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# The Argentine defense industry: an evaluation

*Thomas Scheetz*

### Introduction

Since the early 1990s, Argentina has gone from being one of the major defense industrial producers among less developed countries (LDCs) to one where defense production barely subsists, the only remaining significant instances being those of licensed production and repair of aircraft and surface ships. Argentina's eighty-year experience with defense production allows a wealth of conclusions regarding the limitations on the viability of defense industries in LDCs.

In Argentina, as in other developing countries, historically five reasons have been given for the launching of military-run industries.<sup>1,2</sup> All of these propounded the industries' supposedly positive economic development effects or the need for independence in arms sourcing in case of war. The single most important argument has always been import substitution industrialization (ISI). But the military also frequently justified arms production for its supposed export promoting possibilities. In this chapter, I examine this possibility with respect to the local defense aircraft industry. A third argument was Vernon's "product-cycle theory" (1968), where arms technology, far beyond its initial R&D stages and with the production process long since completely defined, could be produced in Argentina, thereby inserting the country into the technology learning process. A fourth argument used to defend the founding of military-run arms industries was Hirschman's (1958) "poles of development" argument. Here defense production was meant to trigger "backward and forward linkages" to other industrial sectors. Finally, arguments of a political and military nature have been made. Such industries were supposed to provide operational and logistic independence for the country in time of war. My previous analyses (Scheetz, 1993; 2003) demonstrate that none of these five arguments has ever been able to provide support for the reality of the Argentine defense sector; indeed, their irrelevance finally gave way to the sector's collapse and privatization. The military-run industries<sup>3</sup> themselves prospered only when the country itself prospered (during the decade of the 1920s and 1940–1955, when heavy state subsidies were fiscally feasible). Otherwise, they followed the Argentine economy into decline. These "infant industries" never grew up.

### Military "Malthusianism"

One might well attribute defense industry decline in Argentina to the failure of each of the five theories cited above along with the general decline of the local economy. And while these arguments do have explanatory power, there is an additional reason why Argentine arms production was destined to fail. It has to do with the relation between

scarce fiscal income and the rapid growth of weapons costs. This relation could be termed “military Malthusianism,”<sup>4</sup> so named because (similar to Malthus’ theory) it contrasts the exponential growth of the unit cost of major weapon systems with the (at best) linearly growing fiscal income. A “Malthusian” gap between the two opens and increases over time, causing a decline in the acquisition of the number of arms systems. Since 1950 unit costs of arms have risen an average of between 9 and 11 percent annually (Pugh, 1993; Kirkpatrick 1995; 1997). Simultaneously, in the case of Argentina, real GDP grew at an average yearly rate of only 1.73 percent between 1970 and 2001 (Economic Commission for Latin America and the Caribbean). Given that central government<sup>5</sup> fiscal revenue as a share of GDP held fairly constant over the same period, at a yearly average of 13.1 percent of GDP (IMF data), we can assume that Argentine fiscal revenues climbed at approximately the same rate as the GDP. Thus we are confronted by a Malthusian effect whereby over time an ever wider gap is opened between the unit cost of military equipment and the country’s ability to acquire systems of armaments for a given size of air, land, or sea forces. Pugh and Kirkpatrick claim that this factor, which I call military Malthusianism, has been the primary determinant (via changing ratios of budget to unit costs) of the numbers and types of equipment procured and, thence, of industrial and military roles and structures. Pugh elaborates on why all “attempts to halt cost escalation are foredoomed to failure” (1993, p. 179). While this phenomenon does not deny the value of attempts to continually improve the efficiency of production methods, or even the importance of collaboration in order to obtain economies of scale-related cost savings, the fundamental divergence between the two trends is shown to be inevitable. This is grounded in the logic that a country’s use of second-best arms against an adversary would be fatal (and therefore their purchase economically irrational). Thus the security dilemma produces the need for a competitive edge in armaments, an edge ever harder to maintain.

The authors demonstrate that this factor affects the forces of developed countries—for instance, in 1954 Great Britain’s Royal Air Force had 5,213 aircraft, whereas in 1994 it had shrunk to only 1,100 (Kirkpatrick, 1997, p.62). And since economies of scale affect the average unit costs of most weapon systems, smaller producers and purchasers, like Argentina, are inevitably and gradually squeezed out of the market. Their alternative is to simply acquire and produce obsolescent weapon systems. If even countries like the US and UK are confronted by these realities, there appears to be no way that developing countries like Argentina can avoid this Malthusian dilemma.

Kirkpatrick and Pugh point to a dynamic whereby countries first attempt to make their industries more efficient, then search for company fusions both within the country and among allies, followed by plant closures, and gradually moving toward multi-role arms systems (e.g., combat planes like the costly Argentine IA-63 Pampa) with ever more limited demand for the product (witness the Royal Air Force’s shrinking from 5,213 to 1,100 aircraft). If this is occurring in developed countries, the situation is exacerbated for LDCs attempting to compete with a weapon system that would not be competitive in most conceivable combat roles.

Obviously this Malthusian trend takes into account that rival countries face the same unit cost dynamic, and that the acquired systems tend to have greater firepower and accuracy than the systems they replace. Nonetheless, this growing spread between fiscal income and weapons cost severely affects roles and missions (by limiting deployment),

and this becomes a very serious problem for LDCs that may acquire very few units. They have to concentrate their deployment and thereby become more vulnerable to an effective surprise attack. The current purchase of ten F-16s by Chile is an example. At a total cost of US\$650 million, the purchase has stretched the government's ability to purchase other (naval) arms systems. At the same time the limited number of planes deployed can form less than a normal-sized squadron,<sup>6</sup> thus almost guaranteeing their concentrated deployment. LDCs like Chile and Argentina cannot afford large modern air forces. And the deployment of less than modern forces (like that proposed by the local licensed production of the IA-63 Pampa) would put that country at a severe disadvantage in case of war. The failure to take this Malthusian trend into account has led to the Argentine armed forces being overwhelmingly labor intensive (80 percent of the military budget is spent on personnel).

Moreover, the survival of a local defense industry, be it in a developed or less developed country, depends on the capacity to maintain the quality of its research and development (Kirkpatrick, 1997). This is because of the high ratio of weapons development costs to the final product cost (Pugh, 1987). Countries like Argentina have lost this battle. The attempt in the aircraft industry, described below, is an attempt to regain some of this R&D capacity, albeit destined to failure when analyzed in depth. In what follows I briefly present the privatization of the Argentine military-run industries and what remains of the sector today. The chapter then concentrates on the aircraft industry that was licensed to Lockheed Martin Argentina SA (LMAASA), one of two privatized military enterprises attempting to survive in both civil and military production. LMAASA is presented as an example of offset production.<sup>7</sup>

### **The privatization of Argentine military-run industries**

Beginning in October 1990 and running through August 1997, the Argentine national government got rid of (sold off, liquidated, or transferred to province or private hands) almost its entire military basic industrial and arms producing sectors.<sup>8</sup> The reasons are to be found in the recently adopted liberal market ideology<sup>9</sup> along with the fiscal needs of the state to cover budget deficits and solve the external debt crisis. The neo-liberal privatization craze swept the entire continent during the 1990s. The date of property rights transfer is listed (see table 14.1, appended to the chapter) in the case of the privatized enterprises. The airplane factory was given in concession to Lockheed to refit the recently acquired A-4 Skyhawks and to provide maintenance for the Air Force and civil aircraft (as described below in detail). Table 14.1 also lists those few enterprises still in the public sector (they can be easily identified under the arms industry rubric as those which have not been transferred, liquidated, or privatized). They are Fábrica Militar Río Tercero, FM de Pólvoras y Explosivos "Azul," FM Fray Luis Beltrán, FM de Pólvoras y Explosivos Villa María, Sociedad Anónima para el Desarrollo de la Tecnología Acuática (SATECNA), SISTEVAL, Construcción de Viviendas para la Armada (COVIARA), Interbaires, Intercargo, and Ecdadassa.

### The Lockheed Martin aircraft licensed production unit

The only significant arms production unit still operating in Argentina is Lockheed Martin Argentina SA (LMAASA), and in the context of the discussion of defense production offsets it is worth taking a close look at this industry. The original plant was started by the Argentine army in 1927 with German-licensed aircraft, the country's first military industry. Over the years it has produced a series of aircraft (among others, the IA-27 Pulqui,<sup>10</sup> the IA-58A Pucará,<sup>11</sup> and the current advanced jet trainer, the IA-63 Pampa<sup>12</sup>), from first to last employing German licensed technology.<sup>13</sup> As indicated in table 14.1 the factory was licensed by the Air Force to Lockheed Martin in December 1994, the original contract stipulating its task as the reconditioning of a large share of the 36 used A-4 Skyhawks ordered from the US in 1993. The plant's workforce of 2,950 workers was immediately reduced to 1,950 (and then to 950). The current contract, running from 1 July 2000 through 30 June 2005, commits Lockheed to increase the workforce to 1,150, although as of the end of 2003 with capacity utilization below 60 percent, the workforce was further reduced to 900 (*Clarín*, 23 October 2003).

The original contract stipulated that, from December 1994 through mid-2000, the Argentine government (Air Force) would pay Lockheed a total of US\$212.5 million (receiving back US\$12.5 million in repairs and spare parts as a canon representing rental costs for use of the government's plant and equipment). LMAASA was committed to US\$14 million investment during those six years. And Lockheed was only contracted to upgrade the A-4 Skyhawks. There was to be no further aircraft construction, nor was there any commitment to contracts with non-military aviation.

The new concessionary contract (running from 1 July 2000 through 30 June 2005) is supposed to provide P\$230 million (Argentine pesos), the government receiving back P\$10 million as a canon for ownership of plant and equipment. This second contract holds some additional benefits for the Argentine government for two reasons; first, because there are more production benefits for Argentina (see below), and second, because Argentina has, during the course of the contract, undergone a severe devaluation that will probably force a renegotiation of the current contract.<sup>14</sup> Before January 2002, the Argentine peso and the US dollar were pegged at a 1:1 exchange rate. Following a run on the banks (November 2001) and a chaotic devaluation with default (January 2002) the peso is floating, and in mid-2003 was at P\$2.90 per US dollar. But the contract is written in Argentine pesos (see Ministerio, 2000, p. 13, article 5). Whereas in early 2002 LMAASA was to receive the equivalent of US\$230 million, the mid-2003 payment for their contracted products was—because of devaluation—only to be about US\$79.3 million. This unpredictability in Argentine political and economic institutions should make wary those doing business in Argentina. The contract with LMAASA will have to be rewritten, but in 2003 there was no possibility that the treasury accept would make further commitments in the defense sector. Indeed, the possibility exists that in 2004 the plant will be passed again into the public sector if a revised contract is not satisfactory (Cicales and Del Gaizo, 2003, p.31). The Kirchner government, which took office in May 2003, has pushed for a new law strongly supporting defense production, but it is difficult to see where the fiscal support or technological capability will come from.

There follows a description of some significant aspects of the contract and actual situation:

1. Expanded output: On the positive side of the ledger, the 2001 contract greatly expands the work responsibilities of the Lockheed plant. Most especially, it will now provide maintenance for almost all Argentine military aircraft. Lockheed also promised to offer maintenance services for civilian commercial aircraft.<sup>15</sup> The company commits itself to the production of spare parts for (only) 180 days after the beginning of the particular maintenance contract (see Ministerio, 2000, p. 26; article 13.6). This short time period for the guarantee of spare parts would naturally affect all long term contracts with any possible international client for Argentine equipment.
2. Renewed assembly line: After years of suspension the improved IA-63 Pampa (basic technology from Dornier, first deliveries in 1988, employed as an advanced jet trainer and light ground attack roles) will again be produced, 12 having been contracted for by the Argentine government (see Ministerio, 2000, p. 11; article 4.6). The initial production is about 1.5 planes per month, at a local fly-away cost of US\$7 million.<sup>16</sup>
3. Export possibilities and economies of scale: In order to attain scale advantages by bringing the average cost down and to break even on total production costs,<sup>17</sup> it is estimated that 100 aircraft must be produced and sold (Ay, 2000, p. 2). By offering coproduction as a possibility, LMAASA and Argentina have hopes of selling up to 300 units (with advanced APG-67 radar) with a fly-away unit cost estimated between US\$8 million to US\$9 million (see *Overhaul & Maintenance*, 20 June 2002, p. 165). Argentines list possible purchasers as Colombia (10 to 24 units), Israel (60 units), with South Africa, Egypt, Turkey, Greece, Mexico, Bolivia, Chile, and the United Arab Emirates given as marketing targets (Ay, 2000, p.2). Undoubtedly, most of this is wishful thinking for the following reasons: the plane incorporates much dated technology from the late 1970s; present scale factors imply high unit costs; given Argentina's economic situation, repair parts production and supply would probably not be assured; and lastly, most of the prospective buyers will either produce their own plane (coproduction is a possibility offered by LMAASA and Argentina) or buy a cheaper, more recent vintage plane from long-established and reliable arms producing countries.
4. Workforce and human capital: Although LMAASA is committed to the expansion of its workforce from 950 to 1,150 (and total jobs generated from the plant and its local suppliers should expand to between 2,050 to 2,350), according to an interview with an aeronautical engineer, the original layoffs associated with the private concession of the plant in 1994 (when the direct plant workforce was reduced from 2,950 workers to 950) was quite traumatic. By mid-2003 the workforce had shrunk further to 900. Much of the specialized human capital either went into retirement or migrated to Embraer in Brazil. At current salary levels (Argentine management receives US\$1, 500-US\$2,000 per month, whereas they can earn US\$4,000+ in jobs abroad), the plant cannot hope to keep the more qualified personnel in its workforce (see Brzoska, 1999, p. 152 for analysis of this aspect, involving the education of engineers and technicians, and "keeping qualified personnel in the country"). This will affect the future of the plant and any hopes it may have for competing in international markets. Overall, the average cost per man-hour in the new contract falls from US\$73.6/hour to \$49.3/hour, a very significant drop that will no doubt improve profit margins, but will also have an

effect on salaries, the more so following the devaluation. All foreigners formerly working for LMAASA have recently left the country, leaving only Argentine nationals to operate the plant.

5. LMAASA "commitment" to Argentina: LMAASA's total investment in Argentina over the five years of the contract is P\$8.5 million or, currently, US\$2.3 million (Ministerio, 2000, p. 30; article 21). As stated above, it must pay P\$7.8 million for the five year use of the former Air Force facility<sup>18</sup> (present value equal to US\$2.1 million). It will be paid P\$230 million under contract by the Argentine government, P\$168 million of which is to be spent on labor costs (Ministerio, 2000, p. 13; article 5.1). The Argentine Ministry of Defense will receive a 2 percent royalty (not overly generous) for any export sales of the Pampa.<sup>19</sup> Although we have insufficient information to come to any solid conclusion, it does appear that the parent company, Lockheed Martin, is assuming much risk with its concessionary contract in Argentina.
6. Disadvantages for Argentina: The IA-63 Pampa is a one-of-a-kind airplane. There exist only 15 in the world. Thus, unit cost is high, future supplies of spare parts are not assured, and export is most improbable. Before advancing alone with its licensed production, Argentina should have studied its own regional market (mostly Brazil), and common defense planning should have been attempted, if for no other reason than that of attaining economies of scale in production, maintenance, and repair. Lacking these factors, it is hard to see how licensed production of aircraft in Argentina could ever be cost efficient.

### **Lessons learned from the experience with defense industries in Argentina**

Cost limitations on production of major weapons are now widely understood and accepted as an unavoidable policy imperative in South America. This implies that military-run businesses must not depend on the national treasury to continue. There are perhaps ten criteria applicable to those countries, like Argentina, who today still wish to proceed with military-run industries. First, long range strategic and force planning is required (and this should preferably be regional, collective security planning). This is often complicated in LDCs by volatile fiscal and economic situations which make budget projection problematic. Second, long range investment funding for the industry must be assured. Third, nations must establish clear rules of policy behavior acceptable to all the country's major political parties. So that long range plans might survive a change in government, these rules should include a clearly defined position with respect to the payment of bribes and the sale of arms to countries considered pariahs in the international arena. This is important because these international outcasts tend to look to LDC producers as alternative sources when developed country producers close their markets to them. Fourth, before founding any business the country should be sure that key inputs and skilled labor are assured, or can be feasibly developed. This implies a successful education system which supplies technicians and sufficient remuneration levels to keep R&D teams in the country.

Fifth, an attractive opening in international markets should exist, such that economies of scale (or dual use products or production capabilities) can be assumed.<sup>20</sup> Small arms

production, munitions, and short range missiles are possible areas where Argentine scale production can be attained. Sixth, the producer should have the capacity for both manufacturing and marketing (including access to lines of credit for prospective purchasers). Seventh, the enterprise should offer competitive wage rates so as not to lose skilled labor. Moreover, excessive intromission by the military should be avoided. Rank should not be sufficient reason to give a voice in any enterprise, and if a soldier is to work in the enterprise, care should be taken not to limit his commitment to a short tour of duty. Eighth, the country must accept a certain level of technological dependence. Attaining independence in this area is an illusion (although one should of course try to acquire technology through tough negotiation). Ninth, there should exist at least partial (stock) ownership in the private sector, above all in order to obtain financing. And tenth, in the case of offsets, the country requires a very knowledgeable negotiating team. This last requirement was only partially met in the recent LMAASA contract.

None of these conditions are currently met, even though Argentina has recently passed a military restructuring law that recognizes several of these requirements (Law 24,948, article 21). Moreover, a new law regulating the defense production sector itself has been passed by Congress in mid-2003. Brazil and Chile, too, have been moving in the direction suggested in the prior two paragraphs.<sup>21</sup> The outcome of the local debate will probably imply that Argentina keeps its small arms production capability, possibly enhanced by its R&D capability in this field. But it is doubtful that airplane production can continue over the long run, although Brazil, with larger scale and extensive marketing capabilities, is making a go of its regional (non-military) aircraft Embraer production. The fundamental drawback in Argentina (and in other countries of the region) is the lack of long run economic and military policy.

By way of conclusion, how then should Argentina acquire arms for its defense? The answer is to buy competitively; alternatively, joint ventures are a possible solution only if scale and the other ten requirements are present.

### Notes

1. For the Argentine case, see my chapter "Military Business in Argentina" (Scheetz, 2003). Some of the points were previously developed in Scheetz, 1993.
2. These five reasons are not necessarily competing explanations. In principle, they can overlap.
3. Military-run industries in Argentina included arms producing industries, backward-linking producers of inputs into these industries (such as Altos Hornos Zapla, producing high quality steel for tank armor), and other industries considered "strategic" for the country (such as steel, petrochemicals, and oil).
4. Malthus hypothesized a growing gap between population and food supply. He predicted population catastrophe, resulting from famine.
5. In Argentina, central government refers to budget outlays of the Administración Nacional, that is to say, excluding provincial and municipal budgets.
6. As examples, in Ecuador a squadron is formed by 10–12 planes. Chile has a squadron with 16 F-5s. Israel has 30 F-16s in a squadron (see Spector and Marom, 1996).
7. "The U.S. Office of Management and Budget defines the [following] types of offsets on arms export agreements: Coproduction...licensed production... subcontractor production...overseas investment...countertrade (including: barter ...counter-purchase...compensation (or buy-back)." Quoted from Louscher and Schwarz (1989, p.41).
8. It also privatized almost all other business assets held by government.

9. The irony was that the privatization effort came from a Peronist government. Peron's name is perhaps that most associated with fostering the policy of ISI.
10. One of the world's first jet aircraft, first flown on 9 August 1947.
11. A counter-insurgency aircraft, first flown in November 1974.
12. This plane took part in the JPATS competition for an updated trainer for the American armed forces during the 1990s. It lost because it was said to be too advanced a jet trainer for young pilots; it was too expensive; the Argentine plant lacked scale production capabilities; and it would have displaced part of the American defense industry for a large number of aircraft. The Argentine Air Force then tried to place it with a US defense company but lost the bid anyway. Argentina and Brazil had also planned to jointly produce the CBA123 regional transport, with the Argentine Air Force producing 33 percent. This joint venture failed in the late 1980s because of lack of financing on Argentina's part. Brazil has since very successfully gone ahead alone on the project.
13. It is similar to the Alpha Jet, an advanced trainer whose design originated in 1970.
14. This renegotiation was concluded in 2002, but when a new president took power in May 2003 the advances in the negotiation process were simply canceled.
15. Local specialists are not convinced that this promise will be kept.
16. Its original price in the early 1990s was listed as US\$3 million per unit, thus demonstrating military Malthusianism in the Pampa.
17. The plant's high fixed costs, with low production runs, imply high unit costs (see Hartley, 1995).
18. I have no estimate of the value of the plant and equipment at the time of licensing, nor is any profit information available for LMAASA.
19. This according to a published interview with the Air Force head of logistics. See [www.aeroespacio.com.ar/539/site/\\_entrevistacm.htm](http://www.aeroespacio.com.ar/539/site/_entrevistacm.htm)
20. Of course not all production processes require scale production, e.g., submarines.
21. Chile, however, does not jointly plan force structure among the three forces, and neither has Brazil achieved joint planning in arms acquisitions.

## References

- Ay, C. (2000) "Lockheed Martin Contract Revives Pampa." *Aeromilitaria Argentina Reports*, June; see [http://www.geocities.com/aeromilitaria\\_ar/otras/noticias%20/00-06/lmaasa\\_i.htm](http://www.geocities.com/aeromilitaria_ar/otras/noticias%20/00-06/lmaasa_i.htm).
- Brzoska, M. (1999) "Economic Factors Shaping Arms Production in Less Industrialized Countries." *Defence and Peace Economics*, Vol. 10, No 2, pp. 139–169.
- Cicales, J.C. and C.Del Gaizo (2003) "Nueva política de defensa de la República de Argentina." *Teconología Militar*, No. 3, pp. 31–33.
- Hartley, K. (1995) "Industrial Policies in the Defense Sector," pp. 459–489 in K. Hartley and T.Sandler (eds.) *Handbook of Defense Economics*. Amsterdam: Elsevier.
- Hirschman, A.O. (1958) *The Strategy of Economic Development*. Clinton, MA: Yale University Press.
- International Monetary Fund. Various years. *Government Finance Statistics*. Washington, DC: IMF.
- Kirkpatrick, D.L.I. (1995) "The Rising Unit Cost of Defence Equipment—The Reasons and the Results." *Defence and Peace Economics*, Vol. 6, No. 4, pp. 263–288.
- Kirkpatrick, D.L.I. (1997) "The Affordability of Defence Equipment." *RUSI Journal* (June), pp. 58–63.
- Louscher, D. and A.Naylor Schwarz (1989) "Patterns of Third World Military Technology Acquisition," in K.-I.Baek, R.D.McLaurin, and C.I Moon (eds.) *The Dilemma of Third World Defense Industries*. Boulder, CO: Westview Press.



- Luzuriaga, Alfredo (1992). "The Conversion of the Military-Industrial Complex in Progress in Argentina." Paper delivered at Bonn International Conversion Center (BICC) conference. Dortmund, Germany. 25 February 1992.
- Ministerio de Defensa y Lockheed Martin Aircraft Argentina S.A (2000) "Contrato de Prestaciones de Servicios Aeronáuticos para la Fuerza Aérea Argentina." 30 June 2000.
- Overhaul & Maintenance*, Vol. 8, Issue 5, 20 June 2002, p. 165.
- Pérez Esquivel, L. (2000) "La producción de materiales belicos y sensibles. Una indagación acerca de los organismos responsables del monitoreo y control de la producción para la defensa." Unpublished Master's Thesis (Public Administration). Facultad de Ciencias Económicas, Universidad de Buenos Aires, Argentina, July 2000.
- Pugh, P.G. (1987) "Economics and Naval Power." *Naval Forces*, Vol. 8, No. 3, pp. 50–61.
- Pugh, P.G. (1993) "The Procurement Nexus." *Defence Economics*, Vol. 4, No. 2, pp. 179–194.
- Scheetz, T. (2003) "Military Business in Argentina," in J.Brömmelhörster and W.C. Paes (eds.) *The Military as an Economic Actor: Soldiers in Business*. London: Palgrave.
- Scheetz, T. (1993) "Industria y Comercio de Armas: ¿Propulsores de Desarrollo?" EURAL. Working Paper No 48. Buenos Aires: EURAL.
- Spector, Y. and L.Marom (1996) "SQOM-2: The Israeli Air Force's Air Power Multiplier." *Interfaces* Vol. 26, No. 1 (January/February), pp. 75–84.
- Vernon, R. (1968) *Manager in the International Economy*. Englewood Cliffs, NJ: Prentice-Hall.

## Appendix

**Table 14.1: Argentina, military-run industry at moment of privatization**

Sector/ Enterprise	Date of transfer	Pre-transfer personnel	Privatization values		(US\$mn) Total
			Cash	Paper	
Petrochemicals					
Polisur	10/90	n/a	14.1	41	55.1
Petropol	10/90	19	4.5	13	17.5
Induclor	10/90	39	17.8	50.6	68.4
Indupa	10/95	n/a	185.8		185.8
Monómeros Vinílicos	10/90	36	9.3	26.5	35.8
Petroquímica Río Tercero	3/92	355	7.3		7.3
Carboquímica Argentina	9/93	74	0.33	0.66	0.99
Petroquímica Bahía Blanca	10/95	383	171.1		171.1
Petroquímica Gral Mosconi	to YPF	1,095			
Subtotal			410.23	131.76	541.99

**Steel**

Altos Hornos Zapla (FM)	4/92	3,071	3.3	29.7	33
SOMISA	10/92	11,564	140	12.1	152.1
SIDINSA	liquidated	61			
COMIRSA	to Prov	n/a			
HIPASAM	to Prov	1,328			
SIDINOX	liquidated	n/a			
Subtotal			143.3	41.8	185.1

**Arms industry**

(Army)

TAMSE (tanks, arm. veh.)	transf/liq	259			
DGFM (FM)					
FM de Tolueno Sintético	2/93	136	0.79	1.84	2.63
FM de Vainas y Conductores	2/93	1,018	12.4	2.6	15
Eléctricos (ECA)					
FM de Acido Sulfúrico	3/93	71	1.6		1.6
FM General San Martin	4/93	506	8.5		8.5
FM Pilar	7/94	117	2.8		2.8
FM San Francisco	8/97	249	2.5		2.5
FM Rio Tercero		1,171			
FM S.J. De la Quintana		n/a			
FM de Armas Portátiles					
Domingo Matheu		566			
FM de Pólvoras y Explosivas "Azul"		317			
FM Fray Luis Beltrán		856			
FM de Pólvoras y Explosivos		564			
Villa María					
Forja	7/93	472			

Subtotal Army			28.59	4.44	33.03
(Air Force)					
Area Material Córdoba	12/94	2,950			
Fábrica Militar de Aviones					
SITEA		n/a			
INTESA		n/a			
Tecnología Aeroespacial S.A.		5			
Interbaires (civil prod.)		n/a			
Intercargo (civil prod.)		n/a			
Ecdadassa (civil prod.)		n/a			
(Navy)					
Tandanor	12/91	714	7.2	52.56	59.76
AFNE	8/93	2,697			
Astillero Domecq García S.A.		511			
EDESA		63			
SATECNA S.A.		9			
SISTEVAL S.A.		81			
COVIARA		62			
Subtotal Navy			7.2	52.56	59.76
Overall total	approx.	29,500	589.32	230.56	819.88

*Notes:* Pre-transfer assets (US\$ mn): 5,679; pre-transfer sales (US\$ mn): 1,446 (both for 1990/91; see (Luzuriaga, 1992); n/a.=not available; transf.=transferred; liq=liquidated

*Sources:* Personnel in general taken from Ministerio de Defensa (internal memo, 1991); personnel for Sidinsa, Petropol, Induclor, Mon. Vinilicos, and Coviara are for 1984 (internal government memo); other

sources: Pérez Esquivel (1999, p. 94); Luzuriaga (1992); La Nación, 3 October 1990.