between the United States and other major nuclear powers. Prevailing in standoffs with these states depends in part on the projection of resolve, particularly when the use of nuclear weapons is at stake. In this situation, discernible anxiety over even a limited nuclear attack undermines the US bargaining position. This fear does particular harm to the credibility of nuclear threats, which are thought to confer coercive leverage in crises. This is so because such threats require their issuer to appear willing to follow through with a first strike, which in turn requires a willingness to risk some level of damage in retaliation. As Herman Kahn argued, in the nuclear arena "credibility depends on being willing to accept the other side's retaliatory blow. It depends on the harm he can do, not the harm we can do."[18] Nuclar coercion will not succeed if the threatened state perceives its antagonist's damage tolerance to be extremely low and the defender can credibly deliver this level of punishment. Because American leaders may have unwittingly advertised their maximum damage tolerance in the horror they assign to a single nuclear detonation, there is reason to doubt the effectiveness of US nuclear threats.

That US leaders believe they can simultaneously deter nuclear rivals while threatening aggression stems from an artificial distinction between two types of adversaries. In the first category are states—principally Russia and China—with which the United States maintains classic deterrence relationships. The second group is comprised of potentially undeterrable actors against whom US policies on nonproliferation, missile defense, and nuclear counterterrorism are oriented. Yet, this distinction has little bearing where the *offensive* use of nuclear weapons is concerned. In many scenarios, a state subjected to a nuclear attack would have little left to lose, making its leaders no less constrained in retaliating than terrorists would be in attacking outright. Thus, the risk aversion that informs US policy toward the latter should arguably figure in any consideration of an attack on a nuclear power. Overlooking this essential similarity is a significant failure of logic—one that permits a potentially destabilizing emphasis on offensive nuclear capabilities.

The Conceit of Nuclear Primacy

The pioneers of nuclear deterrence theory surmised that a nation would not attack an enemy's cities with nuclear weapons because its own cities would inevitably be destroyed in turn and no advantage would be gained from striking first. Thus, these weapons offered some promise of stability. However, this optimism was soon extinguished by the ballistic missile, the accuracy of which theoretically enabled an enemy's nuclear forces rather than its population centers to be destroyed. Under such an attack, retaliation might be avoided altogether, presenting an incentive to launch a disarming strike. The danger of this temptation defined the brief but terrifying period before the United States and the Soviet Union came to accept their mutual vulnerability, which many scholars consider to have occurred around the time of the Cuban missile crisis. While both sides maintained offensive attack plans for decades afterward, strategists generally accepted that striking first would be successful only if the attacker faced a manageable number of weapons, knew their precise number and location, and could destroy them before they were fired or relocated.[19] A modicum of "first-strike uncertainty" about these conditions or a "seed of doubt" in the minds of decision makers was deemed sufficient to deter.[20]

Since the end of the Cold War, however, the development of certain US capabilities has hinted that this hard-won appreciation of mutual deterrence has eroded. In 2006 scholars Keir Lieber and Daryl Press created a sensation in the nuclear policy world when they argued that, as a result of increasing missile accuracy and other advances, the United States was fast approaching an era of "nuclear primacy." Under this paradigm, US leaders would have the "ability to destroy all of an adversary's nuclear forces" in a preemptive strike.[21] To support this assertion, Lieber and Press modeled a US nuclear attack on Russia and concluded that the United States would have "a good chance" of completely eliminating Russia's intercontinental ballistic missiles (ICBM), heavy bombers, and ballistic-missile submarines. Consequently, they argued that Russia's leaders "can no longer count on a survivable nuclear deterrent." Lieber and Press asserted that China is even more vulnerable, calculating in a separate model that the probability of a US attack destroying every one of China's 20 silo-based ICBMs stood at "well above 95 percent."[22]

Members of the nuclear establishment hotly deny that the United States is pursuing a disarming first-strike capability. Strategist Keith Payne, for example, argues that Lieber and Press's work represents a "gross mischaracterization of US policy," citing as evidence declassified documents and authoritative statements by government officials.[23] However, deducing the orientation of the US arsenal toward preemptive attacks requires no explicit acknowledgement to that effect. Inferences can be made about a state's intended use of nuclear weapons from the size and structure of its arsenal and other related capabilities. Aside from the high accuracy of its missiles, the United States has developed numerous platforms with unmistakable first-strike applications, among them stealth bomber aircraft to penetrate enemy air defenses, space-based systems to track mobile missiles, and precision conventional munitions to destroy command and control facilities. The breadth of US investment in intelligence capabilities for a first strike is especially telling.[24] Analysis of such capabilities led a team of RAND Corporation analysts to the obvious conclusion that beyond central deterrence, US strategic forces appear "best suited to provide . . . a preemptive counterforce capability against Russia and China." Absent this mission, the size and operational doctrine of the nuclear posture "simply do not add up."[25]

While these capabilities are undoubtedly impressive, they reflect a premise that appears to be greatly out of step with US leaders' revealed

preference concerning risk. The conceit of nuclear primacy is the notion that destroying a state's nuclear forces-in-being, and particularly its ICBMs, is synonymous with eliminating its capacity to retaliate. Christopher Chyba and J. D. Crouch capture this misconception in their definition of nuclear primacy as the ability to launch a "confident and disarming nuclear first strike . . . such that no retaliation with *strategic nuclear forces* would be possible" (emphasis added).[26] Nor is this myopia limited to American strategists. Chinese scholars Li Bin and Nie Hongyi worry that some US thinkers are "certain the United States can rely on a preemptive nuclear strike to completely destroy China's *long-range nuclear weapons*" (emphasis added).[27] These writings tend to underplay, or ignore altogether, unconventional means of delivering retaliatory weapons.[28] As such, they betray a basic misunderstanding of the requirements of a successful first strike—at least for an attacker whose damage tolerance is exceedingly low.

As American leaders' rhetoric and policies continually imply, even a modest retaliatory blow would far exceed their stated maximum damage tolerance: a single nuclear detonation. To avoid this risk, a US first strike would have to be quite splendid indeed, destroying not only long-range weapons but also medium- and short-range missiles and nonstrategic warheads. Additionally, nondeployed and inactive warheads would have to be eliminated, for if even one survived, a counterstrike on an American city would be distinctly possible. Yet, by the standard that governs US policies toward terrorists and pariah states, destroying an enemy's constituted weapons would still be insufficient. True nuclear primacy would also require the elimination of a state's nuclear infrastructure and fissile material stocks because these assets could eventually be used to effect a crude form of retaliation. Given that their destruction would be virtually impossible, nuclear primacy is a pursuit fraught with the potential for catastrophe—a conclusion with profound implications for the minimum requirements of deterrence.

Deterrence: Defining Adequacy Down

In determining the appropriate size and composition of a nuclear arsenal, two divergent schools of thought contend. According to the first view, a delicate balance of terror exists between nuclear rivals that can only be maintained if both sides can impose intolerable damage on the

other even after absorbing a first strike.[29] This task is thought to require substantial, highly survivable arsenals and stringent operational protocols to govern their use. The US and Russian nuclear postures reflect this view, although considerable scholarship has documented the extent to which factors other than strategic necessity drove the growth of their arsenals during the Cold War. Among these factors were inter- and intraservice rivalries in both countries and bald political posturing, typified by the US political debate over the "missile gap."[30] Similarly, institutional inertia largely explains the maintenance of nuclear stockpiles today that are similar in configuration if not in size to Cold War postures a generation after that conflict ended. Thus, these arsenals should not be seen as expressions of either nation's true deterrence needs, nor should they nurture the presumption that the strength of deterrence is proportional to the size of one's stockpile.

The opposing school of thought, often referred to as "minimum deterrence," posits that stability is achieved with a relatively small nuclear force and that little, if any, marginal benefit accrues with each additional warhead. Indian defense specialist Rajesh Basrur describes this view as the understanding that "it is not necessary to have large numbers of sophisticated weapons to deter nuclear adversaries; that nuclear 'balances' are not meaningful; and that weapons need not be deployed and kept in a high state of readiness in order that deterrence be effective."[31] Some scholars believe that an even more modest nuclear posture can meet a state's deterrence needs. These advocates of "virtual nuclear arsenals" argue that the latent capability to build nuclear weapons may be sufficient to deter—a concept that will be revisited later in this article.[32]

China's nuclear arsenal is clearly an expression of the minimalist school. Taylor Fravel and Evan Medeiros describe the Chinese deterrent as one that offers simply "assured retaliation," which reflects the belief that "a small number of survivable weapons would be enough to retaliate and impose unacceptable damage on an adversary."[33] As Chinese Maj Gen Pan Zhenqiang puts it, "as long as you are able to give a devastating counter-attack against one or two US big cities, the scenario [is] enough to make the attacker who had the intention of preemptive nuclear strike pause, and hopefully drop [an attack] plan."[34]

Minimum deterrence is not without its critics, of course. Lieber and Press dispute the "notion that deterrence will hold as long as countries face the mere possibility of losing a single city," which they insist is "not

well supported by historical evidence." Citing the outbreaks of the First and Second World Wars, they argue that conflicts "always begin with at least one country taking a tremendous risk, and these gambles are often bigger than the terrible prospect of losing a city."[35] Nuclear policy analyst Ward Wilson goes further, asserting that the *actual* destruction of cities has failed to impress leaders throughout history.[36] He cites as evidence a revisionist explanation for Japan's surrender in World War II, which credits the Soviet declaration of war as the crucial factor in that decision rather than the atomic bombings, which were simply extensions of a bombing campaign that had already devastated Japan's cities.[37] From this data point, Wilson contends that city destruction has no effect on decision making, which, he claims, undermines the very premise of nuclear deterrence. "If destroying one or two cities does not coerce an opponent," he writes, "then perhaps the threat of limited nuclear retaliation does not deter when the stakes are high enough."[38]

It is telling that those who assert leaders' wild risk tolerances must reach back seven decades for confirming evidence to this effect. Indeed, Wilson asks us to accept that the callousness of Japan's leaders—the wartime rulers of a martial culture—is instructive of deterrence calculations in the present day. On the contrary, many foreign strategists now believe that weapons in the low single digits are quite adequate for deterrence. To wit, several scholars at India's Institute for Defence Studies and Analyses endorse the most minimal deterrent against China. Swaran Singh, for instance, "advocates the targeting of five cities," while Sujit Dutta is "of the opinion that China would be deterred if . . . its adversary could destroy even three major cities."[39] The late K. Subrahmanyam, arguably India's most respected nuclear strategist, set the bar lowest of all, writing that "it is now recognized that one bomb on one city is unacceptable."[40]

Central to the question of the minimum requirements of nuclear deterrence are the criteria for a deterrent force to be considered "credible." Conventional wisdom holds that several characteristics are necessary to apply this label, among them survivable second-strike weapons and command and control facilities. However, the definition of a second-strike weapon is somewhat nebulous. At the most basic level, a state is "nuclear capable" if it has sufficient fissile material and expertise to build a nuclear explosive device. The next level is achieved when a state actually builds said device. More credible still is a confirmation to that effect in the form of an explosive test, along with a demonstrated means

of delivery such as a ballistic missile.[41] Finally, a state may take measures to place its weapons beyond the reach of an enemy attack, usually by deploying them on mobile launchers or submarines or within hardened missile silos. Victor Cha, who served as a policy adviser on the National Security Council during the George W. Bush administration, presents two additional criteria in an analysis of North Korea's deterrent: a proven missile reentry capability and evidence of warhead miniaturization. Without these capabilities, he writes, Pyongyang's small arsenal "does not come close to a credible nuclear deterrent," and the regime "gets no added security from these weapons."[42]

If the United States' anxiety over nuclear terrorism is any guide, these requirements vastly overstate the threshold for credibility. After all, the fear that North Korea might transfer a nuclear weapon to terrorists has been central to the case for reversing its nuclear program. If these weapons pose a catastrophic threat in the hands of extremists, on what basis should they be considered less threatening when deployed by their original owners? In truth, Pyongyang can have confidence in its minimalist posture for two reasons. First, contrary to the emphasis placed on strategic delivery vehicles, such platforms are not necessary for nuclear retaliation. In extreme circumstances, a variety of unconventional delivery means can be used. As the late political scientist Kenneth Waltz observed, "Everybody seems to believe that terrorists are capable of hiding bombs. Why should states be unable to do what terrorist gangs are thought to be capable of?"[43] Second, no arbitrary deadline exists for a state to respond to a nuclear attack. Retaliation may come weeks or even months after a first strike, providing ample time to prepare nondeployed warheads or even construct a makeshift weapon from available nuclear material. Together these concepts call into question the key assumption on which nuclear primacy rests: that a nuclear counterstrike must come immediately and in the form of ballistic missile attacks, or not at all. This questionable premise permits US leaders to entertain first strike scenarios that are wildly at odds with their apparent tolerance for risk.

Delayed—But Assured—Retaliation

During the Cold War, it was widely assumed that the United States and Soviet Union would launch a substantial portion of their arsenals the moment either believed itself to be under nuclear attack. Today

retaliation may occur at a more plodding pace, in part because military imbalances are much more pronounced. A US first strike might virtually eliminate an enemy's deployed weapons, requiring considerable time and effort for the state to respond. Additionally, delay is implicit in "no first use" policies, which commit a state not to use nuclear weapons except in retaliation for a nuclear attack. One such state is India, the nuclear strategy of which scholar Ashley Tellis describes as emphasizing "delayed—but assured—retaliation." This posture reflects the belief that "for purposes of deterrence, the ability to retaliate with certainty is more important than the ability to retaliate with speed."[44]

US planners' dismissal of this posture generally centers on doubts about the "certainty" of assured retaliation. According to this line of thinking, no state can be completely confident of its second-strike capacity, especially if elaborate precautions are not taken to preserve it. Yet, this view conflicts with the basic premise of US counterterrorism policy, which emphasizes fissile material rather than assembled weapons as the most basic nuclear threat. As the National Research Council notes, lack of access to this material is the "primary impediment that prevents countries or technically competent terrorist groups from developing nuclear weapons."[45] Its mere possession, on the other hand, confers significant deterrent value even in nonweapon form. Indeed, Albert Wohlstetter, Gregory Jones, and Roberta Wohlstetter present the case of a state that is losing a short conventional war but possesses plutonium "in explosive concentrations" along with the "capability of assembling an implosion system." In light of this combination, they write, "from the standpoint of the adversary who had been winning, it would be facing a government which to all practical effect had nuclear weapons."[46]

By this standard, possession of fissile material alone ensures that a state can never truly be disarmed. Even after a highly successful first strike, the defender could use its surplus plutonium or highly enriched uranium to develop a crude retaliatory weapon, which it could then deliver using unconventional means. Only a small quantity of this material is needed, as US leaders frequently admonish. President Obama has warned that a mass of plutonium "about the size of an apple" would threaten hundreds of thousands of people.[47] The International Atomic Energy Agency defines a "significant quantity" of plutonium—the approximate amount needed to produce a nuclear explosive device—as 8 kg.[48] This unit of measurement should be kept in mind in any discus-

sion of a disarming strike on China, which possesses roughly 1.8 *tons* of weapons-grade plutonium.[49]

Of course, it is far from certain that a nation subjected to a nuclear first strike would succeed in developing and delivering a crude retaliatory weapon to its enemy's territory. However, necessity has always produced remarkable improvisation during wartime. After a nuclear attack, a state could devise unorthodox methods of retaliating, which suggests that credibility, that "magic ingredient" of deterrence, might be purchased more cheaply than is commonly supposed.[50]

Unconventional Delivery Modes

The concept of delivering nuclear weapons clandestinely dates to the earliest days of the nuclear age, when analysts imagined a range of exotic delivery means. In 1947, for example, the Federal Bureau of Investigation speculated that "a complete atom bomb could be smuggled into the United States as freight . . . and the bomb could be detonated by remote control."[51] As the Cold War progressed, both the United States and the Soviet Union developed man-portable nuclear weapons and the protocols for delivering them.[52] In the last two decades, unconventional delivery modes have often been discussed in scenarios involving terrorists and pariah states. In particular, this possibility has figured in the debate over missile defense, with opponents claiming that a state could easily circumvent the system using watercraft, pre-positioned nuclear devices, and the like.

More recently, this concept has been revisited in the context of nuclear war between the great powers. In the debate over Lieber and Press's analysis, for instance, Jan Lodal, former principal deputy undersecretary of defense, suggested that nuclear weapons could be smuggled into the United States on "pleasure boats" as a means of ensuring a second-strike capability. He conceded that this form of attack could not be used to defeat the United States but argued that the "possibility of [water-borne retaliation] does make the idea of a totally disarming attack against an adversary's nuclear forces nonsense."[53] While skeptics tend to dismiss these scenarios as the product of overactive imaginations, this bias stems from the odd perception that annihilating cities with megaton-class weapons is at once more credible and somehow more respectable than delivering Hiroshima-size bombs clandestinely. Another source of skepticism is the

belief that such delivery means simply offer less deterrent value than traditional modes of attack. As the National Intelligence Council (NIC) observes, the former "do not provide the same prestige, deterrence, and coercive diplomacy as ICBMs." However, the NIC swiftly contradicts itself by noting that the United States is more likely to be attacked using nonmissile means because they are "less costly, easier to acquire, and more reliable and accurate."[54] Setting aside this logical contradiction, it may be true that analysts do not associate reliability with deterrent value. However, if they do not, a weaker state could correct this misperception in various ways, including by conducting highly visible military exercises to demonstrate the efficacy of unconventional delivery means.

As with constructing a makeshift device, delivering a nuclear weapon clandestinely would pose significant challenges. Not least, shipborne bombs would be vulnerable to interdiction, and if the United States had intelligence that this mode of retaliation were being pursued, it would take extraordinary measures to defend itself. However, the intensity of this effort could not be sustained for long, and an adversary willing to wait months before retaliating would have a reasonable chance of succeeding. Even if the odds of success were objectively low, the stakes involved would demand worst-case scenario planning. Conservative leaders would have to assume that the bomber will always get through.

Deterrence and Self-Deterrence

If a source of reassurance exists that unconventional retaliation would not occur after a "splendid" first strike and that US nuclear threats still provide coercive leverage, it lies in the distinction between capability and intent. Simply because a state *could* retaliate in this manner does not mean that it would. For a variety of reasons, leaders may be self-deterred from retaliating—even if the means to do so were available and the justification ironclad. First, because these delivery means require countervalue targeting, that is, the mass killing of civilians, this option may not be considered palatable. Second, the weaker side might refrain from retaliating for fear of being annihilated in counterretaliation. If the stronger party believed that either of these considerations was prohibitive, it might still attempt coercion or outright attack, despite the weaker state's possession of a latent nuclear capability. These factors must therefore be

carefully examined before a more complete judgment of the utility of US offensive capabilities can be rendered.

The Credibility of Countervalue Retaliation

In considering unconventional delivery means, most discussion of credibility centers on technical matters, such as whether shipborne weapons can escape interdiction. However, the deterrent value of this attack mode also hinges on credibility of a different sort—whether a decision to retaliate in this manner would really be made. The credibility of countervalue targeting has long troubled nuclear strategists who fear that threats to murder large numbers of noncombatants are simply not believable. This apprehension contributed in part to the adoption of counterforce targeting in US nuclear doctrine.

Whether this concern would apply to countervalue *retaliation* is unclear. China's nuclear strategy implicitly involves city destruction, given the limited quantity and accuracy of its long-range weapons. However, qualitative differences between missile attacks and unconventional delivery modes suggest that a discrete use calculation might apply. Not least, an indiscriminate attack against civilians weeks or even months after a provocation would seem particularly cold-blooded. Nonetheless, the credibility threshold for retaliation is presumably far lower than for initiating nuclear war, and one line of thinking in particular may permit recourse to countervalue strikes despite moral qualms about them.

Counterforce capabilities are the luxury of states that spend lavishly on offensive arms, whereas a minimalist posture is the strategy of a more restrained nuclear power. In the event of a nuclear attack, members of the latter group cannot in fairness be expected to refrain from their only available means of retaliating. This would amount to penalizing the victim for adopting a more stable and responsible nuclear posture than its aggressor. Thus, any civilian deaths that result from such a state's retaliation can be laid squarely at the feet of the initiator of the nuclear exchange.

There are at least two scenarios where the justification for countervalue retaliation would be difficult to deny: a preemptive nuclear attack on a state's strategic forces or a conventional invasion.[55] In these scenarios, nuclear retaliation might be permissible for the reason outlined above: the more powerful side cannot dictate the terms under which its aggres-

sion can legitimately be answered. Nonetheless, no amount of sophistry can obscure the barbarism of nuclear strikes on population centers. A state retaliated against in this manner may very well escalate, especially if its leaders viewed the precipitating attack as having had limited aims. Their reaction may take the form of a grossly disproportionate counter-retaliation—the fear of which constitutes a second potential source of self-deterrence.

The Influence of Escalation Dominance

For more than a half-century, strategists have speculated on the effect of significant nuclear imbalances during crises. In 1959 Bernard Brodie considered the following scenario: "Let us assume that a menaced small nation could threaten the Soviet Union with only a single thermonuclear bomb, which, however, it could certainly deliver on Moscow if attacked." Brodie concluded that this capability would be "sufficient to give the Soviet government much pause."[56] However, the possession of a deliverable weapon is only one ingredient in the recipe for nuclear deterrence. No less important is the aggressor's belief that the defender will actually use it. The threat to do so is thought to lack credibility if the power differential between the two sides is too pronounced. In this circumstance, the stronger state may believe that it can conduct a limited attack—striking only military targets, for instance—while threatening an unrestrained attack on cities if the weaker state responds. This advantage is referred to as *escalation dominance*, which Forrest Morgan and his peers at RAND define as "a condition in which a combatant has the ability to escalate a conflict in ways that will be disadvantageous or costly to the adversary while the adversary cannot do the same in return."[57] If an aggressor enjoys this position, the weaker state may be perceived—and perceive itself—as being unable to retaliate even if it has the technical means to do so. At least one nuclear-weapon state is known to have debated this dilemma, and the conclusion of its leaders appears to call into question Brodie's verdict.

In the 1970s and 1980s, South Africa secretly developed six nuclear bombs, ostensibly to counter the threat from Soviet- and Cuban-backed rebels in Angola. However, some of its leaders doubted that these weapons could credibly deter a communist invasion. In this scenario, South Africa's strategy called for a series of graduated signals to alert the Soviets

that it possessed nuclear weapons, culminating in an explicit threat to use them on the battlefield. Yet, there was no agreement on what to do if this threat failed. One South African official felt that it would be advisable at that point to "throw in the towel, and let the Soviet Union take us," because to do otherwise would have been a "suicidal act." The Soviets would have "every excuse then to actually attack us with nuclear weapons. . . . Then we would still lose, but we would destroy the country and the people as well."[58]

This anecdote seems to undercut the idea that a rudimentary deterrent is adequate against a much stronger nuclear power. It suggests that as long as a preemptive attack spares something that the weaker state values (for example, its cities or its leaders' grip on power), that government cannot retaliate without fear of losing what remains. However, the fatal flaw in this logic is the assumption that leaders will always make rational decisions, even after suffering a national trauma. This is a condition that US decision makers could never take for granted. To resist coercion or deter an attack, the weaker side must simply create uncertainty about whether it would retaliate with nuclear weapons despite a great imbalance in strength. For a desperate or fanatic regime, this task would probably not be difficult. History is replete with vanquished governments fighting on after any prospect of victory had expired, and for cultures that place a high premium on "face," absorbing counterretaliation might be preferable to the dishonor of failing to respond at all. Finally, if a first strike were to occur, the aggressor could not assume unitary decision making on the part of its enemy. Military commanders might retaliate without authorization, especially if communication with the central leadership had been cut off. Each of these possibilities should be sufficient to plant a seed of doubt in the minds of American leaders. Given their manifest risk intolerance, even the smallest uncertainty may effectively render US offensive nuclear forces unusable, and without the credible threat of their use, any attempt at nuclear coercion may in turn ring hollow.

Yet, if US leaders' risk tolerance is indeed prohibitive and their self-deterrence correspondingly high, one might reasonably ask on what grounds counterforce capabilities should be considered dangerous. After all, these weapons are arguably destabilizing only if they are brandished or launched recklessly. However, it should not be assumed that American leaders are immune from cognitive dissonance, especially

under the enormous pressure of a nuclear crisis. It is quite possible they have not internalized the contradiction between their risk-averse counterterrorism and counterproliferation policies on one hand and the nation's footing for offensive nuclear war on the other. In a crisis, well-rehearsed nuclear war plans may assume a certain automaticity, in spite of leaders' obvious intolerance for risk in other domains. Further, a rational, considered decision to launch a first strike is not the only plausible scenario in which these weapons might be used.

A counterforce posture, especially when paired with a "launch on warning" policy, necessarily requires high launch readiness, imposing decision windows of perhaps 15–30 minutes upon receipt of satellite and radar warning of an incoming attack. The risk of a premature or mistaken launch under this model is self-evidently higher than under one designed to ride out a nuclear attack and retaliate with second-strike forces. Nor is the potential for miscalculation limited to a splendid counterforce attack. Consider a scenario presented by Austin Long and Brendan Green in which the United States enters into a limited conventional conflict with a nuclear adversary. In this circumstance, the enemy "would have strong incentives to try and secure their nuclear forces by dispersing them, delegating launch authority, or otherwise increasing readiness." If the United States were decisively winning, these authors suggest, "signs of [its adversary's] increasing readiness or weapons dispersal . . . would create dangerous windows of opportunity on the US side, as American troop concentrations, American allies, or even the American homeland could be potential hostages." Given such high stakes, they argue, "counterforce will likely have advocates in high circles during a crisis."[59]

Far from endorsing these capabilities, this scenario illustrates that US counterforce systems would be the principal driver of the enemy's anxiety about losing its weapons in the first place. Further, movements to secure one's nuclear forces from attack may be mistaken for launch preparations, prompting a counterforce strike and transforming what had been a limited conventional war into a nuclear one. Moreover, the possibility that enemy weapons may prove elusive is no less relevant in this circumstance than in the case of a bolt-from-the-blue attack. As Michael Gerson notes of such a scenario, "In the end, if an attempted disarming first strike leaves some of the adversary's weapons intact, the United States may have started the nuclear war that it had hoped to prevent."[60]

Implications for the United States

Ultimately, this analysis rests on inferences about the true risk tolerance of US leaders and the confidence of their adversaries in both resisting nuclear coercion and retaliating after a nuclear strike. Because neither of these variables can be established conclusively before a crisis occurs, there is room for disagreement about their potential implications. What should be uncontroversial, however, is that widely divergent perceptions of capability and resolve in a crisis may lead to catastrophic misjudgments.[61] Additionally, there should be no doubt that such divergences exist.

Consider the multiple levels of perception that would be operative if the United States attempted nuclear coercion—much less a first strike. First would be US leaders' confidence in their counterforce capabilities, followed by the enemy's estimation of them. Next would be the enemy's confidence in its ability to retaliate after absorbing a counterforce strike and the United States' assessment of this probability. Beneath these first-order judgments are even more subjective evaluations: American leaders' perception of *the enemy's perception* of US first-strike capabilities, the enemy's perception of *US leaders' perception* of its retaliatory capability, and so on. Mistaken assumptions in any one of these dimensions could result in grave errors. For example, if US leaders are so enamored of their first-strike capabilities that they perceive little risk of retaliation, the threshold for launching a preemptive attack—or merely engaging in nuclear coercion—might be dangerously low. Indeed, this prospect has not escaped foreign strategists. Chinese analysts Li Bin and Nie Hongyi have noted that the limitations of US offensive forces are "not clear enough" to American leaders, creating the possibility that they "may think they have" the capability to neutralize China's retaliatory forces. According to Li and Nie, the Americans' "blind confidence" might give rise to attempts at nuclear saber rattling or worse.[62] Compounding this danger is the possibility that a state subjected to American coercion may believe just as strongly in its own capacity to retaliate. Moreover, if either side believes that the other privately shares its own assessment, they may fatally misjudge the robustness of deterrence. In particular, foreign leaders may take at face value US rhetoric on nuclear terrorism and conclude that the ability to deliver a single bomb is sufficient to deter the United States. In this circumstance, they may discount the gravity of American threats even if they are quite sincere.

Because US offensive capabilities are the chief source of these potential risks, the responsibility arguably falls to the United States to minimize them. One doctrinal option is simply to limit offensive nuclear forces exclusively to damage-limitation roles, that is, reducing the brunt of an enemy attack when it is not merely likely but imminent or under way. Striking first in this scenario requires no great tolerance for risk, because some level of damage is inevitable, and preemption merely reduces that damage as much as possible. However, this option would leave counterforce capabilities intact, offering no assurance that American leaders would forswear preemptive attacks in less than dire circumstances. The most effective means of preventing nuclear aggression—and the terrible risks entailed—is to dismantle counterforce capabilities altogether.

Rejection of Counterforce Targeting

The belief that strategic stability requires the capacity to hold an enemy's nuclear forces at risk is canonical in US nuclear doctrine.[63] However, the logical foundation of this axiom has never been firm. Because counterforce capabilities nourish the reciprocal fear of a surprise attack, their effect during crises may be inherently destabilizing. A state's anxiety over losing its weapons only encourages their precipitate launch, and its enemy's anticipation of this mind-set incentivizes attempts to disarm those weapons first. If neither side could target the other's strategic forces, no such "use or lose" pressures would exist.

The case against counterforce need not be confined to the theoretical realm, however. Well-documented historical episodes illustrate the disconnect between this strategy and national leaders' enthusiasm for employing it. During the 1961 Berlin crisis, Pres. John F. Kennedy considered a first strike against Soviet nuclear forces based on a plan that had been drafted earlier that year. US satellites had revealed that the USSR possessed only *eight* ICBMs, presenting the alluring prospect of a disarming attack. However, even this miniscule retaliatory force was sufficient to discourage Kennedy, who lacked confidence that the Soviet weapons could be completely neutralized.[64] As Fred Kaplan reflects on the incident, "even in those halcyon days of 'strategic superiority,' the most determined American officials, who had firmly believed in the counterforce strategy in theory, did not even contemplate taking the awesome risk of executing the strategy in practice."[65] Strangely, this epi-

sode and others like it occasioned no fundamental reevaluation of the US targeting strategy. More than 50 years later, the US nuclear posture is still configured for counterforce strikes, even against states with whom the numerical balance is much less favorable than it was against the Soviets early in the Cold War.

A US nuclear posture that is more consistent with its leaders' tolerance for risk would designate these weapons for an exclusive purpose: deterring a nuclear attack on the United States or its allies with the threat of countervalue retaliation. Many strategists have an allergy to this concept because they consider the presumed targets of these strikes—enemy cities—morally impermissible and the threat to destroy them incredible.[66] However, states do not face a binary choice between targeting missile silos and annihilating civilians. There is a "third way" that removes the dangers of counterforce targeting, while minimizing the collateral damage of countervalue attacks. This doctrine, which Hans M. Kristensen, Robert S. Norris, and Ivan Oelrich term "infrastructure targeting," would hold at risk critical national assets such as energy nodes, transportation hubs, and fuel refineries.[67] Destroying these targets could seriously threaten an enemy's economy and national cohesion without the instability of counterforce strategies or the moral outrage of targeting population centers. Of course, many infrastructure targets are located in close proximity to urban areas, and it is impossible to adopt a targeting posture that completely spares civilians. Indeed, counterforce targeting, despite its emphasis on military assets, also entails substantial civilian casualties because deadly fallout from a massive attack would cover a wide geographic area. Ultimately, however, the criterion that should commend a targeting posture is not the number of civilian deaths it would produce on paper or whether these deaths are intended or collateral. Rather, the most salient quality is whether the posture increases or decreases stability, and a countervalue model is arguably superior in this respect.

Steep Reductions in Nuclear Warheads

Rejecting counterforce targeting would yield many additional benefits beyond shielding leaders from their own risky decision making. Not least of these would be a steep drop in the size of the US arsenal, the overwhelming driver of which is the abundance of military targets in

Russia. Eliminating the requirement to destroy these assets would limit the number of enemy aim points to a fixed set of infrastructure targets, which would substantially reduce warhead needs. As part of this doctrinal shift, the United States could also phase out its silo-based ICBMs, an idea that is rapidly gaining in respectability. Indeed, a panel led by Gen James Cartwright, former commander of US Strategic Command, recommended in 2012 that these weapons be retired.[68]

Eliminating the land-based leg of the triad would occasion great handwringing, but it would hardly constitute the most radical policy of the nuclear age. Certainly more psychologically discomfiting was the Anti-Ballistic Missile Treaty, which hinged on the counterintuitive notion that the United States and the Soviet Union could improve their security by preserving their defenselessness to nuclear attack. And of course a diverse group of nuclear practitioners, including many senior military leaders, has embraced nuclear abolition. Relative to these ideas, it seems distinctly uncontroversial to suggest retiring weapons that pose enormous risks to strategic stability and are of questionable military utility.

Beyond debates about the value of any particular weapon system, a more fundamental objection to steep warhead cuts is the conviction that nuclear superiority translates directly into coercive leverage. Matthew Kroenig, for example, argues that states that possess numerical superiority in weapons have correspondingly higher levels of effective resolve, which in turn causes them to "push harder in a nuclear crisis, improving their prospects of victory."[69] Yet, this phenomenon may argue *against* nuclear imbalances for the reason identified earlier. In crises where states fundamentally misperceive each other's tolerance for risk, the result of overconfidence may not be dominance but rather catastrophe.

De-emphasis of Nuclear Weapons in US Security Policy

Finally, adopting a countervalue strategy would enable a range of policies that circumscribe the role of nuclear weapons in US security policy, a goal that President Obama articulated in Prague.[70] First, the United States could comfortably adopt a pledge not to be the first to use nuclear weapons in a conflict. While US doctrine lists a range of potential first-use scenarios—for example, targeting deeply buried biological weapons facilities—these are mere garnishes to the primary mis-

sion of US strategic weapons: preemptively destroying enemy nuclear forces. If the limitations of this strategy were appreciated more widely and US doctrine modified accordingly, the chief impediment to adopting a no-first-use pledge would be greatly attenuated. Additionally, deployed warheads could be maintained at lower states of alert, which many senior leaders believe even now to be far out of proportion to the nation's deterrence needs.[71]

Coupled with warhead reductions, changes to US targeting policy could influence foreign decision making by reassuring America's rivals that they do not need formidable nuclear forces to deter the United States. While it is important not to overstate the responsiveness of foreign nuclear programs to American policies, it is not implausible that US doctrinal adjustments could have cascading effects. Consider the interlocking nature of the world's nuclear deterrence relationships, where Russia and the United States must deter each other, China must deter them both as well as India, India must deter China and Pakistan, and Pakistan must deter India.[72] A fundamental change to the targeting policy of the most powerful of these states could lead to a steep downward revision in the commonly accepted requirements of nuclear deterrence. Even if Russia's targeting policy remained unchanged, countries that have not yet developed robust counterforce capabilities, such as China, India, and Pakistan, might be persuaded not to pursue them in the first place.

Recognizing the difficulty of making such sweeping reforms to the US nuclear posture, as well as the enduring allure of the counterforce option in some scenarios, it may be necessary to consider more modest changes to reduce the danger of catastrophic misperceptions. Ideally, these reforms would address both sides of the underlying problem—the consequences of signaling the United States' low damage tolerance and the intrinsic dangers of the counterforce model itself. Regarding the former, US leaders should consciously avoid rhetoric in other contexts that gives the impression of their extreme sensitivity to nuclear threats. Whether sincere or exaggerated, these statements may invite boldness on the part of adversaries in a crisis, undermining the US bargaining position. Although signaling that the United States is perfectly willing to gamble its cities may lack credibility, at the very least US leaders should refrain from messaging that reinforces the opposite position.

Likewise, if the United States is unwilling to relinquish its counterforce capabilities, initiatives can still be taken to manage the risk of their imprudent use. First, nuclear practitioners should be made to understand that the United States' coercive leverage in nuclear crises may have been compromised by its leaders' rhetoric and policies in other arenas. Injecting this concept into war games and scenario analysis may increase their appreciation of a potent source of adversary resolve. Most importantly, US nuclear war planning should be made less myopic in its focus on deployed, long-range weapons and take into account the potential for delayed retaliation, including with unconventional delivery means. Consideration of these possibilities may not foreclose counterforce targeting altogether, but it may make decision makers more circumspect about the likelihood of a completely disarming first strike.

Conclusion

More than 30 years ago, Thomas Schelling posed the question, what is meant by "having" the bomb? He suggested that in a decade or two, most countries would "have" nuclear weapons in the sense that Switzerland has an army—a latent military capability that can be quickly constituted in an emergency. Schelling reasoned that it made more sense to characterize many states' nuclear weapon status "not with a yes or a no but with a time schedule."[73] Since then, the idea of "weaponless deterrence" has been at the center of the intellectual case for nuclear disarmament.

Advocates of this controversial model believe that strategic stability can be underwritten by latent nuclear capabilities rather than constituted arsenals and that states with a certain level of nuclear capacity would reap the deterrent value of these weapons without actually possessing them. This condition would arise from the maintenance of a nuclear infrastructure complete with knowledge of nuclear weapon design and access to fissile material. Sweden, for example, maintained a latent nuclear capability for many years by virtue of a deeply buried 65-megawatt reactor capable of producing plutonium and a small cadre of physicists with weapon-design expertise.[74] An adversary weighing aggression against such a state would have to consider its theoretical capacity to retaliate with nuclear weapons, albeit on a much slower schedule.

Many skeptics consider weaponless deterrence to be a fanciful ambition, but the crucial seed of the model may already exist. According to Obama administration official Laura Holgate, some 40 countries already have enough nuclear material to produce a "Hiroshima or a Nagasaki-type explosion."[75] Coupled with evidence that the threat of damage on this scale may be enough to deter even the strongest world power, perhaps weaponless deterrence is less utopian than is commonly supposed. Yet, even if the interval between the status quo and that distant aspiration is ultimately a bridge too far, the insight at the heart of this model may nonetheless call for a wholesale reevaluation of nuclear strategy. If delayed retaliation on a relatively small scale is indeed sufficient to deter, the use or threatened use of counterforce capabilities should be greatly limited whether these systems are dismantled or not.

Ascertaining the United States' maximum damage tolerance, and hence its potential resolve in a crisis, is difficult in the abstract. A useful starting point would be to press US leaders to explain the logical contradictions embedded in US nuclear policy. This exercise may lend credence to the idea that, from the perspective of a state contemplating nuclear aggression, an opponent's mere possession of fissile material may meet the most fundamental requirement of deterrence. SSQ

Notes

1. McGeorge Bundy, "To Cap the Volcano," *Foreign Affairs* 48, no. 1 (October 1969): 1–20.

2. Rose Gottemoeller, "New START Implementation," testimony before the Senate Foreign Relations Committee, 21 June 2012, http://www.state.gov/t/us/193605.htm.

3. See Barack Obama, "Remarks by the President at the United Nations Security Council Summit on Nuclear Non-Proliferation and Nuclear Disarmament" (press release, Office of the Press Secretary, White House, 24 September 2009), http://usun.state.gov/briefing/statements/2009/september/129562.htm; and Barack Obama, "Remarks by the President at the Opening Plenary Session of the Nuclear Security Summit" (press release, Office of the Press Secretary, White House, 13 April 2010, https://www.whitehouse.gov/the-press-office/remarks-president-opening-plenary-session-nuclear-security-summit.

4. See Keir A. Lieber and Daryl G. Press, "The End of MAD? The Nuclear Dimension of U.S. Primacy," *International Security* 30, no. 4 (Spring 2006): 7–44. For a more recent treatment of the subject by the same authors, see Keir A. Lieber and Daryl G. Press, "The New Era of Nuclear Weapons, Deterrence, and Conflict," *Strategic Studies Quarterly* 7, no. 1 (Spring 2013): 3–12, http://www.au.af.mil/au/ssq/digital/pdf/spring_13/lieber.pdf.

5. I am indebted to Joshua Pollack for this insight.

6. See Paul A. Samuelson, "Consumption Theory in Terms of Revealed Preference," *Economica* 15, no. 60 (November 1948): 243–53. I am indebted to Joshua Pollack for bringing this term to my attention.

7. Despite efforts to prevent pariah states from acquiring nuclear weapons, the United States has permitted one such country to do so without recourse to military action. In 1994, after North Korea (DPRK) threatened to reprocess spent fuel from its Yongbyon reactor, the Clinton administration reportedly drew up military plans to attack the facility. However, this option was shelved upon receiving news of a deal brokered by former president Jimmy Carter, which led to the Agreed Framework to halt North Korea's nuclear weapons program. See Ashton B. Carter and William J. Perry, *Preventive Defense: A New Security Strategy for America* (Washington, DC: The Brookings Institution, 1999), 128–31. That the United States did not respond militarily to the DPRK's subsequent violation of this agreement is at odds with its otherwise aggressive counterproliferation posture. This decision is perhaps best explained by the fact that once North Korea's violation was discovered, it was too late to roll back the DPRK nuclear program without risking nuclear retaliation. Thereafter, North Korea was apparently judged to be containable.

8. Jessica C. Varnum, "60 Years of Atoms for Peace," *Nuclear Engineering International*, 23 January 2014, http://www.neimagazine.com/features/feature60-years-of-atoms-for-peace-4164653/.

9. See Ariana Rowberry, "Sixty Years of 'Atoms for Peace' and Iran's Nuclear Program," *Up Front* (blog), Brookings Institution, 18 December 2013, http://www.brookings.edu/blogs/up-front/posts/2013/12/18-sixty-years-atoms-peace-iran-nuclear-program-rowberry; and Leonard Weiss, "Atoms for Peace," *Bulletin of the Atomic Scientists* 59, no. 6 (November 2003): 34–42.

10. Sam Roe, "An Atomic Threat Made in America," *Chicago Tribune*, 28 January 2007, http://www.chicagotribune.com/news/nationworld/chi-061209atoms-day1-story-htmlstory.html.

11. George W. Bush, "Bush: Don't Wait for Mushroom Cloud," *CNN* transcript, 8 October 2002, http://edition.cnn.com/2002/ALLPOLITICS/10/07/bush.transcript/.

12. Bruce G. Blair and Chen Yali, "The Fallacy of Nuclear Primacy," *China Security* 2, no. 4 (Autumn 2006): 51–77.

13. Richard N. Perle, "The Arms Race Myth, Again," *Washington Post*, 3 March 2008, http://www.washingtonpost.com/wp-dyn/content/article/2008/03/02/AR2008030201854.html.

14. James M. Lindsay, Michael E. O'Hanlon, Charles L. Glaser, and Steve Fetter, "Correspondence: Limited National and Allied Missile Defense," *International Security* 26, no. 4 (Spring 2002): 190–201.

15. Matthew Bunn, Anthony Wier, and John P. Holdren, *Controlling Nuclear Warheads and Materials: A Report Card and Action Plan* (Washington, DC: Nuclear Threat Initiative, March 2003), 15–19.

16. Barack Obama, "Remarks by President Obama and President Zuma of South Africa before Bilateral Meeting" (press release, Office of the Press Secretary, White House, 11 April 2010), https://www.whitehouse.gov/the-press-office/remarks-president-obama-and-president-zuma-south-africa-bilateral-meeting.

17. See US Department of Defense (DOD), *Nuclear Posture Review Report* (Washington, DC: DOD, April 2010), iii; and Barack Obama, "Remarks by President Barack Obama in Prague as Delivered" (press release, Office of the Press Secretary, White House, 5 April 2009), https://www.whitehouse.gov/the-press-office/remarks-president-barack-obama-prague-delivered.

18. Herman Kahn, *On Thermonuclear War* (Princeton, NJ: Princeton University Press, 1960), 32.

19. Kenneth Waltz, "The Spread of Nuclear Weapons: More May Be Better," *Adelphi Papers* 21, no. 171 (1981): 15–16.

20. Devin T. Hagerty, "Nuclear Deterrence in South Asia: The 1990 Indo-Pakistani Crisis," *International Security* 20, no. 3 (Winter 1995–1996): 79–114.

21. Keir A. Lieber and Daryl G. Press, "The Rise of U.S. Nuclear Primacy," *Foreign Affairs* 85, no. 2 (March–April 2006): 42–54.

22. Keir A. Lieber and Daryl G. Press, "The Nukes We Need: Preserving the American Deterrent," *Foreign Affairs* 88, no. 6 (November–December 2009): 39–51.

23. Keith Payne, "A Matter of Record," *Foreign Affairs* 85, no. 5 (September–October 2006): 150–52.

24. Since the Persian Gulf War, when the hunt for Saddam Hussein's mobile SCUD missiles proved so daunting, significant advances have been made in three capabilities that could support the tracking and targeting of mobile missiles: stealthy long-loiter unmanned aerial vehicles, signals intelligence enabling geolocation, and networked ground sensors. See Austin Long and Brendan Rittenhouse Green, "Stalking the Secure Second Strike: Intelligence, Counterforce, and Nuclear Strategy," *Journal of Strategic Studies* 38, no. 1–2 (2015): 38–73.

25. Glenn C. Buchan, David M. Matonick, Calvin Shipbaugh, and Richard Mesic, *Future Roles of U.S. Nuclear Forces: Implications for U.S. Strategy* (Santa Monica, CA: RAND Corporation, 2003), http://www.rand.org/pubs/monograph_reports/MR1231.html.

26. Christopher F. Chyba and J. D. Crouch, "Understanding the U.S. Nuclear Weapons Policy Debate," *Washington Quarterly* 32, no. 3 (July 2009): 21–36.

27. Li Bin and Nie Hongyi, "An Investigation of China–U.S. Strategic Stability," translated by Gregory Kulacki, *World Economics and Politics* 2 (2008), 13–19.

28. Chyba and Crouch acknowledge that a state might "retain the capability, over a longer time period, to retaliate with nuclear warheads delivered without the use of strategic delivery systems (e.g., via smuggling by ship or other method)." However, their depiction of an attack that eliminates strategic nuclear forces as a "confident and disarming" one illustrates their disregard for these alternative means.

29. See Albert J. Wohlstetter, *The Delicate Balance of Terror* (Santa Monica, CA: RAND Corporation, 6 November 1958).

30. Fred Kaplan, *The Wizards of Armageddon* (Stanford, CA: Stanford University Press, 1983).

31. Rajesh M. Basrur, *Minimum Deterrence and India's Nuclear Security* (Singapore: National University of Singapore Press, 2009), 1, 25.

32. See Michael J. Mazarr, "Virtual Nuclear Arsenals," *Survival* 37, no. 3 (Autumn 1995): 7–26.

33. M. Taylor Fravel and Evan S. Medeiros, "China's Search for Assured Retaliation: The Evolution of Chinese Nuclear Strategy and Force Structure," *International Security* 35, no. 2 (Fall 2010): 48–87.

34. Pan Zhenqiang, "On China's No First Use of Nuclear Weapons" (paper, presented at Pugwash Meeting 279, London, UK, 15–17 November 2002).

35. Jeffrey S. Lantis, Tom Sauer, James J. Wirtz, Keir A. Lieber, and Daryl Grayson Press, "Correspondence: The Short Shadow of U.S. Primacy?" *International Security* 31, no. 3 (Winter 2006–2007): 174–93.

36. Ward Wilson, "The Myth of Nuclear Deterrence," *Nonproliferation Review* 15, no. 3 (November 2008): 421–39.

37. See, for example, Tsuyoshi Hasegawa, *Racing the Enemy: Stalin, Truman, and the Surrender of Japan* (Cambridge, MA: Harvard University Press, 2005).

38. Ward Wilson, "The Winning Weapon? Rethinking Nuclear Weapons in Light of Hiroshima," *International Security* 31, no. 4 (Spring 2007): 162–79.

39. Gurmeet Kanwal, "India's Nuclear Force Structure," *Strategic Analysis* 24, no. 6 (2000): 1,039–75.

40. K. Subrahmanyam, "A Credible Deterrent: Logic of the Nuclear Doctrine," *Times of India*, 4 October 1999.

41. Micah Zenko, "An Iranian Nuclear Weapon: How Would We Know?," *Politics, Power, and Preventive Action* (blog), Council on Foreign Relations, 7 February 2012, http://blogs.cfr.org/zenko/2012/02/07/an-iranian-nuclear-weapon-how-would-we-know/.

42. Victor D. Cha, "How to Disarm a Nuclear North Korea," *Washington Post*, 9 October 2011, https://www.washingtonpost.com/opinions/how-to-disarm-a-nuclear-north-korea/2011/10/09/gIQAlaZeYL_story.html.

43. Waltz, "Spread of Nuclear Weapons," 19.

44. Ashley J. Tellis, "India's Emerging Nuclear Doctrine: Exemplifying the Lessons of the Nuclear Revolution," *NBR* [*National Bureau of Asian Research*] *Analysis* 12, no. 2 (May 2001).

45. National Research Council, *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism* (Washington, DC: National Academies Press, 2002), 40.

46. Albert Wohlstetter, Gregory Jones, and Roberta Wohlstetter, *Why the Rules Have Needed Changing*, Part I, *Towards a New Consensus on Nuclear Technology* (Los Angeles, CA: Pan Heuristics, 6 July 1979), 37.

47. See Barack Obama, "Press Conference by the President at the Nuclear Security Summit" (press release, Office of the Press Secretary, White House, 13 April 2010), https://www.whitehouse.gov/the-press-office/press-conference-president-nuclear-security-summit.

48. See International Atomic Energy Agency, *IAEA Safeguards Glossary, 2001 Edition*, International Nuclear Verification Series, no. 3 (Vienna, Austria: IAEA, 2002).

49. Hui Zhang, "China's Stockpile of Military Plutonium: A New Estimate" (paper, presented at the Institute for Nuclear Materials Management 52nd Annual Meeting, Palm Springs, CA, 17–21 July 2011).

50. Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York: St. Martin's Press, 1981), 92.

51. Federal Bureau of Investigation, *Suggested Security Measures with Reference to Smuggling Atom Bombs or Parts for Atom Bombs into the United States* (Washington, DC: FBI, November 1947).

52. Amy F. Woolf, *Nonstrategic Nuclear Weapons* (Washington, DC: Congressional Research Service, 23 February 2011).

53. Jan Lodal, "The Counterforce Fantasy," *Foreign Affairs* 89, no. 2 (March–April 2010), 145–46.

54. National Intelligence Council, *Foreign Missile Developments and the Ballistic Missile Threat through 2015* (Washington, DC: National Intelligence Council, December 2001), 4, 7.

55. Nuclear retaliation against a non-nuclear attack might also be justified if the aggressor's aim is strategic in scope. Indeed, Russia and China worry that precision-guided conventional weapons could one day be used to disarm them without violating the nuclear taboo.

56. Bernard Brodie, "The Anatomy of Deterrence," *World Politics* 11, no. 2 (January 1959): 173–91.

57. Forrest E. Morgan, Karl P. Mueller, Evan S. Medeiros, Kevin L. Pollpeter, and Roger Cliff, *Dangerous Thresholds: Managing Escalation in the 21st Century* (Santa Monica: RAND Corporation, 2008).

58. Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security* 26, no. 2 (Fall 2001): 45–86.

59. Long and Green, "Stalking the Secure Second Strike," 38–73.

60. Michael S. Gerson, "No First Use: The Next Step for U.S. Nuclear Policy," *International Security* 35, no. 2 (Fall 2010): 7–47.

61. I am indebted to James Scouras for this insight.

62. Bin and Hongyi, "An Investigation of China–U.S. Strategic Stability."

63. A 2012 report commissioned by the US Air Force argued that strategic stability "requires an arsenal whose qualitative characteristics hold the other party's nuclear weapons at risk, while also signaling a steady state of mutual deterrence." See Jeffrey A. Larsen, Justin V. Anderson, Darci Bloyer, Thomas Devine IV, Rebecca Davis Gibbons, and Christina Vaughan, *Qualitative Considerations of Nuclear Forces at Lower Numbers and Implications for Future Arms Control Negotiations* (Colorado Springs, CO: USAF Institute for National Security Studies, INSS Occasional Paper 68, July 2012), xiv.

64. Fred Kaplan, "JFK's First-Strike Plan," *Atlantic Monthly*, October 2001, http://www.theatlantic.com/magazine/archive/2001/10/jfks-first-strike-plan/376432/.

65. Kaplan, *Wizards of Armageddon*, 306.

66. This is hardly a universal view, however. Gen Eugene Habiger, former commander of US Strategic Command, has advocated for a nuclear posture that targets Russian cities rather than nuclear forces: "You've got to go back to city-busting," he has said. See David Ruppe, "Retired U.S. Nuclear Commander Calls for Strategic Arms Cuts," *Global Security Newswire*, 29 January 2004.

67. See Hans M. Kristensen, Robert S. Norris, and Ivan Oelrich, "From Counterforce to Minimal Deterrence: A New Nuclear Policy on the Path toward Eliminating Nuclear Weapons" (occasional paper, Federation of American Scientists and Natural Resources Defense Council, April 2009).

68. James Cartwright, *Global Zero U.S. Nuclear Policy Commission Report: Modernizing U.S. Nuclear Strategy, Force Structure and Posture* (Washington, DC: Global Zero, May 2012).

69. Matthew Kroenig, "Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes," *International Organization* 67, no. 1 (January 2013): 141–71.

70. Obama, "Remarks by President Barack Obama in Prague."

71. See Robert Burns, "James Cartwright, Former U.S. Commander: Take Nuclear Missiles off High Alert," *Washington Times*, 29 April 2015, http://www.washingtontimes.com/news/2015/apr/29/former-us-commander-take-nuclear-missiles-off-high.

72. George Perkovich, "The Obama Nuclear Agenda One Year after Prague," *Policy Outlook*, Carnegie Endowment for International Peace, 30 March 2010, http://carnegieendowment.org/2010/03/30/obama-nuclear-agenda-one-year-after-prague.

73. Thomas C. Schelling, "Who Will Have the Bomb?" *International Security* 1, no. 1 (Summer 1976): 77–91.

74. Steve Coll, "Neutral Sweden Quietly Keeps Nuclear Option Open," *Washington Post*, 25 November 1994.

75. Lee Michael Katz, "NSC's Holgate: House Vote Shows 'Fundamental Misunderstanding' of Threat Reduction," *Global Security Newswire*, 29 June 2012.

Disclaimer