Complying by Denying: Explaining Why States Develop Nonproliferation Export Controls

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The adoption of UN Security Council Resolution (UNSCR) 1540 in 2004 reflects an emerging consensus that more should be done by the international community to address the proliferation of weapons of mass destruction. UNSCR 1540 articulates a universal, legally binding obligation for all states to confront proliferation by adopting effective export control systems. To date, however, there have been no attempts to systematically analyze compliance with this new obligation, making it impossible to assess the success of this measure and the underlying causes of any shortcomings. This study addresses this by conducting a systematic empirical analysis of state compliance with UNSCR 1540. Drawing upon theories of compliance with international law, we investigate two distinct explanations for variation in the degree to which states adopt nonproliferation export controls: one based on state interests and enforcement and the other based on state capacity. Our statistical tests of these theories use a new, cross-national data set detailing the nonproliferation policies of 30 states. The empirical results indicate that compliance with international nonproliferation obligations is influenced most by a state's economic and governmental capacities and has little to do with interest-based factors. These findings suggest that capacity-building programs are the best option for improving the implementation of UNSCR 1540 and of nonproliferation efforts in general.

The proliferation of weapons of mass destruction (WMD) is widely recognized as one of the leading security challenges of the twenty-first century. While the production of sensitive goods and technologies needed for proliferation was once concentrated in the hands of a small group of supplier states, globalization has increasingly spread their production to a larger number of states and private sector firms. As the A.Q. Khan proliferation network revealed, modern proliferators can acquire many of the dual-use goods and technologies they need for their WMD programs freely in the international marketplace. For example, Khan used companies in Malaysia to manufacture components for his client states and front companies in the United Arab Emirates (UAE) to make their delivery, exploiting these states' lack of export controls.[1] Recognizing the threat posed by nonstate actors, the United Nations Security Council passed a binding resolution in 2004 that requires all states to impose national-level export controls on proliferation-sensitive trade. Adopted under Chapter VII of the UN Charter, UNSCR 1540 has established a universal and binding obligation to refrain from contributing to proliferation. Yet seven years after the resolution's passage, considerable variation still exists in the extent to which states have implemented the export control policies that UNSCR 1540 mandates.

What determines a state's degree of compliance with the obligation to combat proliferation through export controls? To understand the variation in commitment to nonproliferation efforts, this paper evaluates two perspectives on compliance with international obligations, one based on enforcement and the other based on state capacity. The enforcement approach explains compliance as a consequence of national interests and external pressure (for example, Downs, Rocke, and Barsoom 1996). In this view, compliance with UNSCR 1540 will depend on security ties, economic interests, and threats of punishment. By contrast, the capacity explanation emphasizes limitations in the technical and bureaucratic capacities of governments as a central reason why states do not meet their legal obligations and is a primary element of the ''managerial'' approach to compliance (Chayes and Chayes 1993, 1995). This implies that states lacking the regulatory capacity to enforce customs restrictions will engage in less extensive nonproliferation efforts. To evaluate these two perspectives, we present an empirical study of nonproliferation compliance by 30 states. In all, we find strong support for the importance of state capacity.

By addressing nonproliferation as a compliance problem, this paper provides a new theoretical lens for understanding this issue. The subject of compliance is especially important from a policy perspective. UNSCR 1540, as well as other international instruments, will only be effective to the extent that states actually comply. Understanding the reasons why some states comply while others do not is therefore critical for designing future responses to the problem. Analyzing the implementation of nonproliferation policy from this perspective extends a rich body of international relations theory into a substantive issue area that is central to global security.

In addition, this paper draws attention to the ''supply side'' of proliferation. Most existing proliferation research addresses the reasons why states seek WMD, particularly nuclear weapons, but the subject of how they acquire the necessary

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[1]For more on the A.Q. Khan network, see Albright and Hinderstein (2005) and Corera (2006).

technology has only recently begun to receive scholarly attention (Fuhrmann 2009a; Kroenig 2009a). In addition, our paper focuses more broadly on the trade in dual-use goods for all WMD, rather than just nuclear technology. A greater focus on the supply side is also critical from a policy perspective. Because the supply of material and technology is more controllable than the demand for WMD, evaluating the success of efforts to curtail the spread of these items is of major practical importance. Finally, this paper presents a new comprehensive measure of the degree to which states implement policies to combat the spread of material and technology necessary for proliferation. This measurement scheme can serve as the basis for tracking nonproliferation in future studies that use a larger sample of states over a longer period of time.

The following section of the paper explains the problem of dual-use technology as it relates to proliferation and outlines the dependent variable for this study: compliance with nonproliferation obligations. In the third section of the paper, we discuss two different theoretical explanations of compliance and derive corresponding hypotheses regarding the implementation of export control policy. The empirical section of the paper discusses case selection and concept measurement, and presents the results of the empirical analysis of the causes of nonproliferation compliance.

The Problem: Dual-Use Technology and Nonproliferation Norms

Weapons of mass destruction programs rely upon a combination of items and technologies that have weapon-specific uses and those that also have legitimate civilian applications, so-called ''dual-use'' items. For example, triggered spark gaps can be used both as triggering devices to detonate nuclear weapons and as part of medical lithotripters used to break up kidney stones. Legitimate trade in dual-use goods can be quite profitable, making it potentially costly for governments to restrict such trade. Governments therefore tend to impose fewer restrictions on the trade of many dual-use items than they impose on items like munitions and some chemical weapons precursors, which have dedicated security applications.[2]

In a trend deeply troubling to policymakers and experts in global trade and security, recent self-disclosures and IAEA investigations reveal how some states acquired dual-use material and technology through *legal trade*, only to use these items illicitly in the production and dissemination of WMD. The cases of Iraq in the 1990s, Libya, Iran, North Korea, and Pakistan reflect this pattern (Jones 2006). In each case, dense webs of state and nonstate actors, operating on both sides of the law, deceived businesses into contributing technology to WMD programs. The programs depended heavily on imported items that were largely acquired using legitimate commercial channels as cover (Cupitt, Grillot, and Murayama 2001). Yet, in all these cases, the failure of supplier states to control dual-use material proved to be the critical link to illicit proliferation. The importance of dual-use technology is further demonstrated in several recent empirical studies by Kroenig (2009b) and Fuhrmann (2009b), which show that the supply of technology has been a critical determinant of nuclear proliferation.

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[2]It is important to note that not all dual-use items are created equally. Most dual-use items, like precision machine tools or ball bearings, possess nowhere near the strategic importance of items like nuclear power reactors. While the strategic benefits conveyed by most transactions involving dual-use goods are apt to be minimal, Fuhrmann (2008) still finds evidence that the US Government tends to direct its licensed dual-use trade toward allies and fellow democracies while restricting it to potential adversaries thought to be pursuing WMD. This suggests at least some governmental concern exists about the strategic impact of general dual-use trade, even if not all countries share the United States' level of concern.

Given the importance of trade in dual-use technology, this study shifts the emphasis from the small number of states that directly engage in proliferation to the larger set of states that are the sources of the necessary dual-use goods and technology. Numerous studies of nuclear proliferation focus on the demand for weapons (Sagan 1996/1997; Singh and Way 2004; Hymans 2006; Jo and Gartzke 2007; Solingen 2007), but very few address the supply of critical technology (Gartzke and Kroenig 2009). Only recently have scholars begun to conduct systematic studies of the supply-side of nuclear proliferation, by explaining the causes of trade in dual-use items (Fuhrmann 2008), transfers of sensitive nuclear technology (Kroenig 2009a), and civilian nuclear cooperation agreements (Fuhrmann 2009a).

Although these recent studies have addressed the reasons why states transfer dual-use goods and technologies to certain parties, we know relatively little about why states take active steps to stop such transfers. Therefore, this study addresses a different aspect of the supply-side issue: the reasons why states take active steps to control their exports of dual-use technology. Aside from a study conducted by Cupitt et al. (2001), there have been few systematic treatments of this subject. Our specific focus is on state compliance with international obligations to limit WMD proliferation. The international norm requiring states to combat proliferation stems originally from the overlapping obligations of the major global nonproliferation agreements, such as the Nuclear Nonproliferation Treaty (NPT). The Chemical Weapons Convention, for example, contains language that requires state parties to enforce prohibitions on proliferation with respect to all persons within their jurisdiction. This norm is also supported, to a lesser extent, by the voluntary multilateral export control arrangements, which share a *de facto* standard for export controls (Jones 2006).[3] The various aspects of this nonproliferation norm are discussed in detail by Bertsch and Grillot (1998) and Beck, Cupitt, Gahlaut, and Jones (2003).

The obligation to limit the spread of dual-use technology is most clearly delineated in United Nations Security Council Resolution 1540, adopted April 28, 2004. UNSCR 1540 requires UN member states to refrain from assisting nonstate actors in the acquisition or development of these weapons and directs states to implement laws and procedures to prevent the illicit spread of WMD-relevant materials and technology. States are called on to create and enforce ''effective laws which prohibit any non-State actor to manufacture, acquire, possess, develop, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery…'' In addition, states must undertake several different ''measures to establish domestic controls'' over WMD and related materials. The various domestic controls specified in the resolution include the development and maintenance of ''measures to account for and secure such items in production, use, storage or transport; physical protection measures; border controls and law enforcement efforts to detect, deter, prevent and combat… illicit trafficking; and …national export and trans-shipment controls'' (UNSCR 1540 2004).

In contrast to previous export control–related regimes like the Nuclear Suppliers Group, UNSCR 1540 is much closer to ''hard'' international law (Abbott and Snidal 2000). Notably, it is universal in scope and legally binding for all UN members. By adopting UNSCR 1540 ''the Security Council used its binding

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[3]The four nonproliferation export control regimes are the Australia Group (AG), the Wassenaar Arrangement (WA), the Missile Technology Control Regime (MTCR), and the Nuclear Suppliers Group (NSG). These informal regimes are intended to complement the international nonproliferation treaties; namely, the Biological Weapons Convention (BWC), the Chemical Weapons Convention (CWC), the Comprehensive Test Ban Treaty, the International Code of Conduct on Ballistic Missile Exports, and the Nuclear Nonproliferation Treaty (NPT).

authority under Article 25 of the Charter to impose on all UN member states obligations to enact and enforce a range of non-proliferation related regulations of universal scope and unlimited duration…'' (Joyner 2007). From this perspective, UNSCR 1540 can be seen as an effort to clearly define and formalize a universal obligation to combat proliferation. It replaces a *de facto* norm of behavior with a *de jure* legal requirement.

Compliance with international obligations to combat proliferation is typically measured simply as a state's membership in the major international nonproliferation treaties or, more recently, in terms of nations' self-reporting to the UNSCR 1540 Committee (for example, Crail 2006). Although participation in nonproliferation treaties and self-reported compliance is important, *actual behavior*—the extent to which a state adopts and implements export control policies designed to curb illicit proliferation—is the central focus of this study.

Based on the obligations in UNSCR 1540, we identify compliance based on the creation and implementation of national-level laws and institutions intended to prevent the unauthorized export of dual-use items to illegitimate state and nonstate actors. Such export control systems require private sector actors to obtain governmental permission for foreign transactions involving controlled dual-use items.[4] We measure this using a composite index of multiple indicators, grouped into three categories: *legal basis, state institutions,* and *implementation.* The first category includes the creation of requisite export control licensing and enforcement laws, as well as the existence of a national list of sensitive items. *State institutions* involve the creation of government agencies to address licensing of sensitive exports, the degree to which these agents are trained to review export licenses, and the quality and training of border security institutions. *Implementation* includes components that rate the degree to which nonproliferation laws and institutions actually function. Bertsch and Grillot (1998) first proposed this three-part treatment of the nonproliferation norms. We refer to the composite index as the Nonproliferation Compliance Score. The measurement and collection of these data is addressed in greater detail later.

Explaining Compliance: Interests and Capacity

Combating proliferation through export controls has many of the characteristics of a collective action problem. First, it can be economically or politically costly. Implementing and administering export controls will impose financial costs on industry due to administrative burdens (Cupitt et al. 2001) and lost market share for exports (Beck and Gahlaut 2003). Restricting the transfer of sensitive technology can also hinder the pursuit of foreign policy goals by some states. Recent research on the supply-side of proliferation demonstrates that states transfer nuclear technology to further their strategic objectives. Fuhrmann (2009a), for example, concludes that states use civilian nuclear cooperation agreements as a means of strengthening friends and allies and pursuing strategic objectives.

Second, the security benefits of combating proliferation are not excludable; states can benefit from nonproliferation efforts even when they do not contribute. This is further complicated by the fact that the benefits of fighting proliferation are not evenly shared. Some states that export proliferation-sensitive goods may be far removed from their recipients or unlikely targets of the weapons

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[4]Just because a government possesses a strong export control system governing its private sector's trade does not mean that the government itself will refrain from authorizing the transfer of sensitive dual-use technologies to suspect recipients. Russia's provision of nuclear assistance to Iran is a case in point. The presence of a functional export control system ensures at the very least, though, that governments—and not just private individuals or firms—are the ones making the decisions about which transactions involving dual-use goods are appropriate.

programs to which they are contributing. Kroenig (2009a), for example, argues that nuclear proliferation is less of a concern for weaker states because proliferation robs strong states of their ability to use conventional military superiority to deter or coerce other states. Thus, the benefits to some states of allowing trade in dual-use items can outweigh the negative security externalities this trade generates.

The problem of compliance with nonproliferation norms stems from this combination of costly compliance and unevenly distributed benefits. States may be tempted to free ride in order to achieve strategic goals or maintain exports markets while letting others shoulder the burden of addressing global security. Bergenäs (2008), in particular, notes that implementing export controls has the features of a tragedy of the commons. In restricting the trade of dual-use technology, there is always the possibility of ''undercutting,'' which occurs when a government denies approval for the export of an item to a particular party only to have another government approve that same transaction to that party (Gahlaut and Zaborsky 2004). Thus, states may not view export controls as worthwhile when the likelihood of undercutting is high. If enough suppliers of a controlled good defect, the efforts of those states imposing export controls may have little effect on proliferators' ability to acquire what they seek.

To understand the degree to which states implement UNSCR 1540 in the face of these incentives to cheat, we draw on the rich theoretical literature addressing the subject of compliance with international law. We evaluate two different approaches to compliance, one based on states' interests in complying and the other based on their capacity to comply. Given the emerging embeddedness of nonproliferation standards in international law and the absence of any received theory of nonproliferation behavior per se, this analysis is intended as the first step toward a more refined and concrete understanding of compliance with nonproliferation obligations. The hypotheses corresponding to these approaches are summarized in Table 1.

Enforcement and National Interests

The enforcement approach to compliance contends that international law and international norms have little independent influence on state behavior. Instead, it asserts that compliance rests on two factors: national interests and enforcement (Downs et al. 1996). The best predictor of a state's compliance with international law is simply its narrowly defined interests. In those instances where

TABLE 1. Hypotheses

Hypothesis	Indicators	Measurement	Data Sources
Nonproliferation compliance is determined by economic interests	Export Dependence	Ratio of exports to GDP	WTO World Trade Database
Nonproliferation compliance is determined by security interests	Security ties to the US	Alliance ties and alliance similarity with the US	ATOP alliance data
Nonproliferation compliance is determined by state capacity	Economic Capacity	GDP per capita	World Development Indicators
	Bureaucratic Capacity	Quality of governing institutions	Transparency International Corruption scores, World Bank Governance Indicators

states appear to obey international law in spite of their immediate preferences, compliance occurs because of the influence of those powerful states that enforce obligations, rather than the pull of law itself (Mearsheimer 1994/1995; Goldsmith and Posner 2005). In this view, the decision to implement a strong export control policy will be determined by two primary factors: the economic importance of dual-use exports and external pressure to combat proliferation.

First, economic interests should limit the incentive to implement export controls by some states. The role that legitimate trade in dual-use items has in the spread of WMD points to the central problem of nonproliferation efforts in the post-Cold War context: globalization has redefined the relationship between trade and security (Bertsch, Cupitt, and Elliot-Gower 1994). Export controls can deny or hinder trading opportunities for a state's exporters, which can make them economically costly (Beck and Gahlaut 2003). This is especially true for developing states that are pursuing an export-led growth strategy; because dual-use items have legitimate civilian uses, restricting their export can place domestic firms at a serious competitive disadvantage. According to this view, those states that have a higher level of export dependence, particularly in high technology, are likely to implement less rigorous export control policies.

On the other hand, the spread of these items raises serious security concerns, particularly for powerful countries like the United States. In his study of the transfer of sensitive nuclear technology, Kroenig (2009a) proposes that powerful states have incentives to prevent the spread of nuclear weapons in order to preserve military dominance stemming from their conventional capabilities. Indeed, the United States has taken a clear stance regarding international nonproliferation with its sponsorship of UNSCR 1540, its support for the Proliferation Security Initiative, and its bilateral efforts to promote international export control development. As part of its Export Control and Related Border Security (EXBS) program, for example, the US Government spent over $160 million assisting foreign governments to improve their export control systems from 2003 to 2006. Beyond its support for universal compliance with UNSCR 1540, we would expect that the United States would be especially interested in ensuring that its close allies complied as well—leveraging its alliance ties toward that end.[5] Indeed, the United States has consistently tied its export of dual-use goods and technologies to the development of effective export controls by would-be recipients (Cupitt 2000). Being denied access to US dual-use goods could be quite costly for US allies that would otherwise expect to have access to such strategically important items. The role of such external pressure in promoting compliance is especially relevant to UNSCR 1540, as the measure does not contain any explicit provisions concerning the punishment of noncompliance.[6] If interests and enforcement pressure are in fact key determinants of compliance with UNSCR 1540, possessing close security ties to the United States should lead states to impose tighter export controls.

State Capacity

In contrast to the enforcement approach, the managerial approach contends that international law exerts a natural compliance pull. In this view, states have a

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[5]Fuhrmann (2007:145) also argues that US allies should be more receptive to the United States' efforts to promote compliance with UNSCR 1540 than non-allies because of their shared security interests.

[6]It is noteworthy, though, that the UNSCR 1540 does contain an institutional mechanism for monitoring compliance, in that it required states to submit self-reports on their degree of compliance and it established a committee to collect and analyze those reports. The presence of a monitoring capability and the absence of any real enforcement mechanisms in UNSCR 1540 suggest that, once identified, the task of addressing noncompliance was to be left up to external actors.

general propensity to comply with their obligations (Chayes and Chayes 1993, 1995). When noncompliance occurs, it is generally not because a state lacks the *will* to follow its obligations, but because it lacks the *ability*. Implementing an international agreement is often a complex undertaking requiring a substantial technical or regulatory capacity. States typically fail to comply with their obligations due to a lack of the economic or technical resources needed to implement a policy properly and not because of a calculated decision to cheat. The quality of a state's bureaucratic capacity can thus constrain its ability to meet its ability to comply. For example, Linos (2007) finds that the effectiveness and transparency of European Union (EU) member states' bureaucracies positively influences the implementation of EU-mandated social directives. The implication of the managerial perspective, then, is that failed implementation is best addressed by managing the problem and boosting state capacity rather than punishing noncompliance (Young 1979).

With respect to export controls, states may have the political will to combat proliferation, but lack the expertise and/or resources to impose effective export control policies (Fuhrmann 2007:145). Export controls are highly technical policy instruments, requiring detailed legal measures, efficient institutions, and trained personnel. For many states, export controls are unfamiliar policy instruments that are imposed on existing state bureaucracies (Jones 2006). For instance, the general training and skill level of regulators will be crucial, as customs officials must familiarize themselves quickly with the complexities of dual-use materials and controls. A new class of export control officials cannot be hired overnight; thus, existing bureaucrats must administer these tasks. Existing skill levels, training programs, and bureaucratic reliability (that is, the presence or absence of widespread corruption) will significantly affect the quality of export controls. Specifically, implementing effective export controls requires an established customs bureaucracy, a body to issue export licenses, and law enforcement bodies to detect, investigate, and prosecute violations.[7]

From this perspective, the lack of state capacity is the primary reason why states fail to make significant progress in complying with UNSCR 1540. The rule of law and absence of corruption are both tied to levels of governmental competence and efficient policy implementation—key components of an effective export control system. From a broader perspective, a government's financial resources will be important for establishing these capacities where they are lacking. Richer states simply have more resources to spend on establishing new regulatory bodies, reforming existing institutions, and training personnel in new areas of expertise than do poorer states (Fuhrmann 2007:145). While governments may be able to develop issue-specific competencies that over-perform relative to their general levels of bureaucratic and economic capacity, the scarcity of these factors will generally limit the resources and attention that governments can devote to developing their export control systems.

Policy Implications

Very different policy programs naturally follow from these two approaches. Therefore, the policy recommendations produced by this analysis will depend upon which set of hypotheses receive empirical support. If national interests are the primary determinant of export control policy, then the way to convince states to implement tougher exports controls will be to change those interests using some form of issue linkage, by either sanctioning noncompliance or

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[7]See Beck et al. (2003) or Fuhrmann (2007) for more on the particular bureaucratic elements of an export control system.

rewarding implementation with economic inducements or other side-payments. If lack of capacity is found to be the primary cause of noncompliance, then policymakers should support general economic development efforts and provide noncompliant governments with assistance to increase their expertise in the area of export controls. For example, Operative Clause 7 of UNSCR 1540 recognizes that states lacking a strong legal and regulatory infrastructure will require assistance in implementing the resolution and calls on states to offer corresponding aid. We explore the implications of these insights in the paper's conclusion.

Research Design and Measurement

To evaluate these hypotheses, we selected 30 proliferation-salient states from a list of 84 ''key'' states identified by Crail (2006). The states in Crail's list have either the capacities to produce dual-use technology (78 states) or significant infrastructure for transnational trade, but lack the technology to produce it (6 states).[8] These latter states constitute proliferation risks because of their ability to serve as transshipment points for illicit transactions.[9] States on this list are ones in which their degree of compliance has salient implications on nonproliferation efforts, making them relevant cases for analysis. The process of coding the Nonproliferation Compliance Score is complex and time-intensive, forcing us to select a subset of states from this list.[10] Thirty states were included to provide an adequate sample size for statistical analysis, and we chose specific states in order to ensure both variation in our explanatory variables and geographic diversity. The list is as follows: Argentina, Australia, Azerbaijan, Brazil, China, Croatia, Egypt, France, Germany, India, Japan, Jordan, Kazakhstan, Lithuania, Mexico, Pakistan, Philippines, Poland, Romania, Russia, Serbia, Singapore, South Africa, Taiwan, Tajikistan, Thailand, Turkey, the United Arab Emirates, the United Kingdom, and the United States. The base year of the study is 2007, three years after the adoption of UNSCR 1540.

The necessity of including only a subset of countries from the population of interest required us to intentionally select the observations in the analysis; that is, we have a non-random sample. This does not necessarily result in a biased sample, however. As King, Keohane, and Verba (1994) note, the best method of intentional case selection is to choose observations in a way that provides variation in the explanatory variables but does not reference values of the dependent variable. Selecting non-random observations in this way will not produce biased causal inferences as long as it is done without regard to the values of the dependent variable (King et al. 1994). We follow this approach to the letter. All of the states in the sample were selected without regard to their export control policy or degree of compliance with UNSCR 1540. The values of each state's compliance score became known only after a long and extensive data collection process.

As an additional check on the representativeness of our sample, we compared the characteristics of the 30 states in our analysis to the remaining 54 on the list of key proliferation-relevant states. Difference of means tests demonstrated that there was no statistically significant difference between our sample and the

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[8]Only one of the six transit-risk-only states identified by Crail (2006) is included in our sample, which is the United Arab Emirates. Our sample may thus slightly underrepresent the number of such states.

[9]For example, the A.Q. Khan network used Dubai in the UAE as a transshipment point for a large number of its illicit transactions with Iran. As a global hub for international trade with lax export controls, Emirati traders had broad access to sensitive dual-use goods that they could subsequently divert or re-export to Iran.

[10]Each individual country observation took dedicated coders on average between 50 and 70 hours of time to code. During and after coding, each observation was also subject to additional, time-intensive review by external parties. The process of gathering these data thus limited the ability to collect data on the full population.

excluded cases in the mean values of any of the independent variables used in the analysis.[11] Thus, the sample appears to be quite congruent with the larger population of interest. This provides us with a high degree of confidence that the sample of countries we analyze is representative of the broader population of states whose behavior we seek to explain.

The Measurement of Nonproliferation Compliance

According to the established nonproliferation norms (Bertsch and Grillot 1998; Beck et al. 2003), nonproliferation compliance includes three components: (i) national legal development related to nonproliferation (in the project metric: 14 items covering 4 categories), (ii) state institutions with nonproliferation functions (21 items in 4 categories), and (iii) a state's implementation of nonproliferation (17 items in 5 categories). These component variables of nonproliferation compliance, summarized in Table 2, are conceptually parallel but wholly distinct in what they measure. The codification of national control lists is distinct from the bureaucratic aspects of designing, maintaining, and institutionalizing control lists, which is equally distinct from the actual, effective implementation of such lists. The full list of items can be found in a separate document available from the authors.

The Nonproliferation Compliance Score utilizes a 5-point scale (0–4) to measure specific aspects of nonproliferation behavior, such that 0 indicates the absence of meaningful laws, institutions, or implementation, and a score of 4 indicates ''Gold Standard'' system development. A ''Gold Standard'' score indicates that a state's development in a particular area is in line with export control best practices.[12] Multiple items make up each component variable; each item is scored on this 0–4 scale and a raw mean calculated for each of the component variables. We convert the raw number score of each component into a percentage of the maximum possible score for purposes of comparison across the three component variables. Finally, we use the average of the three 100-point scales as an aggregate score. Table 3 previews one item for each of the three categories. Each item is assigned a value on the basis of interpreting clearly identifiable sources, which are cited and assessed in the same row of the questionnaire. The score for each state is collected for the year 2007.[13]

Figure 1 provides a three-dimensional depiction of the three components of the compliance measure for each state in the sample. This graphical breakdown of nonproliferation behavior shows the importance of operationalizing the dependent variable along all three dimensions. For example, states like Tajikistan and the UAE may rate highly in terms of nonproliferation legal basis, but score low in terms of institutional development or implementation. Others, such as the United States, may score extremely high along the institutional and implementation dimensions, but relatively low on the legal dimension, as US export control laws are badly out of date. If coding all three concepts as part of the dependent variable were superfluous, observations should form a clear line moving from coordinates (0 0 0) to (100 100 100). The deviance from this low-to-high line, particularly for the relationship between legal basis and implementation, supports the choice to operationalize nonproliferation behavior in terms

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[11]These variables are trade openness, trade dependence, alliance ties to the United States, regime type, GDP per capita, and governance indicators. These statistics are available from the authors.

[12]The coding criteria used in this study adhere to general standards identified by other authors. For a deeper discussion of the criteria used to evaluate export control development, see Bertsch and Grillot (1998) and Beck et al. (2003).

[13]More detailed information on the measurement, including a complete list of component items and the raw scores, is provided in a separate document available from the authors.

TABLE 2. Nonproliferation Compliance Score Variables

Category	Component Variables
Legal Basis	Export control licensing laws
	Export control enforcement laws
	Control lists (existence and specificity)
	Government-industry outreach laws
Institutions	Export control expertise
	Licensing institutions
	Customs and border-security adjustment
	Government-industry institutions
Implementation	Export control licensing practices
	Use of control lists in licensing and enforcement
	Customs and border-security activities
	Export control follow-up
	Government-industry outreach activities

of all three dimensions and also supports the choice of UNSCR 1540s architects to highlight these three dimensions independent of one another in the resolution's text.

A preliminary analysis of the sample offers some interesting insights. As Figure 1 shows, states have made better progress in establishing the legal basis for their export control systems than they have in institutionalizing or implementing them. Among our sample, the mean level of legal development is 68.2. In terms of institutional development, the mean score is 58.4 and, for implementation, it is 50.5. Though passing comprehensive, technically sophisticated export control laws can be challenging, doing so requires less effort and fewer resources than the task of institutionalizing and implementing them. Aggregating the three export control dimensions together, the average value of the Nonproliferation Compliance Score is 59.0, with a standard deviation of 21.6. This indicates a significant degree of variance in levels of export control development. The state with the least developed export control system in our sample is Egypt, with a Nonproliferation Compliance Score of 10.9, and the United Kingdom has the most developed, with a score of 97.9.

Measurement of the Explanatory Variables

We test the hypotheses derived from realism and capacity using the following explanatory variables, all of which are lagged 1 year compared to our dependent variable and measured for the year 2006. We measure export dependence using the ratio of a state's exports over its GDP. The data are obtained from the World Trade Organization's (2008) trade database. We measure security ties to the United States in two different ways. First, we use Signorino and Ritter's (1999) *S*-scores for alliance similarity with the United States. *S*-scores for this sample are calculated using EUGene (Bennett and Stam 2000) and range from .24 (Jordan) to .79 (Argentina, Brazil, and Mexico), excluding the United States.[14] Second, as a simpler measure, we use a dummy variable for whether a country had a defense pact alliance with the United States in 2006 using data from Leeds, Ritter, Mitchell, and Long (2002) and Gibler (2009).

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[14]We also considered measuring security ties using the Affinity of Nations data (Gartzke and Jo 2002), which measures similarity of voting positions in the United Nations. These data do not contain observations for the United States and Taiwan.

Table 3. Sample Items

| Item	Category	Component Variable	Question
8	Legal Basis	Export Control Enforcement Law	Does a law give the customs authority or border enforcement agencies the authority to search, detain, and seize suspicious cargo?
23	Institutions	Licensing Institutions	Is there an interagency review of license applications?
41	Implementation	National Control List	Does the state have a national list of dual-use goods that it controls for nonproliferation purposes?
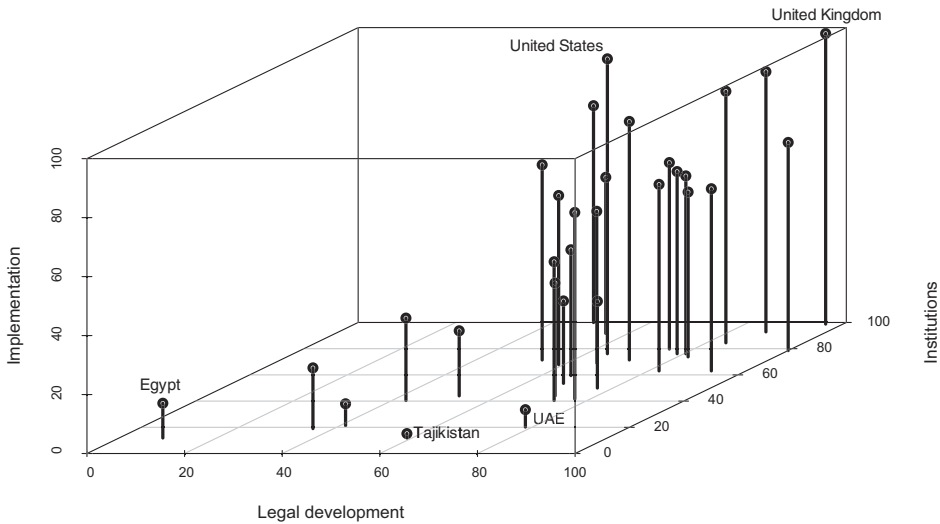
Fig 1. Three Dimensions of Nonproliferation Compliance.
(*Note.* Each Axis Marks One of the Three Dimensions: Legal Development (Increasing from Left to Right), State Institutions (Increasing from Foreground to Background), and Implementation (Increasing from Bottom to Top))

Economic capacity is measured using GDP per capita, obtained from the World Development Indicators (World Bank 2007). As is common practice, we transform the raw scores by taking the natural log. Bureaucratic capacity is operationalized using five bureaucratic quality and government corruption indices: the Transparency International (2007) corruption ranking for 2007 and four scores from the World Bank's *Governance Matters* database (Kaufmann, Kray, and Mastruzzi 2008). These four scores are Political Stability (the likelihood of government destabilization or overthrow), Regulatory Quality (the government's ability to formulate regulations to promote development in the private sector), Rule of Law ("...the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" [Kaufmann et al. 2008:7]), and Control of Corruption ("...perceptions of the extent to which public power is exercised for private gain" [Kaufmann et al. 2008:8][15]). These five

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[15]Whereas the Transparency International score is based on expert and business surveys only, and measures "perceived public-sector corruption," the World Bank measure incorporates a broader variety of sources and includes items designed to detect the extent to which states are "captured" by "elites and private interests" (Transparency International 2007; Kaufmann et al. 2008:4).

indices each measure different aspects of a government's ability to effectively regulate private actors.[16] Factor analysis of the five is used to generate a single bureaucratic capacity variable. The five load onto a single factor (Eigenvalue = 4.39) with a communality of .99.

Empirical Testing and Results

To evaluate the hypotheses derived from the state interests and capacity theories, we use least squares linear regression. Because small samples can be vulnerable to high influence cases, we estimated the coefficients with robust regression.[17] To avoid various estimation problems in small samples, we followed Achen's (2002) recommendation and strictly confined the number of explanatory variables in regression models.[18] Security ties and state capacity are each measured using two different indicators, so we estimated four different model specifications using alternate variables for the enforcement and capacity hypotheses. The results of these models are presented in Table 4.

We find little empirical support for the hypotheses suggested by an enforcement approach. First, economic interest, as measured by trade dependence, does not have a strong relationship with state compliance. For all four models, the coefficient for the ratio of exports to GDP is not statistically significant.[19] We suspect the null finding for trade dependence might be attributable to two contradictory effects. In some cases, the costs of export controls may discourage states from complying. On the other hand, some research suggests that more stringent export controls help promote exports. Cupitt et al. (2001) take the view that export controls, although costly in economic terms, can be seen as a ''membership fee'' for access to the world's liberal economic community. Thus, possessing an extensive export control system will signal that a state is a responsible and modern trading partner, making trading states more willing to comply.

While the United States has been generally active in promoting foreign export control development, we found no evidence that it was able to use its alliance relationships to convince or compel allied states to adopt more stringent export controls than non-allies. According to the enforcement approach, having close security ties to a great power with salient nonproliferation interests and its potential willingness to coerce compliance should have led US allies to have more developed export controls. We find no empirical support for this expectation, using tests of two different measures of security ties with the United States: similarity of alliance portfolios in Models 1 and 3 and a dichotomous variable for possessing a defense pact with the United States in models 2 and 4. None of the coefficients for these variables are significant in any of the regressions.

In contrast, the hypothesis emphasizing capacity receives strong and consistent support. We find strong results for this expectation using two different

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[16]These indicators are intended to measure state capacity in the broadest sense. It is important to note that they are completely distinct from the specific institutional components contained in the nonproliferation compliance measure.

[17]All models are estimated using the rreg command in Stata 11.0. Robust regression weights the coefficient to correct for outliers. The results do not differ in any substantive manner from those produced by standard OLS regression. Diagnostics revealed that Egypt and the United Arab Emirates exert a particularly high influence on the estimated coefficients in a standard OLS regression; however, excluding these two cases from the sample does not change the substantive results.

[18]For instance, we did find evidence for biased estimators due to multicollinearity of related concepts if economic and bureaucratic capacity (or *S*-Scores and US alliance dummies) were included in the same models, indicated by higher variance inflation factors. To circumvent this problem, these related indicators were used only in separate model specifications.

[19]We also tested an alternate variable composed of a state's technology-related exports over its GDP. Using this alternate measure did not change the findings.

Table 4. Robust Regression Results of Nonproliferation Compliance

Variable	Model 1	Model 2	Model 3	Model 4
Exports/GDP (logarithmic)	−4.24	−2.96	−1.89	−2.09
	(6.04)	(5.43)	(6.31)	(5.64)
S-score with System Leader	5.68		23.17	
	(24.32)		(24.48)	
US Alliance		8.68		11.61
		(7.96)		(8.19)
GDP per capita (logarithmic)	9.29**	8.45**		
	(2.97)	(2.82)		
Bureaucratic Capacity			9.79*	9.04*
			(4.02)	(3.90)
Constant	−29.48	−21.6	46.36	52.67
R^2	.35	.38	.27	.31
N	30	30	30	30

(*Notes.* Robust regression coefficients. Standard errors are in parentheses. *$p < .05$; **$p < .01$.)

indicators of the ability to comply: economic resources and bureaucratic capacity. Each of these variables is statistically significant in all four model specifications, suggesting a high degree of confidence for this finding. In Models 1 and 2, if the logarithmic value of GDP per capita rises by one standard deviation, compliance increases by approximately 12 points, out of a 100-point scale. While it could be the case that poorer countries are less inclined to develop stringent export controls due to the desire to stimulate exports, there is no reason to think that only poor countries wish to promote exports. Thus, we are inclined to interpret the relationship between the economic resources of the state and compliance with UNSCR 1540 as a matter of capacity. The variable measuring the quality of a state's governing institutions also has a sizable positive relationship with compliance. The strong and consistent results of both capacity variables suggest that a key determinant of state compliance with UNSCR 1540 is its technical and economic ability to implement costly policy changes.[20]

To check the robustness of these findings, we repeated the analysis for the three separate component variables of the Nonproliferation Compliance Score. Table 5 reports the results from Table 4 with separate dependent variables for the legal, institutional, and implementation aspects of compliance. As the results show, neither economic resources nor bureaucratic capacity have a statistically significant relationship with the legal aspects of export control. In contrast, both variables exercise positive, statistically significant effects on the degree to which states have institutionalized and implemented export controls.

The results in Table 5 provide a more nuanced picture of the influence of state capacity on compliance with UNSCR 1540. In particular, capacity appears to have distinct effects depending upon the dimension of export control policy. Given that adopting a new law is relatively low cost, we should not expect capacity to have a strong effect on the ability to create new export control laws. In contrast, state capacity has a strong effect on the ability to institutionalize and implement those laws. These findings are consistent with the managerial account of compliance with international law. While most states should be able to make

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[20]Scholars have argued that democratic states are more likely to comply with international law due to the importance of the rule of law in democracies (Slaughter 1995). We tested for this possibility by adding regime type as a control variable, using the Polity IV data (Marshall and Jaggers 2002) and identifying democracies as countries with a democracy score of 7 and above (on a scale of −10 to 10). We did not find a statistically significant relationship between democracies and nonproliferation compliance. The findings with regard to capacity were not affected by including this control.

TABLE 5. Regression Results of Disaggregated Export Control Development Scores

Variable	Legal Basis		State Institutions		Implementation	
	Model 5	*Model 6*	*Model 7*	*Model 8*	*Model 9*	*Model 10*
Exports/GDP	2.70	3.43	−4.46	−3.95	−6.46	−6.34
(logarithmic)	(5.94)	(5.97)	(6.36)	(7.09)	(6.22)	(6.72)
US Alliance	0.58	2.32	11.24	14.81	11.27	16.04
	(8.70)	(8.67)	(9.33)	(10.3)	(9.12)	(9.76)
GDP per	3.48		10.77**		12.6**	
capita	(3.08)		(3.30)		(3.22)	
(logarithmic)						
Bureaucratic		2.03		11.17*		14.40**
Capacity		(4.13)		(4.90)		(4.65)
Constant	41.34	72.68	−44.31	49.61	−70.75	37.05
R^2	.07	.03	.42	.32	.50	.44
N	30	30	30	30	30	30

(*Notes*. Robust regression coefficients. Standard errors are in parentheses. *$p < .05$; **$p < .01$.)

progress in complying with UNSCR 1540 by passing export control laws, capacity-poor states appear to face significant challenges in institutionalizing and implementing them—handicapping their export control systems' effectiveness.

The observations in this analysis constitute a single snapshot of the export control systems of these states in 2007, only three years after the adoption of UNSCR 1540. As such, these data, although detailed, offer limited insight into changes in export controls over time unless they are situated within the context of their broader developmental trajectories. This is illustrated by the case of the UAE. Prior to the passage of UNSCR 1540 in 2004, the country had essentially no dual-use export control system. In the fall of 2007, though, the UAE passed a new comprehensive export control law that constituted a milestone improvement for a country that, until that time, had made little headway in developing its export control system—legally or otherwise. However, the administrative committee established to oversee the institutionalization and enforcement of the law only met for the very first time in the spring of 2009.[21] Our coding of the UAE's Nonproliferation Compliance Score captures the fact that the UAE made significant progress in its export control development along the legal dimension in 2007 but had not progressed in the other two areas. By the spring of 2010, though, the government had created and staffed an institutional body to administer its export controls, and by that summer, the body had already begun to issue export control licenses. The remarkable pace of these developments could not be captured by our cross-sectional analysis. Yet given the UAE's wealth and its government's penchant for drawing on foreign expertise (Early 2010), it makes sense according to our findings that the country would be capable of marshaling the resources necessary to rapidly institutionalize and implement export controls.

Viewing our findings as a snapshot of unfolding developmental processes gives further salience to our discovery that export control systems tend to be much more developed along their legal dimensions than they are on their institutional and implemental ones. Collecting a longer time-span of data after the adoption of UNSCR 1540 might reveal that even capacity-poor states can make progress after several decades. Nevertheless, we would expect the pace of compliance for capacity-poor states to be much slower than capacity-rich states like the UAE.[22]

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[21]For more on the UAE's export control development, see Early (2009, 2010).

[22]This interpretation is further supported by Linos's (2007) complimentary finding that it took capacity-poor EU states significantly longer to implement EU directives than it did capacity-rich ones.

The evidence from our cross-national analysis points to the lack of bureaucratic or economic resources as the leading reason why states have failed to make progress in these areas. Thus, our findings capture the fact that states tend to get bogged down in the institutionalization and implementation phases of export control development after they have adopted export control laws. This indicates that more states want to fully comply with UNSCR 1540 than actually have the ability to, which has important implications for the pace at which we can expect compliance with UNSCR 1540 to improve and what can be done to hasten the process.

The fact that compliance takes place over time also raises the issue that some states had strong export control systems in place prior to the 2004 passage of UNSCR 1540. To assess the effect of this on our findings, we added a dummy variable for the founding members of the Nuclear Suppliers Group (NSG) to the analysis. The NSG is a voluntary club of nuclear supplier states founded in 1975 to help coordinate its member states' export control policies to prevent the proliferation of nuclear weapons. Activity in the NSG suggests that these states have been working toward their nonproliferation capabilities long before UNSCR 1540. This additional control variable serves as an indicator for nonproliferation ''vanguards'' that might be different from other states that have only recently begun to establish export control systems. In the absence of a time-series evaluation of nonproliferation efforts, this option comes closest to measuring the effect of time on the quality of export control systems. Adding the NSG variable to our existing models, we find that it is not consistently significant in different model specifications. In no configuration does it eliminate the effect of economic capacity on compliance, though the significance of the bureaucratic capacity variable becomes inconsistent across model specifications.[23] That is, capacity mostly retains its effect on compliance, independent of previous commitments to strengthening export controls.

Conclusion

This study constitutes the first inquiry into the determinants compliance with UNSCR 1540 using an objective measure of compliance behavior. We develop a detailed, comprehensive method of assessing a state's nonproliferation policies and evaluate two different explanations of compliance. Our analysis reveals that states' activities in preventing the proliferation of dual-use materials appear to be strongly related to their bureaucratic and economic capabilities. Effective bureaucracies and higher levels of economic development predict good compliance with UNSCR 1540s requirement for states to take immediate steps to improve their domestic export control systems. In accordance with the managerial approach's predictions, we find specific evidence that state capacity is the factor most closely linked to the institutionalization and implementation of export controls.

In general, we found that approaches based on narrowly defined national interests appear limited in their ability to explain how far states go in developing export control systems. Our findings suggest that economic reliance on exports does not discourage efforts to control exports of dual-use technology. This may be, in part, attributable to the role that export controls play in a state's reputation as a reliable trading partner and responsible member of the world economic community. Strategic partnerships with the United States also do not seem to be connected to more aggressive nonproliferation efforts. This is somewhat surprising given the US Government's salient nonproliferation interests

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[23]We thank an anonymous reviewer for suggesting this additional analysis.

and the active role it has played in offering international export control assistance to countries in need of it.

This latter point has important policy implications. While UNSCR 1540 ''invites States in a position to do so to offer assistance … to the States lacking the legal and regulatory infrastructure, implementation experience and/or resources for fulfilling the above provisions,'' it lacks concrete provisions to ensure the provision of such assistance. ''In other words,'' Scott Jones (2006) surmises, ''Resolution 1540 is an unfunded mandate: compliance is required without direct recourse to resources.'' Our findings indicate that cross-national variance in compliance is largely due to an uneven distribution of resources rather than an uneven distribution of interest in combating proliferation. While many states can take comparatively cheap steps to comply partially with their nonproliferation obligations, such as passing export control laws, a significant number may lack the resources to institutionalize or implement them. As we have noted, these are crucial dimensions of effective export control systems.

Obtaining full compliance with the resolution will require parties with salient nonproliferation interests and substantial resources, primarily the United States and European Union, to dramatically increase export control assistance. In addition, general improvement in the bureaucratic standards and economic development of developing states could also improve global nonproliferation efforts. Nevertheless, our results should not be interpreted as suggesting that the elimination of global poverty and government corruption is the only way to achieve compliance. These variables are analyzed, in part, as proxies for more specific elements of state capacity that could be increased through targeted assistance programs. International export control assistance can help capacity-poor governments make specific strides in developing their export control systems by giving them access to resources and expertise they could otherwise not afford. Such assistance can thus play a crucial role in supporting export control development in countries that want to comply with UNSCR 1540 but lack the domestic capacity to do so on their own. Unless the international community is willing to make significantly greater investments in international export control assistance, our research suggests the goal of achieving widespread effective compliance with UNSCR 1540 is unlikely to be realized anytime in the near future.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. The NONPRO database

Appendix S2. Summary statistics

Appendix S3. Robustness checks

Please note: Wiley-Blackwell are not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other then missing material) should be directed to the corresponding authors for the article.

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