

Missile Defense after the Cold War: Uncertainty, Resolve, and Distinctions between Area and National Missile Defense

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***Abstract:** Missile defense has long been a contentious topic among nuclear strategists and policy makers. Presently, the topic has returned to the policy forefront, as nuclear issues become increasingly relevant to U.S. foreign policy. Nonetheless, there are relatively few rigorous theoretical frameworks analyzing the implications of missile defense for deterrence theory situated in a post-Cold War context. In this paper, I extend existing relevant theoretical perspectives within the framework of a brinkmanship-based model of deterrence to consider the uncertain effectiveness of such systems, connections between missile defense and proliferation, and distinctions between national and area defense. I conclude that national defenses will tend to destabilize, prove counterproductive to U.S. interests, and have few counterproliferation benefits, while area defenses have the potential to be stabilizing, serve U.S. interests in a variety of respects, and have meaningful counterproliferation benefits. Finally, I place this analysis in the context of current policy issues and discusses implications for future U.S. policy.*

Keywords: Nuclear Weapons, Missile Defense, Game Theory, US Security Policy, Security, Counterproliferation, Nuclear Strategy

Introduction

Throughout the Cold War, the concept of a national missile defense system was a prominent item of discussion for policy makers and nuclear strategists. On its face, the prospect of an escape from the ‘delicate balance of terror’ that defined superpower relations of the era was attractive. With the development of a successful missile defense system, a state could be free from the precarity of mutual assured destruction and the nuclear whims of its adversary. Such a defense could restore a state’s freedom of action in international affairs, and, in the event of an accidental nuclear war, could blunt or eliminate the impact of an otherwise apocalyptic event. However, the concept encountered objections regarding the destabilizing nature of such a system and issues of technical infeasibility. Ultimately, there was no deployment of national missile defense on a wide scale during the Cold War.

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Currently, events like the North Korean nuclear crisis and the installation of limited missile defenses in east Asia bring issues of missile defense back to the fore. While invulnerability from the major nuclear powers of the world seems beyond American technical capabilities for the time being, our missile defense capabilities have advanced far beyond those in the 1970s and 80s. However, today the primary focus of debates regarding missile

defense is not defending against an assured destruction capability of a rival superpower, but rather managing ‘rogue threats’ and intermediate nuclear powers. At present, similar frameworks can be applied to Russia as were applied to the Soviet Union, but these theories do not cover the totality of relevant modern security dynamics. In particular, the United States could potentially seek to deploy missile defenses as a means of enhancing its security against small and medium-sized nuclear states and would-be nuclear states (currently policy discourse in this area focuses often on the proliferation challenges posed by Iran and North Korea). In this paper, I seek to address these issues by extending existing relevant theoretical perspectives within the framework of a brinkmanship-based game-theoretic model of deterrence to consider additional relevant factors like uncertainty surrounding the perceived effectiveness of missile defense systems, the potential deployment of offensive countermeasures against missile defense systems, and dynamics related to the acquisition of ICBM-capability by incipient nuclear states.

Within this frame of analysis, I assume states are rational unitary actors, and model nuclear confrontation as a “competition in risk taking.”¹ Formally, this is represented through a sealed-bid, all-pay second price risk auction, where each state bids the maximum risk of war it is willing to run, and subsequently either war occurs with the probability of the second highest bid, or otherwise the higher bidding state wins, and earns a payout equal to the stakes of the confrontation. I focus in particular on effects and links to proliferation decision making and counterproliferation efforts, as well as the distinction between area missile defense systems designed to protect a limited area against short to intermediate range missiles and national defense systems designed to protect a large geographic area against intercontinental ballistic missiles (ICBMs). I conclude that national defenses will tend to destabilize nuclear deterrent relationships, prove counterproductive to U.S. interests, and are unlikely to meaningfully discourage nuclear proliferation, while area defenses have the potential to stabilize deterrence, serve U.S. interests in a variety of respects, and have meaningful counterproliferation benefits.

Further, this outcome is a direct result of the interaction between the differing strategic characteristics inherent to each type of missile defense and the strategic incentives faced by proliferating U.S. adversaries. Placing this analysis in the context of current policy issues has significant implications for future U.S. policy. It suggests that missile defenses may affect the two key proliferation challenges currently facing U.S. policymakers (Iran and North Korea) very differently. Specifically, while missile defenses are unlikely to serve U.S. interests in the case of North Korea, the judicious deployment of area defenses may further U.S. efforts to deny Iran a nuclear weapons program and an ICBM capability.

Analyzing Nuclear Confrontation

The bilateral nuclear relationships of the United States can be broadly classified into five categories. First, there is the case of Russia (a category unto itself), wherein both powers possess survivable annihilatory capacities. The deterrence characteristics of such bilateral superpower nuclear relationships have been discussed at length. Further, for the near-term future, it is unequivocally beyond both the current technical and economic capacities of the United States to develop and deploy a missile defense system capable of denying a survivable, annihilatory nuclear capacity to Russia. Additionally, given the mechanics of hit-to-kill defense systems, even extremely effective systems could potentially be deployed

¹ Thomas C Schelling, *Arms and Influence* (New Haven: Yale University Press, 1966).

without threatening the integrity of the Russian assured destruction capability.² Thus, the discussion of the US-Russia nuclear relationship is beyond the scope of an analysis of the near-term implications of missile defense.^{3,4}

Second, there are the cases of the United Kingdom, France, and Israel. Each of these states possess a large, but not annihilatory nuclear capacity, and are friendly with the United States, undertaking extensive security cooperation. Thus, given that it is doubtful that U.S. nuclear planners spend much time worrying about the threat posed by, say, the French nuclear arsenal, it is unlikely that any U.S. missile defense system will be targeted at these states, and so I will exclude them from my analysis.

Third and fourth, there are states that either have developed, or may in the future, seek to develop, nuclear weapons because of a clear conflict of security interests between themselves and the United States. North Korea is an example of the first category, while Iran is one of the second. It is on these states, which we might call ‘rogue states,’ that I will focus my analysis.⁵

Fifth, there is the case of China, which is a category unto itself. It possesses a significant nuclear arsenal (but not an annihilatory one), on par with those of states like Britain and France, but it can also be considered a semi-adversarial power. It is thus a special case, and, while it is not the focus of this paper, I will briefly address it towards the end of the paper in my discussion of policy implications.

Note that I have excluded India and Pakistan. While both states obviously possess arsenals that are highly significant in their own right (for a wide variety of reasons), their nuclear strategies and decision-making, cannot, for the most part, be related to each country’s security relationship with the United States. Thus, they fall outside the scope of an analysis of U.S. missile defense.

Moving now to the primary subject of analysis, why might a so-called ‘rogue state’ desire a nuclear arsenal because of security tensions with the United States? Answering this question first requires developing a framework for analyzing nuclear confrontation.

Existential Nuclear Confrontation

First, a rogue state may, if it credibly fears U.S. intervention aimed at regime change, seek a nuclear arsenal to deter such regime change. An illustrative example of this dynamic is the nuclearization of North Korea.

However, as Betts points out, in a confrontation between the United States and a rogue nuclear state, the rogue state will always prevail if the stakes of submission are regime

² To elaborate, even if a national level hit to kill system with a near 100% success rate were to be developed, by limiting the number of interceptors deployed to, say, on the order of hundreds rather than thousands, the United States could bring such a system online without threatening to deny an assured destruction capability, and thus leave unchanged the material facts of the strategic nuclear balance between the United States and Russia.

³ For a robust and skeptical discussion of the potential implications of sophisticated missile defense for the U.S.-Russia relationship, see Charles L. Glaser, “Why Even Good Defenses May Be Bad,” *International Security* 9, no. 2 (1984): 92–123, <https://doi.org/10.2307/2538669>.

⁴ For a representation of Cold War era missile defense proponents, see Colin S. Gray, “Nuclear Strategy: The Case for a Theory of Victory,” *International Security* 4, no. 1 (1979): 54–87, <https://doi.org/10.2307/2626784>.

⁵ ‘Rogue’ is not mean pejoratively, but rather, employed for ease of discussion, in accordance with the typical vernacular of related policy discussions.

change.⁶ In short, because the regime of a rogue state should be indifferent between ceasing to exist in a retaliatory (and annihilatory) nuclear strike and ceasing to exist as a result of a conventional regime change operation, such a state can credibly threaten a nuclear strike in response to invasion. meaning that unless the costs of submission for the United States exceed the costs of one or more nuclear strikes on the U.S. homeland (which they almost assuredly do not, as U.S. interests at stake in showdowns with small and distant adversaries can rarely be termed ‘vital’), the United States will back down rather than press a threat of regime change in such a situation.

Limited Nuclear Confrontation

However, both countries which fear U.S. regime change (like North Korea) and countries which are adversaries of the United States, but reasonably secure against wholesale regime change (like Iran),⁷ may also engage in confrontation over more limited stakes. Drawing on brinkmanship theories of nuclear deterrence, Robert Powell’s game-theoretic model is an instructive framework of nuclear confrontation.^{8,9} The fundamentals of the model are simple. The United States and an adversary are modeled as rational, unitary actors who are contesting some disputed issue, and are seeking to maximize their utility from that disputed issue relative to the potential cost of nuclear war. First, the United States decides whether to intervene or back down against a rogue state. If the United States backs down, they pay a specified cost, while the rogue earns a specified payout. If the United States intervenes, then the rogue state must choose to submit, and pay a specified cost (earning the United States a payout), or continue the confrontation. If both states choose confrontation, then each pushes the confrontation as the risk of nuclear war increases, until the maximum level of acceptable risk for one state or the other is reached. Formally, they proceed as in a sealed-bid, second-price all-pay auction. Each state, once both are committed to confrontation, simultaneously specifies the maximum risk of nuclear war (the ‘risk-bid’) they are willing to bear in the contest over the disputed interest. At this point, either this nuclear war occurs probabilistically (the probability of nuclear exchange is the value of the losing risk-bid), leaving both states to suffer the costs of conflict, or the state which has made the lower risk-bid submits, and the other prevails. Each state calculates its confrontation decision and bid based upon the payoffs it faces and the perceived resolution of its opponent, which is uncertain. The resolve of each state is the key parameter for determining the game’s outcome and is defined as the greatest risk for which the value of prevailing in the confrontation exceeds the risk-weighted cost of conflict for each state. Resolve is thus the theoretical upper-

⁶ Richard K. Betts, “Universal Deterrence or Conceptual Collapse? Liberal Pessimism and Utopian Realism,” in *The Coming Crisis: Nuclear Proliferation, U.S. Interests, and World Order* (Cambridge, MA; London: Mit Press, 2000).

⁷ Michael Connell, “Iran’s Military Doctrine | The Iran Primer” (United States Institute of Peace), <http://iranprimer.usip.org/resource/irans-military-doctrine>.

⁸ Robert Powell, “Nuclear Deterrence Theory, Nuclear Proliferation, and National Missile Defense,” *International Security* 27, no. 4 (2003): 86–118.

⁹ While Powell represents well common brinkmanship-based approaches, alternate frameworks exist. For an analysis eschewing nuclear threats executed by nature and grounded in ‘perfect deterrence theory,’ see Stephen L. Quackenbush, “National Missile Defense and Deterrence,” *Political Research Quarterly* 59, no. 4 (December 2006): 533–41, <https://doi.org/10.1177/106591290605900403>. and Frank C. Zagare, “Reconciling Rationality with Deterrence: A Re-Examination of the Logical Foundations of Deterrence Theory,” *Journal of Theoretical Politics* 16, no. 2 (April 2004): 107–41, <https://doi.org/10.1177/0951629804041117>.

bound for the risk each state will run, and is a decreasing function of the cost of conflict and an increasing one of the value of the interests at stake.

We have several key takeaways from Powell's analysis. Most notably, Powell finds that the key determinant of nuclear crisis outcomes is the balance of resolve (both real and perceived). In a confrontation, the more resolute state will generally prevail (if such confrontation does not spiral out of control), because they will, by definition, bid a higher risk. However, when the perceived balance of resolve is clear, there will be no standoff: the less resolute state, knowing it will be outbid, will simply back down from confrontation rather than run any risk at all. Thus, for a nuclear crisis to occur, and a risk of an exchange to be run, each side must perceive the balance of resolve to be favorable enough that they may have enough of a chance of prevailing in a crisis to justify bidding up the risk of nuclear war.

Thus, the probability of confrontation will tend to increase as the resolution of a given state increases. The reasons for this dynamic are two-fold. First, confrontation will become more likely, because a state will judge its likelihood of success in confrontation to be greater, and it also will see the stakes of victory and defeat as higher. Second, once confrontation has occurred, crisis stability (the likelihood the a confrontation ends in nuclear war as opposed to submission, measured by the magnitude of the winning risk bid) will decrease, as said state pushes its interests harder in a crisis, due to both its assessment of the likelihood of prevailing and of the stakes.

Additionally, if the uncertainty surrounding a given state's resolution increases, confrontation is more likely, as states become more likely to misjudge the balance of resolve. Further, if confrontation occurs, the probability that a state badly underestimates the resolve of its opponent and as a result bids an excessive level of risk also increases.

Limited Nuclear Confrontation and National Missile Defense

What does this framework tell us if we extend the analysis to include the potential U.S. deployment of national missile defense? In the case of 'existential' nuclear confrontations considered earlier, where a rogue state faces regime change when confronting the United States, missile defense (unless it is virtually impervious) is unlikely to affect the balance of resolve, as the rogue state will have virtually unlimited resolve if submitting means the end of its regime. The United States is thus unlikely to match this resolve unless the risk of nuclear strikes on the American homeland is virtually nil (meaning a virtually one hundred percent effective missile defense). However, limited stakes confrontations, where the balance of resolve may be in doubt, are another story altogether.

Powell extends his model to consider such a scenario by adding a fractional parameter to represent the percentage of damage in a nuclear exchange prevented by a national missile defense. Briefly, if X is a state's cost to a nuclear exchange absent deployment of defenses, and d is the fraction of damage prevented by national missile defense, the deployment of defenses lowers the cost to the deploying state of a nuclear exchange from X to $X*(1-d)$. Thus, as this parameter d increases, it can be thought to represent an increasingly efficacious national missile defense system. Powell concludes that missile defenses, so modeled, will tend to increase the effective resolve of the deploying state by reducing the potential costs of nuclear war, and thus increasing the willingness of states to run the risk of nuclear exchange. The result of U.S. deployment of national missile defense is thus an increase in the following probabilities: in the probability that the United States declines to back down against a rogue state, the probability that the United States finds itself in a nuclear crisis, the probability the United States prevails in such a confrontation, and in the probability that such a confrontation results in a nuclear exchange (as the United States, emboldened by increased resolve, bids up to higher levels of nuclear risk in a crisis). Further, these destabilizing effects generally tend

to increase as missile defense becomes more effective, and do not decline until the point at which missile defense becomes virtually impervious (at which point, this impenetrability has a clarifying effect on the balance of resolve).

However, Powell, if anything, underestimates the destabilizing effects of national missile defense. Notably, he fails to consider the uncertainty surrounding the effectiveness of missile defenses themselves, and instead models them as reducing the cost of nuclear war by some fixed proportion. In reality, missile defenses are likely to introduce two major sources of uncertainty to an already uncertain balance of resolve. First, the precise effectiveness of missile defenses is likely to be unknown, even to the deploying state.¹⁰ In a nuclear crisis, national missile defense systems targeting enemy ICBMs are (given that a nuclear ICBM has never been deployed in hostility) not likely to have been deployed outside of controlled test scenarios. Even an extensively tested missile defense system will face substantial uncertainty regarding its effectiveness by virtue of the fact that it has not faced a ‘real world’ threat.¹¹ Further, uncertainty surrounding the effectiveness of an ICBM system is likely to be even greater for the state not deploying the system, as it will lack access to reams of technical information available to the deploying state. Second, even if the precise effectiveness of a missile defense system were known, its actual effects versus any enemy nuclear strike would necessarily be probabilistic. A missile defense system, unless it is virtually impenetrable, will have a specific probability of intercepting an incoming missile, but even if this probability is precisely known, it still translates to a great deal of variance in the potential outcome of a nuclear strike.¹²

This uncertainty will affect the balance of resolve and crisis outcomes in multiple ways. First, the deploying state’s resolve will be affected, with the direction of the effect dependent on the risk tolerance¹³ with respect to nuclear strikes exhibited by the deploying state. If the deploying state is risk neutral, uncertainty will not affect its resolve. If it is risk seeking, it will exhibit increasing resolve at any given level of effectiveness as the uncertainty surrounding effectiveness increases. If it is risk averse, it will exhibit decreasing resolve at any given level of effectiveness as the uncertainty surrounding effectiveness increases (intuitively, we might expect that states tend to be risk averse in this respect). Thus, if the deploying state is quite risk averse, Powell’s assessment that missile defense will increase resolve may prove incorrect, depending on the level of perceived uncertainty. Further, if an adversary is significantly more risk tolerant than the deploying state, missile defense may actually shift the balance of resolve away from the deploying state.

¹⁰ George N. Lewis, “Ballistic Missile Defense Effectiveness,” in *AIP Conference Proceedings* (Judith Reppy Institute for Peace and Conflict Studies, Ithaca, NY: Cornell University, 2017), <https://doi.org/10.1063/1.5009222>.

¹¹ David Willman, “Was That Shootdown of a Mock Enemy Warhead in May ‘Realistic’? Not Exactly,” *The Los Angeles Times*, July 7, 2017, <http://www.latimes.com/nation/la-na-missile-defense-test-realism-20170706-story.html>.

¹² To illustrate this point, say the United States deploys a missile defense system with 85% success rate in intercepting an incoming ICBM, and such a system faces the launch of 5 enemy ICBMs. While the expected number of strikes would be .75, there is a 44% percent chance of 0 successful strikes, and 17% chance of multiple strikes. Quite the variance!

¹³ Note that risk tolerance, in this sense (and the sense in which it will be employed throughout this paper), is not the same of the level of resolve (which is the maximum risk a state is willing to bid in a confrontation). Rather, it is the relationship of uncertainty to resolve. If states are risk averse in this sense, they, for a given level of expected cost associated with nuclear war, will bid a lower level of maximum risk (and be less resolute) if the bands of uncertainty surrounding that expected value increase. Essentially, it implies that states will be less willing to risk an uncertain outcome than a certain one, even if the expected cost, is, on average, the same.

These risk-dependent resolve effects do not make the deploying state more likely to misjudge the balance of resolve, as the deploying state is aware of its own level of risk tolerance. Nonetheless, they decrease crisis stability by creating an additional source of uncertainty for the deploying state's opponent as it attempts to judge the balance of resolve. In addition to uncertainty-filled judgements about the opposing perception of the stakes of a crisis, uncertain judgements must also be made about the opposing tolerance for uncertainty. This makes overall judgements about resolve more uncertain than they would be otherwise, and so increases the probability of confrontation, while decreasing crisis stability, as outlined previously.

Additionally, the uncertainty surrounding the true effectiveness of missile defense makes confrontation more likely (and decreases crisis stability) through two mechanisms. First, such uncertainty presents another potential mechanism for misjudgment of the balance of resolve by the non-deploying state. Second, such uncertainty makes it more likely that the deploying state runs an excessive risk of nuclear war on the basis of an overconfident assessment of its own defenses.

Finally, even setting aside the uncertainty surrounding effectiveness of missile defense systems themselves, opposing states facing a missile defense-equipped adversary are likely to seek countermeasures with which to equip their ICBMs in an attempt to defeat said defenses.¹⁴ This introduces additional uncertainty into evaluations of the cost of nuclear war, with effects as outlined above. Even if such countermeasures are not actually deployed, the mere prospect of them decreases crisis stability by making the effectiveness of missile defenses uncertain from one time period to the next. Even supposing states make accurate judgements about missile defense and countermeasure effectiveness in the present, they must also make accurate judgments about missile defense and countermeasure effectiveness in the future. This creates the risk that either state may perceive that, in the future, technical developments may tilt the balance of resolve against them, and thus push its interests more forcefully in present day confrontation than would otherwise be the case. Because such assessments of future technical prospects are likely to be highly uncertain, it is plausible that both states will simultaneously assess that future technical assessments will disadvantage them, greatly increasing strategic volatility.

National Missile Defense and Proliferation Decisions

Given this analytic framework, how might the deployment of U.S. national missile defense affect the decision of rogue states to proliferate? While Powell's analysis surmises that the United States will be more resolute as a resolute of national missile defense, and so win better outcomes in nuclear confrontation (at the cost of greater strategic instability), he also demonstrates that, unless missile defenses are very effective, these effects will be quite small. We have considered additional factors, focusing on increased uncertainty, beyond Powell's analysis, but while these mechanisms unambiguously increase crisis instability, they generally do not serve to further increase U.S. resolve, and may in fact decrease it, depending on U.S. tolerance for uncertainty. Thus, the state motivated to proliferate by the prospect of regime change probably will not forgo the bomb because of missile defense, given that, unless that defense is virtually invulnerable, it is unlikely to increase U.S. resolve sufficiently to contend with a nearly infinitely resolved adversary. Defenses are, therefore, unlikely to

¹⁴ Andrew M. Sessler et al., *Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Planned US National Missile Defense System* (Cambridge, MA; MIT Security Studies Program: Union of Concerned Scientists, 2000).

meaningfully worsen the prospects of the regime threatened with overthrow in a nuclear confrontation, leaving the basic proliferation calculus unchanged.

However, the state motivated to pursue the bomb by more limited security concerns will see its proliferation calculus affected by the deployment of national missile defenses. Debs and Monteiro argue that proliferation decisions are driven by a state weighing the security benefits of nuclearization against the economic costs of nuclearization and the potential costs of preventive wars launched by counter proliferating states.¹⁵ Missile defense is likely to increase the costs of proliferating somewhat. First, the economic costs of developing an arsenal will likely increase somewhat, as incipient nuclear states seeking to overcome defenses build larger arsenals than they would have otherwise, and invest in countermeasure capabilities for weapons delivery systems. Second, states which have pursued the bomb in secret, only to be discovered near acquisition of a nuclear capability, may ordinarily deter some preventative intervention due to uncertainty surrounding their exact capabilities. Essentially, intervening adversaries may think the nascent nuclear program to be more advanced than it actually is, and so be deterred from attacking. Miller and Narang argue persuasively that this dynamic prevented U.S. intervention against North Korea in the late stages of their weapons program.¹⁶ Missile defense ought to make a counter-proliferating U.S. more likely to intervene in such scenarios than would otherwise be the case. Nonetheless, given that this effect is contingent on these specific circumstances, and is likely to be quite small unless missile defenses are very effective, the significance of this mechanism can be considered minor.

On the other hand, missile defenses are likely to have an ambiguous effect on the security benefits of nuclearization. While the tendency towards an increased level of U.S. resolve (by virtue of lower expected costs to nuclear war) will worsen the prospects for a proliferating state in nuclear confrontation and thus decrease the security benefit of proliferation, this effect may be dominated by the effects of decreased crisis stability precipitated by the uncertainty entailed by missile defenses. If the U.S. has a greater risk aversion (that is aversion to uncertainty; see note 13) than the proliferating state (a plausible state of affairs, given that the cost of nuclear war is likely to be much higher relative to the value of the interests at stake in a confrontation for the U.S. than for its proliferating adversary), then these uncertainties will lower U.S. resolve to a greater degree than the resolve of the proliferator. This would then tend to increase the security benefits of proliferation.

In this analysis, therefore, the deployment of national missile defenses will not impact the proliferation decisions of states fearing U.S.-led regime change and are unlikely to dissuade other adversarial would-be proliferators (and may actually encourage them), unless defenses are very effective and there exists a high level of certainty regarding that effectiveness.

Distinguishing between Categories of Missile Defense Systems

Our analysis thus far has neglected to consider key dynamics. Specifically, nuclear confrontations do not necessarily entail a faceoff between the United States and an ICBM capable state, and missile defense is not necessarily of the national variety.

¹⁵ Nuno P. Monteiro and Alexandre Debs, "The Strategic Logic of Nuclear Proliferation," *International Security* 39, no. 2 (October 1, 2014): 7–51, https://doi.org/10.1162/ISEC_a_00177.

¹⁶ Nicholas L. Miller and Vipin Narang, "North Korea Defied the Theoretical Odds: What Can We Learn from Its Successful Nuclearization?," *Texas National Security Review* 1, no. 2 (February 13, 2018): 59–79, <https://doi.org/10.15781/T2M32NT02>.

The US currently operates four major missile defense systems.¹⁷ All operate on the ‘hit-to-kill’ principle (‘hitting a bullet with a bullet’). First, the Ground-based Midcourse Defense system (GMD) consists of 44 interceptors based in Alaska and California, as well as a range of radar and detection capabilities.¹⁸ It is the only system that can offer truly national defense against an inbound ICBM attack and is designed to intercept an inbound ICBM in space. It has a success rate of 56% (under ideal test conditions) and its ability to overcome countermeasures is limited, meaning its prospects are limited to defeating a small, unsophisticated ICBM attack.

Second, the US Army operates the Terminal High-Altitude Area Defense (THAAD) system, which intercepts inbound short and medium range ballistic missiles in the upper atmosphere during their re-entry phase (‘terminal phase intercept’). It currently consists of 6 batteries, each with 48-72 interceptors (deployed mostly in east Asia), and is more accurate than GMD, but limited to protection of a much smaller area.¹⁹ THAAD systems are truck mounted, and thus are highly mobile and easily redeployable.

Third, the U.S. Navy operates the Aegis Ballistic Missile Defense system (BMD).²⁰ This is a ship-borne system, designed to defeat short, medium, and intermediate range ballistic missiles (similar to THAAD). Unlike THAAD, however, it is a ‘midcourse phase intercept’ system, rather than a terminal phase system, so it instead targets enemy missiles prior to re-entry. There are currently 33 BMD capable U.S. ships, as well as 4 BMD capable Japanese ships, with land versions of the BMD batteries also operating in Romania and Poland.

Finally, the U.S. army operates the PATRIOT Advanced Capability-3 (PAC-3), a variant of the widely deployed Patriot missile system geared toward defending against short-range ballistic missiles.²¹ However, the limited range of the PAC-3 system means that it is restricted to providing localized defense against tactical weapons, and is not well-suited to intercepts of larger and faster strategic nuclear weapons.

In considering the track record of each of these systems, there is a clear distinction between the efficacy of national defenses (the GMD), and area defenses (Aegis BMD and THAAD). GMD systems have a dubious test record, even under the controlled conditions entailed, succeeding on 10 of 18 intercepts over the lifetime of the system. In contrast, the Aegis BMD has a 37 for 46 record, while the THAAD system is a perfect 15 for 15.²²

Area Missile Defense and ICBM Capability

¹⁷ “U.S. Missile Defense Programs at a Glance | Arms Control Association,” May 2018, <https://www.armscontrol.org/factsheets/usmissiledefense#pac3>.

¹⁸ “There Is No Guaranteed Defence against Ballistic Missiles—Yet,” *The Economist*, January 11, 2018, <https://www.economist.com/news/united-states/21734465-someone-ought-explain-commander-chief-there-no-guaranteed-defence>.

¹⁹ “Terminal High Altitude Area Defense (THAAD),” *Missile Threat | CSIS*, accessed April 25, 2018, <https://missilethreat.csis.org/system/thaad/>.

²⁰ “Aegis Ballistic Missile Defense,” *Missile Defense Agency*, n.d., https://www.mda.mil/system/aegis_bmd.html.

²¹ “PATRIOT Advanced Capability-3 (PAC-3),” *Missile Defense Agency*, n.d., https://www.mda.mil/system/pac_3.html.

²² “Fact Sheet: Ballistic Missile Defense Intercept Flight Test Record” (*Missile Defense Agency*, March 2018).

Now, consider the diversity of proliferation strategies outlined by Narang.²³ His crucial insight is the realization that proliferation is not merely a binary decision. Rather, states select from a variety of nuclearization strategies depending on their security environments, ranging from different levels of hedging or nuclear latency, to hiding strategies for states which would otherwise be vulnerable to counter-proliferating interventions, to more visible sprinting strategies. We can extend this logic to also realize that nuclear capabilities are far from binary as well. While thus far, we have assumed that a nuclear-armed U.S. adversary is ICBM capable, and thus can hold countervalue targets at risk on the American homeland, it is easy to imagine that a newly nuclear state having regionally-capable weapons systems despite not yet developing ICBM capabilities (by way of example, look no farther than the last decade of the North Korean nuclear program).²⁴ While there are a variety of possible causes for this state of affairs (given that ICBM technology and nuclear weapons capability are two very distinct technical challenges), it is perhaps most likely among states that have pursued a hiding strategy of nuclearization, as outlined by Narang. This is because the repeated missile tests needed to obtain an ICBM capability cannot be effectively hidden from U.S. detection capabilities and would thus risk the secrecy of a weapons program, whereas countries could theoretically advance much closer to a functioning bomb in clandestine fashion. Thus, the hiding state is likely to achieve ICBM capability subsequent to nuclearization, whereas the sprinting state, if it seeks to hold the American mainland at risk, has no reason to refrain from developing missile technology concurrently with its weaponization work.

Therefore, a U.S. adversary which has nuclearized via a hiding strategy will thus face an intermediate period where it can hold regional targets at risk, but cannot threaten the American mainland. Returning to our earlier framework for analysis, we can surmise that nuclear confrontations under these conditions will differ in several important facets from the confrontations with an ICBM-capable state, which we have considered up to this point.

First, let us assume that within the set of regional targets held at risk are what we may term ‘secondary’ countervalue targets, in contrast to the ‘vital’ countervalue targets represented by American cities. These secondary targets might include U.S. allies, overseas military bases, economically important energy supplies, and more. The result of this distinction will be significantly lower costs to the United States from nuclear war. As a result, we should expect U.S. resolve to be correspondingly higher. We should also expect U.S. resolve to be higher as a result of the prospect of a future adversarial ICBM capability, both because successful intervention carries the potential to deny the development of such a capability, and because the balance of resolve in future confrontations will be much worse for the U.S. if such a capability is developed. Nonetheless, the potential destruction from nuclear war is significant, and so U.S. resolve is still unlikely to eclipse the near total resolve of the state facing regime change. Therefore, the results of such a scenario will be largely unchanged from our assessment of the ICBM-capable variation.

However, in the case of confrontation over limited stakes, this increased U.S. resolve is likely to lead to a significantly higher risk of confrontation and nuclear exchange, as well as better U.S. outcomes in nuclear crises as the U.S. pushes its interests more boldly. However, because of the natural tendency for such crises to feature more vital stakes for the rogue state than for the U.S., unless U.S. regard for the risk of nuclear strikes on secondary countervalue targets is very low, the increase in U.S. resolve is unlikely to be so great as to be

²³ Vipin Narang, “Strategies of Nuclear Proliferation: How States Pursue the Bomb,” *International Security* 41, no. 3 (January 1, 2017): 110–50, https://doi.org/10.1162/ISEC_a_00268.

²⁴ “North Korea Missile Tests - a Timeline,” *CBS News*, September 7, 2017, <https://www.cbsnews.com/news/north-korea-missile-tests-a-timeline/>.

clarifying to the overall balance of resolve and will rather tend to blur said balance. Thus, the transition between weaponization and ICBM capability is likely to be a period of heightened nuclear instability.

Confrontation with a regionally capable nuclear power also has significant effects on the dynamics of missile defense. Whereas national missile defenses, exemplified by midcourse intercept systems like the GMD, can defend a large geographic area such as the entire U.S. homeland, area missile defenses, such as terminal phase systems like THAAD, are limited to much smaller zones. Additionally, national defense can protect against ICBMs, but not short to medium range missiles, while the reverse is true of area defense. The final key distinction between the two types is the much greater technical effectiveness of current existing area systems than currently existing national systems.

With those differences in mind, we should expect the deployment of area missile defense against regional nuclear adversaries to affect deterrence differently than the deployment of national defenses against ICBM-capable adversaries. First, because United States will be starting from a much higher baseline level of resolve, we should expect the level of effectiveness required to clarify rather than blur the balance of resolve to be correspondingly lower for area missile defenses. Because of the present state of missile defense technology, achieving any given level of effectiveness is significantly more feasible for area defenses rather than national defenses, and so achieving the lower critical effectiveness required to clarify the balance of resolve in this scenario is exponentially more plausible than in the case of national missile defenses.

Second, if this clarifying level of resolve is achieved, it should dominate the effects of the uncertainty introduced by missile defenses, especially given that the U.S. is likely to be more risk tolerant with respect to the prospect of nuclear strikes on secondary countervalue targets than with respect to the vital countervalue targets held at risk by an ICBM capability. Third, uncertainty regarding the effectiveness of area systems is likely to be significantly smaller, because of the more advanced state of the technology, and because the mechanics of such systems bear a greater relation to missile defenses employed against non-nuclear missile which have seen significant real-world testing. Additionally, new nuclear states which have not yet developed ICBM capabilities are also unlikely to have achieved significant progress in the realm of missile defense countermeasures.

Thus, while national missile defense will, especially given its current level of technical sophistication, tend to take scenarios tending toward instability and destabilize them, area missile defense can plausibly increase the stability of scenarios otherwise tending toward instability by clarifying the balance of resolve in favor of the United States.

Area Missile Defense and Proliferation

Given this analysis, how might the deployment of area missile defense affect proliferation decisions? Again, unless defenses are virtually invulnerable, the state threatened with regime change will remain significantly more resolute than the United States: this much is unchanged from previous scenarios. Thus, area missile defense is unlikely to affect nuclearization decision making in the state confronted with existential stakes. Turning now to consider states motivated by limited stakes confrontations, we find a distinction between states that have pursued hiding strategies of nuclearization and states that have sprinted to the bomb. While the state sprinting for the bomb may, if it acquires a nuclear weapon before an ICBM capability and the United States deploys area defenses, face greater U.S. freedom of action in a confrontation, this fact is inconsequential, because a state sprinting for the bomb has already judged such a strategy viable in the face of an extended period wherein it is exposed to U.S. freedom of action unfettered by any nuclear risk. In any event, a sprinting

state is more likely to develop an ICBM capability if it so chooses, as missile testing does not pose a risk of publicizing an already public weapons program.

Meanwhile, the hiding state, which must develop an ICBM capability subsequent to nuclearization, is likely to be affected by area defenses, as it has chosen hiding precisely because it is vulnerable to intervention. Thus, area defenses, if they are sufficiently effective as to clarify the balance of resolve in favor of the United States, introduce the hiding state to the unwelcome prospect of a period of acute vulnerability at the hands of a resolute adversary. Area defense, then, significantly increases costs associated with pursuing nuclear weapons, by amplifying the vulnerability to intervention of states who have chosen a hiding strategy precisely to try to mitigate such vulnerabilities. It does so by exploiting the lack of ICBM capability necessarily occasioned by said hiding routes to the bomb. Area defenses, if deployed in such a manner as to deny the ability to hold U.S. interests at risk with regional nuclear weapons systems, are thus likely to limit the propensity of the particular subclass of hiding states to pursue proliferation, especially given that hiding states are already likely to be those for whom the cost-benefit decision to pursue nuclear weapons is close to the margin (or else they would pursue sprinting).

Policy Implications and Conclusions

The preceding theoretical analysis has several implications for U.S. security policy. I consider in turn implications for major nuclear security issues facing the U.S. at present, addressing North Korea, Iran, and finally China.

North Korea

Regarding North Korea, it seems clear that increased emphasis on missile defense will prove ineffective at best and counterproductive at worst. Because North Korea has already achieved an ICBM capability, continued or increased deployment of THAAD systems in Japan and South Korea, aimed at shielding secondary countervalue targets from short and medium range missiles, are unlikely to meaningfully shift the balance of resolve.²⁵ Now that North Korea can credibly hold vital countervalue targets (cities on the American mainland) at risk, the balance of resolve in a showdown between the United States and North Korea will be primarily determined by the threat to the U.S. homeland, not threats to northeast Asia. Further, the continued deployment of such THAAD batteries has the potential to destabilize U.S. relations with China, as the radar systems can potentially be repurposed in the service of national-level defenses like the GMD (this dynamic will be addressed in greater detail further on).²⁶

Further, because North Korea acutely fears American regime change, it is likely to be significantly more resolved in any nuclear confrontation, a fact that will be crystal clear to any sober-minded American appraiser of the situation.²⁷ Thus, national missile defenses, even if they were to become significantly more effective than those in place today, are unlikely to meaningfully improve U.S. prospects in such a nuclear confrontation.

²⁵ “Terminal High Altitude Area Defense (THAAD),” Missile Threat | CSIS.

²⁶ JJ Suh, “Missile Defense and the Security Dilemma: THAAD, Japan’s ‘Proactive Peace,’ and the Arms Race in Northeast Asia,” *The Asia-Pacific Journal: Japan Focus* 15, no. 9 (April 27, 2015): 9.

²⁷ Philip Bobbitt, “How Kim Has Misunderstood U.S. Disincentives to Press for Regime Change in North Korea,” Lawfare, December 19, 2017, <https://www.lawfareblog.com/how-kim-has-misunderstood-us-disincentives-press-regime-change-north-korea>.

Additionally, the current GMD posture carries with it significant downsides, even beyond the economic cost of such a system (itself quite substantial).²⁸ In particular, the GMD creates antagonism in the U.S.-China relationship and, if it were to be employed, carries the risk of triggering a false Russian launch warning.²⁹ Moreover, North Korean nuclearization is unlikely to be reversed, precisely because of the link between its ICBM capabilities and its fears of regime change. Even a much more robust U.S. missile defense posture, at either the area or national level, would have been unlikely to dissuade it.

Iran

With the potential collapse of the Iran nuclear deal looming after its abrogation by U.S. president Donald Trump, the world again faces the potential of an Iranian nuclear weapons program.³⁰ However, the development and deployment of effective area missile defenses offers, in this case, a clear mechanism for reducing the probability of future Iranian nuclearization and safeguarding U.S. interests in the Middle East should Iran nuclearize.

There are three key factors facilitating the potential efficaciousness of area defenses with respect to Iran. First, an Iranian nuclear program would be vulnerable to preventative intervention. Iran previously pursued a hiding strategy toward weaponization, switching to hedging after its program was discovered.³¹ This history is a clear indicator of such vulnerability. Second, Iran lacks an ICBM capacity at present and, if it were to resume pursuit of a nuclear weapon, would have to delay developing such a capacity or risk revealing a vulnerable weapons program.³² Thus, a successfully nuclearized Iran would face a period of time post-nuclearization with the ability to strike regional targets, but not the United States. Third, Iran is reasonably secure against direct U.S. regime change (given its large size, rugged terrain, developed military doctrine, and ability to hold valuable energy interests hostage)^{33,34}, and so, in a nuclear showdown with the United States, would not face the same existential stakes that generate North Korea's intrinsic advantage in the balance of resolve.

Thus, area defenses, deployed in U.S. partner nations like Israel, Saudi Arabia, and other Gulf states that might be held at risk by a nuclear Iran, would reduce the benefit to Iranian nuclearization, increase the vulnerability for Iran associated with such nuclearization, help to contain Iranian interests, deny an ICBM capability and stabilize a nuclear deterrent relationship if Iran nuclearized anyways. Additionally, such defenses could be deployed without undermining the strategic deterrent of China, in contrast to area defenses in Korea and Japan and national-level defenses.

China

²⁸ "Assessments of Selected Weapon Programs," Defense Acquisitions (Government Accountability Office, March 2013), <https://www.gao.gov/assets/660/653379.pdf>.

²⁹ Jeffrey Lewis, "How a North Korean Missile Could Accidentally Trigger a U.S.-Russia Nuclear War," *The Daily Beast*, accessed May 16, 2018, <https://www.thedailybeast.com/how-a-north-korean-missile-could-accidentally-trigger-a-us-russia-nuclear-war>.

³⁰ Ari Heistein and Ezra Friedman, "The United States Withdraws from the Nuclear Deal with Iran: Lessons from a Simulation" (The Institute for National Security Studies), <http://www.inss.org.il/publication/united-states-withdraws-nuclear-deal-iran-lessons-simulation/>.

³¹ Narang, "Strategies of Nuclear Proliferation."

³² Michael Elleman and Mark Fitzpatrick, "No, Iran Does Not Have an ICBM Program," *War on the Rocks*, March 5, 2018, <https://warontherocks.com/2018/03/no-iran-not-icbm-program/>.

³³ Michael Connell, "Iran's Military Doctrine | The Iran Primer."

³⁴ Caitlin Talmadge, "Closing Time: Assessing the Iranian Threat to the Strait of Hormuz," *International Security* 33, no. 1 (2008): 82–117.

The U.S.-China nuclear relationship, as mentioned earlier, differs significantly in multiple respects, both from the cases of Iran and North Korea, and from the general theoretical frameworks analyzed in this paper. China ranks unequivocally as a great power, rather than the middle or minor powers seeking a leap in status via nuclearization that I have analyzed thus far. However, the deterrent relationship between the U.S. and China is also unlike that between the U.S. and Russia, because China's arsenal is not so vast as to grant it an assured destruction capacity.

As result of these factors, the U.S.-China strategic balance is especially sensitive to the deployment of missile defenses (both area and national). Talmadge outlines, in course of analyzing the potential for nuclear escalation between China and the U.S., how the Chinese strategic deterrent is vulnerable enough to degradation over the course of a limited U.S.-China conflict to create offensive instability as China faces a 'use it or lose it' imperative.³⁵ Notably, in her accounting, this dynamic is present even in the absence of specific U.S. counterforce priorities in the opening stages of such a conflict. This implies that Chinese nuclear planners face real concerns regarding the integrity of their strategic response, concerns that no doubt escalate with the deployment of even modestly effective national missile defense. When taken in context with China's demonstrated disapproval of THAAD deployment in east Asia (which focuses on the potential for THAAD radars to be employed as an 'early look in' for GMD interceptors), it becomes clear that investments in both area defenses in east Asia, and in national level defenses have the potential to create significant instability between the U.S. and China.³⁶

Conclusions

The prospect of immunity to the harsh logic of nuclear deterrence is an undeniably attractive one today, just as it was during the Cold War. At present, given the increasing salience of a variety of novel nuclear security threats and counterproliferation challenges ranging from Iran to North Korea, policy discussions of missile defense are understandably returning to the fore. However, given the stakes involved in any matter of nuclear security and the significant resources involved in the development and deployment of defenses, the decision to pursue such systems ought to be guided by robust analysis and a clear-eyed accounting of costs and benefits (factors which are often lost in the romantic attraction of potential invulnerability).³⁷

A careful theoretical analysis of the potential effects of missile defense reveals several valuable insights. First, national missile defense systems, unless they are virtually invulnerable (as opposed to their current dubious efficacy), will decrease the stability of nuclear confrontations significantly and, at the same, will be of ambiguous benefit to U.S. resolve in such confrontations. Further, as a result of these dynamics, national missile defenses are likely to be of little counterproliferation benefit.

On the other hand, because nuclear confrontations between the U.S. and a non-ICBM capable state are likely to be more unstable than those between the U.S. and ICBM capable states, area missile defense deployed against non-ICBM nuclear states and nuclear aspirants

³⁵ Caitlin Talmadge, "Would China Go Nuclear? Assessing the Risk of Chinese Nuclear Escalation in a Conventional War with the United States," *International Security* 41, no. 4 (April 1, 2017): 50–92, https://doi.org/10.1162/ISEC_a_00274.

³⁶ Ian E. Rinehart, Steven A. Hildreth, and Susan V. Lawrence, "Ballistic Missile Defense in the Asia-Pacific Region: Cooperation and Opposition," *Congressional Research Service*, April 3, 2015, 29.

³⁷ Fred Kaplan, "The Worst Defense," *Slate*, October 17, 2017, http://www.slate.com/articles/news_and_politics/war_stories/2017/10/trump_claims_that_u_s_missile_defense_works_97_percent_of_the_time_it_doesn.html.

can enhance U.S. security in some cases. Further, such defenses are significantly more effective than national missile defenses, and so can much more plausibly clarify the balance of resolve in nuclear confrontation. This allows greater freedom of action in intervening on behalf of U.S. interests and increases the stability of such situations. As a result, there is a clear potential for area defense to dissuade states that would otherwise pursue hiding paths to nuclear weapons from proliferating.

These insights have significant implications for current U.S. missile defense policies. Notably, in Asia, both area and national missile defense are likely to prove counterproductive. They will not plausibly improve U.S. security with regard to North Korea and carry significant downside risks (chief among them is the introduction of additional antagonism and instability to the U.S.-China relationship). However, in the Middle East, there is a clear mechanism by which the judicious deployment of area defenses could decrease the probability of Iranian nuclearization and enhance U.S. security.

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