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**AN ANALYSIS OF SECOND-TIER ARMS PRODUCING
COUNTRIES OFFSET POLICIES: TECHNOLOGY TRANSFER
AND DEFENSE INDUSTRIAL BASE ESTABLISHMENT**

THESIS

Brian S. Confer, Captain, USAF

AFIT/GRD/ENV/08-M03

**DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY**

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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AFIT/GRD/ENV/08-M03

**An Analysis of Second-Tier Arms Producing Countries Offset Policies:
Technology Transfer and Defense Industrial Base Establishment**

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

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In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Space Systems

Brian S. Confer, BS

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March 2008

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**An Analysis of Second-Tier Arms Producing Countries Offset Policies:
Technology Transfer and Defense Industrial Base Establishment**

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Abstract

The purpose of this thesis is to determine if offsets are an effective means of second-tier countries acquiring technology and if offsets enhance their ability in establishing and maintaining an industrial base capable of producing high-technology weapons for use indigenously and for export. Included in the research was an analysis of factors that lead to the successful or unsuccessful technology transfer through the utilization of offsets. Additionally, the research analyzed the factors that lead to the successful or unsuccessful establishment and maintenance of an indigenous defense industrial base through the utilization of offsets. It was concluded that the utilization of offsets to achieve technology transfer has not substantially improved the technology levels of the buyer's defense industrial base. Furthermore, countries that utilize offsets to establish an autarkic defense industry capable of independent production rarely succeed while countries that utilize offsets to integrate their industry within the global arms market as a niche supplier have been successful.

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An Analysis of Second-tier Country Offset Policies: Technology Transfer and Defense Industrial Base Establishment

I. Introduction

A common practice that has developed in international arms trade over the past three decades is the use of offsets, which Mowery (2007:85) defined as:

a provision in an international export transaction that commits the seller firm to provide technology, to procure locally produced components, or to provide other forms of technical and other assistance to firms in the purchaser nation that go beyond those deemed economically necessary to support the sale.

Bitzinger and Kim (2005), in their study of why small countries produce arms, developed a three-tier framework to categorize weapons-producing countries. First-tier arms-producing countries dominate the global arms market with large defense industries that possess highly advanced defense technology. Second-tier arms-producing countries represent industrially advanced countries with smaller defense industries than the first-tier countries. While the level of sophistication of the second-tier countries is lower than the first-tier countries, their level of sophistication can be on par with the first-tier countries in niche areas. Third-tier arms-producing countries have very limited and technologically insufficient defense industries; therefore, they are unable to compete in the global arms market although they do sometimes export low-grade arms to third-world countries.

Second-tier arms producing countries frequently see offsets as a magic bullet that will permit their defense industry to achieve a great leap forward in capability and

capacity. Additionally, these countries see technology transfer from the offset provider to the domestic defense industry as a primary means of propelling the industry forward. Finally, with a robust defense industrial base, the leaders of these countries believe they will enhance the ability of the defense industry to support national defense needs and improve the nation's defense industry competitiveness in the international arms-trade market.

Second-tier arms producing countries tend to rely on offsets in spite of a lack of conclusive evidence indicating offsets are an effective means to an end. While the use of offsets is a relatively recent phenomenon, the existing literature on offsets is voluminous; professionals from academia, government, and industry performed extensive research and have written at length concerning the topic. However, the lack of public disclosure of data on offset agreements and transactions due to government sensitivity and the proprietary nature of offsets have led to conclusions and results that are difficult to validate. Additionally, conclusions and results are frequently contradictory, often due to the interests and/or perspective of the writer. Therefore, the goal of this research was to analyze the existing literature regarding the efficacy of second-tier country offset policies related to technology acquisition and utilization in promoting the establishment and maintenance of a defense industrial base.

This chapter provides an introductory background on offsets by establishing an offsets framework and discussing the stated offset goals of technology transfer and defense industrial base establishment. Once the background on offsets is established, the chapter defines the problem statement. Finally, the chapter closes with a summary of the methodology used for this research effort.

Background

The U.S. Department of Commerce (2007b) cites the 1960s as the first time offsets were used in international arms trade when the United States (U.S.) successfully pressured West Germany to purchase U.S. weapons to compensate for the foreign exchange costs of stationing U.S. military personnel in West Germany. By 1970, offset provisions became an increasingly common element in international trade, especially concerning U.S. arms exports. However, the end of the Cold War created an international political environment that led to countries increasingly demanding offsets. Thus, from that time forward, the Department of Commerce (2007) states that offsets have been a main characteristic of the international arms trade landscape.

The available data on offsets validates the department's statement, indicating offsets have become more prevalent, have gained importance in relation to other competitive factors, and have increased in value relative to weapon system price. During the Cold War, members of the North Atlantic Treaty Organization (NATO), consisting of roughly 20 countries, employed offsets as a component of arms trade among its member countries. Today, over 130 countries, or virtually every nation that participates in the international arms market, demand offsets from weapons sellers (Preventing, 2007). Additionally, the perceived value of the offset package, rather than the quality of the weapon system sold or weapon system price, is often the determining factor in a purchasing country's contract award decision (Stone, 2007a). As stated by Kent Kresa, former chief executive of Northrop Grumman, the ability to offer an attractive offset package to purchasing countries is "an essential part of doing business overseas" for the defense industry (Wayne, 2003). Finally, the value of offset agreements in relation to

weapon systems purchase price has risen consistently since the end of the Cold War. The latest offset figures released by the Department of Commerce (2007) show the value of offset agreements in relation to the value of defense export contracts increased an average of 2.5 percent per year between 1993 and 2005. Additionally, during that period, offsets represented 71.2 percent of the value of the export contract.

Offset policies for most second-tier arms-producing countries seek to enable the transfer of technology from weapons sellers to the domestic industry and establish and maintain a domestic defense industrial base. However, the existing literature indicates the efficacy of offsets in achieving these goals remains indeterminate. For instance, a U.S. interagency team consulted with various countries receiving offsets during its investigation of ways to mitigate the adverse affects of offsets on the U.S. defense industrial base; the team found that “the consensus of the nations consulted was that it is very hard to determine whether the benefits or adverse effects of offsets are more dominant” (U.S. Department of Commerce, 2007a:4-15). Therefore, despite having offset policies, these countries are unclear whether those policies result in net benefits or losses for their country.

Markusen (2006:3) came to a similar conclusion when noting that “most nations and firms participating in or tolerating offsets are uncertain as to whether they gain or lose from them in the aggregate.” Sköns (2002:6) states there is a disparity between “what countries actually expect (their reason for seeking offsets) and what can be expected more realistically (what the literature says about the possible economic effects of offsets).” She goes on to state that “little is known about the actual, in contrast to expected, economic implications of offsets” (Sköns, 2002:6). Finally, Brauer and Dunne

(2007c:6) note, “very few countries have ever carried out even a single formal and independent offset-contract audit to determine to what degree, if any, the hopes with which offset contracts are invested come to fruition.”

However, defense offsets is a broad, highly complex, and abstract topic to all but those who deal with them on a regular basis. Therefore, this study will begin by providing solid background information of major issues concerning offsets , document their importance, and provide a knowledge baseline to act as the foundation for an analysis of second-tier weapons-producing countries’ offset objectives (i.e., technology transfer and defense industrial base establishment and maintenance).

Offsets Framework

Offsets are agreements that obligate the seller to reinvest the proceeds from arms sales in the purchasing country in both the defense and commercial sectors. Offsets are obligations and are not optional nor voluntary on the part of the seller. They are market-distorting agreements that go beyond those deemed economically necessary to support the sale. The buyer is unequivocally a governmental agency or a government controlled firm. Finally, the methods to implement offsets are through coproduction, licensed production, subcontractor production, overseas investment, technology transfer, and countertrade, which entails barter, counter-purchase, and buyback.

Existing literature divides offsets into two historical timeframes: those that occurred during the Cold War and those that occurred after the Cold War ended. During the Cold War, weapons exporting nations, typically the United States, utilized offsets as a foreign policy tool to improve national security by increasing the industrial and military

capabilities of its allies (U.S. Department of Commerce, 2007b). The motivation behind this policy was the understanding that “nations tend to align politically, economically, and diplomatically with other nations with whom they trade arms” (Kremer and Sain, 1992:31). Although this motivation remained a tenet of international arms trade following the end of the Cold War, a shift occurred as importing nations began to see offsets as a way to improve their country’s economic and industrial competitiveness in the global economy. Therefore, offsets became an economic policy tool following the end of the Cold War in addition to a foreign policy tool.

The impetus behind this motivational transformation can be explained by the peace dividend as countries around the world significantly reduced their defense budgets as the end of the geopolitical struggle against communism, or capitalism, reduced the necessity to heavily arm standing armies to repel invasion from either side. The reduced demand, coupled with an overcapacity of the international defense industry, created what is termed a buyer’s market. This buyer’s market created an environment where the buyer was able to extract extraordinary demands in return for agreeing to purchase weapons from exporting nations (Stone, 2007b). In this highly competitive environment, weapons exporters had to offer attractive offset packages to improve their chances of winning a sale (Waller, 2003). Therefore, offsets became, and continue to be, an important element in the international arms trade market.

Given the perceived benefits of offsets for the purchasing country, one might assume the purchasing country has nothing to lose and should therefore demand the highest level of offsets from the seller. However, offsets do not come without cost to the importing country. Conceptually, an offset is a cost-free compensatory benefit provided

to the purchasing country in return for agreeing to purchase arms from the arms seller. However, offsets are costly, and therefore, must be paid for by one of the parties (Bulgin, 2007). Research indicates that the buyer pays for the offsets and not the seller. In spite of this, governments in the past have been willing to pay the extra cost because they perceived the benefits of the offset program outweighed the increased cost (Bulgin, 2007). However, as stated earlier, whether the benefits outweigh the costs is not clear.

Technology Transfer

The U.S. Department of Commerce Bureau of Industry and Security (2007b:1-5) defines technology transfer as:

Transfer of technology that occurs because of an offset agreement and that may take the form of research and development conducted abroad, technical assistance provided to the subsidiary or joint venture of overseas investment, or other activities under direct commercial arrangement between the defense prime contractor and a foreign entity.

Predominately, second-tier countries seek to improve their technological capabilities through the acquisition of technology from first-tier countries considered to be leaders in state-of-the-art technologies. Ultimately, by improving their technological capabilities, second-tier countries seek to improve their ability to manufacture sophisticated weapons systems and increase their level of competitiveness in the international arms market (Waller, 2003). Therefore, the goal is to gain a level of independence in the production of weapon systems and to improve the marketability of their defense industry products in the international arms market.

Whether offset policies aimed at promoting technology transfer succeed in achieving those goals is unclear. More so, it is unclear if technology transfer occurs at a

significant level. Literature on the efficacy of second-tier country offset policies in promoting technology transfer from first-tier countries shows mixed findings at best; however, the results are predominately negative. For example, Brauer and Dunne (2007c:1) found “virtually no case where offset arrangements result in significant technology transfers.” Another study found that even though technologies were successfully transferred, second-tier industries failed to acquire the needed capabilities to close the technology gap with first-tier countries or keep pace with technological development in weapon systems (2004). Research from Stockholm International Peace Research Institute (SIPRI, 2008) reinforces the inability of second-tier countries to keep pace with first-tier technological advances by noting “whatever technology is transferred is quickly outpaced by global technology advances, especially in the United States” (Hagelin et al., 2006:A-1). Finally, Bitzinger and Kim (2005:205) concluded in their case study on South Korean weapons production policy that “second-tier arms-producing countries...continue to lag far behind the first-tier industrialized states in terms of technological innovation and implementation.” These findings suggest that efforts to promote technology transfer and to utilize the technology to improve the capabilities of the defense industry have not been successful.

Defense Industrial Base Establishment and Maintenance

In addition to technology transfer, defense industrial base establishment and maintenance is a primary goal of second-tier weapons-producing countries in demanding offsets. The primary motivations for establishing and maintaining a defense industrial base are improving national security and the balance of trade. Second-tier countries view

defense industrial capability as an important element of national security; by achieving a level of independence in weapons production capability, these countries rationalize that they also achieve a greater level of security. Former Brazilian Air Force Minister Macedo validated this view when he declared, “it is a condition of security that each nation manufacture its own armaments” (Perlo-Freeman, 2007:4). Part of this belief stems from the fact some countries see defense industrial capability as a countermeasure to the political influence exerted by foreign countries that leverage the dependence of second-tier countries on weapons imports (Bitzinger and Kim, 2005). Thus, by reducing its weapons supply dependence from foreign production sources, a country can formulate and follow foreign policy independent of outside influence.

In addition to achieving security and foreign policy independence, second-tier countries view defense industrial capability as a means to improve the international balance of trade. A country’s balance of trade is its balance of exports and imports. A positive balance indicates a country is exporting a greater value of goods than it is importing. Two elements of a country’s offset strategy enable a country to improve the balance of trade: work transfer created by the arms deal to the importing country and improving the export potential of the indigenous defense industry. The National Defense Industrial Association (NDIA) (Background, 2007) found many offset agreements force the weapons exporter to transfer work generated by the arms sale to the importing country resulting in an improvement in the balance of trade. Improving the export potential is another method to improve the balance of trade. The U.S. Department of Commerce (2007a) states, by moving jobs, investment, and technology from the seller to

the buyer's country, the buyer seeks to improve the export potential of its defense industry by becoming more competitive in the international arms trade market.

Literature on the efficacy of second-tier country offset policies in promoting defense industrial base establishment and maintenance provides findings similar to that of promoting technology transfer – the results are predominately negative. Measures of efficacy in promoting the establishment and maintenance of a defense industrial base can be analyzed by measuring job levels and the long-term viability of the national defense industry. Numerous sources, according to Brauer and Dunne (2007a), stated offsets had not created substantial or sustainable job growth in the purchasing nation. Additionally, Hagelin et al. (2006) found that offsets had not advanced the long-term industry viability of countries receiving the offsets.

Further indication of the failure of offsets to promote the establishment and maintenance of second-tier defense industries is evidenced by the exit of many second-tier weapons-producing countries from the defense industry; and those that remain are now dependent on state aid for survival. The Brazilian experience highlights the failure of offsets to establish a defense industrial base in the recipient country. Brazil had used defense offsets extensively since the 1970s (Perlo-Freeman, 2007). By the early 1990s, however, the Brazilian defense industry had virtually disappeared from the international landscape (Bitzinger, 2003). Taiwan, another benefactor of offsets, recently acknowledged the futility of remaining in the defense industry when stating that “the original plan for independent production of weapons must be stopped or reduced” (Bitzinger, 2003:39). State dependence for industrial survival provides another indication of the failure of offsets to produce viable defense industries through offset programs.

Brazil, India, Indonesia, South Africa, and South Korea, all of whom participated extensively in offset programs, are now heavily dependent on state aid for survival (Brauer and Dunne, 2007b). Furthermore, their products are not competitive in the international arms market.

Problem Statement

Second-tier weapons-producing countries routinely demand offsets. These countries commonly tailor offsets agreements to achieve technology transfer and defense industrial base establishment and maintenance. However, existing literature seems to indicate second-tier countries do not consistently meet these goals (e.g., Brauer and Dunne (2007a, 2007b, and 2007c), Hagelin et al. (2006), Bitzinger and Kim (2005), Perlo-Freeman (2007), Bitzinger (2003)). Therefore, this research investigates the efficacy of offsets in enabling technology transfer and defense industrial base establishment and maintenance. The research then analyzes factors that lead to success and failure in achieving the goals.

Research Questions

While the offset policy goals of second-tier arms-producing countries are numerous, the researcher found technology transfer and defense industrial base establishment and maintenance as the two dominant goals. Therefore, this research will attempt to determine the efficacy of second-tier arms-producing country offset policies in achieving these goals and will seek to determine the factors that lead to their success or failure. Specifically, this research will attempt to answer the following questions:

1. What are the characteristics of the global arms market structure that impact offset policy formulation and/or success?
2. What economic and political factors influence the formulation and/or success of offset policy?
3. What are the characteristics of second-tier arms-producing countries that might influence the success or failure of their offset policy?
4. What are the characteristics of the technology transferred?

Methodology

This research utilized historical, documentary, and case study methodologies. According to Lang (1984), historical methodology is the collection, evaluation, and synthesis of the existing data into an accurate description of the topic. Documentary methodology is similar to historical in that it also involves data collection, evaluation, and synthesis. However, Lang notes, it is cross-sectional as opposed to longitudinal in nature. Finally, Lang describes case study methodology as the detailed analysis of a research subject. In the case of this thesis, the research subjects consist of select second-tier weapons-producing and exporting countries. The literature review employed the historical and documentary methodology. It provided the background on the offset issue and set the stage for the introduction of the case study methodology. The case study methodology, which utilized data gathered through historical and documentary methodology, allowed the researcher to study offsets as they interact with the policies of the individual countries, the cases.

Limitations

There were inherent limitations in the methodologies used in this thesis. When using historical, documentary, and case study methodologies, it is necessary for the researcher to verify the accuracy and truthfulness of the sources and to continually guard against bias and prejudice compromising the need for a professional, critical perspective on the thesis topic. Thus, the researcher performed an exhaustive search of primary and secondary sources and verified the accuracy of the data by crosschecking the sources along with verifying the legitimacy of the source by utilizing historical criticisms.

Importance of Topic

This research is important to second-tier weapons-producing countries. Second-tier countries dedicate a great deal of resources towards offsets. The results of this research will enable these countries to evaluate the effectiveness of their offset programs and provide recommendations to improve their effectiveness. Additionally, this research is important to the U.S. government as well as its defense industry. Knowledge of second-tier countries efficacy in achieving stated goals through offsets and the factors that lead to their success or failure will permit government and industry leaders formulate appropriate policy in response.

Overview

Chapter II presents an overview of the current literature on the subject of offsets by documenting the importance of the topic and providing a knowledge baseline from which the offset policies and objectives of second-tier weapons-producing countries

regarding technology transfer and the establishment and maintenance of a defense industrial base can be analyzed. Therefore, Chapter II discusses the definition and history of offsets, offset characteristics, the global arms market structure, offsets in the global arms market, technology acquisition and utilization, and defense industrial base establishment and maintenance. Chapter III identifies the research methodology used in this research as well as limitations of the methodology. Chapter IV provides analysis and results of the research. First, the chapter provides an analysis of the efficacy of second-tier arms-producing country offset policies in enabling technology acquisition and utilization followed by factors that determine the success or failure of these countries in acquiring and utilizing technology through offsets. Next, the chapter provides an analysis of the efficacy of second-tier arms-producing country offset policies in promoting the establishment and maintenance of a defense industrial base followed by factors that determine the success or failure of these countries in utilizing offsets in defense industrial base establishment and maintenance. Finally, Chapter V offers conclusions and recommendations.

II. Literature Review

Defense offsets is a broad, highly complex, and abstract topic. Therefore, this research first sought to provide detailed background information on the topic in the literature review. The intent is to document not only the importance of the topic but to provide a knowledge baseline from which the analysis of offset policies and objectives of second-tier arms-producing countries can proceed. Prior to delving into technology transfer and defense industrial base establishment issues though, the research conducts a detailed literature review in which background material is limited to major issues concerning offsets as they impact the study. Therefore, this chapter is divided into the following sections: defining offsets, history of offsets, offset characteristics, the global arms market structure, offsets in the global arms market, technology acquisition and utilization, and defense industrial base establishment and maintenance.

Defining Offsets

The literature contained numerous definitions of what is considered an offset which were used to develop an operational definition. Brauer and Dunne (2007c:1) define offsets as agreements in arms trade that “obligate the seller to reinvest (‘offset’) arms sales proceeds in the purchasing country.” Healey (1999) reinforces the obligatory nature of offsets by noting offsets are obligations rather than optional or voluntary agreements on the part of the seller; he further notes that the obligatory nature of offset agreements is the product of laws, regulations, or expectations of the purchasing country that mandate offsets or the competitive forces of the arms market that dictate offsets. The

U.S. Government Accountability Office (GAO) (2004) discusses the reinvestment aspect of offsets by noting the seller reinvests the proceeds from arms sales in the purchasing country through defense industrial and/or commercial benefits. Those benefits come in the form of subcontracting opportunities for companies in the purchasing country, coproduction agreements, technology transfer from the seller to the buyer, marketing assistance of the buyer's goods and services unrelated to the arms sale, financial assistance, and numerous other investment activities in the purchasing country's economy.

A key element from Mowery's (2007) definition of offsets is missing from the above discussion. Recall that he defined offsets as:

a provision in an international export transaction that commits the seller firm to provide technology, to procure locally produced components, or to provide other forms of technical and other assistance to firms in the purchaser nation that go beyond those deemed economically necessary to support the sale. (Mowery, 2007:85)

The missing element is the fact that offsets commit the seller to provide benefits that “go beyond those deemed economically necessary to support the sale.” This omission is common in the existing literature. However, it is important to note that this element of offsets is due to the way offsets interfere with free-market forces in the arms-trade environment. As will be discussed in subsequent sections, the provision of benefits provided in the absence of economic necessity, and outside the control of free-market forces, creates market distortions in the arms-trade environment that lead to economic inefficiencies and inefficient industrial policy. Furthermore, it significantly influences the structure of the arms-trade environment. A U.S. presidential commission analyzing the future of the U.S. aerospace industry validates the impact of offsets on the free

market, describing offsets as a “form of market distortion in global aerospace trade” (Presidential Commission, 2002). Therefore, as an operational definition is constructed, it is vital to include the market-distorting nature of offsets in the definition.

A second element missing from Brauer and Dunne’s definition is a description of the buyer in the offset agreement. Unequivocally, for the agreement to be an offset, the buyer must be a governmental agency or a government controlled firm. The Defense Offsets Commission agrees by stating that “an offset ‘agreement’ is...between the U.S. exporter and the foreign government (or its state-controlled company)” (GAO, 1994:19). Including this aspect of offsets in an operational definition excludes other forms of international arms agreements such as agreements between commercial interests. Therefore, agreements between commercial interests (i.e., between two defense companies not controlled or owned by the government) do not constitute offsets. Taylor (2007c) agrees in his assessment of what constitutes an offset by pointing out that an agreement between two private firms does not qualify as an offset. These agreements are more appropriately termed international cooperative programs (U.S. Department of Commerce, 2007a).

Implementation Methods

The final task in providing an operational definition of offsets is to describe the various methods used to implement offsets. Verzariu (2000) lists the various methods to implement offsets as co-production, licensed production, subcontractor production, overseas investment, technology transfer, and countertrade. Each of these areas is briefly described in the remainder of this section.

Co-production. Overseas production that permits a foreign government or producer to acquire the technical information to manufacture all or part of an article originating in the seller country. Co-production related to military exports is based upon a government-to-government agreement. It includes government-to-government licensed production and excludes licensed production based upon direct commercial arrangements by U.S. manufacturers. Coproduction in nonmilitary exports is based on an agreement contracted directly between exporter and importer.

Licensed Production. Overseas production of an article originating in the seller country based upon transfer of technical information under direct commercial arrangements between a U.S. manufacturer and a foreign government or producer.

Subcontractor Production. Overseas production of a part or component of an article originating in the seller country. The subcontract does not necessarily involve license of technical information and is usually a direct commercial arrangement between the U.S. manufacturer and a foreign producer.

Overseas Investment. Investment arising from the offset agreement, taking the form of capital invested to establish or expand a subsidiary or joint venture in the foreign country.

Technology Transfer. Transfer of technology that occurs as a result of an offset agreement and that may take the following forms: research and development conducted abroad, technical assistance provided to the subsidiary or joint venture of overseas investment, or other activities under direct commercial arrangement between the U.S. manufacturer and a foreign entity.

Countertrade. In addition to the types of offset defined above, various types of commercial countertrade arrangements may be required as part of offset commitments. They may include one or more of the following mechanisms. Barter is a one-time transaction only, bound under a single contract, that specifies the exchange of selected goods or services for another of equivalent value. Counterpurchase is an agreement by the initial exporter to buy (or to find a buyer for) a specific value of goods (often stated as a percentage of the value of the original export) from the original importer during a specified time period. Finally, compensation (or buyback) is an agreement by the original exporter to accept as full or partial repayment products derived from the original exported product.

Operational Definition

Thus, the operational definition of offsets can be considered to include the elements. Offsets are agreements that obligate the seller to reinvest arms sales proceeds in the purchasing country; they are obligations and are not optional nor voluntary on the part of the seller. Offset reinvestment takes place in both the defense and commercial sectors of the buying country. Offsets are market-distorting agreements that go beyond those deemed economically necessary to support the sale. The buyer is unequivocally a governmental agency or a government controlled firm. Finally, the methods to implement offsets consist of co-production, licensed production, subcontractor production, overseas investment, technology transfer, and countertrade, which entails barter, counter-purchase, and buyback.

Direct and Indirect Offsets

The literature divides offsets into two distinct categories: direct and indirect. Direct offsets are transactions directly related to the weapon sold under the terms of the contract. An example of a direct offset is Pratt & Whitney agreeing to purchase engine components manufactured in Poland to install on F-100 engines that Poland bought under the terms of the original contract. Indirect offsets are transactions not related to the weapon sold under the terms of the contract. An example of an indirect offset is Lockheed Martin providing submarine technology under an offset agreement contained in a contract with Poland to purchase F-16s. Indirect offsets can involve both military and civilian based transactions.

Reports issued by the U.S. Department of Commerce provide data detailing direct and indirect offset agreements and activities. The U.S. Department of Commerce is the focal point for data collection on offsets for the U.S. Congress. It is required to submit an annual report to Congress detailing offset agreements and activity, along with statistical data analyzing the activity. Thus, it is an invaluable source of information for offset research. In its *Eleventh Report to Congress on Offsets in Defense Trade*, the department categorizes the different methods to implement offsets as either direct, indirect, or both. Direct offsets, according to the report, include co-production, subcontracting, technology transfer, training, production, licensed production, or financing activities; indirect offsets include purchases, investment, training, financing activities, marketing/exporting assistance, and technology transfer (2007b). It is important to note the type of activity, such as technology transfer, does not necessarily determine whether an offset is direct or

indirect. Rather, it is determined by whether the offset is related to the weapon sold under the terms of the contract.

For the 13-year period (1993-2005) the U.S. Department of Commerce (2007b) collected data on offsets, 39.8 percent of offset transactions by value were direct, 59.5 percent were indirect, and 0.7 percent were unspecified. Thus, almost 60% of offset transactions entailed activities not related to the weapon sold under the terms of the contract. However, it is important to note that the U.S. Department of Commerce found, in general, countries with developed economies and defense industries predominately request direct offsets while developing countries request indirect offsets. Since second-tier weapons-producing countries typically possess developed economies, the majority of second-tier country offset activity falls under direct offsets.

One of the theories on why developed and developing countries differ in whether they demand direct or indirect offsets is that developed countries can more easily absorb technology related to the weapon being sold. Developing countries do not have the capability to do so. Therefore, developed countries, with a higher level of industrial development, seek direct offsets and developing countries, with insufficient levels of industrial development, seek alternative forms of offsets such as development of their infrastructure or other areas unrelated to high technology weapon systems purchased (Preventing, 2007).

History of Offsets

The literature also divides offsets between two periods: Cold War and post Cold War. During the Cold War, geopolitical concerns and national security implications of

the confrontation between the East and West dominated international arms trade and, by extension, offsets. Thus, countries traded arms with each other to strengthen their respective alliances. Further, arms-exporting countries exercised restraint in their participation in international arms trade. However, with the end of the Cold War, geopolitical and national security implications became secondary to market share and domestic defense industry survival. In addition, following the end of the Cold War, offset agreements became a primary competitive factor in the buyer's contract award determination.

Cold War Offsets

The U.S. originated the concept of offsets following the end of World War II to enhance its national security and foreign policy. Offsets improved U.S. national security by allowing the U.S. to achieve interoperability and standardization with its NATO allies through the export of American weapons. Offsets served U.S. foreign policy goals by promoting the reconstruction efforts of Europe (U.S. Department of Commerce, 2007a). Kremer and Sain (1992: 31) summarized the rationale of using offsets to achieve national security aims by noting that “nations tend to align politically, economically, and diplomatically with other nations with whom they trade arms.” By encouraging European countries to engage in arms trade with the U.S. through the provision of offsets, they noted that the U.S. was able to not only provide its European allies with interoperable and standardized weapons but was also able to establish a close alliance with its NATO members. At the same time, the U.S. achieved foreign policy aims by

offering offsets. By establishing production facilities in European countries, the U.S. utilized offsets to reconstruct and revitalize their European industrial capability.

European industrial participation in the production of U.S. weapons was limited at first and increased gradually. Immediately following the end of World War II, European industry did not take part in weapons production. Rather, the United States exported finished defense goods to quickly reestablish a European military force in Western Europe capable of assisting the United States in countering the communist threat (Lorell, 2002). However, exporting finished defense goods did not contribute to the U.S. goal of European industrial reconstruction. Therefore, the United States gradually changed its approach to rearming Europe by permitting the use of co-production and licensed production agreements between U.S. defense industry and European governments. These agreements proved to be an effective means of revitalizing Europe's industry. Moreover, they were welcomed by Western European countries who increasingly demanded their industries play an increased role in the supply of arms to its military forces. Thus, European industry began to play a greater role in arms production through offset agreements (Ilbas, 2002).

Offsets proved a valuable tool for European countries to reestablish their defense industrial capacity. Initially, European industry was incapable of producing complete weapon systems. Therefore, early offset agreements entailed relatively basic tasks such as assembling kits provided by foreign firms. Over time, as the European defense industry began to recover, offsets expanded into more complex tasks such as production of components for incorporation into weapon systems (Mowery, 2007). By the 1970s, offsets enabled many European countries to advance to the point where they could

independently produce weapon systems to meet many of their military requirements (Verzariu, 2000).

Thus, the U.S. succeeded in achieving its foreign policy and national security goals following the end of World War II partly by employing offsets; the NATO alliance possessed weapons in its inventory that were standardized and interoperable with U.S. weapons and Europe's industry had returned to pre-war production levels. Additionally, offsets created a technologically sophisticated European defense industry that could compete with U.S. weapons manufacturers in the arms export market and provided European countries with an alternative source for its military requirements. In fact, the arrival of a technologically sophisticated European defense industry came at a time when Western European countries were beginning to reject the notion of exclusively using U.S. designed arms and embarked on a program to create an indigenous, autarkic defense industrial base (Lorell, 2002). Therefore, offsets not only allowed the U.S. to achieve its foreign policy and national security goals but also created competition for U.S. weapons manufacturers who, by the late 1970s, were competing for sales on the international market.

Countries that benefited the most from offsets provided by the U.S. were France, Germany, the United Kingdom, and Italy. By the late 1970s, these countries possessed advanced defense industries on par with the United States. Thus, these countries not only sought to produce their own weapons, but also sought to compete with the United States for a share of the international arms trade market, especially in aerospace. Combat aircraft such as the French Mirage III/5/2000 series, the British/French Jaguar, the British/German/Italian Tornado, and the French/German Alpha Jet emerged from

factories across Europe. Although the capabilities of these aircraft were slightly inferior to U.S. designed combat aircraft, it became clear that the structure of the global defense industry had evolved from one dominated by U.S. and Soviet designed aircraft to one that included European arms producers as a third source of highly sophisticated weapon systems.

Post Cold War Offsets

Offsets and the international arms trade environment following the end of the Cold War were heavily influenced by increased competition and a reduction in defense spending. During the Cold War, arms-producing countries exercised restraint in selling arms in the international market due to the geopolitical and national security implications of the confrontation between the East and West. However, as the Cold War came to an abrupt halt with the dissolution of the Soviet Union, arms-producing countries were no longer bound by geopolitical and national security concerns and began to see the economic benefit of actively participating in arms trade (Mowery, 2007). The result was an international arms trade environment in which U.S. arms producers competed with European first-tier arms-producing countries for international sales.

Adding to the competitive environment was the peace dividend that came with the end of the Cold War; countries around the world were able to significantly reduce their defense budgets when the confrontation between the East and West come to a dramatic conclusion. Therefore, countries were no longer compelled to expend a significant portion of their gross domestic product (GDP) on national defense. Data from the International Monetary Fund provides evidence of the reduced defense budgets

throughout the world following the end of the Cold War. According to their data, worldwide military spending in 1990 was 3.6 percent of world GDP. Five years later, worldwide military represented only 2.4 percent of world GDP, a 33% drop (Verzariu, 2000). The result is the confluence of reduced demand and increased competition as the Cold War ended.

The competition resulting from the emergence of European countries to first-tier arms-producing status, a reduction in geopolitical and national security considerations in weapon sales, and a significant reduction in the budgets of weapons importing countries predicated by the end of the Cold War created what is termed a buyer's market. A buyer's market is an environment characterized by the existence of more sellers than buyers, or reduced demand, resulting in either lower product prices or the ability of the buyer to secure favorable or compensatory provisions in exchange for agreeing to buy from a seller. Thus, the resulting market power shift created an environment where the buyer was able to extract extraordinary demands in return for agreeing to purchase weapons from exporting nations (Stone, 2007b). In this highly competitive environment, weapons exporters had to offer attractive offset packages to improve their chances of winning a sale (Waller, 2003).

Acknowledging the international arms trade market had entered a period in which the buyer had the upper hand, arms-importing countries intensified their demands for offsets. Once a tool utilized predominately by the United States to persuade European countries to buy U.S. arms, offsets evolved into a benefit demanded by arms-importing countries as compensation for buying foreign produced weapons. The unrelenting demand for offsets by arms-importing countries created a situation where the exporting

company, faced with foreign demands for offsets in exchange for agreeing to purchase arms, felt compelled to comply with the demands lest they risk the loss of the sale to an international competitor (Scott, 1999).

The provision of offsets in a buyer's market remains a dominating aspect of the arms-trade environment today. European and U.S. defense companies are in heated competitions from export opportunities; many need foreign sales to ensure their survival (Falco, 1998). Plagued with excess capacity and understanding the need to secure sales in the export market, defense companies are more than willing to offer attractive offset packages to buyers. Furthermore, they understand that the use of offsets will not go away any time soon.

Characteristics of Offsets

A review of the literature on offsets reveals numerous characteristics. First, the use of offsets has increased steadily over time. Second, the value of offset agreements in relation to the value of the original contract has increased significantly over time. Third, the quality and value of the offset package in proposal evaluation has grown in importance relative to price and technical performance criteria. Fourth, foreign governments focus their offset efforts in the defense aerospace sector. Lastly, offsets result in an increased price for the arms procurement. The first three characteristics establish the importance of offsets in the arms trade environment, the fourth characteristic highlights the importance of aerospace offsets, and the last characteristic shows offsets do not come without cost to the recipient country. Each of these characteristics is further discussed in the remainder of this section.

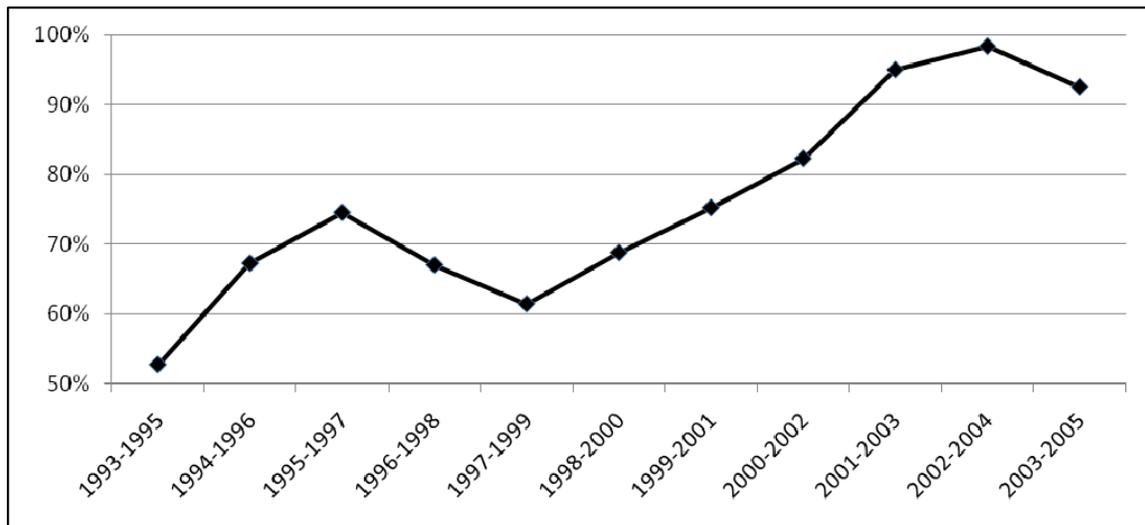
Increasing Use of Offsets

The number of countries demanding offsets has increased steadily to the point where their inclusion in arms-sales agreements has become the norm rather than the exception. As stated by Kent Kresa, former chief executive of Northrop Grumman, the ability to offer an attractive offset package to purchasing countries is “an essential part of doing business overseas” for the defense industry (Wayne, 2003). During the Cold War, members of NATO (roughly 20 countries) predominately received offsets. However, over 130 countries currently receive offsets and have offset policies describing their requirements to receive offsets (Preventing, 2007). Verzariu (2000) found the level of development in a country, once a factor determining whether or not a country demanded offsets, is no longer a factor. Countries with highly developed, technologically sophisticated defense industries, those with less developed industries, and developing countries equally demand offsets in one form or another. Therefore, in the current environment, weapons exporters must offer offset packages that are attractive to the buyer if they hope to secure export contracts.

Increasing Value of Offsets

In addition to the prevalence of offsets in arms trade, the value of offset agreements in relation to the value of the export contract has risen steadily over time as shown in Figure 1. According to the U.S. Department of Commerce (2007b), between 1993 and 2005, U.S. companies entered into 538 offset agreements, with export sales for the original contracts totaling \$79.5 billion and the offset agreements totaling \$56.6

billion, or 71.2% of the export contract value. In 1993, the first year the Department of Commerce collected offset value data, offset agreements were worth 49.3% of the value of the export contract. In 2005 alone, the value was 102.9% (U.S. Department of Commerce, 2007b). As the percentage indicates, the cumulative value of all offset agreements during 2005 exceeded the value of the export contracts for that year. In fact, with increasing frequency, the value of the offset agreement exceeds the value of the original contract. The offset agreement signed in 2003 between the government of Poland and Lockheed Martin serves as perhaps the most dramatic example of this reality. As part of Poland's procurement of 48 F-16 aircraft, Lockheed Martin entered into an offsets agreement valued at \$9.7 billion; the original contract was worth \$3.5 billion. Thus, the government of Poland received an offset agreement worth 2.6 times the value of the original contract (U.S. House of Representatives, 2004).



(U.S. Department of Commerce, 2007b)

Figure 1. Offset Agreement Value/Export Contract Value (Three-Year Moving Average)

Offsets Often Determining Factor in Contract Award

Thus far, the research has shown the number of countries demanding offsets has risen to the point where virtually every nation in the world that procures weapons from foreign countries demands offsets and the value of offsets in relation to the original contract value has risen steadily over time. This section describes how offsets are, in many cases, the determining factor in a country's contract award decision. Healy (2007:216) lists "four fundamental criteria" upon which international sales of weapon systems are won: price, technical performance, politics, and offsets. Price and technical performance criteria are self-explanatory. In the highly competitive arms-trade market that exists today, price and technical performance of the competing bidders is often indistinguishable (Preventing, 2007). Political influence comes in the form of regional favoritism, in-country political forces, and buy-local preferences, among others. While politics can be a deciding factor, the value of offset packages is the deciding factor in contract award with increasing frequency (Stone, 2007b.). Furthermore, even when there is a clear distinction between the price and technical performance of the competing bidders, the importing country is increasingly awarding contracts based on the quality and quantity of the offsets package. This indicates that, in many cases, the quality and price of the weapon system are not as important as the offset package being offered (U.S. Department of Commerce, 2007b).

To illustrate the importance of offsets in the selection process, consider Czechoslovakia and Poland's procurement of fighter aircraft in 1999 and 2003, respectively. In 1999, Czechoslovakia sought to replace its aging fleet of fighter aircraft. During the competition and selection process, the Czechs placed the majority of their

decision in the area of offsets as indicated by their weighting of evaluation factors (Taylor, 2007b). In the evaluation of bids from potential aircraft producers, the Czechs applied a 50% weight to the bidder's offset proposals, 30% towards the technical requirements, and 20% towards price. Clearly then, offsets were the determining factor in the evaluation process. This represents a departure from the traditional evaluation process where price and performance were the primary evaluation criteria in proposal evaluation (Taylor, 2007b).

Poland's procurement of fighter aircraft in 2003 further illustrates the importance of offsets in the selection process. In commenting on the evaluation factors in the selection process, Poland's Deputy Prime Minister and Finance Minister Steinhoff stated, "one of the most important elements that would affect the final choice would be terms of offsetting the purchase with orders placed in Polish plants" (Seguin, 2007:8). Similarly, Poland's Deputy Defense Minister and Tender Commission Chairman Zemke, commented on the choice of Lockheed Martin by stating that the "offset deals proposed were the key factor influencing the government's choice" (Seguin, 2007:30). Furthermore, the media in Poland also commented on the evaluation process and noted that the unprecedented offset agreement offered by Lockheed Martin was the deciding factor in contract award. Thus, the Polish government placed a great deal of importance on the value and quality of the offset proposals offered as opposed to basing their decision on the price and performance of the competing aircraft.

Aerospace Sector Focus of Offset Activity

The aerospace sector has been, and will continue to be, the focus of activity for offsets. In the past, foreign governments predominately focused their demand for offsets in the aerospace sector. A July 2003 U.S. Commerce Department report stated 90 percent of offset agreements are in the aerospace sector. Furthermore, foreign government focus on the aerospace sector will likely continue in the future to achieve three perceived benefits. Primarily, foreign governments focus on the aerospace sector in the belief that an indigenous aerospace industry is vital to their economy as an excellent source of high paying jobs, for its export potential, and as a driver of rapid technological advancement for the greater national industrial base (Wessner, 2004). In addition to the benefits to the economy, foreign governments see the aerospace industry as one that is vital to national security since aircraft expenditures typically represent the largest portion of a country's defense budget (Flamm, 2007). Therefore, to retain their sovereignty, foreign governments consider it vital to obtain the capability to produce at least a portion of their aerospace defense needs indigenously.

Offsets Paid for by Purchasing Country

Conceptually, an offset is a cost-free compensatory benefit provided to the purchasing country in return for agreeing to purchase arms. However, offsets are economically inefficient since either the buyer or seller must pay for the additional costs that are incurred (Bulgin, 2007). Experts in the field differ on the cost of offsets in relation to the price of the arms-sales contract. However, they agree offsets are costly and are paid for by the purchasing country. A U.S. interagency team found offsets result

in a price increase of between 15-30% of U.S. exported equipment (Hawkins, 2007a). As cited by Ianakiev (2007), Martin and Hartley stated that offsets result in an average price premium of 14.4% over comparable articles purchased free of offsets. Bulgin (2007) reported increases in contract price of between three and five percent. Finally, Markusen (2006) reported a seven to ten percent increase resulting from the administrative costs of managing offsets alone, indicating an overall increase significantly above ten percent (as cited in Brauer and Dunne, 2007a). Therefore, while the costs of offsets in relation to the price of the arms-sales contract is hard to pin down, it is clear that they result in significant increases in contract price paid by the purchasing country.

Numerous factors influence the cost and resultant price increase experienced when offsets are included in an arms sale. Ianakiev (2007) researched the effect of offset policies on the international division of labor and identified three possible factors to explain the cost increase: supplier search and switching costs, supplier inefficiencies, and administrative costs incurred by the arms seller in managing offsets. Additionally, the National Defense Industrial Association (NDIA) (Background, 2007) identified the price premium charged by offset providers as a condition of transferring technology as a factor that increases the contract price. Lastly, Jones (2007) found that offsets often introduce diseconomies of scale which result in cost increases.

Supplier search and switching costs is the first factor Ianakiev (2007) identified. Arms sellers incur search costs when searching for alternative sources of supply. The sellers incur the costs in the process of gaining information about a potential supplier's characteristics such as product price, quality, production location, and capacity. Arms sellers incur switching costs when switching from an incumbent supplier to a new

supplier. The costs are those that are incurred when switching to a new source of supply that would not have been incurred had the seller remained with the original supplier.

Supplier inefficiency is the second factor Ianakiev (2007) identified. Offsets may introduce market rigidities when the arms buyer forces the arms producer to change their sources of supply from established sources to sources located in the buyer's country. Often, these new supply sources are less efficient, and therefore more costly than the original ones (Jones, 2007). The difference between the component production cost of the new source of supply and the original source of supply represents the increased costs experienced by supplier inefficiencies.

Administrative cost is the third of Ianakiev's (2007) factors. Sellers incur additional administrative costs during the contract negotiation process due to the increased complexity of the contract negotiation process resulting from the inclusion of offsets in the proposal. Additionally, sellers incur administrative costs following contract award in managing burdensome offset programs. As stated above, Markusen (2006) reported a seven to ten percent increase resulting from the administrative costs of managing offsets alone.

The NDIA (2004) also identified intellectual property as a major factor that leads to price increases in arms sale. Intellectual property is a highly valued asset in the defense industry; it provides companies an edge over its competitors. Therefore, a company will not readily sacrifice this edge without receiving significant monetary compensation. Thus, according to the NDIA, the offset provider adds a price premium to the contract by the amount represented by the present discounted value of the net income from future sales resulting from its intellectual property. The value represents, and

should be close to, the price that the buyer of the intellectual property would have to pay for receiving the technology in the absence of an offset agreement.

Finally, Jones (2007) found diseconomies of scale associated with offset agreements as a source of cost increase. Jones (2007) illustrates the diseconomies of scale through co-production. Co-production frequently results in the seller firm locating a duplicate facility in the buyer country with the intent of utilizing that facility specifically for production associated with the current purchase agreement. Thus, potential production orders spilt between the established facility as well as the new facility. Thus, Jones (2007) concludes, the diseconomies of scale resulting from splitting the production orders between duplicate plants results in higher unit costs for the components produced in both facilities.

Given there are real costs incurred when offsets are attached to the original contract, and these costs must be recovered by the arms seller, offsets are not cost free. In fact, they result in a substantial increase in the price of the original items procured under the contract. Therefore, Waller (2003) concluded that offsets are paid for, indirectly, by the procuring nation in the form of a price premium on the original contract.

Purchasing countries are cognizant of the increased price paid for defense items resulting from the inclusion of offsets, yet seem to turn a “blind eye” to this reality (Bulgin, 2007:9). Bulgin reasons that the purchasing country’s willingness to ignore this reality stems from their belief that the short and long-term benefits received as the result of the inclusion of offsets far outweigh the increased price. Similarly, Hawkins (2007a) found that purchasing countries rationalize that the seller invests this price differential

within the domestic economy through offsets that improve industry capability, employment, etc. Waller (2003), along the same line, considers offsets as an indirect subsidization of select sectors of the purchasing country's economy; the purchasing country directs and receives investments in its economy in the form of offsets and in return pays a higher price for defense items.

The Global Arms Market Structure

A discussion of the global arms market structure and its characteristics is necessary to understand the context in which offsets operate. First, the defense industry transitioned from one of domestic focus to one that is global in nature over the last 25 years. Second, the global defense industry went through significant consolidation to adjust to the global arms market following the end of the Cold War. Third, arms-producing countries in the global arms market consist of those that possess large defense industries with highly advanced technology (first-tier), those that possess smaller, advanced industries (second tier), and those that possess a very limited and technologically insufficient defense industry (third tier). Fifth, the United States dominates the arms trade market through research and development (R&D) and economies of scale advantages. Sixth, the European defense industry represents the most significant competition for the United States although other countries throughout the world are attempting to capture U.S. market share. Finally, political and economic factors play a vital role in the current structure of the global arms market.

Increasing Globalization of Defense Industry

Perhaps the most significant development in the defense industry over the last 20 years is how the industry has become increasingly global in nature. The transition from a domestic to a global orientation was driven in part by a consensus among leaders in the U.S. defense industry, the defense aerospace industry in particular, that globalization was imperative to its survival (Lorell, 2002). In fact, by the time the industry embraced it, globalization was already the dominant international system. Thus, for an industry to thrive in the changing environment, it increasingly needed to commit to a global focus in its operations.

However, the defense industry was not the only entity promoting increased globalization; the push also came from the U.S. government, especially within the Department of Defense. Officials within the department perceived the need to expand the U.S. defense industrial base from domestic to global in nature due to the increasingly reduced domestic competition caused by the consolidation of the U.S. defense industry. Additionally, officials saw the improved capabilities of foreign firms to provide high-tech capability solutions as rationale for promoting defense industry globalization (Lorell, 2002).

Two key components of globalization are the integration of sources of supply and the increased importance of foreign markets for sales. With increased globalization, defense companies around the world increasingly depend on arms sales in the export market for a large portion of sales; therefore, they increasingly develop subcontracting and other business relationships with overseas firms (Johnson, 1999). Globalization thus produced an environment in which offsets thrived; the defense industry, increasingly

dependent on foreign markets for sales and sources of supply, experienced increased exposure to offset demands from arms-purchasing countries.

Defense Industry Consolidation

Another important development has been the rapid consolidation of the defense industry in the United States and Europe. The U.S. defense aerospace industry went through a significant period of consolidation following the end of the Cold War. In 1990, eight prime contractors in the United States produced fixed-wing aircraft. By 1998, only Boeing and Lockheed Martin remained. Similarly, the European defense aerospace industry consolidated and there are currently only three major defense aerospace companies: BAE Systems; European Aeronautic, Defense, and Space Company (EADS); and Thales (Sköns, 2002). The impetus for the European consolidation was to create corporations comparable in size and capabilities to U.S. companies, thus enhancing their competitiveness (Hartley, 2007).

Additionally, in today's environment of reduced defense expenditures, indigenous, autarkic defense industries cannot survive. Therefore, the European defense industry created pan-European defense companies through cross-border mergers with the intent of achieving economies of scale (GAO, 1997). The strategy has been largely effective; ultimately, their goal is to become more financially and technologically competitive with U.S. firms in more product areas and promote European products for European countries and third-country procurements (Lorell, 2002). Thus, defense industry consolidation created an environment of increased competition wherein European firms compete intensely with U.S. firms for limited export opportunities. In

this environment, offset packages offered by the competing firms takes on increased significance.

Three Tiers of Arms-Producing Countries

The previous sections documented the globalization and consolidation of the defense industry over the last few years. This section describes the categorization of arms-producing countries into three tiers. Bitzinger and Kim (2005), in researching small arms-producing countries, organized the global structure of the defense industry into three tiers according to the arms-producing capabilities of the countries. According to their definition, first-tier arms-producing countries dominate the global arms market with large defense industries that possess highly advanced defense technology. In Bitzinger and Kim's model, the first-tier is an exclusive category, consisting only of the United States, the United Kingdom, France, Germany, and Italy. Flamm (2007) similarly limits the number of first-tier states. However, he includes Russia and groups European nations into a single unit. His reasoning in grouping the European countries together is that they are "beginning to move toward a single European conglomerate in some, though not all, defense sectors" (1999:118). Therefore, he includes European countries that Bitzinger and Kim categorize as second-tier countries in the first-tier as members of a "conglomerate."

Second-tier arms-producing countries represent industrially advanced countries with smaller defense industries than the first-tier countries. Overall, the level of sophistication of the second-tier countries is lower than the first-tier countries. However, in niche areas, their level of sophistication can be on par with the first-tier countries.

Australia, Canada, Japan, Sweden, Brazil, Iran, Israel, Poland, Singapore, South Africa, South Korea, and Taiwan are in the second-tier, among others. Third-tier arms-producing countries have very limited and technologically insufficient defense industries. Therefore, they are unable to compete in the global arms market but sometimes also export low-grade arms to third-world countries. Countries such as Pakistan and Egypt are in the third-tier.

United States Domination

The United States dominates the arms-trade market, especially in aerospace. Bitzinger and Kim (2005) and Flamm (2007) collectively include the United Kingdom, Germany, Italy, France, Russia, and a European conglomerate in the first-tier with the United States. In reality though, the capabilities of U.S. defense companies far exceed those of other first-tier countries. Based on revenue, 17 of the 30 largest defense companies are located in the United States. Meanwhile, 11 of those 30 companies are located throughout European countries. Expanding the list, 30 of the 60 largest defense companies are located in the United States, while 20 are located in European countries (Guay, 2007). The dominance in the aerospace sector is even more pronounced; 7 of the top 10 aerospace companies, measured by aerospace related sales, are based in the United States (Presidential Commission, 2002).

One might assume the dominance of U.S. firms in the defense industry stems from the fact that the U.S. has a significantly larger defense budget than other countries and protectionist measures that give preference to U.S. sources of supply. However, the source of dominance is not exclusive to domestic sales; global supplies for aerospace

products are similarly dominated by the United States (Lorell, 2002). The Rand Corporation reported in 2002 that U.S. arms producers supply more than half of the global arms market, including the aerospace sector (Lorell, 2002).

Two factors primarily explain the market dominance: R&D investment and economies of scale. On the topic of U.S. market dominance, Markusen (2000:14) stated that “American firms make most of the best weapons in the world, thanks to decades of public R&D investment.” Similarly, BAE chairman Richard Olver stated, “It's obviously clear that the extent of R&D in the United States is a very different order of magnitude to the R&D investment in the rest of the world, including the United Kingdom” (as cited in Hawkins, 2007b). In fact, the European countries Bitzinger and Kim placed in the first-tier along with the United States spent \$7.1 billion on defense research and development in 1997 compared to \$32.2 billion spent by the United States (GAO, 2000).

The size of the U.S. defense budget and the preference given to domestic production sources by the U.S. government create economies of scale that no other country can match. In 2007, the defense budget of the United States was \$439 billion, larger than the sum of the world's next 20 biggest defense budgets; of the \$439 billion, \$147 billion was marked for weapons procurement (Guay, 2007). U.S. arms producers are able to maintain a viable, broad-based defense industry because of the size of the domestic market. However, foreign arms producers do not have a domestic defense industry of sufficient size to be viable. Therefore, they must rely on revenues generated from exports to sustain their industry (Flamm, 2007).

U.S. Competitors

In spite of the U.S. dominance of the global defense industry, it is not without rivalry and competition. European companies present the United States defense industry with its most significant competition in the global arms market. Within Europe, the United Kingdom is the leading competitor in the aerospace industry, employing more people than France, Germany, and Italy combined (Hartley and Braddon, 2007).

Additionally, numerous countries outside of Europe are attempting to capture market share from the U.S. defense industry. Asian nations such as China, Korea, Japan, and Singapore are aggressively pursuing an industrial policy to become a world leader in aerospace products. The Chinese government, for instance, identified aerospace as an industry it intends to develop into a self-reliant, high-technology industry for the 21st century. In fact, Chinese aerospace companies have stated intentions of becoming highly competitive producers by 2012 (Presidential Commission, 2002).

Influence of Economic and Political Factors

Economic and political influences created a globalized arms market characterized by an integrated arms-development and manufacturing structure that connects prime contractors in first-tier countries with foreign government buyers and subcontractors in second-tier countries. Often precipitated by offsets, global trade increased as prime contractors in first-tier countries sold complete systems to foreign customers and increasingly awarded subcontracts to foreign suppliers in the second tier (Markusen, 2006). As the arms industry became more global, prime contractors located in the U.S. and European first-tier arms-producing countries maintained dominance in the field of

design and innovation. While second-tier arms-producing countries possess technologically advanced industries, they did not have the resources or knowledge to perform design and system integration activities. However, second-tier participation in arms manufacturing increased as prime contractors in first-tier countries increasingly subcontracted operations they traditionally performed internally. First-tier arms producers sought to improve their efficiency by searching for the best suppliers, regardless of location (Guay, 2007). Therefore, while first-tier countries continued to dominate the design and systems integration activities, second-tier countries increasingly provided components for integration.

According to Hawkins (2007c), industrialization “introduced a qualitative difference between states, similar to that between weapons: henceforward, the international order was divided between those state which possessed the materials, skills and facilities to manufacture the improved weapons and techniques, and those which did not.” Today, first-tier arms-producing countries possess the materials, skill, and facilities to manufacture the improved weapons. Second-tier countries typically do not. Essentially, U.S. and European companies dominate the defense industry through superior design, development, and integration capabilities; therefore, they are the major sellers of complete systems in the world market.

Not only did economic factors drive the allocation of development and production activities abroad, political factors such as the demand for offsets also played a role. First-tier companies increasingly saw foreign market access as vital to their survival in the era of reduced domestic defense budgets (Lorell, 2002). As foreign governments increased their offset demands, first-tier arms producers increasingly looked to companies in

second-tier countries to fill subcontracting orders in hopes of gaining market access (Markusen, 2006). Prime contractors increasingly conducted make-buy decisions to create offset opportunities and in the process gain market access. The prime contractors, therefore, increasingly became specialized in integration activities and other complex operations that typically had high entry barriers. This resulted in prime contractors purchasing a higher proportion of the value of the final product from suppliers in second-tier countries. Design, integration, and innovation remained with the prime contractors in first-tier countries that possessed the resources, technology, and expertise, while subcontracting opportunities increasingly were let to second-tier countries (Markusen, 2000).

Offsets in the Global Arms Market

The preceding discussion of the structure of the global arms market and its characteristics provide the contextual environment in which offsets operate. This section further discusses offsets in the global arms market.

Objectives in Demanding Offsets

A review of the literature revealed three primary objectives regarding offsets: influence the balance of trade, win popular support of the public for the purchase of expensive weapon systems, and industrial development. While balance of trade and public support objectives warrant discussion, industrial development is clearly of greatest importance to most countries demanding offsets.

The rising cost of defense equipment, combined with limited post-Cold War defense budgets, created an increased awareness of the negative effect of arms purchases on the balance of trade (GAO 1984). Purchasing countries saw offsets as a method of balancing trade in their favor by having some of the work, investment, and technology transferred to the domestic industry rather than having all the jobs, investment, and technology remain with the arms-selling country. Additionally, both developed and developing economies demanded offsets to prevent arms purchases from draining government budgets when funds were needed for other sectors of the economy such as transportation, education, and health care (Bulgin, 2007). The balance of trade measures were also an effective means of winning public support needed to spend funds on foreign defense equipment; the public was willing to accept the government purchase of weapon systems from non-domestic sources if they perceived the domestic industry received compensation in return.

Research indicates the primary objective of governments in demanding offsets is to increase or maintain the level of economic development of the domestic industry. Conceptually, offsets enable an arms-purchasing country to spend their budgets on foreign-produced arms while at the same time developing their domestic industry (Brauer and Dunne, 2007a). Thus, governments view offsets as an economic development strategy wherein the government procures foreign arms and in return receives offsets that increase the type and level of capabilities of the domestic economy (Taylor, 2007a). The GAO highlights the focus on economic development by noting that “concerns about domestic employment levels, and the importance of industrial competitiveness in a global economy have led governments to leverage their imports of major weapon systems so as

to yield benefits for their domestic economies” (GAO, 1998:35). Thus, offsets provide a method of leveraging arms imports.

In addition to the GAO’s findings, Sköns (2002:6) found several studies seeking to determine the motivation of industrialized countries in demanding offsets and concluded that “industrial countries seek offsets for three major economic reasons: to support their domestic defense industrial base, to reduce their dependence on foreign suppliers of military equipment, and to support their non-military high technology industries.” Economic development of the domestic industry is the methodology employed to achieve these goals. A U.S. governmental interagency team investigating offsets came to similar conclusions. It found that purchasing countries demand offsets primarily to foster economic benefits for their country that, in turn, enhance national security and promote economic development (U.S. Department of Commerce, 2007a). Finally, the priority of economic development in offset policy is evidenced by the fact that, in some governments, offset deals are negotiated by ministries in the foreign governments concerned with economic development as opposed to defense ministries (Markusen, 2006).

Governments can focus their economic development objectives on the defense sector, the non-defense sector, or both. The GAO (1996) determined that whether foreign governments direct offsets toward the defense industry depends partly on the level of development of the defense industry at the time of the offset agreement. The report concluded that countries possessing developed defense industries typically direct offsets to the defense industry and the aerospace industry, countries with developing defense and commercial industries tend to direct offsets to both the defense and non-defense

industries, and countries with less industrialized economies direct offsets to commercial industries. Examples of countries with well-developed defense industries that direct offsets to their defense industries include Canada, the Netherlands, Spain, and the United Kingdom. South Korea, Singapore, and Taiwan direct offsets to both their defense industries and non-defense industries; their goal is to further the development of both their defense and non-defense industries. Finally, the GAO (1996) identified Kuwait, Saudi Arabia, and the United Arab Emirates as countries that direct offsets to non-defense industries; their goal is to direct offset towards the development of the country's infrastructure and businesses.

Verzariu (2000) chronicled the evolution of offset practices from the 1970s through the 1990s and concluded that non-defense related offsets were becoming increasingly dominant in offset agreements (2000). Similarly, Bulgin (2007) found non-defense offsets accounted for the majority of offsets provided by the United Kingdom. More so, non-defense offsets were growing in importance and volume. Both authors highlighted select agreements that were non-defense in nature that showed how defense industries became intertwined with industries outside of their competency. For instance, Verzariu (2000) showed how General Dynamics invested in hotels, port development, and a thermal power plant in Turkey in return for Turkey agreeing to purchase 160 F-16s. Bulgin (2007) points to non-defense industrial investments in hospitals and the automotive and railway industries in Saudi Arabia, Kuwait, and the United Arab Emirates.

Economic Development Strategy

Foreign governments typically promote key sectors of the domestic industry through their economic development strategies; offsets are a tool these governments often use to focus industrial development on targeted, special interest sectors (Jones, 2007). In this respect, Waller (2003:225) argues that offsets represent a form of indirect subsidy where the buying government's motives are to promote select areas of the economy; in most cases, he states that offsets "are a form of commercial policy that the buying government use to address domestic problems." Along the same argument, the GAO (1984) argues that, by demanding offsets, the purchasing government is able to direct the seller to make investments in specific areas of the domestic economy that might not have been made in the absence of offsets. Governments typically place a great deal of emphasis on technology acquisition, one method of improving domestic capability, in their economic development strategy. A lack of existing capability and the resulting need to rely on imports is the motivational factor behind the strategy; often, the importing government must import arms because its industry does not possess the technologies needed to produce the arms locally (Taylor, 2007a).

A key factor in the success of a purchasing country's industrial development program is to promote the increase in skills and productivity of the targeted sectors. According to Taylor (2007a), offsets enhance industrial development by promoting the cooperation of an established supplier with domestic suppliers, which allows the domestic supplier to learn and develop new skills. Previous research by Hartley and Braddon (2007) validated this sentiment and found that the exposure of a company to highly productive leaders in a manufacturing industry results in increased productivity of

the company. Additionally, they found the higher the level of exposure to the industry leaders, the higher the relative productivity of the company. Similarly, the GAO (1998) stated that offsets allow companies in the purchasing country the opportunity to leverage the experience and expertise of large prime contractors located in first-tier arms-producing countries, thus improving their skills and productivity.

Since foreign governments view the defense industry as a key sector of the domestic industry, a primary goal of most buying countries in demanding offsets is to develop or maintain its defense industrial base. Falco (1998) concluded in his research on offsets in the aerospace industry that most countries demanding offsets do so with the intention of establishing or expanding their defense industrial base. Sköns (2002) found that second-tier arms-producing countries demand offsets to develop the defense industry through technology infusion. Finally, Brauer and Dunne (2007b) concluded that some states demand offsets with the goal of reviving a collapsed or failed domestic arms industry and cited Poland as one such country.

Increasing the level of exports of the domestic economy is another aspect of the purchasing government's economic development strategy. The purchasing government perceives offsets as an effective method to increase exports by placing manufacturing and service jobs within the domestic industry that will produce goods and services for export (GAO, 1984). Through an offset agreement, the purchasing government can demand the selling company establish co-production and subcontracting agreements with domestic companies. Therefore, the buying government ensures manufactured components are produced by the domestic industry for export (Waller, 2003).

Poland Offset Program

Poland's offset program provides an illustration of a country's concern for its defense industrial capability, its offset policies, goals in demanding offsets, and their motives for establishing a defense industrial base. In its handbook on the Polish defense industry, Poland confirms the importance of an independent defense industry as "one of the basic factors maintaining the independence of the state and necessary condition to implement the security strategy of the Republic of Poland" (Ministry of Economic Affairs and Labor, 2007:6). The handbook also states: "due to the importance of defense policy, every country pays special attention to the development of its national defense sector." Additionally, it indicates Poland seeks to attain a level of independence in its weapons production potential by stating: "Polish Armed Forces must be equipped with modern armament and military equipment. Among many factors essential in fulfilling those tasks, very important are the defense industry potential and its productive and innovative capabilities" (Ministry of Economic Affairs and Labor, 2007:4). Therefore, the handbook indicates Poland's view of the importance of developing an independent defense industrial base capable of supplying the equipment needs of its forces. However, Poland also seeks to integrate its defense industry with its allies.

One of the most essential assumptions of the restructuring process in the defence industry sector...is the creation of possibilities to include the entities of the Polish defence industry into the European and transatlantic cooperation in the field of the development and production of armament and military equipment, thus developing the common market of defence industry products. (Ministry of Economic Affairs and Labor, 2007:4)

Poland's goal of integration with its allies is further validated by The *Security Strategy of the Republic of Poland*, adopted on 4 January 2000. It describes how Poland intends to

restructure and modernize its defense industry to achieve “full integration” with its European and U.S. allies (Wolosz, 2004:4).

Therefore, while Poland places great importance on its ability to indigenously produce arms required by its armed forces, it also seeks to integrate its industry with its allies in Europe and the United States. One of the goals of international defense industrial integration is to enhance the export potential of its defense industry. The handbook highlights the potential export opportunities of a revived Polish defense industry by noting, “The potential and structure of the Polish Defense Industry are being shaped according to the size and type of the defense requirements determined in the technical modernization program of the Polish Armed Forces...taking into account the ... possibilities arising from export contracts” (Ministry of Economic Affairs and Labor, 2007:6). Furthermore, the handbook indicates Poland’s desire to achieve export opportunities by noting that the restructuring process of the defense industry will be tailored to “cope effectively with the competition in the international market of defense products and participate in international cooperation in this field” (Ministry of Economic Affairs and Labor, 2007:4). Thus, it is clear Poland intends to enter the arms export market and is focusing its defense industrial modernization efforts with this goal in mind.

In addition to describing the goals of the defense industrial modernization program, the handbook rationalizes the need for offsets and the expectations and objectives of Poland’s offset program. It begins by noting: “the national industry is not always able to meet all the requirements and needs concerning the nation’s defence and security. This situation forces the government to import armaments, apart from purchasing them domestically” (Ministry of Economic Affairs and Labor, 2007:10). The

handbook then explains that offsets obligate foreign suppliers to cooperate with national contractors as compensation for receiving the contract. The handbook concludes by noting that offsets are “one of the instruments for contributing to economic growth” (Ministry of Economic Affairs and Labor, 2007:10).

Thus, Poland expects offsets to contribute positively to the growth of the Polish economy and specifically to the growth of its defense sector. Specifically, the handbook lists the expectations and objectives of offsets.

According to the Offset Law offset agreements ensure the participation of foreign suppliers in the process of restructuring and developing the economy of the Republic of Poland, in particular: development of Polish industry, especially with regard to the Polish Defense Industry; gaining access to new export markets for Polish industry or increasing current export potential; transfer of new technologies and improvements in organization; development of research work, development of Polish universities and R&D centers; creation of new jobs in the Republic of Poland, in particular in regions affected by unemployment. (Ministry of Economic Affairs and Labor, 2007:11)

Therefore, Poland’s offset objectives closely mirror those cited in the literature concerning offset objectives. Namely, their offset objectives consist of general economic development, industrial development with the defense industry receiving special attention, increasing Polish exports, technology transfer, and job creation.

Poland's procurement of 48 F-16 aircraft provides an example of the expectations government officials have for offsets. Seguin (2007:6) researched Poland’s choice of the F-16 over European fighter options and noted that “Polish aircraft production capacity [was] in a dismal state.” Similarly, Wolosz (2004:6) chronicled Poland’s air force reform and modernization program and described the state of Poland’s aerospace industry by noting, “The Polish aviation industry at the end of Communist rule was adept only at

building variants of Soviet designs and selling its wares to a captive Warsaw Pact market. The plants probably cannot support the extensive, present-day modernization of the Polish air force at a reasonable cost.” Therefore, the capability to produce a modern fighter in Poland did not exist at the time of the agreement to purchase F-16s from Lockheed Martin. In addition, its modernization could not be supported without the assistance of offset agreements. Thus, Poland determined it must look externally in its efforts to modernize the Polish Air Force. Certainly, the Polish industrial base, and the defense industry in particular, requires assistance. Offset demands appear to be one of Poland’s major strategies for rebuilding its ailing defense industry. However, Poland will not know for years whether offsets were the appropriate method of achieving their objectives.

The Economics of Offsets

While international trade outside of the arms market has become increasingly liberal, the arms market has been largely sheltered from liberalized trade. Governments exert a great deal of influence on the arms market through protectionist measures and industrial development policies. Thus, free market forces characteristic of a liberalized trade regime in markets other than the defense market wield less influence than governments. Foreign government policies on offsets, in particular, contribute to the illiberal nature of the arms market. Verzariu (2000) equates policies employed by foreign governments to a form of a non-tariff barrier to trade, or a cost of doing business in a market not characterized by perfect competition. Waller (2003) likens foreign government offset policies to indirect government subsidization of its domestic defense

industry; through government intervention in the arms market, the government is able to indirectly subsidize the defense industry by forcing the arms seller to invest in the domestic industry.

Economists, scholars, and offset practitioners alike present arguments against the use of offsets on economic grounds. A U.S. interagency team notes, “while there is not a consensus among scholars on the pros and cons of offsets, they are generally regarded as trade-distorting and economically illiberal and inefficient” (U.S. Department of Commerce, 2007a:1-1). In addition, the team points out the decreased level of competition and innovation resulting from forced prime-subcontractor relationships rather than competitiveness and best value. Economists question the use of offsets as policy when offsets place benefits that have no relation to the arms procured ahead of market factors such as price and quality (Taylor, 2007c). Struys (2006:A-8) states, “Offsets are antithetical to free trade, they alter the nature of sales by including terms unrelated to prices and performance, introduce market rigidities, cause growing state intervention, and create distortions in world economy and trade.” Additionally, Wessner (2007:50) states that foreign governments “meddle in market behavior” by using offsets as an industrial policy tool. Finally, Markusen (2006: 21) claims offsets are antithetical to the “national specialization envisioned by Adam Smith and David Ricardo.” She claims offsets create a global arms market where a country can purchase a portion of the economic activity resulting from the arms purchase for its domestic economy, thereby circumventing the national specialization that naturally occurs on the basis of comparative advantage. Therefore, seller firms place work in the buying country due to offset demands and not economic incentives. The outcome can lead to perverse

economic market distortions. For example, a seller company might finance infrastructure in a country that has little chance of being utilized beyond the typical short production run that comes from a single procurement contract. Thus, offsets may force prime contractors to replace efficient incumbent suppliers with less efficient ones located in the buying country (Struys, 1999).

To understand why foreign governments utilize offsets, it is important to understand other factors that lead to the illiberal nature of the global arms market and how they influence the use of offsets in the arms market. The following sections describe how offsets are not only a contributing aspect of the illiberal trade environment but also the result of, and in response to, other determinates that create an illiberal arms trade environment. The other determinates are national security priorities, arms trade and domestic preference policies of other countries, constraints on search and switch activities, and imperfect information in the arms market.

National Security Priorities and Free-Trade

The current structure of the global arms market is the result of the interplay between national security and free trade considerations. As mentioned above, the international economy has become increasingly liberal as industrial countries embraced the principles of free trade and the unrestricted flow of foreign investment. However, Sköns (2002) states that, in the arms trade market, countries have been reluctant to permit a free trade environment for fear the increased efficiency of the market would come at the expense of national security. Broadly speaking, countries consider an indigenous industrial defense capability and capacity necessary to meet national defense

requirements as key to achieving and maintaining national security. Therefore, countries frequently institute policies that reflect protectionist measures to prevent the erosion of their domestic defense industrial capabilities, impeding the benefits of a liberal trade environment such as competition and comparative advantage in the determination of the division of labor.

Based on free-market grounds, one might argue against policies that do not promote economic efficiency. However, other important considerations come into play in policy determination. As a Brookings Institute paper points out,

avoiding foreign dependencies and protecting technological knowledge with regard to things that are used to defend a nation is rational policy. It is also rational policy to leverage the substantial benefits of the global free market to obtain the best value and capability available when procuring things that are used to defend a nation. (Robinson, 2007:iii)

Therefore, an overview of each position, liberal trade and national security, is vital to understanding the current structure of the global arms market.

Proponents of free trade present numerous arguments against the illiberal aspects of the arms market. Economists hypothesize markets that do not operate in a free trade environment are subject to economic inefficiencies in the form of resource misallocation caused by “distortions in the location and composition of industry” (Markusen, 2006:7). Government intervention in the marketplace through managed trade practices and policies meant to control and manipulate markets prevent those markets from operating in a free trade environment. Therefore, economists argue government intervention policies such as protection of domestic markets create economically inefficient outcomes. To economists, offsets are a form of government intervention and represent an “illegitimate distortion of normal trade practices” (Hawkins, 2007a).

Citing Wolf, McLean (2007) argues for a reduction in government obstacles to free trade, such as offsets, to promote the many benefits of liberal trade. His argument is that free trade creates an economically efficient outcome through an efficient allocation of resources based on economies of scale and comparative advantage. The resultant specialization in the production of goods by the participating countries results in each country producing only those products they can produce more efficiently than another country. In turn, countries engage in trade to acquire products from other countries in exchange for those products. Other benefits that Wolf attributes to a liberal trade regime are competition and increased productivity through the exchange of technology (McLean, 2007). In summary, the free trade proponents argue that if a country's economic development and growth were its highest priority, it would achieve them by opening up protected markets to free trade (Brauer, 2007).

Proponents of national security argue against the dominance of free trade principles in determining government policy concerning the global arms market. At the simplest level, proponents believe national security is too vital to expose to the vulnerabilities of the free trade environment (Hawkins, 2007a). They further argue that countries depending on foreign sources of armaments subject themselves to the foreign policy priorities of the arms exporting country. In effect, the country cannot independently pursue foreign policy objectives counter to those of the exporting country without risking the loss of its source of arms. Therefore, the country must place national security ahead of the economic advantages achieved through free trade.

In fact, this is what is seen in the arms market; countries widely use protectionist measures in the form of offsets and buy domestic provisions. While countries might

publicly proclaim their support and adherence to free trade principles, the reality is most countries pursue managed arms trade policies to control markets in support of domestic production (Hawkins, 2007a). As Jones (2007:115) stated in his investigation of offsets, “defense trade is and has been anything but laissez-faire. Interests of national security, balance of trade, and industrial bases constantly influence proposed transactions.”

International organizations and trade agreements support government intervention in the global arms market by permitting governments to manage arms trade. In fact, the World Trade Organization (WTO, 2007: 23) published the Government Procurement Agreement (GPA) to explicitly prohibit offsets in government procurement activity in world trade. Specifically, Article XVI of the GPA states, “Entities shall not, in the qualification and selection of suppliers, products or services, or in the evaluation of tenders and award of contracts, impose, seek or consider offsets.”. However, Article XXIII, Exceptions to the Agreement, of the GPA states,

Nothing in this Agreement shall be construed to prevent any Party from taking any action or not disclosing any information which it considers necessary for the protection of its essential security interests relating to the procurement of arms, ammunition or war materials, or to procurement indispensable for national security or for national defence purposes.
(WTO, 1994:28)

Additionally, the General Agreement on Tariffs and Trade (GATT), which is administered by the WTO, permits governments to use offsets in procuring items on the global arms market. Mimicking the language of the GPA, GATT prohibits offsets in government procurement except for the procurement of defense articles (GAO, 1996). Therefore, while the WTO prohibits the use of offsets in government procurement in world trade, the prohibition is waived for government procurement of national security

items, particularly all items sold on the global arms market. Lastly, member states of the European Union abide by the European Commission (EC) Treaty. Article 296 of the EC Treaty states,

Any Member State may take such measures as it considers necessary for the protection of the essential interests of its security which are connected with the production of or trade in arms, munitions and war material; such measures shall not adversely affect the conditions of competition in the common market regarding the products which are not intended for specifically military purposes.” (European Union, 2007:173)

The language of the GPA, GATT, and EC Treaty provide evidence that international organizations and trade agreements restrict government intervention in the global market. However, they support government intervention in the global arms market by permitting governments to manage arms trade through offsets and other market distorting mechanisms in the interest of national defense.

Foreign Domestic Preference Requirements

Most countries have foreign domestic preference requirements that distort free trade in the arms market. While the United States does not have an official offset policy or require offsets for its arms purchases, it does have laws that give preference to domestic products and services over those from foreign sources. These practices are no less trade distorting than offset requirements of foreign nations (Mowery, 2007). One such law is the Buy American Act, which was passed by Congress in 1933. This act requires that all government purchased products and services meet a 50 percent made-in-America standard. Further, the act requires a six percent competitive pricing advantage to domestic business bids over foreign bids (McLean, 2007). Another act that gives

preferences to domestic sources is the Defense Production Act of 1950. This act allows the Secretary of Defense to restrict purchases of what are deemed critical items from foreign sources with the intent of preserving United States ability to quickly mobilize in times of war.

Finally, the annual Department of Defense appropriations acts frequently contain language and Buy American requirements prohibiting purchase of specific products from foreign firms with the intent of protecting domestic firms (GAO, 1996). The United States is not alone in the use of domestic preference policies to protect its defense industry. Most members of the European Union do not have open defense markets either; they give preference to its domestic industry in weapons procurement and impose offsets when they agree to purchase weapons from external sources. Similarly, most every country that imports defense items has domestic preference policies and demand offsets of foreign sources (Meyer, 2007).

Many countries believe the domestic preference laws of the United States equate to a de facto offset policy; the U.S. government requires that foreign sources of weapon systems meet U.S. domestic production requirements by moving a substantial amount of production and assembly work to the United States (Mowery, 2007). Foreign governments contend the United States rarely purchases arms from international sources without requiring the production of the arms in the United States (Johnson, 2007b). Therefore, while the United States may not refer to its domestic production requirements as offsets, they appear no different than a 100% direct offsets policy to its trading partners (Johnson, 2007a).

A U.S. interagency team reported countries employ offsets out of necessity to mitigate the impact U.S. domestic preferences have on their defense industry (U.S. Department of Commerce, 2007b). The National Defense Industrial Association (Background, 2007) reported similar findings, stating that foreign countries indicate offsets or domestic participation requirements are necessary to “level the international market due to domestic source or participation requirements.” Finally, Bulgin (2007), in his investigation of offset practices, found that the United Kingdom Ministry of Defense has a policy of Industrial Participation to correct the imbalance caused by barriers to competition in foreign markets caused by protectionist measures or closed markets.

The consensus in the literature is that offsets will continue to dominate the arms-trade environment as long as other nations erect barriers to international participation in domestic defense markets. Scholars on defense offsets note offset demands will continue as long as the United States maintains domestic preference requirements that limit the ability of foreign countries from participating in the U.S. arms market. Similarly, the U.S. Industry Trade Advisory Committee, after determining there was a connection between the demand for offsets by foreign countries and U.S. domestic preference laws, stated that offsets will not be eliminated from the arms trade environment as long as domestic preference laws remain, especially in the United States (U.S. Department of Commerce, 2007a).

The U.S. government has taken action in the form of treaties, international agreements, and “Determinations of National Interest” to ease many of the restrictions placed on foreign procurement from allied countries. For instance, the Secretary of Defense, under the authority of the Culver-Nunn Amendment, restricted the application

of the Buy American Act from U.S. procurement of defense equipment from the following nations: Australia, Belgium, Canada, Denmark, Egypt, Federal Republic of Germany, France, Greece, Israel, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Turkey, and the United Kingdom. Additionally, the Secretary of Defense can exclude other nations outside those mentioned above when deemed to be in the national interest. Thus, although the Buy American Act is still law, subsequent amendments exclude virtually every nation that sells high-technology weapon systems and components from U.S. domestic preference laws (Lorell, 2002).

In light of these exemptions and their frequent application, foreign perceptions that the U.S. defense market is closed to competition outside the United States should be alleviated. However, foreign countries continue to consider the U.S. defense market closed (Lorell, 2002). The findings in a Department of Defense White Paper validates this perception; it found the United States spent less than 2 percent on imports of U.S. defense articles during 2004 (Guay, 2007). Therefore, they rationalize, offsets are still necessary to act as a counterweight to U.S. protectionist measures and to level the playing field in the arms market.

Search and Switching Costs

Search and switching costs represent another barrier to the liberal arms trade market. Arms sellers incur search costs when searching for alternative sources of supply; the costs are incurred in the process of gaining information about a potential supplier's characteristics such as product price, quality, production location, and capacity. Arms sellers incur switching costs when switching from an incumbent supplier to a new

supplier (Ianakiev, 2007). Ianakiev's (2007) investigation into how offset policies affect the international division of labor provides an in-depth analysis of search and switch costs as an impediment to liberal trade and how offsets act to remove the impediment.

He states that,

if informational deficiencies and switching costs are present, relations between large defence system integrators and potential partners or suppliers may not occur spontaneously. ... Offset policies can be effectively used to modify the exporting company's incentives to seek out and establish links with firms located in the importing country. (Ianakiev, 2007:2)

The global arms market operates in an environment characterized by imperfect information (i.e., arms sellers do not have perfect information on potential foreign sources of supply). Obtaining information implies that the seller will incur search costs. However, Ianakeiv (n.d.) found that arms sellers are unlikely to search for alternative sources of supply when the search costs are higher than the potential efficiency increase or cost saving gained by changing suppliers. Thus, the arms market naturally favors incumbent suppliers over new suppliers.

Offsets provide an incentive to entice sellers to search and switch by supporting the incurred costs through a contract price premium. Refusing to search for suppliers as a condition of the offset agreement would result in the seller losing profits through the contract. Thus, (2007) found that the seller will perform search and switch activities up to the point the costs are less than the profits from the contract. In the absence of the offset, the seller likely will not search for suppliers in the purchasing country and will remain with the incumbent supplier. Therefore, by providing incentives for the seller to search and switch, offsets enable the purchasing country to overcome the natural barriers

that result from the search and switching costs. The result, theoretically, is a transfer of work from external sources to the domestic industry.

The literature provides instances where the use of offsets to force a company to perform search and switch activities resulted in a beneficial relationship for both parties and instances that did not benefit the parties. Ianakiev (2007) cites a survey by Martin and Hartley to illustrate the positive effects of offsets on promoting search and switch by sellers and the resultant relationships established with new sources of supply. The survey states, “In six of the 11 offset sales the respondents said that the offset obligation had led to the discovery of new, lower cost, sources of supply and in all six cases the intention was to continue to do business with new source once the offset obligation had been fulfilled” (Ianakiev, 2007:5-6).

Similarly, a U.S. interagency team reported that offset requirements had led their companies to discover efficient subcontractors that they would not have found in the absence of offsets (U.S. Department of Commerce, 2007a). Conversely, the potential exists for offsets to create market-distorting effects when the incentives to search and switch lead to the seller replacing incumbent suppliers with less efficient ones located in the buyer country. Ultimately, this can lead to deterioration in the international distribution of productive activities. Once the offset obligations are fulfilled, the seller may be have no other option but to remain with the new supplier; otherwise, the seller would incur additional search and switch costs in changing its source of supply (Ianakiev, 2007).

Imperfect Information

Offsets are a government policy tool in response to the lack of perfect information and the oligopsonistic and oligopolistic nature of the global arms trade market. Taylor (2007c) describes the economic environment of the arms market and the use of offsets by buyer countries. In the theoretical competitive market, numerous buyers and sellers have perfect information about product quality, cost, and value. Moral hazard and adverse selection is non-existent in a market where both buyers and sellers have perfect information. Therefore, risks associated with “arm’s length exchange” are not present.

However, very few actual markets fit the definition of the textbook competitive market. In fact, information is often asymmetric; either the buyer or seller possesses information not shared with the other, allowing for moral hazard and adverse selection to exist. Concerning the arms trade market, there are neither numerous buyers nor sellers in the market; sellers are part of an oligopoly and buyers an oligopsony. As Taylor (2007c:11) states, “exchange hazards tend to increase as the market structure approaches oligopoly” due to the prevalence of high technology products and tacit information in these markets. Therefore, the existence of asymmetric information and the oligopolistic and oligopsonistic nature of the market create environments where buyers and sellers are vulnerable to opportunistic behavior.

Taylor (2007c:2) further states, “When oligopolistic multinational firms are key decisionmakers, it would be foolhardy for a developing country to proceed with policy on the basis of traditional models of pure competition, perfect markets, and comparative advantage.” In most markets, buyers use their leverage to achieve price discounts. However, in the arms market, governments instead use their oligopsony power to demand

offsets rather than price discounts that actually increase the price of the procured product. Taylor (2007b) states the use of offsets by an oligopsony power points to the market imperfections that exist in the arms market and the importance of non-market activity; he concludes that offsets are a response to the existence of hazardous exchange environments in the global arms trade market (Taylor, 2007b). In another paper, he similarly concluded that offsets enhance the efficiency of the market by decreasing the probability of seller opportunism resulting from imperfect information (Taylor, 2007a).

Technology Acquisition and Utilization

The goal of most arms-buying countries in demanding offsets is to develop or maintain the domestic defense industrial base. As Brauer and Dunne (2007b:12) state, “a number of countries have been clear that their primary purpose with arms trade offset work regards not general economic development but development of the indigenous arms industry.” A crucial element of their defense industrial development strategy is the acquisition of technology from arms sellers through offset agreements (Brauer and Dunne, 2007b). The U.S. Department of Commerce (2007b:1-5) provides the following definition of technology transfer.

Transfer of technology that occurs as a result of an offset agreement and that may take the form of research and development conducted abroad, technical assistance provided to the subsidiary or joint venture of overseas investment, or other activities under direct commercial arrangement between the defense prime contractor and a foreign entity.

There exists a wide technology gap between first and second-tier arms-producing countries necessitating the need of second-tier countries to pursue technology transfer.

To demonstrate this concept, the Polish defense industry handbook, *Vademecum*, states the following.

The basic decisive factor in the level of competitiveness of the defence industry is its innovation capability which is mainly expressed in the use of modern technologies... The key role in the acquisition of modern technologies is played by the research and development activities (Ministry of Economic Affairs and Labor, 2007:8)

Yet, Poland cannot hope to compete with first-tier weapons-producing countries due to the disparity between the investment in research and development of the first-tier countries compared to second-tier.

The United States spends far more on defense research and development than any other country. For example, in 1997, the United States spent \$32.2 billion on defense research and development while the remaining first-tier weapons-producing countries (France, Germany, Italy, and the United Kingdom) spent \$7.1 billion combined; second-tier countries spent even less (GAO, 2000). Thus, second-tier arms-buying countries import technology from weapons sellers in the first-tier to improve their technological base (Waller, 2003). Through its offset policies, these countries seek to attain the technology that will provide their firms with the capability to produce and market their products, either as a supplier or in direct competition to prime-contractors in first-tier countries (GAO, 1996). Through offset policies, these countries believe offsets will provide the technology infusion needed to enable their companies to produce advanced weapon systems.

Proponents of utilizing offsets to enable the transfer of technology from weapon seller to weapon buyer believe offsets are effective at achieving significant technology transfer. A GAO (1994:2) report investigating Asian aeronautical industrial development

noted that technology transfer through offset agreements “allows Asian nations to develop industrial and technological capabilities in a fraction of the time needed to cultivate them from scratch.” Similarly, Polish officials believe the offset agreements attached to the purchase of F-16s from Lockheed Martin will allow their country to develop an indigenous defense industry through technology transfer. As Michael Kleiber, head of the offset committee in Poland notes: “Most of the proposals [in the F-16 offset agreement] involve state-of-the-art technology... a technological bridge would be created between the United States and Poland” (Spreading, 2007). Offsets will therefore allow Poland to revitalize its defense industry through technology transfer.

Critics of utilizing offsets to enable the transfer of technology from weapon seller to weapon buyer disagree with this positive assessment. Brauer and Dunne (2007a) conducted research to investigate how effective offsets are at achieving the reported benefits by examining empirical evidence contained in existing literature. They found “virtually no case where offset arrangements have yielded unambiguous net benefits for a country’s economic development” (Brauer and Dunne, 2007a:1). Additionally, they found that offsets, with “very few exceptions do not result in significant technology transfers, not even within the military sector” (Brauer and Dunne, 2007a:1). While technology transfer did occur, they found that the indigenous defense industry did not acquire sufficient capabilities to close the technology gap with technologically advanced weapons producers. Even if they did attain sufficient capabilities to close the gap, they failed to keep up with the ever-advancing technology following the initial technology transfer. The inability to keep up with the state of technology in the United States was especially pronounced. Finally, Brauer and Dunne (2007a) observed that the limited

technology transfer that did occur took decades to achieve and came at a high cost. Therefore, Brauer and Dunne's (2007a:1) findings indicate utilizing offsets in an attempt to close the technology gap between second-tier and first-tier weapons-producing countries is not effective in transferring technology, is costly, and does not "allow...nations to develop industrial and technological capabilities in a fraction of the time needed to cultivate them from scratch."

Defense Industrial Base Establishment and Maintenance

A review of the literature on offsets indicates a primary goal of most buying countries in demanding offsets is to develop or maintain the domestic defense industrial base. The objective for arms-buying countries in developing or maintaining their defense industrial base is to reduce the dependency on foreign sources for arms, thereby increasing their level of self-sufficiency. Secondly, these countries hope to improve the export potential of their defense industry. Typically, countries pursue both objectives, although the levels of each vary depending on their ambitions. Thus, the pursuit of these objectives is rarely mutually exclusive; improving export potential of defense systems is vital to achieving self-sufficiency through economies of scale. Additionally, some second-tier countries have ambitions to become first-tier weapons-producing countries while others have more modest goals such as becoming niche market producers.

Increased Self-Sufficiency

Adam Smith, in *Wealth of Nations*, stated: "It is of importance that the kingdom depends as little as possible upon its neighbors for the manufactures necessary for its

defense” (Robinson, 2007:4). To many, Smith’s basic principle for maintaining national sovereignty remains valid today. “A fundamental element of the national security policy of many nations (including most U.S. allies) is the creation and maintenance of their own independent, autonomous capabilities to produce at least some advanced weapons systems” (Flamm, 2007:116). By reducing their exposure to foreign sources of arms supply, countries are able to assert a greater level of political independence and sovereignty.

To many, events of the past validate the need for countries to attain a level of independence in arms production if they wish to attain sovereignty. Historically, governments have frequently attempted to influence the sovereignty of other nations by withholding arm shipments or issuing orders to domestic firms (Lorell, 2002). One such event involved Turkey and the United States. In response to Turkey’s military actions in Cyprus in 1974, the United States imposed an arms embargo that lasted until 1977. By the time the embargo was lifted, the Turkish armed forces were in a severely weakened state; less than half of Turkey’s aircraft were operational due to their inability to acquire spares and other military equipment. Thus, Turkey’s sovereignty was compromised by having to rely on foreign sources of supply for its arms (Ilbas, 2002).

The use of offsets to improve the capabilities of indigenous sources of production is one method countries use to reduce their dependency. Existing research shows reduced dependency on foreign sources for arms and increasing the level of self-sufficiency has been an important objective for many countries in their offset policy objectives. Sköns (2002) argued that governments demand offsets for security related factors and desire independence in their defense and security policy. By independently developing and

producing arms, Sköns (2002) concluded that the government becomes less dependent on the seller.

Johnson (2007b) determined many countries demand offsets to improve the skills in their defense industries with the goal of reducing dependency on foreign sources of arms over time and attaining a level of self-sufficiency. Similarly, Brauer and Dunne (2007b:3) listed countries such as Brazil, India, and Indonesia that used offsets in the past in an attempt to attain a level of self-sufficiency in the defense industry through “the development of an indigenous ability to produce a sweeping plate of weapons systems in-country.” The motivation of these countries, they concluded, was to establish their countries as regional powers through self-sufficiency. Finally, Taylor (2007b) found many countries view an independent defense industry as vital to their national security.

A survey of offset policies from numerous countries further demonstrated that reduced dependency on foreign sources for arms and increased self-sufficiency remain important objectives for many countries. For instance, Spain has a law requiring the provision of offsets in return for agreeing to procure foreign military equipment with the goal of promoting self-sufficiency in their defense industry (GAO, 1984). Similarly, Turkey’s “Offset Guidelines” directs their Undersecretary for Defense Industries to manage the offset program with the goal of ensuring established defense industries are self-sufficient regarding weapons production (Falco, 1998). Brazil, in the past, has also sought to attain independence in arms production. Brazil’s offset policy “has been pursued not so much for direct economic benefit but to develop Brazil’s arms industry to fulfill a certain view of its place in the world” (Brauer and Dunne, 2007a:10). Their vision of their place in the world was one in which Brazil would “take a leading,

independent role on the world stage.” With the goal of “fulfilling Brazil’s potential for greatness, and also in asserting sovereignty over her vast landmass and waters,” former Air Force Minister Macedo, mirroring Adam Smith’s principle, declared, “It is a condition of security that each nation manufacture its own armaments” (Perlo-Freeman, 2007:4). Finally, South Korea provides another instance of a country focusing its offset policies on attaining independent arms production capability. In fact, South Korea has some of the most ambitious goals. Two of its primary objectives are for offsets to enhance their ability to “independently develop primary weapon systems for core force capability” and independently develop an advanced fighter jet by 2015 (Bitzinger, 2003:49).

Arms Export

Countries are motivated to enter the arms export market primarily by two factors: a desire to improve balance of trade and to improve the economies of scale of their defense industry. In reviewing current offset regulations of various countries, Verzariu (2000) found the offset provisions frequently focus on enhancing the country’s balance of trade through exports. Additionally, countries utilize offsets to pursue sales opportunities in the arms market and in the process create economies of scale, thus improving the viability of the defense industry. Therefore, countries tailor their offset policies to achieve these goals.

Brauer and Dunne (2007a) found that second-tier countries specializing in niche production in the defense industry use offsets to maintain their competitiveness in the global arms market. They listed countries such as Sweden and the Netherlands that fit in

this category. Norway is another country that limits itself to the export of niche defense items. Thus, it tailors its offset demands to enhance its defense industries competitiveness in those markets (U.S. Embassy Office of Defense Cooperation, 2007). Similarly, less developed economies have sought to enter the arms export market by structuring their offset programs to grow industries that specialize in certain arms niche areas (Brauer and Dunne, 2007a). A U.S. interagency team summed up the goals of these nations in stating, “The goal of these countries as demanders of offsets is to ensure that their high quality, niche technology defense firms maintain competitiveness through access to global markets... Their goal is to make their defense firms indispensable subcontractors to larger European and U.S. prime contractors” (U.S. Department of Commerce, 2007a:4-4).

Second-tier arms-producing countries typically specialize in niche arms production and provide a source of supply for first-tier arms-producing countries. However, there are countries that have attempted to transition from the second-tier to the first-tier. South Korea’s objective was to participate broadly in global arms trade, thus matching their ambitious goals of building a robust indigenous defense industry capability. Therefore, South Korea sought to participate in the market through the export of a wide array of arms as opposed to specializing in a niche market (Brauer and Dunne, 2007b). South Korea is pursuing this policy in spite of the fact its defense exports have traditionally been restricted to small niche markets (Bitzinger and Kim, 2005). India, a country not known for its arms export potential in the past, has similar ambitions. It intends to not only produce niche products but to utilize offsets to develop its defense industry’s ability to design, develop, and export complete systems (Hawkins, 2007c).

Efficacy

According to Brzoska, countries have typically followed an arms industry development plan that entails ‘5 easy steps’ which consist of “assembly, component production, licensed production with imports of sophisticated components, domestic design and production, and independent production with few imported components” (as cited in Perlo-Freeman, 2007:1). However, research indicates an arms industry development plan is neither easy nor should it necessarily proceed through all five stages. Indeed, empirical evidence suggests second-tier weapons-producing countries that attempt to establish an autarkic defense industry capable of independent production rarely succeed. Bitzinger (2003:39) describes the “dual dilemma” faced by second-tier arms producers in their quest to achieve self-sufficient arms production capability characteristic of Brzoska’s fifth step:

[Second-tier arms producers] tend to pay higher costs for less-capable indigenous weaponry, while at the same time they have not freed themselves of their dependencies on and subordination to first-tier arms producers in critical technologies and components. ...sustainable self-reliance is neither technologically feasible nor cost-effective, resulting in indigenous weapons that are often inferior to, as well as more expensive than, those readily found on the international arms market.

Brauer and Dunne (2007a, 2007b) repeatedly assert the inability of offsets to achieve a sustainable defense industrial base in their research. The evidence, they contend, fails to show offsets have succeeded in creating new or sustainable jobs in the economy in general and the defense industry in particular. Further, they find the evidence indicates offsets do not advance the country’s long-term economic or military goals. Brauer and Dunne (2007b) also cite the realities of the marketplace in describing why these countries have been unsuccessful. The market for arms, they contend, has witnessed a dramatic

drop in demand due to the absence of conflict. Thus, they argue “it seems absurd then that some countries still intend to build the [defense] industry and that offsets are thought (and sought) to promote this” (Brauer and Dunne, 2007b:17). As demand in the market decreases, defense industries should exit, not enter. Finally, they argue that due the exponential rise in unit weapon costs, coupled with the drop in defense budgets worldwide, creates arms-producing countries that are too weak to survive. Thus, there are “an increasing number of arms producers ... kept alive by an infusion of costly state aid” (Brauer and Dunne, 2007b:19). They cite Brazil, India, Indonesia, South Africa, and South Korea as examples.

The literature also cites evidence of successful offsets programs. As was shown earlier in the literature review, the defense industry has globalized. Thus, while the U.S. continues to dominate the international arms market as a first-tier producer and integrator of complete systems, many second-tier countries have established successful defense industries based on a strategy that acknowledges their second-tier status. As pointed out by the U.S. Department of Commerce (2004:51), “many European firms are technically comparable and some superior to U.S. firms in the production of various critical components.” Therefore, the U.S., and other first-tier weapons producers have increasingly come to rely on these second-tier countries to provide critical components.

To many second-tier countries, offsets provided valuable assistance in enabling their industry to integrate with the global industry (U.S. House of Representatives, 2004). As the U.S. Department of Commerce (2007b:3-1) points out, “previous studies and discussions indicate that U.S. prime contractors sometimes develop long-term supplier relationships with overseas subcontractors based on short-term offset requirements.” For

example, Eland (2007:7) found that “U.S. prime contractors already purchase a growing proportion of critical parts and technologies for weapons from foreign subcontractors.” Similarly, the U.S. Department of Commerce (2004) observed an increased role of second-tier arms producers in supplying critical components to U.S. prime contractors; the department found imports of components increased substantially in the ten years prior to 2004. Further, it attributed the use of offsets as a main contributory factor. Due to offsets, the department stated, U.S. prime contractors have increasingly relied on second-tier arms-producers as sources of parts rather than relying on traditional domestic sources.

Data provided by the U.S. Department of Commerce (2004) report supports these findings. While they only provide data for the aerospace industry, it is reasonable to presume that offsets have also had the same effect on other sectors of the defense industry. During 1993 to 2000, imports of parts and components, measured by dollar value, rose 82 percent. During the eight-year period, the U.S. imported \$71.5 billion in aircraft and engine parts. Of that amount, \$4.7 billion was attributed to direct offsets with \$2.9 billion coming from indirect offsets. Thus, almost 11 percent of the imports resulted from offset agreements.

Case Studies

Numerous case studies have been conducted to analyze the efficacy of individual countries’ offset policies in achieving their stated goals. Perlo-Freeman (2007) conducted case studies on the experiences of Brazil in its attempt to establish and maintain a defense industrial base. Noting that Brazil has pursued the development of its

defense industry through an extensive use of defense offsets since the 1970s, he states, “Brazil did not pursue arms trade offsets to achieve general economic development; Brazil’s offset policy and practice ... involving ... technology transfer has been pursued ... to develop Brazil’s arms industry to fulfill a certain view of its place in the world” (Perlo-Freeman, 2007:12). Primarily, Brazil used offsets to achieve licensed production, co-production, and technology transfer.

During the 1980s, Brazil’s attempt to establish an independent defense industrial base appeared to be a success as the country consistently ranked as a top 10 arms exporter (Perlo-Freeman, 2007). As Perlo-Freeman (2007:1) points out, Brazil achieved “spectacular success for a Third World producer and exporter in the 1980s.” However, the source of their success can be traced to politics more than their ability to produce high-quality, technologically advanced weapon systems. Brazil’s major selling point was the fact that they “followed a very loose export control policy, indeed making a primary selling point to 3rd World buyers the fact that Brazil would impose no political conditions on sales” (Perlo-Freeman, 2007:6).

Two events exposed the weakness of their export strategy and ultimately led to the collapse of their defense industry in the early 1990s: the end of the Iran-Iraq in 1988 and the 1991 Gulf War (Perlo-Freeman, 2007). The Iran-Iraq war served as a valuable source of demand for Brazilian arms; thus, the war’s end resulted in a substantial reduction in demand. Additionally, the Gulf War “demonstrated the superiority of US technology, rendering Brazil’s ‘cheap and cheerful’ but technologically less sophisticated weapons much less attractive” (Perlo-Freeman, 2007:7). Another indication of Brazil’s failure to establish their industry as a competitor with first-tier weapons-producing

countries was the fact that Brazil still relied heavily on imports of advanced weapons and components to equip their military. Thus, although it appeared Brazil's use of offsets to establish a defense industrial base appeared to be successful, the reality is it merely allowed its industry to supply substandard weapons to Third World countries and did not free Brazil of reliance on the U.S. as a source of advanced weapon systems (Perlo-Freeman, 2007).

The current state of the Brazilian defense industry leads one to conclude that Brazil's attempt to establish and maintain an indigenous defense industrial base has been a failure. As Brauer and Dunne (2007b:14) point out, "of all of Brazil's extensive indigenous arms production ventures started since the 1930s with various forms of offsets, only a single one – Helibras – might be deemed commercially viable." Perlo-Freeman (2007:23) similarly commented on the failure of the Brazilian arms industry by noting "the arms industry in Brazil has proved costly, has been difficult to maintain as a commercially viable concern, and cannot realistically hope to attain full independence of arms supply in any case." Finally, Bitzinger (2003:41) notes in spite of being one of the largest arms industries during the 1980s, "by the early 1990s... [Brazil's] defence industry all but disappeared."

Another interesting case study involves the Turkish offsets program. Prior to the mid-1980s, Turkey lacked a defense industrial base capable of producing sophisticated weapons. Since then, Turkey has undertaken a program to develop its defense industry through offsets. Turkey's "Offset Guidelines" directs their Undersecretary for Defense Industries to manage the offset program with the goal of ensuring established defense industries self-sufficiency in weapons production (Falco, 1998). Ilbas (2002:70) provides

a positive assessment of Turkey's efforts to establish an indigenous defense industry by stating: "The production capabilities of the Turkish defense industry...indicate[s] that the offset implementations significantly contribute to the development of the country's defense industry." However, according to Sariıbrahımođlu (2007), Turkey continues to rely on foreign components for its main system exports with around 80 percent of its exports consisting of components produced by foreign contractors. This indicates that Turkey has not been successful at creating defense industry self-sufficiency through offsets as the "Offset Guidelines" mandate. A further indication of the inability of the industry to achieve self-sufficiency is that they continue to rely on offset commitments by foreign contractors to keep their production lines running (Sariıbrahımođlu, 2007).

Turning specifically to the defense aerospace, Turkey's attempt to enter the defense aerospace business, which centered on the F-16 production deal, appears to have achieved limited success based on aircraft export data provided by SIPRI (2008). Under the Peace Onyx program, Turkey embarked on a ten-year plan to develop an indigenous aerospace industry. Under the program, U.S. manufacturers transferred technology and expertise to Turkey's infant aerospace industry. However, once the program ended, Turkey's industry was left with industrial capacity but no demand. Therefore, a second program, Peace Onyx II, was initiated between the U.S. and Turkey. The program resulted in additional orders for Turkey's industry (Ilbas, 2002). However, with the completion of the program, the industry once again faced production capacity with no demand. In fact, Turkey has not exported significant aerospace systems since 1999 (SIPRI, 2008). Thus, although Ilbas (2002) provides a positive assessment of Turkey's offset program in 2002, the available data since then, at least in the aerospace industry,

indicate its effort to utilize offsets to establish and maintain an aerospace defense industrial base has not been successful.

South Korea provides another case study of a country focusing its offset policies on attaining independent arms production capability. Beginning in the 1970s, South Korea pursued ambitious goals that included utilizing offsets to enhance their ability to “independently develop primary weapon systems for core force capability” and providing the jump start for their industry to independently develop an advanced fighter jet by 2015 (Bitzinger, 2003:49). Additionally, South Korea sought to achieve the ability to participate broadly in the global arms-trade market through the export of a wide array of arms as opposed to specializing in a niche market (Brauer and Dunne, 2007b). These are ambitious goals since South Korea defense exports have traditionally been restricted to small niche markets and have not involved export of complete systems (Bitzinger and Kim, 2005).

South Korea’s attempt to transition from a second-tier niche supplier to a first-tier supplier of complete weapon systems has not been successful in spite of the fact it was the fourth highest recipient of offsets during the 13-year period the Department of Commerce (2007) has collected data on offsets. As Bitzinger and Kim (2005:183) state: “After more than 30 years of significant public and private inputs in infrastructure and technology ... [South Korea] still possesses only limited capacities for self-reliant arms production, and, in general, indigenous arms production has turned out to be neither technologically practicable nor cost-effective.” In spite of its failure, South Korea continues to pursue its strategy of defense industrialization and autarkic arms production.

The case study of Sweden provides an illustration of a country that successfully employed offsets to achieve realistic goals for its defense industrial base. For years, Sweden has utilized offsets as a method of developing and maintaining its defense industrial base with the goal of achieving autarky in armaments production. However, Swedish authorities have recently acknowledged autarky is “no longer ‘economically and technically possible’ and that the country ‘can no longer afford to sustain a national defense industry to the extent that this was possible in the past’” (Bitzinger, 2003:53). Thus, Sweden has set about to consolidate and rationalize its defense industrial base with the intent of concentrating on its “core competencies and niche production and the expanded promotion of arms exports” (Bitzinger, 2003:53). Sweden has shown through its defense industrial base policies that it understands the realities of globalization and the need to integrate its defense industrial base with first-tier weapons producers. As such, it has realized it can no longer rely on domestic orders for its survival nor be an independent arms producer. As a result, Sweden has become “one of the few second-tier arms producers to have consistently ranked among the world’s top ten arms exporters” (Bitzinger, 2003:53)

Sweden’s ability to recognize its place as a second-tier arms-producer in the current global arms market enabled it to formulate a successful defense industrial strategy. The experiences of other second-tier countries provide additional evidence of the realities facing these countries. Singapore, which similarly recognized the futility of autarkic arms production, shifted its strategy to focus on core competencies and niche production; its defense industry is consequently thriving (Brauer and Dunne, 2007b). Taiwan recognized the need to adjust its defense industrial strategy as well. As the

second leading recipient of offsets over the past 13 years, Taiwan recently acknowledged “the original plan for independent production of weapons must be stopped or reduced” and has pursued a strategy to integrate its industry with foreign producers (Bitzinger, 2003:39). Similarly, Spain recently “had to abandon dreams of an integrated, comprehensive, indigenous arms industry to be generated via arms trade offsets” (Brauer, 2007:10). Indonesia experienced the collapse of its defense aerospace industry despite ambitious attempts to create an indigenous industry (Brauer and Dunne, 2007b). South Africa once pursued a strategy of “possessing the capacity to design, develop and manufacture a broad array of weapon systems” (Bitzinger, 2003:45). Over the past few years, South Africa has abandoned this strategy in favor of one based on mastery of core competencies and specialization in niche programs (Bitzinger, 2003). Thus, one can see that second-tier countries who recognized the futility of indigenous, autarkic arms production in the current globalized arms market shifted their defense industrial strategy to specialization in niche markets and concentrated on core competencies rather than attempting to achieve the ability to produce a broad array of weapon systems.

Summary

This chapter presented an overview of the current literature on the subject of offsets by documenting the importance of the topic and providing a knowledge baseline from which an analysis of offset objectives regarding technology transfer and the establishment and maintenance of a defense industrial base in second-tier weapons-producing countries can proceed. The next chapter identifies the research methodology used in this research as well as limitations of the methodology.

III. Methodology

This chapter describes the methodology used for this thesis. First, an overview of past methodologies utilized in offset research will be described along with their limitations. Next, justification for the methodology used in this thesis will be provided. Finally, limitations of the methodology will be discussed.

Overview

Initially, an exploratory study was conducted due to the complexity of the offsets issue and the need to significantly refine and scope the research problem. According to Emory (1991), an exploratory study is useful in refining and scoping a research problem into a manageable effort and allows the researcher to demonstrate the importance of the topic. At the conclusion of the exploratory research, the researcher is able to formulate specific research questions. Additionally, Emory (1991) notes that an exploratory study enhances the researcher's ability to determine the appropriate research methodology to gather and analyze data pertaining to the research questions resulting from the study.

As discussed in Chapter I, the existing literature on offsets is voluminous; professionals from academia, government, and industry performed extensive research and have written at length concerning the topic. Therefore, the exploratory study revealed numerous research efforts on offsets to include books, theses, government publications, and journal articles devoted exclusively to offsets. However, research on offsets is limited by the lack of public disclosure of data on offset agreements and transactions due to government sensitivity and the proprietary nature of offsets. Thus, offset research in

the past predominantly utilized qualitative methodologies that included case studies, personal interviews, questionnaires, and historical and documentary analysis. Due to the continued existence of these limitations, this research similarly relied on qualitative methodologies. Considering this thesis sought to analyze offsets in the context of foreign government policy and practice and the efficacy of those policies and practices, the use of questionnaires and interviews was not considered appropriate due to the lack of available sources and a natural reluctance of foreign government officials to discuss internal government policies with outside interests.

Justification for Methodology

Utilizing qualitative methodologies, this thesis sought to pursue the synthesis of previous work on offsets as the primary research activity, also known as a critical qualitative review. As is the case with many research topics, there exists a need to synthesize the existing literature to bring to light the underlying trends and implications implicitly evident in the literature. Weed (2008:2), in discussing the propensity of researchers to add to the already overwhelming volume of existing literature through primary research, noted that “there is a general concern that too little use is made of existing research.” Along the same lines, Mills (as cited in Weed, 2008:2) commented: “There are never enough bricks and there are too few good synthesizers who wish to search out the bricks and thus put the wall together. These worthy people are usually too busy working on their own data!” Finally, Solesbury (as cited in Weed, 2008:2) noted: “Most research effort is expended on new primary research and yet, on virtually any topic

you can name, there is a vast body of past research that may have some continuing value but mostly remains ignored.”

Critical qualitative reviews can be categorized as systematic or narrative. Systematic reviews “use rigorous, structured methods, to search, select, evaluate, and synthesize the existing evidence” (Reviews, 2005:1019). Additionally, Collins and Fauser (2008:103) note systematic reviews have “explicit and transparent criteria for appraising the quality of existing research evidence, especially identifying and controlling for different types of bias in existing studies.” Further, they state that systematic reviews have “explicit ways of establishing the comparability of different studies” (Collins and Fauser, 2008:103). Oftentimes, due to the availability or quality of existing literature, utilizing a systematic methodology can be inappropriate and thus represents “more an aspiration than an achievable goal” (Systematic, 2008:3).

Limitations

While systematic reviews have their strengths, there are also weaknesses that can lead the researcher to pursue less systematic reviews in their methodology. For instance, Collins and Fauser (2008:103) point out that a primary problem with the systematic review is the “narrow focus and prescribed methods ... do not allow for comprehensive coverage.” The “narrative thread” they conclude, “could be lost in the strict rules of systematic review” and thus, some topics are best served through the “wider scope of a traditional narrative review, in which less explicit methods are the trade-off for broader coverage” (Collins and Fauser, 2008:3). Jones (2008:96) agrees and argues against the presumption of the systematic review as the “gold standard” of qualitative research by

stating “the time has come when it may be best to reacquaint ourselves with the adage that ‘the hallmark of good qualitative methodology is its flexibility rather than its standardisation’.”

Collins and Fauser (2008) also point out that the narrative review has many shortcomings the researcher must acknowledge and seek to mitigate as much as possible. For one, while systematic reviews follow strict rules about searching the literature, while narrative reviews do not follow strict rules. Further, the methodology does not document “how the decisions were made about relevance of studies and the validity of the included studies” (Collins and Fauser, 2008:103). This is not to say selection is non-critical and is not subject to the researcher’s sense of propriety; merely, the reader may not have cognizance of the methods and thus is restrained in their ability to make judgments about the value of the literature.

Research that pursues the traditional narrative review over a systematic review must seek to mitigate the potential shortcomings of the narrative review from impacting the quality of the research to the maximum extent possible. Bushman and Wells (2008:1123) note that narrative reviews are “more susceptible to the subjective judgments, preferences, and biases of a particular reviewer’s perspective.” Additionally, Davies (2007) notes that narrative reviews are selective in that they do not search all the relevant literature. To mitigate these shortcomings, an exhaustive search of all relevant literature was performed using electronic and print sources. A search of the unpublished studies and works in progress was also performed.

This thesis utilized historical and documentary research methodologies detailed by Lang (1984). Historical research culminates in a written, integrated narrative based on

critical analysis and synthesis of sources. The first step in conducting historical research is to perform an extensive search of the existing literature for information related to the topic. Once collected, the researcher evaluates and synthesizes the data and information to represent an accurate description of the topic. In addition, search and evaluation of the literature allows the researcher to provide further understanding of the research subject. Meanwhile, Lang (1984) notes that documentary research is similar to historical research; it involves the steps of data collection, evaluation, and synthesis in formulating theories and explanations. However, where historical research is longitudinal in nature, documentary research is cross-sectional – focusing on a point in time. Finally, the use of historical and documentary methodologies allows the researcher to build a solid foundation of knowledge upon which to analyze the topic and formulate conclusions and recommendations.

Lang (1984) lists two limitations of the historical and documentary method. The first limitation is the necessity for the researcher to verify the accuracy and truthfulness of the sources. To mitigate the possibility of inaccurate or false information contaminating the thesis, Lang (1984) states the researcher must continually verify the accuracy of the data contained in primary and secondary sources. This verification is called “historical criticism” and consists of two components: external and internal criticism. External criticism consists of the researcher determining the source is authentic. Internal criticism requires the researcher to determine whether the data contained within the source is accurate. To the maximum extent, the researcher must perform this internal criticism on secondary sources by cross checking against the primary source. Additionally, the researcher must perform internal criticism on primary sources. Optimally, the researcher

should limit the review to well respected, properly documented data to mitigate the inclusion of inaccurate or false information in the thesis.

The second limitation is the requirement to continually guard against bias and prejudice, which requires a professional, critical perspective on the thesis topic. To mitigate the possibility of bias and prejudice influencing the thesis, the researcher should consult as many sources as practical. Furthermore, the researcher must investigate the legitimacy and background of the author, the research sponsor, etc., to verify bias and/or prejudice did not influence the perspectives and findings of the source.

According to Lange (1984), a primary weakness of the historical and documentary methodologies is the propensity of these methodologies to produce generalized conclusions that are difficult to validate or refute. Whereby quantitative methodologies are testable and repeatable, and tend to test a specific, refined problem, historical and documentary methodologies do not lend themselves to such processes. However, this weakness can also be a strength. While quantitative research methods can constrain the researcher to analyzing small aspects of the bigger picture, historical and documentary methodologies allow the researcher to investigate broad problems that typically do not lend themselves to quantitative analysis. Thus, the use of historical and documentary methodologies enable the researcher to approach the issue at a higher level than is typically possible through other methods.

IV. Analysis and Results

This research analyzed the existing literature to determine the efficacy of second-tier country offset policy in enabling technology acquisition and utilization and in promoting the establishment and maintenance of a defense industrial base. Additionally, this research sought to document factors that determine the success or failure of offsets in enabling technology acquisition and defense industrial base establishment and maintenance.

Technology Transfer

A major goal of weapon buyers in utilizing offsets is to enable the transfer of technology from the weapon seller to the domestic defense industry. Many offset recipients believe offsets are effective at achieving significant technology transfer. Thus, second-tier arms-buying countries import technology from weapons sellers in the first-tier to improve their technological base (Waller, 2003). Through its offset policies, these countries seek to attain the technology that will provide their firms with the capability to produce and market their products, either as a supplier or in direct competition to prime-contractors in first-tier countries (GAO, 1996). Through offset policies, these countries believe offsets will provide the technology infusion needed to enable their companies to produce advanced weapon systems.

Efficacy of Offset Policies

To analyze whether offsets are effective at achieving significant technology transfer, the case studies summarized in Chapter II were reviewed to gather evidence of each country's success. Of those case studies, only four contained a sufficient amount of information to relevant to technology transfer efficacy. Three of the case studies documented the failure of the respective countries (South Korea, Taiwan, and India) to achieve significant technology transfer, while the fourth case study documented Japan's successful efforts.

South Korea's goal in its offset policy was to achieve self-sufficiency in weapons production through technology transfer. From 1993 to 2005, the period the Department of Commerce collected data on offset agreements between U.S. firms and foreign government recipients, South Korea received over \$5.2 billion in offset agreements (U.S. Department of Commerce, 2007b). In spite of the substantial infusion of technology, South Korea continues to lag far behind first-tier weapon-producing countries and possesses limited capacities for self-reliant arms production due to its failure to overcome the technology gap with the first-tier (Bitzinger and Kim, 2005). The case study by Bitzinger and Kim (2005) on South Korea illustrates its failure to achieve its goal through technology transfer:

After more than 30 years of significant public and private inputs in infrastructure and technology...the ROK still possesses only limited capacities for self-reliant arms production, and, in general, indigenous arms production has turned out to be neither technologically practicable nor cost-effective. Yet, even in the face of such intimidating technological and economic challenges, the ROK continues to pursue an ambitious, overly optimistic, and perhaps even naive strategy of defense industrialization and arms production. (Bitzinger and Kim, 2005:183)

Similar to South Korea, Taiwan's goal in its offset policy was to achieve self-sufficiency in weapons production through technology transfer. From 1993 to 2005, Taiwan received \$2.2 billion in offset agreements from the United States. However, Taiwan remains heavily dependent on imported technology from the first-tier to support its defense industry (Chinworth, 2004). Chinworth attributes the dependence on the first-tier to the inability to absorb transferred technologies due to insufficient human and research and development resources in Taiwan's infrastructure.

Case studies by Baskaran (2004:218) show India's offset program failed to achieve the results it sought through technology transfer. Technology transfer programs involving tanks, aircraft, and naval vessels, "resulted in spectacular failures." While certain technologies were transferred, the Indian defense industry "failed to acquire capabilities sufficient to close the technology gap with developed countries and keep pace with technological change" Baskaran (2004:219). Finally, Baskaran (2004) cites a reluctance on the part of the exporting company to release core technologies as a major impediment to India's attempt to improve the technological capability of its defense industrial base.

Of the country case studies that investigated the efficacy of offsets in technology transfer, only Japan succeeded in absorbing technology effectively and cost efficiently. Japan sought technology transfer in its offset agreement to build its industrial capacity. Chinworth and Matthew (in Martin, 1996:177) state: "Technology Transfer, particularly offsets, has been the driving force behind the development of post-war Japan's defense industry." Two key factors enabled Japan's to achieve transfer technology through offsets, the preexistence of workforce that possessed high skill and education levels that

could readily assimilate transferred technology, and the special relationship it had with the United States that assured an unrestricted flow of technology. These factors were not present in the countries that failed to achieve technology transfer.

Second-tier countries seek to attain technology through offsets to provide their firms with the capability to produce and market their products. The case studies reviewed indicate a country's success in attaining the sought after technology transfer is not assured. Of the four case studies reviewed, three documented the failure of the respective countries (South Korea, Taiwan, and India) to achieve significant technology transfer, while the fourth case study documented Japan's successful efforts.

Factors Determining Success or Failure

One of the objectives of this research was to analyze the key factors implicitly evident in the literature that determine the success or failure of a second-tier country in achieving technology transfer. Consequently, three key factors were identified regarding the ability of the purchasing country to: acquire state-of-the-art technology, absorb and utilize the transferred technology, and keep pace with technological advances following the technology transfer.

Acquiring State-of-the-Art Technology

The first factor that appears to determine the success or failure of a second-tier country in achieving technology transfer is the ability of the purchasing country to acquire state-of-the-art technology. As shown in Table 1, the literature indicated that technology transferred through offsets typically is not considered state-of-the-art. Further

review of the literature revealed that two variables seem influence whether a second-tier country is able to acquire state-of-the-art technology: the willingness of the exporting company to release its key technologies and the export controls of the exporting company's government. Each of these areas are addressed in the subsequent two paragraphs.

Table 1. Summary of Statements in Literature on Quality of Technology

Source	Statement
(Brauer and Dunne, 2007a:13)	Limited technology transfer into the military sector occurs, often over decades and at high cost
(GAO, 1984:13)	Technology transfers rarely involve state-of-the-art technology
(U.S. Department of Commerce, 2007a:4-16)	Technology transferred through offsets is not leading edge
(U.S. Department of Commerce, 2007a:C-3)	Offsets tend to transfer older, established technologies to foreign firms
(Brauer, 2007:12)	Companies typically use offsets to dispose of technology that is on the verge of being outdated
(U.S. House of Representatives, 2007:11)	Old technology transferred to help defray the cost of developing new technology
(Wessner, 2007:35)	Most products sold internationally are mature, sometimes to the point that they may almost be obsolete

Considering the selling company's willingness to release technology, the seller has its future competitiveness in mind when making technology transfer decisions; therefore, sellers are unlikely to put their competitiveness at stake when making those decisions. Firms consider the shelf-life of a technology as an important consideration in

maintaining their competitive advantage when making technology transfer decisions.

Table 2 provides statements in the literature on competition considerations in technology release decisions.

Table 2. Summary of Statements in Literature on Competition in Technology Release Decisions by Exporting Firms

Source	Statement
(Taylor, 2007b:14)	Sellers...are keenly aware of the potential loss of competitive advantage from technology sales
(Kramer and Sain, 2001)	A company's decision is tempered by an analysis of whether transferring a specific technology will hurt its future competitiveness
(Jones, 2007)	A company will only transfer technology that will not negatively affect their future competitiveness
(Healey, 1999:222)	Companies are not likely to be so shortsighted in their technology transfer decisions that they would export technologies that will create future competitors
(Taylor, 2007a:5).	Sellers earning supernormal profits have incentive to guard their technologies. While they may be willing to disclose information about ancillary competencies to win a contract, a firm usually guards its core competencies at all cost
(Kramer and Sain, 2001:111)	Technology is perishable with time. If held too long, it becomes worthless. If transferred too soon, it harms the firm's competitiveness...Companies release technology they believe will become outdated within two to three years

The exporting government's export controls is the second variable in whether a second-tier country is able to acquire state-of-the-art technology. National security concerns motivate governments to impose restrictions on technology exports and thus impede a second-tier country's efforts to acquire state-of-the-art technology. Potential threats to national security in releasing technology include the ability of the released

technology to compromise technological leadership and threats to the defense industry's capacity and capability to meet defense requirements (Lorell, 2002). Thus, export controls are put in place that allow the exporting government to retain its technological advantage over potential adversaries. Thus, offset transactions pass through the same export control mechanisms as the associated weapon. Therefore, technology transfers contained in offset programs are subject to the same controls as any other technology transfer (NDIA, 2004).

The Arms Export Control Act (AECA) of 1976, as amended, provides the statutory basis for the U.S. export control system currently in place. The act establishes U.S. policy for international programs to achieve specific national defense requirements and establishes the need for export regulations to reduce weapons trade. Meanwhile, the International Traffic in Arms Regulation (ITAR) determines the defense articles and services requiring Department of State's approval for export; it also describes the procedures for gaining export approval and outlines criminal penalties for not complying with the regulation (GAO, 2000).

Absorbing and Utilizing Technology

The second factor that determines the success or failure of a second-tier country in acquiring and utilizing technology is the ability of the second-tier country to absorb and utilize the transferred technology. Success in absorbing and utilizing technology is highly dependent on a country's ability to match the level of technology transferred with its defense industrial capabilities. Research has indicated that core competencies, consisting of the tacit process knowledge, required to utilize the technology must be in

place prior to the transfer (Taylor, 2007a). Thus, without the existing capacity and capabilities, a country is unlikely to develop a technologically sophisticated arms industry through an infusion of production orders attached to offset agreements; a country's capacity prior to the technology transfer determines its actual arms production.

Therefore, a technically advanced country is better able to absorb technology than countries with less advanced industries due to the existence of a trained workforce and infrastructure capable of absorbing advanced technology (U.S. Department of Commerce, 2007b). Finally, Brauer (2007:11) alludes to the inability of developing countries to absorb and utilize technology due to the absence of core competencies:

It is not actual arms production that creates the potential, but the potential that permits actual arms production. A country's arms production potential depends on the state of its human and physical capital... As a group, developing nations do not possess the requisite capital, neither to engage in arms production nor arms coproduction, and that technology transfer and training do not transfer this capital in a self-sustaining manner. These capabilities apparently cannot be imported; they need to be grown indigenously.

Keeping Pace with Technology Advances

The third factor that determines the success or failure of a second-tier country in acquiring and utilizing technology is the ability of the second-tier country to keep pace with technological advances following the technology transfer. The literature indicated that countries are not very successful in this area; whatever technology is transferred as part of an offset agreement is quickly outpaced by the technological advances of seller countries (Brauer and Dunne, 2007b). Due to the perishable nature of technology, transferred technology becomes obsolete within two to three years of transfer (Kremer

and Sain, 1992) Thus, it is imperative for a recipient country to either acquire follow-on technology through future offset agreements or have in place a research and development (R&D) infrastructure that allows the importing country to keep pace with technological advances following the transfer. However, that infrastructure typically does not exist in second-tier countries.

A possible explanation of the inability of second-tier countries to keep pace with technological advances following the technology transfer is the disparity of R&D investment between the U.S. and other countries. For example, the R&D budget of all European countries in 1997 was 22 percent of the U.S. R&D budget (GAO, 2000). As Markusen (2000:14) states, “American firms make most of the best weapons in the world, thanks to decades of public R&D investment.” Therefore, second-tier countries cannot hope to keep pace with the technology advances of the United States and other first-tier countries that invest substantially more in their research and development.

Defense Industrial Base

The research found the efficacy of a country’s offset policy in developing or maintaining the domestic defense industrial base was determined by whether the country sought to achieve an autarkic, self-sufficient defense industry or whether it sought to integrate its defense industry globally with first-tier weapons-producing countries. A primary goal of most buying countries in demanding offsets is to develop or maintain the domestic defense industrial base. Two primary objectives motivate arms-buying countries in developing or maintaining their defense industrial base: reduce or eliminate the dependency on foreign sources for arms and improve the export potential of their

defense industry. Although countries pursue both objectives to varying degrees, empirical evidence shows that tailoring offset policies in pursuit of defense autarky has not succeeded in the past while those that pursued defense industrial integration strategies have been successful.

Numerous case studies have been reported in the literature that analyze the efficacy of second-tier country offset policies regarding defense industrial establishment and maintenance. Therefore, this research analyzed the nine case studies summarized in Chapter II. Each study covered one of the following countries: Brazil, Turkey, South Korea, Sweden, Singapore, Taiwan, Spain, Indonesia, and South Africa. Additionally, each of the studies is discussed in either the defense autarky or global defense industrial integration section below.

Defense Autarky

Empirical evidence suggests that second-tier weapons-producing countries attempting to utilize offsets to establish an autarkic defense industry capable of independent production rarely succeed. Brauer and Dunne (2007a, 2007b) repeatedly assert the inability of offsets to achieve a sustainable defense industrial base in their research; offsets has not succeeded in creating new or sustainable jobs in the defense industry nor have offsets advanced long-term economic or military goals. They further note that offsets have resulted in “an increasing number of arms producers...kept alive by an infusion of costly state aid” (Brauer and Dunne, 2007b:19). Table 3 summarizes the efficacy of Brazil, Turkey, and South Korea in utilizing offsets to achieve defense autarky.

Table 3. Efficacy of Offsets in Achieving Defense Autarky

Country	Offsets From U.S. (1993-2005)	Goal	Result
Brazil	Not available	Self-sufficiency defense industry with focus on aerospace ^b	Failure: - 31 st largest exporter (1990-2006) ^c - Military reliant on imported weapons and components ^b
Turkey	\$1.3 billion (15 th) ^a	Self-sufficiency defense industry with focus on aerospace	Failure: - 42 nd largest arms exporter (1980-2006) ^c - 5 th highest importer of global arms (1977-2006) ^c - 10 th largest importer of U.S. arms (1993-2005) ^a
South Korea	\$5.2 billion (4 th) ^a	Self-sufficiency defense industry with focus on aerospace	Failure: - 10 th highest importer of global arms (1977-2006) ^c - 22 nd largest exporters (1977-2006) ^c - Limited Capacities for Self-Reliant Arms Production ^d

^a U.S. Department of Commerce, 2007b

^b Perlo-Freeman, 2007

^c SIPRI, 2008

^d Bitzinger and Kim, 2005

Brazil Case Study

The case study discussed Brazil's failed attempts to establish an autarkic defense industrial base through the use of defense offsets since the 1970s (Perlo-Freeman, 2007). During the 1980s, Brazil consistently ranked as a top 10 arms exporter, appearing to indicate that it had developed a robust defense industry that produced technologically sophisticated weapons (Perlo-Freeman, 2007). However, Brazil's success can be traced to its loose export policies rather than the quality of its weapons; Brazil imposed no political

conditions on its international sales and freely exported substandard weapons to Third World countries(Perlo-Freeman, 2007). In fact, Brazil was a major exporter of arms to Iraq during the Iran-Iraq war (Perlo-Freeman, 2007).

However, the end of the Iran-Iraq war and the cold war led to the collapse of the Brazilian defense industry as shown in Figure 2. Brazil's arms industry thrived in the 1980s and peaked in 1983 when it exported 308% more arms than it imported. In the 1990s though, the country exported only three percent of the amount it imported from 1997 to 1999. Other indications of Brazil's failure to establish self-sufficient arms production which were discussed in Chapter II include the Italian and Brazilian AMX sub-sonic fighter program and the continued reliance on imports of advanced weapons and components to equip their military.

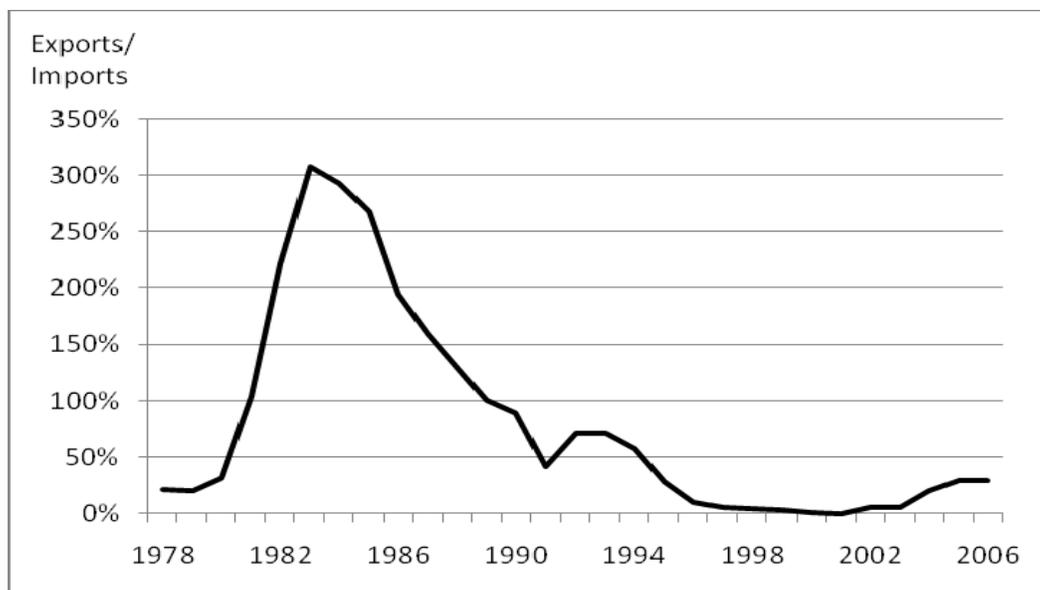


Figure 2. Brazil Defense Exports/Imports Ratio (SIPRI Database, 2008)

Turkey Case Study

The Turkey case study provides another example of a failed attempt to establish an autarkic defense industrial base. Turkey undertook a program of defense industrial development through offsets in the 1980s with a goal of achieving self-sufficiency in weapons production with a focus on the defense aerospace industry (Falco, 1998). During the period 1993 to 2005, Turkey was the 15th highest recipient of defense offsets from the United States, receiving \$1.3 billion in offset agreements (U.S. Department of Commerce, 2007b). However, Turkey's attempt to enter the defense aerospace business achieved limited success. Under the F-16 Peace Onyx program, Turkey embarked on a ten-year plan to develop an indigenous aerospace industry and succeeded in establishing the domestic capacity necessary for production and assembly of the aircraft. However, once demand for the F-16 waned, the aerospace industry faced excess production capacity (Ilbas, 2002) and Turkey has not exported significant aerospace systems since 1999 (SIPRI, 2008).

Figures 3 and 4 illustrate the inability of Turkey to establish a self-reliant defense industry. During the period 1982 to 1998, Turkey exported less than 1% of the ratio of its defense imports; even today, Turkey is still only exporting about 7% of the amount of its defense imports. From 1977 to 2006, Turkey was the fifth highest importer of arms in the world, accounting for 3.5% of world demand (SIPRI, 2008); additionally, it was the 10th largest importer of arms from the United States from 1993 to 2005 (U.S. Department of Commerce, 2007b). Furthermore, Turkey's percentage of world imports has declined since reaching 8% during the mid 1990s (SIPRI, 2008). Finally, during the period 1980

to 2006, Turkey ranked as the 42nd largest exporter in defense goods and services (SIPRI, 2008). Therefore, the data indicate that Turkey failed to achieve its goal of establishing an autarkic defense industrial base through the use of defense offsets: it failed to export greater than 10% of the ratio of its imports, it imports a large percentage of defense items in relation to world demand, and it consistently ranks as a top recipient of arms exports and defense offsets from the United States.

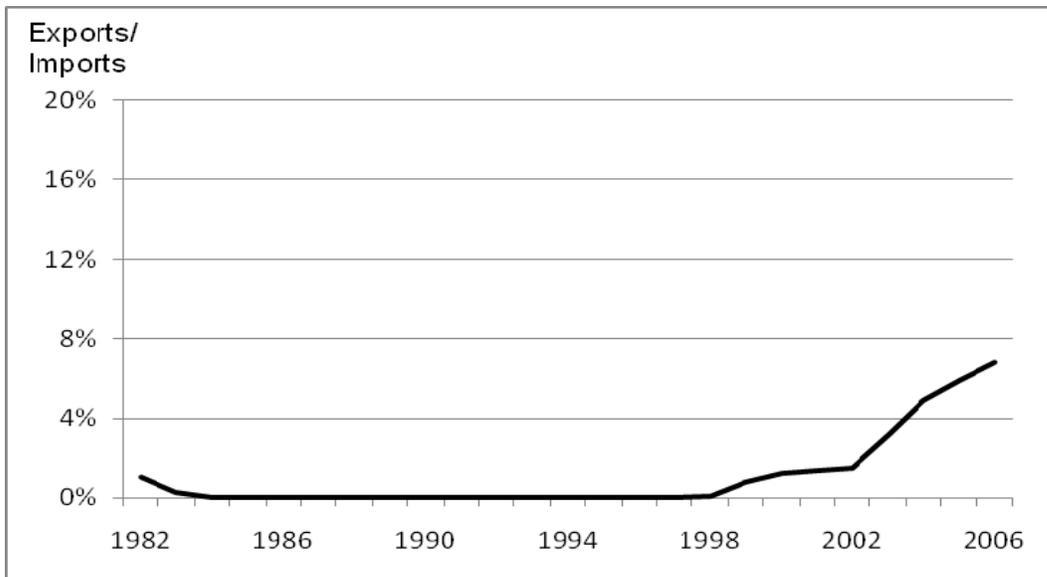


Figure 3. Turkey Defense Exports/Imports Ratio (SIPRI Database, 2008)

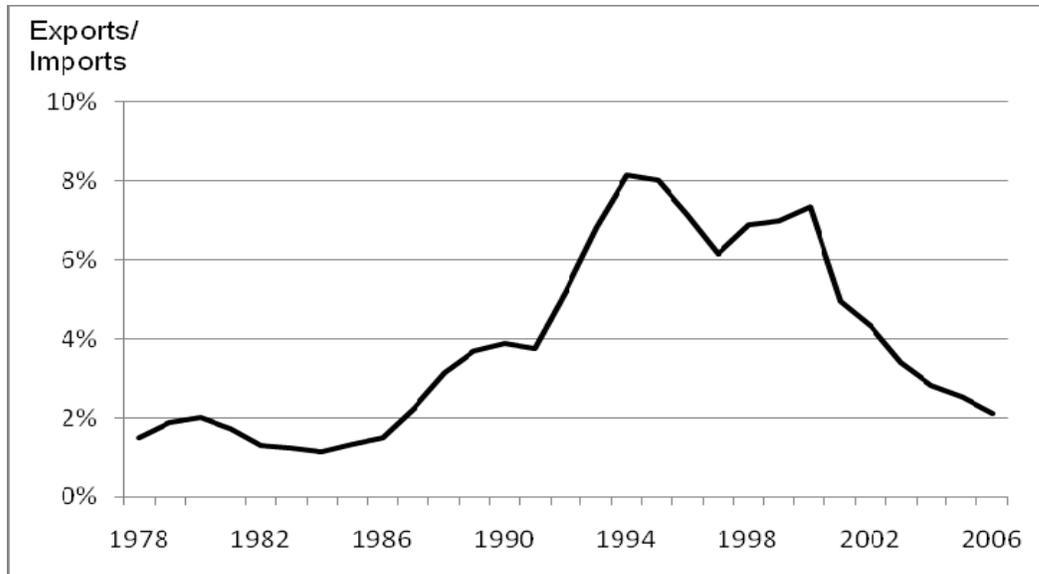


Figure 4. Turkey Defense Imports/Global Imports (SIPRI Database, 2008)

South Korea Case Study

South Korea is the final case study illustrating the inability of a country to achieve defense autarky through its offset policies. Beginning in the 1970s, South Korea utilized offsets to achieve defense industry independence despite its inexperience with production of complete systems and its traditional role as a niche market supplier (Bitzinger and Kim, 2005). South Korea’s strategy called for industry to develop “primary weapon systems for core force capability” and an advanced fighter jet (Bitzinger, 2003:49). As Bitzinger and Kim (2005:183) state: “After more than 30 years of significant public and private inputs in infrastructure and technology...[South Korea] still possesses only limited capacities for self-reliant arms production, and, in general, indigenous arms production has turned out to be neither technologically practicable nor cost-effective.”

South Korea’s attempt to transition to a first-tier supplier of complete weapon systems has not been successful in spite of the fact it was the fourth highest recipient of

offsets during the 13-year period the Department of Commerce (2007) has collected data on offsets, receiving \$5.2 billion in offsets agreements. Figures 5 and 6 illustrates South Korea's failure to achieve meaningful defense industry self-sufficiency as it hoped. The country has failed to increase its exports to imports ratio above 16% and its imports in relation to world demand have risen since 1983. During the period 1977 to 2006, South Korea was the 10th highest importer of arms in the world (SIPRI, 2008) while it was the 4th largest importer of arms from the United States from 1993 to 2005 (U.S. Department of Commerce, 2007b). Finally, during the period 1977 to 2006, Turkey did not rank in the top 20 largest exporters (SIPRI, 2008).

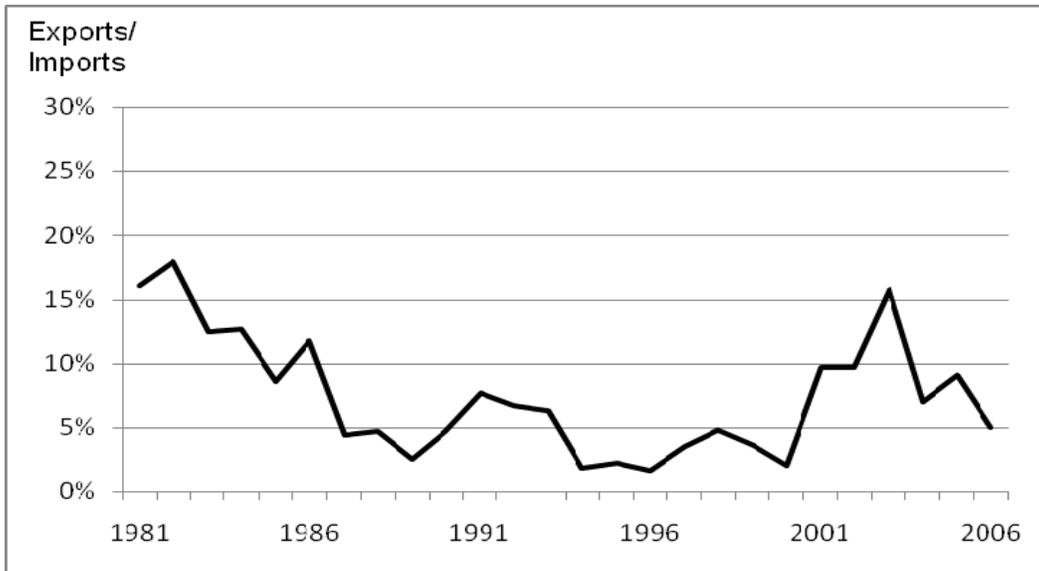


Figure 5. South Korea Defense Exports/Imports Ratio (SIPRI Database, 2008)

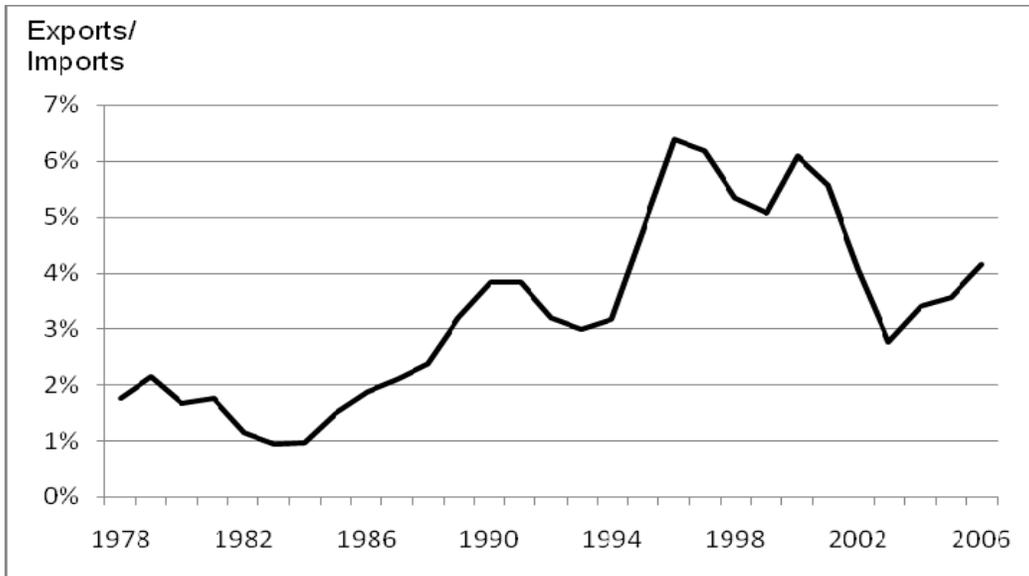


Figure 6. South Korea Defense Imports/Global Imports (SIPRI Database, 2008)

Thus, the data indicate that South Korea failed to achieve its goal of establishing an autarkic defense industrial base through the use of defense offsets: it failed to export greater than 16% of the ratio of its imports, it imports a large percentage of defense items in relation to world demand, and it consistently ranks as a top recipient of arms exports and defense offsets from the United States. Therefore, the literature indicates that the country's industry possesses limited capabilities for independent production.

Global Defense Industrial Integration

Empirical evidence suggests that some second-tier weapons-producing countries attempt to utilize offsets as a tool to integrate the domestic defense industry with the global arms market. While the U.S. continues to dominate the international arms market as a first-tier producer and integrator of complete systems, many second-tier countries have established successful defense industries based on a strategy that acknowledges

their second-tier status. To an extent, the United States and other first-tier countries have increasingly come to rely on these second-tier countries to provide critical components. To many second-tier countries, offsets provide valuable assistance in enabling their industry to integrate with the global industry (U.S. House of Representatives, 2004). In fact, during 1993 to 2000, imports of parts and components rose 82 percent, with almost 11 percent of the imports resulting from offset agreements (Department of Commerce, 2004).

The case study of Sweden provides an illustration of a country that successfully employed offsets to achieve realistic goals for its defense industrial base. Figure 7 summarizes the success Brazil has experienced as through its offset policies. Similar to Brazil and South Korea, Sweden utilized offsets as a method to develop and maintain an autarkic defense industrial base. However, Swedish authorities recently acknowledged autarky is “no longer ‘economically and technically possible’ and that the country ‘can no longer afford to sustain a national defense industry to the extent that this was possible in the past’” (Bitzinger, 2003:53). Therefore, it adjusted its defense industrial strategy to take advantage of its core competencies and specialize in niche production. Thus, Sweden has shown that it understands the realities of globalization and the need to integrate its defense industrial base with first-tier countries. As a result, Sweden has become “one of the few second-tier arms producers to have consistently ranked among the world’s top ten arms exporters” (Bitzinger, 2003:53). Figures 8 and 9 illustrate the success Sweden has experienced. Since 1983, its export/import ratio has averaged 187 percent and managed to achieve an exports to imports ratio of 850 percent in 2001. For the time period 2000 to 2006, it ranks as the 7th highest exporter of defense items, trailing

only the first-tier nations and one other second-tier nation, the Netherlands (SIPRI, 2008).

Finally, Figure 8 shows Sweden's imports have been insignificant in terms of world demand. Therefore, the data provide an indication of Sweden's success at establishing a robust, globally integrated defense industry.

- Sweden
- Goal – global integration of defense industrial base with 1st tier
 - One of few 2nd tier countries to consistently rank as top 10 world exporter
 - 7th highest global exporter of arms (2000-2006)
 - Exports to imports ratio consistently above 100% since 1984
 - Imported less than 1% of world arms since 1977

Figure 7. Efficacy of Sweden Offset Policies (SIPRI Database, 2008)

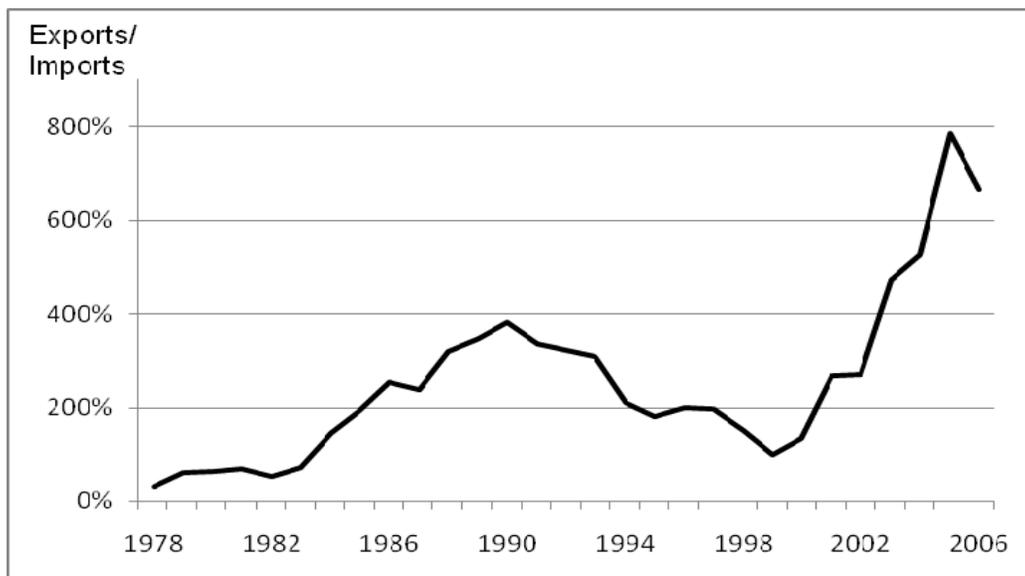


Figure 8. Sweden Defense Exports/Imports Ratio (SIPRI Database, 2008)

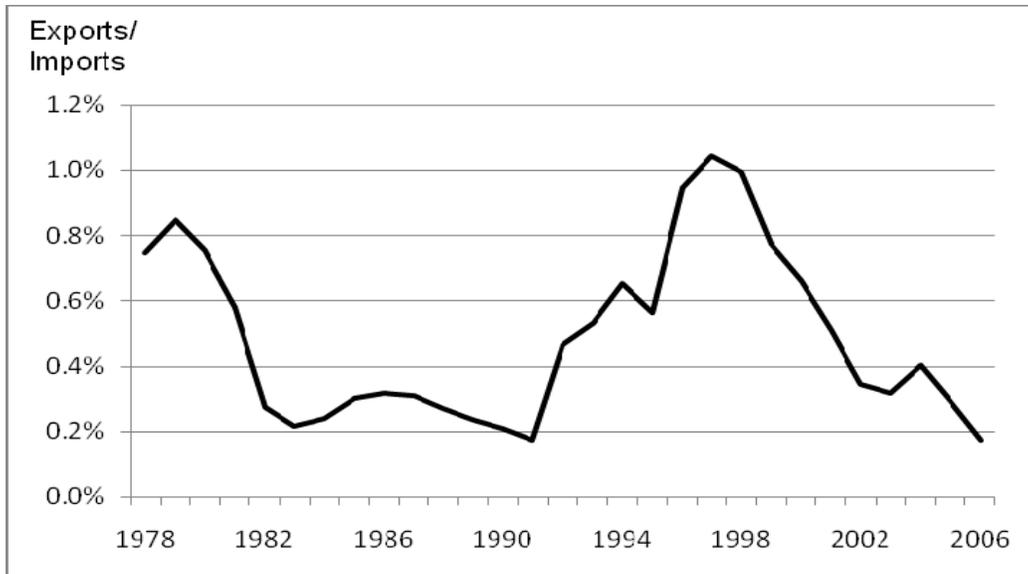


Figure 9. Sweden Defense Imports/Global Imports (SIPRI Database, 2008)

The experiences of other second-tier countries provide additional evidence of the realities facing these countries. Singapore, which similarly recognized the futility of autarkic arms production, shifted its strategy to focus on core competencies and niche production. Its defense industry is now thriving (Brauer and Dunne, 2007b). Taiwan recognized the need to adjust its defense industrial strategy as well. As the second leading recipient of offsets over the past 13 years, Taiwan acknowledged “the original plan for independent production of weapons must be stopped or reduced” and has instead pursued a strategy to integrate its industry with foreign producers (Bitzinger, 2003:39). Similarly, Spain recently “had to abandon dreams of an integrated, comprehensive, indigenous arms industry to be generated via arms trade offsets” (Brauer, 2007:10). Indonesia experienced the collapse of its defense aerospace industry despite ambitious attempts to create an indigenous industry (Brauer and Dunne, 2007b). South Africa once

pursued a strategy of “possessing the capacity to design, develop and manufacture a broad array of weapon systems” (Bitzinger, 2003:45). Over the past few years, South Africa has abandoned this strategy in favor of one based on mastery of core competencies and specialization in niche programs (Bitzinger, 2003). Thus, these second-tier countries recognized the futility of indigenous, autarkic arms production in the current globalized arms market; they subsequently shifted their defense industrial strategy to specialization in niche markets and concentrated on core competencies rather than attempting to achieve the ability to produce a broad array of weapon systems.

Factors Determining the Success or Failure

This section discusses economic and political factors that determined the success or failure of a second-tier weapons-producing country at establishing and maintaining a defense industrial base through offsets. The economic factors include defense industry overcapacity in a declining market, economies of scale, and comparative advantage. The political factors include foreign government restrictions on arms trade, military and political alliances and relationships, and government strategy for defense industry development.

Overcapacity of the Defense Industry in a Declining Market

One of the primary impediments to second-tier countries in establishing and maintaining a defense industrial base is the overcapacity of the international defense industry combined with shrinking worldwide defense expenditures. Overcapacity and shrinking worldwide expenditures are especially evident in the defense aerospace

industry. During the 1980s and 1990s, many industrializing countries sought to jumpstart their economies by establishing some level of defense aerospace industry capacity. At the same time, the countries in Europe, Russia, and the U.S. experienced the emergence of excess capacity as the Cold War ended (Johnson, 2007a). Thus, the defense market today is characterized by intense competition as defense contractors with substantial excess capacity pursue declining sales opportunities (Wessner, 2007).

Offsets have exacerbated the problem of overcapacity. For instance, in *The Economics of Offset*, Smith (1996) points out how offsets have contributed to Belgium's overcapacity. He states, "overcapacity has been and remains one of the major problems facing the Belgian defense industry, and that offsets, far from encouraging rationalization, have served to keep inefficient producers in business and to create additional capacity" (Smith, 1996:7). Thus, as Brauer and Dunne (2007c:19) point out, with lower demand for their products, "it seems absurd then that some countries still intend to build the industry and that offsets are thought (and sought) to promote this." They conclude by stating, "in a declining market, exit not entry has to occur."

Economies of Scale

A second factor for second-tier countries to consider in establishing and maintaining a defense industrial base is the need of these weapon producers to achieve sufficient economies of scale to sustain their industries. Economies of scale are achieved when costs are spread over more units, thus reducing the average costs of overhead and other fixed costs. As shown in Table 4, the literature indicated that the use of offsets to

establish production facilities in the buyer country is ineffective due to the inability to achieve economies of scale to sustain the industries.

Table 4. Summary of Statements in Literature on Economies of Scale

Source	Statement
(Perlo-Freeman, 2007)	Offsets result in short production runs that lead to higher unit cost and unsustainable industries in the long-term
(Markowski and Hall, 2006:A-3)	“developing countries experience demonstrates that investments in defense-related industry are difficult to sustain because export opportunities are limited and domestic demand is small”
(Gholz, 2007:6,7)	In Europe especially, domestic markets are considered too small for ‘national champions’ to achieve economies of scale”...a country that attempts to maintain its industry based on sales exclusively from its domestic market “will be overthrown by cost-effective imports”
(Wessner, 2007:29)	Second-tier countries “need exports to maintain essential economies of scale, or they die”
(Flamm, 2007)	Prohibitively high cost of entry as a large fixed investment that requires sufficient economies of scale to justify... nations can no longer achieve economies of scale on domestic orders alone; the only way to remain viable is to export substantial amounts of the products... only the U.S. is capable of being able to sustain its defense industry based on domestic demand alone.
(Bitzinger and Kim, 2005:192)	Inability of South Korea to achieve economies of scale was a major reason it was unable to create a viable sustainable defense industrial base...strategy of self-sufficiency in weapons production created inefficiencies due to the inability to achieve sufficient economies of scale...South Korea defense industry consisted of “highly inefficient and uneconomical operations, involving small production runs, high unit costs, and considerable overcapacity in manufacturing”

Comparative Advantage

Comparative advantage is the third, and last, economic factor that influences the ability of a second-tier weapons producer to establish and maintain a defense industrial

base. Landsburg (2007:1) states “a [country or company] has comparative advantage at producing something if [it] can produce it at lower cost than [another country or company].” As shown in Table 5, the literature indicated that the use of offsets to establish defense autarky would be inefficient due to comparative advantage while a country that specializes in production where it has comparative advantage will succeed.

Table 5. Summary of Statements in Literature on Comparative Advantage

Source	Statement
(Eland, 2007:8)	“Different nations specialize in different weapons and produce them more efficiently than other countries”... comparative advantage makes self-sufficiency in weapons production an inefficient goal since, according to comparative advantage, a “nation should produce the weapons that it can build most cost-effectively and buy the rest from friendly nations that can build them more efficiently”
(GAO, 1997)	The U.S. has a comparative advantage over the rest of the world as a producer and integrator of complete weapon systems based on economies of scale and scope and substantial investments in research and development
(U.S. Department of Commerce, 2007a)	Second-tier countries are taking advantage of their comparative advantage achieved through cheap sources of labor in the area of niche producer and supplier of components
(Williams, Maull, and Ellis, 2007)	Comparative advantage of many second-tier producers led to the exodus of contracts from domestic sources in the UK to second-tier countries; many Eastern European nations, with their cheap labor sources are becoming suppliers to first-tier weapons producers in the UK

The preceding section considered economic factors that determined the success or failure of a second-tier weapons-producing country at establishing and maintaining a defense industrial base through offsets. The next section considers political factors.

Foreign Government Restrictions on Arms Trade

Protection of the domestic defense industry by many nations restricts the sales opportunities of foreign weapons producers. Practically every country that imports arms has some measures in place that protect their domestic defense industry at the expense of international producers. Most members of the European Union do not have open defense markets; they give preference to its domestic industry in weapons procurement and impose offsets when they agree to purchase weapons from external sources. Similarly, almost every country that imports defense items outside of the European Union has domestic preference policies and demand offsets from foreign sources (Meyer, 2007). In addition, while the United States does not have an official offset policy or require offsets for its arms purchases, it does have laws that give preference to domestic sourced products and services over those from foreign sources. Many countries believe the domestic preference laws of the United States equate to a de facto offset policy; the U.S. government requires foreign sources of weapon systems meet U.S. domestic production requirements by moving a substantial amount of production and assembly work to the United States (Mowery, 2007).

The restrictive policies of the U.S. are especially damaging to foreign arms producers due to the loss of potential sales. Foreign governments contend the United States rarely purchases arms from international sources without requiring the production of the arms in the United States (Johnson, 2007b). As shown in Table 6, the literature indicates restrictions exist due to U.S. policies.

Table 6. Summary of Statements in Literature on Government Restrictions on Arms Trade

Source	Statement
(Lorell, 2002)	Most U.S. built weapon systems have very few foreign components by value
(Guay, 2007)	According to a 2005 UK Ministry of Defense White Paper, the U.S. spent less than two percent of its budget during the previous year on imports from foreign-based companies and seven percent with foreign-owned companies producing in the U.S.
(Office of the Under Secretary of Defense, 2006)	“very few defense articles and components from foreign suppliers”...In 2005, the Department of Defense awarded to foreign firms 2.4 percent of all defense contracts for defense articles and components.

Industrial Relationships and Military Alliances

Industrial relationships and military alliances with foreign countries is an important factor in the ability of second-tier countries in establishing and maintaining their defense industrial base. As was mentioned previously, second-tier countries do not possess a defense market large enough to sustain independent production. Therefore, access to foreign markets is vital to the survival of their defense industry. Offsets have become a vital tool second-tier countries use to establish industrial relations with foreign industries, especially first-tier producers of complete systems. As shown in Table 7, the literature indicates second-tier countries benefit through access to foreign markets for their defense industry through industrial relationships and military alliances.

Table 7. Summary of Statements in Literature on Industrial Relationships and Military Alliances

Source	Statement
(Ianakiev, 2007)	“defence sector’s future is conditioned by the ability to build and/or maintain competitive, niche specialised, companies with access to international markets”... companies should establish relations with first-tier countries by specializing in component and subassembly production
Brauer and Dunne, 2007b:20)	“joining arms supply chain may... be the only remaining realistic option for several small, industrialized European and non-European countries”
Markusen, 2006:8)	The defense industry will mirror the international division of labor seen in commercial sectors as international trade in subsystems and components occurs between second and first-tier weapons producers... an environment characterized by “hyper-specialization” will evolve where offsets enable countries with comparative advantage to supply first-tier producers at the expense of traditional domestic sources
(McLean, 2007:10).	“Access to the U.S. defense market and to U.S. defense technology is as critical to the future of the U.K. aerospace industry as it is to the operational effectiveness of the U.K. armed forces”
(Office of Undersecretary of Defense, 2006:12	While there are severe restrictions on the ability to enter the U.S. market by U.S. allies, it is even more severe for non-allies; most foreign sources for sub-contracting are from NATO nations and other “historically reliable trading partner nations”

Government Strategy for Defense Industry Development

The final political factor influencing the ability of second-tier countries in establishing and maintaining their defense industrial base through offsets is the government’s strategy for industry development. Specific offset strategy considerations include securing offset agreements that complement the existing level of defense industrial development, avoiding short-term industrial development at the expense of long-term viability, restraining the level of government intervention in the defense industry, and promoting the global integration of the defense industry thus disavowing an overly ambitious pursuit of an autarkic defense industry.

The first offset strategy consideration is the need to secure offset agreements that complement the existing level of defense industrial development. As shown in Table 8, the literature indicates offset agreements that complement defense industrial development are vital to success.

Table 8. Summary of Statements in Literature on Complementing Offset Agreements with Level of Defense Industrial Development

Source	Statement
(Brauer, (2007:8)	“Empirically found an almost one-to-one correspondence between a country’s potential to produce arms and its actual arms production”...defense industrial capability cannot be built by infusing arms production orders on an industry that lacks an appropriate level of human and physical capital. Rather, the potential to produce arms must be in place prior to any offset agreement. Brauer concludes “capabilities apparently cannot be imported; they need to be grown indigenously”
(Verzariu, 2007)	Type of offset arrangement implemented should consider the ability of the country’s existing industrial base to produce the hardware and its ability to absorb the transferred state-of-the-art technologies
(Jones, 2007:116)	“Characteristics of successful offset programs” are those that take into consideration the country’s existing industrial infrastructure
(Meyer, 2007)	Good offset policy is one that considers the industrial capacity and economic situation of the country. A major problem with many recipient country’s policies is their government often “is often asking more than it can really do”

The second offset strategy consideration is avoiding short-term industrial development at the expense of long-term viability. Recipient government offset policy frequently focuses on short-term gains in industry capacity without taking into consideration long-term viability of the industry. The failure to consider the long-term viability of the defense firm frequently results in negative economic impacts as firms fail

to secure follow-up contracts for the productive capacity. Table 9 provides a summary of the literature.

Table 9. Summary of Statements in Literature on Short-term and Long-term Viability

Source	Statement
(Meyer, 2007:3)	“Many countries have succeeded through offsets to obtain important industrial plant, but once the contract has ended these plants do not have enough workload”... a successful strategy should “establish industries which are truly competitive...and not establish industries which require subsidies and which are not economically viable”
(Sköns, 2002:21)	For offsets to be successful, the recipient needs to conduct a “realistic assessment of the long-term prospect for the domestic defense firm or technology to survive in international competition”
(Williams, 2007:20)	offsets are often described as “white elephants” due to the inability of new plants constructed to fulfill offsets where incapable of winning subsequent orders and thus became excess capacity
(Mawdsley and Brodzka, 2006)	Few firms continue to produce at a level comparable to that experienced during the original offset transactions. In some cases, they found offsets resulted in a discontinuation of production due to a lack of follow-up contracts
(U.S. Department of Commerce, 2007a:4-14)	Many foreign governments found “direct offsets are of no economic value because they establish a production line for which there is no work after the initial production run”

The third offset strategy consideration is restraining the level of government intervention in the defense industry. Literature indicates offset strategy stands the best chance of success if industry, rather than government, determines how to initiate offset agreements. While industry-initiated offsets consider both economic as well as political considerations, government-initiated offsets favor political over economic considerations (Lorell, 2002). Table 10 provides a summary of the literature.

Table 10. Summary of Statements in Literature on Government Intervention in the Defense Industry

Source	Statement
(U.S. Department of Commerce, 2007a:4-18)	U.S. government interagency team found offsets based on political factors resulted in requirements being fulfilled without regard to best business practices...government directed offsets result in decreased competition and innovation...industry believed offsets based on competition and best value increases international competition by forcing subcontractors to be innovative...“nations whose authorities demonstrate flexibility...gain demonstrably greater and longer term economic benefits than when policies are rigidly and inflexibly enforced”
(Lorell, 2002:149-150)	In government directed offsets, “standard commercial business practices related to relative economic advantage, such as the competitive selection of suppliers on the basis of best value, cost, and technological capabilities, generally played lesser roles. The result was often a loss in economic efficiency” 150)
(Brauer, 2007)	If offsets are mandated by government, then offsets will be economically inefficient and will not provide the most favorable outcome for the indigenous defense industry. However, if offsets are voluntary and initiated by industry, they may be economically efficient

The final offset strategy consideration is the global integration of the defense industry. Attempts in the past by second-tier weapons-producing countries to develop an autarkic defense industry inevitably met with failure. Second-tier countries have a great deal of difficulty achieving economies of scale when attempting to establish an autarkic defense industry; large development costs, production and tooling costs, and learning economies result in costs well above what a second-tier country can support. Thus for a country to succeed in its offset strategy, it is vital that it construct a policy that enhances the ability of its industry to integrate within the global defense industry rather than attempt to establish an indigenous, self-sufficient defense industry.

Bitzinger and Kim (2005) illustrate the inability of South Korea to achieve economies of scale as a major source of its inability to create an autarkic defense industrial base. They conclude, when South Korea attempted to produce its arms indigenously, its industry experienced conditions marked by “highly inefficient and uneconomical operations, involving small production runs, high unit costs, and considerable overcapacity in manufacturing” (Bitzinger and Kim, 2005:192). South Korea is one of many nations that failed to tailor their defense industry while taking into account the advantages of global integration. As Bitzinger and Kim (2005:194) note, “second-tier arms-producing states around the world have discovered too late that they lack both the financial resources and the know-how to further advance indigenous defense industrialization.” Not even all first-tier weapons-producing countries have the resources to maintain an autarkic defense industrial base. In fact, perhaps only the United States currently is capable of doing so. Thus, it is vital to second-tier countries offset strategy to integrate within the global defense industrial base.

This chapter provided analysis and results of the research. First, the chapter provided an analysis of the efficacy of second-tier arms-producing country offset policies in enabling technology acquisition and utilization followed by factors that determine the success or failure of these countries in acquiring and utilizing technology through offsets. Next, the chapter provided an analysis of the efficacy of second-tier arms-producing country offset policies in promoting the establishment and maintenance of a defense industrial base followed by factors that determine the success or failure of these countries in utilizing offsets in defense industrial base establishment and maintenance. The next chapter offers conclusion and recommendations.

IV. Conclusions and Recommendations

Offsets have been a main characteristic of the international arms trade landscape since the end of the Cold War. More so, they have progressively increased in prevalence, have gained importance in relation to other competitive factors, and have increased in value relative to weapon system price. Many second-tier arms-producing country's offset policies seek to enable the transfer of technology from weapons sellers to their domestic industry and to establish and maintain a domestic defense industrial base. However, the evidence suggests the efficacy of offsets in achieving these goals remains indeterminate.

Second-tier arms producing countries tend to rely on offsets in spite of a lack of conclusive evidence indicating offsets are an effective means to an end. Thus, this research sought to analyze the existing literature to determine the efficacy of second-tier country offset policy in enabling technology acquisition and utilization and in promoting the establishment and maintenance of a defense industrial base. Additionally, this research sought to document factors that determine the success or failure of offsets in enabling technology acquisition and defense industrial base establishment and maintenance. This chapter provides conclusions and recommendations for second-tier weapons-producing countries in formulating offset policies and offers recommendations for further research.

Technology Acquisition and Utilization

A major goal of weapon buyers in utilizing offsets is to enable the transfer of technology from weapon seller to the domestic defense industry. Many offset recipients

believe offsets are effective at achieving significant technology transfer. The literature indicates technology transfer agreements have been ineffective and have not substantially improved the technology levels of the buyer's defense industrial base relative to first-tier countries. Furthermore, the research indicates technology transfer through offsets is an inefficient method of achieving a technologically advanced defense industry.

The research documents three factors that determine the success or failure of a second-tier country in acquiring and utilizing technology. The first is the ability of the purchasing country to acquire state-of-the-art technology. The second is the ability of a second-tier country to absorb and utilize the transferred technology. The final factor is the ability of the second-tier country to keep pace with technological advances following the technology transfer.

The first factor that determines the success or failure of a second-tier country in acquiring and utilizing technology is the ability of the purchasing country to acquire state-of-the-art technology. Research indicates second-tier countries typically do not acquire state-of-the-art technologies through offsets. Further, what technology is acquired is of limited long-term value and comes at a high cost. While offsets do result in technology transfer, the technology is usually older, established technologies. The willingness of the exporting company to release technology and the export controls of the exporting company's government highly influence the ability of second-tier countries to acquire technology through offsets. Both typically impede, rather than enhance, technology transfer.

The second factor that determines the success or failure of a second-tier country in acquiring and utilizing technology is the ability of a second-tier country to absorb and

utilize the transferred technology. The research found the primary determinate of success in the ability of the buyer country to absorb and utilize the transferred technology is the country's ability to match its defense industrial capabilities with comparable technology transfers. Thus, offsets typically do not succeed in transferring technology if the industry does not possess the core competencies, as reflected by the state of the human and physical capital, required to utilize the technology. Therefore, technically advanced countries are more successful at absorbing technology than countries with less advanced industries.

The third factor that determines the success or failure of a second-tier country in acquiring and utilizing technology is the ability of a second-tier country to keep pace with technological advances following the technology transfer. The literature indicates countries are not very successful in this area; recipient countries fail to achieve self-sustainable technology advances as other countries quickly outpace, and make obsolete, whatever advances achieved through technology transfer. The U.S. defense industry is especially adept at staying ahead of second-tier country technological advances due to its large investments in research and development. Conversely, most second-tier countries cannot hope to keep pace with first-tier countries since their research and development budgets represent a fraction of first-tier budgets.

Defense Industrial Base Establishment and Maintenance

The research reveals the efficacy of second-tier country offset policies in promoting defense industrial base establishment and maintenance is similar to that of promoting technology transfer – the results are predominately negative. However,

evidence suggests the level of development and the countries global integration plan is highly influential in whether or not countries succeed or fail; countries that attempt to establish an autarkic defense industry capable of independent production rarely succeed while countries that attempt to integrate their industry with the global arms market as a niche supplier have been successful. While the U.S. continues to dominate the international arms market as a first-tier producer and integrator of complete systems, many second-tier countries have established successful defense industries based on a strategy that acknowledges their second-tier status.

There are numerous economic and political factors, in addition to second-tier country's decision to pursue an autarkic or niche focused defense industrial base, that determine the success or failure of a second-tier weapons-producing country at establishing and maintaining a defense industrial base through offsets. The economic factors include defense industry overcapacity in a declining market, economies of scale, and comparative advantage. The political factors include foreign government restrictions on arms trade, military and political alliances and relationships, and government strategy for defense industry development.

One of the primary impediments to second-tier countries in establishing and maintaining a defense industrial base is the overcapacity of the international defense industry combined with shrinking worldwide defense expenditures. Overcapacity and shrinking defense expenditures are especially evident in the defense aerospace industry. In such a market, the entry of second-tier weapons producers seems an unwise policy choice; with lower demand for products in an industry faced with overcapacity,

companies typically exit the market rather than enter. As countries start up new production lines through offsets, the opposite is happening in many offset receiving countries.

A second factor for second-tier countries to consider in establishing and maintaining a defense industrial base is the need of these weapon producers to achieve sufficient economies of scale to sustain their industries. An argument against offsets is offsets frequently result in short production runs that lead to higher unit costs and unsustainable industries in the long-term. Therefore, second-tier countries are unable to achieve economies of scale due to insufficient long-term demand. The U.S. domestic market for defense products is large enough to allow its defense industry to achieve economies of scale without exports. Most other countries, especially second-tier arms-producing countries, cannot.

Comparative advantage is the third, and last, economic factor that influences the ability of a second-tier weapons producer to establish and maintain a defense industrial base. Comparative advantage makes second-tier self-sufficiency in weapons production an unwise and inefficient goal since these nations lack the ability to produce all its weapons more cost-effectively than outside nations. Rather countries experience greater success when taking advantage of their comparative advantage achieved through cheap sources of labor in the area of niche producer and supplier of components.

The following political factors that determine the success or failure of a second-tier weapons-producing country at establishing and maintaining a defense industrial base through offsets include foreign government restrictions on arms trade, military and political alliances and relationships, and government strategy

for defense industry development. Most countries utilize foreign government restrictions on arms trade to protect the domestic defense industry from foreign competition. European Union members give preference to its domestic industry in weapons procurement and impose offsets when they agree to purchase weapons from external sources. Similarly, almost every country that imports defense items outside of the European Union has domestic preference policies and demand offsets from foreign sources. In addition, while the United States does not have an official offset policy or require offsets for its arms purchases, it does have laws that give preference to domestic sourced products and services over those from foreign sources. Foreign restrictions on arms trade result in the loss of potential sales, including second-tier countries. Therefore, in spite of the potential to efficiently produce marketable defense items, foreign government restrictions is a negative factor in defense industrial base establishment by second-tier countries.

Industrial relationships with foreign countries are an important factor in the ability of second-tier countries in establishing and maintaining a viable defense industrial base. Since second-tier countries do not possess a defense market large enough to sustain independent production, access to foreign markets is vital to the survival of their defense industry. Through industrial relationships and military alliances, second-tier countries gain access to foreign markets for their defense industry. Second-tier countries have successfully used offsets to establish industrial relations with foreign industries, especially first-tier producers of complete systems. In doing so, second-tier countries are hoping to secure long-term relationships.

Military alliances are another important factor determining the ability of second-tier countries in establishing and maintaining their defense industrial base. Most important to second-tier countries is the ability to establish an alliance with the United States. While there are severe restrictions on the ability to enter the U.S. market by U.S. allies, it is even more severe for non-allies. While the Buy American Act requires the addition of a price differential to the price of foreign products during source selection, the U.S. Secretary of Defense is authorized to waive these provisions based on reciprocity. Currently, most U.S. allies and friendly foreign nations received this waiver. Therefore, these countries have greater access to an important source of exports for their defense industry, enhancing its viability.

The final political factor influencing the ability of second-tier countries in establishing and maintaining their defense industrial base through offsets is the government's strategy for industry development. Specific offset strategy considerations include securing offset agreements that complement the existing level of defense industrial development, avoiding short-term industrial development at the expense of long-term viability, restraining the level of government intervention in the defense industry, and promoting the global integration of the defense industry thus disavowing an overly ambitious pursuit of an autarkic defense industry. Securing offset agreements that complement the existing level of defense industrial development is vital offset strategy. To be successful, type of offset arrangement implemented should consider the ability of the country's existing industrial base to produce the hardware and its ability to absorb the transferred state-of-the-art technologies.

The second offset strategy consideration is avoiding short-term industrial development at the expense of long-term viability. Recipient government offset policy frequently focuses on short-term gains in industry capacity without taking into consideration long-term viability of the industry. The failure to consider the long-term viability of the defense firm frequently results in negative economic impacts as firms fail to secure follow-up contracts for the productive capacity.

The third offset strategy consideration is restraining the level of government intervention in the defense industry. Offset strategy stands the best chance of success if industry, rather than government, determines how to initiate offset agreements. While industry-initiated offsets consider both economic as well as political considerations, government-initiated offsets favor political over economic considerations. Government directed offsets frequently results in decreased competition and innovation.

The final offset strategy consideration is the global integration of the defense industry. Attempts in the past by second-tier weapons-producing countries to develop an autarkic defense industry inevitably met with failure. Second-tier countries have a great deal of difficulty achieving economies of scale when attempting to establish an autarkic defense industry; large development costs, production and tooling costs, and learning economies result in costs well above what a second-tier country can support. Thus for a country to succeed in its offset strategy, it is vital that it construct a policy that enhances the ability of its industry to integrate within the global defense industry rather than attempt to establish an indigenous, self-sufficient defense industry.

Recommendations for Further Research

Investigating the efficacy of offsets in enabling technology transfer and defense industrial base establishment and maintenance along with analyzes factors that lead to success and failure in achieving the goals is an important research subject; second-tier arms producing countries demand offsets in spite of a lack of conclusive evidence indicating offsets are an effective means to achieve their goals. While the use of offsets is a relatively recent phenomenon, they have been the topic of numerous research projects and reports. However, due to the lack of public disclosure of data on offset agreements and transactions due to government sensitivity and the proprietary nature of offsets, researchers have been restricted to methodologies that offer conclusions and results that are difficult to validate. This research experienced similar limitations in addition to limitations on the availability of literature that discussed technology transfer and defense industrial base establishment and maintenance efficacy at length. Future research that expands on this research using different methodologies would prove valueable.

One methodology would be to conduct a country case study that focused on the addressing the objectives of this research effort. Another would be to pursue quantitative methodologies. Two potential sources of data necessary for conducting a quantitative research effort are the Department of Commerce, Bureau of Industry and Security offsets database and CTO Data Services company offsets database. The Department of Commerce database is restricted from release to the public. However, access to the database, perhaps by a Department of Commerce employee, would benefit future research greatly. In addition, the CTO Data Services database provides a second source of data although the quality and quantity of the data is unknown.

A second recommendation for further research on defense offsets is to predict the efficacy of defense offsets for second-tier weapon-producing countries in achieving their stated goals and adjusting offset policy based on each of the four potential U.S./European defense market arrangement scenarios of the future as described by Dumez and Jeunemaitre (2007). Dumez and Jeunemaitre discuss four models of potential defense market arrangements. The first model is an arrangement based on European and U.S. “twin markets” with common foreign policy objectives by independently managed defense industries. The second model is one where a significant gap exists between the U.S. and Europe with regards to economies of scale and research and development investment with Europe dependent on European technology. The third model is one where European fragmentation is reduced and European mergers result in defense firms similar in size to those in the U.S. and European and U.S. firms enter into equal alliances. The final model is an “Atlantic Alliance with military integration” where there exists a pure monopsony (Dumez and Jeunemaitre, 2007:11). Depending on which defense market arrangement results, second-tier weapons producing countries will have to tailor their offset policies to achieve the maximum benefit for their nation and/or alliance.

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