DISRUPTIVE INNOVATION AND THE GLOBAL ARMS TRADE

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Abstract

Why has the United States’ share of the global arms market declined so precipitously since the mid-1990s? What are the consequences of that decline both for the proliferation of conventional weapons and for the relative influence of the United States and other major powers? We address these questions in three ways. First, we present data identifying changes in the international arms market. Second, we advance a new theory for American loss of influence that contrasts strikingly with other “declinist” explanations. We argue that the US defense industry builds weapons to meet the needs of its primary customer, the Pentagon, which demands expensive, sophisticated tools of power projection. The market for such weapons is intrinsically limited; many states are instead seeking to acquire anti-access or counter-intervention weapons that the United States neither purchases nor produces. This has left the market open to “disruptive innovation” from countries, such as Russia, China, and South Korea, which produce and export less sophisticated and cheaper weaponry. Third, we illustrate these new dynamics with data on missile exports, and also use a new data set to show how the price of weapons for all US customers from 1970-2013 has risen, and US market share fallen, with increases in US defense spending.

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At the Cold War’s end, the United States seemed poised to monopolize the global arms trade. Its rivals in Europe and the former Soviet Union were reeling under sharp defense budget cuts, and relative newcomers to the arms market, like China, were minor players. Yet despite these promising structural conditions, the US market share of global weapons sales has plummeted from unprecedented but fleeting heights in the 1990s to its present, historic lows. Why does the United States appear to be losing its dominant position in the arms trade? And what are the consequences for the global proliferation of conventional weapons, as well as for international order and American influence in the 21st century?

Concern for this development should go beyond those interested in the health of the US defense industrial base. A more competitive arms market will likely result in the increased production and sale of major conventional weapons (MCW) around the world. Moreover, weapons sold by other countries rarely have the same limitations on technology transfer and end-use monitoring requirements of American products. Declining US market dominance, therefore, could result in more weapons being sold with fewer end-use restrictions, making the world a more dangerous place.

Examining the international arms market also sheds light on the shifting distribution of international power and the consequences for international order. The United States (like all major powers) has long promoted the sale of weapons to influence smaller states, manage regional arms races, encourage allies’ interoperability, contain rivals’ capabilities, as well as support its own defense-industrial base and broader economy. Arms sales are an explicit component of the United States’ revitalized effort to “train and equip” other military forces to
more effectively carry out joint security interests around the world.¹ The loss of market share puts several aspects of the United States’ political-economic order at risk.

To explain this decline, we argue that the United States and its firms face what Clayton Christensen calls the “innovator’s dilemma,” the failure of high-end producers to identify and respond to the competitive pressures emanating from their lower-end rivals.² The dilemma emerges in industries where leading firms focus on providing their most important customers with superior performance in the areas these clients value most. But as one firm after another has discovered, many consumers are quite willing to purchase large quantities of somewhat inferior goods at a cheaper price. While the US defense industry excels at producing the type of arms that its principal client (the Pentagon) wants—power-projecting weapons that enable policing the “global commons”—it does not produce cheaper variants of items well-suited for the missions that much of the world currently demands.

In this paper we show that the United States’ position in the arms trade is largely due to the domestic defense budget and the price tag associated with building cutting edge conventional weaponry. At the end of the Cold War, with defense spending and weapons demand falling across the NATO countries, the United States effectively subsidized its allies and best customers to purchase its platforms. Following the launch of the “Global War on Terror,” however, defense budgets rose substantially and the Pentagon’s demand for both power projection and military occupation increased. With the lack of budget constraints, conventional weapons became, to use

Mary Kaldor’s term, increasingly baroque.\textsuperscript{3} As a consequence of these changes in demand, the value proposition of US arms exports has declined over the past decade.

The paper proceeds as follows. After reviewing the literature, we first make the empirical case that US arms market share is indeed declining, and identify an historically unusual disconnect between arms sales and broader measurements of power. Second, we introduce the concept of disruptive innovations in the arms market. We then present data on the global missile market to illustrate our theory. Finally we turn to data on American arms exports from 1970-2013. We find first that market share is inversely correlated with American defense spending. Additionally, we find that the prices for American weapons climb sharply with rising US defense budgets. We conclude with the ironic implication that the United States’ pursuit of cutting edge, world-beating weapons may make its managing and securing the “global commons” more difficult.

1. Why the Arms Market Matters

One goal of this paper is to renew scholars’ attention to the international significance of the arms trade, traditionally considered one of the drivers (and menaces) of world politics. In the aftermath of World War I, for example, the “merchants of death” received a great deal of blame for fueling that conflict.\textsuperscript{4} During the Cold War, scholars and policymakers expended considerable efforts to analyze the spread of conventional weapons and its effects on conflict.

\textsuperscript{3} Mary Kaldor, \textit{The Baroque Arsenal} (New York: Hill and Wang, 1981).
\textsuperscript{4} Helmut Carol Engelbrecht and Frank Cleary Hanighen, \textit{Merchants of Death; a Study of the International Armament Industry} (New York,: Dodd, Mead & company, 1934).
Unfortunately, while the study of the transfer of small arms\textsuperscript{5} and nuclear capability\textsuperscript{6} is undergoing a renaissance, analysis of the trade in major conventional weapons (MCW) has largely stagnated since the Cold War’s end.

However, in recent years global MCW purchases have risen steeply. Moreover, even as demand rises, the development and construction of sophisticated MCW has become so difficult that even fewer countries can produce them indigenously.\textsuperscript{7} In short, for almost all countries, including rising powers such as India and China, arms imports make up the bulk of their arms acquisitions. The few states that can export weapons use them to advance a variety of international political goals.\textsuperscript{8}

Most scholars looking at the post-Cold War transfer of arms were pessimistic about the prospects of proliferation in an era of economic globalization.\textsuperscript{9} Andrew Pierre went so far as to predict an impending “cascade of arms.”\textsuperscript{10} Jurgen Brauer foresees a “buyers’ market” as


\textsuperscript{8} Keith Krause, \textit{Arms and the State: Patterns of Military Production and Trade} (London: Cambridge University Press, 1995).


suppliers became increasingly desperate to sell weapons, and the consequent rise of additional suppliers.\textsuperscript{11} Anne Markusen has argued that emerging multinational defense would pursue their own economic interests with greater autonomy, taking less account of the security interests of any particular state client.\textsuperscript{12} Some identified a “gray threat,” in which the post-Cold War decline in defense budgets would result in pressure on firms to export to states with security interests that differed from those of the United States and Western Europe.\textsuperscript{13} Aaron Friedberg agreed that globalization confronted US policy-makers with a choice between taking steps to maintain its autonomy or an “ideology” of governmental non-interference that would undermine American economic competitiveness in defense and related high-technology sectors.\textsuperscript{14} While optimistic about the prospects for peace, Stephen Brooks advances an ambitious liberal theory in which the complex production chain of advanced weapons constrains even the United States’ ability to “run the tables.”\textsuperscript{15}

Other scholars argue that the arms industry remains a function of the balance of power, and that the economic and political barriers to entry into the arms market are higher than pessimists predict.\textsuperscript{16} Privileged states have means to shape the market in spite of globalization, and in a unipolar world there is only one such actor. Michael Mastanduno and Joseph Grieco suggest that rising interdependence helps to consolidate American power, mitigating the spread

\textsuperscript{11} "The Arms Industry in Developing Nations," 107.
\textsuperscript{16} In a comparative analysis of the inter-war and post-World War II arms trade, Harkavy examined supplier and recipient market structures and showed how they corresponded to the shifting distribution of power during these two periods. Robert E. Harkavy, \textit{The Arms Trade and International Systems} (Cambridge, MA: Ballinger, 1975).
of technology and military capability to weaker states. Ethan Kapstein specifically links the massive economies of scale found in its domestic industry to the American potential for an arms trade monopoly, predicting that the United States would take advantage of this power to sell only finished products to select customers. Jonathan Caverley claims that the United States can leverage arms sales for influence, giving up some economic benefits in exchange for its clients’ agreement to refrain from competing with US products or to selling to such rivals as China. Stephanie Neuman gives several qualitative examples of the United States using its market leverage to influence other states’ international behavior.

This line of reasoning helps explain some broader empirical findings on the arms trade and international behavior. Blanton finds that since the end of the Cold War (and only since then), both the level of democracy and the protection of human rights have become significant considerations in US arms export policy. Kinsella shows how dependence on a single state for arms can dampen a state’s tendency towards conflict.

Possibly excepting Brooks, all sides in the debate appear to agree that, in the absence of a dominant weapons supplier, a more competitive marketplace would result in more weapons being sold, and the diffusion of more sophisticated killing technologies to more states, particularly in the developing world. Considerable evidence suggests that increased volume of weapons exacerbates arms races and stimulates crises. At the global level, more arms exports

correlate to the number of states involved in wars and militarized disputes.\textsuperscript{23} Drawing on a variety of cases, Brzoska and Pearson found that increased arms imports influence states’ decisions to go to war and that arms deliveries prolong and intensify ongoing wars.\textsuperscript{24}

More recently, policy analysis has refocused on the ability of non-top tier countries (particularly China) to design (often from stolen blueprints), build, and operate advanced conventional weapons rivaling the United States’. While the claim that US market dominance was declining was a controversial statement not long ago, among contemporary policymakers, there is a strong sense that the United States may be losing its competitive edge.\textsuperscript{25}

2. The State of the Global Arms Market

To describe the state of the international arms market, we turn to data collected by the Stockholm International Peace Research Institute (SIPRI).\textsuperscript{26} SIPRI draws on a variety of publically available sources to generate an annual report on global arms transfers using a “Trend Indicator Value” (TIV, in constant 1990 USD). The TIV enables analysts to compare flows (rather than prices) of different types of weapons exported around the world, in an effort to make them comparable across time and across countries.


Figure 1 presents the 4-year moving average annual TIV for US exports as well as total world exports since 1950. Some basic points are readily apparent. First, contrary to the pessimists’ prediction of widespread proliferation of conventional weaponry, arms exports plummeted from the Cold War’s end to about 2003. Since then, overall exports have once again started to rise. For the last two decades of the twentieth century, the United States exported roughly the same amount of weapons each year, but its exports began dropping after 1998. While in the past few years US export volume has recovered somewhat, the United States continues to lose market share, as the world now imports an even larger amount of weapons from other sources.

While American market share is at its lowest level since 1950 (the first year in SIPRI’s data set), another interpretation of Figure 1 is that this represents a “return to normal” after the anomalous 1990s. This in itself would be a remarkable development since arms sales have traditionally reflected the larger balance of power, and the current distribution looks nothing like the bipolarity of the Cold War era, the last time US exports were at similar levels.

To distinguish between these interpretations, Figure 2 shows trends in both military spending and arms exports as a percent of global share from 1988-2013 for the world’s largest arms exporters. The link between defense spending and exports makes intuitive sense; assuming a great power has the ability to produce its own arms, the more weapons a state acquires for its own purposes, the more competitive its exports become due to economies of scale and scope. While the traditional relationship between arms exports and “power” in the form of military spending looks tightly correlated at the beginning of the time period, it grows less consistent over time.27

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27 1988 is the first year SIPRI provides military spending data. Correlates of War data on spending is difficult to compare across countries and time, as its codebook readily attests.
While the link between spending and arms sales appears to break down, the variation among countries conveys significant information. Russia has recovered much of its market share despite relatively weak increases in domestic spending levels. Until very recently, the European exporters, traditional competitors with the United States in selling cutting-edge weapons, punched above their weight relative to their defense budget. The rest of the world’s export share is steadily rising but is still much lower than its collective budget would predict. On the other hand, United States market share has plummeted even as it became responsible for over forty percent of global defense spending. Indeed, among the major exporters, the United States is the only state that exports less than its defense spending would predict.

Together, these figures suggest some puzzles. The 1990s did not see an increase in proliferation and the entrance of many new exporting countries, but the United States also failed to consolidate the privileged position it briefly held in this market. There does not appear to be much of a link between the balance of power in the world and market share, an historic anomaly. Finally, the United States’ relationship between its spending and arms exports looks unusual compared to other exporting countries.

GDP is an even poorer predictor of market share. Also, contrary to much over-heated rhetoric in the United States, China does not seem to be exporting much more than its share in the late 1980s. To further explore the link between military spending and exports, we regressed arms exports on military spending for each of the last decade’s twenty-five largest arms exporters for the years 1988-2013. We divided these countries by whether the regression coefficient was positive or negative, and whether the relationship was significant at the $p=0.05$ level (two-tailed). In 16 of the 25 countries, defense spending correlates to more exports. What is more, the states showing the positive relationship tend to be “up-and-coming” exporters; seven of them (in bold) were not in the top-25 list for 1950-1960. On the other hand, states (mostly in Europe) with long histories of defense industrial competence have a negative if weak (in the statistical significance sense) relationship between spending and exports. This may reflect these countries’ firms increased drive to export in times of lower domestic procurement. Finally, the United States is a unique case. Not only do American exports vary inversely with defense spending, unlike any other country, this relationship is statistically significant (over a mere 26 years of observations).
3. Building Hegemony while Destroying Market Share

Basic economic logic and the historical data would suggest that American defense spending and its share of the global arms market should be positively correlated. The unmatched size of its superpower-sized economy and defense budget provides massive economies of scale and learning effects in the production of armaments compared to any other country, where relatively small production runs drive up unit costs. As a consequence, US weapons should be relatively cheap given the marginal costs of production, making it easy to win foreign sales.

To be sure, many reasons exist to not buy American. Rather than buy weapons “off the shelf” from foreign suppliers, governments may seek to create jobs at home through work-share agreements and offsets. In order to jump-start their own weapons production and midwife a larger high technology manufacturing industry, importers often demand significant levels of technology transfer. Policy-makers consider the effects of arms sales on their foreign policies and alliance relations. Corruption also plays a role in arms sales, as with Britain’s notorious Al-Yamamah deal with Saudi Arabia or, earlier American sales to South Korea that prompted passage of the quite stringent Foreign Corrupt Practices Act (FCPA).

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30 Krause, Arms and the State.
Relative to many other suppliers, the United States is quite stingy on all these fronts, a luxury it can afford given the great many advantages its industry enjoys.\textsuperscript{34} It has strict technology transfer controls, relatively comprehensive anti-corruption standards for its companies, and makes quite onerous demands on importing states to ensure that weapons do not get transferred to third parties. Moreover, the United States has in the past cut off countries over policy differences, such as the sanctions that crippled India’s \textit{Tejas} light combat aircraft program following that country’s testing of nuclear weapons.

Nonetheless, the United States has historically been adept at convincing countries to buy American, for which it provides compensation by delivering a better product at a lower, even subsidized, price. The controversial Joint Strike Fighter (F-35), so expensive that one critic calls it the “Jet that Ate the Pentagon,” illustrates American advantages.\textsuperscript{35} Despite its sizable cost, the United States has successfully sold the plane abroad though a combination of industrial incentives, the promise of increased security cooperation, and, at times, muscular diplomacy.\textsuperscript{36} International procurement decisions about the F-35 have been unusually fractious and controversial, yet the F-35 has not lost an international contract to a rival (in Israel, Italy, Japan, Netherlands, Norway, South Korea, Turkey, and Great Britain). On the other hand, the visible losses of American aircraft to foreign competitors, such as in India and Brazil, have been in markets where the F-35 was not offered.

\subsection*{3.1 The Innovator’s Dilemma}

\textsuperscript{35} Winslow Wheeler, "The Jet That Ate the Pentagon," Foreign Policy, http://foreignpolicy.com/2012/04/26/the-jet-that-ate-the-pentagon/.
Our explanation for declining US market share despite all its advantages is based on an underappreciated aspect of the arms trade: different states want different weapons. The United States has been in the business of developing and buying globe-straddling weapons for power projection for decades, and its demand for such products dramatically rose alongside its ballooning post-2001 US defense budgets. The massive but distorted US defense market leaves a hole in the global arms trade for entrants producing less sophisticated products that are nonetheless sufficient for buyers with fewer strategic ambitions (i.e. all of them).

Much of the vast literature on military innovation focuses on the failure of major powers to identify and nurture “disruptive” innovations that will dramatically alter the military balance. This is not our concern. Indeed, for good reason, we argue that it is not the primary concern of the United States military either. To do so we employ Clayton Christensen’s immensely influential work in business administration on the “innovator’s dilemma,” which distinguishes between “disruptive” and “sustaining” innovations.37 The latter term describes improvements in existing products that give a firm’s most important (and profitable) clients superior performance along the parameters they value. Building on Christensen’s theory, Dombrowki and Gholz demonstrate that: 1) many of the innovations sought by the US military are essentially sustaining innovations and 2) the American-based defense industry is quite adept at serving the needs of its primary customer (i.e. the Pentagon) by providing them. Indeed, the bias towards sustaining

37Christensen, Innovator's Dilemma. For some applications to security policy see Michael Horowitz, The Diffusion of Military Power: Causes and Consequences for International Politics (Princeton, N.J.: Princeton University Press, 2010); Gautam Makunda, "We Cannot Go On: Disruptive Innovation and the First World War Royal Navy," Security Studies 19, no. 1 (2010). We invoke Christensen with some trepidation because of the ubiquity of his term “disruptive innovation” in business and economic discourse in general and the US Department of Defense (DoD) in particular. When DoD entities address “disruptive” technologies, they are more often than not describing advanced systems, such as high-end drones or network-centric warfare that, while potentially “revolutionary,” remain beyond the capability of all but the most advanced militaries and defense firms, at least at the present time. The DoD thus often uses the term “disruptive” in ways unintended by Christensen.
innovations is over-determined in military acquisitions compared to other industries, given the
genral lack of hard budget constraints, the dense network of defense industrial lobbyists, the
thicket of regulations that firms must master to even contemplate selling to the Pentagon, and the
Congress’s aggressive role in steering funds to local firms.38

Dombrowski and Gholz focus on how the Pentagon can achieve its innovation goals, and therefore do not pursue the larger implications of Christensen’s theory: American defense firms are unlikely to produce disruptive innovations because the demand for them is unlikely to come from their principal customer. Christensen’s novel argument is that truly “disruptive” innovations often result in reduced performance but at a greatly diminished price. Established firms do not invest in these simpler, cheaper products due to their lower margins and smaller profits. Disruptive innovations thus tend to be first commercialized in emerging or seemingly insignificant markets, where “good enough” performance is sufficient.39 These less-established customers might also use the product for quite different purposes. It is this combination of functionality and price, what we term “value,” that drives a disruptive innovation.

Over time, these new entrants can use the resulting revenue and experience to work their way up the “quality ladder.” Honda initially gained a foothold in the US motorcycle market not by building powerful, luxury products like those of Harley-Davidson and BMW, but through selling cheap, fun “Supercub” bikes to an entirely different set of customers. Honda now

39 In later work, Christensen and co-authors (Seeing What's Next: Using the Theories of Innovation to Predict Industry Change (Boston: Harvard Business School Press, 2004), 5-14.) distinguish between “non-market” disruption (which creates a new market from previous non-consumers), and “low-end” disruption (which serves less demanding customers largely ignored by established industry leaders. This distinction does not appear germane to this paper, although almost all states buy weapons for similar reasons, so the arms market largely falls in the “low-end” category. While initial “non-market” disruptive innovations may be high in price (like early cellular phones), compared to alternatives all disruptive innovations offer lower prices relative to the dominant alternatives.
competes effectively at every level of this and many other markets.\textsuperscript{40} Korean Aerospace Industries (KAI) has built on its experience producing licensed versions of Lockheed’s F-16 to produce a trainer aircraft (the T-50) sufficiently capable (and affordable) that the Philippines purchased it for combat missions. KAI now seeks to develop a high-end aircraft to compete against the F-16 in future export competitions.\textsuperscript{41}

To reiterate, disruption emerges because established firms provide only the products that its best, most sophisticated customers demand, leaving space for competitors at lower levels of price and performance. As already noted, the ties between the defense firms and their most important client are more intimate and numerous than those of any other corporate relationship. By giving their best customer, the Pentagon, exactly what it wants, both the firms and the US government are losing influence over increasingly critical segments of the global market, including many nations in the “pivotal” Asia-Pacific region.

3.2 Giving the Customer What It Wants

The United States’ privileged position in the world and the ambition of its foreign policy have ensured that it produces the materiel necessary for what Barry Posen calls “command of the commons.” The requirements for this capability are extremely demanding, and are unlikely to be matched by any other state in the “near to medium term.”\textsuperscript{42} Posen describes at length the massive physical and organizational infrastructure requirements for such a mission and the consequently enormous barriers to entry for other states.

\textsuperscript{40} Christensen, \textit{Innovator’s Dilemma}.
\textsuperscript{41} Richard Weitz, "South Korea’s Defense Industry: Increasing Domestic Capabilities and Global Opportunities," (Washington, DC: Korea Economic Institute of America, 2013).
Elliot Cohen uses the United States’ uniquely ambitious post-Cold War tactical fighter acquisition strategy to reveal the massive scale and unique nature of US procurement efforts: simultaneous investment in two new fighters (F-22 and F-35), upgrading its pre-existing tactical fighter force (F-15s, F-16s, and F-18s), while developing an entirely different platform through its many UAV programs. Put simply, no other country has the fiscal luxury of such formidable acquisition plans, nor the geopolitical ambition justifying them.

Indeed, even the United States has difficulty making these massive projects work. The F-35 Joint Strike Fighter is one obvious case of a troubled, ambitious weapons program, but it remains a relative success compared to the now defunct Army Future Combat System and the Coast Guard’s Deepwater program. Building cutting edge weapons is hard; former Lockheed Martin CEO Norm Augustine famously observed that “the last 10 percent of performance generates one-third of the cost and two-thirds of the problems.”

Few other states possess the systems engineering ability to develop such a military, the defense industry needed to produce it, or the organizational capital required to operate it effectively. Then again, most countries do not seek to do so, and any state that did harbor such ambitions (perhaps China and possibly India) would be unlikely to depend on the current hegemon. The global market therefore appears to be inherently limited.

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On the other hand, what Posen describes as the “weaponry of the close fight” is cheaper to purchase, simpler to operate, and easier to develop. The more ready supply of potential exporters for these types of weapons helps ensure a “contested zone” that demarcates the limits of American (or any other state’s) hegemony. In the American parlance, these products are designed for “Anti-Access/Area Denial (A2/AD)” products. Andrew Krepinevich lists the components of A2/AD as: “[diesel] submarines, antisubmarine-warfare aircraft, anti-ship cruise missiles, defensive mining, air and missile defenses, and military base hardening and dispersion.”

Figure 3 shows graphically a stylized depiction of the tradeoffs in cost and capabilities for the weapons needed for both command of the commons and the close fight. Many weapons fit comfortably in one sector of the chart. Armored vehicles are relatively easy to produce and are most useful for the “close fight.” Aircraft carriers are fabulously expensive and designed for maximum power projection. Some weapons are nominally similar but have vastly different cost/mission profiles; a diesel submarine is best for short-range operations of modest duration, coastal defense, and threatening of shipping. Nuclear-powered submarines can operate indefinitely at high speed far away from home and even those without nuclear missiles carry a large arsenal of formidable deep-strike weapons. Finally, some categories, such as aircraft and missiles, cover a spectrum of operations and costs.

Importantly, weapons that can perform command of the commons missions can also be used for counter-intervention operations, but not vice versa. Embraer’s Super Tucano turboprop plane cannot penetrate hardened air defenses, but the F-35 can theoretically perform close air

48 Posen, "Command of the Commons."
49 Ibid., 24.
support and counterinsurgency operations. No one would suggest this to be an efficient use of such an expensive plane, however. A state with no need to suppress sophisticated enemy air defenses would not purchase the F-35. Put another way, the continuing improvement of high-end weapons desired by the United States for its demanding missions produces “overshot” customers, states no longer willing to pay the premium for performance improvements they have little use for.51

The US defense industry does not bother to produce many of the weapons required for such counter-intervention operations, and indeed in many cases has not done so for decades. Since the 1950s, the United States Navy has deliberately refused to procure diesel submarines in favor of nuclear-powered, ocean-spanning undersea capital ships.52 Nor does the American defense industry build ground-based anti-ship missiles, leaving this rapidly growing export market to smaller producers such as France, Russia, Sweden, Norway, and Italy.53

Even when the United States develops weapons ostensibly for both export and domestic consumption, the value proposition is not always compelling for purchasers. Seeking a flexible, multipurpose plane that can do many missions satisfactorily, Brazil recently chose the lighter, less sophisticated, but much less expensive Gripen (made by Sweden’s Saab) over prominent competitors that included Boeing’s F/A-18 (a “cheap” plane by American standards). In terms of performance, the Gripen is the inferior plane in nearly every way, but as one analyst pointed out, “If you are not a country that wants to bomb areas with really strong air defences on day one of a

war, you have to take the Gripen very seriously."\(^{54}\) Israel considered buying Littoral Combat Ships, developed by the United States to serve as affordable, coast-hugging vessels. Small by American standards but larger than anything the Israelis owned to date, their spiraling costs were too much for Israel. As one Israeli admiral noted, "As much as we sought commonality with the U.S. Navy…we had no choice but to face the fact that, for us, it was unaffordable."\(^{55}\)

Demand for this counter-intervention capability is particularly acute in Asia. Sovereignty protection, rather than power projection, appears to be the primary mission of contemporary arms purchases in the region (which have grown by 34% between 2004-2008 and 2009-2013).\(^{56}\) Territorial defense not only for a state’s major landmass, but also for smaller islands and more tenuous sovereignty claims, underpins much of Asian strategic planning.\(^{57}\) As an example, Indonesia aspires to build a “Green Water Navy,” quintupling its diesel submarine inventory to ten by 2024. In the past five years it acquired four Dutch missile frigates as well as four Landing

\(^{54}\) Sash Tusa quoted in Carola Hoyos, "Gripen Outmanoeuvres Bigger Rivals in Brazilian Dogfight," *Financial Times*, December 13 2013.


\(^{56}\) Worldwide demand only grew 14% over that same period. SIPRI

Platform Dock ships (licensed from South Korea), each carrying up to 400 troops and five helicopters.  

Unipolarity therefore contains an ironic dynamic in terms of the arms market in Asia and elsewhere. Almost by definition, the hegemon is not arms racing with any particular state; its very preeminence means there is little market for the type of hardware its own arms industry specializes in building. On the other hand, defense spending in East Asian states is rising for types of weapons that the world’s superpower has little interest in producing or purchasing.

3.3 Alternate Explanations

Several alternate, but not necessarily competing, explanations for declining US arms market share exist. Indeed, we find that some of these mechanisms do provide additional insights into the structure of the international arms market. We do not believe, however, that these alternative theories undermine our argument that disruptive innovation has become a significant feature of the contemporary arms market.

A first set of explanations link market share to broader international power. Perhaps the recent loss of market share by the United States is a natural consequence of the rise of other powers; arms sales historically reflect the broader balance of international power. When the United States is powerful, other countries may seek to curry favor with it (i.e. bandwagoning). Conversely if the United States looks relatively weak, then states may seek to diversify their defense suppliers. On the other hand, a “soft balancing” argument could link American power inversely with market share; states may prefer not to be so dependent on an actual or aspiring

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58 Andrew T. H. Han, "The Emergence of Naval Power in the Straits of Malacca," *Defence Studies* 12, no. 1 (2012).
hegemon, especially if they disagree with that hegemon’s foreign policy. Moreover, allies of the United States might be tempted to free ride on a country spending so much on defense.

Second, perhaps the United States is simply uninterested in selling weapons to many countries. Indeed, the United States restricts what products may be sold through policies such as the Missile Technology Control Regime (MTCR) or the more informal “Qualitative Military Edge” for Israel. Some examples exist of deliberate denial of weapons sales to potential importers. For example, South Korea is buying long-range air-to-ground missiles from the German-Swedish joint venture Taurus Systems because the United States will not sell it Joint Air-to-Surface Standoff Missiles (JASSM). But most of these policies have been in place for decades, while the US decline in market share is a recent development. Further, the Obama administration has greatly increased its efforts to sell weapons abroad, for example by reducing the number of technologies on the United States Munitions List (which are subject to strict export controls) and by generally modernizing the export regime. Nonetheless, American market power does allow it to restrict weapons sales and attach caveats; and so we expect a correlation between the competitiveness of the international market and demand.

Third, declining exports could be the result of rent-seeking by an increasingly concentrated American defense sector that drives up prices for both the Pentagon and for potential export clients. The Pentagon’s senior procurement officer recently accused Lockheed

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Martin of trying to “squeeze every nickel out of the Joint Strike Fighter program.”\textsuperscript{63} It is true that the American defense firms have consolidated since the Cold War, resulting in a concentrated, and potentially less competitive, industry. However, the intensive lobbying, adverse selection, and asymmetric information that distort the American defense market are even more starkly present in competitor nations. While the United States undoubtedly faces a diminishing number of domestic prime contractors, other export-oriented states face actual local monopolies, as in France’s Dassault and Russia’s United Aircraft Corporation, and thus should be even more prone to this behavior.\textsuperscript{64}

4. Platform Data Analysis

To begin testing our theory that the arms market is diverging due to disruptive innovation, we examine export trends for three weapons platforms. Analyzing export data by platform allows us to tease out the divergence of the market between American demands and those of the rest of the world. As illustrated in Figure 3, armored vehicles are relatively simple products to produce and are not the primary tool for hegemonic power projection. Combat aircraft, on the other hand, are some of the most sophisticated and expensive products on the market, a vital tool for command of the commons as well as the “American way of war.” Finally, missiles vary widely in terms of sophistication and cost based on whether they are used for power projection or for counter-intervention. Comparing the military value versus the number of units exported can also give us a window on market divergence.


Figure 4a and 4b present US market shares in three weapons categories expressed in terms of SIPRI TIV and unit numbers (reported by the UN Office of Disarmament Affairs, UNODA), respectively. Figure 4a suggests that the US is holding on to much of the market in aircraft (a high cost, low volume instrument of power projection), and has little share in the armored vehicle market (a much less complex platform). The broad category of missiles, which ranges widely from very sophisticated to extremely simpler, lies somewhere in between. But if one looks at unit numbers instead of TIV (Figure 4b), US market share has plummeted in every category.\(^{65}\)

We focus further on the global missile market for several reasons. First, missiles are an important and unexamined market relative to military aircraft, which takes up the lion’s share of market and academic analyses. These weapons are an essential component of an A2/AD arsenal. They also represent a major proliferation problem, as evidenced by the arms control regimes that have been set up around them. Mettler and Reiter show empirically how ballistic missiles in particular enable aggressive behavior by states that possess them.\(^{66}\)

Second, as depicted in Figure 3, the term “missile” covers many different types of weapons ranging from the ubiquitous Strela portable anti-air missile (made by a several countries), to the Russian Buk anti-aircraft system used to down a Malaysian airliner over Ukraine, to the sophisticated JASSM, which the United States exports to only a handful of close allies.

Comparing these SIPRI and UN missile export data allows us to look at the relative sophistication of American imports relative to the market. Figure 5a depicts the TIV for the

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\(^{65}\) The uptick in US exports of armored vehicles may be due to the United States divesting itself of thousands of armored vehicles over the Iraq and Afghanistan drawdowns.

United States and the rest of the world; Figure 5b shows these two values in terms of number of missiles exported.\(^6^7\) Both figures show a gradual decline in the value and number of US missile exports, even as the total market has risen over the past decade. But whereas the TIV of global missile exports has risen gradually, the actual number of (non-American) missiles being exported has skyrocketed. Clearly, states are buying less sophisticated missiles than the type that American firms are likely to produce and the US military is likely to buy. Finally, Figure 6 depicts the financial value of guided missile exports from the US Census Bureau for years 2000-2014.\(^6^8\) Although the previous graphs show the United States exporting fewer missiles, its revenue has risen, providing further evidence that the United States remains focused on (and successful in) selling to its most profitable customers.

Taken together, the data demonstrate that the United States is not selling the type of weapons many states want. The weapons it does export in low numbers are very expensive. Finally, and perhaps most importantly, the global missile market is booming and most missiles are not bought from the United States.

5. Analysis of Market Share and Export Premium

We next test hypotheses about US market share among its export customers. To better specify the causal path, we then move on to a novel measurement of the cost of US exports, the export premium, and whether it rises in response to changes in the domestic defense budget. We

\(^{67}\)Bear in mind that the UN data relies on countries reporting their imports and exports and so almost certainly undercounts the number of missiles sold by the rest of the world. \(^{68}\)U.S. International Trade Statistics, “Guided missile and space vehicle manufacturing, as well as parts and auxiliary equipment,” Data retrieved for NAICS 336414, 15, and 19 from http://censtats.census.gov/naic3_6/naics3_6.shtml; comparable global data does not exist.
use these data also to test other potential factors that shape export pricing: the balancing/bandwagoning logic, rent collection by increasingly oligopolistic US defense firms, and exploitation of its global market power by the United States itself.

5.1 Hypotheses

The innovator’s dilemma links the mismatch between American arms production of high-priced hegemonic weapons and world demand for cheaper technologies to lower US market share. Put schematically, our theory suggests:

\[ \text{GRAND STRATEGY} \rightarrow \text{EXPORT VALUE} \rightarrow \text{EXPORT SHARE} \]

We operationalize, and describe below, these three variables in the following way:

\[ \text{US DEFENSE SPENDING}_{\text{YEAR}} \rightarrow \text{US EXPORT PREMIUM}_{\text{COUNTRY,YEAR}} \rightarrow \text{US MARKET SHARE}_{\text{COUNTRY,YEAR}} \]

Our first hypotheses link the three steps of this causal chain:

Hypothesis 1: A higher US budget leads to lower US export market share

Hypothesis 2: A higher US export premium leads to lower US export market share

Hypothesis 3: A higher US budget leads to higher US export premium

Combined, the above three hypotheses suggest that the effect of higher US defense spending on its export market share is mediated through higher-priced exports. We expect that, when market share is regressed on both US defense spending and export premium, the effect of the former should weaken, due to the inclusion of the mediating variable.⁶⁹

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⁶⁹ Our approach to mediation, based on linear models using continuous treatment and mediating variables is described in Reuben M Baron and David A. Kenny, "The Moderator–Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations.," *Journal of Personality and Social Psychology* 51, no. 6 (1986). For an overview of mediation, see Kosuke Imai,
Importantly, taken together these hypotheses contrast with the simpler balancing and bandwagoning logics. If states are free-riding on or soft-balancing against American ambition, increased US demand for power projection (proxied by defense spending) would correlate to a drop in market share. But it should also correlate to a drop in price, as demand for US weapons declines. Conversely, if states are reducing their US arms imports as a reaction to American decline, lower US spending should correlate to lower demand (and lower prices), but market share should also fall. Table 1 illustrates these contrasting predictions.

We also use the export premium to test two hypotheses based on alternate explanations for higher prices. We first test if lack of competition (and thus increased rent-seeking by firms) leads to a less competitive product:

*Hypothesis 4: A more concentrated US defense industry leads to higher export prices*

Finally, we test to see if the United States takes advantage of its existing market dominance to charge higher prices, or whether it seeks to maintain this position by subsidizing export sales:

*Hypothesis 5: A more concentrated international arms market leads to higher export prices*

### 5.2 Dependent and Explanatory Variables

We proxy the demand for high-end weapons by the Pentagon, as well as its military ambition, by using domestic defense spending (in billions of constant 2009 USD, from 1962-2013) by the United States government on “National Defense.” This covers not only the

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Department of Defense’s budget, but also related spending by other departments (such as Energy) and on “overseas contingency operations.”\footnote{Office of Management and Budget, “Historical Tables: Outlays by Budget Enforcement Act Category,” \url{https://www.whitehouse.gov/omb/budget/Historicals}} Obviously, this is an annual figure.

Our dependent variables vary by both country and year. The first, \textit{US market share}, is the portion of a country’s annual arms deliveries (TIV, from SIPRI) from the United States over total arms imports. Figure 7 shows the distribution for each country (roughly 40\% of the world’s states do not import any American weapons). The mean US market share over all importing countries has dropped over time. On average, however, countries get about half their imported weapons from the United States, a quite high number.

Our second dependent variable, \textit{US export premium}, is a ratio of two data sources associated with the physical transfer of weapons from the United States to other countries. The denominator is SIPRI’s TIV, described in detail above. The numerator is the annual financial value in constant 1990 US dollars of all reported weapons transfers to another state, contained in the US Defense and Security Cooperation Agency’s (DSCA, available from 1970-2013). The ratio, which has attractive econometric qualities besides being an accurate measurement of the dependent variable takes the following form:\footnote{Ron P. Smith and Ali Tasiran, “The Demand for Arms Imports,” \textit{Journal of Peace Research} 42, no. 2 (2005).}

\[
	ext{Export Premium} = \frac{\text{Financial Value of Arm Exports}}{\text{Military Resources Transferred}} = \frac{\text{DSCA Sales}}{\text{SIPRI TIV}}
\]

Figure 8 depicts each country-year observation over time, using a logarithmically scaled y-axis, as well as the annual mean. The graph makes clear the extremely wide range taken by the premium across countries in any given year, especially considering the logarithmic scale.
Excepting a period of decline correlating with the dominant US market share of the 1990s, the premium clearly and consistently rises over time. The premium spikes sharply as US market share declines to an historic low in what appears to be an increasingly competitive market.

5.3 Other Independent Variables

To determine if American firms employ increased market power to collect rent through arms exports, we operationalize *US firm power* by including the Herfindahl-Hirschman Index (HHI$_{firms}$) of the top 100 recipients of Defense Department prime contract awards.\(^\text{72}\) This lack of competition can also result in inflated US defense budgets, resulting in a spurious correlation between our explanatory and dependent variables if we do not include it.

Our final independent variable captures *global market competitiveness* by constructing a Herfindahl-Hirschman Index (HHI$_{states}$) of exporter states (not firms) from SIPRI’s TIV data. Obviously, the HHI$_{states}$ incorporates American market share (i.e. one of our explanatory variables), but it also captures the role of other exporters. The HHI increases both as the number of states exporting weapons decreases and as the disparity in market share between those states increases.\(^\text{73}\) A lack of competitiveness in the global export market could conceivably raise both US spending as well as export prices, again leading to a spurious correlation.

5.4 Methods of Analysis

\(^{72}\) Data generously shared by the authors of Ryan R Brady and Victoria A Greenfield, "Competing Explanations of U.S. Defense Industry Consolidation in the 1990s and the Policy Implications," *Contemporary Economic Policy* 28, no. 2 (2010). The HHI approaches zero when a market consists of a large number of firms of relatively equal size. The US Department of Justice used the HHI for anti-trust regulation, and considers markets in which the HHI is between 1000 and 1800 points to be “moderately concentrated,” and those in which the HHI is in excess of 1800 points to be “concentrated.” [http://www.justice.gov/atr/public/testimony/hhi.htm](http://www.justice.gov/atr/public/testimony/hhi.htm)

\(^{73}\) Over the 61 years that SIPRI provides data, the mean *global market competitiveness* is 2672. It peaked at 3603 in 1992, and hit its historic low (i.e. most competitive market) of 1554 in 2009.
While the unit of analysis of our dependent variable is the country-year, our explanatory variables only vary by year. We are consequently left with relatively few observations for statistical analysis. Before turning to the pooled data, we therefore first analyzed each state in separate regressions across time (see appendix). While there was variation in coefficient size across states, in general an increase in US defense spending in roughly two out of every three countries is associated with a drop in market share and a rise in export premiums.

Because we are testing relationships of US-specific factors on our dependent variables, and because the country-specific regressions show an unsurprising amount of heterogeneity in their coefficients, we take the very conservative approach of analyzing the data using OLS with country-specific fixed effects.

Arms deals are years in the making and deliveries of a product take place over a long time period. Export numbers thus move slowly. While the small number of annual observations makes this a demanding approach for finding significant correlations, we include lagged dependent variables in all regressions. In short, we take a very conservative approach to the data’s analysis at the risk of Type II errors. Finally, while our fixed effects absorb (for better or worse) any country-specific influences on the dependent variable, the possibility exists that time-related antecedent factors may produce a spurious correlation between defense spending, export premiums, and market share. Year fixed effects are not feasible due to the annual nature of our explanatory variable. We therefore include the two broadest indices of system-wide factors that vary over time: \textit{global change in GDP} (IMF) and \textit{global military spending} (SIPRI).

6. Results
Table 2 presents the OLS results. Model 1 simply regresses US market share on US defense spending and finds a significant, negative relationship. Even with country fixed effects and a lagged dependent variable, a 100 billion USD increase in spending (roughly one standard deviation) appears to reduce market share by 1.4%. The effect of defense spending, while still negative, essentially disappears in Model 2 which incorporates our theorized mediating variable of export premium. A one standard deviation increase in export premium reduces US market share by 10.5%, a large effect.

The remaining models take the US export premium as the dependent variable. Model 3 shows a strong and significant relationship between how much money the United States spends on defense and the price of its arms exports. By providing evidence in support of this relationship, Model 3 also serves as the third leg to suggest that defense spending’s influence on market share is mediated by the export premium.74

Models 4 and 5 regress export premium on the competitiveness of the international arms market and the US domestic market, respectively. Perhaps counterintuitively, a more concentrated international market correlates to a drop in the export premium. This supports the claim that United States has, at times, aggressively subsidized its arms exports. While a concentrated domestic arms market correlates to higher premiums, the effect does not achieve statistical significance. Rent collection by US defense firms does not appear to be a strong predictor of whether other states will buy American.

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74 Using the Stata code of Raymond Hicks and Dustin Tingley, "Causal Mediation Analysis," *The Stata Journal* 11, no. 4 (2011), we estimate the “Average Causal Mediation Effect” (ACME) of defense spending acting through export premiums. We simulated the effect of a “treatment” of increasing defense spending from the mean by one standard deviation (about $100 billion). The results suggest that over 70% of defense spending’s effect on market share is explained by movement in the premium correlating to spending increases.
The final two models re-examine the effect of defense spending on export prices while controlling for potentially confounding variables. Spending alone among all these potential correlates remains a good predictor of how reliant a country will be on American weapons. Given the results, we can safely claim that the relationship between export premiums and defense spending is by far the strongest in our analysis. On balance, it appears that any economies of scale provided by increased US defense spending do not translate into lower export prices. Instead, the shifting of the demand curve appears to make buying American more costly, which provides evidence in favor of our innovator’s dilemma argument.

It appears from our statistical analysis that the less competitive the international market the lower the prices charged. This suggests that the US has indeed subsidized its exports to maintain market share at various points of time. The weakest relationship, perhaps surprisingly, is that between firm concentration (as a proxy for domestic firms’ power to collect rent) and price. If a less competitive domestic arms industry in the United States leads to higher prices abroad, it is a very weak effect.

7. Conclusions and Implications

Brooks and Wohlforth make a simple but powerful argument that the post-Cold War distribution of power is so skewed that balancing against the United States is no longer feasible. We identify another transformation to international politics wrought by the divergence between the United States and other states: the disappearance of Waltz’s socialization effect in which competitive pressures encourage states to imitate the practices of the most “successful”

country. The result is a bifurcation in grand strategy and thus the “disruptive” splitting of the international arms market. Unlike Brooks and Wohlforth, the mechanism we propose may actually undermine the United States’ international position, removing an important foreign policy tool in the short- and making balancing easier in the long-term.

The massive American military acquisition budget should provide economies of scale that enable the United States to shape the international arms trade, and consequently the international security environment, to suit its interests. This paper’s theory and empirical analysis suggest that countervailing forces have undermined this effect. The quest for primacy, which correlates to both the size of the defense budget and the type of weapons acquired with it, undermines the effectiveness of a classic tool of great power management: the sale of arms to client states. Ironically, as the US government aims to both “pivot” to Asia and “train and equip” its allies, its defense industrial efforts are fixated on building weapons that much of Asia, from potential foes (China) to potential friends (Philippines), is trying to overcome.

We employed the concept of disruptive innovation to explain the loss of global market share for US weapons exports. The Pentagon, the US defense industry’s main customer, has very different and demanding needs for its weapons compared to the rest of the world. As such, other exporting states can fill this breach with better value products appropriate to the strategic needs of non-hegemonic states and regional powers. By estimating the annual premium paid by states for American weapons deliveries, we demonstrated a strong correlation between large US budgets to both lower market share and higher export prices. This supports our argument that US domestic demand is skewing the export value of the weapons produced by its suppliers, and undermines an alternative explanation that states are either simply balancing against or bandwagoning.

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While correlations of our novel measurement of weapons prices and US spending provide suggestive evidence for our theory that is robust across a large number of countries and years, we view this empirical analysis as a first step. Finding other ways for statistically linking product type, market share, and proliferation must be developed to establish the theory’s empirical robustness as well as explore its causal pathways. In-depth analysis of the decisions by states and firms to develop, export, or import new weapons will help flesh out the causal pathway. The conditions under which new products and firms can enter into the defense marketplace both in the United States and other countries require study. Christensen cites short-term profit concerns as the causal mechanism behind the innovator’s dilemma, suggesting the fruitfulness of comparatively analyzing privately-held, publically traded, and state-owned defense firms.77

Finally, the ways that states use arms exports as tools of foreign policy influence need to be updated in the context of this newly competitive environment. More broadly, we hope this paper’s argument and findings encourage more research on the international arms trade, a growing and dynamic aspect of international politics. To emphasize the stakes, we conclude by exploring three political implications of our argument.

First, we explore possible responses by the United States to a potential decline in its international influence. Second, we argue that a more competitive arms market will result in increased proliferation and less regulation of international weapon sales and use. Finally, the inability of the United States to meet the demand of small states in Asia may contribute to crisis instability in that region.

What can the United States do given the incentives we identify? The Pentagon could build simpler weapons or the strategic benefits of arms exports in its acquisition policies, but,

previous experience suggest neither reform is likely. The Obama administration has enthusiastically promoted defense exports, but if US firms are not making products other people want, this will have limited effect.

Still, the United States remains the unrivalled maker of certain systems and services that even less powerful states want. The United States will continue to aggressively sell advanced products to wealthy allies such as Japan, Australia, and South Korea. For example, Japan and South Korea’s participation in the Aegis-based missile defense system incorporates two states unlikely to bilaterally cooperate into something resembling a collective security network. The United States still enjoys unmatched expertise in intelligence collection and information management. Even the anti-access weapons discussed above require significant amounts of upgrading in both the human capital and the information-intensive C4SIR capability of small states’ militaries.78 As with the larger US economy, providing software and services may not bring with it the economic advantages of “bending metal,” but can still enhance American interests.

Even if the United States will not produce many weapons smaller states need, it can encourage sales within a larger arms network that it continues to dominate. Sweden’s Gripen contains so much American technology that, from a regulatory standpoint, it might as well be exported from the United States.79 South Korea’s quite successful T-50 Golden Eagle multirole trainer is largely a Lockheed Martin derivative. These countries would be hard pressed to export these products (or service the ones already in operation) without American approval. Choking off as large a percentage of the Russian export market as possible, starting with India, in favor of the products of more closely aligned countries, appears to be in the US interest. Better for Vietnam

78 “Command, control, communication, computers, intelligence, surveillance, reconnaissance.”
to buy German or South Korean submarines, rather than Russian. This will have the added
benefit of diminishing the quality of the products Russia will export to states, like Syria, that
cannot buy arms from anywhere else.

The United States has used such indirect influence successfully in the past. In one sense,
India’s 2004 ordering of the Phalcon Airborne Warning and Control Systems from Israel,
represents a $1.1 billion dollar loss to the US defense industry, which is largely responsible for
the technology transfer that helped build the thriving Israeli arms export sector. But the deal still
required American approval, which it had withheld in 2000 for a similar sale to China.⁸⁰ An
American-dominated arms network can still be designed to keep China down, Russia out, and
friendlier states in.

Disruptive innovation will lead to increased proliferation of advanced conventional
weapons. Monopolistic industries tend to sell to fewer customers. In general the United States is
relatively circumspect in its arms exports in areas where it has a dominant advantage. Higher US
market share likely results in fewer weapons going to states that are politically unstable or
human rights violators. Historically, the United States has foregone exporting its highest-
capability weapons to a region until a viable competing product from another country emerges.
The United States for example refused to deliver AMRAAM missiles to Asian states until China
purchased the Russian AA-12 Adder.⁸¹ A more competitive market will place pressure on
existing American regulations. The recent removal of many technologies from the United States
Munitions List was driven in part because American industry has convinced the government that
it is losing competitive advantage abroad. Consequently, many weapons transfers may no long

⁸⁰ Efraim Inbar and Alvite Singh Ningthouham, "Indo-Israeli Defense Cooperation in the Twenty-First
⁸¹ "Three Asian Countries to Get U.S. Missiles," Arms Control Today 33, no. 7 (2003). For a recent
restatement of this policy see Gregory M. Kausner, "Conventional Arms Transfer Policy: Advancing
be subject to rigorous human rights vetting and end-use monitoring by the US State Department.\(^{82}\) In short, American market dominance of high-end weapons makes it more likely that it will “exercise unilateral restraint” in their sale.\(^ {83}\) Lower levels of proliferation, technology diffusion, and corruption result from US power not because it is a “nicer” country but because it can afford to use its competitive advantage to restrict these nuisances.

Finally, the declining competitiveness of US arms may undermine regional stability given the large number of Asian maritime disputes. One of the benefits provided by arms exports is the ability to manage clients’ excess aggressiveness, what Stephen Van Evera calls the “drunk tank” approach to alliance politics.\(^ {84}\) While the regional spread of anti-access weapons may appear to favor the defense, consequences exist if small states gain the tools to act unilaterally. In 2010, then-Secretary of State Hillary Clinton claimed an American “national interest in freedom of navigation, open access to Asia’s maritime commons, and respect for international law in the South China Sea.” The interests of Indonesia, Malaysia, Vietnam, and the Philippines are much more parochial. The acquisition of anti-access weapons such as Kilo diesel submarines and Yakhont anti-ship missiles will not only enable these countries to defend themselves against Chinese revisionism, it will also allow them to threaten Chinese (and other states’) freedom of navigation through vital sea lines of communication such as the Straits of Malacca. This could lead to more arms racing, regional crisis instability, and “extreme self-help” even without


American regional disengagement.\textsuperscript{85} Nor can the possibility of conflict \textit{between} these small countries be dismissed.

As it pivots towards Asia, the United States appears to be contemplating intensification and hardening of its power-projecting military, even as that region acquires weapons designed to deter such a force.\textsuperscript{86} An ironic consequence of the US focus on “anti-anti-access” weapons will be an increasingly competitive market in counter-intervention capabilities, largely beyond American control. Anti-access will grow cheaper, while power-projecting strategies such as AirSea Battle will grow more expensive.\textsuperscript{87} Empirically, this paper does not yet find that declining US arms market share is a result of other states’ balancing. However, our analysis suggests that United States’ acquisitions policy is leading to a market that makes balancing against it increasingly cheap.

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<table>
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<th>Dependent Variable</th>
<th>Balancing</th>
<th>Bandwagoning</th>
<th>Disruptive Innovation</th>
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<td>US Arms Market Share</td>
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<td>↑</td>
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<td>US Arms Export Premium</td>
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<table>
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<tr>
<th></th>
<th>(1) US Market Share(_i)</th>
<th>(2) US Market Share(_i)</th>
<th>(3) Export Premium(_ii)</th>
<th>(4) Export Premium(_ii)</th>
<th>(5) Export Premium(_ii)</th>
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<tr>
<td>US Defense Spending(_t) (logged)</td>
<td>-0.000141*** (0.0000392)</td>
<td>-0.00000851 (0.0000646)</td>
<td>0.00216*** (0.000408)</td>
<td>0.00285*** (0.000727)</td>
<td>0.00514+ (0.00271)</td>
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<tr>
<td>Export Premium(_t) (logged)</td>
<td>-0.0523*** (0.00388)</td>
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<td>Global Market Concentration(_t)</td>
<td>-0.000613*** (0.0000830)</td>
<td>-0.000341** (0.000113)</td>
<td>-0.000312 (0.000192)</td>
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<td>US Firm Concentration(_t)</td>
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<td>Global GDP Growth(_t)</td>
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<td>Global Defense Spending(_t)</td>
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<td>DV(_{t-1})</td>
<td>0.486*** (0.0129)</td>
<td>0.355*** (0.0207)</td>
<td>0.323*** (0.0265)</td>
<td>0.285*** (0.0278)</td>
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<td>Intercept</td>
<td>0.222*** (0.0193)</td>
<td>0.719*** (0.0399)</td>
<td>4.108*** (0.245)</td>
<td>6.941*** (0.331)</td>
<td>5.034*** (0.274)</td>
<td>5.236*** (0.620)</td>
<td>4.426** (1.629)</td>
</tr>
</tbody>
</table>

| N                  | 4709 | 1731 | 1392 | 1286 | 1140 | 1140 | 601  |
| Year Range        | 1286 | 1140 | 1140 | 601  |
| R\(^2\)            | 0.246 | 0.240 | 0.145 | 0.153 | 0.098 | 0.141 | 0.175 |

OLS with lagged dependent variable and country fixed effects. Standard errors in parentheses. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001
Supplemental Material

8. Notes on the Data

8.1 SIPRI (Export volume and market share)

Because of licensed production and the provision of US subcomponents, the American share of the arms market is likely to be quite underestimated by existing data. Measurement of services might be another source of downward bias, as this is a strength of the larger American economy. Of course, the relatively high life-cycle costs of American weapons (i.e. servicing them is expensive) is one of the most important reasons why US weapons have grown less competitive. In short, SIPRI may indeed be underestimating the size of US exports, but the trends are unmistakable.

To generate the Trend Indicator Value (TIV) SIPRI measures the production costs of similar products. For example, the same variant of an F-16 being sent to Pakistan and to Poland by the United States would be assigned the same TIV, regardless of the price these two governments paid for it. The TIV data has several limitations. SIPRI uses a fixed comparison of used weapons with new weapons (the former are given a 60% discount), and it considers the transfer of a weapon into a country and the licensed production of that same weapon within that country as equivalent “imports.” Since SIPRI relies on open source information, there are no doubt biases involved in the information gathered, as many transfers will remain secret. For example, the countries that produce official data on their arms exports account for over 90% of
the total volume of deliveries of major conventional weapons, so while there is some bias in the
data, it is only likely to matter at the margins.

8.2 DSCA (Financial Value of US Arms Exports)

The Defense Security Cooperation Agency (DSCA) report lists the total financial value
of all weapons transactions for every country and every year. It reports both Foreign Military
Sales (transactions directly involving the US government) and Commercial Military Sales
(transactions in which the importing state negotiates directly with the arms-producing
company).\(^8^8\)

DSCA captures many, but not all, aspects of American subsidization by reporting the
values of various programs that defray the client state’s costs of purchasing weapons. These
include grants given directly to purchasers of American arms through the Foreign Military
Financing program, and other, smaller subordinate programs such as the Excess Defense Articles
Program and the now-defunct Military Assistance Program. However, it does not assess the costs
of offset agreements that are normally negotiated by the client state directly with the American
corporation producing the weapon for export.\(^8^9\) Nor is it likely to accurately assess the follow-on
service agreements that normally accompany these sales. Some sales are classified, but a recent
GAO report states that this amount is small relative to overall export totals.\(^9^0\)

\(^8^8\) There is legitimate reason to believe that the Commercial Military Sales (CMS) reported to DSCA are
of poor quality, to the point that the Congressional Research Service will not report them. That said, not
including them could potentially introduce systematic bias into our analysis, whereas we make the
assumption that errors in the CMS is unlikely to be skewed in any particular direction. For discussion see
Richard F. Grimmett and Paul K. Kerr, "Conventional Arms Transfers to Developing Nations, 2004-
\(^8^9\) A FOIA request for these data was denied by DSCA. In general, the evidence appears overwhelming
that the costs of offsets are passed on to the purchaser, Brauer and Dunne 2011, 251-254. As such, offsets
are best described as a means of an importing state of shifting resources within its own borders, and is
less relevant to our purposes.
\(^9^0\) United States Government Accountability Office 2010.
Turning to the TIV data, SIPRI cautions against directly comparing these values with “the sales values or the financial value of export licenses” in order to “measure the economic burden of arms imports or the economic benefits of exports.” We do not abuse the data in this manner; rather we seek to study the ratio of one cross-sectionally and longitudinally comparable measurement over another one. These caveats aside, the data are the best available means to analyze a large cross-section of countries across several decades.

8.3 UNODA (Arms Exports in Unit Numbers)

The United Nations defines a missile as “(a) Guided or unguided rockets, ballistic or cruise missiles capable of delivering a warhead or weapon of destruction to a range of at least 25 kilometres, and means designed or modified specifically for launching such missiles or rockets” (that are not artillery or other vehicle). It does not include armed unmanned aircraft, but does include “remotely piloted vehicles” but not ground-to-air missiles.” Man-Portable Air-Defense Systems (MANPADS) are also included as a subcategory.91

9. Regressions by country

Figure 8 presents graphically the coefficient for the export premium paid by each country market regressed on US defense spending, with 90% confidence intervals. The procedure is a useful way to diagnose data with where we are trying to describe the relationship between the same annual explanatory variable in multiple cases across time.92 About two thirds of the coefficients are positive, that is higher US spending is associate with higher premiums. Note that the maximum number of observations for a country is 43 (few countries import US weapons

91 [http://www.un-register.org/Background/Index.aspx](http://www.un-register.org/Background/Index.aspx)
every year from 1970-2013), and thus the fact that we have so many coefficients significant at $p<0.01$ is remarkable.

In similar fashion, Figure 9 presents the coefficients when market share is regressed on the US defense spending. An even higher proportion of countries have a negative coefficient, as predicted by our theory.

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Figure 9: Coefficients for Regressing Arms Export Premium on US Defense Spending, by Country
Figure 10: Coefficients for Regressing US Arms Market Share on US Defense Spending, by Country

- Significant at p<0.1


Han, Andrew T. H. "The Emergence of Naval Power in the Straits of Malacca." Defence Studies 12, no. 1 (March 2012): 106-35.


