

The Arms Industry in Developing Nations: History and Post-Cold War Assessment

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ABSTRACT:

This paper reviews which developing nations are producing armaments, what their economic and non-economic motives are, and whether or not the promises of economic benefits from indigenous arms production are fulfilled. The paper concludes with a distillation of major themes on arms production and arms control and suggests directions for further research.

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1. Introduction

Even before the end of the cold war, the study of the arms industry in developing nations was ill-attended to. It was, and still is (see, e.g., Ozsoy, 1997), more fashionable to study military expenditures and their impact on economic development and growth in general rather than to study developing nations' arms industry in particular. At least part of the explanation is that some, albeit often dubious, data on military expenditures and economic growth is readily available and can be subjected to statistical analysis with relative ease. In contrast, the detailed case study of an arms industry requires field work — in an industry that for obvious reasons always has much to hide.

Nonetheless, a number of studies emerged — on Brazil, South Korea and Taiwan, on Israel, on India, to name a few examples — many of them, at least early on, coming out of or being otherwise connected to the work of the Stockholm International Peace Research Institute (SIPRI). Partly in response to these writings, a set of "justifications" emerged that suggested not only the existence of good *political* reasons to establish an indigenous arms industry, but the existence of good *economic* reasons as well. In the present paper, I evaluate some of these arguments.

The issue of arms industry and arms exports in and by developing and "emerging" countries has been at the forefront of two recent remarkable political revolutions: that of the "velvet" revolution of Czechoslovakia in 1989 and that of the democratic election, in 1994, in South Africa. In both cases, leaders as revered as Vaclav Havel and Nelson Mandela quickly articulated odd-sounding reasons to promote the continuation of their countries' indigenous arms production capacities and even to promote arms exports to a stable of strange and fearsome clients. This suggests that the issues and questions surrounding arms production capabilities, including and especially of technologically relatively unsophisticated weaponry ("small arms"), are highly important matters that are likely to reemerge from time to time. Clearly, an assessment is warranted.

2. Arms production in developing nations

The production of arms in developing nations ranges from relatively simple to very sophisticated weaponry. This section has two objectives: (a) to list the names of developing nations known to produce and/or export weapons and (b) to list and assess the supposed *non-economic* and *economic* motives for indigenous arms production; the bulk of attention is paid to economic motives.

Which developing nations are arms producers?

Table 1 (on p. 2) draws on three sources, ACDA (1997), Brzoska (1995), and Rana (1995). The US Arms Control and Disarmament Agency (ACDA) lists countries' arms exports, by year, between the years 1985 and 1995. Arms *exports* do not necessarily imply arms *production*: in a small number of cases, e.g., countries such as Nicaragua, previously imported weapons have been re-exported. In addition, some countries might produce but not export arms and would therefore not be captured in ACDA's listing (e.g., Bangladesh). Michael Brzoska (1995) lists African, Asian, Latin American, and Middle Eastern producers of conventional arms as of the "early 1990s," mostly drawn from SIPRI sources, and Swadesh Rana (1995, p. 29) lists more than fifty producers of "small arms," half of whom might be considered "developing countries" and whose names are reproduced in the table.

Table 1: Developing Nations' Arms Producers/Exporters, ca. 1985-1995.

ACDA (1997)*		Brzoska (1995)*	Rana (1995)*
Afghanistan	1994	Algeria	Argentina
Argentina	all years	Argentina	Bangladesh
Brazil	all years	Bangladesh	Brazil
Cape Verde	1985	Bolivia	Chile
Chile	all years	Brazil	China, PRC
China, PRC	all years	Burkina-Faso	Cuba
Cuba	1985, 1988, 1989	Burma	Dominican Republic
Egypt	all except 1991, 1995	Cameroon	Egypt
Ethiopia	1990	Chile	India
Greece	all years	China, PRC	Iraq
India	all except 1988, 1989, 1992	Columbia	Iran
Indonesia	all except 1986, 1987	Dominican Republic	Libya
Iraq	1985-1990	Egypt	Malaysia
Iran	1991-1995	India	Mexico
Jordan	1986-1989, 1994	Indonesia	Namibia
North Korea	all years	Iraq	Nigeria
Kuwait	1988, 1992	Iran	North Korea
Libya	1985-1992	Ivory Coast	Pakistan
Malaysia	1994, 1995	Libya	Peru
Mali	1989	Malaysia	Philippines
Mexico	all years	Mexico	South Africa
Nicaragua	1992, 1995	Morocco	Saudi Arabia
Nigeria	1986, 1989	Nigeria	Turkey
Oman	1986	North Korea	Venezuela
Pakistan	all years	Pakistan	Yugoslavia
Panama	1992, 1993	Peru	
Philippines	1985, 1986	Philippines	
Saudi Arabia	all except 1990, 1991, 1993	Saudi Arabia	
South Africa	all years	South Africa	
Sudan	1986	Sri Lanka	
Syria	1986, 1992	Sudan	
Thailand	1988, 1989	Syria	
Turkey	all except 1986	Thailand	
Venezuela	1990	Venezuela	
Vietnam	1985, 1987, 1988, 1992		
Yugoslavia	1985-1991		
— Slovenia	1992, 1994, 1995		
Zimbabwe	1994		

* For ACDA, "all years," refers to all years from 1985 to 1995; see text for details and sources. ACDA lists arms exporters; Brzoska lists only African, Asian, Latin American, and Middle Eastern nation, counting Turkey as "European"; Rana only lists producers of "small arms". Countries listed in **bold** typeface appear on all three lists.

Table 2: The ‘Ladder of Arms Production’

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- 1 Capability of performing simple maintenance**
 - 2 Overhaul, refurbishment and rudimentary modification capabilities**
 - 3 Assembly of imported components, simple licensed production**
 - 4 Local production of components or raw materials**
 - 5 Final assembly of less sophisticated weapons; some local component production**
 - 6 Co-production or complete licensed production of less sophisticated weapons**
 - 7 Limited R&D improvements to local license-produced arms**
 - 8 Limited independent production of less sophisticated weapons; limited production of more advanced weapons**
 - 9 Independent R&D and production of less sophisticated weapons**
 - 10 Independent R&D and production of advanced arms with foreign components**
 - 11 Completely independent R&D and production**

Source: Krause (1992a, p. 171)

For simplicity, I have chosen to designate countries as "developing" when their per capita GNP is estimated as below US\$ 9,700 in 1995, i.e., those countries not classified as "high-income economies" by the World Bank (World Bank, 1997). One may of course quibble with that approach, not least because some important arms producers once considered "developing" thus do not appear in my table (e.g., Israel, South Korea, Taiwan, Singapore, Spain, and Portugal). Similarly, I have left out East-Central and Southeast-Central European nations, i.e., erstwhile satellites and republics of the former Soviet Union that nowadays would appropriately be designated as "developing." By my ordering, ACDA lists 37 countries (counting Yugoslavia and Slovenia but once), Michael Brzoska lists 34 and Swadesh Rana lists 25 nations. Eighteen countries appear on all three lists.

What exactly do we mean by "arms production"?

One must be clear from the outset that *arms production* is not a self-evident term. In reviewing the literature Keith Krause (1992a, p. 171) finds eleven ways by which one may conceive of an activity as constituting arms production, ranging from simple maintenance tasks on imported arms to completely independent R&D and production capabilities (see Table 2, on p. 3). But on account of two reasons this "laddering" of stages of arms production, as culled from the literature, is inadequate. First, the laddering suggests that any country wishing to produce arms starts at stage 1 and works its way up until the highest stage is reached. Differently put, there is no notion that countries may choose an entry stage other than stage 1 and a goal stage other than the highest stage. For example, Singapore early on appeared to follow a deliberate strategy of servicing naval vessels, and Greece followed a strategy of servicing NATO aircraft, as a means of amassing knowledge and experience valuable for potential entry into more sophisticated stages of arms production later on. At least some countries are able to choose the entry point, and the entry point may differ across different classes of arms. Conversely, some countries appear to have chosen a goal stage that cannot be achieved given their capacities (e.g., Israel, South Africa, Egypt, India), and yet other countries have chosen to produce weaponry at a stage below their likely capabilities (e.g., Mexico).

Second, it is increasingly apparent that there should be at least *two*, or even *three*, tables of stages of arms production: one table referring to weapon *platforms* (call it "Krause-table 1"), the other to *weapons* and associated control-units and sub-systems ("Krause-table 2"). Since control-units and sub-systems are often electronic modules, one might even distinguish between complete weapon-systems production and module production ("Krause-table 2a" and "Krause-table 2b"). For example, a country may be able to produce a coast-guard patrol craft but still need to import the actual weapon to be mounted onto the platform. Or, of the weapon to be mounted, it may be able to produce some, but not all, needed components or modules. Thus, any given country may be relatively advanced with respect to the production of platforms, but rank low with respect to producing weapons or weapons components. A few years ago, for instance, Indonesia bought naval vessels from the former East Germany, stripped the vessels of everything but the hull, and imported new weaponry and guidance systems to be mounted onto the old platform.

Once the conceptual separation between weapons and platforms is made, one immediately realizes that much of the activity involved in platform production is generic work with dual-use features applicable to both, military and civilian, purposes. For instance, the famous export success of Brazil's arms industry in the 1980s relied in good measure on the success of its civilian commuter and trainer aircraft (Franko-Jones, 1992), a point to which I return later on.

Non-economic motives

Observers are united in their opinion that the *initial* motivation for indigenous arms production in developing nations almost always is *strategic*. Chief among the strategic reasons are weapons embargoes or other threats to an existing arms-import supply line. For example, in the 1950s both China and Egypt used to rely on Soviet weaponry before the supply line became uncertain and unreliable, and both went on to develop indigenous arms industries. Taiwan and South Africa suffered generalized arms supply embargoes, and both went on to set up indigenous arms industries. Turkey and Brazil suffered specific arms supply embargoes from the administration of US President Carter, and both went on to build up indigenous arms industries (see, e.g., Pearson, 1994, pp. 19-20, generally; on Turkey, see Günlük-Senesen, 1993; on Brazil, see Franko-Jones, 1992). Noting this pattern, some analysts suggest that the increasing threat, in the post-cold war era, to impose arms embargoes of various sorts might drive even more countries into efforts to produce indigenous weaponry and to achieve some degree of self-sufficiency in at least some arms category (e.g., Baek et al., 1989; Brzoska, 1995, p. 28). This suggestion may not hold for the new century, however, since unlike the 1960s, there are so many more alternative weapon supply lines available that an embargoed country could draw upon.

A relatively new version of the *acute strategic motive* is the *preemptive strategic motive*. It runs as follows: even if no actual conflict involving the country is thinkable, a country may nonetheless wish to produce arms indigenously *just in case* a conflict emerges. Moreover, the arms in question will have to be suffused with high-technology so as not to place oneself at a military disadvantage in case an armed conflict actually arises. Pearson (1994, p. 48) spells out this argument for Brazil, but it is illustrated to perfection by Joe Modise, the South African Minister of Defense. Defending continued South African arms production he is quoted as follows (in Batchelor, 1995, p. 2): "The immediate danger lies in the instability around us. We have to face up to it and cannot safely assume that it will not spill over into South Africa or otherwise affect our interests."

Several authors speak of *political* motives for arms production, as separate from *strategic* ones. For the most part, these involve considerations of foreign policy and the potential influence and leverage that one may bring to bear on the recipients of one's arms production and arms exports (e.g., Krause, 1992a; Smith, Humm, Fontanel, 1985). Exceptions notwithstanding, this "arms-for-good-behavior" policy was predominantly the domain of the so-called first and second-tier producers, i.e., the US, Russia, France, and Britain in particular. This kind of influence peddling is on the decline since the number of arms export desperate second-tier producers has increased rapidly in recent years and now includes a number of former developing nations such as the aforementioned South Korea, Taiwan, Singapore, Israel, Spain, and Portugal, i.e., former third-tier producers that have "graduated" to second-tier rank in some respects. This means that desperate arms importers are offered a broad choice of suppliers — the arms market is a buyers' market — thus reducing the effectiveness of influence peddling, putting purely political considerations on the back-burner and bringing commercial considerations into the foreground. This situation is likely to persist.

Economic motives

The effective limiting factor to indigenous arms production is industrial capability, including the human-capital constraint of sufficiently well-trained production personnel, and scientists and

engineers. That is the overriding expert opinion (e.g., Wulf, 1987; Ball, 1988, p. 375; Brauer, 1991a; Krause, 1992b, p. 141). But perhaps, or so the reasoning once went, one can simultaneously kill two birds with one stone: engage in capacity building by investing in an indigenous arms industry. The specific form of this hope comes in two major clusters of arguments. They are (a) arms production as industrial policy and (b) export-promotion industrialization and foreign-exchange earnings. For any one specific country, these two arguments might be used in combination rather than in the isolation in which I present them. (An additional "economic motive" argument, I refer to it as the *distress argument*, is dealt with toward the end of this section.)

ARMS PRODUCTION AS INDUSTRIAL POLICY. Among the earliest arguments, in line with the state of thinking in the field of development economics at the time, was that indigenous arms production could be viewed as a form of *import-substitution industrialization*. The logic of the argument roughly runs as follows. We will install an arms industry. Not only will this be useful for strategic reasons, but there will be specific economic benefits. An indigenous arms industry will prevent or mitigate "brain drain," i.e., it will keep our best scientists and engineers in the country. It will tell us what other industries we need to build up in order to build arms. Therefore, upon an arms industrial base, generalized industrialization and capacity building will follow. The arms industry will be our leading sector, promoting backward linkages to support industries, especially in heavy manufacturing and the chemical, electrical, and electronic industries. It will also provide industrial spin-offs useful for civilian industry. Our arms industry will be a pole from which seeds of generalized industrialization will grow up; it will be a development pole around which other economically useful industrial activities will cluster. Moreover, over time as the first and second-tier arms exporters compete for markets, we gain increasing leverage — in a buyers' market — to ask for and receive co-production agreements, licensed production, and various offset and barter deals, even if unrelated to arms (see, e.g., Hartung, 1994, p. 249 on South Korea), in which our agreement to buy some arms (or licenses) from others allows us not only to produce or co-produce our own arms, but obligates others in return to buy something else from us, thereby spurring on that unrelated market as well.

This line of reasoning has been advanced, in one form or another, for countries such as Turkey and Brazil, South Korea and Taiwan, Israel, Spain, and South Africa (on the latter, see Batchelor, 1995, p. 13). For instance, Günlük-Senesen (1993, p. 260) paraphrases a 1991 news interview with the head of Turkey's Under-Secretariat for Defense Industry as follows:

"It has been officially expected that domestic spill-over effects from the modern arms industry would include more diverse industrial production, more efficient production, product quality improvement, foreign exchange savings, acceleration of economic growth, increased value added, less unemployment, increases in the overall technology level, and improvement of the quality of the labour force and university education, especially engineering."

What's the evidence? After the Cyprus war, Turkey came under an arms embargo by the US, the first-tier producer that attempted to use its arms exports to Turkey as a policy tool to influence Turkey and events in the Aegean Sea. In response Turkey developed an arms-import substitution program with the intention of using it as a springboard to a generalized industrialization of the requisite underlying support industries. But, as would be true for other countries, Turkey's program was quickly broadened, as regards arms, to the desire to simply secure multiple-source weapons supply-lines, whether produced indigenously or not, *irrespective* of whether or not generalized

industrialization would follow on the heels of indigenous arms production. Thus, in addition to building requisite industrial infrastructure to support its indigenous efforts, Turkey began a variety of co-production and licensing ventures with countries such as Spain, France, Germany, Italy, and eventually even with the US itself. (On Turkey, see Ron Ayres, 1983, and Günlük-Senesen, 1993; see Nolan, 1986, on South Korea and Taiwan; and see, generally, Sandler and Hartley, 1995, pp. 187-188).

In turn, the case for secure, diversified, multiple-source supply lines eventually gave way to the idea that supply diversification by an arms buyer should permit it to emerge as a niche supplier in its own right, i.e., once "our" country has achieved some degree of military industry, it could subsidize these efforts by exporting weapons. The case especially of Brazil (Franko-Jones, 1992) illustrates this further shift of emphasis and justification. What started as a notion of arms-import substitution became "arms production as industrial policy" (Pearson, 1994, p. 33), with or without an arms-export component attached.

If the *pure* case of arms-import substitution industrialization fails, as the broadening of its scope and mandate suggest, *why* did it do so? In answer, consider this ten-year old quote from a prominent writer on the subject. Nicole Ball (1988, p. 375) writes:

"Although the establishment of a domestic capacity to produce arms is often justified in Third World countries by the technological spin-offs that can be expected from the military to the civil sector, present experience suggests that primarily the military sector benefits from know-how and other resources *already* available in civil-sector industry" (my emphasis).

This point is empirically demonstrated in Brauer (1991a): at issue is *not* military-led industrialization but civilian-led military possibilities. Günlük-Senesen (1993) documents well how purely indigenous Turkish efforts remain at low technical sophistication and limited spin-offs, and how the more advanced arms production efforts are suffused with foreign co-production, licenses, design assistance, and the like.

It is not that analysts dismiss, out of hand, the potential for success of an arms-import substitution industrialization strategy. It is, rather, primarily a matter of the degree to which technology and scientific and engineering technology knowledge embodied in products and production processes are available to developing nations. Michael Brzoska puts the point nicely. With respect to India, he writes (1989, p. 514):

"The Indians have repeatedly bought the newest available technology and then tried to advance from there on their own. After a while, finding themselves falling behind, they again bought the newest technology on the international market."

A country, thus, has a choice. To gain some economic benefits from arms-import substitution, produce what you can in fact substitute for, but do not overreach. What many countries can, in fact, substitute for, are relatively simple items ranging from uniforms to platforms of various sophistication, i.e., items on the "Krause-table 1." As Brzoska writes (1989, p. 526): "Arms production can provide a net positive contribution to both the enhancement of military capability and the economy if production is focused on easily produced weapons." But exactly what is an "easily produced weapon" depends on *already established capabilities*. Where many countries ambitiously overreach is on items on the "Krause-table 2."

Some countries have been more judicious than ambitious in their arms related decision-making and planning. Nolan's (1986) accounts of the South Korean and Taiwanese arms industries, Bitzinger's (1995) recent evaluation of South Korea's arms industry, and Anderson's (1995, 1996) assessment of mainland China's arms industry and conversion efforts, all suggest a more deliberate, more closely integrated and supervised, and therefore potentially more successful interaction between military and civilian production. But even in the South Korean case of a technically fairly advanced arms industry, Bitzinger writes that "the presence of an already well-established, domestic heavy industrial base," in addition to "extensive foreign assistance" was key to propel the nation's indigenous arms production efforts forward (1995, p. 236). And even then, "South Korean arms exports have consisted mostly of low-tech items such as uniforms, nonlethal military equipment, small arms and ammunition, and patrol boats" (1995, p. 243).

Why is this so? Bitzinger summarizes the reasons: (a) lack of interest by South Korean industry because private industry could make more profits in other industrial branches (Korea's arms industry, like Turkey's and Brazil's, is heavily privatized); (b) lack of interest by the South Korean armed forces because of the impetus always to obtain the most advanced equipment available from overseas; (c) structural weaknesses in the defense R&D base, i.e., the lack of linkages between the knowledge establishment and the production facilities; and (d) lack of overall, long-term planning that would allow South Korea to steer resources into appropriate basic research. South Korea is bumping against a "technology plateau," (Bitzinger, 1995, p. 246), and it is highly relevant that other authors make similar observations over and over again for other countries, e.g., Günlük-Senesen (1993) on Turkey and Franko-Jones (1992) on Brazil.

In sum, "one cannot reach for too much with too little." But this means only that import-substitution as an arms production strategy has failed in its *pure* form. It does not mean that we will not see more and increased, and increasingly sophisticated, arms production efforts by developing nations. It merely means that the *form* that arms production takes is changing. I will return to this point in section three below.

EXPORT-PROMOTION INDUSTRIALIZATION AND FOREIGN-EXCHANGE EARNINGS. Turkey and South Korea are examples of nations that wished to create military-led industrialization without much thought for foreign-exchange *earnings*. But in some countries, most prominently in Brazil, an arms-export promotion strategy and foreign-exchange earnings potential was instrumental in the argument for the creation and expansion of a domestic arms industry. Especially for Brazil, whose domestic arms needs always have been modest because it does not face any substantial external security threat, arms exports would permit the subsidization of domestic production runs, would thereby permit unit-cost reductions, and would even result in foreign-exchange earnings and therefore ease balance-of-payment difficulties.

Again, what is the evidence? If it were true that the foreign exchange cost of domestic arms production outweighs arms-import costs, then one should observe increased foreign-exchange use as a country increasingly substitutes domestically produced for imported arms. For example, Terhal's 1982 study ("Foreign Exchange Costs of the Indian Military, 1950-1972") is often cited in this regard. But using Terhal's own data, Deger (1986, p. 137) showed that in spite of increasingly substituting domestic for imported weapons, the Indian military's foreign-exchange needs show "almost no increase at all" (see also Brauer, 1989, pp. 257-266). This would suggest that there might be something to the foreign-exchange argument.

But, to be blunt, there does not exist a single sufficiently documented case in which a developing country exporting arms earned *net* foreign-exchange. Part of the problem with the foreign-exchange point is that the foreign-exchange *earnings* from selling arms, if truthfully reported, are relatively easy to account for. In contrast, the foreign-exchange *costs* of domestic arms production and exports are difficult to account for (Smith, Humm, Fontanel, 1985, p. 241). For example, costs arise to import needed machinery and raw materials and experts and licenses and components and subsystems. Had the resources devoted to arms production been poured into another export sector, perhaps larger foreign-exchange earnings would have resulted. If so, these *foregone earnings* would have to be netted out against the actual arms export earnings. The foreign-exchange *savings* that arise by not importing arms have to be taken into account as well. No one has tried to bring all these facets together into a single, comprehensive, empirical study so that the *net* foreign-exchange benefit or cost could be assessed, although some (e.g., Batchelor, 1995, pp. 19-21) have made a good effort at least to enumerate some of the usually invisible foreign-exchange costs associated with indigenous arms production (for example, export infrastructure, export incentives; counter-trade and offset deals).

In any event, it appears that even the evidence in support of appreciable export earnings is lacking. For the single-best case that I am aware of, Franko-Jones writes with respect to a particular year, 1982, of the Brazilian aircraft maker EMBRAER that "for every dollar of imports, the industry generated two dollars of export earnings" (1992, p. 159). That is the very best foot that has been put forward: a single year, a single industry, a single country. Surely, this does not amount to making the case that *net* foreign-exchange earnings are in fact commonplace in developing nations' arms industry. Moreover, Franko-Jones points out, as have others, that Brazil's arms exports on occasion seem vastly overstated (pp. 140-147), and this before taking implicit foreign-exchange costs into account. The foreign-exchange earnings case is thin indeed.

It should be mentioned that parts of the extant literature overstates the case against arms export promotion and foreign-exchange earnings through arms exports. In the literature, it is far more common (e.g., Krause, 1992a, p. 166 as well as note 31 on p. 257) to find grand, unequivocal statements to the effect that the cost of imported components and subsystems is greater than the cost of importing the whole weapons system than to find carefully documented cases. For instance, Raimo Väyrynen (1992, p. 98) claims: "A detailed scrutiny of the export and import patterns of the Brazilian aeronautical industry in the 1970s and the early 1980s suggests that the imports of various components clearly exceeded the value of Embraer's export." But other writers, in contrast, stress Brazil's deliberate and heavy use of domestically produced inputs (preproducts) that went into the Brazilian arms output (Franko-Jones, 1992) so that a writer as unsuspected of arms industry sympathies as Brzoska (1989, p. 516) concludes that "the Brazilian arms industry seems to have been an important foreign exchange earner from the mid-1970s."

Thus, despite the assured tone of certain pronouncements, and in spite of spectacular cases such as Israel's Lavi fighter, that would tend to support the critics of the foreign-exchange earnings argument, by far the best evidence that the *net* foreign exchange effect is negative is *not* that anybody has conclusively proven anything about the import content and foreign-exchange cost of indigenously produced arms; rather, the best evidence is that no one has made a nearly convincing case that the *net* earnings are in fact positive.

In any event, Brazil's arms exports in particular rode high on a "speculative bubble," namely the Iran-Iraq war throughout the 1980s. Franko-Jones (1992) presents a nuanced analysis of why Brazil's

arms industry collapsed in the late 1980s and early 1990s. Based on her research and interviews, she believes that the bursting of the arms export bubble happened to *coincide* with a fatal misjudgment and external circumstance: the misjudgment was that exactly at the time when the arms export bubble burst, Brazil also decided to move up the ladder of technological sophistication (up on the "Krause-table 2") so that the cost of imported components rose at a time when export earnings fell, putting many of its largely privately owned military-industrial firms into debt. In addition, the external macroeconomic environment of Brazil at the time — 1,000 percent inflation, seemingly a new currency every other year, structural adjustment pressures from the IMF, political turmoil — served to divert attention from what was up until then a carefully orchestrated public-private arms-industry partnership.

In sum, we do not have a definite study that would conclusively settle the matter of the export-promotion and foreign-exchange earnings argument. But we do know (a) that foreign-exchange *earnings* are at times overstated, (b) that foreign-exchange *costs* are not properly accounted for; and (c) that no one has provided conclusive evidence that the *net* effect is positive for the arms exporting country. Krause concludes with the suggestion that "arms production may ... not provide major spin-off benefits, but may at least ameliorate the negative impact of military spending" (1992a, p. 167), a finding empirically confirmed in Brauer (1993) with respect to military expenditures, arms production, and economic performance in general. Specifically with respect to foreign exchange, Brauer (1991b) finds that military investments by developing nations appear to result in domestic absorption rather than foreign exchange leakages, again possibly *mitigating* the foreign exchange effect of domestic arms production as compared to the foreign-exchange costs of arms imports. In either case, however, is it not clear that the mitigation effect is due solely to the existence of indigenous arms production! Instead, the effect might be due to the fact that, relative to non-arms producing developing nations, the arms producing developing nations generally exhibit a stronger economy to begin with so that they could absorb more easily any negative effects stemming from indigenous arms production and military expenditures.

An export-promotion industrialization strategy via arms-exports is a niche market effort at best. Niche markets are vulnerable to rapidly changing market conditions. They can grow "soft," as the collapse of the Brazilian arms industry showed when petroleum prices fell, and arms demand from the Middle East for niche market suppliers dried up. An interesting, new development is taking place in South Africa. As Peter Batchelor observes (1995, p. 13), there is some desire by South Africa's neighbors to *want* to have a South Africa nearby that is arms-manufacturing capable and able and willing to refurbish and service weapons — a sentiment that is shared by officials at AMSCOR, the South African arms marketing agency. In this regard it is noteworthy to recall that before Brazil became a big player in the *global* arms market during the Iran-Iraq war, it was in fact a big player in the *regional* arms market in South America, and it is entirely possible that the future will bring more focused efforts by one or the other regional behemoth to take on the role of primary regional arms supplier, at least for certain categories of weaponry.

THE DISTRESS ARGUMENT. Assorted other claims about benefits from indigenous arms production have been made. Relatively new is the *distress argument*. It consists of two components. The first argument goes as follows: since we *already* have an arms industry and poured so much money into it, we cannot just abandon it. For if we do, all the cost sunk into the arms industrial projects will be lost for good and be wasted (for examples, see, e.g., South Africa under Mandela in 1994; the *SSR*

under Havel in 1989; and, generally, Ball, 1988, ch. 9). The second part is this: in the current arms sales market climate — oversupply, relative lack of demand, and therefore fire-sale prices — the prices we obtain do not cover our average costs. To bring down average cost we need to increase the quantity of our arms sales, thus not only avoiding losses but saving jobs. I am not suggesting that expert observers make these arguments; rather I am saying that one hears this line of reasoning expounded in public debates about indigenous arms industries. This line of argument is an example of the fallacy of sunk costs. A simple example illustrates the point. If fixed costs incurred for research and development, set-up of production lines, etc. amount to \$1,000 and each unit actually produced amounts to an additional or *incremental* charge of \$100 for materials and direct labor (i.e., a marginal cost of \$100 per unit), then the total cost of producing ten units is $\$1,000 + (10 \times \$100)$ or \$2,000. Sold at a price of \$200 each for a total revenue of \$2,000, the profit, from an accountant's point of view, is zero.

If market conditions are adverse and the average price that can be obtained falls to \$150, an accounting loss of \$500 results (total revenue of \$1,500 minus total cost of \$2,000). In response, an effort might be made to expand production to 20 units. Total costs now run at $\$1,000 + (20 \times \$100)$ or \$3,000, for an average unit-cost of \$150. Selling each unit at \$150 restores the accounting profit back to zero. Thus, in public debates, apparently stark choices of "economic reality" are offered to an unsuspecting public: *either* do not expand arms production and lose money in the short-run by taking losses on each unit sold and also lose money in the long-run by having to close down production altogether (loss of unrecovered fixed costs and loss of jobs) *or* expand arms production, arms sales, and arms exports, even if one might have moral quibbles about doing so. (This argument works special wonders when linked to the notion that it is not arms sellers but arms *users* who are the morally responsible parties.)

From an economist's point of view, the cost argument is different. Once the up-front cost for research and development is committed or sunk into the project, the deed cannot be undone — these costs are "lost" in any event. The only economically relevant point is to make offsetting contributions toward defraying the sunk costs. Thus, if producing one more unit incurs an incremental cost of \$100, then any price obtained above \$100 will make a positive contribution to the recovery of the sunk cost. Consequently, following the earlier numeric example, if the price of arms falls from \$200 to \$150, there will *still* be a positive contribution of \$50 toward offsetting the up-front cost (Smith, Humm, Fontanel, 1985, pp. 242-244).

Since every experienced business manager, including every arms-industry manager, is familiar with this elementary economic principle — that decision-making is driven not by average but by marginal costs — my suggestion here is that it is likely that the distress argument is a hoax hoisted upon an unsuspecting public, aimed at evoking nationalistic sympathies toward potentially unemployed workers, even if that implies shunting aside moral scruples in favor of expanded arms production and arms export sales. If the public debate is won by this kind of incorrect argument, arms sellers will be less cautious as to whom they sell weapons and weapons technology to.

3. Assessing the Developing World's Arms Industry

Summarizing what has been said so far, developing nations possess legitimate security interests and some of them — for strategic reasons — wish to build up their own, indigenous arms industry. But the supposedly positive *economic* benefits do not exist. Military-led, generalized industrialization, an

occasional exception notwithstanding, is virtually always dependent on the prior state of civilian industrial accomplishment, and as regards arms exports, there does not exist a convincing study showing *net* foreign exchange earnings for any country for any sustained period of time. Where does this state of affairs leave us?

I agree with Stephanie Neuman's post-cold war assessment. She writes: "worldwide the military sector is shrinking. Democratic regimes are replacing military rulers. Defense spending is down. Military industries are going out of business. Defense production is declining, military assistance is dwindling, and the arms trade has contracted dramatically." (Quoted in Pearson, 1994, p. 26, based on a conference paper Neuman delivered in 1993.) But, along with a number of experts, I also share misgivings about certain new trends and features of arms production. In this section, I take up three themes.

THE MISSING LDCS. First, it should be remarkable to note that former developing nations such as South Korea, Taiwan, Spain, Portugal, and Israel are now "graduated" in a number of arms production capabilities to the ranks of Sweden, Austria, Switzerland, Japan, Canada, and similar countries, i.e., they have become just another set of industrialized nations. Of all of these countries, none are entirely self-reliant in arms production. Globally, therefore, we note a huge convergence and falling out at the same time. The US and Russia (for the time being, but perhaps not for long) are first-tier producers, who are completely and independently able to design and construct highly sophisticated weaponry across the entire weapons spectrum (stage 11 on the "Krause-table"). Then there is a large cohort of second-tier arms producers including, increasingly, France, Britain, and the aforementioned countries whose primary distinguishing mark is the ever increasing transnationalization of arms design and production — rather like the automobile or other transnational industries. The array of co-production, licensing, joint development, replete with complex counter-trades and offsets generates an ever more dense maze of mind-boggling transnational networks of arms producers.

It is very important to differentiate between *internationalization* and *transnationalization* of production. *Internationalization* means that a firm operates production facilities in a variety of countries that are relatively independent of one another. In contrast, *transnationalization* means that production and production facilities across countries are interdependent with one another. This is the new technological imperative affecting all globalized production, not just arms production. Instead of producing from the "ground-up," production — including arms production — becomes "modular" where systems are co-developed across nations and plugged in wherever in the world they are needed. This encourages component buying, modifications, retrofitting, and re-exporting activities in an increasingly Adam Smithian free armaments market. It is co-mingled with the increasingly dual-use nature of components and platform basics. Arms production becomes more fluid, more like any other "normal" industry (see Pearson, 1994, p. 27; Hartung, 1994, ch. 12; Sköns and Wulf, 1994; Gold, 1995). It is the era of the two "Krause-tables" that separate capabilities and accomplishments in platform production from module and components production. Some former developing nations, such as the aforementioned South Korea, Spain, Portugal, etc., have been able to "catch up" with the industrialized world but by far the majority of developing countries are barely able to produce platforms, let alone modern weapons.

Following the converging second tier of arms producers, which collectively but not individually, could match the US and Russian arms production capabilities, there is a third tier of arms producers.

These are countries that are falling behind technologically. The best of them produce good platforms ("Krause-table 1"), but as regards weapons, control-systems, and sophisticated sub-systems ("Krause-table 2") they are highly import dependent (Brzoska, 1995, 29). This would include countries such as Egypt, Turkey (at the moment), Indonesia, India and Pakistan, Brazil, Argentina, Iraq, Iran, and others. At some point, these nations either will slip up to second tier-status — on account of expanded civilian industrial capacities — or recognize, as some already have, that their only, and crazy, hope lies in building mad-man's weapons of mass destruction. (There is a fourth tier to which I turn in a moment.)

ARMS CONTROL. The second major theme concerns arms control. Pearson, for example, notes that "today more countries have more varied and advanced types of equipment from more numerous suppliers" (Pearson, 1994, p. 27). Consequently, writers such as Bitencourt (1995, p. 172-173) suggest that control of conventional arms will become more difficult as there are more suppliers, fewer power-bloc alignments, and more broadly commercial interests by developing and developed countries alike, compounded by increasing dual-use technology usage and developing countries' legitimate interests in high-technology access and use (e.g., in space and therefore missile technology). In this context, I believe that Bitencourt correctly identifies "... growing [LDC] mistrust surrounding the [arms] control regimes. These are frequently viewed as a ... disguise used by developed countries because they are seen as having a higher influence on the organizations interested in non-proliferation, and can thus keep their dominance of the market" (Bitencourt, 1995, p. 174).

As noted earlier, in the past supply embargoes merely induced recipients to enter the market themselves as producers and, if possible, exporters. This suggests that, at a minimum, supply embargoes be mixed with an exit strategy, lest the embargoed nation feels compelled to devote scarce resources to armaments production or to develop extensive and costly multiple arms-supply lines.

But there is a superior approach to arms control, at least in theory. Among others, Bitencourt (1995, p. 175) is entirely correct in pointing out that instead of controlling the *supply* of arms, what is needed is to encourage regional peace treaties to reduce the *demand* for arms and arms production. As in any market, the supply will then take care of itself. Conventional arms registers and missile control regimes are good ideas and items, but control on the demand side — as the end of the cold war amply demonstrates — works much more effectively to reign into the armaments market.

Even if armaments were restrained from the demand side, arms production and war are, despite the current lull (if that's the term to use), not irreversible. The ultimate objective must be to put incentives and institutions into place that make peace achievable and, once achieved, irreversible so that resources saved may be applied to address other economic needs. But irreversibility cannot be achieved technologically since the capacity to produce industrial goods implies the capacity to produce arms (Brauer, 1991a). There is no technology fix to the reversibility problem. The fix must be one of institutions and proper incentives. For example, security between and among nations will be strengthened when *regional* peace treaties reduce the perception of threat and therefore reduce the demand for weapons (Ball, 1993, p. 342), when the international "self-help" system (Krause, 1992a, 1992b) gives way to co-operative security arrangement that transcend nation-state borders. Yet it must be realized that most conflicts are not of the interstate but of the intrastate variety and that the coming about of any peace treaty itself is subject to incentives and disincentives, and to policing and

enforcement activities and costs (on incentives, see, e.g., Cortright, 1997; Garrett, 1997; Brauer and Roux, 1998).

SMALL ARMS. Finally, the third major theme in assessing developing nations' arms industry concerns so-called "small arms." Obviously, nuclear and major conventional weapons do present substantial dangers, indeed catastrophic dangers. But the fact of the matter is that most wars and other violent conflicts take place in developing nations that are characterized by the absence of major weapons: people are primarily killed by dismissively labeled "small arms." Small arms are formidable killers. Ninety percent of all conflict deaths or injuries were, by one recent accounting, attributable to small arms, and per injured or killed person another twenty or so were displaced or uprooted by the immediate, personal threat these arms pose (Rana, 1995, p. 1). Small arms are particularly prevalent in *intra* rather than *interstate* conflict, by far the majority of violent conflicts nowadays.

Small arms are easily hidden and, therefore, smuggled. At present the world market is flooded with small arms, ammunition, land mines, and the like, making these killers gruesomely cheap. Moreover, they are easy to manufacture even by technologically impaired nations. Since it does not take much by way of civilian industry to produce small arms, we may expect more countries to enter the fray. But that is not the major point here. It is, rather, that if economists wish to account for the cost of indigenous arms production, or any arms production, or any conflict made possible by arms, we must turn away from merely accounting for narrowly construed direct and indirect costs of *preparing* for conflict. In particular, we finally need to pay much more attention to counting the cost of *actual* war, i.e., the cost in terms of economic and human development foregone. Initial attempts have been made (see, e.g., Deger and Sen, 1990; Brauer, 1996; and part III in Brauer and Gissy, 1997). Beyond that, it should be economists' task to consider the incentives and institutions that give rise to conflict, war, and peace, and again little work has been done in this regard (Sen, 1992; part IV of Brauer and Gissy, 1997; Brauer and Roux, 1998).

4. Conclusion

To summarize the major topics of this wide-ranging paper, consider the following points:

- From the early 1980s to the late 1990s, a number of *former* developing nations have "graduated" from relatively low levels and sophistication of arms production to relatively high levels (e.g., South Korea, Taiwan, Singapore, Spain, Portugal, Israel). This coincides with the continued development of their civilian industrial capabilities. Among the remaining developing nations, as of the late 1990s, between 25 and 35 are engaged in some form of arms production and arms (re)exports.
- "Arms production" is a misleading term. At a minimum, one must distinguish between the production of platforms (air, ground, sea) and the weapons themselves. An increasing number of countries are able to build platforms in the course of the development of their civilian transport industries, but are still unable to build weapons, control-units, and sub-systems. By far, the primary motive for indigenous arms production is *acute strategic need*. In recent years, a number of countries plead a *preemptive strategic need*, "just in case" a conflict should emerge.

- Strategic motivations apart, indigenous arms production efforts have been justified on economic grounds. The two major "economic" arguments are: (1) that building up an indigenous arms industry will spur generalized industrialization by means of spill-over or spin-off effects; and (2) that building up an indigenous arms industry and arms-export sales will permit foreign-exchange earnings. On the first point, the evidence is clear: if anything, the development of indigenous arms industries in developing nations depends crucially on *already* established *civilian* capacities. As regards foreign-exchange earnings, the evidence is less clear-cut but three points need be kept in mind: (a) foreign-exchange *earnings* often appear overstated; (b) foreign-exchange *costs* are never fully counted, in part because such costs are socialized rather than borne by the firm or accounting unit that actually produces armaments for export; and (c) no one has ever presented an uncontroversially convincing case that the *net* foreign-exchange effect is in favor of arms exports.
- The recent emergence of the *distress argument* relies on generating public sympathies with faulty economics. The relevant costs that flow into decision-making are not *average* costs, but *incremental* costs. Low incremental costs, combined with the urge to recover sunk costs, foster domestic and arms export sales at low market prices. This alone makes arms control from the supply side difficult to achieve.
- Developing nations *can* graduate to higher levels of arms production sophistication as the underlying *civilian* capabilities increase and as they become more integrated into the *transnationalization* of arms production efforts. This also complicates arms control efforts aimed at the supply side. Indeed, supply restrictions tend to drive up prices, thus providing an *incentive* for new suppliers to enter the market. The real killer, in any event, are "small arms," which are easy to manufacture, transport, smuggle, maintain, use, and pay for.
- Economists, and others, might therefore consider expending more intellectual resources on understanding the structure of *incentives* and *institutions* to give rise to and/or exacerbate violent conflict and war and that prevent the peaceful settlement of conflict. Similarly, we need to study incentives and institutions that would give rise to peace and prevent war, i.e., study the economics of the demand for conflict and the derived demand for armaments. Finally, even economists that are expert in the study of the economics of conflict tend to focus on the economic cost of *preparing* for war. We would do well also to study the cost of *actual* war and of its aftermath. For example, the recent slaughter in Rwanda will economically cripple the country for decades to come — surely a cost much greater than the cost of prevention would have been.

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