
New Challenges to Arms Export Control: Whither Wassenaar?

RON SMITH & BERNARD UDIS¹

Ron Smith is Professor of Economics, Birkbeck College, University of London. He has been Visiting Professor at the London Business School and the University of Colorado and has published seven books and over a hundred papers in the areas of applied econometrics and defense economics. Bernard Udis is Professor of Economics, Emeritus, at the University of Colorado at Boulder. During 1997, he was a Foster Fellow at the U.S. Arms Control and Disarmament Agency, where his responsibilities included the Wassenaar Arrangement. In addition to several books on the adjustment of the U.S. and European economies to reduced military spending, his publications on defense economics have appeared in numerous scholarly journals.

It is widely recognized that arms exports can have negative externalities on national security; as a result, there are almost universal national controls on this industry. There are also a variety of international organizations that attempt to regulate the international trade in arms through the coordination of suppliers. Paul Levine and Ron Smith developed a theory of such coordination that examines the interaction that occurs in the coordination of the supply of weapons through international export controls, the coordination of the production of weapons through collaboration, and the coordination of the levels of military expenditure through alliances.² In this article, we wish to examine the institutional features of arms export controls: the practical and logistic issues involved, the international organizations that are working to regulate exports, and the factors that determine the effectiveness of the various arrangements.

Of the large number of export control organizations that exist, we have chosen to focus on the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-

Use Goods and Technologies (WA). The end of the Cold War allowed the formation of the WA, the first multilateral agreement covering both conventional weapons and sensitive dual-use goods and technologies. The member list includes Russia, but not China, and is designed to prevent destabilizing acquisitions of weapons and technologies through a formal process of transparency and consultation. The WA is the successor to the now defunct Coordinating Committee for Multilateral Export Controls (COCOM), which was created and designed to restrict the transfer of arms and dual-use technologies to communist countries during the Cold War.³ Andrew Pierre referred to the WA as "...[t]he best hope for creating a supplier-based multilateral regime."⁴ William Keller and Janne Nolan noted, however, that the WA "...has received scant attention from the policy community and ridicule from the arms lobby, and it is presently languishing with no high level involvement."⁵

In surveying the challenges, we first set out the background of what is currently controlled, why these particular

items have been chosen, and how the controls are instituted. Second, we discuss some general theoretical issues that arise in international agreements of this sort and, in particular, the ways in which arms export controls differ from classic arms control. Third, we address the disruptive potential of technical change. Finally, in light of this analysis, we then return to examine the role of the WA. Many of these issues have been discussed extensively in the literature on this topic, which we have summarized briefly.⁶

CONTROLLING THE INTERNATIONAL FLOW OF ARMS

Although they overlap, it is useful to distinguish five main categories of militarily useful goods and services that may be subject to control. These are: weapons of mass destruction (WMD), major weapons systems, light weapons, dual-use technologies, and services (e.g., training and maintenance). Each category raises very different issues and involves very different market structures and control mechanisms. There is a widespread, though far from unanimous, consensus that the proliferation of WMD—including chemical, biological, radiological, and nuclear (CBRN)—and their delivery systems should be controlled. This trend is reflected in a set of treaties and supplier groups that have been created and instituted, discussed below. Whatever their limitations, illustrated by the 1998 Indian and Pakistani nuclear tests, these arrangements have nonetheless inhibited the proliferation of WMD. In contrast, there is no such consensus that there should be general controls on the sales of conventional weapons, since a state's right to self defense, embodied in the U.N. Charter, gives it the right to buy arms from abroad.

However, there may be specific reasons to control particular transfers, and the 1991 declaration by the five permanent members of the U.N. Security Council (P5) outlines such reasons.⁷ Typically, transfers should be restricted if the recipient's acquisition of arms is excessive or destabilizing. Not only is it difficult to define what a "destabilizing acquisition" of weapons entails, but some, like Colin Gray, argue that the concept itself is incoherent: a category mistake, since it is governments, not weapons, that cause war.⁸ Nonetheless, various export control arrangements have attempted and are attempting to define the notion of a "destabilizing acquisition," either in terms of the capabilities of the weapons or the characteristics of the recipients.

Within conventional weapons, it is useful to distinguish major systems from light weapons. The latter include small arms, land mines, small mortars, and man-portable missiles. While light weapons have probably caused 90 percent of the casualties in recent wars,⁹ major weapons systems have the potential to change regional balances of power. Light weapons are also more difficult to control than major systems, partly because whereas major systems are supplied by an oligopoly, light weapons are competitively supplied by large numbers of producers.¹⁰ With the exception of the anti-personnel landmine agreement, there has been little action on light weapon control.¹¹ Dual-use systems raise unique difficulties, partly because many of the technologies required to produce WMD and their delivery systems have important industrial applications (i.e., nuclear, biological, chemical, and space) and partly because, as COCOM found, it is difficult to define militarily-relevant technologies. Services are not generally subject to control, but are increasingly important in the transfer of military knowledge and technology. Without training and support services, many states have difficulty using the advanced weapons they acquire.

There are a variety of reasons for which states attempt to control arms exports. The simplest is strategic embargo: to prevent the sale of weapons to a potential enemy to limit its military capability. This was the main objective of COCOM. As Michael Mastanduno has pointed out, however, a recurrent source of conflict between the United States and its allies was whether the objective of COCOM was strategic embargo or more general economic warfare.¹² Strategic embargos may overlap with the prevention of the proliferation of particular types of arms, such as inhumane weapons or WMD, either in general or to particular pariah states like North Korea, Iraq, Iran, Libya, and previously South Africa. Suppliers may also fear in some cases that the external supply of weapons may prolong a war—hence the embargo of military supplies to the former Yugoslavia. In yet another situation, states may fear that the introduction of particular arms in a region, such as high technology weapons, may destabilize international relations, either through an expensive arms race or through encouraging pre-emptive aggression. For instance, until late 1997, U.S. policy did not permit selling F-16s to Latin America (the exception was to Venezuela, where there were particular U.S. security concerns regarding Cuba). Supplier states may prohibit arms sales to governments with poor human rights records, either as a general indication of disapproval or with the concern that

weapons may be used in internal repression. The embargo on China after the Tiananmen Square incident, as well as objections to selling to Indonesia during its illegal occupation of East Timor, are examples. Finally, suppliers may be concerned that the cost of the arms purchases could damage the recipient's economy, through the excessive accumulation of debt or the diversion of resources from development needs.

These objectives are wider and more vague than those of classic arms control, which theoretically aims to: (1) reduce the probability of war; (2) reduce the adverse consequences of war should it occur; and (3) reduce the cost of military preparations.¹³ Frequently, there are trade-offs between these objectives: for example, measures that reduce the probability of war could, in effect, increase costs. However, the trade-offs in traditional arms control are much simpler than those in arms export control. For instance, if arms control prohibits a state from acquiring a system, such as an anti-ballistic missile system (ABM), it saves on expenses; however, if export controls stop a state from making a sale to another country, money is lost.¹⁴ We return to the differences between traditional arms control and arms export control below.

There are a variety of international mechanisms for controlling arms exports, but most rely on national export regulations. These usually involve: lists of products that require a license/notification; lists of countries to which exports can or cannot be made; a list of criteria used to judge uncertain cases; customs procedures to stop unlicensed exports; a system to guarantee the end use of the equipment and prohibit third-party transfers; and, in multilateral systems, a notification mechanism for reporting exports that are denied, as well as perhaps a "no-undercutting rule" (i.e., states agree to deny sales that are refused by another member state). Not all countries possess well-functioning export control systems and, as the Iraq case demonstrated, even reasonably well-functioning systems can be evaded. The developments in the European Union (EU) system of arms export controls should be seen as an extension of national export controls, since the single market, which removes restrictions on cross-border trade within the EU, has reduced the effectiveness of national controls.¹⁵

There is a range of U.N. embargoes or sanctions that prohibit the supply of weapons to particular states. There is also an array of treaties, by which participants agree to restrict their acquisition of certain sorts of weapons. Ex-

amples include the Nuclear Non-Proliferation Treaty (NPT), the Landmine Treaty, the Chemical Weapons Convention (CWC), and the Biological and Toxin Weapons Convention (BTWC).¹⁶ These treaties are open to all states, and a large number of countries typically sign on (often over 90). By joining and becoming a member of "the club," states gain international reputation benefits (and sometimes direct economic benefits, as with the NPT). For most, the costs of signing are not high. A majority of the signatories do not seek these weapons in the first place, and, for those that do, enforcement is not very strict and punishment for violation rare. For instance, the 1972 BTWC has no mechanism to check compliance, though discussion about the development of a verification protocol to the treaty has been ongoing since 1994. There also exists a range of transparency measures, of which the U.N. arms transfer register is the most important. The United Nations requests states to report transfers of seven types of arms: battle tanks, armored combat vehicles, large caliber artillery systems, combat aircraft, attack helicopters, warships, and missiles/missile launchers. Over 90 countries have reported transfers. The WA employs these same categories, and the first five were used in the Conventional Forces in Europe (CFE) Treaty.

Finally, in addition to embargoes/sanctions, treaties, and transparency measures, there is a patchwork quilt of supplier agreements, sometimes referred to as regimes.¹⁷ These more restrictive "clubs" include: the Nuclear Suppliers Group (NSG), established in 1975 as the "London Club"; the Missile Technology Control Regime (MTCR), established in 1987; the Australia Group (AG), formed in 1985 to control chemical and biological weapons (CBW); and the Wassenaar Arrangement, established in 1996 to monitor the transfer of conventional weaponry. Often, both treaties and supplier groups cover the same categories of equipment, materiel, and technology; but, whereas the former are formal and open to all, the latter tend to be more informal with restricted membership. In general, supplier groups originated in loose cooperation among a small number of countries. Most have become organized more formally and expanded to typically about 30 industrialized states. Non-member states may choose to adhere to the guidelines of these arrangements without being members. In contrast to today's multilateral emphasis, COCOM was a supplier group of U.S. allies, and the controls were aimed at the rival Soviet bloc. The neutral states, though not members, tended to abide by COCOM controls broadly, albeit often after U.S. pressure was applied.

Again, in the case of supplier groups, there may be economic incentives to join; for example, the promise of space cooperation with the United States encouraged Russia to comply with MTCR restrictions.¹⁸ Because these are arrangements or agreements rather than treaties, they are enforced, like COCOM, by the national legislation of members. Notice that in this context it is usual to think of suppliers as states, whereas it is companies, often transnational, that do the actual supplying.¹⁹

The natural supplier group—small, dominating a large part of the market, and with no ambiguities about membership—is the P5. These five states began discussions and drew up a set of guidelines; but after the decision by President George Bush Sr. to sell F-16s to Taiwan, China ceased cooperation and has not participated since. Direct export controls are not the only way to restrict arms transfers. The United States bought 21 Moldovan Mig-29 fighters under the Department of Defense (DOD) Cooperative Threat Reduction (Nunn-Lugar) program, to prevent them from being acquired by Iran.²⁰ This program was also used to help persuade Belarus, Ukraine, and Kazakhstan to relinquish Soviet-origin nuclear weapons on their territory.²¹

THEORETICAL ISSUES OF ARMS EXPORT CONTROL

If arms exporters can agree to coordinate their actions, the impact of controls is increased. Thus, collective action and cooperation are more effective in meeting common arms export control objectives than individual action. However, individual states have an incentive to defect from the agreement, as the short-term economic incentives to sell may be more attractive than the long-term security benefits.²² Therefore, export controls contain both “public good” (i.e., non-rivalry, non-excludability) as well as prisoner’s dilemma “cartel stability” components (i.e., there is a joint interest to restrict supply, but an individual interest to cheat if detection can be avoided). These are repeated games; individual suppliers in the group decide whether to abide by the agreement or to defect over a sequence of possible sales.²³

While the game theory literature has not produced robust predictions, it does suggest that five factors affect the outcome of such games: (1) the structure of payoffs; (2) the discount rate or myopia of the agents (i.e., how they weight long- and short-term factors); (3) how well agents can monitor each other’s behavior; (4) the credibility of threats, in particular whether it would be in the

interest of the agent *ex post* to carry out the threat; and (5) the sequence of moves (e.g., whether there is a leader or not). The credibility of the threat to punish defectors can be increased through various forms of precommitment; for example, ceasing certain activities or severing particular relationships can be useful in establishing legitimacy. Leadership plays a central role in creating a coalition and in reaching consensus on particular issues, defined during the negotiations. In the case of export controls, leadership may be provided by small countries that act as facilitators; yet, it is more often provided by large countries, particularly the United States.

One general question that arises in such games concerns the performance of a centralized organization versus decentralized trigger strategies, which punish defection. The most famous of these trigger strategies is the “tit-for-tat” strategy embodied in the concept of the prisoner’s dilemma. One begins by cooperating in the first move and then continues by mimicking the first corresponding move of the opponent (or cooperator, as the case may be).²⁴ The main problem with “tit-for-tat” is that it is vulnerable to imperfect monitoring of whether the other agents are cooperating or defecting.²⁵ In general, trigger strategies do not necessarily enforce the first best cooperative outcome. In addition, states cannot rely on this type of interaction, due to its inherent unpredictability.

Instead, states have chosen to create international organizations to try and solve the collective action problem. The reasons why states choose to act through international organizations are explored by Kenneth Abbott and Duncan Snidal, who noted that international organizations provide centralization (a concrete and stable administrative apparatus managing collective activities) and independence (the authority to act with a degree of autonomy and often with neutrality in defined spheres).²⁶ This autonomy allows organizations to “launder” activities, which would be unacceptable if performed by a single state. International organizations also reduce transaction costs, internalize externalities, gain economies of scale, and pool costs and risks. They can act as trustee, allocator, information provider, and arbiter. Certainly arms export control organizations help share intelligence and operating procedures, usually through a flow from large to small member countries.²⁷ However, supplier arrangements like the WA have almost no autonomy compared to international organizations like the North Atlantic Treaty Organization (NATO) or the International Monetary Fund

(IMF). In the case of export controls, states have so far been unwilling to delegate authority to a centralized agent.

Given that there is a strong case for developing an international organization to oversee arms export controls, the obvious question remains: why are there so many supplier groups performing such closely related tasks? Why is there a patchwork quilt rather than an overarching organization?²⁸ A possible analogy to explain this phenomenon involves numerical problems containing many linked variables and conflicting constraints. In such cases, good solutions to complicated conflict-laden calculations can best be found by breaking the entire problem into non-overlapping domains, patches, with some coupling between the patches.²⁹ Competing organizations that develop unique approaches can share information, so that solutions or practices that work at one can be transmitted to the others, as weapon lists were transferred from the CFE Treaty to the U.N. Register, to the WA. Pierre emphasizes the importance of a composite approach: "...a multifaceted regime with overlapping and complementary institutions and initiatives, none of which may be fully adequate by themselves but which are mutually reinforcing."³⁰ There are two dimensions to the optimal size of an arms export control patch: (1) the range of activities that it controls; and (2) the range of members that it includes. In principle, each margin would be determined by a comparison of costs and benefits of extension. The marginal member or activity would be the one at which the costs of extension just equaled the benefits.

It is worth returning to the distinction between classic arms control and arms export controls.³¹ Todd Sandler and Keith Hartley emphasized two features of classic arms control:

- First, the greater its success in achieving security and stability, the less important it becomes. The 1817 agreement between the United States and Britain to limit naval vessels on the Great Lakes and Lake Champlain is an example; compliance with this agreement has not been an issue in U.S.-U.K. relations.
- Second, arms control is only needed in an adversarial environment. However, in such an environment the level of trust and confidence required to negotiate an agreement rarely exists.

A paradox remains: when achievable, arms control is not needed; and when needed, it is not achievable.³² Arms control exists on this fine line between necessity and achievability. It exists on the edge of chaos, a characteristic of many adaptive systems.³³

Although they now appear to overlap, the origins of arms control and arms export control are quite distinct. Arms control originally involved agreements between enemies, whereas arms export control involved agreements between allies to reduce the military capability of enemies through embargo. Overlap occurs because nominal allies in arms export control (the United States, Russia, and France in the WA, for instance) behave like enemies in arms control agreements.

Classic theories of arms control ask the following: what incentives exist for states to come to an agreement, and what incentives exist for the states subject to the agreement to comply? These incentives are, in fact, a function of the technologies involved, institutional structure, and the verification possibilities. For classic arms control to work, all parties to the agreement must benefit. One must be able to draw up a contract that can be monitored and verified, and there must be penalties for non-compliance. Arms control works easiest where there are a small number of parties involved (easier to negotiate and more likely to benefit all parties); there is an identifiable object (piece of equipment or technology that can be monitored); that object has an unambiguous military purpose; and control of that object restricts destabilizing military capability. Even in the classic framework, there are problems of distinguishing between avoidance and evasion, and between what the parties know and what they can prove. Arms export control, in contrast, tends to involve fairly large numbers of parties, diffuse incentives and punishments, severe monitoring and punishment problems, and poorly identified objects of control that make verification difficult. The problems that COCOM faced were illustrative in each of these respects.

The classic arms control framework does not apply to arms export control, in that the targets of control—potential recipients—are not willing parties to the contract. They are either excluded from agreements, which are between suppliers, or coerced to agree, as was the case with Iraq at the end of the Gulf War. From the demand side, export controls appear to be hypocritical, selective, and discriminatory.³⁴ Recipients may recognize the joint interest of supplier groups in restricting the flow of destabilizing weapons, but they are more likely to accuse suppliers of forming "cartels" to restrict the flow of goods or technology in order to raise prices and maintain military dominance and joint monopoly. Countries, like firms, must choose how to source essential inputs; whether by buying on the open market, within established relationships, or through self-

sufficiency. Restricting supply to recipients alters those choices. Supply restrictions make it more attractive for states to set up their own indigenous arms industry, to develop unconventional weapons, and to use unorthodox methods of transfer, all of which reduce the transparency of arms acquisition.³⁵ Because export control involves the regulation of others rather than cooperation, it tends to reflect the classic forms of the regulatory dialectic characteristic of financial markets. Regulations are avoided and evaded, and then new regulations are required.³⁶

Any control system involves compliance costs, and the costs of export controls fall heavily on commercial firms, which are the potential suppliers. At some stage, compliance costs may outweigh the regulatory benefits for the supplying countries. However, since it is the firms that pay the cost and the government/military that reaps the benefit, states must make a distributional judgment. In the United States, this judgment is sometimes expressed in terms of whether the Department of Commerce or the Department of State has jurisdiction over export controls. Compliance costs were always an issue within COCOM, and when they became too high relative to the regulatory benefits, the system worked poorly. Changing technology, which we discuss below, changes the number of firms that may be able to supply militarily relevant goods and services, changing both regulatory benefits and compliance costs. Traditional approaches to export control may now be infeasible. Michael Moodie argues that non-traditional approaches to control will be needed, "...broadening its scope, increasing its flexibility, simplifying its methods, and enhancing the speed of its accomplishments."³⁷ This may involve a shift from controlling supply, as such, to monitoring the end use and application of the technology in order to stop diversion to military purposes.

Supplier groups usually require unanimity to operate (e.g., to define and change lists, admit new members, etc.). This is almost certainly unavoidable, but raises problems of maintaining speed and flexibility. States may also have incentives to join clubs in order to exploit the unanimity rule by exercising their veto power to inhibit smooth operation of the organization. For instance, some suggested that this was the United Kingdom's main motivation in joining the EU, (the European Economic Community, or ECC, as it was then known). One cannot assume that the desire to join a club signals agreement with its objectives. The slow progress of the WA has raised similar suspicions about the motives of some of its members. Unanimity requirements also mean that change will inevitably be in-

cremental. For example, it may be necessary to first establish procedures and precedents in relatively uncontroversial areas, such as inhumane weapons, and then continue to extend the scope as confidence in the arrangement grows. If such organizations are effective, they may assist in the establishment of a set of norms that maintain compliance.³⁸ Existing arms export control organizations are a long way from establishing strong norms of this sort.

TECHNOLOGY ISSUES

The impact of technology on arms control is not a new problem. The 1922 Washington Naval Treaty restricted the range of Japanese battleships, giving Japan incentives to circumvent the constraint through the development of aircraft carriers.³⁹ COCOM, while not watertight, did raise the cost of gaining technology and weapons for the Soviet Union, but there were problems addressing the export of dual-use technologies and keeping lists updated. Like COCOM, the WA faces continuously changing military technology. If the WA is to have any effect, "...it must at a minimum, identify a set of specific technologies and particular weapons that must not be proliferated."⁴⁰ Furthermore, adjusting to changing technologies is made more difficult by shifting relationships between civil and military technologies, spin-in rather than spin-off, and increasing international economic integration and globalization.

There have been long cycles in the relationship between military and civilian technology. After World War II, military technology was in advance of civilian technology; thus, the military was familiar with the relevant applications of a technology before it was widely adopted by civilians. In certain cases, the military actually restricted the civilian adoption of technology in ways that reduced the potential threat. For example, the military restricted the public adaptation of the global positioning system (GPS) resolution available to civilians, because it controlled all of the satellites.⁴¹ Now that civilian technology is often in the lead, the military may find it better to adopt an operating civilian technology, as it did with the iridium global satellite-communications system. Colonel Robert Weber, program manager for the Defense Information Systems network, a unit of the U.S. DOD, stated, "[t]he DOD used to be a leader in satellite communications. Now everyone has caught on to space.... We'll take advantage of [the private sector's] economies of scale."⁴² Consequences must be addressed when the private sector finds it un-

profitable to provide technology, as was the case with the Iridium satellite system.

There are cases where traditional military technologies (e.g., encryption and simulation) have such important commercial applications that private firms are willing to invest heavily in research and development (R&D) to duplicate the effective knowledge that the military will not release. When there is a large and obvious profit potential, as with cryptography, private R&D may dwarf that of the military. Unhampered by bureaucratic and security restrictions, private R&D may also be more flexible, more innovative, and better organized. In addition, attempts by the military to control the technology are likely to confront major difficulties. Traditionally, dual-use technologies were process technologies, such as the machine tools that Toshiba sold to the Soviet Union, which were used to improve submarine propellers. Now, however, they are often product technologies directly useful in combat. The product may be types of information technology (IT), such as: communications systems like fiber-optic networks; civilian sub-components that can be assembled into weapons; or civilian products, like remotely piloted vehicles designed for crop-spraying, but capable of being used as delivery or reconnaissance vehicles.

The military must constantly consider future technologies and how they may change combat; but usually it focuses on a few critical military-relevant technologies. It is difficult to forecast the tortuous path that must be followed in moving from a technology to a weapons system, then to an appropriate doctrine for its use, and finally to a change in military organization to deploy the new system effectively. Now it is more difficult than ever, as there is a large range of generic technologies that have the capability to revolutionize military affairs. Some of these are familiar but changing rapidly, like biotechnology and IT; others are relatively new, like smart materials, nanotechnology, and high temperature super-conductors. These technologies are being developed with private rather than public funds, often within transnational companies where technology flows globally. Therefore, the technology is also perceived as central to economic competitiveness and export success. By the time the military utility of such technologies has been identified, significant commercial interests may have already developed, making controls more difficult to apply. Even where there are clear technological trajectories, as with Moore's Law, the applications of the technology are unpredictable.⁴³ So-called "killer applications," made possible by Moore's Law, have

been crucial to the diffusion of technologies. Applications such as word-processing and spreadsheets for personal computers and electronic mail on the internet were not predicted in advance by those who understood the technology.

These general changes in technology give rise to three particular sources of military apprehension. The first concerns traditional military products, for example, advanced fighters or precision guided weapons. Competitive pressure in the arms export market means that firms are increasingly selling state-of-the-art equipment. In some cases, the recipients may not have the skills in organization or military doctrine to use these complex systems effectively; in other cases, the systems may be relatively autonomous and simple to use. Argentina, for instance, was unable to adjust its air force tactics (matching altitude of attack with bomb-fusing) or its army tactics rapidly against the United Kingdom during the Falklands/Malvinas War, but it could use an Exocet to destroy a British warship.⁴⁴

The second source of concern is that competitive pressures are forcing the arms industry to transfer technologies as part of the offset requirement for arms deals, thus diffusing military technologies. Unfortunately for the recipients, they often do not have the broader scientific and industrial infrastructure to absorb the technology in a way that allows them to develop their own systems.⁴⁵ Traditional military systems are highly specialized and complex, and even advanced industrial countries have difficulty with the system integration problems involved. In many cases, technology transfer creates dependence, rather than independence.

The third source of concern centers around the innovative military applications of generic civilian technologies; i.e., the military equivalent of the "killer applications." This is the most speculative, but potentially the most dangerous concern: "[o]ne has visions of an Indian software engineer developing a new algorithm that can jam command and control broadcasts, selling it to Iran, which then uses it to bring the U.S. Navy to a halt in the Strait of Hormuz."⁴⁶ It is now common for U.S. software engineers to work on a program during the day, beam it by satellite to India, Israel, or Russia, where another team works on it during the U.S. night and passes it back the next morning. Controlling such technology transfer raises obvious difficulties for traditional export control mechanisms. Predicting such "killer applications" poses even greater problems for traditional intelligence communities,

and the threat from these new technologies will probably be taken seriously only when they are unexpectedly used by a small or revisionist state to change the balance of military power. Having observed the Gulf War and the conflict that occurred in Kosovo, revisionist states might realize that they should not attempt to compete on traditional battlefields, where the United States dominates. Instead, they are likely to turn to asymmetric means of warfare, using generic capabilities that have been widely diffused, rather than traditional military technologies monopolized by the larger military powers.

THE WASSENAAR ARRANGEMENT

With the end of the Cold War, COCOM was no longer viable or legitimate. At a high-level meeting in The Hague on November 16, 1993, members decided to phase out the organization by March 31, 1994. After considerable discussion, the WA was formed, named after the town in the Netherlands where it was provisionally established in 1995. The WA was formally established in Vienna, Austria, in July 1996. It differs from COCOM in its membership and method. Russia and other members of the former Warsaw Pact participate, although China does not; and transparency is a key feature, rather than the secretiveness that surrounds a control regime. The principal goal of the WA is to gather information, which reportedly reveals potentially destabilizing accumulations of weapons or militarily useful dual-use technologies.

Participating states agree to maintain national controls on the transfer of items specified in the dual-use and munitions lists; notify other members of aggregate transfers of munitions to non-participating states; and notify other members of individual cases where licenses to transfer dual-use items are denied. In principle, unlike COCOM, the WA is not directed at any state or group of states; in practice, it is directed at countries whose behavior is a cause for serious concern, particularly Iran, Iraq, Libya, and North Korea. The first operational plenary session was held in Vienna in December 1997. The WA is still a young arrangement, and while this immaturity contributes to its current ineffectiveness, it may make it sufficiently pliable to be shaped in ways that could allow it to evolve into a more effective organization in the future.

Within the WA, the “Big 6” (France, Germany, Italy, Russia, the United Kingdom, and the United States) have agreed informally to meet for more intensive consultations and more intrusive information sharing. This may potentially lead to a subset within the WA. The issue of “opti-

mal composition” is important. In principle, the WA is open to any country that is a producer or exporter of arms or items subject to control; adheres to the NPT, the BTWC, and the CWC; and maintains and applies effective national export controls. The WA, with 33 members as of June 2001, is a fairly large group that lacks the coherence that was provided to COCOM by the shared perception of the Soviet threat. Building a coherent vision of shared interests is important. The WA is a supplier group and will inevitably lack legitimacy on the demand side. According to some, supplier groups are basically cartels with a common interest not merely in preventing the spread of destabilizing arms and technologies, but in restricting supply to raise prices. Such groups are seen by the “have-nots” as an attempt by the “haves” to maintain their monopoly positions in arms and technology. To increase the legitimacy of the WA, important outreach measures to integrate recipient states into the agreement are conducted. Outreach efforts may also include participation in regional restraint discussions aimed at establishing demand-side agreements to stop the diffusion of particular systems or technologies to a region.

At the June 1997 meeting of the General Working Group of the WA, the United States tabled a paper entitled, “Emerging Weapons of the 21st Century.” The paper identified five areas where the United States expects the development and improvement of advanced weapons capabilities within the next 15 to 20 years. These areas included: WMD; long-range precision weapons; reconnaissance, surveillance, and target acquisition systems; counters to precision strike capabilities; and information warfare. The United States argued that these issues were of concern to the WA because of the threat of proliferation of such capabilities through exports, diversion, or the upgrading of existing weapons. U.S. representatives pointed to the danger of increasing the combat capability of states that might deploy them in an irresponsible or destabilizing way.

The traditional method of handling technology change is through a process of list review, where old items are removed and new items added—a process that tends to lag behind very rapid changes in technology. Within COCOM, list review was fraught with difficulties, and lists grew quickly out of date, sometimes due to older technologies that were widely available. Of particular danger are precursor technologies, which present the possibility of vaulting over the traditional stages in the development of militarily useful products and technologies. Presently,

the WA lacks the means to identify such developments; its munitions list includes only the seven categories of the U.N. arms transfer register.⁴⁷ This excludes many munitions, particularly retrofit equipment, which can substantially upgrade the military capability of old tanks, combat aircraft, or warships. Extending the list has been the subject of discussion within the WA recently. Sometimes, though, it is also necessary to pull items off of the list or further define covered technologies that have wide civilian use. For example, at the December 1998 meeting, the control lists were changed to reduce coverage of civil telecommunications and to update controls on encryption.

Different states are subject to different domestic, political, and bureaucratic constraints, as well as varying international perceptions. Several states have expressed fears that the United States, traditionally the dominant supplier, attempts to use controls to further its own interests and to maintain its monopoly. This was a recurring problem within COCOM as well. Despite the fears of U.S. exploitation of its powerful international position, the United States is the natural leader, if only because it exports the most arms. However, the United States, partly because of the constitutionally imposed separation of government powers, has difficulty providing consistent, coherent leadership over long periods. Instead, there is a process of sequential attention to different goals, as different issues become salient in Washington. This myopia has weakened U.S. leadership. Myopia is not just a U.S. problem; France has often appeared myopic due to its focus on short-term economic self-interest at the expense of longer-term common interest.

Another institutional feature that shapes the effectiveness of the arrangement is that, for bureaucratic reasons, the United States, unlike other nations, tends to separate its delegation membership by regime. Rarely do the same persons participate in all of the various arrangements. As a consequence, if items arise at MTCR or AG meetings that are relevant to the WA, the U.S. representative has difficulty in responding on the spot in a meaningful way.⁴⁸ Conversely, the French are quite centralized; if the crucial decisionmaker has not made a decision, the representatives at all of the arrangements must stall the overall decision.

Technology, however, does not respect these artificial boundaries between regimes. The creation of a comprehensive regime combining all of the existing control and information sharing systems would not be sensible. Nevertheless, systematic cross-fertilization and coherent

decisionmaking at the national level would help to transmit insights and increase the pace of decisions in the various arrangements. At an institutional level, the WA must develop an effective monitoring system, including its own IT system to track movements of weapons and sensitive technologies, based on information provided by national participants. This would also increase the autonomy of the WA.

Alternative approaches do exist. Wolfgang Reinicke proposed an innovative arms export control system that operates on a self-regulatory basis at the level of the individual firm, a model derived from financial self-regulatory organizations (SROs).⁴⁹ This would be very different from the traditional WA framework, and it is not clear whether a multilateral system of this sort would be feasible. Relative to finance, far more firms would be involved, and there is no natural definition of the market, since so many technologies can be used for military purposes. In addition, the activities subject to control are not as well defined as in finance, and arms sales are far more politically sensitive than financial transactions. On the logistical side, the monitoring requirements seem to exceed current IT and reporting capabilities. Finally, there is no experience to draw upon with respect to international SROs, even in finance.⁵⁰

In drawing lessons from other arrangements, it is perhaps instructive to observe the progress made by the Anglo-French proposal for a "Code of Conduct for Arms Exports," agreed to by EU Ministers in May 1998. The code outlines eight guidelines to govern the process by which states give licenses; establishes consultation mechanisms between states; and requires all EU countries to submit annual reports on arms exports. The Anglo-French proposal originally faced opposition from other EU members—smaller countries were concerned that the controls were not strict enough and that consultations were only bilateral (between the state that first denied a license and the state considering supplying) rather than multilateral. In the negotiations, the conflicting interests between the main exporters, Britain and France, and the other EU countries were apparent.

GAME THEORY DETERMINANTS

While we cannot make firm predictions about whether the WA will develop into an effective organization, we can identify certain factors drawn from game theory that could be determinant.

The first concerns the structure of payoffs, or incentives. The long-term payoff is the security benefit of a reduction in proliferation. To the extent that the participants share the perception of a serious threat, they will work together and solve the technical problems of control. This is a lesson from COCOM: the Europeans cooperated with the United States best when they perceived a serious Soviet threat. However, it may take more than the Indian and Pakistani nuclear tests to persuade the participants that new technologies pose a serious threat. Rather, it may require the use of a “killer application” by a revisionist power. The short-term payoffs, on the other hand, involve the economic consequences of a sale. At present, economics reward non-compliance, as there are profits to be made from (even potentially destabilizing) sales. There may be scope to design rewards for compliance as was done with the NPT, soliciting Russian adherence to the MTCR, and the denuclearization of the former Soviet Republics.

A second factor is the degree of myopia that states possess, or the discount rate. Myopia may arise for a variety of reasons, since different motivations exist for different countries, as was witnessed in the cases of France and the United States. For the WA to prove successful, the participants must accept short-term economic and political costs in return for long-term security benefits. The relative weight given to the present and the future is thus crucial. An imminent threat, of course, reduces myopia with regard to security consequences. For instance, the Iraqi invasion of Kuwait, and the subsequent discovery of a covert nuclear weapons program in Iraq, increased security concerns among suppliers and motivated them to enhance control. The effect wore off, however. Reviewing the lessons from the conventional arms transfer (CAT) control negotiations, Janne Nolan commented on the danger of “...a permanent ascendance of short-term over long-term interests.”⁵¹

Third, the monitoring capability of the system (or lack thereof) is significant. While the main source of monitoring involves national export control systems and intelligence sources, the WA could increase the degree of transparency by pooling and tracking information. This would also serve to increase shared perceptions of potentially threatening developments in technology, intentions, or capabilities. To do this effectively will require better IT capability and more flexible procedures to identify what should be monitored. Traditional list review procedures to determine what will be monitored are likely to be too

slow. This would require suppliers to delegate authority to the WA, making it a much more autonomous body.

Fourth, the degree of credibility in the system is essential. The continuity of policies and the certainty of consequences must be clear. Each member must know that defection will be detected (monitoring) and punished (credibility), while compliance will be recognized and rewarded. At present, the WA has little credibility.

Finally, the degree of leadership cannot be ignored. In the case of the WA, concerted commitment by the major arms producers would be required—particularly the United States, the United Kingdom, and France—in order to change the structure of payoffs (putting more weight on long-term security consequences); develop an effective monitoring capability; and infuse the arrangement with more credibility and autonomy. Without this commitment, which currently does not exist, it is unlikely that Russia and the smaller producers will cooperate, or that the WA will be effective.

¹ The opinions in this paper are those of the authors and should not be attributed to the U.S. government. Smith is grateful to the Department of Economics, University of Colorado at Boulder for its hospitality during 1997-1998, when most of the work on this paper was done, and to the ESRC for financial support under research grant R00235685 on models of the arms trade. We are also grateful to Mary Ann Casey, Yongmin Chen, Saadet Deger, Paul Levine, and Somnath Sen for comments on an earlier draft.

² Paul Levine and Ron Smith, “The arms trade game: from laissez-faire to a common defence policy,” *Oxford Economic Papers* 52 (2000), pp. 357-380.

³ For a history of COCOM, see Michael Mastanduno, *Economic Containment: COCOM and the Politics of East West Trade* (Ithaca, NY: Cornell University Press, 1992).

⁴ Andrew J. Pierre, ed., *Cascade of Arms* (Washington, D.C.: Brookings for the World Peace Foundation, 1997), p. 398.

⁵ William Keller and Janne E. Nolan, “The Arms Trade: Business as Usual,” *Foreign Policy*, No.109 (Winter 1997-1998), p. 123.

⁶ Useful references are Pierre, ed., *Cascade of Arms*; Robert E. Harkavy and Stephanie G. Neuman, eds., “The Arms Trade: Problems and Prospects in the Post-Cold War World,” *The Annals of the American Academy of Political and Social Science* No. 535 (September 1994); David Mussington, *Understanding Contemporary International Arms Transfers, Adelphi Paper 291* (London: International Institute of Strategic Studies, 1994); Peter van Ham, “Managing Non-Proliferation Regimes in the 1990s,” *Chatham House Papers*, (London: Printer Publishers for the Royal Institute of International Affairs, 1994); and RAND, *Arms Proliferation Policy: Support to the Presidential Advisory Board* (Santa Monica, CA: RAND, 1994).

⁷ These P-5 guidelines are discussed in Pierre, ed., *Cascade of Arms*, pp. 377-380.

⁸ Colin S. Gray, *House of Cards: Why Arms Control Must Fail* (Ithaca, NY: Cornell University Press, 1992).

⁹ Pierre, ed., *Cascade of Arms*, p. 4.

¹⁰ The theory of the decision as to when a country becomes a producer of arms is examined in Paul Levine, Fotis Mouzakis, and Ron Smith, “Arms Export Controls and Emerging Domestic Producers,” *Defence and Peace Economics* 11 (September 2000), pp. 505-531; and Paul Levine and Ron Smith, “Arms

Export Controls and Proliferation," *Journal of Conflict Resolution* 44 (December 2000), pp. 885-895.

¹¹ For a review of the trade of light weapons, see Jeffrey Boutwell, Michael T. Klare, and Laura W. Reed, eds., *Lethal Commerce: The Global Trade in Small Arms and Light Weapons* (Cambridge, MA: American Academy of Arts and Sciences, 1995). For a discussion on the control of light weapons, see Owen Greene, *Tackling Light Weapon Proliferation: Issues and Priorities for the EU* (London: Saferworld, 1997).

¹² See Mastanduno, *Economic Containment*.

¹³ A classic statement of arms control theory can be found in Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control* (New York: Twentieth Century Fund, 1962). Gray provides a fundamental critique of the whole activity. See Gray, *House of Cards*.

¹⁴ The economics and security trade-offs and their implications for control have been analyzed in the context of formal models. See Paul Levine and Ron Smith, "The Arms Trade and Arms Control," *Economic Journal* 105 (March 1995), pp. 471-484; and Paul Levine and Ron Smith, "The Arms Trade," *Economic Policy*, No. 25 (October 1997), pp. 335-370.

¹⁵ The early development of EU policy is reviewed in Paul Cornish, "The Arms Trade and Europe," *Chatham House Papers* (London: the Royal Institute of International Affairs, 1995).

¹⁶ These agreements are described in Stockholm International Peace Research Institute (SIPRI), *SIPRI Yearbook, Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 1999), Annex A.

¹⁷ The term "regime" has a specialized meaning in international relations theory; for instance, see Mastanduno, *Economic Containment*, p. 5. He states, "By 'regime,' I mean a set of rules, norms and expectations around which actors' expectations converge in a given issue area." It is a subject of dispute as to whether these agreements are regimes in this sense, so we have avoided the term. For a discussion on what an arms control regime might involve, see Pierre, ed., *Cascade of Arms*, Ch. 15. For Levine and Smith, a regime is used to denote particular combinations of forms of coordination. See Levine and Smith, "The arms trade game."

¹⁸ Alexander A. Pikayev, Leonard S. Spector, Elina V. Kirichenko, and Ryan Gibson, *Russia, the US and the Missile Technology Control Regime*, *Adelphi Paper* 317 (London: International Institute for Strategic Studies, 1998).

¹⁹ For a discussion of the implications of this, see Wolfgang H. Reinicke, "Cooperative Security and the Political Economy of Nonproliferation," in Janne Nolan, ed., *Global Engagement: Cooperation in the 21st Century* (Washington, D.C.: Brookings Institution, 1994), pp. 175-234.

²⁰ See Wade Boese, "US Buys Moldovan Aircraft to Prevent Acquisition by Iran," *Arms Control Today* 27 (1997), p. 28.

²¹ A formal analysis of such measures is given in Philippe Jehiel, Benny Moldovanu, and Ennio Stacchetti, "How (Not) to Sell Nuclear Weapons," *American Economic Review* 86 (September 1996), pp. 814-829.

²² The magnitude of such economic benefits to the supplier states is a matter of dispute. Commercial confidence requires that little of the detail is disclosed, and the contracts are very complex, involving subsidized R&D, soft credit, and offsets. Firms clearly make profits, for they would not accept the contracts otherwise; but these profits may come from supplier subsidies and not recipient payments. For a discussion of financial aspects of the arms trade, see Joel L. Johnson, "Financing the Arms Trade," in Harkavy and Neuman, eds., *The Arms Trade*, pp. 110-121. Trends in the mid-1990s are reviewed in George Anayiotis and Nancy Happe, "Recent Trends and the Financing of the Arms Trade," *Peace Economics, Peace Science and Public Policy* 4, No. 4 (1997), pp. 1-30. The costs and benefits of offsets are discussed in Bernard Udis, *Offsets in Defense Trade: Costs and Benefits*, unpublished NATO Research Report, 1994. See also Bernard Udis and Keith E Maskus, "Offsets as Industrial Policy: Lessons from Aerospace," *Defense Economics* 2 (1991), pp. 151-164.

²³ Such collective action problems are discussed in Todd Sandler, *Collective Action* (Ann Arbor, MI: University of Michigan Press, 1992); and Todd Sandler, "Arms Trade, Arms Control and Security: Collective Action Issues," *Defence and Peace Economics* 11 (September 2000), pp. 533-548.

²⁴ See Robert Axelrod, *The Evolution of Cooperation* (New York: Basic Books, 1985).

²⁵ Robert Axelrod, *The Complexity of Cooperation*, Princeton Studies in Com-

plexity (Princeton, NJ: Princeton University Press, 1997).

²⁶ Kenneth W. Abbott and Duncan Snidal, "Why States Act Through Formal International Organizations," *Journal of Conflict Resolution* 42 (February 1998), p. 9.

²⁷ The dynamics of the international negotiations involved are discussed in Fen Osler Hampson and Michael Hart, *Multilateral Negotiations: Lessons from Arms Control, Trade and the Environment* (Baltimore, MD: The Johns Hopkins University Press, 1995).

²⁸ A framework for examining the relationship between the various patches is given in Robert E. Harkavy, "Harmonizing Policies across Arms Control Domains: Dilemmas and Contradictions," in R. E. Harkavy and E. Kolodziej, eds., *American Security Policy and Policy Making: The Dilemmas of Using and Controlling Military Force* (Lexington, MA: Lexington Books, 1980), pp. 129-147.

²⁹ For a non-technical discussion, see Stuart Kauffman, *At Home in the Universe* (Oxford: Oxford University Press, 1995), Ch. 11.

³⁰ Pierre, ed., *Cascade of Arms*, p. 428.

³¹ There are of course cases where they overlap, and some arms transfer negotiations with the Soviet Union or Russia involve very traditional elements. Two examples are: (1) the U.S.-Soviet negotiations on conventional arms transfer (CAT) control, discussed in Janne E. Nolan, "The U.S.-Soviet Conventional Arms Transfer Negotiations," in Alexander L. George, Philip J. Farley and Alexander Dallin, eds., *U.S.-Soviet Security Cooperation: Achievements, Failures, Lessons* (Oxford: Oxford University Press, 1988), pp. 510-523; and (2) the U.S.-Russian negotiations on the MTCR, described in Pikayev et al., *Russia, the US and the Missile Technology Control Regime*.

³² Todd Sandler and Keith Hartley, *The Economics of Defense* (Cambridge: Cambridge University Press, 1995).

³³ See Kauffman, *At Home in the Universe*. See also Gray, *House of Cards*.

³⁴ Michael Moodie, "Constraining Conventional Arms Transfers," in Harkavy and Neuman, eds., *The Arms Trade: Problems and Prospects*, p. 136.

³⁵ For discussions on the use of black and gray markets to acquire arms, see Aaron Karp, "The Rise of Black and Gray Markets," in Harkavy and Neuman, eds., *The Arms Trade: Problems and Prospects*, pp. 175-189; and Michael T. Klare, "The Subterranean Arms Trade: Black-Market Sales, Covert Operations and Ethnic Warfare," in Pierre, ed., *Cascade of Arms*, pp. 43-71

³⁶ See Reinicke, "Cooperative Security."

³⁷ Moodie, in Harkavy and Neuman, eds., *The Arms Trade*, p. 132.

³⁸ See Axelrod, *The Complexity of Cooperation*, Ch. 3; Robert D. Cooter, "Law from Order: Economic Development and the Jurisprudence of Social Norms," in Mancur Olson and Satu Kahkonen, eds., *A Not So Dismal Science* (Oxford: Oxford University Press, 2000), Ch. 9.

³⁹ For a discussion of the treaty, see Cassidy B. Craft, "An Analysis of the Washington Naval Agreements and the Economic Provisions of Arms Control Theory," *Defence and Peace Economics* 11, No. 2 (2000), pp. 127-148. For military technology and the arms trade, see W. Seth Carus, "Military Technology and the Arms Trade: Changes and Their Impact," in Harkavy and Neuman, eds., *The Arms Trade*, pp. 163-174.

⁴⁰ William Keller and Janne E. Nolan, "The Arms Trade: Business as Usual," *Foreign Policy*, No. 109 (Winter 1997-1998), pp. 123-124.

⁴¹ See Irving Lachow, "The GPS Dilemma: Balancing Military Risks and Economic Benefits," *International Security* 20 (Summer 1995), pp. 126-148.

⁴² *Wall Street Journal*, January 26, 1998, p. B4.

⁴³ Moore's law: that the number of components on a chip or computer power per dollar doubles every 18 months. Moore proposed this concept in 1965, and it still seems to hold, though it must hit physical limits eventually.

⁴⁴ For a discussion about the failure of the MTCR to control cruise missiles, see Dennis M. Gormley, "Hedging Against the Cruise Missile Threat," *Survival* 40 (Spring 1998), pp. 92-110.

⁴⁵ See Stephen Martin, ed., *The Economics of Offsets: Defense Procurement and Countertrade* (London: Harwood, 1996); and Joanna Spear, "The Role of Offsets in the International Arms Trade," paper presented at the ISA Annual Meeting, Toronto, April 1997.

⁴⁶ For an example, see David Silverberg, "Global Trends in Military Production and Conversion," in Harkavy and Neuman, eds., *The Arms Trade*, p. 126.

⁴⁷ Battle tanks, armored combat vehicles, large caliber artillery systems, combat aircraft, attack helicopters, warships, and missiles/missile launchers.

⁴⁸ For a discussion on the limitations of the U.S. export control process, see RAND, *Arms Proliferation Policy*, Chapter 7. For a discussion on the impact of bureaucratic disputes on the CAT, see Nolan, "U.S.-Soviet Conventional Arms Transfer Negotiations."

⁴⁹ See Reinicke, "Cooperative Security."

⁵⁰ We should note, however, that in a more recent work, Reinicke has presented a devastating critique of the structure and functioning of the WA and

indicated how a more fully developed version of his model might work to correct these deficiencies. See Wolfgang H. Reinicke, *Global Public Policy: Governing Without Government* (Washington, D.C.: Brookings Institution Press, 1998), pp. 173-217.

⁵¹ See Nolan, "U.S.-Soviet Conventional Arms Transfer Negotiations," pp. 510-523.