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NATIONS PURCHASE WEAPONS TO DEFEND and advance state interests, but the decision to acquire any major weapon system must also consider the economic impact, for at least two reasons. First, weapons are purchased with the taxpayers' money and must therefore be justified politically. Political justification often requires being able to point to the benefits of an acquisition for the domestic economy. Second, nations seek to preserve a defense industrial base, a collection of industries capable of producing weapon systems or parts thereof, so as to minimize dependence on other nations for essential arms. These defense industrial bases need to produce if they are to be sustained.

The perceived need for defense acquisitions to provide economic benefits and to support a defense industrial base can lead governments to maintain entire industries. For example, Sweden, a nation of approximately nine million people, produces expensive high-technology fighter aircraft. Israel, an even smaller nation of five million, built the Kfir fighter and sought to produce the Lavi, a very expensive, state-of-the-art aircraft. Even when a government has decided to buy military equipment from a foreign source, however, it often seeks to negotiate *offsets*—a collective term for various industrial and commercial concessions extracted from sellers by foreign governments or firms as conditions for purchasing military exports.[1] Examples include coproduction, licensed

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production, subcontractor production, overseas investment, technology transfer, and countertrade.[2] Offsets may be implemented in three ways or combinations of them: directly (an agreement that components for the items being purchased will be produced within the country buying them), "semidirectly" (an agreement that the vendor will incorporate components produced by the purchasing nation in items sold to third countries or even domestically), and indirectly (all other types of economic activity that the purchasing nation agrees to "count" towards the seller's offset obligation).[3] Of these three types of offset, the direct and semidirect are of the most concern, because they affect the production and cost of the item being acquired and may have long-term effects on the ability of the original vendor to sell it, either domestically or abroad. While indirect offsets may have an important aggregate economic effect, it is difficult to measure the effect of any individual indirect offset.

The amount of money being spent worldwide on armaments has declined as a result of the end of the Cold War.[4] This decline has resulted in economic pressures on weapons manufacturers and has heightened national concerns about preserving defense industrial bases.[5] Hence the economic and military effects of offsets have become more important than ever. Balancing the efficient development and production of weapons with the need to allocate economic benefits equitably will be a growing, yet difficult to achieve, priority for governments and contractors. This article describes the effects of several well known offset transactions, reviews how governments have sought to procure weapon systems at reasonable cost while justifying politically the acquisition from foreign suppliers, describes the half-hearted efforts of the U.S. government to limit offsets in transactions financed by its own money, then suggests some measures for achieving a better balance between efficiency and political acceptability.

Offsets become a public policy concern for the nation of the vendor for the same reasons that the purchasing nation asks for them in the first place. First, offsets reduce the money that flows into the seller's nation as a result of the sale, thus reducing the economic advantage from it and affecting the balance of trade with the purchasing nation.[6] Second, an agreement to produce all or part of a weapon system elsewhere may reduce a nation's defense industrial base. Part of this concern involves technology transfer, that is, selling one's defense or industrial secrets to actual or potential competitors. Third, the purchasing nation may pass on weapons, parts, or technology to nations unfriendly to the nation of the original vendor. On the other hand, although the vendor's nation and the purchasing nation have clearly conflicting interests when offsets are negotiated, keeping the cost of the weapon system reasonable is a large unifying interest. Certain offsets, like coproduction (discussed below), may raise costs significantly

and, if they result in seriously inefficient production arrangements, reduce the number of weapons that can be purchased.

Coproduction: The Most Visible Offset

Of all the types of offset, coproduction has the greatest and easiest to measure economic effect, since it affects the cost of the very item being acquired. Offsets such as countertrade have an overall economic effect and may even have devastating impact on small or localized industries, but, in general, their effects are more diffuse and difficult to measure than those of coproduction. Coproduction is an arrangement that enables a foreign company to acquire the know-how to manufacture or assemble, repair, maintain, and operate all or part of a defense item. It may be implemented either directly between governments or through specific licensing arrangements by designated commercial firms. Coproduction arrangements may include codevelopment: an agreement to design and develop a new or modified model of equipment in the expectation that it will eventually be produced.[7]

Vendors and their nations resist coproduction. Firms have little incentive to set up potential rivals in foreign countries and possibly lose sales both in their customers' countries and in others in which the latter may market their new products; their nations have the same concerns, since coproduction may have adverse balance-of-trade implications and reduce the domestic defense industrial base. Nevertheless, the immediate economic gains to the vendor resulting from the sale, coupled with the economic benefits for the purchasing nation and its industrial base of insisting on coproduction, are so substantial that coproduction remains a popular form of offset.[8]

An illustration of coproduction is the agreement between McDonnell Douglas and British Aerospace for the former to build T-45A Goshawks for the U.S. Navy; these jet trainers are a variant of the British Hawk aircraft. While British Aerospace would have preferred to be the direct supplier, that arrangement would have been politically unacceptable to the U.S., because of the number of aerospace industry jobs involved and the cost of the contract. On the other hand, by accepting McDonnell Douglas as a coproducer, British Aerospace secured a valuable contract that included production and delivery of parts of the T-45A airframe and engine, as well as the licensing fee.[9]

Acquisition Costs. Coproduction almost always raises costs.[10] The vendor already has production facilities and arrangements with subcontractors and suppliers; if simply acquiring the item for the least cost were the objective, buying "off-the-shelf" would be the solution. The U.S. itself ordinarily insists on eventual domestic manufacture of systems that it acquires from vendors in

foreign countries. The T-45A is one example; two others are the Beretta M-9 pistol and the Fabrique National M-249 squad automatic weapon. While these arrangements have the potential for inefficiency, the American military market is so large that its facilities can ordinarily attain the economies of scale necessary to avoid dramatically increased costs. When the purchasing country seeks to replicate all or some of these production assets, inefficiencies arise.[11] For relatively simple items such as ammunition, coproduction may not raise costs significantly, since the acquiring nation can achieve the economies of scale necessary to produce efficiently.[12] For a technologically sophisticated system, however, acquisition costs can rise dramatically.

One good example is the Egyptian M1A1 tank. The reasons for coproduction were largely political. In the early 1980s, Egypt decided to modernize its army by procuring a new main battle tank. Egyptian officials, noting that Israel, India, and Brazil all produced (or proposed to produce) tanks, decided that Egypt, as the most populous country in the Arab world, should do so also.[13] In August 1984, General Dynamics and the government of Egypt signed a $150 million contract, financed by U.S. foreign military assistance, for a tank factory; Egypt spent an additional $605 million to build it. When Cairo approached Washington with its proposal to coproduce the M1A1, the existence of the plant, and the fact that the Egyptians saw in tank coproduction an important indicator of American support, caused the U.S. government to agree.[14] In the end, coproducing tanks in Egypt raised the cost of each M1A1 from $3.6 million to $5.2 million.[15]

This U.S.-Egyptian coproduction program is by no means unique in raising costs. Japan will spend about twice the money per plane to acquire its FS-X fighter ($61 million apiece in 1988 dollars) than it would have cost to buy an equivalent number of U.S.-built F-16s ($28 million apiece).[16] The Japanese government chose this course of action for reasons of industrial development and political acceptability. In the late 1970s the Japan Defense Agency began considering replacing its fleet of domestically produced F-1 fighters. The U.S. Department of Defense sought to persuade the Agency to purchase a U.S. aircraft off the shelf, but in 1985 the Japanese Technical Research and Development Institute announced that Japan possessed the domestic capability to develop an advanced fighter, except for the engine. From that point on, American efforts turned toward convincing the Japanese to codevelop an aircraft with the U.S.[17]

Other Management Problems. If coproduction had only the effect of raising acquisition costs, it would be just another example of the triumph of economic and political goals over narrow cost-effectiveness. In addition, to the extent that a purchasing nation spends its own funds, it is not of overriding concern to the United States whether or not that nation obtains maximum military efficiencies

in its defense expenditures. But coproduction arrangements pose other problems that *do* directly affect the U.S.: the security implications of any transfer of hardware or technology beyond the nation originally acquiring them, and the security and economic effect of both the loss of sales and the establishment of foreign competitors.

Transfer problems result when foreign governments or contractors do not honor limitations that the U.S. government imposes on transfers of the products of coproduction efforts to additional nations. The U.S. has had only limited success in enforcing such restrictions. For example, according to a 1971 Memorandum of Understanding (MOU) between the United States and the Republic of Korea for the coproduction of M-16 rifles, Korea agreed not to transfer rifles or components to third parties without American consent. Nonetheless, according to a General Accounting Office (GAO) study, Korea manufactured more M-16s and components than were permitted by the MOU and sold them.[18] The problems of unauthorized transfer experienced by the Korean M-16 coproduction program are not isolated. In a review of eighteen U.S. military coproduction arrangements with six nations, the GAO found that unauthorized sales had occurred in five programs governed by MOU's and in several governed by Letters of Offer and Acceptance. The GAO found that controls over coproduction were weak and that the U.S. had little ability to verify production quantities or final destinations.[19]

Technology transfer issues arise when the U.S. government seeks to limit the knowledge and skills that the vendor can transfer to the acquiring nation as part of a coproduction arrangement; when it seeks to keep the transferred technology out of the hands of countries other than the immediate recipient; or when the U.S. insists on rights to technology developed during the course of the effort. The nation and company receiving the U.S.-developed technology would, naturally, prefer to have unlimited rights to use and transfer it and to be able to protect any technology developed during the coproduction effort.

Technology transfer issues became the dominant concern in the U.S.-Japanese FS-X codevelopment.[20] Although the United States pressured Japan to codevelop and coproduce an aircraft in conjunction with an American company, the agreement to do so raised fears that the Japanese company's acquisition of aerospace technology would produce a significant competitor, possibly undermining the American aerospace industrial base.[21] The concern raised by members of Congress and various agencies caused President George Bush to order, in February 1989, an interagency review of the FS-X agreement. This review resulted in clarifications that increased safeguards for American technology transferred to Japan, and it confirmed U.S. access to technology developed by Japanese industries during the course of the project. Despite these modifications, concern that the Japanese aerospace industry would use the FS-X

program to compete with American firms continued to generate strong opposition, and the program only narrowly missed being disapproved by Congress.[22] The FS-X was unusual in that the U.S. was particularly insistent that it be permitted access to technology developed by the Japanese.[23] Whether Japan ever produces an aerospace industry that realizes the fears of FS-X codevelopment opponents, and to what extent the codevelopment effort will have played a role in its doing so, are questions that only time will answer.[24]

The cumulative effect of offsets on the U.S. defense industrial base has been debated. One economic model, developed by Data Resources Incorporated for the Office of Management and Budget, concluded that export sales increased the real output of the top thirty American defense industries, even after factoring out the offset effects.[25] However, at least one microeconomic example, the U.S.-Egyptian M1A1 tank, suggests that offsets may have an adverse effect on the domestic defense industrial base.[26] While the U.S. did sell twenty-five complete tanks to Egypt and components for an additional 499 built in Egypt, thus extending worker employment on the domestic M1A1 production line, General Dynamics' own study estimated that coproduction of tanks would, over the long run, significantly reduce American jobs.[27] While coproduction was preferable to selling no tanks at all, it was largely financed by U.S. security assistance funds; Egypt would have had difficulty arranging similar foreign funding for another tank from a manufacturer of a different nation.[28] In fact, one of Egypt's stated objectives was to produce spare parts for export to other countries that use the M1A1. As long as the Egyptian plant stays in the parts business, it will compete with U.S. firms.

It is difficult to predict the effect of an offset, even one like coproduction, on the defense industrial base of either nation. There are simply too many factors, and subsequent efforts to expand the program may succeed or fail depending on matters that, like the market, are beyond the control of either country.[29] Nevertheless, the inherent risk of coproduction—that of setting up a potential rival—is always present.[30]

A peculiar situation exists for American contractors selling to nations that receive U.S. foreign military assistance.[31] Governments receiving such assistance (largely Israel and Egypt) often seek to obtain offsets even though the money for the purchase has come from the United States itself. The incongruity of U.S. money being used to extract concessions from domestic contractors has led Washington to try to eliminate offsets in transactions based on foreign military financing, but these efforts have been a good example of exceptions swallowing the rule. On 16 April 1990 the Bush administration issued a policy that "U.S. government funds should not be used to finance offsets in security assistance sales except in accordance with currently established policies and procedures." While

this language appeared to solve the problem, the fact that "established policies and procedures" permitted such offsets meant that matters continued just as before. Congress subscribed to this "non-policy" by incorporating it verbatim in the Defense Production Act of 1992.[32] The persistence of offsets that work to the clear economic disadvantage of the U.S.—transactions financed by the U.S. government itself—is an excellent example of the "problem of the commons": *all* American contractors would be better off if offsets in transactions funded by foreign military financing were eliminated, but each individual contractor continues to offer offsets in order to compete for the foreign military financing that is available.

Attempts to Rationalize Offsets

The fact that offsets cause such problems as those described is not news, and most companies prefer to avoid them. However, because the arms market is very competitive, most find that to sell military systems they must offer acceptable offset packages; accordingly they resist government efforts to limit them.[33] Companies contend that restricting their ability to offer offsets puts them at a competitive disadvantage, an argument generally accepted by the U.S. government.[34] Congress has, however, acted to prohibit American contractors from offering to pay third parties to buy from the original foreign customer.[35]

One effort to rationalize offsets—by developing an economically sound equivalent for them—has been the activity of the Independent European Program Group, or IEPG (now the Western European Armaments Group) to develop an integrated European armaments market.[36] In 1986 an IEPG report, *Towards a Stronger Europe*, identified the need for *juste retour*, a fair return, in the form either of technology transfer or work sharing (that is, the ability to produce some portion of the system domestically in order to obtain some direct, immediate economic advantage from the transition) for a purchasing country's investment in a weapons program. While the concept of *juste retour* is similar to offsets in that it seeks to confer an economic benefit on a nation acquiring military systems from another, it differs in operating on a broad, long-term basis rather than project by project. To substitute *juste retour* for offsets, the IEPG members agreed that national contracting procedures would remain in place but that awards would be based on "the most economic offer," regardless of the bidder's country. The proposed criteria included not only price and fulfillment of technical specifications but also the maintenance and strengthening of the European technological and industrial base, *juste retour* (how production of the system would be allocated within the IEPG membership), technology transfer issues, the interests of countries with developing defense industries, and life-cycle costs.[37] The IEPG made gradual progress toward improved cross-border

contracting within Europe. The post–Cold War efforts of its successor, the Armaments Group, however, have been delayed by the reluctance of Western European Union members to risk large layoffs in their defense industries, and also by the slow process of restructuring Europe's security organizations.[38]

Is the idea of *juste retour* as part of a large system of transnational contracting superior to offsets? Offsets are negotiated between two knowledgeable parties and can be tailored in a variety of ways to accommodate differing interests, subject to the approval of the governments involved. The Armaments Group system, by contrast, seeks to fit each proposed transaction into an already existing pattern of defense contracts and related trade. It requires a bureaucracy to implement and has all of the disadvantages associated with attempts to manage any sort of economic activity.[39] Moreover, it may be difficult to allocate work shares to the satisfaction of the governments. For example, a nation is unlikely to forego participation in high-technology electronics projects in exchange for a high work share in entrenching tools, no matter how lucrative the manufacture of picks, spades, and shovels may be. Finally, *juste retour* is merely one aspect of a set of reforms designed to lead to a European Defense Equipment Market, a market guided by the principle that an industry from any member country should have equal opportunity to bid for contracts offered by any other member country. Because of difficulties with other portions of the Armaments Group agenda, it may never be successfully implemented.

Despite the drawbacks of *juste retour*, it does have advantages over transaction-specific offsets. First, defense trade is and has been anything but laissez-faire.[40] Interests of national security, balance of trade, and industrial bases constantly influence proposed transactions; the only question is how this influence is to be managed. Second, as discussed, there are difficulties associated with two forms of offset, coproduction and technology transfer. Other forms of offsets also raise problems, although the effects are more difficult to measure and assess.[41] *Juste retour*, by contrast, helps to achieve more efficient development and production, while conferring economic benefits on the participants. It can consider the region-wide effects of sales and technology transfers, and it can produce arrangements more understandable than (often very confusing) offset agreements. A fair test of *juste retour* as a generally available alternative to offsets will apparently have to wait until a European Defense Equipment Market has been established and develops a track record of managing the details of cross-border weapon development and production.

In addition to the efforts of the IEPG and the Armaments Group to establish a more open market for defense equipment within Europe, there has been at least one proposal to expand the idea of an open defense market beyond a single region. In March 1990, the U.S. ambassador to Nato, William Taft, proposed creation of a structure modeled on the General Agreement on Tariffs and Trade

(better known simply as the GATT).[42] Its members would include the Nato nations plus Japan, South Korea, and Australia. The "defense GATT" would have an agreed code of conduct limiting protectionist practices, eliminating tariffs on defense goods, and establishing dispute settlement mechanisms.

The Nato Conference of National Armaments Directors established a special task group in October 1990 to examine Ambassador Taft's proposal. Its initial report, published in March 1991, reflected the different ideas of the Nato members on the respective roles of government and the market in governing defense production and trade. The report identified both the potential benefits and problems of a defense GATT; the key constraint mentioned was the limited amount of defense trade among Nato allies. It offered four options, ranging from a simple code of conduct to a Nato purchasing agency.

In July 1991 the North Atlantic Council established a group to continue studying the issue and develop the code of conduct recommended by the task group report. In addition, the new Council group attempted to gather statistics on the size and destinations of the arms exports of Nato members—a difficult task since on that subject most nations are even more secretive than the U.S.[43] By January 1992 the Council group had a proposed a code with a provision very similar to the IEPG's *juste retour*.[44] The effort toward a defense GATT has, however, been slowed by the same factors that have impeded the efforts of the Armaments Group, as well as by the fact that the United States is a member of neither the Western European Union nor the European Union. It is unlikely that the idea of a defense GATT can be realized until significant progress is made toward a European Defense Equipment Market. It should be noted, however, that American manufacturers fear that the development of such a regional market will shut them off to a significant degree from European sales.[45]

A Worthy Goal But a Major Challenge

While nations have always had to consider the economic consequences of decisions on whether and how to acquire weapons, those considerations will become even more important in the future. The market for armaments is shrinking at the same time that weapons are growing more sophisticated and consequently more expensive. Left unaddressed, these factors lead to acquisition arrangements such as coproduction that drive costs even higher. Moreover, the efforts of individual nations, including the U.S., to maintain domestic defense industrial bases tend to produce fragmented and inefficient industries, causing even higher costs.

Such problems lend themselves to supranational solutions. The idea of apportioning defense development and production so that every nation receives some economic benefit, while costs of development and production are kept

reasonable, has led to efforts by the IEPG, the proposal for a defense GATT, and the idea of a European Defense Equipment Market.[46] These ideas are worthwhile, but they suffer from being essentially regional efforts to rationalize a worldwide market. European efforts to develop jointly very sophisticated weapon systems (e.g., Eurofighter 2000, the Tiger helicopter, and the Future Large Aircraft) have had major difficulties; in general, any European armaments program that ignores the United States appears highly unrealistic.[47]

If regional efforts to develop an integrated arms market are problematic, perhaps a worldwide defense GATT is possible. Any proposal for a large-scale defense trade agreement, however, runs afoul of the nature of armaments themselves: they are designed to be used *against* other countries—one buys them if one assumes that some other nation or nations may have to be resisted forcibly. States will not accede to the production even of parts of essential weapons in countries that may be hostile, nor have they any incentive to lower weapon acquisition costs for such states. On the other hand, if a worldwide defense GATT is unworkable, one less than worldwide may be seen as threatening by nations left out.[48] If the cost of sophisticated weapons can be reduced through a system that substantially reduces redundant production facilities, more such weapons can be purchased for a given amount of money—which, even without overt threats, could increase tensions.

Consequently, if efforts to replace offsets with a broader system of apportioned work shares are not likely to yield positive results in the near future, what should the United States do here and now? Several approaches that could reduce the inefficiencies associated with offsets should be tried. First, the U.S. should continue to encourage domestic manufacturers as well as other governments to avoid offsets, especially when they result in conspicuously uneconomical production. While rhetoric may not change behavior immediately, the fact that offsets often lead to substantial inefficiencies needs to be emphasized. Second, offsets should not be permitted in contracts financed with U.S. foreign military funds. It is bad enough for American contractors to have to agree to economically irrational offsets in order to win a contract; it should be intolerable for the U.S. government to provide the money that enables foreign governments to require them. Third, the U.S. should not insist on domestic production of weapon systems if it raises costs significantly and if the reliability of the supplier can be reasonably assured. Finally, the United States should encourage the development of supranational armaments markets in which *juste retour* is substituted for offsets. The fact that there are problems with the idea of a defense GATT—just as GATT itself has problems—does not mean that improved rationality in weapons development and production should not be pursued. Nations nervous that other countries belong to a defense GATT could be encouraged to qualify for membership themselves by changing their behavior. While weapon acquisition,

by its very essence, can probably never be made fully rational economically, its high costs make even partial success a worthy goal. Until the day when nations compete to "beat their swords into plowshares, and their spears into pruning hooks," balancing the tension between efficiency and equity in foreign defense acquisitions will be a major challenge to national leaders, military officials, and contractors.

Notes

1. A good definition of offset is contained in U.S. General Accounting Office (hereafter GAO), *Defense Production Act: Offsets in Military Exports and Proposed Amendments to the Act* (Washington: April 1990), p. 1, fn. 1.

2. "Countertrade" refers to economic transactions in which something other than cash is accepted in payment for goods. It can be as simple as barter but often becomes more complicated, because the original seller must dispose of commodities received. In one example, U.S. contractors financed the establishment of a Greek corporation that in turn invested in companies engaged in medical diagnostics, sportswear, wire-bending machines, financial services software, and textiles. In another example, American contractors used brokers to link buyers with foreign commodities sellers in Israel, Turkey, and Greece; the commodities included wiring, petroleum, and chemicals. GAO, *Military Exports: Concerns over Offsets Generated with U.S. Foreign Military Financing Program Funds* (Washington: June 1994), p. 19. Coproduction is discussed below. Licensed production is the grant of a right by a holder of a patent, copyright, or other legal right to another person to engage in production that would otherwise constitute an infringement of the patent, copyright, or other legal right.

3. J.A. Kirtland, *Offsets: What They Are, Why We Do Them*, handout distributed at a conference in Washington, D.C., on the Globalization of the Aerospace and Defense Industries and the Role of Offsets (hereafter Globalization Conference), 5 March 1990, p. 6. See also Joseph Kelley, GAO, "U.S.-Korea Fighter Coproduction Program," testimony before the Subcommittee on Investigations of the Committee on Armed Services, U.S. House of Representatives, 4 April 1990, p. 7. For descriptions of the offset arrangements in the sale of F/A-18s to Malaysia, Switzerland, and Finland, see Jeff Cole and Sarah Lubman, "Bombs Away: Weapons Merchants Are Going Great Guns in Post–Cold War Era," *The Wall Street Journal*, 28 January 1994, p. A6. For the Malaysian offset transaction, "Malaysian Modernization," *Armed Forces Journal International*, October 1994, pp. 62, 65. The controversy associated with the Finnish transaction is described in Jeff Cole, "Pentagon Contractors Often Offer Cash to Help Foreign Firms Compete in the U.S.," *The Wall Street Journal*, 7 May 1993, p. A4. The indirect offset is especially important, yet difficult to evaluate because it may allow the exporter to count already existing activities toward an offset requirement; it may also allow "multipliers," that is, credits toward an offset obligation reflecting the economic effect of a given amount of money spent in the purchasing country. For example, General Instrument Company claimed to have received $1 million in offset credits for having spent $100,000 in South Korea as part of a contract to sell radar warning equipment to that nation. (Author's notes, presentation of Michael Stephen of General Instrument Company, 5 March 1990, Globalization Conference.) A description of how offsets benefit a nation receiving them is contained in Grant Hammond, "Offset, Arms, and Innovation," *The Washington Quarterly*, Winter 1987, p. 179. Examples of all three types of offsets are contained in GAO, *Military Exports: Concerns over Foreign Military Financing*, pp. 18–9.

4. For a description of the effects of the end of the Cold War on the defense industry, see Gary Pagliano, *Defense Industry in Transition: Issues and Options for Congress*, Congressional Research Service Issue Brief, 11 January 1994, pp. 1–4.

5. The effect of defense cutbacks on defense industries and on the export efforts of defense firms and governments is described in "World Market Forces Improved Military Exports," *Aviation Week & Space Technology* (hereafter *AWST*), 14 February 1994, pp. 55–6; and John Tirpak, "Army Aiding Foreign Sales," *AWST*, 9 May 1994, p. 76. One possible response to the shrinking defense market, cross-border mergers, is discussed in John Tirpak, "Next Stop: International Defense Consolidation," *AWST*, 24 October 1994, p. 57.

6. Concerns about the balance-of-trade effects of offsets become especially acute when a vendor agrees to an obligation *in excess* of the amount of the contract, as Boeing did in its sale of Awacs aircraft to the United Kingdom. (F. Clifton Berry, Jr., "British Offset Policy," *National Defense*, May/June 1989, p. 32.)

7. GAO, *Technology Transfer: Japanese Firms Involved in F-15 Coproduction and Civil Aircraft Program* (Washington: June 1992), p. 1.

8. The first instances of coproduction involving American defense contractors were the F-104 Starfighter aircraft and the Hawk antiaircraft missile systems, with European nations in the late 1950s. (Leo G.B. Welt, "Military Offsets," *National Defense*, March 1984, p. 21.) Further examples include the Turkish F-16 fighter, pursuant to a contract with General Dynamics (Cole and Lubman, p. A7); South Korean M-16 rifles, with Colt Industries (GAO, *U.S.-Korea Coproduction: A Review of the M-16 Rifle Program* [Washington: April 1988], pp. 6–7); and South Korean F-16s, with General Dynamics (Joseph Kelly, GAO, "U.S.-Korea Fighter Coproduction Program—the F-16 Version," testimony before the Subcommittee on Arms Control, International Security and Science, and the Subcommittee on Asian and Pacific Affairs of the Committee on Foreign Affairs, U.S. House of Representatives, 1 August 1991, pp. 1–6). A comprehensive list of government-to-government coproduction agreements as of 1985 appears in GAO, *Military Coproduction: U.S. Management of Programs Worldwide* (Washington: March 1989), p. 25. One of the most recent candidates for codevelopment and coproduction is the AIM-9X air-to-air missile; see David Hughes, "Review of Foreign Missiles to Parallel AIM-9X Dem/Val," *AWST*, 23 May 1994, pp. 20–1.

9. Norman Polmar, *The Naval Institute Guide to the Ships and Aircraft of the U.S. Fleet*, 15th ed. (Annapolis, Md.: Naval Institute Press, 1993), p. 433.

10. A presidential policy statement of 16 April 1990, developed by an interagency group chaired by the National Security Council, stated the U.S. government's view that certain offsets for military exports are economically inefficient and market-distorting. (GAO, *Military Exports: Implementation of Recent Offset Legislation* [Washington: December 1990], pp. 2–3.) To the extent that foreign customers coproduce American military systems, sales of portions of those systems may result in reduced cost to the U.S. government if manufacturers can spread their overhead costs over a greater number of units; see Hammond, "Offset, Arms, and Innovation," p. 177. This potential for savings is, however, even more true of direct sales than for coproduction. (But see note 15, below.)

11. In addition to production inefficiencies, there are often other costs associated with coproduction, e.g., royalties, and licensing and technical assistance fees. (Kelley, "U.S.-Korea Fighter Coproduction Programs," p. 6.)

12. There has been, for example, little controversy associated with the Greek or Korean coproduction of small arms and artillery ammunition; see GAO, *Military Coproduction*, p. 25.

13. Author's notes of personal conversation with Egyptian Major General Abdel Moneim el Tawil, Deputy Chief of Armaments Ministry, and Brigadier Aly Fahmy, Project Manager, on 3 April 1989, and of conversations with Major General Andrew Cooley and Colonel Terry Carr, U.S. Army, on 4 April 1989.

14. GAO, *Military Aid to Egypt: Tank Coproduction Raised Costs and May Not Meet Many Program Goals* (Washington: July 1993), pp. 1, 10.

15. GAO, *Military Aid to Egypt*, pp. 10–4, 22–6. The cost per tank could climb to as much as $6 million if the Egyptian government cannot use at least 60 percent of the factory for some other purpose.

16. GAO, *U.S.-Japan Codevelopment: Review of the FS-X Program* (Washington: February 1990), pp. 4, 35. FS-X development costs have continued to rise as the program has progressed, although the Japanese government has declined to provide specific cost data; see GAO, *U.S.-Japan Codevelopment: Update of the FS-X Program* (Washington: June 1992), pp. 3, 18–9. Japan also spent 55–80 percent more to produce the Patriot surface-to-air missile in Japan rather than buying the system off the shelf from Raytheon, while European governments acquiring the Patriot paid about 80 percent more for their coproduction arrangements. Michael Chinworth, "Industry and Government in Japanese Defense Procurement: The Case of the Patriot Missile System," *Comparative Strategy*, no. 3, 1990, pp. 222, 228. The European nations coproducing the F-16 paid about one-third more for each aircraft because of the coproduction arrangement, while the U.S. Air Force paid about 5 percent more for each F-16 that it bought because of coproduction with European manufacturers. (Michael Rich and William Stanley, "Cost and Schedule Implications of Multinational Coproduction," *Defense Management Journal*, no. 2, Second Quarter, 1984, p 7.)

17. GAO, *U.S.-Japan FS-X Review*, pp. 10–1.

18. Not only did the Korean contractor, Daewoo Precision Industries, sell M-16s and their parts to third parties but it entered into a contract in 1983 with a *U.S. company* to sell spare parts *back* to the U.S. While the U.S. sale was blocked by a court injunction, sales of Korean M-16s and parts to other nations continued. (GAO, *U.S.-Korean M-16*, pp. 6–12.)

19. GAO, *Military Coproduction*, pp. 5, 13–9. The precise list of items found by GAO to have been shipped without authority was classified, and they were not identified in the unclassified report. In addition, concerns have been raised about the transfer of U.S.-furnished missile technology by Israel to other nations, but information about such transfers remains classified. (GAO, *U.S.-Israel Arrow/Aces Program: Cost, Technical, Proliferation, and Management Concerns* [Washington: August 1993], p. 3.) For a discussion of other concerns about technology transferred to Israel, see Cole and Lubman, p. A.7.

20. A less dramatic example of problems with technology transfer in a codevelopment effort is contained in GAO, *Weapons Codevelopment: U.S. National Interests in the MLRS Terminal Guidance Warhead Program*

(Washington: April 1992), pp. 2, 9–11. An example of a codevelopment program that failed entirely because of technology transfer issues is the German-American attempt to develop target-sensing submunitions for attacking armored targets with artillery ammunition. (GAO, *Defense Acquisition: U.S.-German Examinations of the MLRS Terminal Guidance Warhead Program* [Washington: October 1991], p. 26.)

21. See "Japan's FS-X: What's Behind the Controversy?," *The Estimate*, February 24–9 March, 1989, pp. 5–8. There has never been any question that the Japanese government has targeted the aerospace industry for development; see GAO, *F-15 Coproduction*, p. 5. Much of the concern expressed by opponents of FS-X codevelopment lay in the fear that Japanese industry would acquire aerospace systems integration technology; see Ted Agres, "FSX Deal Polarizes Options on Trade in U.S. and Japan," *Research and Development*, May 1989, pp. 36–7. Although South Korea clearly regarded coproduction of the F-16 as the basis for developing its own aerospace industry, the arrangement between General Dynamics and South Korea never generated the same amount of opposition as did the FS-X; Kelley, "U.S.-Korea Fighter Coproduction Program," pp. 5–6.

22. GAO, *U.S.-Japan FS-X Update*, pp. 12–3. Despite congressional fears about technology transfer to Japan, the latest review of the FS-X project concludes that the U.S. adequately controlled the release of technical data to Japan; *ibid.*, pp. 26–32. In light of the concerns generated by the FS-X codevelopment and coproduction program, it is surprising that U.S.-Japan coproduction of the Patriot missile excited so little interest, even though it involved substantial transfers of systems-integration technology, about which the most concern was expressed by opponents of the FS-X. Raytheon, the principal contractor, agreed to coproduction almost from the outset, and the U.S. government raised no objection, aside from concerns about transfer of certain software packages. This acquiescence might have been the result of previous Japanese production of such missiles as the Hawk, Sparrow, and Sidewinder; see Chinworth, pp. 198, 209–13, and 218.

23. GAO, *U.S.-Japan: FS-X Update*, pp. 18–25. During the course of the FS-X codevelopment project, the U.S. has gained access to a number of technologies incorporated in the FS-X, including electromagnetic wave-absorbing material, phased array radar, central computer, inertial navigation, and integrated electronic warfare system. (*AWST*, 11 April 1994, p. 13.) As of November 1994, Lockheed, General Dynamics' successor on the American side of the FS-X project, had received over twenty thousand technical documents related to the FS-X. (*AWST*, 7 November 1994, p. 53.)

24. Developing a high-performance military fighter may not be an economical way of gaining experience in producing civil aircraft. Transfers of military aerospace technologies to civil aircraft may be decreasing, since the latter must be proven safe and efficient, while for military aircraft the emphasis is on performance; see GAO, *F-15 Coproduction*, p. 2.

25. GAO, *Defense Production Act*, p. 6. The model assumed that the reported offsets were necessary for the reported exports; *ibid.*, pp. 7–8. Coproduction programs such as the Egyptian M1A1 make this assumption questionable; it should be noted that other departments involved in the preparation of the report refused to sign it, although it is not clear whether their objection was to this model or other factors. (Author's notes, presentation by John Kirtland of FMC Corporation, 5 March 1990, Globalization Conference.) In addition, use of offsets and the percentage of the value of contracts required to be covered by offsets have increased since 1991, after having declined for several years; Cole and Lubman, pp. A6–A7. Finally, the economic effects of offsets may be difficult to compute, because of multipliers and of existing or planned economic activity in the purchasing country. For example, General Instrument Company claimed to have fulfilled a $5.7 million offset obligation to South Korea by spending only $440,000 within South Korea. (Author's nores on Stephen presentation.)

26. Other anecdotal examples of adverse effects of offsets on the U.S. defense industrial base are contained in GAO, *Military Exports: Concern with Foreign Military Financing*, pp. 9–11.

27. The General Dynamics study was an economic analysis dated February 1988 and performed by Science Applications International Corporation. GAO, *Military Aid to Egypt*, p. 13, fn. 7.

28. GAO, *Military Aid to Egypt*. pp. 14–6. Egypt did consider adopting the French AMX 40, the German Leopard II, the British Challenger II, and the Brazilian Ossarro prototype tank. The French and Brazilians discussed financing terms with the government of Egypt, but the terms are unknown; it is unlikely that they were as favorable as U.S. foreign military financing. (Author's notes, personal conversations in Egypt.)

29. A comparison of the various factors influencing costs and schedules of U.S., European national, and European collaborative programs with the U.S.-European F-16 coproduction arrangement is contained in Rich and Stanley, pp. 3–8.

30. The effects of setting up rivals are well illustrated by the example of the F-16. In the case of the South Korean F-16, General Dynamics had so many offset arrangements with previous purchasers of the F-16 that it became very difficult to estimate the percentage of the aircraft built in South Korea that would be produced in the U.S.; Kelley, pp. 9–11. For example, Norway, Denmark, Belgium, and the Netherlands had been guaranteed continued European coproduction of 15 percent of the value of all third-country sales of F-16s, and, therefore, these nations had a right to produce 15 percent of the value of the U.S. F-16s sold to South

Korea; GAO, *Military Exports: Recent Legislation*, p. 3, n. 2. But this indirect offset requirement had to be reconciled with the offset arrangement agreed to by General Dynamics in connection with coproduction of the F-16 in Turkey by which Turkey was guaranteed $396.5 million in follow-on coproduction of F-16 parts. Satisfying the Turkish offset obligation resulted in forty aircraft being assembled in Turkey for export to Egypt. F-16s built in Turkey obviously generated some U.S. jobs, but not as many as F-16s built in Fort Worth. (Cole and Lubman, p. A7; and GAO, *Military Exports: Concerns over Foreign Military Financing*, p. 7.)

31. The U.S. foreign military financing grant aid program is unique in the world. No other arms supplier has a program that provides a combination of grant aid *and* allows offsets. (GAO, *Military Exports: Concerns over Foreign Military Financing*, p. 3, 23.)

32. GAO, *Military Exports: Concerns over Foreign Military Financing*, pp. 2–3, 9. The Department of Defense response to a June 1994 GAO recommendation that offsets be eliminated in FMF transactions was that such a bar could cause severe foreign policy repercussions. See *AWST*, 24 October 1994, p. 57.

33. GAO, *Military Exports: Recent Legislation*, pp. 4–5; Kirtland, p. 5; and author's notes on Kirtland presentation.

34. The U.S. government at one time encouraged offsets as a means of stabilizing then-fragile economies of U.S. allies, providing for defense standardization, and creating a defense industrial base in friendly nations; Welt, p. 22. One conspicuous exception to the present general U.S. policy of nonintervention in offset arrangements occurred in the competition between General Dynamics and McDonnell Douglas to sell either F-16s or F/A-18s to South Korea. When the government learned that these two companies were competing to offer more attractive offsets, it intervened and limited offsets to 30 percent; Kelley, p. 14. Congress has also shown concern about the economic effects of offsets and has sought to pressure the executive branch to do more to limit them. The National Defense Authorization Act for fiscal 1989 required reports on offsets and that the executive branch establish a comprehensive policy on offsets and attempt to negotiate with foreign governments to limit their adverse effects. (GAO, *Military Exports: Recent Legislation*, pp. 2–5; and GAO, *Defense Production Act*, pp. 1–2.) That requirement led to an April 1990 policy that recognized the need to minimize market distortion and other adverse effects of offsets, reaffirmed the traditional policy of noninvolvement in offset arrangements, and emphasized that American firms were responsible for negotiating offset arrangements with foreign governments. That policy became part of the Defense Production Act, passed in 1992; GAO, *Military Exports: Concerns over Foreign Military Financing*, p. 2. The acceptability of offset-associated costs as overhead expenses properly chargeable to government contracts has changed over time; *ibid.*, pp. 20–3.

35. *Ibid.*, p. 26. The transaction that provoked the legislation, which involved Northrop's sale of F/A-18s to Finland, coupled with Northrop's subsequent subsidization of a bid of a Finnish papermaking-machine firm to a U.S. company, is described in Cole and Lubman, p. A6.

36. The IEPG, established in 1976, was an intergovernmental organization whose membership included all the European Community members of Nato plus Norway and Turkey. The IEPG's objectives were to promote European cooperation in research, development, and production of defense equipment, improve transatlantic armaments cooperation, and maintain a healthy European defense industrial base. (GAO, *European Initiatives: Implications for U.S. Defense Trade and Cooperation* [Washington: April 1991], p. 13.) In December 1992 the IEPG was succeeded by the Armaments Group as an agency of the Western European Union, the security arm of the European Union. (The IEPG was then dissolved.) The objective of the Armaments Group is the establishment of a European Defense Equipment Market. The Armaments Group is a complicated organization, because it includes countries like Denmark, Norway, and Turkey which were members of the IEPG and thus of the Western European Armaments Group but are not in the Western European Union. (Giovanni de Briganti, "Europe Ideal of Open Defense Market Stalls," *Defense News*, 22 November 1993, pp. 8, 12.)

37. GAO, *European Initiatives*, p. 28.

38. *Ibid.*, pp. 25–30; and Briganti, pp. 8, 12. The efforts by the Western European Union to create a common defense equipment market could easily be the subject of a separate article. They have been marked by a considerable effort to suggest how such an equipment market could be structured, but very little progress in actually achieving one. An example of how a truly integrated European defense equipment market might work would be governmental agreement that Germany would become the tank maker for Europe, France the aircraft manufacturer, Britain the shipbuilder, Italy the helicopter supplier, other countries playing their parts by producing smaller systems and components. Such an arrangement appears a long way off. "Messrs. Walker and Gummet Stress Difficulty and Necessity of Integrating the Armaments Industry in Europe," *Atlantic News*, 29 October 1993, p. 3.

39. For the IEPG to implement its system of *juste retour*, each member country's defense ministry had to record both prime contracts and subcontracts awarded to foreign firms. The IEPG then compiled an overall survey, developed a baseline, and sought to evaluate intra-European defense trade imbalances; GAO, *European Initiatives*, p. 28. Suggestions have been made that no mechanism for *juste retour* can be institutionalized without creating an IEPG or Armaments Groups trade manager. (Theodor Galdi, *The European Defense Industry:*

Responses to Global Change and European Integration, Congressional Research Service [Washington: March 1992], p. 12.) Offsets, however, also require bureaucracy to administer. A description of the British system of determining whether particular economic activity can be counted in fulfillment of a vendor's offset obligation is found in Berry, "British Offset Policy," pp. 32–3.

40. In terms of output, the majority of each of 60 percent of the French arms firms are state-owned, and another 28 percent are wholly state-owned. Only 12 percent of French arms output is generated by principally private firms. In the United Kingdom, while the arms industry is almost entirely in private hands, the government possesses a high-level, well organized sales promotion system; Galdi, pp. 5, 7, 9. Even the United States has introduced an aggressive national export policy aimed at using nineteen federal agencies to help U.S manufacturers compete in foreign markets, and the fiscal 1994 Department of Defense authorization bill established a one-year discretionaty program of loan gnarantees for American defense exports to Nato members, Israel, Australia, Japan, and South Korea. (Pagliano, pp. 9, 11.)

41. Examples of offsets not involving coproduction are given in notes 2 and 3 above.

42. The plan for a defense GATT was part of a wider four-point plan to foster efficiency and rationalization in Nato's defense industry and to maintain military strength at lower cost; Galdi, p. 13.

43. Relatively complete information about the defense economy of the twelve European Union nations was presented for the first time in a survey published by the European Institute for Research and Information on Peace and Security, located in Brussels, in June 1994. ("The Armaments Industry Still in a Deep Crisis," *Atlantic News*, 17 June 1994, p. 4.)

44. *Ibid.*, pp. 13–4. A similar attempt by Nato's Conference of National Armaments Directors to develop a code of conduct has yet to be finalized; *Atlantic News*, 6 May 1994, p. 2.

45. While the IEPG sought to eliminate offsets among its members, they could continue to impose them on outside competitors, including those from the United States; GAO, *European Initiatives*, pp. 24, 34, 45. European defense contractors, for their part, complain that procurement practices followed by the U.S. military have the effect of shutting them out of large portions of the lucrative American military equipment market; GAO, *International Procurement: NATO Allies' Implementation of Reciprocal Defense Agreements* (Washington: March 1992), pp. 3–5. The attitude of the French government appears especially hostile to transatlantic cooperation; Holger Mey, "Germany Faces Crossroad," *Defense News*, 7–13 November 1994, p. 19.

46. Even France, which has been one of the most insular nations in Europe insofar as defense equipment is concerned, has acknowledged that it must give up its self-sufficiency in armaments production. In 1993 France and Germany set up a joint procurement agency and invited other nations to participate. (Francis Tusa, "Long-Range Vision: Procurement Chief Grapples with Structural Disarmament," *Armed Forces Journal International*, June 1994, p. 42; and Francis Tusa, "Can France Face the Future?" *Armed Forces Journal International*, June 1994, p. 44.) The commander of the French air force has stated that France's next jet fighter after the Rafale must be a joint European project. (Francis Tusa, "General Vincent Lanata: Interview with Commander of the French Air Force," *Armed Forces Journal International*, June 1994, p. 43.) In addition, the French government, in its role as president of the Western European Union Armaments Group, will name a full-time chairman for the group with the specific task of advancing the idea of a European armaments agency. France may have some difficulty, however, since some WEU members are unhappy about the Franco-German armaments agency formed in late 1993; see Giovanni de Briganti, "French Set Out to Revamp European Industry," *Defense News*, 3–9 October 1994, p. 37.

47. Giovanni de Briganti, "German Hesitation Impedes Joint Weapon Efforts," *Defense News*, 22 November 1993, p. 8; and Carole Shifrin, "Eurofighter Partners Debate Program Issues," *AWST*, 23 May 1994, pp. 42–4. In both the Eurofighter 2000 and the Tiger helicopter programs, codevelopment, coproduction, or off-the-shelf sales offers from an American company were rejected—McDonnell Douglas's "Hornet 2000" F/A-18 derivative for the Eurofighter 2000 and its AH-64 Apache helicopter for the Tiger. (GAO, *European Initiatives*, pp. 48–9.) The government of the United Kingdom may decline further participation in the Future Large Aircraft program in favor of purchasing Lockheed C-130Js as a more cost-effective way of meeting Royal Air Force air transport requirements; *AWST*, 9 May 1994, p. 76.

48. The problem of which nations to include and which to exclude is presently plaguing the Clinton administration's efforts to create a "NAFTA for Arms Trade." ("DOD, NSA, State, Commerce Draft Conventional Arms Trade Plan," *Inside the White House*, 10 March 1994, p. 11.)

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