Industry Snapshot

Aluminum Semi-Fabricating in Canada

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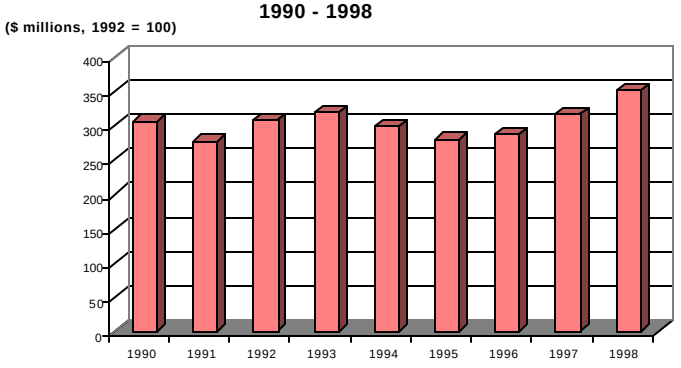
Highlights
Aluminum Semi-Fabricating Industry

- In 1998, the aluminum rolling, casting and extruding industry contributed $352.0 million to the Canadian economy, an 11.4% increase over 1997 ($316.0 million).
- Manufacturing shipments have continuously grown from 1990 at an average rate of 6.2% per annum to reach $2.94 billion in 1998, an 8.1% increase over 1997 ($2.72 billion).
- The industry has become increasingly export oriented in recent years.
- Despite the increase in exports, Canada continued to be a net importer of aluminum rolled, cast and extruded products, although the sectoral trade deficit has decreased since 1990.
- Aluminum sheet/plate/strip products have remained the top cluster of aluminum semi-fabricated products traded internationally since 1990.
- In order to produce more fuel-efficient vehicles, the automotive industry has increased its use of lighter weight aluminum in vehicle manufacturing.
- The most dynamic areas of growth over the next few years appear to be aluminum castings, sheet and extrusions for the transportation sector.
- As market globalization continues, the Canadian semi-fabricating industry will be particularly well-placed to benefit from foreign market opportunities as it has already adapted to foreign competition.
- The United States, European and Japanese extrusion industries are booming as demand for extrusions from the transportation industry is very strong. Deliveries extend into months and there is a chronic shortage of extrusion billets.
- Should suppliers of primary billet in Canada decide to devote metal to other applications, such as sheet, which is finished in the United States, instead of increasing billet capacity, Canada could miss an opportunity in the extrusion business.

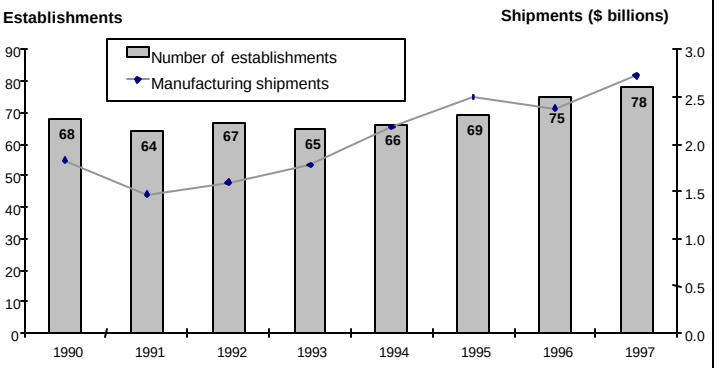
The Aluminum Semi-Fabricating Industry at a Glance

Gross Domestic Product
Aluminum rolling, casting and extruding industry
1990 - 1998



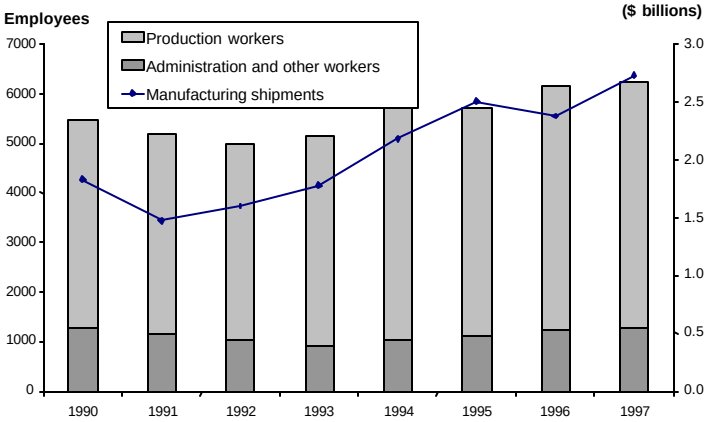
Source: Statistics Canada

Manufacturing shipments and number of establishments
Aluminum rolling, casting and extruding industry
1990 - 1997



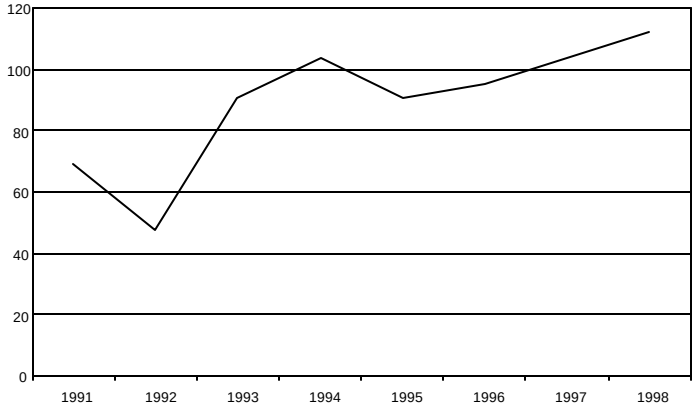
Source: Statistics Canada, Industry Canada

Manufacturing shipments and number of employees
Aluminum rolling, casting and extruding industry
1990 - 1997



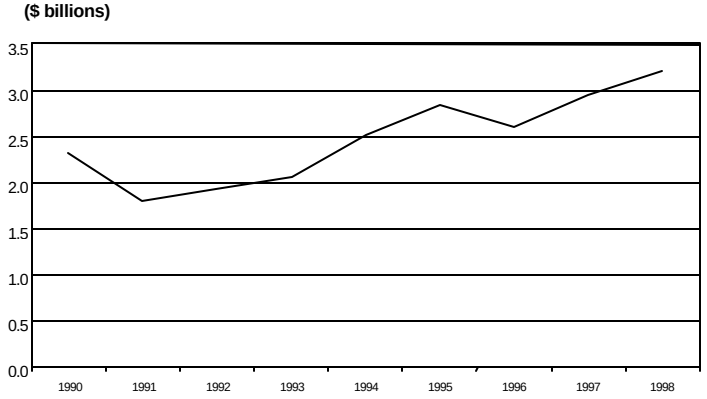
Source: Statistics Canada, Industry Canada

Capital expenditures
Aluminum rolling, casting and extruding industry
1991 - 1998



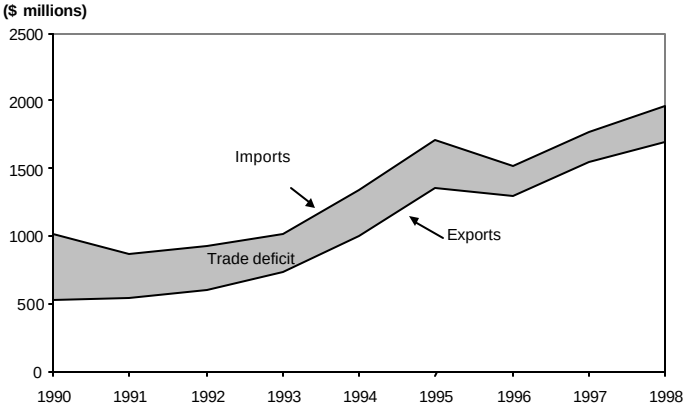
Source: Statistics Canada

Apparent Canadian market
Aluminum rolling, casting and extruding industry
1990 - 1998



Source: Statistics Canada

Trade balance
Aluminum rolling, casting and extruding industry
1990 - 1998



Source: Statistics Canada

1. Introduction

The objective of the *Industry Snapshots* is to provide an economic overview of certain sectors of the metals and minerals processing industry as well as a description of the factors influencing its performance. This Snapshot focuses on the **Aluminum Rolling, Casting and Extruding Industry** (aluminum semi-fabricating industry) for the 1990-1998 period. Establishments in this industry fall under 1980 Statistics Canada's Standard Industrial Classification (SIC) 2961.

According to Statistics Canada's definition of the industry, establishments falling under SIC 2961 are engaged in the production of:

- Aluminum bars, rods and structural shapes (including alloys)
- Aluminum castings
- Aluminum foil
- Aluminum pipe and tubing
- Aluminum plate, sheet and strip
- Aluminum powder
- Aluminum wire and cable, not insulated

Establishments primarily engaged in pressure die casting of aluminum are classified in SIC 2999 - Other Rolled, Cast and Extruded Non-ferrous Metal Products Industries. Those primarily engaged in extracting aluminum from alumina are classified in SIC 2958 - Primary Production of Aluminum Industry and Other Primary Smelting and Refining of Non-ferrous Metals Industry.

In 1998, the aluminum semi-fabricating industry represented 10.7% of the primary metal industry (SIC 29) in terms of value of shipments and accounted for 0.7% of the total Canadian manufacturing industry (Figure 1).

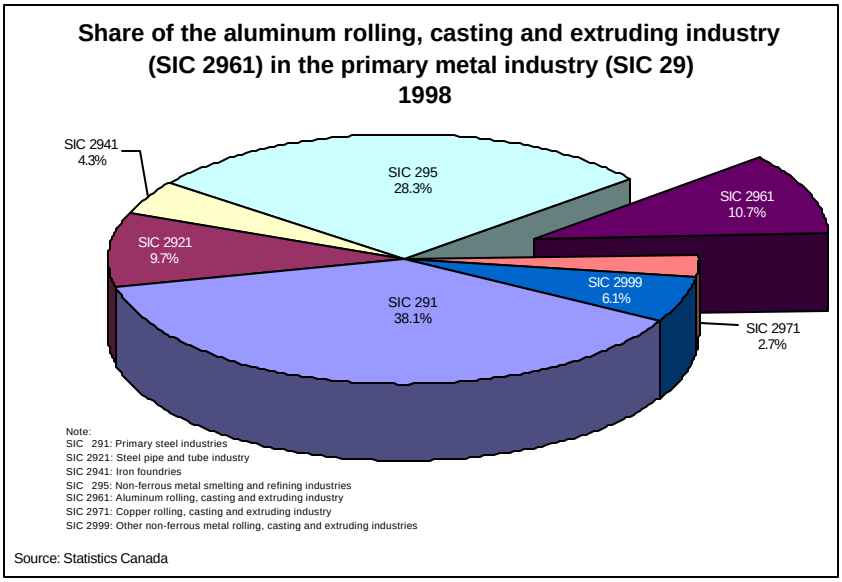
Table 1 shows the key statistics for this industry for 1997 and 1998.

Table 1: Key statistics (1997-1998) for the aluminum semi-fabricating industry

Aluminum rolling, casting and extruding industry – SIC 2961							
Year	**Shipments**	**GDP**	**Exports**	**Imports**	**Trade balance**	**Establishments***	**Employees***
1998	2944.6	352.0	1695.1	1966.1	-271.0	78	6240
1997	2724.9	316.0	1546.0	1772.0	-226.0	75	6160
(1998/1997)	8.1%	11.4%	9.6%	11.0%	19.9%	4.0%	1.3%

Source: Statistics Canada
Figures in $ millions for shipments, exports, imports and trade balance; in constant 1992 $ millions for GDP.
* Data for 1997 and 1996.

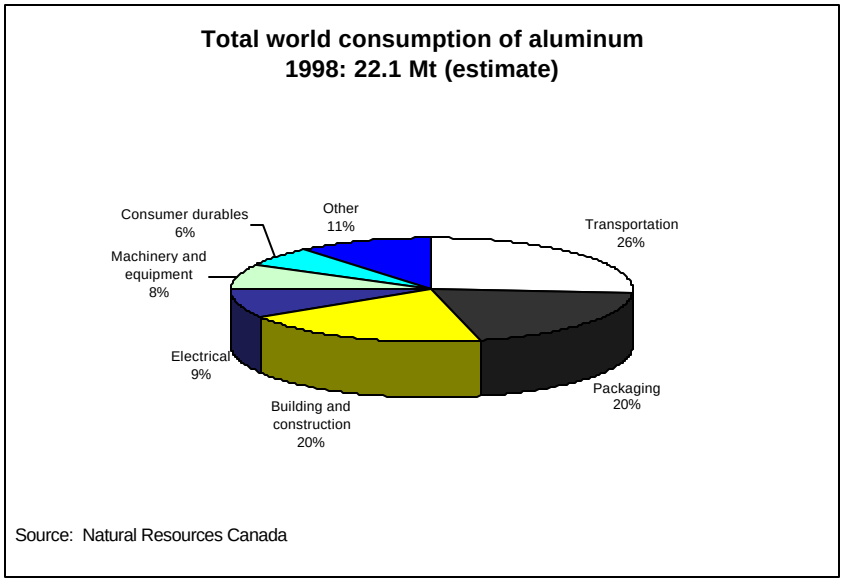
Figure 1



In 1998, the aluminum semi-fabricating industry contributed $352.0 million to the Canadian economy, an 11.4% increase over 1997 ($316.0 million). Since 1990, the sector's GDP has increased by 15.0% at a compounded average annual growth rate (CAAGR) of 1.8%.

The semi-fabrication of aluminum comprises several manufacturing processes and technologies, which constitute a critical link in the manufacturing chain from rough ore to consumable finished product. Technological advancements in the semi-fabrication stage enable the manufacture of products with specific end-use properties. Aluminum in its pure and alloyed forms is used in the production of a variety of products for both the consumer and capital goods markets. Total world consumption by end-use market is illustrated in Figure 2.

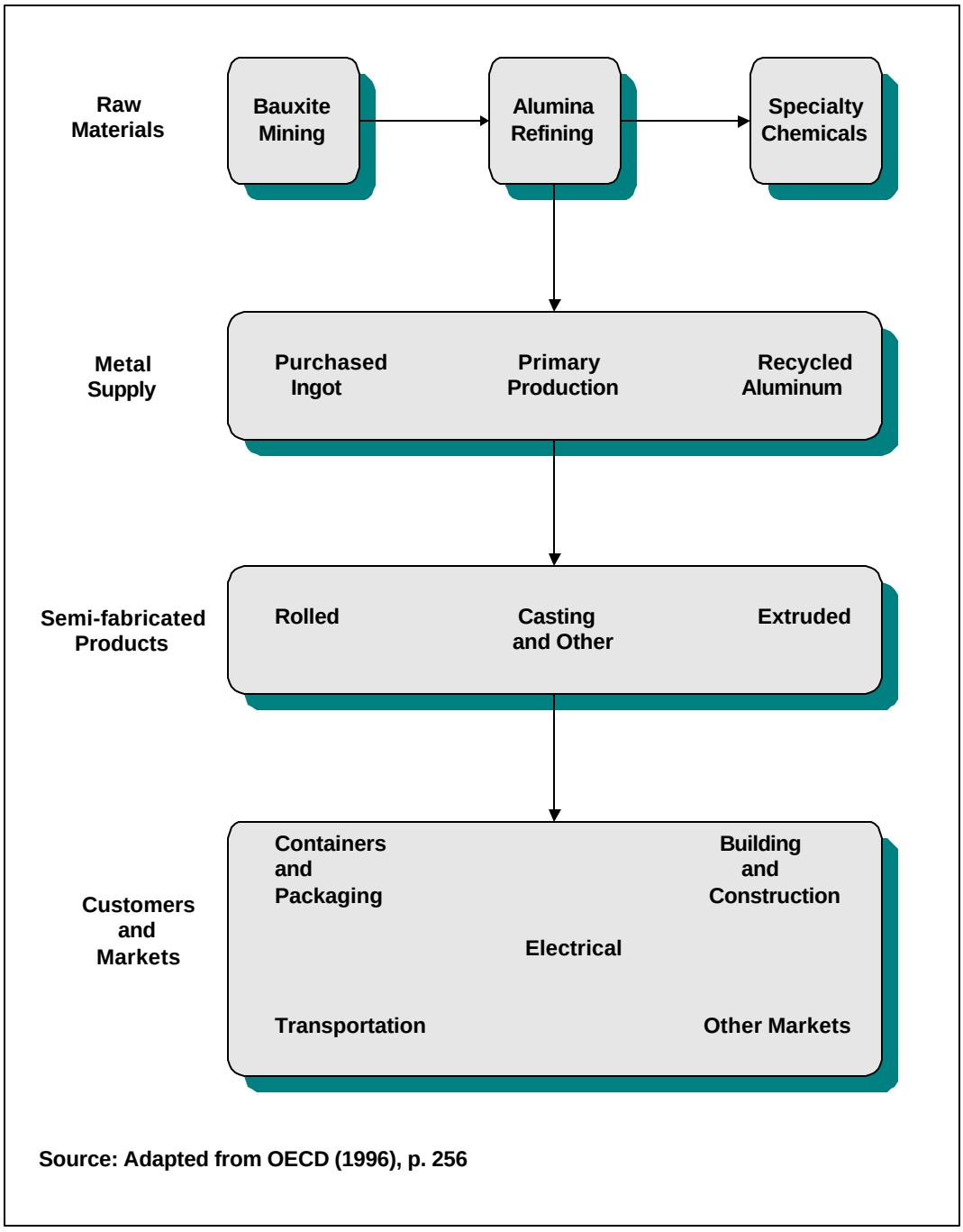
Figure 2



2. Overview of Manufacturing Process

A schematic representation of the aluminum manufacturing process is provided in Figure 3.

Figure 3



Source: Adapted from OECD (1996), p. 256

Rolling

In the rolling process, aluminum ingots are passed between rolls under pressure and rolled to the desired thickness or gauge. The products at the end of the rolling process are classified as plate, 0.635 cm or more (0.25 inch or more); sheet, 0.634-0.015 cm (0.249-0.006 inch); or foil, less than 0.015 cm (less than 0.006 inch).

Plate is used in applications requiring high strength and meets the needs of the machinery, equipment and transportation markets. Aluminum plate, machined to shape, forms the skins for jumbo jets, structural sections of rail cars and large ships, and storage tanks and containers in many industries.

Sheet, the most widely used form of aluminum, is used in the packaging industry for cans and closures, in the transportation industry for automobile bodies and in the building construction industry for siding, roofing, awnings, etc. Sheet is also used for a number of consumer goods, such as household appliances and cookware.

Foils of different gauge are manufactured into several products. These include standard household foil, semi-rigid foil cookware and flexible foil packaging. Formed into fins, foil is used as the heat exchanger in air-conditioning units and car radiators.

Casting

The three most important methods are die casting, permanent mould casting and sand casting. (Although data for companies involved in die casting are included under SIC 2999 and not SIC 2961, a brief description of die casting is provided here for information purposes.)

In die casting, molten metal is forced into a steel die or mould under pressure to form the desired shape. This method is normally used for high-volume production of accurate parts requiring a minimum of machining.

Permanent mould casting involves moulds and cores of steel or other metal into which molten aluminum flows either by gravity or through the application of a vacuum. These castings are stronger than either die or sand castings. When permanent cores would be impossible to remove from the finished product, semi-permanent mould casting, which uses expendable cores of sand or other material, is used.

In sand casting, virtually any pattern can be pressed into a fine sand mixture to form a mould into which the aluminum is poured. This method, although slower, is used to produce intricate designs or very large castings. It is also the preferred method of producing small quantities of a particular shape economically.

The automotive industry is the largest market for aluminum castings, with cast components currently making up more than half of the aluminum used in cars. Cast aluminum components include transmission housings, pistons, engine blocks and catalytic converter shields.

Extruding

The extruding process can be likened to squeezing toothpaste from a tube with the extruded metal assuming the shape of the die through which it is pressed. Log-shaped aluminum billets are preheated and fed into an extrusion press where thousands of kilograms of pressure are applied to force the aluminum through the die and onto a run-off table where the extrusion is straightened by stretching and then cut to length.

The extruding process can produce virtually any shape. While basic products, such as rod, bar and tube, may be sent for further fabrication, the extrusion process can produce products ready for placement in the finished product without further fabrication. Aluminum extrusions are used as structural components in automobiles, aircraft, buildings, bridges and electrical transmission towers, as well as window and door frames, ladders and lawn furniture.

3. Industry Performance and Structure

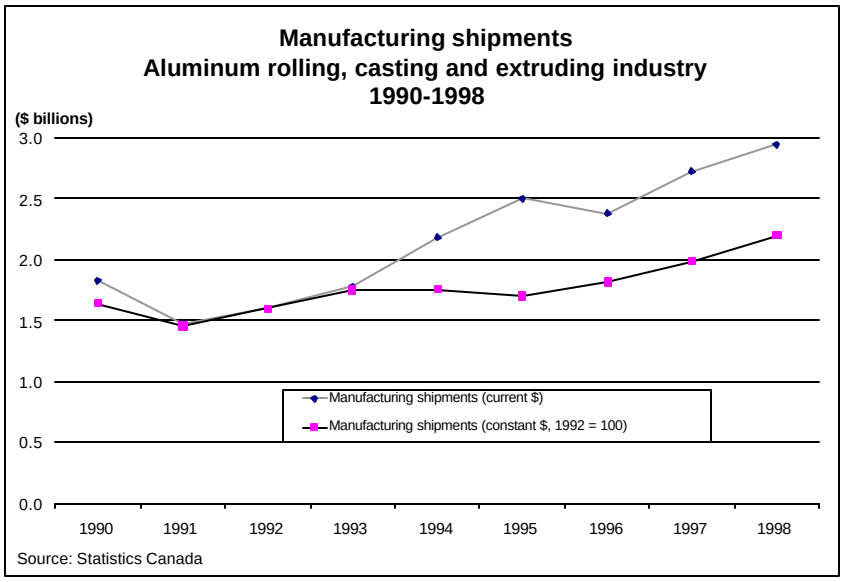
The following section provides a description of the performance and structure of the aluminum rolling, casting and extruding industry since 1990.

3.1 Industry Performance

3.1.1 Production

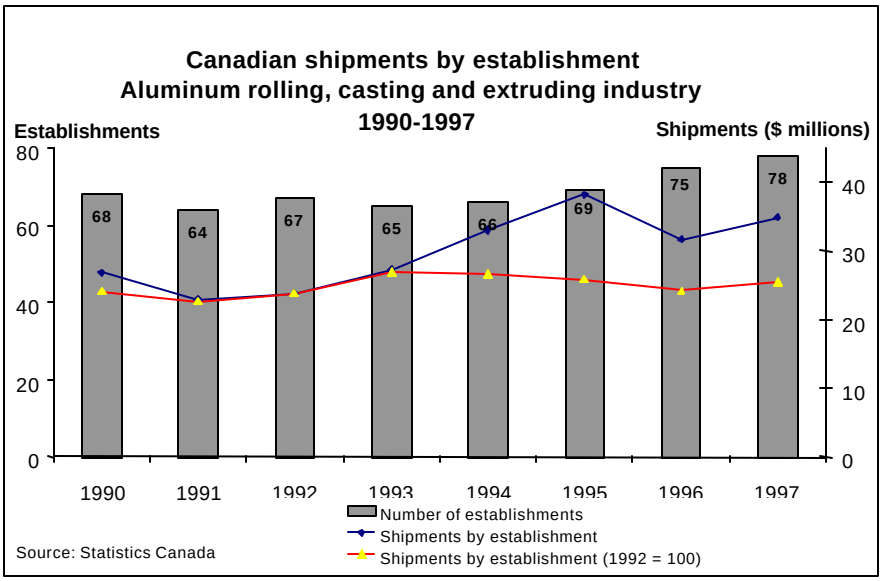
The value of manufacturing shipments was an estimated $2.94 billion in 1998, an 8.1% increase over 1997 ($2.72 billion) (Figure 4). Except for 1991 and 1996, manufacturing shipments have demonstrated an upward trend with an average annual growth rate of 6.2%. Measured in both current and constant dollars, the growth in shipments for the aluminum semi-fabricating industry was positively correlated to all manufacturing shipments, maintaining a 0.6% share of all manufacturing shipments during the 1990-1998 period.

Figure 4



The number of establishments remained relatively stable throughout the 1990-1997 period, with a cumulative increase of 14.7%, reaching its highest level in 1997 with 78 establishments, a 4.0% increase over 1996 (75 establishments). Comparing shipments by establishment in current and constant dollars indicates that prices influenced the growth in shipments to a greater extent than the larger number of establishments, especially at the end of the period (Figure 5).

Figure 5

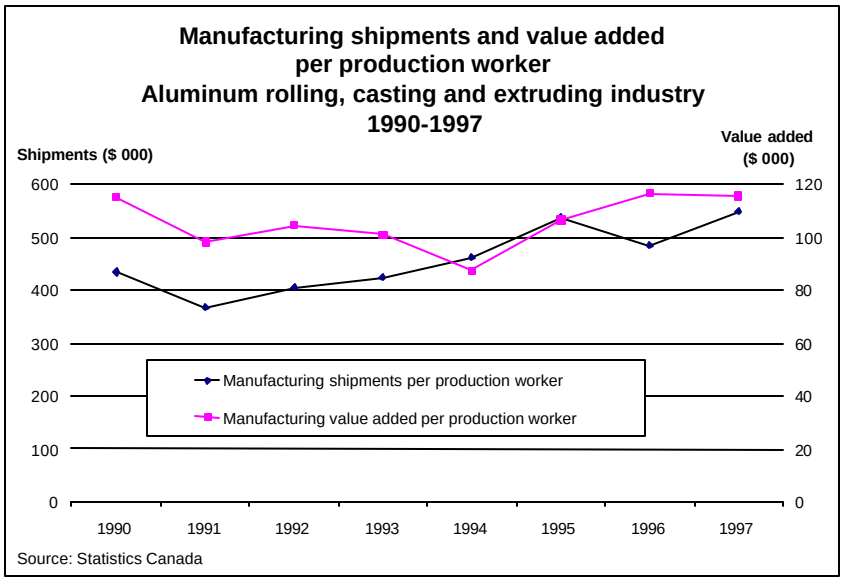


3.1.2 Productivity

Manufacturing shipments per production worker exhibited an upward trend from 1991 to 1995, falling slightly in 1996 and recovering again in 1997. Overall, manufacturing shipments per production worker increased cumulatively by 26.3% between 1990 and 1997 (Figure 6). In 1997, this indicator reached its highest peak level, amounting to $548.7 thousand per production worker.

Manufacturing value added (MVA) per production worker exhibited a downward trend between 1990 and 1994, but recovered in subsequent years (Figure 6). In 1997, MVA per production worker amounted to $115.7 thousand, only marginally higher than the 1990 value of $115.1 thousand.

Figure 6



According to Statistics Canada, in 1996, unit labour cost in the aluminum semi-fabricating industry was higher, at 1.29, than in either the primary metal industry (0.90) or the total manufacturing industry (0.69). This indicates that labour compensation per worker was higher than the value added per worker. Moreover, unit labour cost increased by 55.4% in 1996 over 1990 at 0.83.

3.2 Structural Indicators

3.2.1 Size and geographic distribution of establishments

The aluminum semi-fabricating industry comprised 78 establishments in 1997, 61.5% of which are considered small businesses (less than 50 employees) (Table 2).

Table 2: Distribution by size of establishments, 1997

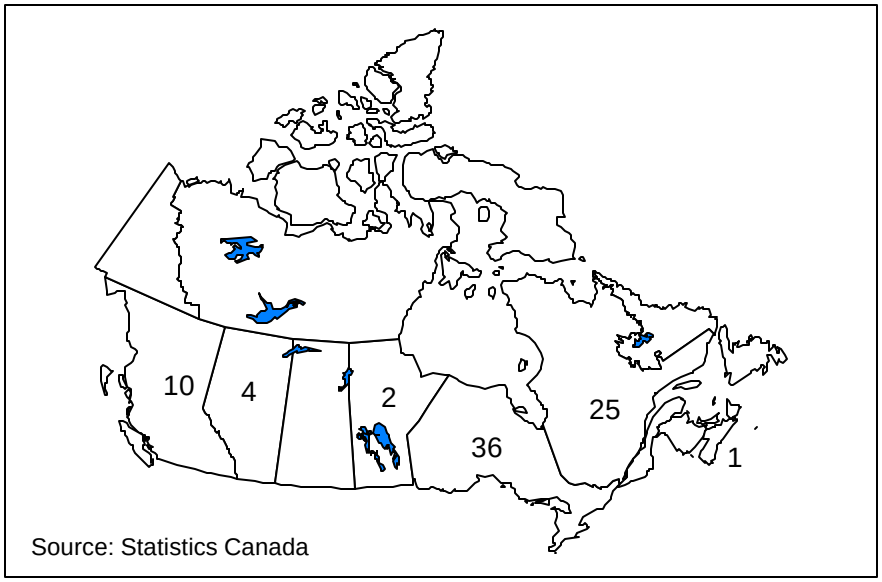
Aluminum rolling, casting and extruding industry – SIC 2961		
Size of establishment	**No. of establishments**	**% of total**
Small (1-49 employees)	48	61.5
Small-medium (50-99 employees)	9	11.5
Medium (100-199 employees)	12	15.4
Large (200 or more employees)	9	11.5
Total	78	100*

Source: Statistics Canada

* Note: Total may not be exact due to rounding.

In 1997, 46.2% (36) of establishments were located in Ontario and 32.1% (25) of establishments were located in Quebec (Figure 7). The remaining 21.7% (25) of establishments were spread among British Columbia (10 establishments), Alberta (4 establishments), Manitoba (2 establishments) and Nova Scotia (1 establishment).

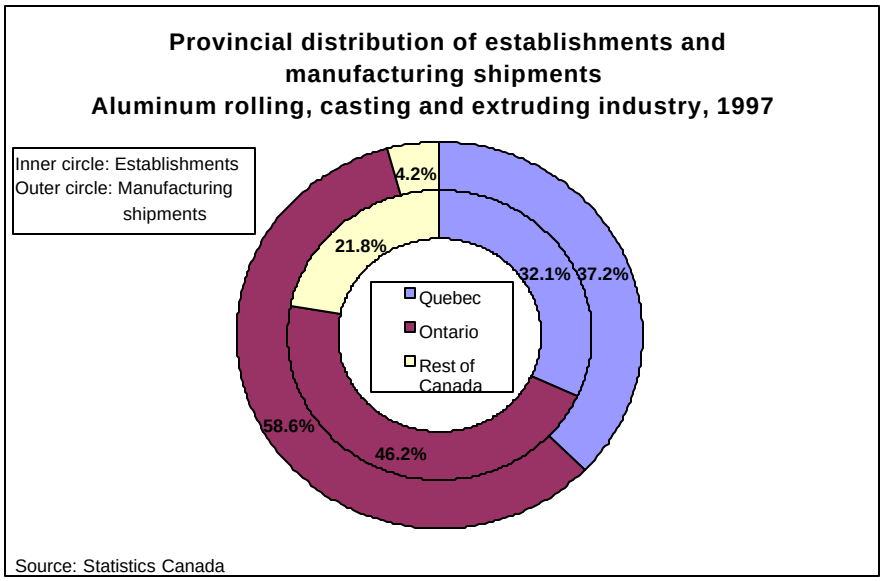
Figure 7: Geographic distribution of establishments
Aluminum rolling, casting and extruding, 1997



Source: Statistics Canada

Although Ontario and Quebec accounted for 78.3% of total establishments, these two provinces produced 95.8% of total manufacturing shipments (Figure 8).

Figure 8



3.2.2 Industry concentration

The aluminum semi-fabricating industry is highly concentrated, with its four largest enterprises accounting for 77.6% of the industry's manufacturing shipments and its eight top enterprises generating 91.3% in 1996 (Table 3). However, the industry has experienced a 10.1 percentage points and 2.6 percentage points decrease in the concentration share of the four and eight largest enterprises, respectively, between 1990 and 1996.

Table 3: Industry concentration of the four and eight largest enterprises of the industry, 1990-1996

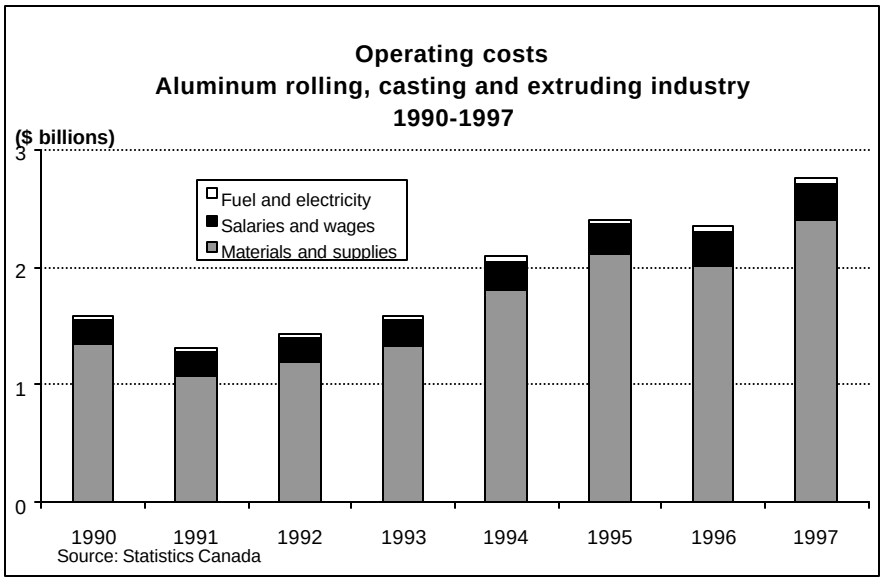
Aluminum rolling, casting and extruding industry – SIC 2961		
	Four largest enterprises	Eight largest enterprises
	% of industry total manufacturing shipments	
1990	87.7	93.9
1995	85.3	92.1
1996	77.6	91.3

Source: Statistics Canada

3.2.3 Operating costs (variable costs)

Operating costs accounted for $2.7 billion in 1997, an increase of 17.3% over 1996 ($2.3 billion) (Figure 9). Since 1990, operating costs have grown by 74.0%, or 8.2% annually on average. Operating costs in the industry were dominated by the cost of materials and supplies. In 1997, these inputs accounted for 87.3% of total operating costs compared with 11.0% for wages and salaries and only 1.7% for fuel and electricity (Figure 9). This cost distribution differed from that of all manufacturing, which demonstrated the following breakdown in 1997: 78.9% for materials and supplies, 18.4% for wages and salaries, and 2.6% for fuel and electricity. With materials and supplies being the major cost factor in the manufacturing of aluminum semi-fabricated products, the sector is vulnerable to any fluctuation in international raw material prices.

Figure 9



3.2.4 Employment and wages

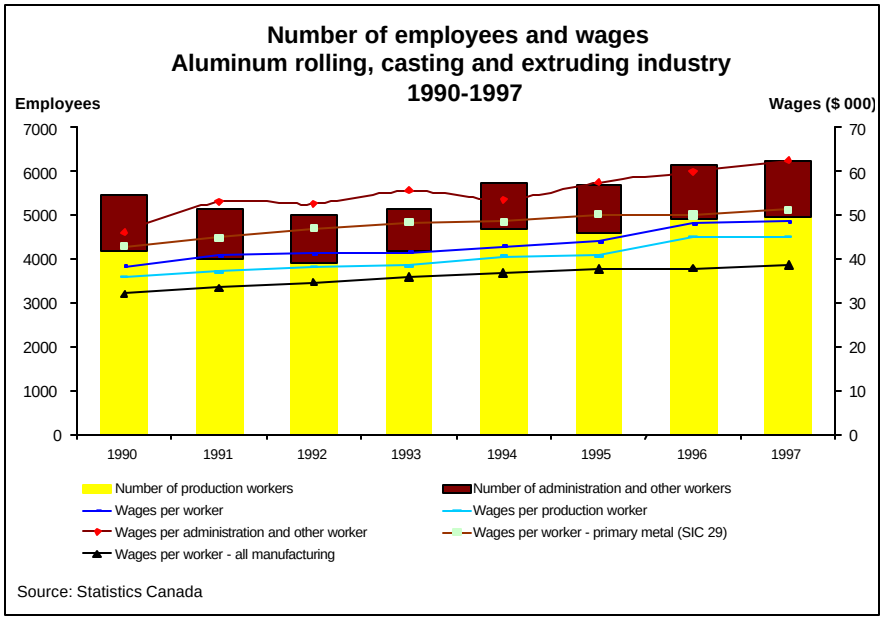
In 1997, the sector reached its highest level of employment (6240 workers) (Figure 10). This is up by 80 employees, or 1.3%, from 1996 (6160 employees). Between 1990 and 1997, the industry saw its work force go down from 1990 to 1992 and move up afterwards for a cumulative increase of 14.2%, an average rate of 1.9% annually, led by the growth of production workers. The majority of the industry's work force fell under production activities, with an estimated average of 79.6%, during the 7-year period. The remaining activities, including administrative and other workers, accounted for an estimated average of 20.4% over the same period.

Salaries in the aluminum semi-fabricating industry were $10 300, or 26.9%, higher in 1997 ($48 600) than in 1990 ($38 300). Moreover, measured in constant dollars (1992 = 100), salaries were $4200, or 10.2%, higher in 1997 ($45 200) than in 1990 ($41 000). Therefore, the growth in earnings was sufficient to compensate for inflation, thus keeping employees' purchasing power stable over the period.

Salaries in this industry's sector have been on average 10.0% lower than the average wages in the primary metals industry during the period, but the gap has been shrinking since 1995. However, salaries have largely surpassed those in the total manufacturing industry during the period.

Wages for non-manufacturing (i.e., administrative) workers grew at a slightly higher pace than for manufacturing workers. Therefore, non-manufacturing employees saw their salaries increase by 35.1%, an average annual rate of 4.4%, between 1990 ($46 200) and 1997 ($62 400), whereas manufacturing employees saw their salaries improve by 25.6% between 1990 ($35 900) and 1997 ($45 100), an average annual rate of 3.3%.

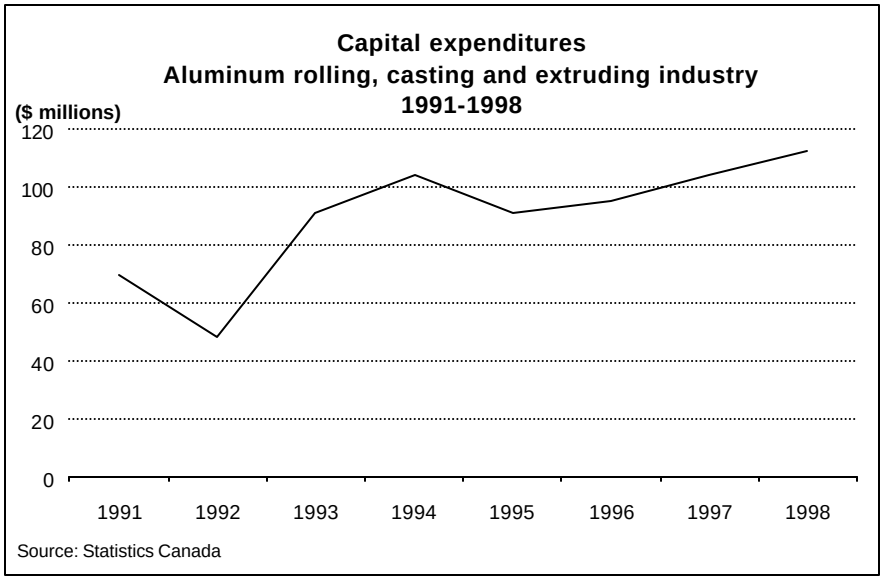
Figure 10



3.2.5 Capital expenditures

In 1998, the sector's capital expenditures totaled $112.4 million, an increase of 8.2% over 1997 ($103.9 million) (Figure 11). They represented 3.8% of the value of the sector's manufacturing shipments. Of these expenditures, 84.3% were directed to machinery/equipment and 15.7% to construction. Capital expenditures grew by 62.0%, an average rate of 7.1% per year, between 1991 and 1998.

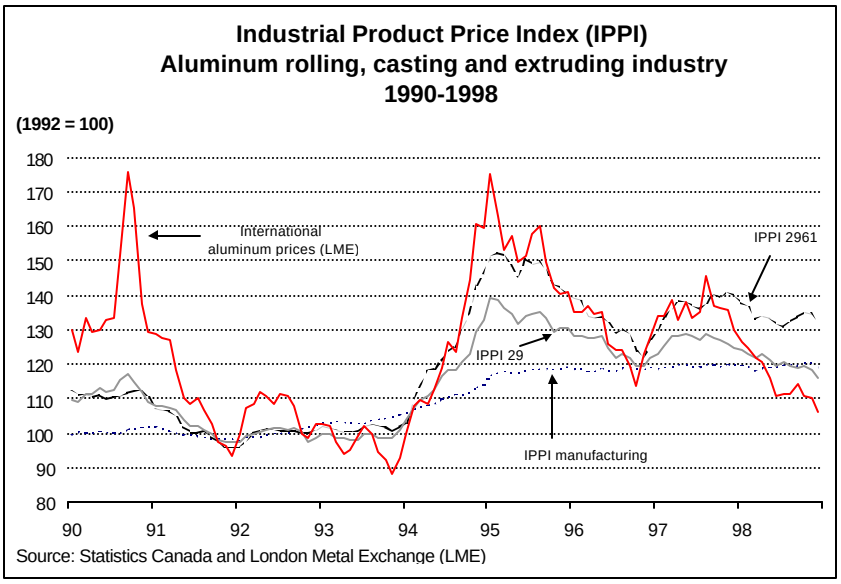
Figure 11



3.2.6 Prices

Between 1990 and 1998, aluminum semi-fabricated product prices, reflected by the Industrial Product Price Index (IPPI), fluctuated significantly (Figure 12). In part due to weaker aluminum prices worldwide and to the recession of the early nineties, the IPPI decreased by approximately 10.0% from 1990 to 1994. In 1995, prices more than recovered to reach their highest level of the 1990-1998 period. They then exhibited a downward trend until 1998, but remained higher than the pre-1995 period. The IPPI for the aluminum semi-fabricating industry followed the same trend as the IPPI for the primary metals industry and was significantly correlated with international market prices for aluminum during the 9-year period.[1] In general, the aluminum semi-fabricating industry reflected the high volatility in prices in the primary sector.

Figure 12



4. International Trade

Canada has negotiated a number of trade deals over the last few years that have improved access to key markets for Canadian products. Implementation of the Canada-U.S. Free Trade Agreement (FTA) in 1988, the North American Free Trade Agreement (NAFTA) in 1994 and various World Trade Organization (WTO) agreements have provided a rules-based framework to facilitate trade and investment. In addition, Canada has been pursuing complementary market access improvements for Canadian exporters through initiatives such as the Canada-Chile FTA and Canada-Israel FTA and current negotiations with countries of the European Free Trade Area (Norway, Switzerland, Liechtenstein and Iceland). Canada is also involved in the Free Trade Area of the Americas (FTAA) process, which aims to start reducing barriers to trade among the 34 democratic countries of the Western Hemisphere by 2005. Canada is also weighing the possibility of entering into bilateral negotiations with Costa Rica, with a view to gaining quicker preferential access to this fast-growing market. In the WTO, Canada is still looking forward to further liberalization of trade through various negotiating processes, including

[1] Industry Canada estimated a correlation coefficient for the aluminum semi-fabricating industry of 97.1% with prices of the primary metals industry and 72.6% with prices on the international market.

the accession of new members to the WTO. Accession talks permit Canada, and the other members of the WTO, to set the market access terms countries must meet before becoming WTO members. Canada, and most other WTO members, has completed bilateral accession talks with China and the final multilateral talks are scheduled to begin shortly. Other key countries still waiting to accede to the WTO include Taiwan, Russia, the Ukraine, Vietnam and Saudi Arabia.

With the reduction of tariffs subsequent to the signing of the Free Trade Agreement and the North American Free Trade Agreement, international trade in the Canadian aluminum rolling, casting and extruding industry has increased significantly since 1990. The volume of trade has increased by 136.0%, going from $1551.3 million in 1990 to $3661.2 million in 1998.

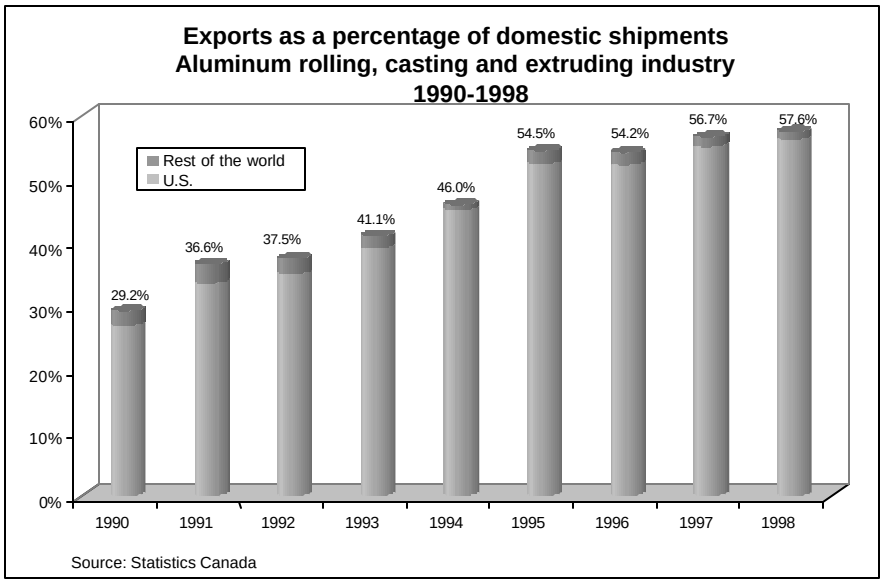
4.1 Exports

Trade data for the 1990-1998 period indicate that the aluminum semi-fabricating industry has become significantly more export oriented (Figure 13). Whereas exports represented 29.2% of the industry's domestic shipments in 1990, they accounted for 57.6% of domestic shipments in 1998.

The value of Canadian exports has shown an increasing trend every year from 1990 to 1998 with the exception of 1996. Canadian exports reached $1695.1 million in 1998, a 9.6% increase over 1997 ($1546.0 million). The United States remained Canada's major trading partner with $1659.0 million, or 97.9%, of Canada's exports of these products directed to the U.S. in 1998. In fact, 56.3% of aluminum semi-fabricated products production was destined to the U.S. market. This increase in the last part of the period can be partially attributed to the North American Free Trade Agreement and to a favourable Canada/U.S. exchange rate.

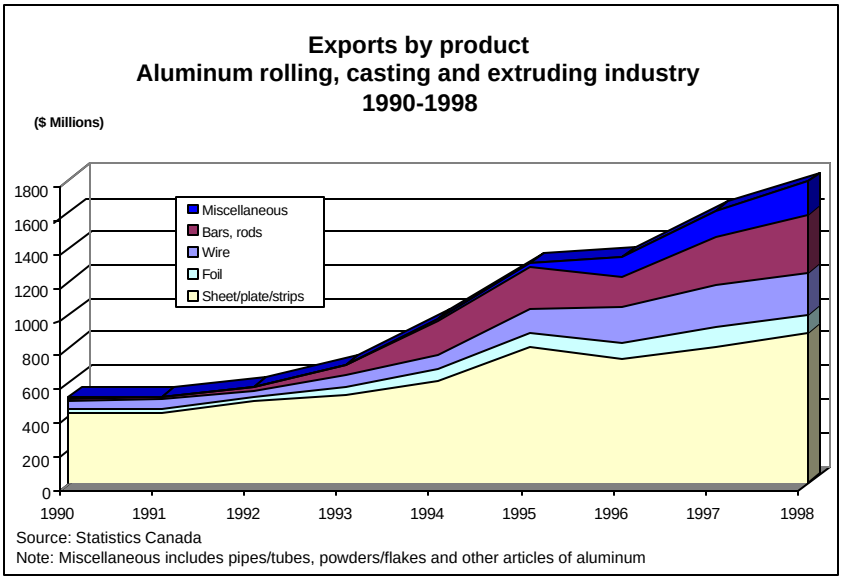
In 1998, the top ten countries of destination for exports were, in decreasing order: United States (97.9%), Italy (0.2%), New Zealand (0.2%), Australia (0.2%), Germany (0.2%), Argentina (0.1%), Switzerland (0.1%), United Kingdom (0.1%), Brazil (0.1%) and South Africa (0.1%).

Figure 13



Most Canadian exports are sheet, plate and strip products, with an average share of 66.8% of the sector's total exports between 1990 and 1998 (Figure 14). In terms of growth, exports of aluminum bars and rods exhibited the highest increase during the 9-year period, with a cumulative increase of 4652.3%, an average annual growth rate of 62.04%.

Figure 14

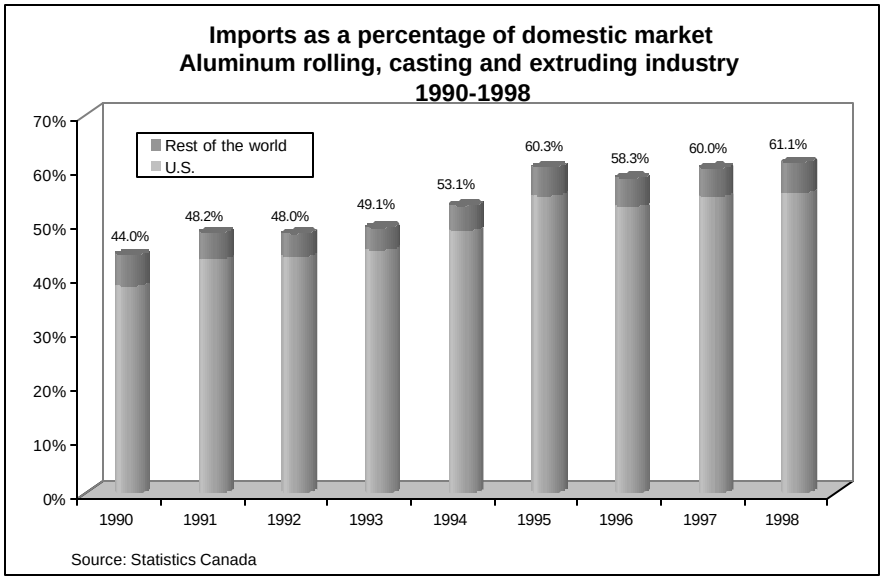


Source: Statistics Canada
Note: Miscellaneous includes pipes/tubes, powders/flakes and other articles of aluminum

4.2 Imports

The 1990s have also witnessed a high import penetration from foreign countries into the Canadian apparent domestic market (CADM) (Figure 15). Imports from all countries represented 44.0% of the CADM in 1990 and have increased their share to 61.1% of the CADM in 1998. Moreover, the demand for imported aluminum rolled, cast and extruded products increased by 93.2%, an average annual growth rate of 8.6%, between 1990 and 1998. The value of imports was $1966.1 million in 1998, an 11.0% increase over 1997 ($1772.0 million).

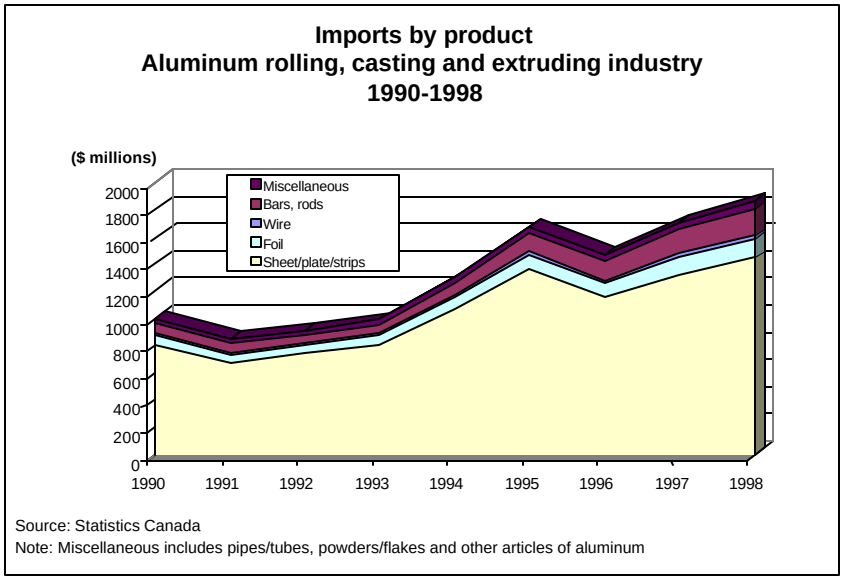
Figure 15



Again the United States has been the principal exporter of these goods to Canada. In 1998, 90.7% of total imports, representing $1784.0 million, to the Canadian market originated from the United States. Moreover, imports from the United States accounted for 55.5% of the CADM.

The top ten countries of origin for imports in 1998 were as follows: United States (90.7%), United Kingdom (1.7%), France (1.5%), Germany (1.3%), South Korea (0.7%), Belgium (0.7%), Switzerland (0.3%), Japan (0.3%), Australia (0.3%) and South Africa (0.3%).

Figure 16

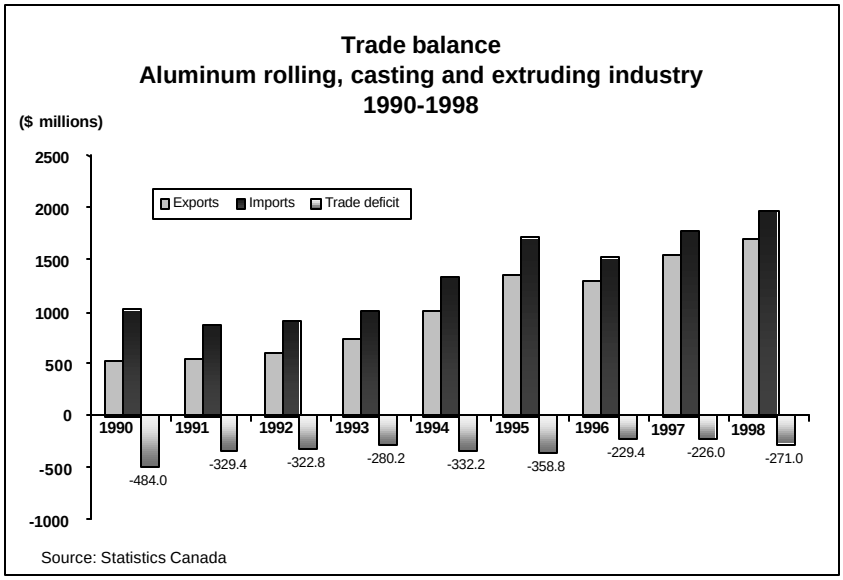


Similar to exports, foreign aluminum sheet, plate and strip products constituted Canada's largest cluster of aluminum products demanded, with an average share of 80.0% of the sector's total imports between 1991 and 1998 (Figure 16). In terms of growth, the demand for imported aluminum bars and rods showed the highest cumulative increase of 158.6%, an annual average growth rate of 12.6%, between 1991 and 1998.

4.3 Trade Balance

Despite the increase in exports, Canada continued to be a net importer of aluminum rolled, cast and extruded products, although the sectoral trade deficit has decreased since 1990 (Figure 17). Canada's aluminum semi-fabricating industry's trade deficit diminished by 44.0% between 1990 ($484.0 million) and 1998 ($271.0 million) (Figure 17). The industry's trade deficit increased by 19.9% in 1998 over 1997 ($226.0 million), due mainly to a sharp increase in imports from countries other than the United States. In 1998, the trade deficit with countries other than the United States was $146.0 million, a 31.5% rise over the previous year. The trade deficit with the United States, alone, reached $125.0 million in 1998, an increase of 8.7% over 1997 ($115.0 million).

Figure 17



5. Challenges and Opportunities

The aluminum industry may see many changes in 2000 as decisions are made in Canada, the United States and the European Union regarding the proposed merger of Alcan Aluminum Limited and Alusuisse and the acquisition of Reynolds Metal Co. by Alcoa Inc. Furthermore, the drive to reduce the weight of vehicles in just about all forms of transportation in order to reduce fuel consumption in industrialized countries is accelerating the demand for light metals in this sector, particularly for castings, extrusions and sheet.

The major driving force favouring the use of light materials in the transportation industry is spurred by environmental regulations aimed at reducing emissions caused by fuel consumption. Specifically, the automotive industry faces ever-growing pressures to reduce fuel consumption, as the transportation sector is by far the greatest consumer of petroleum fuel.

As a consequence, major efforts are occurring around the world to reduce vehicle weight. For example, in the United States, the Partnership for a New Generation Vehicle, or "Clean Car," has established dramatic fuel economy goals. California is a trendsetter and requires that in the year 2001 at least 5% of the sales of major car companies in the world be vehicles with zero emissions. This will affect vehicle design and propulsion (fuel cells, hybrids, etc.) profoundly over the decade.

5.1 Future Trends and Market Opportunities

Currently, the market for extrusions is extremely tight and could remain so for many months. This situation is brought on by the fact that, in unison, the United States, European and Japanese extrusion industries are booming as the transportation sector worldwide seeks to reduce vehicle weight in order to meet fuel economy requirements imposed by most governments in industrialized countries. The situation is also affecting billet supply in Canada as some independent extruders are experiencing a tightening of supply.

As market globalization continues, the Canadian semi-fabricating industry will be particularly well-placed to benefit from foreign market opportunities as it has already adapted to foreign competition. However, industry must keep abreast of competition from other countries and other lightweight materials.

Vehicle weight reduction programs have had most positive effects on aluminum consumption in vehicles since 1990. Aluminum content has grown from 83 kg to 112 kg per vehicle (1990-1998) and by 2009 the metal could total up to 147 kg per vehicle. Castings made by various processes represent nearly 80% of the total aluminum content. Flat rolled sheet, plate and foil represent a little over 11%; extrusions are approximately 7%. Casting content share is expected to decline as rolled and extruded products grow at a more rapid rate. These figures are positive; however, the competition among materials is ongoing as research and development efforts continue to position high-strength steel, magnesium, plastics and composite materials for the high volume transportation market.

The opportunities for Canadians in the casting area are positive; however, there are caveats:

- Continued customer demand for lower costs, better product quality and improved service is putting tremendous pressure on the casting industry, forcing it to use its own design staff for complete design, correction and revision to components.

- Magnesium die castings are now being used for an increasing variety of auto parts. Improved creep resistance alloys have been developed, allowing the metal to be used for engine parts. These open up a large market opportunity for magnesium die castings.

- Developing world companies copy and produce equally good castings so the technical level of Canadian firms must increase to remain competitive.

- For the aluminum casting industry to remain competitive internationally, the technical level of the industry must be increased. Some firms develop incremental technical processes internally, but most seem to rely upon suppliers' fully commercialized products.

Several other areas offer interesting opportunities for aluminum and could see growth over the decade:

- Of the approximately 590 000 highway bridges in the United States, 32% have been categorized as structurally deficient or obsolete. Increased traffic, de-icing salts and improper maintenance compound these problems. Aluminum's many benefits, particularly its strength, non-corrosive properties and low maintenance costs, make it a metal for future consideration in bridge applications.

- Aircraft, boats from small to large ferries, trucks, buses and railroad cars, both passenger and freight, offer other applications for extrusions, castings and plate as weight reduction for reduced fuel consumption acts as a driving force for the aluminum industry.

5.2 Research and Development (R&D)

Many countries have extensive vehicle weight reduction programs. For example, the United Kingdom has a 10 million pounds program to create components and systems for "vehicles of the future." Germany has a Green Car program to develop the 3 litre per 100 km car.

One of the most extensive automobile weight reduction programs is the United States Partnership for a New Generation Vehicle (PNGV), or "Clean Car." This program sets itself dramatic fuel economy goals. In order to attain fuel economy targets, manufacturers will have to slash 40% of the mass of both the body and the chassis from today's standard sedan. As a result, PNGV will receive U.S. federal support of some $250 million per year, as well as in-kind support through the extensive system of U.S. laboratories and federal scientists.

Furthermore, the "auto aluminum alliance" is expected to accelerate aluminum's use in light vehicles. In June 1999, the Aluminum Association in the United States, the Big Three automotive manufacturers, General Motors, Ford and Daimler Chrysler, and a research consortium of the U.S. Council for Automotive Research (USCAR) unveiled their plans to jointly participate in pre-competitive research to further accelerate the use of aluminum in motor vehicles.

Canada cannot delay the development of a sizeable, well-coordinated program in lightweight materials research without falling behind significantly in value-added manufacturing capacity compared with competitive nations.

To this end, the federal government, under the leadership of the Canada Centre for Mineral and Energy Technology (CANMET), has established The Canadian Lightweight Materials Research Initiative (CLiMRI). CLiMRI, a government/industry partnership, is aimed at developing materials and manufacturing processes for fuel-efficient transportation vehicles.

Other research efforts are going forward in the country as several Canadian institutions are active in R&D initiatives for the commercial aircraft sector. The National Research Council has close to $1 million aimed at this area. Furthermore, many Canadian universities have developed industrial Chair programs for research into the casting sector. Close to $3 million, part in cash and part in kind, are earmarked at the University of Windsor, École Polytechnique and Université du Québec à Chicoutimi (UQAC). This work is aimed mainly at next-generation engine component durability.

The National Research Council and its Industrial Materials Institute, along with university researchers, are conducting work related to thixomoulding, semi-solid casting, powder metallurgy, etc.

Industry Canada, jointly with the National Research Council and Economic Development Canada, is undertaking a Technology Roadmap for the Transformation of Aluminum. The study will cover the following four sectors: primary, secondary and tertiary transformation as well as suppliers of equipment and services to these three sectors. However, the principal focus will remain on the secondary and tertiary transformation sectors, as well as on the equipment providers for the primary industry. The roadmap should be available in the fall of 2000.

5.3 Standards and Regulations

It is clear from the above, regarding fuel consumption reduction for vehicles in most of the industrialized countries, that regulations regarding emissions are the major driving force favouring the use of light metals.

The aluminum industry in general is subject to a multitude of environmental regulations. Each phase of transformation brings on its own particular set of regulations and standards related to health and safety.

Within the Aluminum Association of Canada, an environmental task force has been active for several years bringing together various specialists responsible for environmental management. Proceedings deal mostly, but not solely, with the reduction of air emissions and effluents, and the management and recycling of waste, as well as the improvement of existing processes.

In Canada, environmental regulations are a provincial jurisdiction, except for the transport of dangerous goods, which is a federal responsibility. In Quebec, many environmental regulations are applicable to the aluminum transformation industry, but without being specific. Regulations are applicable to the quality of the atmosphere, dangerous waste generation and solid wastes.

Regulations in the United States will affect specific industries. For example, the Occupational Safety and Health Administration (OSHA) in the United States has proposed an ambitious regulatory agenda that will have a significant impact on the casting industry. OSHA is in the process of developing a new system to target high-hazard sites. This is a supplement to the Interim Targeting Program, which identified die casting as one of the top 100 hazardous industries.

Canada has adopted the approach of harmonizing safety and emission standards with the United States to the greatest extent possible. In 1995, the Canadian Council of Ministers of the Environment (CCME) recommended the adoption of a national approach for setting vehicle emission and related fuel standards.

Canada has several R&D incentives and tax incentives for the execution of projects leading to industrial development in the country. Information on these programs can be obtained from Industry Canada's *Strategis* Web site (**http://strategis.ic.gc.ca**).

5.4 Human Resources Issues

There is a lack of technical and engineering professionals entering the casting industry. The trend toward sophisticated equipment and computerized control systems results in a significant competitive advantage for North America, but the technical people and engineers needed to run the process are in short supply.

For the last 25 years and more, the North American education system has favoured university graduation above technical schools and the apprenticeship training process followed in Europe. The factory floor in manufacturing in general has lost its appeal to young people. As a consequence, today the pipeline of well-trained technical people, such as tool and die makers, Numerical Control (NC) and Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) machine operators, casting plant technicians and the many specialists needed for the transformation of aluminum and other metals, is in very short supply. Many companies have their own training programs. In Quebec, the government requires that the equivalent of 1% of total salaries be devoted to the training of employees.

The North American education system, along with industry, must promote technical work as valuable, challenging and rewarding to young people if industry is to continue to produce quality products and meet demand in all sectors.

Annex A

Selected Industry Statistics

Table A1 : Main statistics

SIC 2961: Aluminum Rolling, Casting and Extruding Industry

	1990	1991	1992	1993	1994	1995	1996	1997	1998	Rate of change (%) 1997-98	Compound average annual growth rate (%) 1990-98	Cumulative growth rate (%) 1990-98
Establishments	68	64	67	65	66	69	75	78	n/a	4.0	2.0	14.7
Canadian shipments ($ million)	1 826.3	1 473.4	1 597.9	1 777.2	2 180.6	2 475.5	2 377.5	2 724.9	2 944.6	8.1	6.2	61.2
Canadian shipments ($ million, 1992 = 100)	1 640.8	1 453.6	1 597.9	1 751.6	1 757.6	1 676.1	1 814.9	1 984.5	2 199.6	10.8	3.7	34.1
Shipments as a share of the primary metal industry shipments (%)	9.5	8.3	8.9	8.9	9.3	9.6	9.2	9.8	10.7	_	_	_
Shipments as a share of all manufacturing shipments (%)	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	_	_	_
Manufacturing value added ($ million)	484.0	393.9	412.5	423.4	411.8	491.3	571.7	574.7	n/a	0.5	2.5	18.7
Total value added ($ million)	482.6	392.0	408.8	418.6	407.3	490.1	571.9	547.9	n/a	-4.2	1.8	13.5
Gross domestic product ($ million, 1992 = 100)	306.0	277.0	308.0	319.0	300.0	280.0	288.0	316.0	352.0	11.4	1.8	15.0
Capital expenditures ($ million)	n/a	69.4	47.7	90.6	104.0	90.6	95.1	103.9	112.4	8.2	6.2	62.0
Canadian apparent domestic market ($ million)	2 310.3	1 802.8	1 920.8	2 057.3	2 512.8	2 998.4	2 606.9	2 950.9	3 215.6	9.0	4.2	39.2
IPPI (1992 = 100) - aluminum semi-fabricating industry	111.3	101.4	100.0	101.5	124.1	147.7	131.0	137.3	133.9	-2.5	2.3	20.3
IPPI (1992 = 100) - primary metal industry	112.3	102.7	100.0	99.2	117.0	133.9	124.3	126.9	120.5	-5.1	0.9	7.3
IPPI (1992 = 100) - all manufacturing	100.6	99.5	100.0	103.6	109.9	118.1	118.6	119.5	119.4	-0.1	2.2	18.7

Source: Statistics Canada

Notes: 1) IPPI = Industrial Product Price Index.

2) Where there are no 1998 data, the value of the rate of change refers to the 1996-97 and 1990-97 time periods.

Table A2: Employment

SIC 2961: Aluminum Rolling, Casting and Extruding Industry

	1990	1991	1992	1993	1994	1995	1996	1997	Rate of change (%) 1996-97	Compound average annual growth rate (%) 1990-97	Cumulative growth rate (%) 1990-97
Total workers	5 463.0	5 169.0	4 998.0	5 128.0	5 763.0	5 713.0	6 160.0	6 240.0	1.3	1.9	14.2
Production workers	4 205.0	4 007.0	3 946.0	4 193.0	4 715.0	4 611.0	4 905.0	4 966.0	1.2	2.4	18.1
Administration and other workers	1 258.0	1 162.0	1 052.0	935.0	1 048.0	216.0	2 404.0	4 069.0	69.3	18.3	223.4
Production workers as a share of total workers (%)	77.0	77.5	79.0	81.8	81.8	80.7	79.6	79.6	_	_	_
Administrative and other workers as a share of total workers (%)	23.0	22.5	21.0	18.2	18.2	3.8	39.0	65.2	_	_	_
Average annual salaries and wages per worker ($ 000)	38.3	40.7	41.3	41.6	43.0	44.0	48.1	48.6	1.0	3.5	26.9
Average annual salaries and wages per production worker ($ 000)	35.9	37.1	38.2	38.5	40.6	40.8	45.1	45.1	-0.1	3.3	25.4
Average annual salaries and wages per administration and other worker ($ 000)	46.2	53.0	52.6	55.5	53.6	57.5	60.0	62.4	4.1	4.4	35.1

Source: Statistics Canada

Table A3: Performance Indicators

SIC 2961: Aluminum Rolling, Casting and Extruding Industry

	1990	1991	1992	1993	1994	1995	1996	1997	Rate of change (%) 1996-97	Compound average annual growth rate (%) 1990-97	Cumulative growth rate (%) 1990-97
Manufacturing shipments per production worker ($ 000)	434.3	367.7	404.9	423.8	462.5	536.9	484.7	548.7	13.2	3.4	26.3
Manufacturing value added per production worker ($ 000)	115.1	98.3	104.5	101.0	87.3	106.6	116.6	115.7	-0.7	0.1	0.6
Unit labour cost	0.8	0.9	0.8	0.9	1.0	1.1	1.3	n/a	13.2	7.6	55.4
Manufacturing shipments by establishment ($ million)	26.9	23.0	23.8	27.3	33.0	35.0	31.3	32.9	5.3	3.0	22.6
Wages and salaries/total operating costs (%)	13.2	16.0	14.4	13.4	11.9	10.5	12.6	11.0	_	_	_
Materials and supplies/total operating costs (%)	84.8	81.5	83.1	84.2	86.2	87.9	85.5	87.3	_	_	_
Fuel and electricity/total operating costs (%)	2.0	2.4	2.5	2.4	2.0	1.7	1.8	1.7	_	_	_

Source: Statistics Canada

Table A4: Trade statistics and performance indicators

SIC 2961: Aluminum Rolling, Casting and Extruding Industry

	1990	1991	1992	1993	1994	1995	1996	1997	1998	Rate of change (%) 1997-98	Compound average annual growth rate (%) 1990-98	Cumulative growth rate (%) 1990-98
Statistics					**($ millions)**							
Total exports	533.7	539.2	599.2	730.3	1 003.3	1 350.2	1 289.6	1 546.0	1 695.1	9.6	15.5	217.6
Total imports	1 017.7	868.6	922.0	1 010.5	1 335.5	1 709.0	1 519.0	1 772.0	1 966.1	11.0	8.6	93.2
Trade balance with all countries	-484.0	-329.4	-322.8	-280.2	-332.2	-358.8	-229.4	-226.0	-271.0	19.9	-7.0	-44.0
Exports to U.S.	491.5	495.0	561.0	696.1	984.5	1 299.2	1 244.7	1 504.0	1 659.0	10.3	16.4	237.5
Imports from U.S.	885.1	780.7	838.6	926.1	1 220.1	1 559.1	1 381.4	1 619.0	1 784.0	10.2	9.2	101.6
Trade balance with U.S.	-393.6	-285.7	-277.6	-229.9	-235.6	-259.9	-136.7	-115.0	-125.0	8.7	-13.4	-68.2
Exports to the rest of the world	42.1	44.2	38.2	34.2	18.9	50.9	44.9	42.0	36.1	-14.1	-1.9	-14.3
Imports from the rest of the world	132.6	87.9	83.5	84.5	115.4	149.9	137.6	153.0	182.1	19.0	4.0	37.4
Trade balance with the rest of the world	-90.4	-43.7	-45.2	-50.3	-96.5	-99.0	-92.6	-111.0	-146.0	31.5	6.2	61.4
Canadian apparent market	2 310.3	1 802.8	1 920.8	2 057.3	2 512.8	2 834.3	2 606.9	2 950.9	3 215.6	9.0	4.2	39.2
Performance					**(%)**							
Exports to all countries as a share of domestic shipments	29.2	36.6	37.5	41.1	46.0	54.5	54.2	56.7	57.6	_	_	_
Exports to U.S. as a share of domestic shipments	26.9	33.6	35.1	39.2	45.1	52.5	52.4	55.2	56.3	_	_	_
Exports to the rest of the world as a share of domestic shipments	2.3	3.0	2.4	1.9	0.9	2.1	1.9	1.5	1.2	_	_	_
Imports from all countries as a share of domestic market	44.0	48.2	48.0	49.1	53.1	60.3	58.3	60.0	61.1	_	_	_
Imports from U.S. as a share of domestic market	38.3	43.3	43.7	45.0	48.6	55.0	53.0	54.9	55.5	_	_	_
Imports from the rest of the world as a share of domestic market	5.7	4.9	4.3	4.1	4.6	5.3	5.3	5.2	5.7	_	_	_
Exports to U.S. as a share of total exports	92.1	91.8	93.6	95.3	98.1	96.2	96.5	97.3	97.9	_	_	_
Exports to the rest of the world as a share of total exports	7.9	8.2	6.4	4.7	1.9	3.8	3.5	2.7	2.1	_	_	_
Imports from U.S. as a share of total imports	87.0	89.9	90.9	91.6	91.4	91.2	90.9	91.4	90.7	_	_	_
Imports from the rest of the world as a share of total imports	13.0	10.1	9.1	8.4	8.6	8.8	9.1	8.6	9.3	_	_	_

Source: Statistics Canada

Table A5: Trade statistics (breakdown by products)

SIC 2961: Aluminum Rolling, Casting and Extruding Industry

	1990	1991	1992	1993	1994	1995	1996	1997	1998
					(%)				
Exports									
Bars and rods	1.4	1.4	3.3	8.3	21.1	19.1	13.0	17.4	19.3
Wire	9.6	10.6	7.4	10.5	8.8	11.2	15.6	15.3	13.8
Sheet, plate and strips	82.9	81.2	83.7	74.0	62.9	61.7	54.4	50.2	50.0
Foil	4.3	5.6	4.3	6.1	6.4	6.6	7.7	7.4	6.0
Miscellaneous	1.8	1.2	1.3	1.2	0.9	1.4	9.2	9.8	10.8
Total exports	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Imports									
Bars and rods	7.8	8.5	6.9	6.8	6.6	7.6	10.0	10.2	10.9
Wire	1.4	1.5	1.2	1.2	1.7	1.9	1.2	1.5	1.5
Sheet, plate and strips	80.0	79.5	82.0	81.7	82.5	81.6	78.5	77.3	77.4
Foil	7.5	7.2	6.7	6.8	6.1	5.9	7.4	8.1	7.2
Miscellaneous	3.3	3.4	3.2	3.5	3.1	3.0	2.9	3.0	3.1
Total imports	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada

Note: Miscellaneous includes pipes/tubes, powders/flakes and other articles of aluminum.

Annex B

List of Concordances of Harmonized System (HS) Codes for Standard Industrial Classification (SIC) 2961

The Harmonized System of codes is an international system of commodity classification that is employed to keep track of exports and imports passing through customs. The Standard Industrial Classification is a coding system used by Statistics Canada to define industries in terms of specific activities. The following is a list of the HS codes attributed to SIC 2961.

HS	Description
760310	Aluminum powders - of non-lamellar structure
760320	Aluminum powders - of lamellar structure; aluminum flakes
760410	Aluminum bars, rods and profiles - not alloyed
760421	Aluminum hollow profiles - alloyed
760429	Aluminum bars, rods and non-hollow profiles - alloyed
760511	Aluminum wire - not alloyed - maximum cross section of more than 7 mm
760519	Aluminum wire - not alloyed - maximum cross section of 7 mm or less
760521	Aluminum wire - alloyed - maximum cross section of more than 7 mm
760529	Aluminum wire - alloyed - maximum cross section of 7 mm or less
760611	Aluminum plates, sheets and strip - not alloyed - rectangular, thickness of 0.2 mm or more
760612	Aluminum plates, sheets and strip - alloyed - rectangular, thickness of 0.2 mm or more
760691	Aluminum plates, sheets and strip - not alloyed - not rectangular, thickness of 0.2 mm or more
760692	Aluminum plates, sheets and strip - alloyed - not rectangular, thickness of 0.2 mm or more
760711	Aluminum foil - not backed - rolled but not further worked - thickness (excluding backing) of 0.2 mm or less
760719	Aluminum foil - not backed - other not elsewhere specified (nes) - thickness (excluding backing) of 0.2 mm or less
760810	Aluminum tubes and pipes - not alloyed
760820	Aluminum tubes and pipes - alloyed *(applies to exports only for this SIC code/falls in imports under SIC code 3099)*
761410	Aluminum stranded wire, cables, plaited bands and the like - steel core - non-insulated
761490	Aluminum stranded wire, cables, plaited bands and the like - without steel core - non-insulated
761699*	Articles of aluminum not elsewhere specified (0.4/2999 0.5) *(applies to exports for this SIC code and SIC 2999/falls in imports under SIC code 3049, 3059 and 3099)*

Annex C

List of Tariffs

Item No.	Description	Canada			United States	EU	Japan [1]
		MFN	GPT	USA	Canada	MFN	WTO
2606.00.00	Aluminum ores and concentrates	Free	Free	Free	Free	Free	Free
2818.20.00	Aluminum oxide, other than artificial corundum	Free	Free	Free	Free	4.3%	Free
7601.10	Unwrought aluminum, not alloyed	Free	Free	Free	Free	6%	0.2%
7601.20	Unwrought aluminum alloys	Free	Free	Free	Free	6%	0.2%
7602.00	Aluminum waste and scrap	Free	Free	Free	Free	Free-0.6%	Free
76.03	Aluminum powders and flakes	3.5-5%	Free	Free	Free	5.1-5.3%	3.6%
76.04	Aluminum bars, rods and profiles	Free-5%	Free	Free	Free	8%	8.3-8.6%
76.05	Aluminum wire	Free-4%	Free	Free	Free	8%	8.3-8.6%
76.06	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm	Free-6.5%	Free-5%	Free	Free	8%	Free-2.2%
76.07	Aluminum foil not exceeding 0.2 mm	Free-6.5%	Free-5%	Free	Free	8-10%	8.6%
76.08	Aluminum tubes and pipes	Free-5%	Free	Free	Free	Free-8%	8.6%
7609.00	Aluminum tube or pipe fittings	5.5%	3%	Free	Free	7%	3.6%
76.10	Aluminum structures (excluding prefabricated buildings of heading no. 94.06) and parts of structures, aluminum plates, rods, profiles, tubes and the like, prepared for use in structures	6.5%	5%	Free	Free	6.2-7%	1-3.4%
7611.00	Aluminum reservoirs, tanks, vats and similar containers, for any material	Free-6.5%	Free-5%	Free	Free	6.2%	3.6%
76.12	Aluminum casks, drums, cans, boxes and similar containers, for any material	6.5%	2.5-5%	Free	Free	6.2%	3.6%
7613.00	Aluminum containers for compressed or liquefied gas	6.5%	5%	Free	Free	6.2%	3.6%
76.14	Stranded wire, cables, plaited bands and the like, of aluminum, not electrically insulated	4.5%	3%	Free	Free	6.2%	4%
76.15	Table, kitchen or other household articles and parts thereof, of aluminum	6.5%	Free-5%	Free	Free	6.2%	1%
76.16	Other articles of aluminum	Free-6.5%	Free-5%	Free	Free	6.2%	3.4%

Sources: Customs Tariff, effective January 1999, Revenue Canada; Harmonized Tariff Schedule of the United States, 1999; Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of the European Union (38th Annual Edition: 1998); Custom Tariff Schedules of Japan, 1998.
[1] WTO rate is shown; lower tariff rates may apply circumstantially.
Abbreviations: MFN, most favoured nation; GPT, general preferential tariff; WTO, World Trade Organization; EU, European Union.

Annex D

List of Industry Associations

- Aluminum Association of Canada (AAC)
  Mr. Christian L. Van Houtte
  President
  Aluminum Association of Canada
  1010 Sherbrooke Street West, Suite 1509
  Montréal, Québec
  H3A 2R7
  Tel.: (514) 288-4842
  Fax: (514) 288-0944
  http://www.aia.aluminum.qc.ca/english/index.html

- Aluminum Extruders Council
  1000 North Rand Road, Suite 214
  Wauconda, Illinois
  USA
  60084
  Tel.: (847) 526-2010
  Fax: (847) 526-3993
  E-mail: **mail@aec.org**
  http://aec.org/index.html

- Aluminum Foil Container Manufacturers Association
  Post Office Box 531335
  Mountain Brook, Alabama
  35253-1335
  Tel.: (205) 802-7600
  Fax: (205) 802-7610
  http://www.afcma.org/

- Canadian Die Casters Association
  Ms. Anne Moran
  Executive Director
  Canadian Die Casters Association
  One Nicholas Street, Suite 1500
  Ottawa, Ontario
  K1N 7B7
  Tel.: (613) 789-4885
  Fax: (613) 789-5957
  E-mail: **cdcassn@istar.ca**
  http://home.istar.ca/~cdcassn/

- Canadian Foundry Association
  Ms. Judith Arbour
  Canadian Foundry Association
  One Nicholas Street, Suite 1500
  Ottawa, Ontario
  K1N 7B7
  Tel.: (613) 789-4894
  Fax: (613) 789-5957
  http://home.istar.ca/~metassn/

- European Aluminum Association and Recycler's World
  Mr. L. Ernst
  European Aluminum Association
  Konigsallee 30, Postfach 1207
  Duesseldorf 1
  Germany D-4000
  Tel.: 211 80871
  Fax: 211 132567
  http://www.recycle.net/recycle/assn/metal_08.html

- International Primary Aluminum Institute
  New Zealand House
  Haymarket
  London SW1Y 4TE
  United Kingdom
  Tel.: 00 44 (0)171 930 0528
  Fax: 00 44 (0)171 321 0183
  http://www.world-aluminium.org/

- North American Die Casting Association (NADCA)
  9701 West Higgins Road, Suite 880
  Rosemont, Illinois
  60018-4721
  Tel.: (847) 292-3600
  Fax: (847) 292-3620
  http://www.diecasting.org/

- The Aluminum Association Inc. (U.S.)
  900 19th Street Northwest
  Washington, D.C.
  USA
  20006
  Tel.: (202) 862-5100
  Fax: (202) 862-5164
  http://www.aluminum.org/

Annex E

List of Relevant Web Sites

- Automotive Aluminum
  http://www.autoaluminum.org/

- Canadian Lightweight Materials Research Initiative
  http://www.nrcan.gc.ca/mms/canmet-mtb/mtl/ENG/test/climri/default_e.htm

- Casting Source Directory
  http://www.castingsource.com/

- Centre Québecois de Recherche et de Développement de l'aluminium
  http://www.cqrda.d4m.com/

- Export Development Corporation
  http://www.edc.ca/

- Exportsource
  http://exportsource.gc.ca/

- The U.S. Aluminum Industry Technology Roadmap
  http://www.oit.doe.gov/aluminum/aluminum_roadmap.shtml

- Trade Commissioners Abroad
  http://www.dfait-maeci.gc.ca/english/missions/rep-can1e.htm

Annex F

List of Companies

Industry Canada's Web site *Strategis* includes an on-line directory of Canadian companies in all industrial and service sectors. Known as the "Canadian Company Capabilities" (CCC), this directory enables Canadian companies the opportunity to connect with customers and suppliers around the world, 24 hours a day, 7 days a week.

Companies can register electronically by going to *Strategis* at **http://strategis.ic.gc.ca/cdncc** and selecting the Register button. Companies that are not on the Internet can call the *Strategis* Help Desk toll-free at 1-800-328-6189 to receive a registration form.

The following is a list of companies involved in aluminum rolling, casting and extruding.

Rolling Companies

Alcan Aluminum Limited
1 Lappan's Lane
Kingston, Ontario
K7L 4Z5 Canada
Tel.: (613) 541-2400
Fax: (613) 541-7030

Reynolds Aluminum Company of Canada Limited
290 St. Laurent St.
Cap-de-la-Madeleine, Québec
G8T 7W9 Canada
Tel.: (819) 373-6363
Fax: (819) 373-6425

Extruding Companies

Alcan Cable
Jonquière
2040, rue de Neuville
Jonquière, Québec
G7S 4L3 Canada
Tel.: (418) 699-5222
Fax: (418) 699-5293

Almag Aluminum Inc.
22 Finley Road
Brampton, Ontario
L6T 1A9 Canada
Tel.: (905) 457-9000
Fax: (905) 457-9006

Altex Extrusion Inc.
2000, boulevard Fortin
Laval, Québec
H7S 1P3 Canada
Tel.: (514) 629-4260
Fax: (514) 629-4227

Alumiform Inc
7202, boulevard Talbot
Chicoutimi, Québec
G7H 5B7 Canada
Tel.: (418) 693-0227
Fax: (418) 693-0393

APEL Extrusions Ltd
7929 30th Street Southeast
Calgary, Alberta
T2C 1H7 Canada
Tel.: (403) 279-3321
Fax: (403) 236-2944

Bon L Canada Inc.
1850 Clements Road
Pickering, Ontario
L1W 3R8 Canada
Tel.: (905) 427-6550
Fax: (905) 427-2239

Can Art Extrusion, Inc.
85 Parkshore Drive
Brampton, Ontario
L6T 5M1 Canada
Tel.: (905) 791-1464
Fax: (905) 791-9151

Caradon Indalex
A Division of Caradon Ltd
5675 Kennedy Road
Mississauga, Ontario
L4Z 2H9 Canada
Tel.: (905) 890-8821
Fax: (905) 890-8385

Daymond Aluminum
A Division of Daymonex Ltd
P.O. Box 2006
Chatham, Ontario
N7M 5M5 Canada
Tel.: (519) 352-6600
Fax: (519) 352-9373

Decor Products International
140 Bay Street
Midland, Ontario
L4R 4L5 Canada
Tel.: (705) 526-9371
Fax: (705) 526-3068

Kaiser Aluminum & Chemical of Canada Ltd
3021 Gore Road
London, Ontario
N5V 5A9 Canada
Tel.: (519) 457-3610
Fax: (519) 457-3615

Kawneer Company Canada Ltd
Subsidiary of Alcoa Inc.
1051 Ellesmere Road
Scarborough, Ontario
M1P 2X1 Canada
Tel.: (416) 755-7751
Fax: (416) 755-1829

Spectra Aluminum Products
127 Aviva Park Drive
Woodbridge, Ontario
L4L 9C1 Canada
Tel.: (905) 856-5992
Fax: (905) 856-5328

Casting Companies

Alcast Technologies
328 Lake Avenue North
Hamilton, Ontario
L8E 3A2
Tel.: (905) 561-0033
Fax: (905) 561-6434

American Brass and Aluminum Foundry Ltd.
12520-123 Street
Edmonton, Alberta
T5L 0H8
Tel.: (403) 455-6661
Fax: (403) 451-3588

Cercast - A Division of Howmet Cercast
(Canada) Inc.
3905 Industrial Boulevard
Montréal, Québec
H1H 2Z2
Tel.: (514) 322-2371
Fax: (514) 322-1340

Custom Aluminum Foundry Limited
740 Beaverdale Road
P.O. Box 21119
Cambridge, Ontario
N3C 4B1
Tel.: (519) 658-5173
Fax: (519) 658-2380

Fondremy Inc.
1465, boulevard Industriel, Suite 100
Chambly, Québec
J3L 4C4
Tel.: (450) 539-0233
Fax: (450) 539-5033

Grenville Castings Limited
10 Grenville Way
P.O. Box 100
Merrickville, Ontario
K0G 1N0
Tel.: (613) 269-4701
Fax: (613) 269-3527

Pacific MAKO
5481-268 Street
Langley, British Columbia
V3W 3W1
Tel.: (604) 856-6668
Fax: (604) 856-6512

Powercast Manufacturing Inc.
540, boulevard Industriel
St. Eustache, Québec
J7R 5V3
Tel.: (450) 473-1517
Fax: (450) 473-5591

Tritech Precision Inc.
2 Bloor Street West, Suite 3400
P.O. Box 79
Toronto, Ontario
M4W 3E2
Tel.: (416) 975-8251
Fax: (416) 975-8253

Additional companies involved in the casting of aluminum products may be found on the Web sites of the Canadian Foundry Association at **http://home.istar.ca/~metassn/** and the Canadian Die Casters Association at **http://home.istar.ca/~cdcassn/**

Annex G

The North American Industry Classification System (NAICS)

The North American Industry Classification System (NAICS) is an industry classification system developed by the statistical agencies of Canada, Mexico and the United States. Created against the background of the North American Free Trade Agreement, it is designed to provide common definitions of the industrial structure of the three countries and a common statistical framework to facilitate the analysis of the three economies. NAICS is based on supply-side or production-oriented principles to ensure that industrial data, classified to NAICS, is suitable for the analysis of production-related issues such as industrial performance.

NAICS is a comprehensive system encompassing all economic activities. It has a hierarchical structure. At the highest level, it divides the economy into 20 sectors. At lower levels, it further distinguishes the different economic activities in which businesses are engaged.

NAICS is designed for the compilation of production statistics and, therefore, for the classification of data relating to establishments (and locations). It takes into account the specialization of activities generally found at the level of the producing units of businesses. The criteria used to group establishments into industries in NAICS are similarity of input structures, labour skills or production processes used.

Definitions

NAICS is principally a classification system for establishments and for the compilation of production statistics. At the lowest level of the operating structure of businesses are producing units, such as the mill, plant, factory, farm, mine, warehouse, store, airline terminal and movie theatre. The establishment, as a statistical unit, is defined as the most homogeneous unit of production for which the business maintains accounting records from which it is possible to assemble all the data elements required to compile the full structure of the gross value of production (total sales or shipments, and inventories), the cost of materials and services, and labour and capital used in production. Provided that the necessary accounts are available, the statistical structure replicates the operating structure of the business. In delineating the establishment, however, producing units may be grouped.

Based on the new classification by NAICS industries, SIC 2961, under which the aluminum rolling, casting and extruding industry falls, will be replaced by the following NAICS:

331317 aluminum rolling, drawing, extruding and alloying rolling, drawing, extruding and alloying purchased aluminum

331529 non-ferrous foundries (except die-casting) aluminum, casting (except die-casting)

332113 forging aluminum, forging

332810 coating, engraving, heat treating and allied activities aluminum castings, grinding for the trade

Glossary

Many of the following definitions of terms are adapted from Statistics Canada's Census of Manufactures.

Capital Expenditure
Capital expenditure refers to expenditure on the two components of capital:
-construction
-machinery and equipment

Company
A company is a legal entity. For census purposes, four types of organization are distinguished: individual ownerships, partnerships, incorporated companies and co-operatives.

Although the company is recognized in census tabulations when distributing establishments according to their type of legal organization, basis census tabulations classify each establishment of a company to its own industry, not to the industry most characteristic of the company as a whole. For example, if a company operates establishments manufacturing small electrical appliances and other establishments manufacturing synthetic plastic resins, the output of the two kinds of establishments is included in their respective industries.

Constant (Real) Value
(Current dollar value/Industrial Price Index) x 100

Cost of Fuel and Electricity
Consumption of purchased fuel and electricity only at laid-down cost, including transportation and handling charges, excise duties, etc.

Cost of Materials and Supplies
Consumption of purchased items only at laid-down cost, including transportation and handling charges, excise duties, etc. Includes transfers between units of the same company, but does not include the cost of services except for contract manufacturing services.

Domestic Exports
Includes goods grown, extracted or manufactured in Canada, including goods of foreign origin that have been materially transformed in Canada.

Enterprise
An enterprise is a company or family of companies controlled or managed by the same interests as a result of common ownership. In Statistics Canada's Census of Manufactures, enterprises are simply tabulating units; the census gathers no information from enterprises or about enterprises as such.

Establishment
An establishment is the smallest separate operating entity that produces as homogeneous a set of goods and services as possible and for which records exist that permit the calculation of census value added and are capable of reporting the following statistics:
-materials and supplies used
-goods purchased for resale
-fuel and power consumed
-number of employees and their wages and salaries
-person-hours worked and paid
-inventories
-shipments or sales

In practice, a manufacturing establishment is usually equivalent to a factory, plant or mill.

Gross Domestic Product (GDP)
The market value of an economy's domestically produced goods and services over a specified period of time.

Harmonized System (HS)
The Harmonized System of codes is an international system of commodity classification that is employed to keep track of imports and exports passing through customs.

Imports
Includes all goods that have crossed Canada's territorial boundary, whether for immediate consumption in Canada or stored in bonded custom's warehouses.

Industrial Product Price Index (IPPI)
Measures price change for domestically produced products, whether sold in Canada or abroad. Represents selling prices at the boundary of the establishment, wherein the cost of taxes collected at that point and transportation provided by public carriers beyond that point are excluded.

Industry
An industry is a group of operating units, such as companies or establishments, that are engaged in the same or a similar kind of economic activity.

Production Workers
Employees engaged in any of the following activities: processing and assembling, storing, handling, packing, warehousing, inspecting, maintenance, repair, janitorial or watchman services, and working foremen doing work similar to that of employees they supervise. Outside pieceworkers' remuneration is included in the cost of materials. The number of employees is reported as an average.

Raw Materials, Supplies, Components and Fuel
Includes all items bought for processing and assembling that have not been charged out to processing.

Salaries and Wages
Salaries and wages refer to gross earnings of employees before deductions for income tax and the employee portion of employee benefits. They include payment for regular work, overtime and paid leave as well as bonuses and commissions paid to regular employees.

Standard Industrial Classification (SIC)
The Standard Industrial Classification is a coding system that defines industries in terms of specific groupings of activities. Every industry is assigned a two-, three- or four-digit code. Two-digit codes represent the broadest industry definition and the broadest range of activities; four-digit codes represent the most detailed industry definition and the most detailed range of activities. For example, SIC 29 represents the Primary Metal Industry (which includes both primary and semi-fabricated metals); SIC 2961 represents the Aluminum Rolling, Casting and Extruding Industry. If at least 50% of an establishment's value added derives from activities associated with a particular SIC code, the establishment is classified in that industry.

Unit Labour Cost
Ratio of labour compensation to real GDP.

Value Added
Value added refers to the value a producing unit adds to the goods and services it purchased from suppliers. Value added is thus a measure of net output, i.e., the value of gross output minus the value of purchased inputs used to create the product. Value added avoids double counting because products purchased from other establishments are deducted as input costs.