THE EUROPEAN UNION ALUMINIUM INDUSTRY

THE IMPACT OF THE EU TRADE MEASURES ON THE COMPETITIVENESS OF DOWNSTREAM ACTIVITIES

June 2019

GRUPPO DI RICERCHE INDUSTRIALI E FINANZIARIE - GRIF "FABIO GOBBO"

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Disclaimer

This project has been funded with support from FACE - The Federation of Aluminium Consumers in Europe. We were asked by FACE to carry out an independent study with the aim of establishing a constructive and transparent exchange of views on the competitiveness of the aluminium value chain in the European Union with a specific focus on trade policies on unwrought aluminium and their impact on manufacturers of aluminium semi-finished products. To have consistent information and to ensure the robustness and the comparability of the quantitative analysis for well-informed design of policies, the study only relies on data provided by institutional sources and independent third parties, having market recognition for reliability. While also benefitting from the industry knowledge of FACE stakeholders, any views expressed herein, including interpretation(s) of policies, reflect the current views of the author(s), which do not necessarily correspond to the views of FACE. Reproduction, publication and reprint are subject to prior written authorisation of the authors.

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Glossary

TERM	DEFINITION
Aluminium products	
Aluminium	Unalloyed aluminium or aluminium alloy. In the USA the term “aluminium” is used.
Aluminium, alloyed	Aluminium which contains alloying elements, where aluminium predominates by mass over each of the other elements and where the aluminium content is not greater than 99.00%. HS tariff nomenclature classifies aluminium alloys under heading: HS 7601 20. Aluminium alloys includes two main categories of products corresponding to different subheadings under the Combined Nomenclature (CN) of the EU’s Common Customs Tariff: - aluminium alloys in the form of slabs and billets (CN Code 7601 20 20), including all kind of billets and slabs with the aluminium content less than 99.00% (primary and secondary), used for extrusions and rolling; - slabs and billets containing Lithium (CN Code 7601 20 20 10); - slabs and billets, other (CN Code 7601 20 20 90); - aluminium alloys excluding slabs and billets (CN Code 7601 20 20), also called foundry alloys, including all cast alloys (primary and secondary) with the aluminium content less than 99.00%.
Aluminium, not alloyed	Aluminium products in all kind of shapes without alloying elements where the minimum aluminium content is specified to be greater than 99.00%. Unalloyed aluminium is often called “aluminium", i.e. the term "aluminium" then does not include aluminium alloys. Aluminium, not alloyed, typically includes four different types of products: remelt ingots / commodity (LME tradable), high Purity Aluminium, used for remelting; slabs 1xxx (Not-alloyed slabs) used for rolling; billets 1xxx series (Not-alloyed billets) used for extrusions; 1xxx – first grade of alloys. Harmonized Commodity Description and Coding System (HS) tariff nomenclature classifies aluminium, not alloyed, products under heading: HS 7601 10.
Aluminium powder	Aggregate of discrete metal particles in specified size ranges, typically below 0.15 mm in diameter.
Bar	Solid wrought product that is long in relation to its cross-section which is square or rectangular (excluding plate and flattened wire) with sharp or rounded corners or edges, or is a regular hexagon or octagon, typically sup-plied in straight length
Casting	Product at or near finished shape, formed by solidification of the metal in a mould or a die. Aluminium castings typically encompass aluminium wheels, parts and

<table>
<tr><th>TERM</th><th>DEFINITION</th></tr>
<tr><td></td><td>accessories, which are classified under heading 8708 including parts and accessories of the motor vehicles (CN Code 87087050).</td></tr>
<tr><td>Extrusions</td><td>Aluminium profiles, bars, rods, tubes, and pipes mechanically shaped from a preheated aluminium billet by pushing it under pressure in a hydraulic extrusion press through the opening of a steel die. Aluminium extrusions are classified by the Combined Nomenclature (CN) of the EU's Common Customs Tariff under the Headings CN 7604 (Aluminium bars, rods and profiles).</td></tr>
<tr><td>Flat-rolling products</td><td>Plates, sheets, strip, or foil produced by reducing a preheated aluminium slab via successive passes between paired, flat-surfaced steel rolls to attain the desired final thickness. Flat-rolling products are classified by the Combined Nomenclature (CN) of the EU's Common Customs Tariff under the following headings:
- CN code 7606 (aluminium plates, sheets and strip, of a thickness exceeding 0.2 mm);
- CN code 7607 (Aluminium foil (whether or not printed or backed with paper, paperboard, plastics or similar backing materials) of a thickness (excluding any backing) not exceeding 0.2 mm).</td></tr>
<tr><td>Foil</td><td>Flat-rolled product of rectangular cross-section with uniform thickness equal to or less than 0.20 mm (200 microns)</td></tr>
<tr><td>Plate</td><td>Flat-rolled product that is rectangular in cross section and with thickness not less than 6 mm (in USA not less than 0.250 inch) with sheared or sawn edges</td></tr>
<tr><td>Primary aluminium</td><td>Aluminium (either pure or subsequently alloyed) produced from alumina, typically by electrolysis, and with an aluminium content of 99.7%, typically at a primary smelter. Primary aluminium production commonly includes not-alloyed aluminium, aluminium alloys in the form of slabs and billets, foundry alloys, and wire rods, that is aluminium wire of which the maximum cross-sectional dimension exceeds 7 mm of not-alloyed aluminium (CN Code 7605 1100 00) and aluminium alloys (CN Code 7605 2100 00)</td></tr>
<tr><td>Profile</td><td>Wrought product that is long in relation to its cross-sectional dimensions which is of a form other than that of sheet, plate, rod, bar, tube, wire or foil.</td></tr>
<tr><td>Recycled aluminium ingot</td><td>Aluminium ingot obtained by recycling of scrap.</td></tr>
<tr><td>Rod</td><td>Solid wrought product of circular cross section that is long in relation to its diameter, typically supplied in straight length.</td></tr>
<tr><td>Secondary aluminium</td><td>Aluminium (usually alloyed) produced from aluminium-bearing scrap or aluminium-bearing materials, other than aluminium-bearing concentrates (ores) derived from a mining operation. Aluminium scraps, melted down along with some primary aluminium and alloying metals, can be either old or new (see below).</td></tr>
</table>

TERM	DEFINITION
Secondary refiner	A refiner that produces aluminium casting alloys by melting blended aluminium scrap, adding alloying metals, and removing contaminants to meet customer specifications.
Secondary remelter	A remelter that produces aluminium wrought alloys from aluminium scrap, in unwrought forms of billets and slabs.
Semi-finished product	Product that has undergone some processing and is supplied for further processing before it is ready for use. Semi-finished products include wrought products and aluminium castings.
Semis	A short-form term for semifabricated or wrought aluminium products.
Sheet	Flat-rolled product that is rectangular in cross section with nominal thickness less than 6 mm (in USA less than 0.250 inches [6.3 mm]) but not less than 0.20 mm (in USA greater than 0.006 inches [0.15 mm]) and with slit, sheared or sawed edges.
Tube	Wrought product of uniform cross-section with only one enclosed void and with a uniform wall thickness, supplied in straight lengths or in coiled form; cross-sections are in the shape of circles, ovals, squares, rectangles, equilateral triangles or regular polygons and can have corners rounded, provided the inner and outer cross-sections are concentric and have the same form and orientation.
Unwrought product	Product obtained by casting without further hot or cold working, other than by simple trimming, scalping, or descaling. e.g. ingots for rolling, ingots for extruding, ingots for forging, ingots for remelting, castings. Unwrought aluminium is thus intended for downstream wrought processing or remelting for casting or atomization.
Wire	Solid wrought product that is long in relation to its cross-section, which is square or rectangular with sharp or rounded corners or edges, or is round, hexagonal, or octagonal. Wire is produced by drawing unwrought wire rod through one or more steel dies to attain the desired final outside dimensions. Wires do not exceed 10 mm in maximum diameter.
Wire Rod	A solid wrought product of circular cross section that is long in relation to its diameter. Wire rods exceed 7 mm in maximum diameter. Wire rod is a raw material used to produce aluminium wire, strand, and cable.
Wrought product	Product that has been subjected to hot working and/or cold working (including rolling, drawing, extruding, forging, and other mechanical working, i.e. forming). Also referred to as "semifabricated," "semis," or "mill products."
Technical and metallurgical processes, scrap and residues	
Casting process	Process in which molten metal is introduced into a mould where it solidifies. Different casting techniques are currently employed in the aluminium industry, such as sand casting, permanent mould casting, DC casting, die casting and investment casting.

TERM	DEFINITION
Rolling	Forming of solid metal in a gap between two rotating cylinders. Cylinders, moved by an axle connected to motors, shape the aluminium; it means that, depending on the type of output, the rolls can have different surface, stiffness and dimension.
Drawing	Pulling metal through a die in order to reduce or change the cross-section or to work harden the metal.
Extrusion (process)	Process in which a billet in a container is forced under pressure through an aperture of a die. Three types of extrusion can be used: a) direct extrusion, that is the use of a horizontal, hydraulic press to force the aluminium billet through the steel die, b) indirect extrusion, where the hydraulic press forces the steel die into the heated billet; conform or continuous extrusion, where a continuous rod is fed round a wheel and then blocked to travel at right angles through a die. Direct extrusion is used in most production processes.
(aluminium) scrap	Raw material, destined for trade and industry, mainly consisting of aluminium resulting from the collection and/or recovery of metal that arises as by-product at various production stages; or products after use to be used for the production of wrought and cast alloys and for other production processes
New scrap	Scrap arising from the various production stages of aluminium products, before the aluminium product is sold to the final user.
Old scrap	Scrap arising from products after use.

Source: authors' elaboration based on Global Advisory Group (2009) and (United States International Trade Commission, 2017)

Key findings

- The competitive advantage of the EU aluminium industry lies in the technological leadership of the downstream segments, i.e. producing semi-finished products for many end-user industries.
- The downstream segments account for about 70% of the annual turnover of EU aluminium industry and for nearly 92% of the total industry employment.
- In the last twenty years, the EU aluminium industry has experienced massive structural changes with a strong decline of aluminium primary production and underinvestment being the leading trend.
- Rising dependency on imports of unwrought aluminium and intensifying competition from third countries are increasingly becoming key factors influencing the competitiveness of EU downstream activities.
- Other than unwrought aluminium, EU has constantly worsened its trade balance in all segments of semi-finished aluminium products over the period 2000-2017.
- EU import tariffs on unwrought aluminium have been ineffective in sustaining primary aluminium production, while they are imposing additional costs to downstream transformers and potentially repealing the effects of trade measures on semi-finished products.
- It can be estimated that up to 17.8 billion euros was the extra cost of the tariff for unwrought aluminium for EU downstream producers over the period 2000-2017. In the same time, import tariffs have resulted in additional revenues for EU primary and secondary (recycling) producers, as well as additional incomes for primary producers with duty-free access to EU internal market.
- From a policy perspective, EU trade measures should be placed in a broader industrial policy framework aimed at preserving and possibly reinforcing the competitiveness of the downstream activities and, in turn, of the EU aluminium industry as a whole.
- To this end, the study suggests to abolish import tariffs on unwrought aluminium, to define *ad-hoc* measures for primary and secondary production and to provide incentives to downstream transformers to expand their innovative and technological capabilities, to improve their sustainability in a circular economy perspective, and to enhance, including with the tools of the so-called fourth industrial revolution, the relationships with relevant end-user industries.

Executive summary

Context and objectives of the study

The aluminium industry is an industry that is essential to the economy of modern countries as it provides a range of highly differentiated products, from those for final consumption to the intermediate inputs that are required for many high-tech industries. Aluminium is currently used as an input material in the manufacturing of investment goods (automotive, shipbuilding, aerospace, building and construction, mechanical and electrical engineering), and consumer goods (like mobile devices, computers, recreational vehicles, household appliances, etc.). Regarded as one of the most sustainable metals, aluminium is increasingly used by companies strongly committed to improving their environmental performance.

The global aluminium industry has undergone fundamental changes in recent years in terms of geographical relocation of production and consumption, degree of concentration and integration, development of new end-use markets, increasing financialisation, and international trade. Globally, China’s role has increased substantially in all segments of the aluminium value chain as well as in the consumption of aluminium products, to the detriment of North America and the EU.

The decline in the EU aluminium industry has been particularly severe in the upstream segments of the value chain, causing an increasing unwrought aluminium deficit and rising costs of raw materials. This trend has, in turn, progressively affected the competitiveness of downstream companies, which represent the bulk of the EU aluminium industry in terms of turnover, value added and employment.

The structural changes in the aluminium industry have sparked renewed interest in trade policies’ role in driving economic development and in influencing the competitiveness of the manufacturing sector as a whole. The aluminium industry was recently at the core of the international debate on protectionist measures mainly because of the decision taken by the US administration to impose additional import tariffs on aluminium products. In the EU, the aluminium industry is one of the sectors that has featured most prominently in the anti-dumping investigations which have taken place since the conclusion of the Uruguay Round.

As a result, the need for a comprehensive revision of trade rules has become increasingly clear, to take into account the greater complexity of international production and to place those measures in a broader industrial policy framework.

Against this background, the purpose of this study is threefold:

- to provide a comprehensive overview of the EU aluminium industry value chain;
- to quantitatively estimate the economic impact of the EU import tariffs on unwrought aluminium in terms of additional costs imposed on other segments further down the value chain;

- to strategically assess the role of import tariffs on unwrought aluminium as an industrial policy instrument for promoting the competitiveness of downstream activities and the EU aluminium industry as a whole.

Some policy recommendations are finally made with the aim of preserving the technological leadership, as well as possibly restoring the industrial competitiveness, of firms producing semi-finished products, while also helping the EU to achieve its sustainability and industrial renaissance targets.

Overview of the EU aluminium industry

The aluminium industry includes a range of activities along the value chain. They can be divided into 3 main segments:

1. upstream, including all the producers of the raw material from the unwrought mineral, namely the extractors (mining and quarrying) and the primary aluminium smelters;
2. downstream, involving a broad group of producers manufacturing high differentiated outputs (so-called "wrought aluminium", "semi-finished," "semis," or "mill products") by rolling, extruding, casting and drawing unwrought aluminium into various forms;
3. aluminium recycling and remelting, comprising producers of aluminium alloys (recyclers/remelters) from metallic waste and scrap generated either as a by-product of manufacturing or from recycled goods.

For the purpose of this study, recycling and remelting activities are included in the upstream segment as they both produce unwrought aluminium for the downstream transformers.

The EU aluminium industry encompasses more than a thousand companies, directly employs about 230.000 employees and is indirectly responsible for around 1 million jobs.

Lacking raw material (i.e. bauxite), the EU aluminium industry is actually characterised by few facilities which produce alumina (the white powder produced by the refining of bauxite) and by a limited number of companies which use alumina to produce primary aluminium in any form (commodity ingots and value-added products, such as slabs, billets, foundry alloys, and wire rods). Hundreds of small- and medium-sized vertically non-integrated firms are involved in the manufacturing of aluminium semi-finished products, such as extrusions, flat-rolled products, castings, foil, wire and slug.

It can be estimated that the aluminium downstream sector now accounts for about 70% of the annual turnover of the EU aluminium industry and for nearly 92% of the total employment in the industry, compared to 5% of the primary segment and 2% of the secondary segment. Secondary aluminium is produced by recycling and remelting aluminium-bearing scrap and/or aluminium-bearing materials.

The global positioning of primary aluminium production has dramatically changed over the last twenty years. China's role has increased substantially to the detriment of North America and the EU.

Since 2008, the EU's production of primary aluminium shrank by 30%. A decreasing number of EU member states have operating aluminium smelters. Some primary aluminium producing countries, such as Italy, the UK, and the Netherlands, have significantly curtailed or definitively ceased their production in the last few years. As a result, the EU lost more than one quarter of its smelting capacity in the period from 2008 to 2017. The process of disinvestment is almost certain to continue, as Alcoa recently announced the closure of its three aluminium smelters in Spain.

Since 2004, the EU has produced more secondary (that is unwrought aluminium produced by recycling and remelting scrap and waste) than primary aluminium. As of 2017, however, secondary aluminium output has not yet matched pre-crisis levels.

As for semi-finished products, global manufacturing of aluminium extrusions, flat-rolled products (FRPs) and aluminium castings more than doubled over the period from 2000 to 2017. China has driven much of this expansion, now representing around 50% of global output of aluminium semis. The EU production of aluminium FRPs and aluminium castings has increased in the period from 2000 to 2017, but at a significantly slower pace than at the global level. In 2017, the EU production of aluminium extrusions was even slightly below 2000 levels, although global production has tripled in the same period. As a result, the EU's share in global manufacturing of semi-finished aluminium products has constantly declined, from 29% in 2000 to 14% in 2017.

Germany, Italy, and France are the largest producers of semi-finished products in the EU, representing about 62% of the EU's total production in 2017. Germany further strengthened its leadership in the manufacturing of aluminium semis over the last few years and now constitutes about one third of the total production in the EU. France, Italy and Spain have roughly maintained their share of total EU production. Other EU member states have progressively seen their relative production shrink, cumulatively representing less than one quarter of EU total output in 2017.

Trade flows of unwrought and wrought aluminium products

Over the period from 2000 to 2017, the EU's trade balance has consistently worsened in all segments of the aluminium value chain.

EU imports of unwrought aluminium increased significantly during the period from 2000 to 2017. In particular, imports in 2017 were 69% higher than in 2000. Although EU exports of unwrought aluminium to third countries showed a significant upward trend over the last ten years, these exports only constitute a negligible quantity of EU trade flows, corresponding on average to roughly 4% of the imports. Between 2000 and 2017, the trade deficit of unwrought aluminium has thus steadily worsened.

In the same period, the EU trade balance in aluminium semi-finished products has also deteriorated.

Structurally being a net exporter of FRPs, the EU has experienced an increasing trade deficit in the last four years. FRPs now account for the vast majority of the EU imports of semis (about 70%). The EU's reliance on imported aluminium extrusions has also grown rapidly in recent years. In 2017, the EU net imports of aluminium extrusions were more than five times higher than in 2000. Finally, the EU is currently a net importer of aluminium castings, including aluminium road wheels as one of the main product categories. Much of the growth of EU imports of aluminium semis is due to the increase of Chinese imports to the EU. In 2017, the amount of aluminium extrusions imported from China was about 36 times higher than in 2000, imports of Chinese FRPs increased by 20 times, while the imports of aluminium casting from China rose 46 times.

A notable exception to the EU trade imbalance is the trade surplus registered in the aluminium waste and scrap sector since 2002. This surplus has even increased over the last few years, notwithstanding the fact that secondary production is actually regarded as the most energy efficient method of producing aluminium—especially for countries with high energy and carbon costs and significant availability of secondary raw material. As waste and scrap are typically used as input for secondary production, the positive EU trade balance should be interpreted as an outflow of raw materials, although these are of low quality and are very expensive to sort and process. Asian countries, such as China and India, are markets to which an increasing quantity of waste and scrap has been exported.

EU trade policies on unwrought aluminium

A complex system of import tariffs currently applies to unwrought and wrought aluminium products.

With regard to unwrought aluminium, after two successive autonomous temporary suspensions, adopted in 2007 and 2013, the conventional customs duty rates are respectively 3% for not alloyed aluminium, 4% for aluminium slabs and billets and 6% for foundry alloys. Unwrought aluminium can be imported into the EU duty-free from countries having signed Preferential Trade Agreements (PTAs) with the EU and from less developed countries (SPGA) covered by the Generalised Scheme of Preferences (GSP).

Over the period 2000-2017, about half of the imports of unwrought, not alloyed, aluminium originated from countries with duty-free access to the EU market. The share of duty-free imports has increased in periods in which imports are sensibly lower in quantity, such as during the economic crisis. Among countries subject to the tariff, Russia accounts for slightly less than 38% of the EU's total imports of unwrought, not alloyed, aluminium, also representing about 63% of the total imports subject to the tariff. Conversely, Mozambique (17%) and Iceland (16%) are the main exporters among duty-free countries.

The share of imports of aluminium alloys which were duty-free averaged 75% during the period 2000-2017. Among countries with duty-free access to the EU internal market, Norway and Iceland are by far the leading exporters, accounting together for 57% of the EU's imports of slabs and billets and 47% of the EU's imports of foundry alloys. Among countries subject to duties, the UAE accounts for slightly less than 18% of total EU imports of alloyed slabs and billets in 2017 (equivalent to about 55% of the total imports subject to duties in the same year) and 16% of total EU imports of foundry alloys (about 39% of the total imports subject to duties in the same year).

EU trade policy also offers companies the option of processing imported products without paying any duty. Companies can temporarily import raw materials or semi-manufactured goods from various countries, assemble or transform them so as to re-export the products for final consumption in third countries. In the period 2000-2017, the inward processing procedure was extensively used by EU companies both for not alloyed aluminium (averaging 43% of the total import subject to duties) and aluminium alloys (averaging 39% of the total import subject to duties).

Estimates of the impact of import tariffs on unwrought aluminium on the aluminium industry value chain

The adoption of import tariffs is meant to increase prices of both imported and domestic goods. Given the regional market conditions and the structural characteristics of the EU aluminium industry, there is an incentive for domestic producers of unwrought aluminium, including those with duty-free access to the EU internal market, to align their prices with the highest possible level, namely the duty-paid price. This theoretical prediction is largely confirmed by findings of many studies focusing on the aluminium industry.

The price increase induced by import tariffs imposes extra costs on companies operating in segments further down the value chain, in particular on downstream transformers, while simultaneously representing a net transfer of financial resources to upstream activities.

As such, they correspond to extra revenues for primary and secondary producers (in addition to revenue for EU customs). EU primary and secondary aluminium producers should in principle use the additional revenues to compensate for cost differences with respect to extra-EU competitors as well as to invest in improving their products and production technologies. Moreover, as a result of current PTAs, extra costs for EU downstream transformers also represent additional revenues for primary producers based in countries from which primary aluminium can be imported on a duty-free basis (mainly Norway, Iceland, and Mozambique).

Increasing international competition from developing countries and limited bargaining power vis-à-vis their customers have mostly prevented EU downstream transformers from further passing through the extra costs imposed by import tariffs down the value chain, thus progressively squeezing their margins and putting further pressure on their survival, in particular on SMEs. Whenever partial or full pass-through is possible, import tariffs would still result in higher prices of semi-finished products to the detriment of EU end-user industries and final consumers.

Total estimated cumulative extra costs sustained by EU aluminium downstream industry, net of inward processing, range from €9.7 to €17.8 billion in the period 2000-2017. Those additional expenses represent up to 75% of the turnover of the European downstream aluminium industry in 2015. This also implies yearly average extra costs ranging between €529 million and €1 billion.

Impact on downstream transformers of the EU import tariffs on unwrought aluminium (2000-2017, € billion - real 2018)

Scenario	Cumulative extra-costs for EU downstream transformers	Duty revenues (net of inward processing)	Extra revenues		
			EU primary producers	Primary producers with duty free access to the EU	EU secondary producers
Lower bound	9,7	1,4	2,6	2,5	3,1
Upper bound	17,8	3,9	4,8	4,6	5,8

** Duty revenues are net of inward processing of unwrought aluminium.*
Source: Authors' own elabouration.

The largest share of the extra costs translated into extra revenues for remelters and refiners based in the EU producing secondary aluminium (33% of total extra costs). The price increase due to the EU import tariffs also led to extra revenues for EU smelters (28% of total extra costs) and for primary producers based in countries from which primary aluminium can be imported on a duty-free basis (26% of total extra costs).

Assessing EU trade measures on unwrought aluminium from an industrial policy perspective

At the EU level, the task of supporting the aluminium industry was mainly left to trade rules, including the use of import tariffs as the main industrial policy measure. National measures were primarily aimed at sustaining existing upstream activities by lowering their energy costs, often as a part of a wider regulatory intervention for energy-intensive sectors. National governments were also left with the burden of dealing with the economic and social consequences of shuttered smelting facilities.

The import tariffs on unwrought aluminium were mainly justified by the need to prevent EU smelters from reducing their production or even shutting down their facilities, eventually moving them to countries with low energy and labour costs, as well as lax environmental regulations. In turn, this would make more difficult for EU producers of semi-finished products and end-user industries to reliably and competitively source unwrought aluminium and aluminium products.

The customs duty on imports of unwrought aluminium has not worked as expected in achieving the EU objectives.

The EU's production of primary aluminium has decreased significantly because of the major curtailments and shutdown of numerous EU smelters. More than 11,300 jobs were lost in the upstream segment, including in the alumina and metal supply sectors, in the period 2002-2015. Consequently, the EU trade deficit regarding unwrought aluminium has considerably worsened and will be further exacerbated with the closure of additional smelters.

In 2017, the EU's primary aluminium production was about 27% of the EU's apparent consumption of primary aluminium. Furthermore, in the same year, as a consequence of several smelter closures, the total installed smelting capacity in the EU was instead equal to 30% of the EU's apparent consumption of primary aluminium. The increasing demand for primary aluminium has been met by rising imports. Dependence on imported unwrought aluminium for the production of aluminium semi-finished and finished products has thus steadily increased.

No increases in production capacity or new entries in the unwrought aluminium segment are expected in the EU member states in the next few years. This will further increase the EU's dependence on imports, as unwrought aluminium consumption is expected to grow, though at a slower pace than in the past.

Import tariffs, having failed to sustain the EU's primary aluminium production, have negatively affected the competitiveness of other segments of the value-added industrial chain, especially downstream users that are not able to pass through the price increase of unwrought aluminium.

An effective protection of segments further down the value chain would necessitate sourcing unwrought aluminium at the lowest possible costs, leaving aside any issues related to security and continuity of supply. The adoption of import tariffs works exactly in the opposite direction by potentially counteracting the effects of trade measures in downstream segments (i.e. import tariffs on semi-finished products). Not surprisingly, many countries such as China have adopted policies to make unwrought aluminium cheaper as to explicitly confer a cost advantage on domestic manufacturers of semis.

The overall effects are clearly visible. In 2017, EU production of aluminium extrusions was slightly below 2000 levels, although global production has tripled in the same period. The production of aluminium FRPs and castings has increased compared to 2000, but at a significantly slower pace than on the global level. In the period 2000-2017, the EU's trade balance has constantly worsened in all sectors of aluminium semi-finished products, as consumption of semi-finished aluminium products has increased at a compound growth annual rate of 3% in the same period.

The impact has been different depending on the specifics of downstream producers, with specialised SMEs inevitably suffering more than vertically integrated companies. Better performing companies have generally been characterized by long-standing customer relationships—based on geographical proximity, flexibility and customization—with end-user industries.

The autonomous temporary suspension of customs duty, adopted in 2007 for not alloyed aluminium and in 2013 for aluminium slabs and billets, which was primarily intended to reduce input costs for downstream aluminium users while preserving the profitability of the upstream segment, has failed to reverse the described trends.

Industrial policy recommendations for the competiveness of the EU aluminium industry

The competitive advantage of the EU aluminium value chain undoubtedly lies in the technological leadership of the downstream activities. From a broader industrial policy perspective, it is thus essential to provide all the right support to maintain this leadership and possibly reinforce the economic and industrial competitiveness of firms producing semi-finished products and using aluminium products.

Overall this report's findings suggest the following policy recommendations:

- Import tariffs on unwrought aluminium should be abolished. A customs duty on unwrought aluminium should not be regarded as the right policy instrument, as it artificially raises downstream costs without offering any appreciable results in supporting upstream production.
- The maintenance of primary aluminium production can be justified only through recognising its strategic value for the entire EU economy. Government intervention may be required to avoid being totally dependent on imports.
- Secondary aluminium production should be encouraged through appropriate support schemes other than customs duties (e.g. by promoting innovative sorting and separation technologies, consistent product design, etc.) and by creating incentives for the secondary raw materials produced in the EU to be increasingly recycled and reused domestically.
- Maintaining the technological leadership and possibly reinforcing the competitiveness of the EU's semi-finished transformers would require policy measures other than simply reducing the costs these firms incur while procuring the inputs and intermediates. The suggested removal of import tariffs on unwrought aluminium would generate additional financial resources (estimated between 530 million and 1 billion euros per year) for EU downstream transformers' investments. Incentives for downstream transformers should be primarily directed at expanding their innovative, research and technological capacities and at improving their sustainability, resource efficiency and environmental performances from a circular economy perspective.
- Finally, improving the competitiveness of the whole EU aluminium value chain requires enhancing, including with the tools of the so-called fourth industrial revolution, the collaborations and the relationships between EU semi-finished transformers and relevant end-user industries.

1. Introduction

The purpose of this study is to provide a comprehensive overview of the aluminium value chain in the European Union (hereafter EU[1]), to quantitatively estimate the economic impact of the EU import tariffs on unwrought aluminium in terms of additional costs for other segments further down the value chain, to strategically assess the role of import tariffs on unwrought aluminium as an industrial policy instrument for promoting the competitiveness of downstream activities and the EU aluminium industry as a whole.

The aluminium industry is an industry essential to the economies of modern countries which provides a range of highly differentiated products, from those intended for consumption to the intermediate inputs that are required for many high-tech industries.

Since 2008, the European Commission has shown increasing concern for the aluminium industry and other non-ferrous metals, such as copper and zinc, renewing interest in the need for industrial policy measures to revitalise the European economy (European Commission, 2008). Non-ferrous metals are essential for mechanical engineering, transport, aerospace, construction, packaging, electricity and energy, electronics, and medical devices. While the EU is one of the biggest consumers of non-ferrous metals worldwide, its dependence on imported raw materials for the production of semi-finished and finished products has increased rapidly in the last few years (Dessart and Bontoux, 2017). Therefore, the need for concrete actions has become ever more crucial in light of the EU's objective of strengthening its industrial base and bringing back the industry's share of the EU's Gross Domestic Product (GDP) to 20% by 2020, as put forward by the European Commission in 2010[2].

Aluminium has, from this perspective, a particularly important role to play, given the absence of substitutes for many of its applications in the automotive, aerospace, mechanical engineering, packaging and construction sectors, as well as for its characteristics of lightness and recyclability that make it indispensable for the achievement of European targets for energy efficiency and use of resources[3].

Furthermore, the aluminium industry is a global industry which also affects the development of the local areas where it operates. The aluminium industry's value chain is divided into several stages, from the extraction of mineral raw materials to the production of intermediate and semi-finished products and final goods. These stages are developed in markets that have a different geographic focus. While the upstream segments address global markets and upstream operations are carried out by a few large multinational companies, downstream firms operate mainly in regional, sometimes even local, markets,

[1] EU refers to EU-28, unless otherwise specified.

[2] See COM(2010) 614 final.

[3] See https://ec.europa.eu/clima/policies/strategies/2030_en.

characterised by lower concentration and a high number of operators. The downstream, therefore, is the segment that generates development at the local level, and also represents the main source of employment.

The global aluminium industry has undergone fundamental structural changes in recent years in terms of geographical relocation of production and consumption, the degree of concentration and integration, the development of new end-use markets, increasing financialisation, and international trade (Nappi, 2013). Consequently, the shape of the EU aluminium industry has also fundamentally changed, both externally and internally. From a global perspective, China's role has increased substantially, to the detriment of North America and the EU. Still, the Middle East has attracted huge investments, and now accounts for an increasing share of the total global output of unwrought aluminium.

The decline in the EU has been particularly severe in the upstream sectors; the primary production of unwrought aluminium shrank by 28% over the last few years. The downstream sector— which actually represents the bulk of the EU aluminium industry in terms of production, value added and jobs created— has progressively suffered from an increasing primary aluminium deficit and from rising costs of raw materials. The downstream industry's dependence on imports is even more problematic considering that manufacturers of semi-finished products are fundamentally price-takers. As a result, increasing trade deficits have characterised all the main segments of the downstream aluminium sector.

All of the downstream segments of the aluminium value chain have typically been characterized by a lack of analytical data. The common mistake of identifying the aluminium industry only with primary (and secondary) producers has often led to biased policy debates ignoring how the value chain as a whole functions and the impacts on those segments capable of generating major economic benefits at the local level. The present study thus aims to support policy-making by providing a comprehensive overview of the aluminium industry that includes the three main segments of aluminium processing in terms of output and employment: aluminium extrusions, flat rolled products manufacturing, and foundry castings. Wire and cable segments are not the object of this study.

The structural changes in the aluminium industry have sparked renewed interest in the role of trade policies in driving economic development and in influencing the competitiveness of the manufacturing sector as a whole. Indeed, the aluminium industry was recently at the core of the international debate on protectionist measures, mainly because of the choice made by the United States administration to impose additional import tariffs on aluminium products (United States International Trade Commission, 2017). More specifically, since March 2018, the United States has assessed duties of 10% or more on foreign-made primary unwrought aluminium and certain semi-finished aluminium products on national security grounds (Section 232 of the Trade Expansion Act). As of June 1, 2018, duties also apply to the EU[4].

Furthermore, the recent increases in aluminium smelting capacity, partially related to direct and indirect governmental support, have raised growing concerns about competitive implications not only in the upstream segment but also in downstream activities, such as the production of semi-fabricated products of aluminium (OECD, 2019). While governmental support is common along the aluminium value chain,

[4] An investigation was conducted by the U.S. Department of Commerce into the effect of imports of aluminium on the national security of the United States (U.S. Department of Commerce, 2018). As a result, consistent with the America First trade agenda, President Trump imposed a 10% tariff on aluminium imports in early March of 2018. Later, on June 1, 2018, tariffs were extended to the European Union, Canada, and Mexico.

it is especially heavy in the People's Republic of China (hereafter, China), currently the leading producer in most segments of the aluminium value chain[5].

In reviewing the regulatory framework in which economic activity takes place in China, the European Commission has also recently examined the aluminium sector as one of the sectors that have featured most in the EU's anti-dumping investigations since the conclusion of the Uruguay Round (European Commission, 2017a). As a result, the need for a comprehensive revision of trade rules has been increasingly advocated, a revision which must also take into account the greater complexity of international production.

From this perspective, the present report devotes particular attention to EU trade policies with the purpose of quantitatively assessing the economic impact of the EU import tariffs on unwrought aluminium in terms of additional costs for downstream producers and for other manufacturing processes further down the value chain. In this respect, the analysis aims to update data and conclusions of the first GRIF Report, "The impact of EU policies on the competitiveness of the EU aluminium industry: a focus on non-integrated downstream users" (GRIF, 2015). The first GRIF Report was the first study to focus on the aluminium industry's entire value chain, providing evidence that the duty on unwrought aluminium penalises the downstream sector while favouring large, primary, vertically-integrated, firms as well as producers outside the EU that have duty-free access to the EU.

Based on the overview of the structural changes of the EU aluminium industry and on the analysis of the effectiveness of EU import tariffs on raw materials in achieving the expected results, the study finally provides industrial policy recommendations aimed at fostering the competitiveness of the EU value chain. Data available from the past few years makes it an opportune time to take stock of the overall effects achieved by the customs duty on raw material. The report takes the view that EU measures on trade should be placed in a broader industrial policy framework taking into account expected benefits and costs in terms of growth, jobs, investment and competitiveness along the entire value chain, as well as considering the contribution that the aluminium industry could make to achieving overall EU targets and in underpinning a sustainable social market economy.

As already noted, a fundamental lack of analytical data on the downstream segments of the aluminium industry value chain constitutes a major impediment in describing the current shape and functioning of these segments. To have consistent information on the aluminium industry and to ensure the robustness and the comparability of the quantitative analysis, this study relies on secondary data and official statistics on the global aluminium industry derived mainly from the following sources: the Eurostat ComExt statistical database on international trade in goods; the International Aluminium Institute, the world association of companies engaged in the production of bauxite, alumina, aluminium, the recycling of aluminium, or the fabrication of aluminium; European Aluminium, the equivalent association of European aluminium companies; and the CRU Group, a London-based international consultancy specializing in the global mining, metals, and fertilizer industries. Trade data for different aluminium

[5] In its Resolution on "State of EU-China relations" of last September, the European Parliament expresses concern about the China's measures that caused trade distortions, including industrial overcapacity in raw material sectors such as the steel and aluminium sectors. Recognising the link between global industrial overcapacity and the surge in protectionist trade measures, the European Parliament also highlighted the opportunity to continue to urge multilateral cooperation in order to address the structural concerns behind overcapacity.

products was extracted from Eurostat's COMEXT, which is a statistical database on trade of goods managed by Eurostat, the Statistical Office of the European Commission.

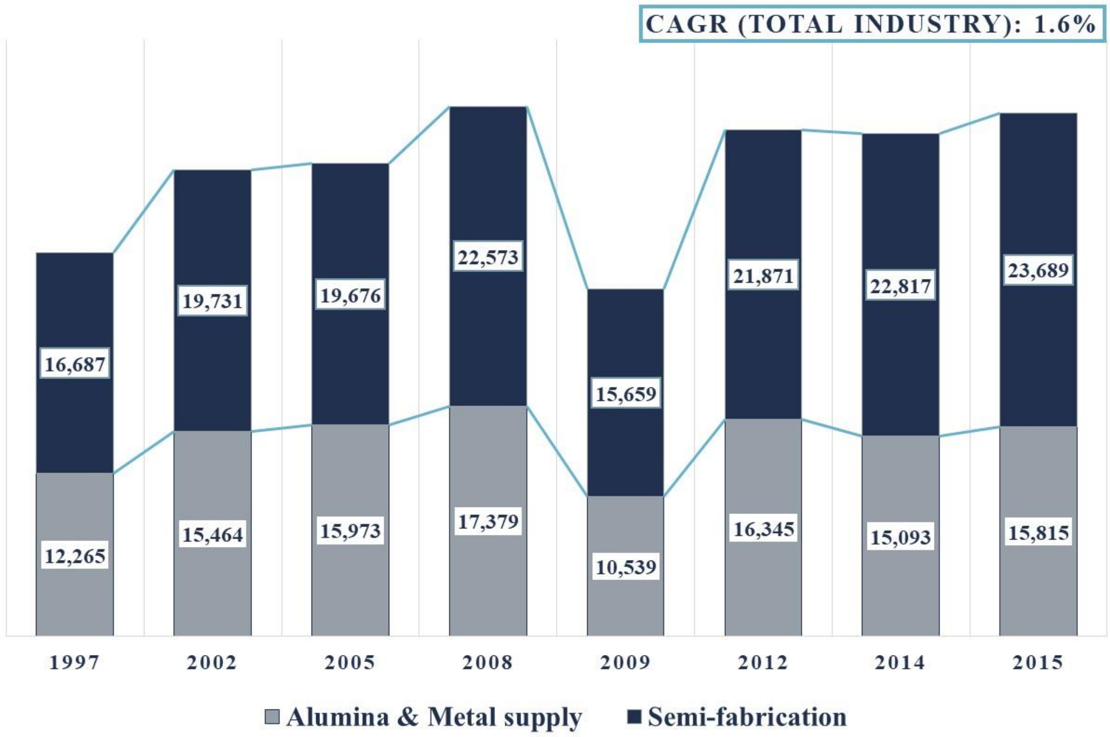
2. The EU aluminium value chain

1.1. Overview

The EU aluminium industry encompasses more than a thousand companies involved in processing the metal and in the manufacturing of a wide range of aluminium products, directly responsible for the employment of about 230.000 employees and indirectly responsible for around 1 million jobs (European Aluminium, 2017).

Lacking raw material, the EU aluminium industry is characterised by a few facilities involved in the production of alumina and by a limited number of large global companies producing primary aluminium. Few of those firms are vertically-integrated, meaning that they also manufacture aluminium semi-finished products, such as extrusions, flat-rolled products and castings. Hundreds of small non-vertically-integrated firms are also involved in the downstream sector.

Figure 2.1: Total revenues generated by the European (EU + EFTA) aluminium industry



Source: European Aluminium

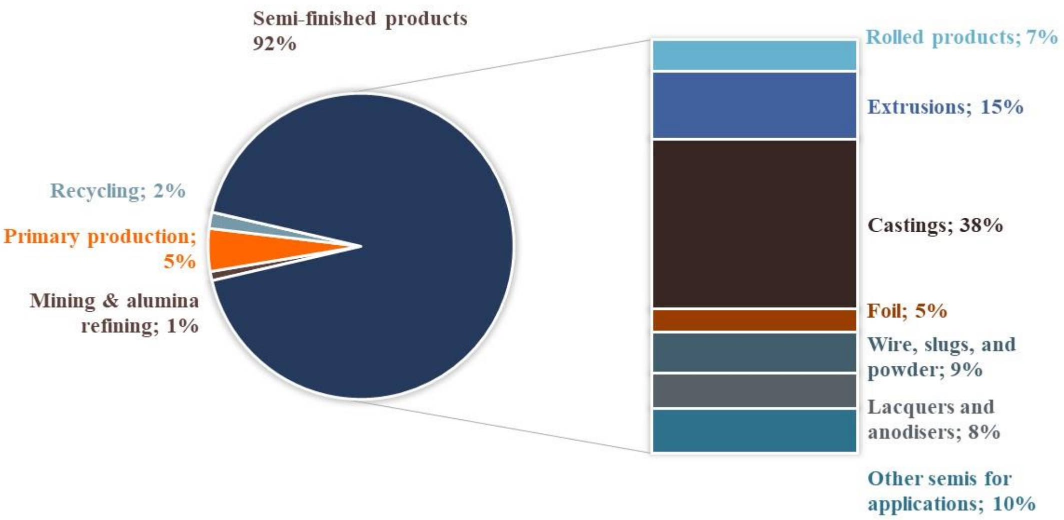
According to European Aluminium (2017), which nonetheless provides aggregate data on European Union and EFTA countries (Norway, Iceland, Switzerland and Liechtenstein), the European aluminium industry had an annual turnover of 39.5 billion euros in 2015; this turnover increased by more than 36% over the period 1997-2015, with a 1.6% Compound Annual Growth Rate (CAGR) (See Figure 2.1).

About 60% of the annual turnover is currently generated in the downstream sector. The share of the total aluminium industry turnover corresponding to the manufacturing of semi-finished aluminium products has also progressively increased in the last twenty years, reflecting fundamental changes in the structure of the EU aluminium industry (56% in 2002).

In 2015, the value added (calculated as the difference between the total revenue of a company or plant and the cost of energy and raw materials) of the European aluminium industry amounted to 11.5 billion euros. Around two thirds of the total value added is currently generated by aluminium semi-finished producers. Moreover, the economic weight of downstream activities is likely to be much greater in EU member states alone, as upstream facilities are mainly located in EFTA countries.

Focusing on the EU, the aluminium downstream sector (including manufacturers of aluminium extrusions, flat-rolled products and castings, as well as producers of foil, wire, slug, and powder, lacquers and anodisers, and other processing applications) accounts for nearly 92% of the total employment in the whole EU aluminium industry, compared to 5% of the primary segment and 2% of the secondary segment (see Figure 2.2). Among the semi-finished aluminium products sectors, castings shows the highest share (38%), followed mainly by aluminium extrusions (15%), wire, slugs, etc. (9%), and flat-rolled products (7%).

Figure 2.2: Total employment in the EU aluminium industry by sector/segment



Source: European Aluminium (2012)

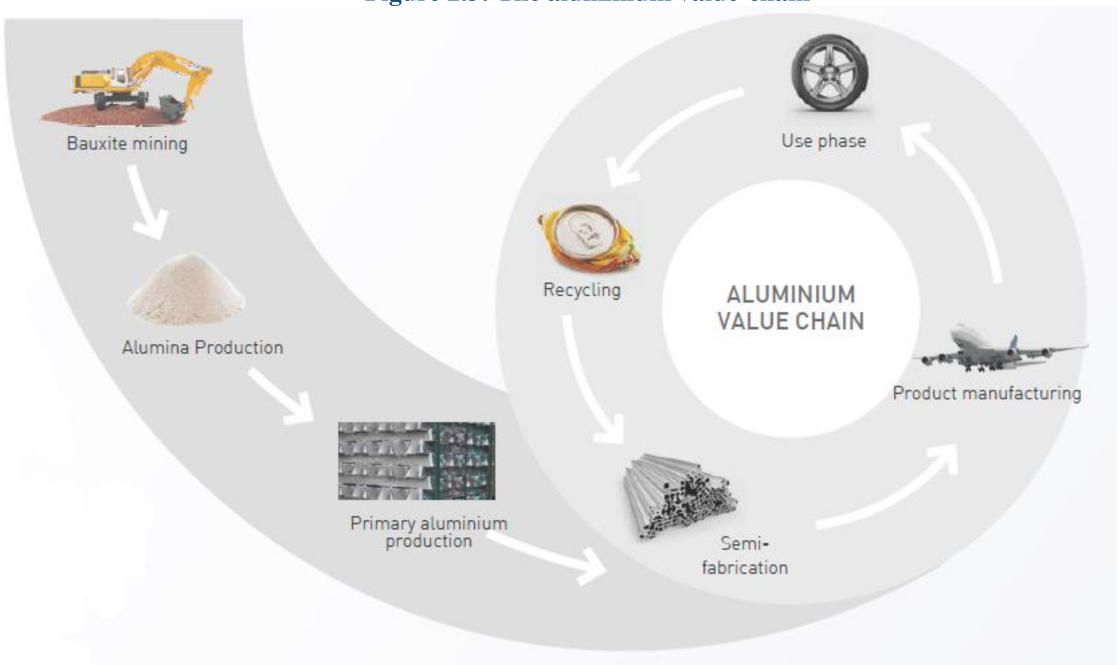
The following section provides an overview of the aluminium industry in the EU.

1.2. The aluminium production value chain

Aluminium is a light metal used in different forms and ways in everyday life since the first years of the 19th century. Aluminium is currently used as an input material in the manufacture of investment goods (automotive, shipbuilding, aerospace, building and construction, mechanical engineering), and consumer goods, like mobile devices, computers, recreational vehicles, household appliances, etc. (CEPS, 2013; Conserva M., Bonollo F., 2004; King, 2001).

Well-known performance characteristics, such as aluminium's light weight, high resistance to corrosion, electrical and thermal conductivity, ductility and strength, surface finish, reflectivity and infinite recyclability, has underpinned the increased use of aluminium and aluminium alloys in many industrial processes (Holloway, 1988; International Aluminum Institute, 2009).

Figure 2.3: The aluminium value-chain



Source: European Aluminium (2015)

Traditionally, the aluminium value chain is divided into three main segments:

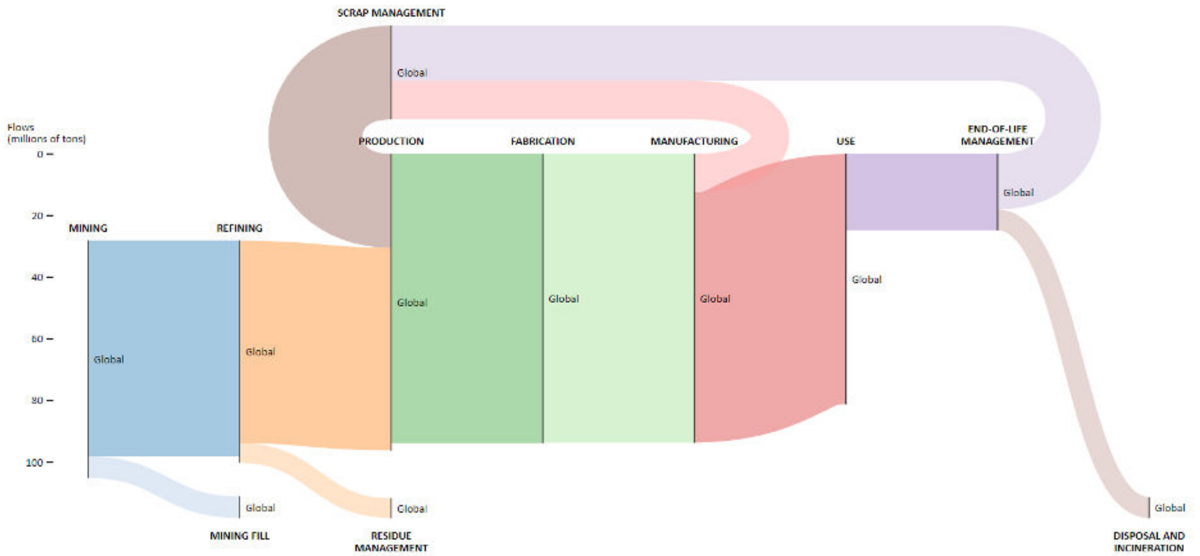
1. upstream, including all the producers of the raw material from the unwrought mineral, namely the extractors (mining and quarrying) and the primary aluminium smelters;
2. downstream, involving a broad group of producers manufacturing high differentiated outputs (so-called "wrought aluminium", "semi-finished," "semis," or "mill products") by rolling, extruding, casting and drawing unwrought aluminium into various forms;
3. aluminium recycling and remelting, comprising producers of aluminium alloys (recyclers/remelters) from metallic waste and scrap generated either as a by-product of manufacturing or from recycled goods.

For the purpose of this study, recycling and remelting activities are included in the upstream segment as they both produce unwrought aluminium for the downstream transformers[6].

Figure 2.3 presents the value chain of aluminium. Primary metal is aluminium tapped from electrolytic cells or pots during the electrolytic reduction of metallurgical alumina (aluminium oxide), which is in turn the result of bauxite refining (see). Secondary unwrought aluminium is produced by recycling and remelting aluminium-bearing scrap and/or aluminium-bearing materials. Semi-finished aluminium products are sold to a wide variety of final customers using them in manufacturing processes further down the chain. The main markets include packaging, construction and building, engineering, automotive, airspace, and electrical transmission.

The figure below summarises the material flows of aluminium at global scales throughout its life cycle from mining and manufacturing to use and recycling stages (Bertram et al., 2009; Passarini et al., 2018).

Figure 2.4: Global aluminium cycle 2017



Source: World Aluminium

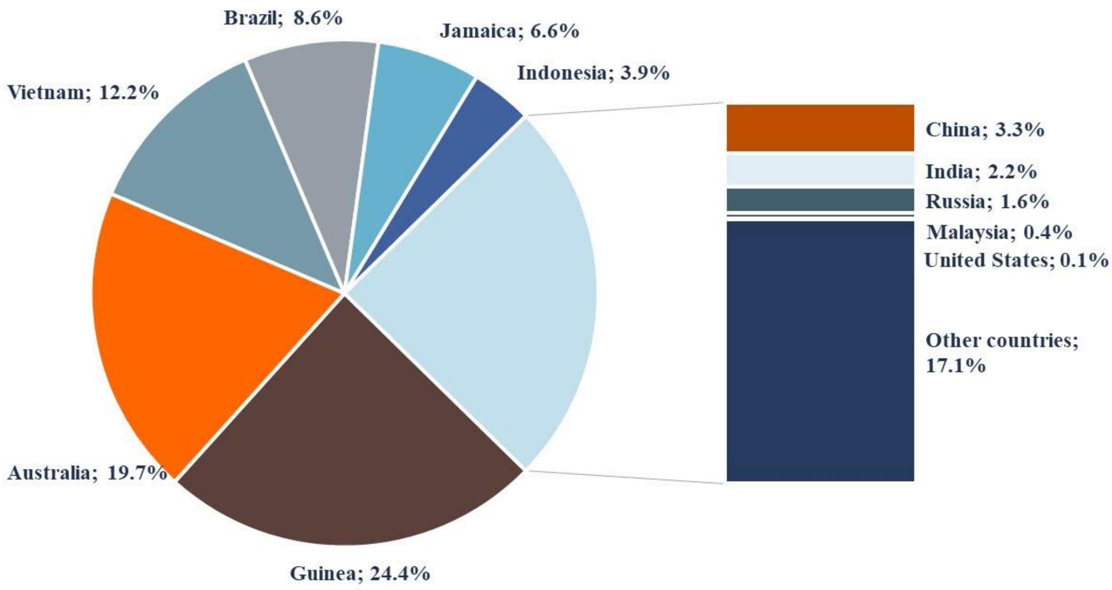
6 The real functioning of the aluminium industry can be much more complex and diverse. For instance, recycling and remelting facilities can be integrated with downstream activities in a single plant. Still, OECD has recently included both primary and secondary aluminium in the middle segment.

1.3. The upstream

1.3.1. Bauxite mining

The industrial production of primary aluminium typically begins from extracting alumina from bauxite ore by the Bayer process[7]. Bauxite is roughly 25% composed of aluminium (OECD, 2010).

Figure 2.5: The world's bauxite reserves



Source: U.S. Geological Survey (2019)

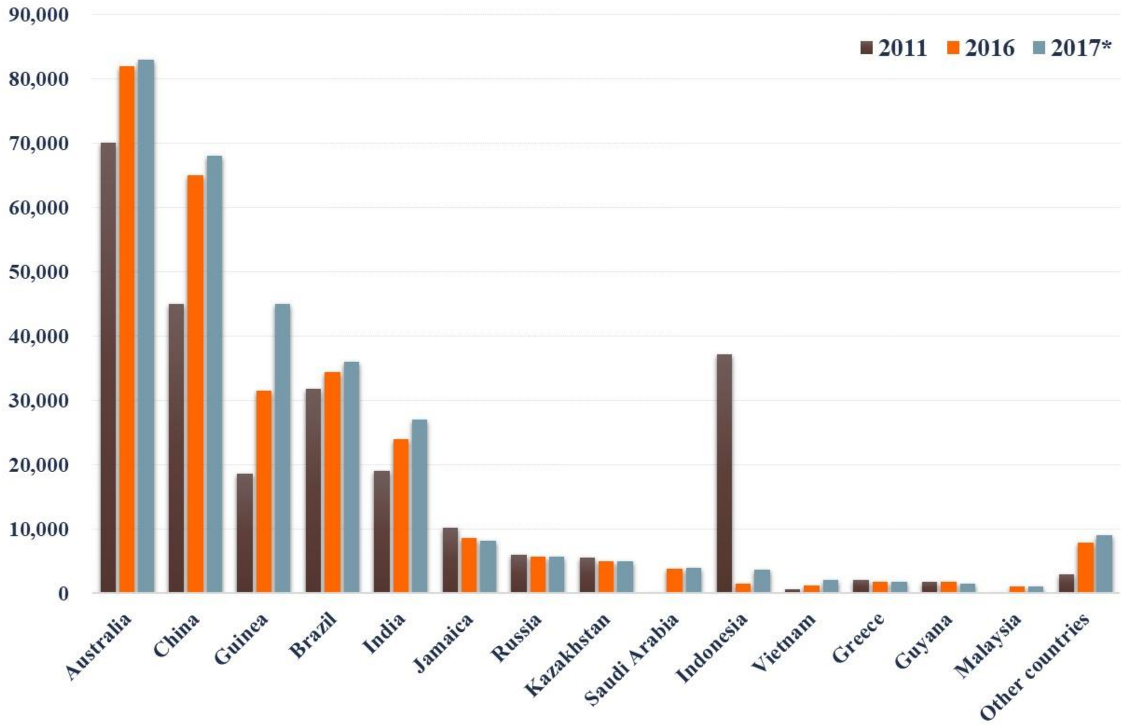
The mining operations are quite complicated and require high costs for the equipment (bulldozers, backhoes, front-end loaders and excavators) used in the different phases of the extraction (Gendron et al., 2013; OECD, 2010). The bauxite obtained from the excavations is not always properly pure and the ores can be additionally treated (i.e. crashing, washing, etc.) to increase the grade. Then, the ores are dried in order to reduce the volume. In this way, the mineral can be shipped to the alumina refining plants at the lowest possible transport cost (CEPS, 2013).

[7] In addition to bauxite, which is the most important source, aluminium is also extracted from other ores, such as nepheline. Although currently not economically competitive with bauxite, vast resources of clay are technically feasible sources of alumina. Other raw materials, such as alunite, anorthosite, coal wastes, and oil shales, offer additional potential alumina sources (U.S. Geological Survey, 2019). Although abundant, aluminium is usually found in combination with other elements in more than 270 different minerals.

Bauxite resources are present in many areas of the world (see Figure 2.5). Bauxite resources are estimated by the U.S. Geological Survey to be 55 billion to 75 billion tons, considered adequate to meet the world demand for aluminium into the future (U.S. Geological Survey, 2019, 2018).

Bauxite is more abundant in tropical regions such as Africa (32%), Oceania (23%), South America and the Caribbean (21%), Asia (18%). Conversely, North America and Europe suffer from a relative lack of bauxite resources. Almost three quarters of the world's bauxite reserves are located in just five countries, with Guinea and Australia alone accounting for roughly half of the total: Guinea (24.4%), Australia (19.7%), Vietnam (12.2%), Brazil (8.6%), and Jamaica (6.6%).

Figure 2.6: The bauxite production in the world (thousand tonnes)

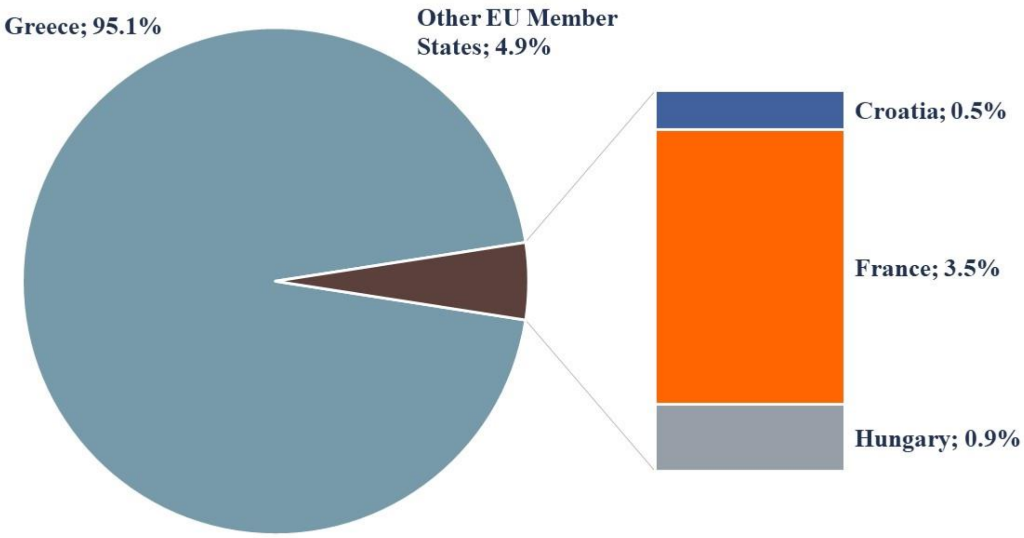


** Estimated*
Source: U.S. Geological Survey (2018)

Between 2011 and 2017, global production of bauxite increased from 250.5 million tonnes to 300.5 million tonnes. As can be seen in Figure 2.6, the largest producing countries in the world are Australia (whose share of global output measured 28% in 2017), China (23%), Guinea (15%), Brazil (12%) and India (9%).

Greece is the only significant bauxite producer in the EU, with 1.8 million tonnes in 2017 (this figure was roughly the same in the previous year) (See Figure 2.7). Other Member States which produce trivial quantities of bauxite are France (about 70 thousand tonnes in 2016), Hungary (17 thousand tonnes in 2016) and Croatia (ca. 10 thousand tonnes in 2016). In the period 2011-2016, the EU's production and market share of bauxite both decreased; bauxite production fell from about 2.7 million tonnes in 2011 to ca. 2.0 million tonnes in 2016. As a result, the EU's market share in global bauxite production fell from 1.1% in 2011 to 0.7% in 2016.

Figure 2.7: The bauxite production in the EU (2016)



Source: British Geological Survey (2018)(British Geological Survey, 2018)

1.3.2. Alumina Refinery Production

Approximately 90% of bauxite produced is used as input for the production of metallurgical alumina or aluminium hydroxide, and the remainder is used in chemicals and other products such as abrasives, cement, proppants, refractories, and as a slag adjuster in steel mills (OECD, 2010). Alumina is a white powder, composed roughly 50% from aluminium. On average, to obtain one metric tonne of alumina, plants have to refine about two metric tonnes of bauxite[8].

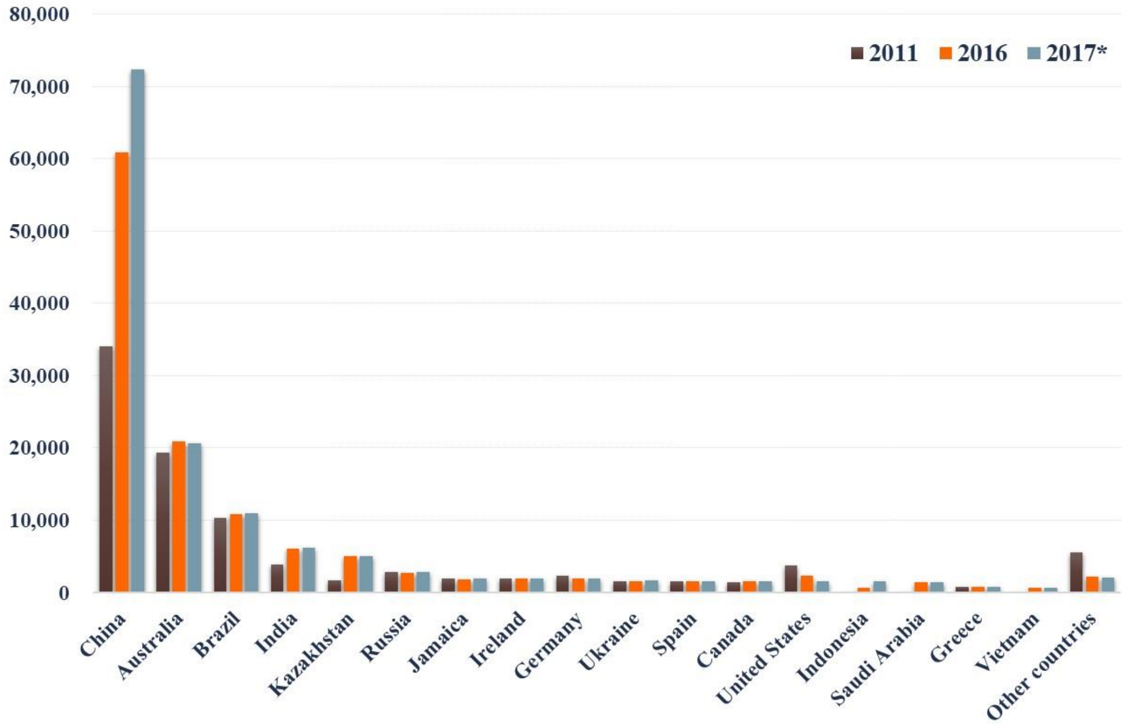
The high costs involved in transporting bauxite ore create an incentive to locate alumina refining plants close to extraction sites, sometimes to serve a single mining site. Moreover, the need to closely cooperate, to minimise potential opportunistic behaviours in case of specific investment[9], and to hedge against price fluctuation of raw materials justify joint ownership (vertical integration), or long-term detailed contracts between the two activities (GRIF, 2015). As a result, alumina refineries are operated

[8] The process adopted to extract alumina from bauxite is called the Bayer process, introduced by Carl Josef Bayer in 1887, and based on a solution of caustic soda and lime (King, 2001).

[9] Specific investments are those made to support a particular transaction. The higher the degree of specificity, the lower the value of the investments made if they were redeployed for any purpose other than the initial one. Opportunistic behaviour (hold-up problem) can be a potential problem with highly specific assets. Hold-up problem occurs where a party of a future transaction has to release specific investments before concluding the contract, and the optimal contract specifications cannot be known with certainty before signing the contract. The risk is linked to the fact that when the contract has to be renegotiated, one party could ask for unfair conditions as the specific investment cannot be used for other purposes without losing most of its economic value.

by vertically-integrated firms in conjunction with bauxite mines. In addition, this also explains why most alumina-producing regions are also important producers of bauxite, with the exception of the United States and some EU member states (such as Ireland, Germany and Spain).

Figure 2.8: World Alumina Refinery Production (thousand tonnes)



** Estimated*

Source: USGS (2018), U.S. Geological Survey, Mineral Commodity Summaries, January

In 2017, the biggest producer of alumina in terms of quantity was China (about 72 million tonnes, 53% of global output), followed by Australia (20 million tonnes, 15%), Brazil (11 million tonnes, 8%), and India (6 million tonnes, 4.5%): all non-European countries. As with bauxite, between 2011 and 2017, global production of alumina increased by 47%, from 93 million tonnes to 136 million tonnes, largely driven by China, which more than doubled its output over the last seven years. The combined market share of the five largest-producing countries (China, Australia, Brazil, India, and Kazakhstan) is now slightly less than 85% (see Figure 2.8).

Table 2.1 lists the leading alumina producers in terms of production capacity.

As can be seen, four out of the ten are Chinese companies; Beijing has heavily invested in new domestic refining capacity[10], even though China currently suffers from a high dependence on bauxite imports, partly because of low-quality domestic resources. Other major companies, such as Alcoa (United States), Norsk Hydro (Norway), and UC Rusal (Russian Federation), have also invested in Australia, Brazil and Guinea, where they operate bauxite mines and alumina refining facilities.

[10] China Hongqiao Group is also planning the construction of a refinery in Guinea through its participation in the SMB-WAP consortium.

Table 2.1: Top 10 producers of alumina, by capacity

Rank	Firm name	Annual capacity (thousand tonnes)	Parent country
1	Aluminium Corporation of China (Chalco)	15,944	CHN
2	Alcoa	14,370	USA
3	China Hongqiao Group	12,500	CHN
4	Rio Tinto	10,930	GBR
5	UC Rusal	9,733	RUS
6	Norsk Hydro	5,712	NOR
7	South32	5,216	AUS
8	East Hope Group	5,200	CHN
9	Hangzhou Jinjiang Group	3,840	CHN
10	Hindalco	3,145	IND

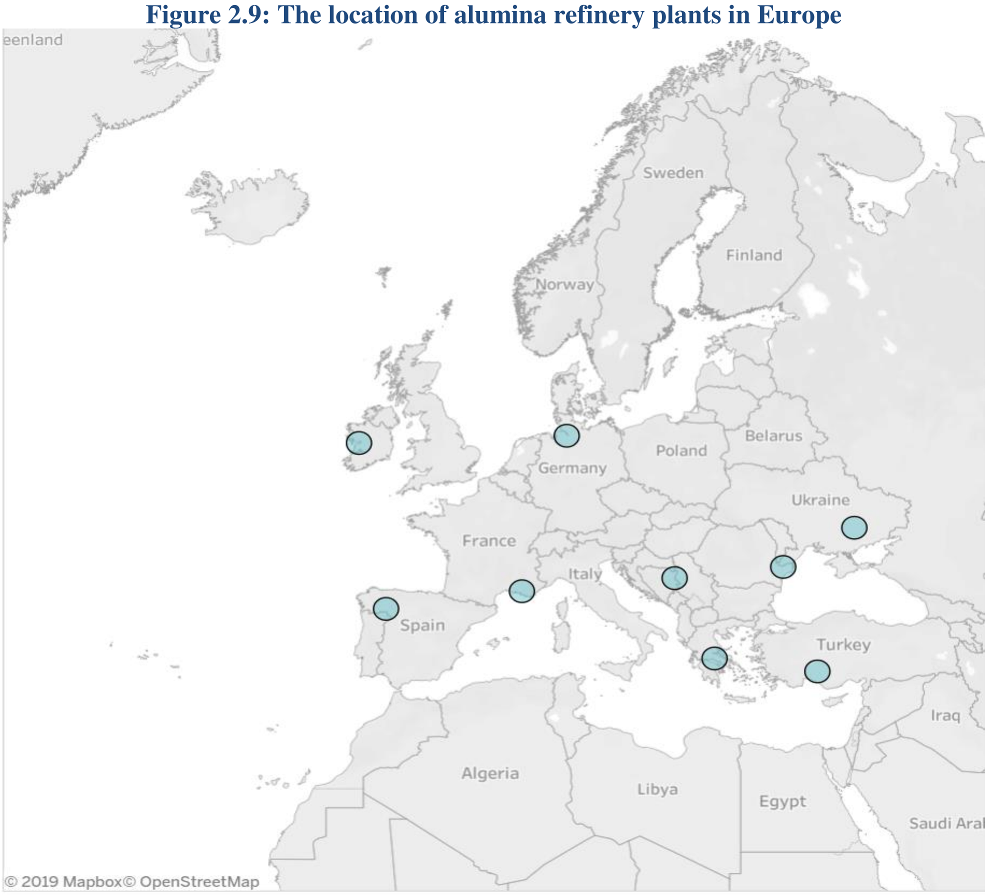
Source: OECD (2019)

Table 2.2: Estimated Alumina Refinery Production in the EU (thousand tonnes)

Country	2011	2012	2013	2014	2015	2016	2017
France	470	430	430	400	432	500	n.a.
Germany	2,355	2,331	2,360	2,400	2,400	1,900	1,900
Greece	810	784	812	812	807	821	820
Hungary	132	111	81.1	1	0	0	n.a.
Ireland	1,927	1,926	1,935	1,951	1,983	1,970	1,930
Romania	484	414	391	363	405	467	n.a.
Spain	1,500	1,500	1,573	1,517	1,633	1,580	1,570
Total	7,678	7,496	7,582	7,444	7,660	7,238	6,220

Source: British Geological Survey (2018); U.S. Geological Survey (2019)

Figure 2.9: The location of alumina refinery plants in Europe



Source: European Aluminium Statistics (accessed March 6, 2019)

Ireland, Germany, Spain and Greece cumulatively represented the 4.6% of the global alumina refinery production in 2017, meaning that in the EU, alumina is mainly imported and internal production is not sufficient to satisfy the member states' demand. Other than those countries, refineries exist in France and Romania. However, no data on alumina refinery production was reported in 2017 (see Table 2.2).

Hungary definitely ceased its alumina production, together with bauxite mining, in 2014 after MAL, which had been the leading bauxite and alumina producer in the country, went into liquidation as a consequence of the environmental disaster which occurred in October 2010. The EU's production and market share of alumina both decreased in the period 2011-2016; production fell from ca. 7.7 million tonnes to 7.2 million tonnes. Consequently, the EU's market share in global alumina production fell from 8% to 6%.

Figure 2.9 shows the location of alumina refinery plants in Europe. As can be seen, alumina refineries also operate in Bosnia & Herzegovina, Turkey and Ukraine. In 2017, Ukraine was the 10th largest alumina producer worldwide with an annual production of about 1.7 million tonnes.

1.3.3. *Production of primary aluminium*

Alumina is used for the production of aluminium metal through the Hall–Héroult electrochemical smelting process[11].

The major factor driving the choice of where to situate primary aluminium production facilities is the need for access to abundant, cheap and reliable sources of energy. The primary aluminium industry is extremely energy-intensive, with energy costs ranging from 20 to 40% of total aluminium production costs, depending on local power prices. It is estimated that, on average, between 14,000 and 15,000 kilowatt hours of electricity are required to produce 1 tonne of primary aluminium (Godzimirski, 2018)[12].

Energy costs vary much more between countries than other cost elements, explaining about 70% of the variability in aluminium's total cost at international level (Nappi, 2013). Smelters in North and South America (e.g. Canada, the United States, and Brazil) and in EFTA countries (e.g. Iceland and Norway) predominantly use electricity sourced from hydropower. Likewise, UC Rusal, the largest primary aluminium manufacturer in Russian Federation, produces over 80% of its domestic aluminium output using hydropower. Middle Eastern primary aluminium producers (e.g. in Qatar and Saudi Arabia) tend to rely on the region's vast reserves of natural gas. By contrast, smelters in Australia, China, and India rely on coal-fired power plants (OECD, 2019). Figure 2.10 reports recent trends in primary aluminium smelting energy intensity in terms of kilowatt hours per tonne of aluminium in different regions of the world.

Conversely, contrary to what has been stressed for the upstream producers, transport costs are comparatively less significant since alumina and scrap can be easily shipped.

The geographical positioning of the world's unwrought aluminium production has dramatically changed over the last twenty years.

China's role in unwrought aluminium production has increased substantially, to the detriment of North America and the EU. According to World Aluminium and CRU Group, the production of primary aluminium in China has risen more than tenfold in the period 2000-2017 (see Table 2.3). The primary production of aluminium also increased in the other Asian countries (+78%), in the Gulf Cooperation Council (GCC) countries (+89%) and Africa (+43%). Among the GCC's member countries, only Kuwait does not engage in aluminium smelting.

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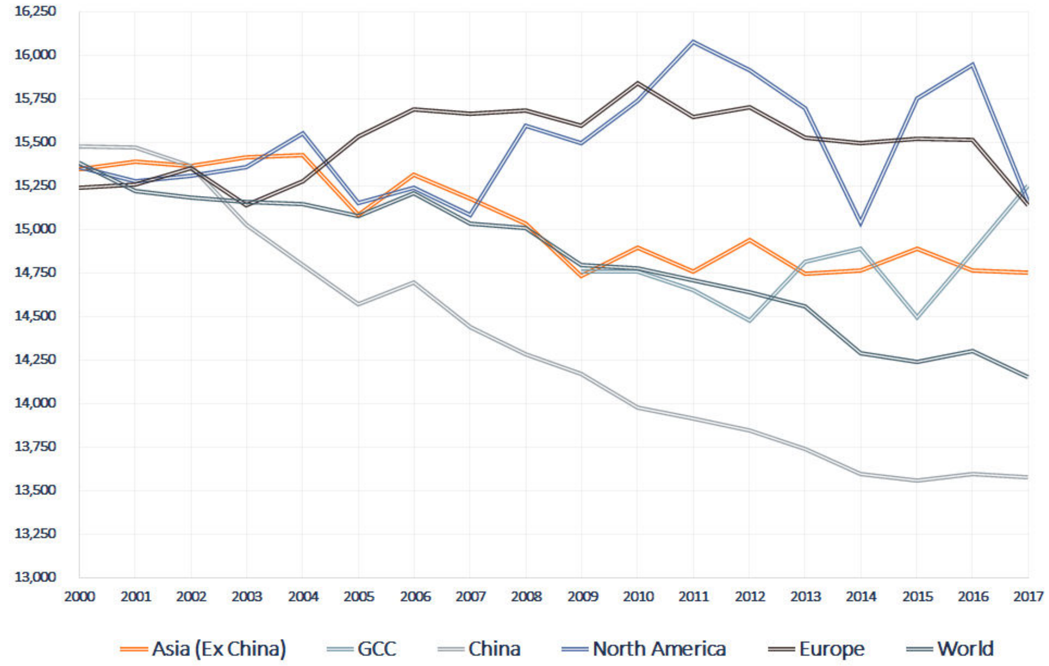
[11] The "Hall-Heroult" process electrolyses alumina. It requires three main elements: alumina, electricity, and carbon (King, 2001). This process is articulated in 3 main steps. At first, alumina is placed in the so-called reduction cell (pot) where the electrolysis takes place. Thanks to the electrolytic bath and to the connected reaction with oxygen, alumina is then converted into liquid aluminium that is finally cast into different ingots according to its subsequent use (GRIF, 2015).

[12] The US Energy Information Agency estimated that the production of non-ferrous metals, mostly aluminium, accounted for 2% of all delivered industrial energy consumption in both OECD and non-OECD regions (U.S. Energy Information Administration (EIA), 2016, p. 118).

Figure 2.10: Primary aluminium smelting energy intensity (kilowatt hours per tonne of aluminium)



This upward trend in China is undoubtedly partly explained by the increase in both domestic and global demand, which has indubitably attracted substantial investment in the sector. Moreover, apart from access to abundant and relatively cheap energy resources in particular in the country's western and north-western regions, primary production has also been moving to China as a result of industrial policies adopted in the last few years. These have taken the form of a wide range of government interventions, such as provincial subsidies, subsidised bank loans, non-financial support (including energy subsidies) and trade measures aiming at encouraging the construction of new smelters or preventing the retirement of older ones (OECD, 2019).

State-owned enterprises (SOEs) also play a role in the aluminium value chain, mainly by providing other public as well as private producers with below-market-cost inputs and loans (European Commission, 2017a). Comparatively low energy prices and government subsidies are the main reasons explaining many aluminium companies' decisions to invest in the Middle East, which have rapidly become one of the main regions for the production of primary aluminium[13]. According to the OECD (2019), other than tax concessions, policy intervention in GCC countries has mainly taken the form of government ownership and subsidies in energy markets.

[13] Many multinationals have established partnership with local companies, as in the case of Alcoa's partnership with the Saudi Arabian Mining Company (Ma'aden) to operate one of the world's largest fully integrated aluminium facilities, including a mine, refinery, smelter and rolling mill in Ras Al Khair. Norsk Hydro owns a 50-percent stake on the Qatalum joint venture, established with Qatar Petroleum to operate a primary aluminium plant in Mesaieed. Rio Tinto jointly owns in partnership with Oman Oil Company and Abu Dhabi National Energy Company PJSC – TAQA, the Sohar smelter in Oman.

Table 2.3: Global primary production of unwrought aluminium (thousand tonnes)

Region[14]	2000	2005	2010	2015	2016	2017	00-17
Africa	1,178	1,753	1,742	1,687	1,691	1,679	43%
Asia (EX China)	2,221	3,139	2,500	3,001	3,442	3,951	78%
GCC	n.a.	n.a.	2,724	5,104	5,197	5,149	89%*
China (Est.)	2,794	7,806	17,331	31,518	32,641	35,905	1185%
North America	6,041	5,382	4,689	4,469	4,027	3,950	-35%
South America	2,167	2,391	2,305	1,325	1,361	1,378	-36%
European Union	2,951	3,256	2,298	2,141	2,199	2,135	-28%
Rest of Europe	4,539	5,290	5,755	5,433	5,561	5,640	31%
Oceania	2,094	2,252	2,277	1,978	1,971	1,817	-13%
ROW est. Unreported	672	636	732	1,080	1,800	1,800	168%
Total	24,657	31,905	42,353	57,736	59,890	63,404	157%

** The GCC percentage value refers to the period 2010-2017.*
Source: authors' elaboration on World Aluminium and CRU Group

The European countries' (including the European Union and the rest of Europe) market share in global primary production of unwrought aluminium fell from 30% in 2000 to roughly 12% in 2017, although production volumes increased slightly from 7.5 million tonnes in 2000 to 7.8 million tonnes in 2017. In 2017, ca. 71% of primary aluminium was produced outside of Europe and North America, while the latter countries had produced ca. 55% in 2000 (see Figure 2.11).

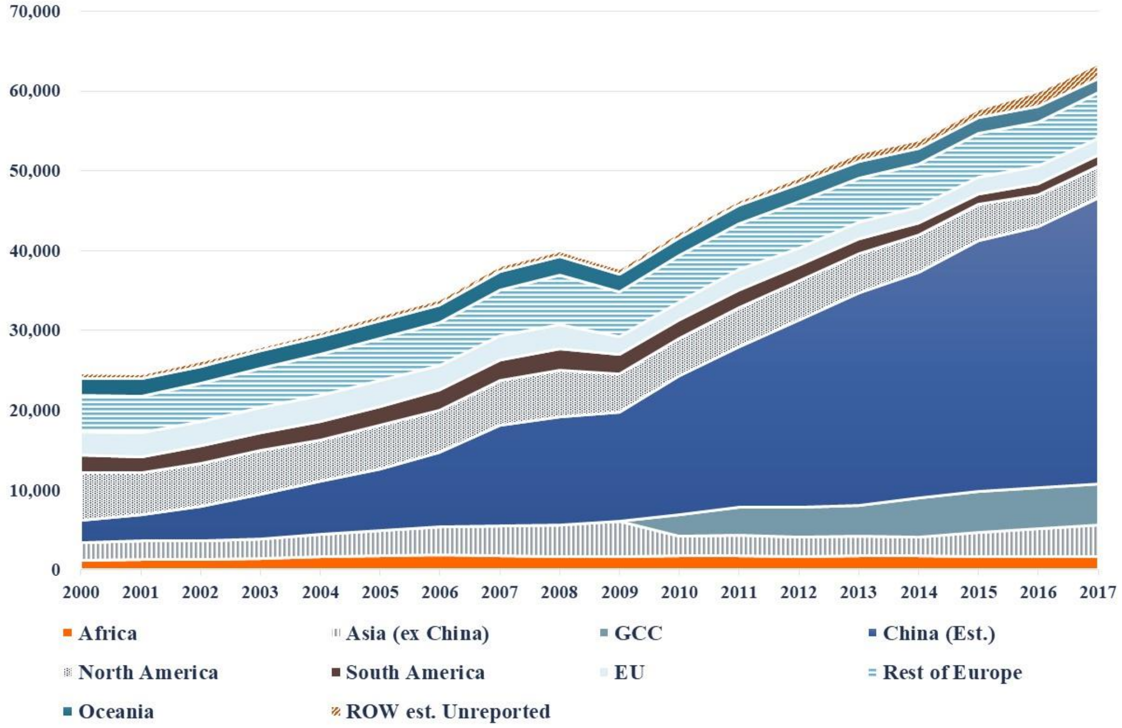
In total, around 63.4 million tonnes of primary aluminium were produced worldwide in 2017. World Aluminium recently reported a total output of 64.3 million tonnes of primary aluminium in 2018, an increase of 1.4% compared to the previous year.

As noted, China overtook all other countries in terms of primary production of aluminium in 2012; it now accounts for about 57% of global production volumes (see Figure 2.12). Figure 2.13, showing monthly data on refined aluminium production in China as compared with other countries, clearly represents how fast and radical the described changes were. It's also important to consider that,

[14] Africa: Cameroon, Egypt (12/1975-Present), Ghana, Mozambique (7/2000-Present), Nigeria (10/1997-Present), South Africa; Asia (ex China): Azerbaijan, Bahrain (1/1973-12/2009), India, Indonesia (1/1973-12/1978), Indonesia (1/1979-Present), Iran (1/1973-6/1987), Iran, Iran (7/1987-12/1991), Iran (1/1992-12/1996), Japan, Kazakhstan (10/2007-Present), Malaysia, North Korea, Oman (6/2008-12/2009), Qatar (11/2009-12/2009), South Korea (1/1973-12/1992), Tadzhikistan (1/1973-12/1996), Tadzhikistan (1/1997-Present), Taiwan (1/1973-4/1982), Turkey (1/1975-2/1976), Turkey (3/1976-Present), United Arab Emirates (11/1979-12/2009); China: China (01/1999-present); Gulf Cooperation Council (GCC): Bahrain (1/2010-Present), Oman (1/2010-Present), Qatar (1/2010-Present), Saudi Arabia (1/2013), United Arab Emirates (1/2010-Present); North America: Canada, United States of America; South America: Argentina, Brazil, Mexico (1/1973-12/2003), Suriname (1/1973-7/2001), Venezuela; European Union: Austria (1/1973-10/1992), Croatia, France, German Democratic Republic (1/1973-8/1990), Germany, Greece, Hungary (1/1973-6/1991), Hungary (7/1991-1/2006), Hungary (7/1991-1/2006), Italy, Netherlands, Poland, Romania, Slovakia (1/1975-12/1995), Slovakia (1/1996-Present), Slovenia (1/1973-12/1995), Slovenia (1/1996-Present), Spain, Sweden, United Kingdom; Rest of Europe: Bosnia and Herzegovina (1/1981-Present), Iceland, Montenegro (6/2006-Present), Norway, Russian Federation (1/1973-8/1994), Russian Federation (9/1994-Present), Serbia and Montenegro (1/1973-12/1996), Serbia and Montenegro (1/1997-5/2006), Switzerland (1/1973-4/2006); Ukraine* (1/1973-12/1995), Ukraine (1/1996-Present); Oceania: Australia, New Zealand.

according to Götz (2018), the cumulative quantity of primary aluminium produced in China since 2005 (about 201 million tonnes) is almost double that produced in the EU after 1950 (about 112 million tonnes).

Figure 2.11: Global primary production of aluminium (thousand tonnes)



Source: authors' elaboration on World Aluminium and CRU Group

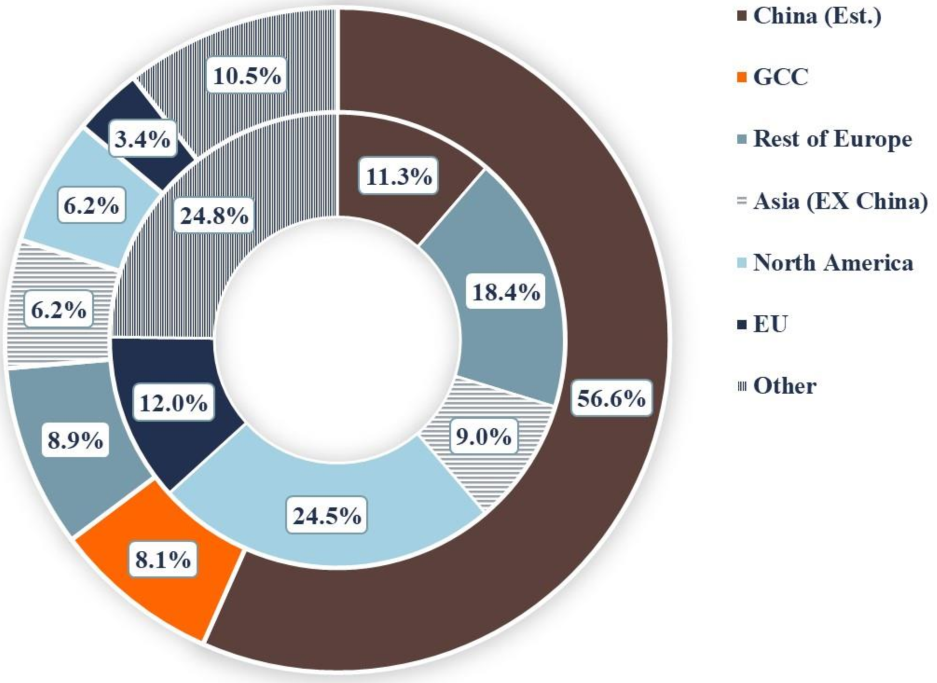
As can be expected, the last few years have seen Chinese companies grow exponentially. Nowadays, the Shandong-based company China Hongqiao Group[15] is the largest aluminium smelter in the world with an annual production of 7.5 million tons in 2017 (see Figure 2.14).

China Hongqiao Group, as well as other large aluminium companies in China (such as the state-owned Chalco, also known as the Aluminium Corporation of China; the private company Shandong Xinfa; the State Power Investment Corporation, SPIC; and East Hope Aluminium Co. Ltd.), reported increases in unwrought aluminium primary production in the last year notwithstanding the shutdown of several aluminium facilities to comply with the national supply-side reform of the aluminium industry[16].

[15] The Shandong China Hongqiao Group was mainly engaged in the production and distribution of jeans and yarn-dyed denim up to 2002, when entered into the power generation sector. In 2006, it started engaging in the aluminium industry by acquiring the aluminium products manufacturing facilities from Chuangye Group.

[16] See European Commission (2017).

Figure 2.12: Global primary production of aluminium in 2000 (inner ring) and in 2017 (outer ring)

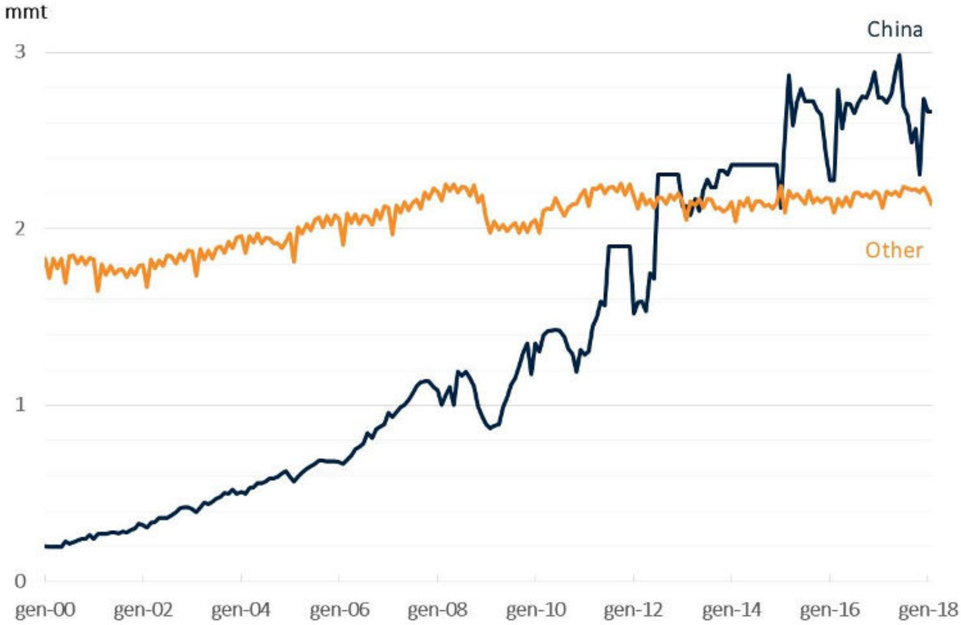


Source: authors' elaboration on World Aluminium and CRU Group

The primary aluminium industry has been historically characterised by high concentration levels (Bertilorenzi, 2018). Although the arrival of numerous new players from developing countries (and from China in particular) notably reduced the degree of concentration at a global level over the last four decades, as of 2017 the top ten companies producing unwrought aluminium still account for roughly 53% of total production output.

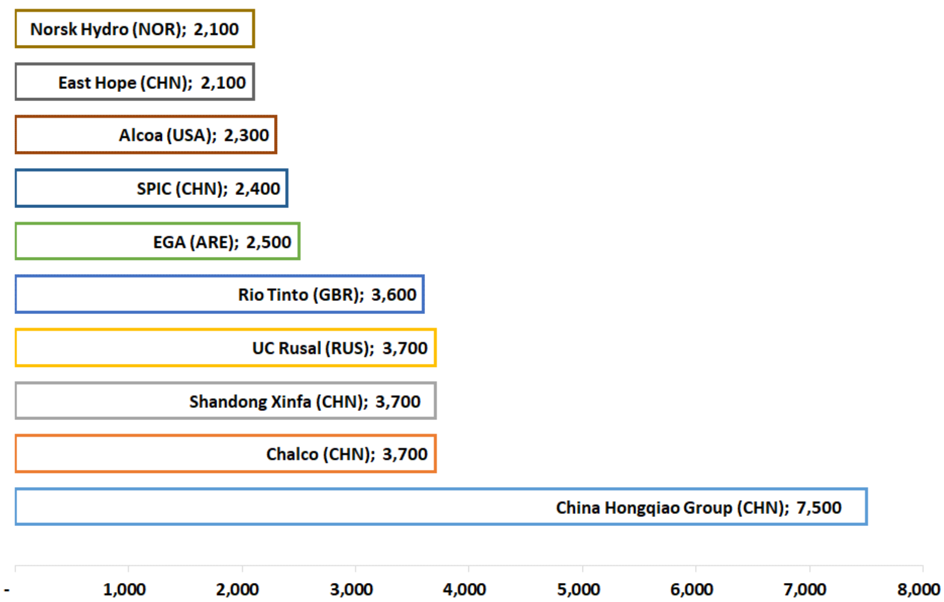
The largest non-Chinese company is UC Rusal, the largest aluminium producing company in the Russian Federation, with a total aluminium production of 3.7 million tonnes in 2017. That same year, the Norwegian company Norsk Hydro ASA was Western Europe's largest producer of aluminium by output (2.1 million tonnes). Apart from older incumbent companies, namely Rio Tinto Alcan (3.6 million tonnes) and Alcoa (2.3 million tonnes), the growing prominence of Middle Eastern producers is underscored by Emirates Global Aluminium (EGA), which produced 2.3 million tonnes of primary aluminium in 2017.

Figure 2.13: World refined aluminium production in China and in other countries



Source: World Bureau of Metal Statistics

Figure 2.14: The world's leading primary aluminium producing companies in 2017, based on production output (thousand tonnes)



Source: Rusal, Annual Report 2017, p. 8

Table 2.4, ranking the top twenty producers of primary aluminium by production capacity, shows even more clearly the role of Chinese companies at a global level. China Hongqiao Group has a production capacity of 7.8 million tonnes, followed by UC Rusal with 4.4 million tonnes and Shandong Xinfa Group. Taken together, Chinese companies represent slightly less than 63% of the total production capacity of the top twenty producers of primary aluminium. In contrast with large multinational firms which tend to invest in multiple countries and regions, Chinese companies display a stronger tendency to carry out the bulk of their activities domestically (OECD, 2019).

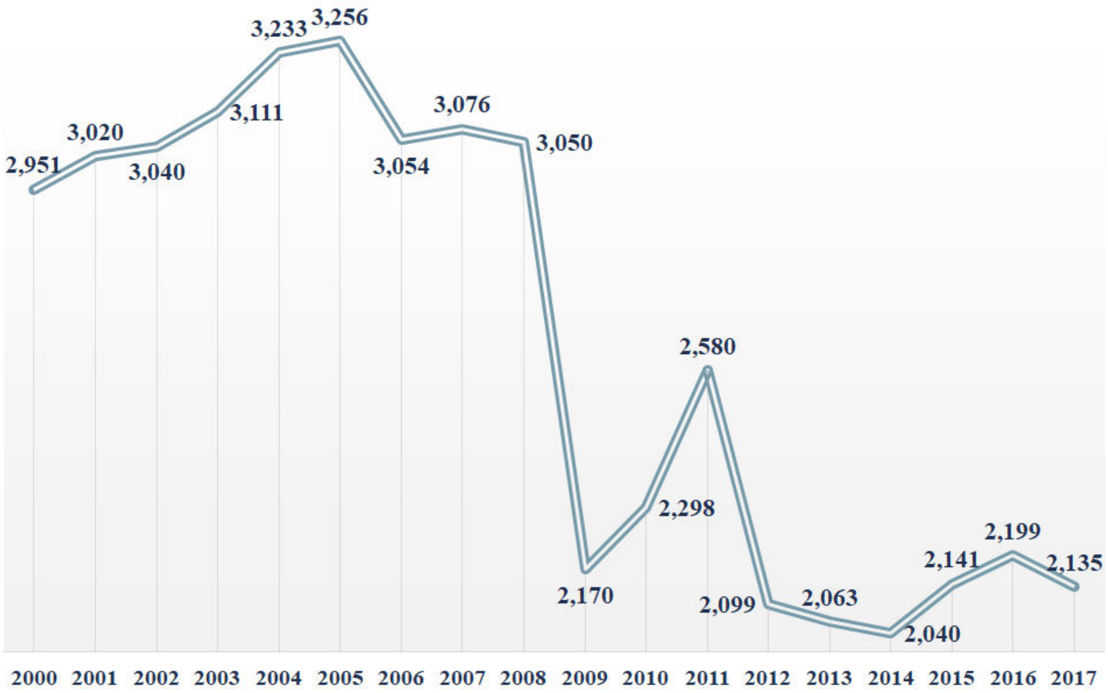
Table 2.4: Top 20 producers of primary aluminium, by capacity

Rank	Firm name	Annual capacity (thousand tonnes)	Parent country
1	China Hongqiao Group	7,802	CHN
2	UC Rusal	4,402	RUS
3	Xinfa Group	4,322	CHN
4	Aluminium Corporation of China (Chalco)	3,987	CHN
5	Alcoa	3,402	USA
6	Rio Tinto	3,389	GBR
7	State Power Investment Corporation (SPIC)	3,103	CHN
8	Emirates Global Aluminium	2,600	ARE
9	Henan Shenhuo Group	2,402	CHN
10	Yunnan Aluminium Co. Ltd.	2,216	CHN
11	East Hope Group	2,079	CHN
12	Norsk Hydro	2,060	NOR
13	Hangzhou Jinjiang Group	2,037	CHN
14	Vedanta Resources	1,570	IND
15	Jiuquan Iron and Steel Co. Ltd. (JISCO)	1,555	CHN
16	Hunan Zengshi Group	1,506	CHN
17	Qinghai Provincial Investment Group Co. Ltd.	1,374	CHN
18	Hindalco	1,343	IND
19	Shaanxi Youser Group	1,220	CHN
20	Vimetco N.V.	1,178	NLD

Source: OECD (2019)

Within the described trend, the decline of primary aluminium production has been particularly severe in the EU over the past few years (see Figure 2.15). Since 2008, primary production of primary aluminium shrank by 30%. Moreover, some primary aluminium producing countries, such as Italy (Alcoa smelters in Fusina and Portovesme, 2013-2014), UK (Rio Tinto Lynemouth smelter in Northumberland, 2012), and Netherlands (Klesch smelter in Vlissingen, 2011) have largely curtailed or entirely ceased their production over the last few years as a result of rising energy costs and stringent environmental regulation, coupled with falling aluminium prices and lower demand by major customers, especially by the automotive and construction sectors.

Figure 2.15: Primary production of aluminium in the EU (thousand tonnes)



Source: Authors on CRU Group

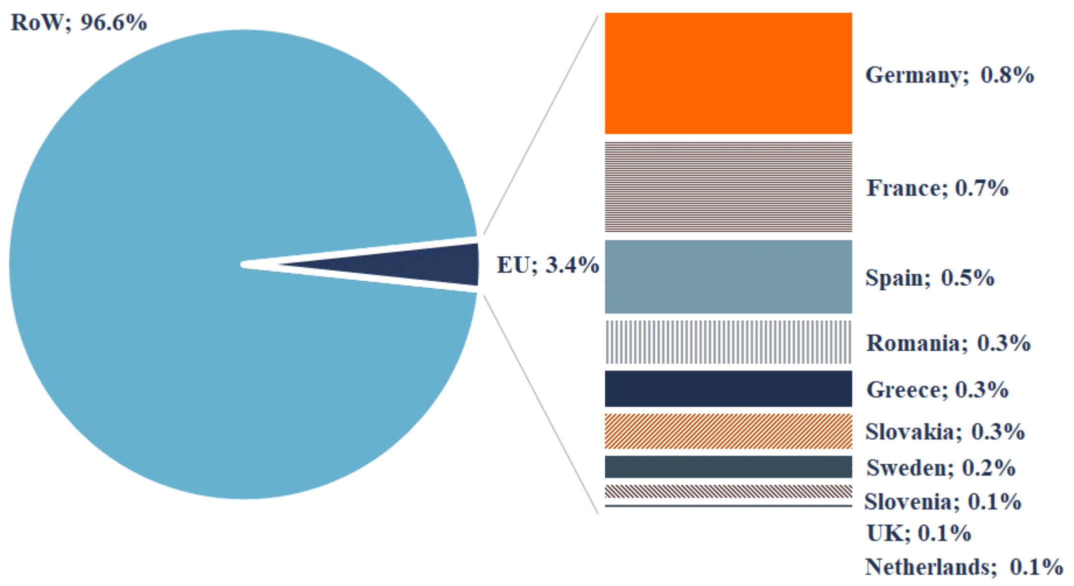
Table 2.5: EU production of primary aluminium (thousand tonnes)

Country	2000	2005	2010	2015	2016	2017	Δ 00-17
Germany	644	643	401	542	548	535	-17%
France	441	442	357	419	425	416	-6%
Spain	365	397	366	349	353	337	-8%
UK	305	366	186	47	46	40	-87%
Netherlands	302	334	214	31	57	36	-88%
Italy	189	193	135	0	0	0	-100%
Romania	179	244	207	207	208	210	17%
Greece	163	165	135	176	182	181	12%
Slovakia	110	159	163	171	174	174	58%
Sweden	100	103	93	116	123	123	23%
Slovenia	75	121	41	84	84	84	11%
Poland	45	55	0	0	0	0	-100%
Hungary	34	36	0	0	0	0	-100%
Total	2,951	3,256	2,298	2,141	2,199	2,135	-28%

Source: CRU Group

In this respect, note that while in 2009, total motor vehicle production in EU was 23% lower than in 2007, total production in 2017 was substantially similar to pre-crisis levels[17]. Between spring 2008 and early 2013, the amount of total construction in the EU declined quite dramatically. In total, the EU construction production index lost more than 30 percentage points. According to Eurostat, since spring 2013 the index began to increase steadily, reaching 90% of its former peak level in 2017[18]. The price of aluminium slumped almost 50% since its peak in spring 2008 and recovery started in early 2009.

Figure 2.16: EU primary production of aluminium by countries (in percentage of the global total, 2017)



Source: Authors on CRU Group and World Aluminium

Currently, a decreasing number of EU member states have aluminium smelters producing primary aluminium in any form (commodity ingots and value-added products, such as slabs, billets, foundry alloys, and wire rods). In terms of the geographical distribution of production, Germany, France, and Spain are the three countries with the largest share of production. In 2017, they produced roughly 60% of primary aluminium in EU (compared to 46% in 2008). However, these three countries represent just 2.0% of the global production of primary aluminium (see Figure 2.16).

As a result of the considerable disinvestments and resulting several smelter closures, the EU lost more than one quarter of its smelting capacity in the period 2008-2017. According to the European Aluminium, the number of smelters in operation in the EU decreased by 38% in the period 2002-2016. Closures have typically concerned old smelters (mostly built in the 1960s and early 1970s) with

[17] See https://www.acea.be/statistics/tag/category/production.

[18] https://ec.europa.eu/eurostat/statistics-explained/index.php/Construction_production_(volume)_index_overview#Main_tables

relatively small production capacities (average capacity of 104,000 metric tonnes per year). Moreover, it is worth noting that last October Alcoa announced the closure of two of its three aluminium smelters in Spain (in Aviles and La Coruña) with a combined production of 180,000 metric tonnes per year and respectively employing 317 and 369 employees. The aim of the US-based company is to reorganise production at a single plant (in San Ciprián, with a production capacity of 228,000 metric tonnes per year and 1,700 employees), which produces both alumina and aluminium[19]. However, Alcoa has also recently warned that also the financial viability of the remaining primary aluminium plant in San Ciprián would be put at risk if the Spanish government does not adopt specific measures to help large consumers of electricity[20].

Table 2.6 lists the number of plants actually operating in the EU, as well as in EFTA countries (that is, Iceland, Liechtenstein, Norway and Switzerland), and their total capacity in 2017, while shows the location of primary aluminium facilities in Europe (including smelters located in Montenegro, Bosnia-Herzegovina, and Turkey).

Table 2.6: Primary aluminium plants and production capacity in Europe (thousand tonnes, 2017)

Country	Number of plants	Capacity (thousand tonnes)	% of total capacity (EU + EFTA)
France	2	429	9.2
Germany	4	561	12.1
Greece	1	182	3.9
Netherlands	1	150	3.2
Spain*	3	408	8.8
Sweden	1	132	2.8
UK	1	48	1.0
Romania	1	265	5.7
Slovakia	1	174	3.7
Slovenia	1	84	1.8
EU	16	2,433	52.4
Iceland	3	876	18.9
Norway	8	1,336	28.8
EFTA	11	2,212	47.6
TOTAL	27	4,645	100.0

** Data does not consider the planned shutdown of three smelters owned by Alcoa.*

Source: European Aluminium

[19] https://investors.alcoa.com/news-releases/2018/10-17-2018-210949659.

[20] See https://cincodias.elpais.com/cincodias/2019/03/19/companias/1552988361_605259.html and https://www.elindependiente.com/economia/2019/03/19/alcoa-amenaza-cerrar-tambien-ultima-planta-espana-no-recibe-mas-ayudas/.

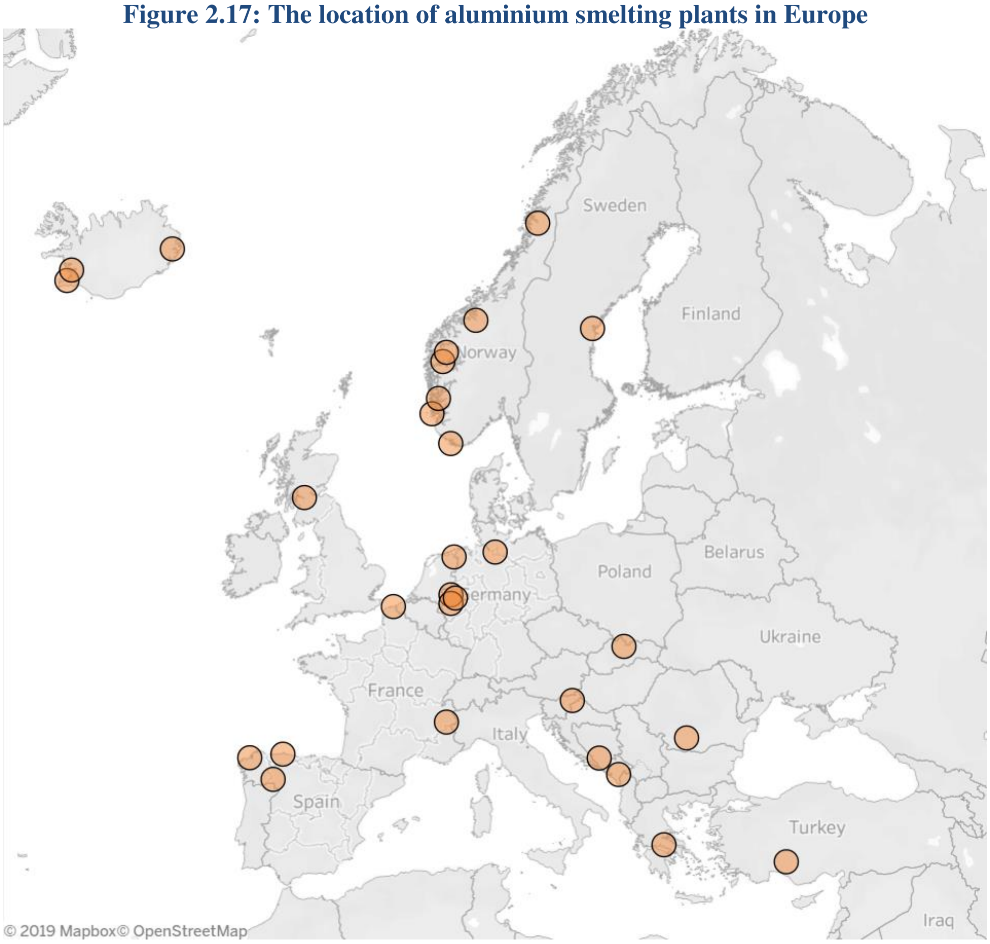
As already noted, Norway's and Iceland's smelters benefit from low-cost electricity (deriving from hydropower and large-scale geothermal power), and together account for slightly less than half of European production capacity (see Figure 2.17). The planned shutdown of at least two of the three smelters located in Spain will further concentrate European primary aluminium capacity in EFTA countries.

Six companies hold about 76% of the total production capacity in EU:

- Trimet Aluminium SE (22.5%) - with smelters located in Germany;
- Alcoa Corp. (16.8%) - with smelters located in Spain;
- Rio Tinto (11.7%) - with smelters located in France;
- ALRO S.A. (10.9%) - with a smelter located in Romania;
- Aluminium de Greece (7.5%) - with a smelter located in Greece, and;
- Norsk Hydro (6.6%) - with smelters located in Germany.

The same companies also have about 80.5% of the total European (including EFTA countries) primary aluminium production capacity, with Norsk Hydro and Alcoa together controlling slightly more than 48% of output capacity (respectively 26.2% and 22.3%).

Figure 2.17: The location of aluminium smelting plants in Europe



Source: European Aluminium Statistics (accessed March 6, 2019)

1.3.4. Production of secondary aluminium

Secondary aluminium is produced by recycling and remelting aluminium-bearing scrap and/or aluminium-bearing materials.

Aluminium scrap is often categorised as:

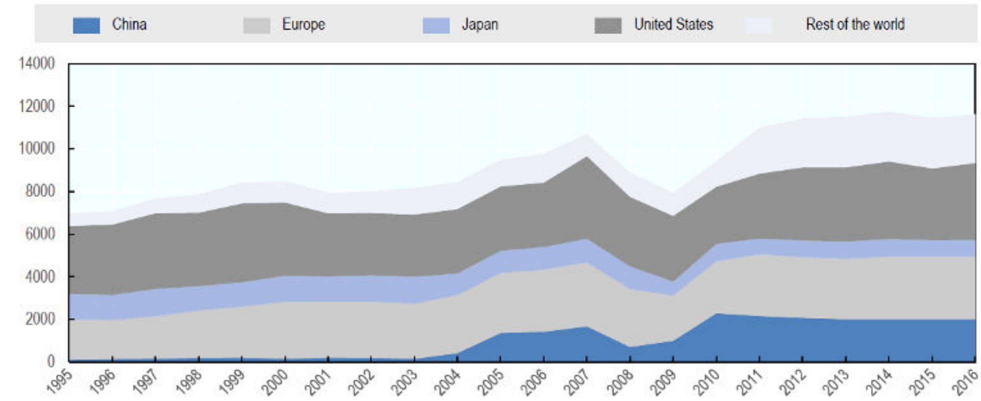
- “new” (post-manufacturing), which arises from primary aluminium production or from the manufacturing of aluminium semi-fabricated and final products, before the aluminium product is sold to the final user, and;
- “old” (post-consumer), which results from the collection and/ or treatment of products containing aluminium after use by consumers (e.g. beverage cans, automobiles, wires, and cables).

The secondary production of unwrought aluminium typically employs two different production processes.

- In the refining process, predominantly old scrap is used to produce casting alloys, mainly for the automotive industry. Additional metals and compounds are usually added during the refining process to achieve the requested composition for the finished product.
- In the remelting process, new scraps are used to produce wrought alloys, usually in the form of extrusion billets and rolling ingots.

The world’s largest secondary producers are usually large aluminium downstream transformers or manufacturing companies which produce the required secondary aluminium in-house to satisfy their needs of semi-finished aluminium products (extrusions, flat-rolled products and especially aluminium castings for the automotive industry). There are also large independent remelters. A wide range of alloyed products are substitutable between primary and secondary aluminium, especially aluminium obtained by processing “home scrap” (leftovers from secondary producers) and “prompt scrap” (leftovers from downstream transformers or their customers) in remelting facilities.

Figure 2.18: Global production of secondary (recycled) aluminium, 1995-2016 (thousand tonnes)



Source: OECD (2019)

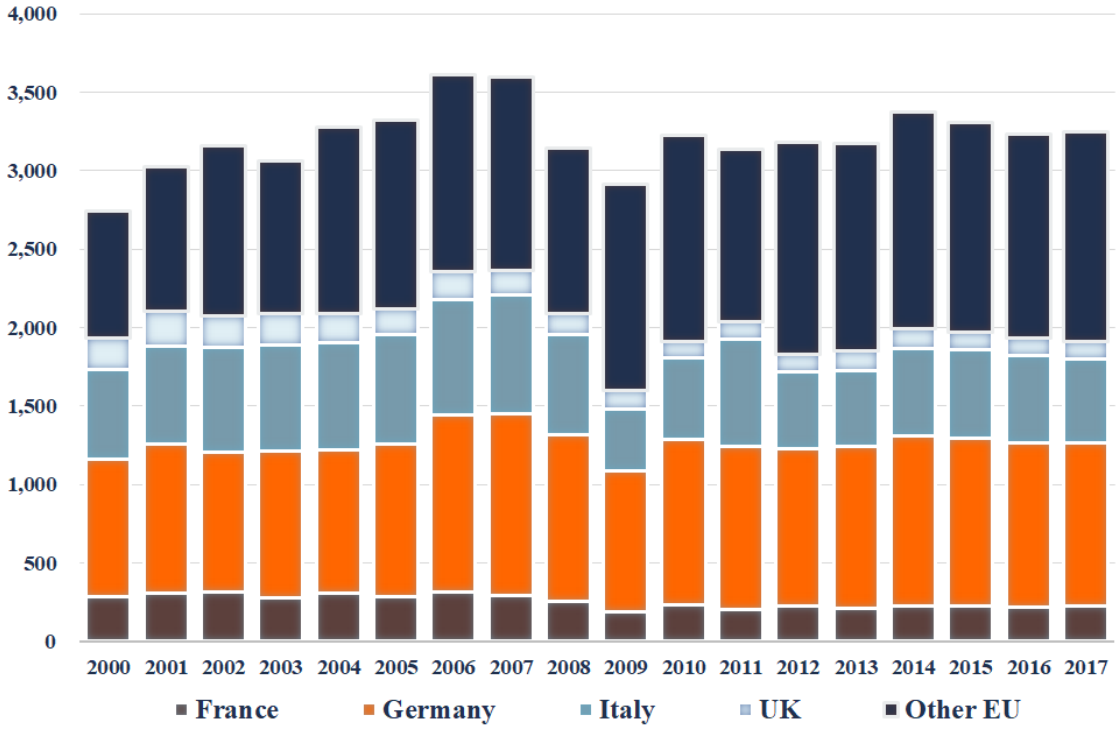
Scraps, including industrial waste and end-of-life products, are increasingly important in the aluminium industry as the most energy efficient method of producing aluminium (Ecorys, 2011). It has been estimated that remelting aluminium for new uses requires between 90 and 95% less energy than producing primary unwrought aluminium, as the energy-intensive phases of refining bauxite into alumina and smelting alumina into pure aluminium are not necessary (European Aluminium, 2015; United States International Trade Commission, 2017).

Unsurprisingly, secondary production is increasingly regarded as highly suitable for the EU, as well thanks to the increasing quantities of domestically-generated scrap available within the region (Material Economics, 2018). Note that in developed countries the aluminium stock in-use (per capita)— that is, the total amount of metal embodied in structures and products such as cars, buildings or machinery— is roughly 270-420 kg/capita.

The data available on secondary aluminium is not fully reliable. According to World Aluminium, in 2015, refiners and remelters produce around 27 million tonnes of recycled aluminium annually from old and traded new scrap, compared with 58 million tonnes of primary aluminium. The OECD (2019) recently reported significantly lower figures for the global production of secondary aluminium, amounting to about 12 million tonnes in 2016. Such disparities reflect the inherent difficulty of taking into account recycling and remelting activities, especially when these operations are carried out within vertically integrated firms or large manufacturers.

As illustrated by Figure 2.18, the United States, Japan, and European countries are major producers of secondary aluminium, although China is rapidly increasing its recycled aluminium output. Japan has decided to definitively cease producing primary aluminium and to focus on secondary production. It is estimated that secondary aluminium represented about 37% and 36%, respectively, of the total aluminium used in the United States and the EU in 2016.

Figure 2.19: Estimated secondary aluminium production for EU Member States, 2000-2017 (thousand tonnes)

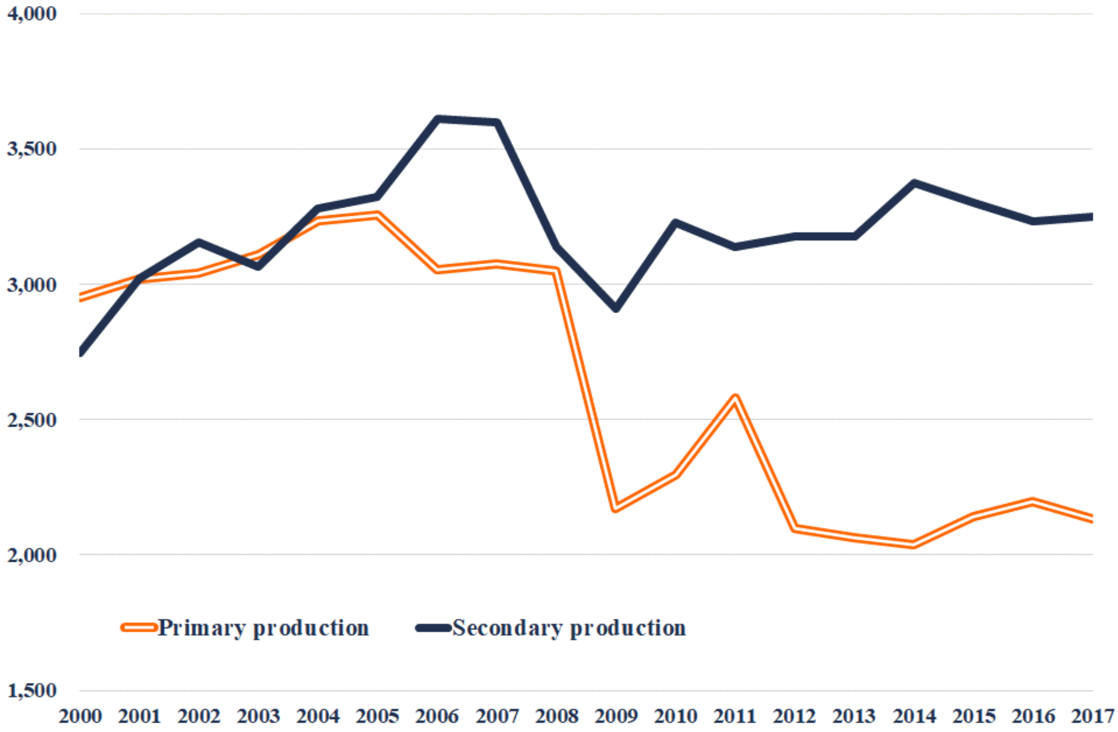


Source: CRU Group

As for the secondary production of unwrought aluminium in EU member states, the production output in 2017 was estimated at 3.2 million tonnes. Current production levels have not matched yet pre-crisis levels (ca. 3.6 million tonnes in 2007). In terms of the geographical distribution of production, Germany and Italy are the two countries with the largest share of production. In 2017, they both produced slightly less than 50% of the EU's secondary unwrought aluminium (see Figure 2.19).

As can be seen in Figure 2.20, the EU has produced more secondary than primary aluminium since 2004.

Figure 2.20: EU primary and secondary production of aluminium, 2000-2017 (thousand tonnes)

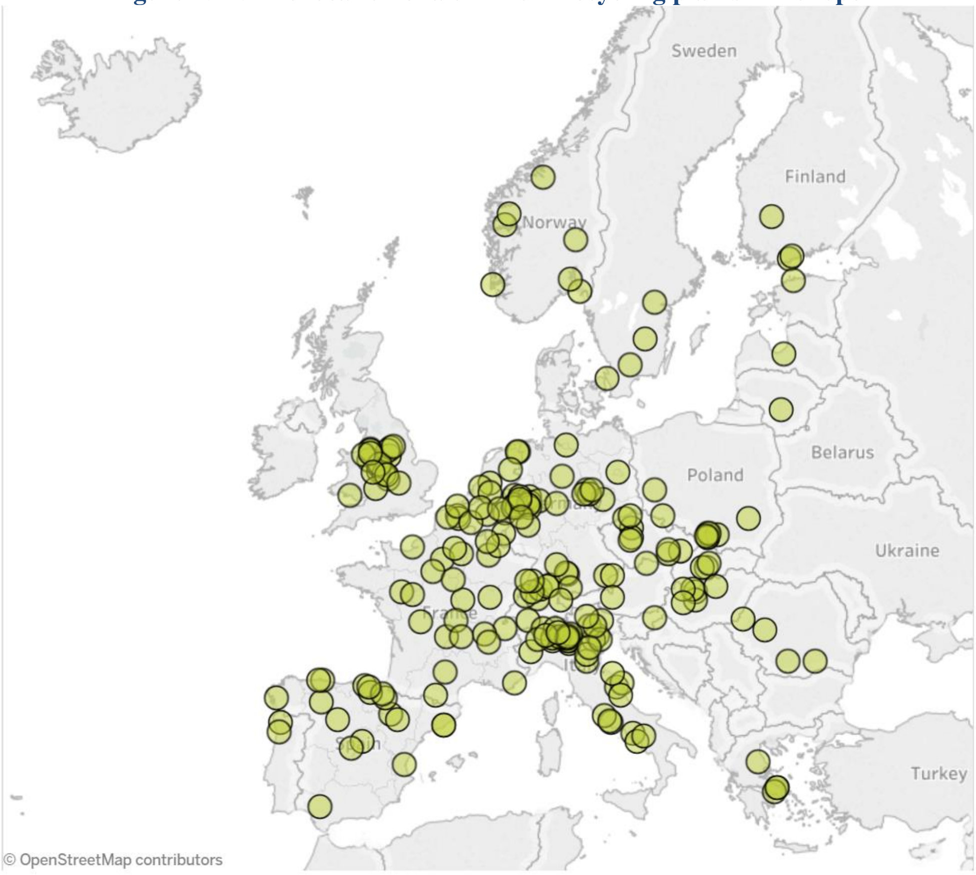


Source: CRU Group

According to European Aluminium (2015), there are about 220 recycling plants in Europe, many of which are small and medium-sized enterprises (SMEs) and family-owned businesses. There also large companies—such as Norsk Hydro, Hindalco's subsidiary Novelis, AMAG Austria Metall, and TRIMET Aluminium— operating aluminium recycling facilities as a part of their comprehensive activities throughout the aluminium value chain. These companies thus obtain in-house the secondary aluminium they need downstream for the production of semi-finished aluminium products (United States International Trade Commission, 2017).

Figure 2.21 shows the location of aluminium recycling plants in Europe. However, no reliable data on secondary aluminium capacity is currently available.

Figure 2.21: The location of aluminium recycling plants in Europe



Source: European Aluminium Statistics (accessed March 6, 2019)

1.4. Semi-finished aluminium products

The output of the primary and secondary aluminium producers, namely aluminium ingot products, such as slabs, billets, foundry (casting) alloy ingots and remelt ingots (T-bar, sow or standard ingots), are purchased by downstream operators to produce the semi-finished products (also called “wrought aluminium”, “semis,” or “mill products”) which are needed as inputs for other relevant sectors such as automotive, aerospace, mechanical engineering, packaging, building and construction, and consumer goods.

The downstream segment includes rollers, extruders, casters as well as other operators producing aluminium wire, powder, and slugs. Those firms employ different production processes to manufacture a very wide variety of goods serving a high number of sectors. Some semi-finished aluminium goods are commodities competing primarily on price, whereas others are highly engineered and differentiated, thus competing on their specific physical and performance characteristics, primarily given specific requirements by end-use industries.

From a structural perspective, a distinction should be made between downstream manufacturers which are vertically-integrated and those which are independently-owned firms. The former are often subsidiaries of large multinationals that also have sizable upstream operations (producing primary aluminium and sometimes bauxite and alumina). The latter includes local, specialised SMEs often serving a single customer, e.g. a car manufacturer (OECD, 2019). In some cases, downstream manufacturers have also diversified their activities by producing different semi-finished products, e.g. aluminium extrusions and flat-rolled products.

Since the purchase of unwrought aluminium accounts for at least 50% of downstream transformers' total production costs, producers of semi-finished products are highly exposed to the economic conditions and physical availability of unwrought aluminium. Price fluctuations at global level, closely related to London Metal Exchange (LME) quotes, as well as local supply and demand conditions, strongly influence downstream activities and their competitiveness.

Independently-owned downstream producers do not only have limited bargaining power vis-à-vis their suppliers (primary and/or secondary producers), but also face highly concentrated demand for their products. Especially in end-user markets where price competition is fierce (during economic crises in particular), downstream transformers are constantly asked to cut costs by their customers; this pressure inevitably results in squeezing their margins whenever corresponding reductions in the costs of production inputs cannot be obtained. Intuitively, limited bargaining power vis-à-vis their suppliers (primary and/or secondary producers) often hampers small independently-owned downstream producers.

In the following section, we focus on the three main segments of the downstream industry: rolling, extruding, and casting. Wire and cable segments are not the object of this study. The three segments of rolling, extruding, and casting account approximately for 90% of the EU's production of aluminium semi-finished products.

Flat Rolled Products (FRPs) are produced through a process that reduces the thickness of aluminium alloys in order to obtain aluminium plates, sheets, and foils. Indeed, FRPs are called plates (at least 6 mm thick), sheets (less than 6 mm thick), and foils (the thinner ones, less than 0.2 mm thick)[21]. Raw materials for FRPs manufacturing are slabs (for rolling) and ingots (for continues casting process). Slabs can be produced at smelters or can be produced by remelting commodity ingots and/or scrap. FRPs can be different not only in thickness, but also in weight and length according to the characteristics of the final output.

The main industrial sector driving demand for FRPs is the packaging industry. In fact, rolled products are the main component of food and beverage containers, tubes and bottles, semi-rigid containers, wrapping foil, converted foil, aseptic packaging, and bottle caps and closures. Another sector that uses very large quantities of rolled aluminium in its production process is the transport sector. The automotive industry is one of the main consumers of rolled aluminium, which it mainly uses for radiators and the bodies of cars, trucks, trailers and buses. FRPs are also used in the aerospace industry, to produce the body, wings or baggage containers of aircraft. Finally, the rail segment is another user of rolled aluminium, as well as the maritime sector which employs rolled aluminium in the production of the hulls of small boats and the superstructure on ships. The electrical sector uses rolled aluminium in smaller proportions, mainly to produce cable wrap, while the engineering sector needs those products in order to produce off-shore oil and gas platforms, printing plates, general parts for machinery, and defence and armour equipment. The construction sector needs rolled aluminium to produce cladding and siding, roofs, caravans and mobile homes, road signs, and street furniture. Finally, rolled aluminium

[21] For a more detailed description of different groups of FRPs, see GRIF (2015).

is purchased by sectors producing consumer durables, mainly in lighting, refrigerators and air conditioners, domestic appliances and cookware.

Extrusions come in a wide range of diverse and complex shapes (profiles), and are produced by placing aluminium in the shape of a billet in a container and by forcing it under pressure through a steel die[22]. Aluminium billets, produced at smelters or by remelting commodity ingots and/or scrap, are fundamental inputs in the extrusion process. Superior physical characteristics, including high strength-to-weight ratio, formability, and a relatively low melting point, make aluminium an ideal material for extrusion. The extrusion process for aluminium is thus relatively simple and cost-effective.

As a result, extruded products are used in a wide variety of end-use applications and industries, such as transport, building, aerospace, renewable energy, among others. Moreover, technological advances and product designers' creativity constantly open the door to new extruded products or new applications. Transport and construction are sectors where extruded aluminium components have been most commonly incorporated into final products. As for transport, aluminium profiles are employed in the automotive industry (car and truck components), the aerospace industry (structural components), and the rail industry (passenger car frames). In construction and building, extruded components have typically been incorporated into windows, doors, sunshades, and light shelves. Extruded aluminium components are commonly used in industries such as consumer durables (e.g. domestic appliances), those producing engineered products (e.g. irrigation systems, machinery, defence equipment, renewable energy).

Finally, aluminium castings are manufactured in foundries by allowing aluminium foundry alloys (either primary or secondary), commodity ingots and aluminium scrap to melt in a furnace and by introducing the molten aluminium into a mould where it solidifies. The term "casting" properly identifies the solidified part which is ejected or broken out of the mould.

Aluminium castings range from engineering components and builders' hardware to automotive parts, such as cylinder heads, engine blocks, transmission housings, oil pans, wheels; from aircraft components and structures to marine engines. There is often a strong connection between product requirements, alloy candidates and the process to be used. The dimension, design features, and material property requirements of the product limit the range of alloy candidates, which in turn influences the choice of casting method[23]. In many cases, the selection is imposed by the end-users on the basis of the final application of aluminium castings and their required mechanical properties. Although the bulk of the casting products are shipped to the transport sector, many small appliances, lawnmowers, cookware and hand tools are made from aluminium castings. The extreme versatility of casting products is also reflected by the possibility of using more than 300 aluminium alloys.

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[22] For a more detailed description of different semi-finished extruded products (that is, profiles or extruded sections), see GRIF (2015).

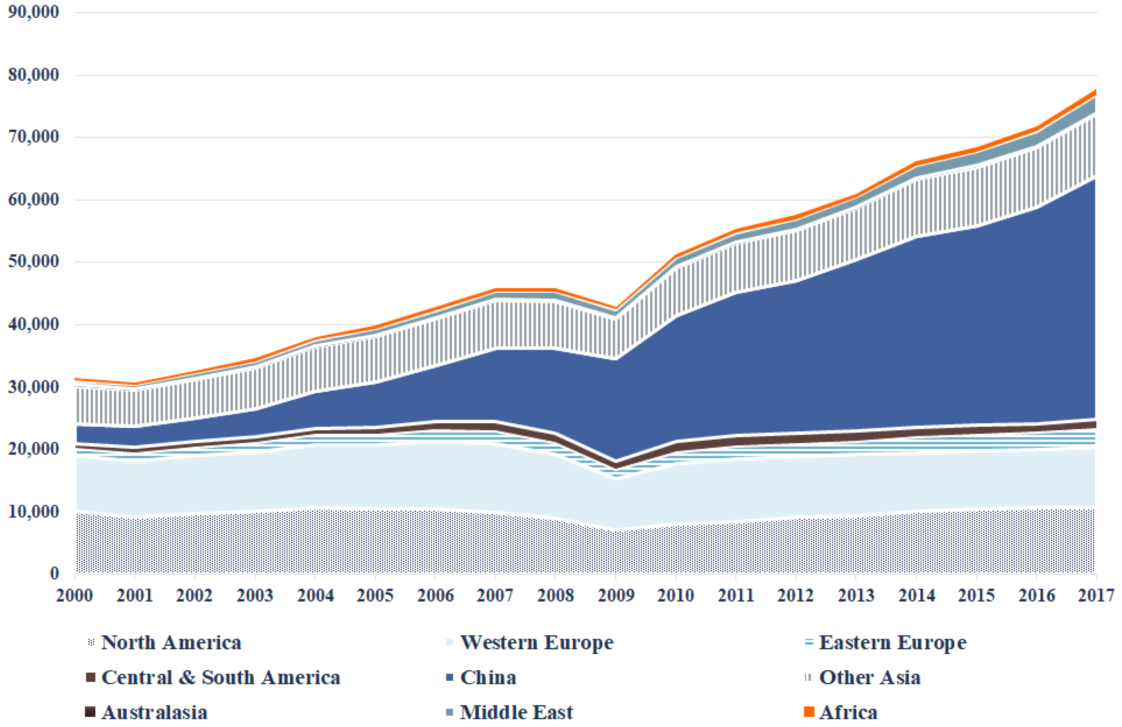
[23] For a more detailed discussion about the complex interactions between casting alloys, foundry practices and thermal treatments and their relevance for different end-uses, see GRIF (2015).

1.4.1. Global and EU production

Global manufacturing of the selected semi-finished aluminium products (aluminium extrusions, FRPs and aluminium castings) increased by 147% over the period 2000-2017, rising to 77.7 million tonnes in 2017. When including wire and cable production, the total output of semi-finished aluminium in 2017 amounted to 87.8 million tonnes.

Still, China drove much of this expansion, as production of wrought aluminium increased almost thirteenfold in the same period (from 3.1 million tonnes in 2010 to 39 million tonnes in 2017), markedly above the much more limited growth, of around 36%, which all other regions enjoyed (see Figure 2.22).

Figure 2.22: Global production of semi-finished aluminium products (thousand tonnes)



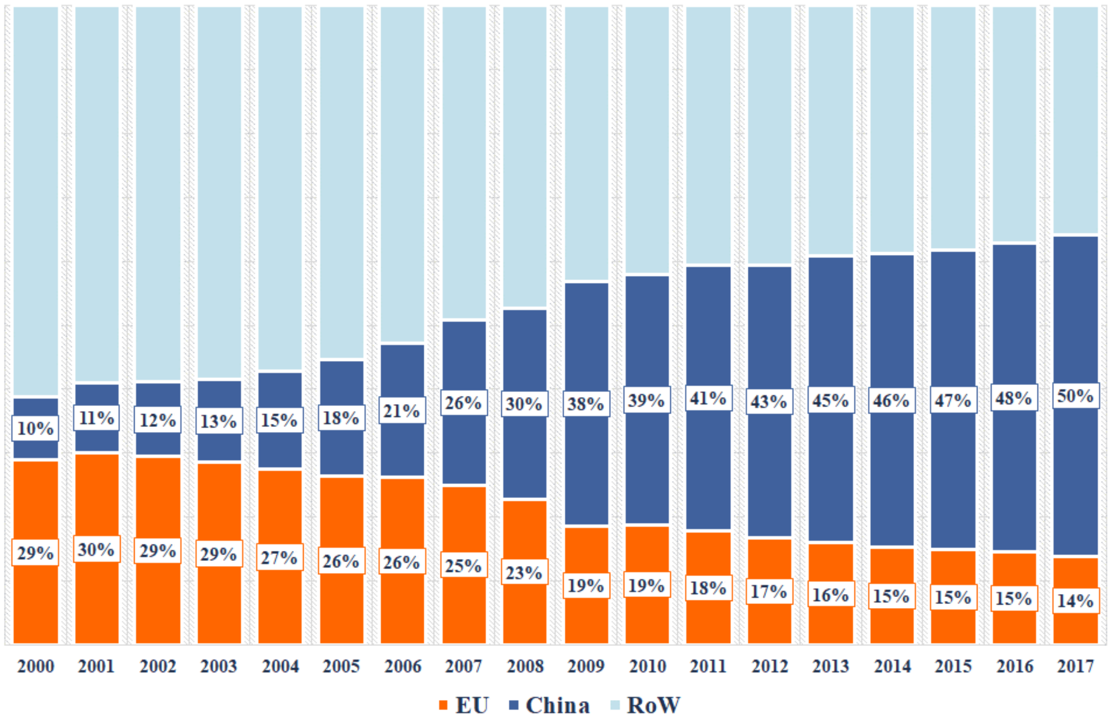
Source: CRU Group

Over the period 2000-2017, positive trends were observed across all regions, with the sole exception of Australasia (-43%). Apart from China, the production of semi-finished aluminium products increased in particular in the Middle East (+323%) and Eastern Europe (+175%), while in North America and Western Europe it increased only slightly (5% and 8%, respectively). Over the same period, although the EU's production volumes grew by about 18%, the EU's share in global manufacturing of semi-finished aluminium products consistently declined, from 29% in 2000 to 14% in 2017 (see Figure 2.23).

Over the last six years, China, North America and the European Union have remained the largest producing regions of semi-finished aluminium products in the world (see Table 2.7). However, the compound annual growth rate remained strong only in China, about 9.7%, noticeably higher than those recorded in North America and EU (respectively 2.2% and 2.4%). Production volumes are growing particularly rapidly in Middle Eastern countries (10.0%). Conversely, in Australasia and Central &

South America, the period 2012-2017 was characterized by a strong decline in production (-16.5% and -1.7%, respectively).

Figure 2.23: EU share of the global production of semi-finished aluminium products (percentage)



Source: CRU Group

Table 2.7: Production of semi-finished aluminium products, by countries and product categories, 2012– 17 (thousand tonnes)

Region/Country	2012	2013	2014	2015	2016	2017	Δ 12-17	CAGR
North America	9,489	9,684	10,138	10,398	10,550	10,585	12%	2.2%
USA	*7,968*	*8,101*	*8,427*	*8,615*	*8,723*	*8,698*	*9%*	*1.8%*
Canada	*684*	*693*	*717*	*771*	*778*	*793*	*16%*	*3.0%*
Mexico	*837*	*890*	*994*	*1,012*	*1,049*	*1,095*	*31%*	*5.5%*
EU	9,544	9,557	9,907	10,112	10,425	10,760	13%	2.4%
Germany	*3,144*	*3,200*	*3,352*	*3,418*	*3,478*	*3,526*	*12%*	*2.3%*
Italy	*1,879*	*1,838*	*1,824*	*1,906*	*1,969*	*2,095*	*11%*	*2.2%*
Other Europe	2,533	2,646	2,675	2,658	2,728	2,952	17%	3.1%
Russian Federation	*1,029*	*1,056*	*988*	*916*	*925*	*967*	*-6%*	*-1.2%*
Total Asia	35,000	38,426	41,720	43,623	46,646	51,915	48%	8.2%
China	*24,619*	*27,835*	*30,468*	*32,045*	*34,614*	*39,096*	*59%*	*9.7%*
Japan	*3,379*	*3338*	*3,447*	*3,382*	*3,405*	*3,527*	*4%*	*0.9%*
India	*1,562*	*1,562*	*1,658*	*1,737*	*1,864*	*1,921*	*23%*	*4.2%*
Rest of Asia	*3,625*	*3,805*	*4,033*	*4,209*	*4,321*	*4,445*	*23%*	*4.2%*
Middle East	*1,815*	*1,886*	*2,068*	*2,245*	*2,442*	*2,925*	*61%*	*10.0%*

Australasia	423	421	367	227	223	172	-59%	-16.5%
Africa	693	682	711	728	800	900	30%	5.4%
Central & South America	1,595	1,666	1,608	1,500	1,408	1,462	-8%	-1.7%
Total	58,618	62,431	66,413	68,451	71,828	77,753	33%	5.8%

Product	2012	2013	2014	2015	2016	2017	Δ 12-17	CAGR
Extrusions	22,521	24,387	25,949	26,725	28,112	29,695	32%	5.7%
FRPs	20,417	21,596	22,999	23,716	24,802	26,253	29%	5.2%
Castings	15,679	16,447	17,465	18,010	18,913	21,805	39%	6.8%
Total	58,618	62,431	66,413	68,451	71,828	77,753	33%	5.8%

Source: CRU Group

The increase in production volumes was substantially similar in all three categories of semi-finished products. In 2017, aluminium extrusions accounted for the largest share (over 38%) of global production of semi-finished aluminium products, followed by flat-rolled products (slightly less than 34%). Although aluminium castings represented the smallest share of total semi-finished output, they experienced the largest growth, with production volumes rising by 39% over the period 2012-2017.

Germany, Italy, and France are the largest producers of wrought aluminium in the European Union, representing about 62% of the total production of semis in 2017 (see Table 2.8). The role of these countries even increased over the period 2000-2017, given that they represented 57% of the total output of semis in 2000. By 2017, all three countries had fully recovered their pre-crisis production levels of semi-finished products.

Table 2.8: EU Production of semi-finished aluminium products, by countries and product categories, 2000, 2007, 2012– 17 (thousand tonnes)

Country	2000	2007	2012	2013	2014	2015	2016	2017	Δ 00-17	CAGR
France	983	988	992	959	994	1,026	1,067	1,077	10%	0.5%
Germany	2,632	3,432	3,144	3,200	3,352	3,418	3,478	3,526	34%	1.7%
Italy	1,628	1,884	1,879	1,838	1,824	1,906	1,969	2,095	29%	1.5%
Spain	632	875	753	728	714	739	776	764	21%	1.1%
UK	638	484	282	310	317	309	325	356	-44%	-3.4%
Other countries	2,803	3,883	2,121	2,177	2,353	2,371	2,455	2,612	-7%	-0.4%
Total	9,124	11,483	9,544	9,557	9,907	10,112	10,425	10,760	17.9%	1.0%

Product	2000	2007	2012	2013	2014	2015	2016	2017	Δ 00-17	CAGR
Extrusions	2,797	3,850	2,622	2,519	2,585	2,576	2,658	2,733	-2%	-0.1%
Flat-Rolled Products	3,796	4,440	4,044	4,136	4,228	4,264	4,406	4,503	19%	1.0%
Castings	2,531	3,193	2,878	2,902	3,093	3,272	3,361	3,524	39%	2.0%

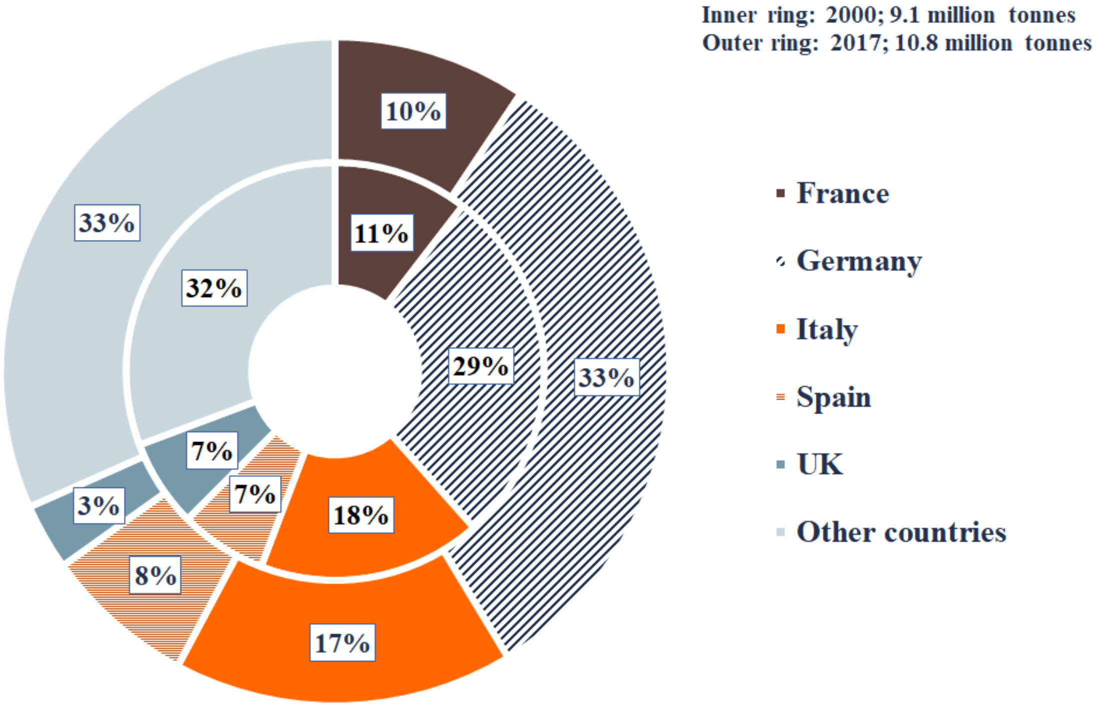
Total	9,124	11,483	9,544	9,557	9,907	10,112	10,425	10,760	17.9%	1.0%

Source: CRU Group

During the period 2000-2017, especially after the economic downturn, Germany further strengthened its leadership in aluminium semis manufacturing (+34%) from 2.6 million tonnes in 2000 to 3.5 million tonnes in 2017; it now constitutes about one third of the EU's total production (its share was 29% in 2000). Conversely, the UK experienced a substantial contraction of production volumes (-44%). As a result, its share of the EU's total production of semi-finished products dropped from 7% to 3%. France, Italy and Spain have roughly maintained their share of total EU production.

As a result, other member states have progressively seen their relative production shrink with regards to the EU's total output, cumulatively representing less than one third in 2017 (See Figure 2.24).

Figure 2.24: EU production of wrought aluminium by countries (percentage)



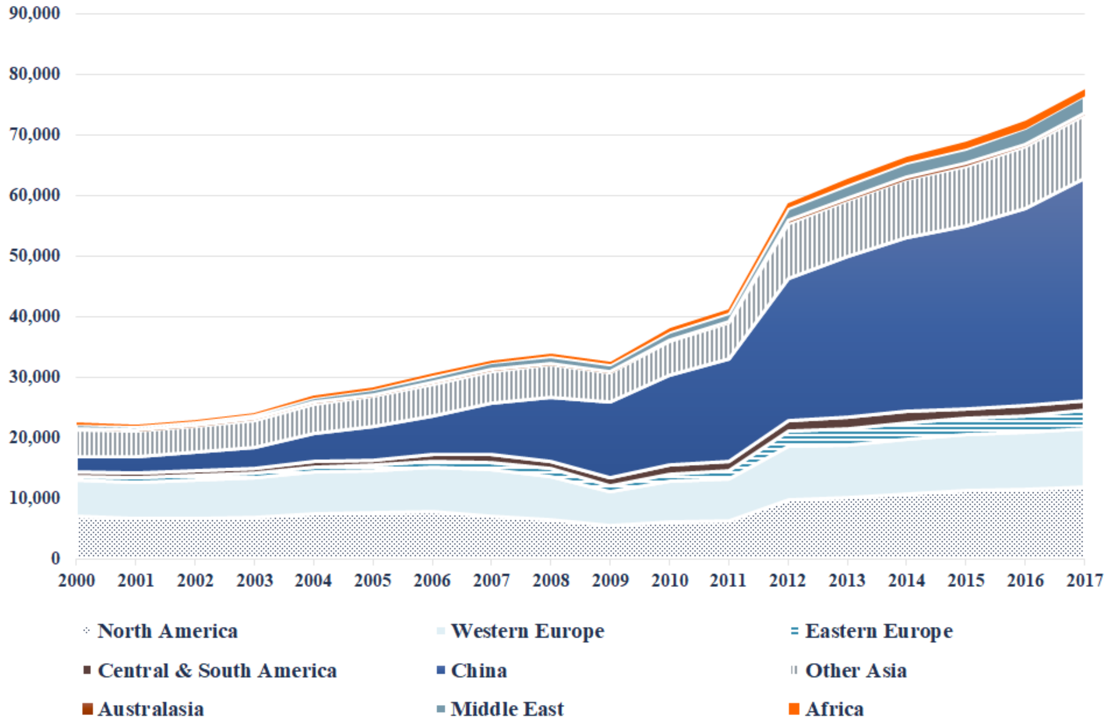
Source: CRU Group

From 2000 to 2017, the increase in the EU's output of semi-finished aluminium products has been mainly driven by castings (+39%) and flat-rolled products (+19%). Current volumes of aluminium extrusions production (roughly 2.7 million tonnes) are not only yet to recover pre-crisis levels (2007), but are even below the figures from the year 2000.

1.4.2. Global and EU consumption

The global demand for the selected semi-finished aluminium products (aluminium extrusions, FRPs and aluminium castings) has increased in the period 2000-2017 from 22.5 to 77.6 million tonnes (see Figure 2.25)[24].

Figure 2.25: Global consumption of semi-finished aluminium products (thousand tonnes)



Aluminium castings data are not available for the period 2000-2011.
Source: CRU Group

Global consumption of aluminium semi-finished products has mainly been driven by China. In 2017, the Chinese economy's demand for aluminium semis was 36.6 million tonnes, fifteen times higher than in 2000, and represented about 47% of the global consumption of aluminium semi-finished products. In 2017, the Chinese market was more than four times larger than the second-largest market, the USA, and ten times higher than the third-largest market, Germany.

In 2017, 60% of the world's aluminium extrusions, flat-rolled products and aluminium castings were directed to the Asia Pacific area, while Europe (both Western and Eastern), and North America respectively accounted for 16% and 15% of the global demand (see Figure 2.26).

Between 2012 and 2017, Asian countries' consumption grew by a CAGR of 7.6%, reaching 49.8 million tonnes. Still, the largest increase during this period occurred in China and the Middle East, which registering a CAGR of 9.4% and 6.6%, respectively, from 2012 to 2017.

24 Note that the figures do not include the consumption of aluminium castings for the period 2000-2011.

The increase in consumption of semi-finished products was mainly the result of infrastructure spending and growing domestic demand and private consumption resulting from high level of GDP per capita. Developed economies, such as the USA, Japan, and the various member states of the European Union, experienced slower growth in consumption, whereas the other European countries (including Russia) and Australasia suffered from a decline in demand for semi-finished aluminium products (see Table 2.9).

Table 2.9: Consumption of semi-finished aluminium products, by countries and product categories, 2012–17 (thousand tonnes)

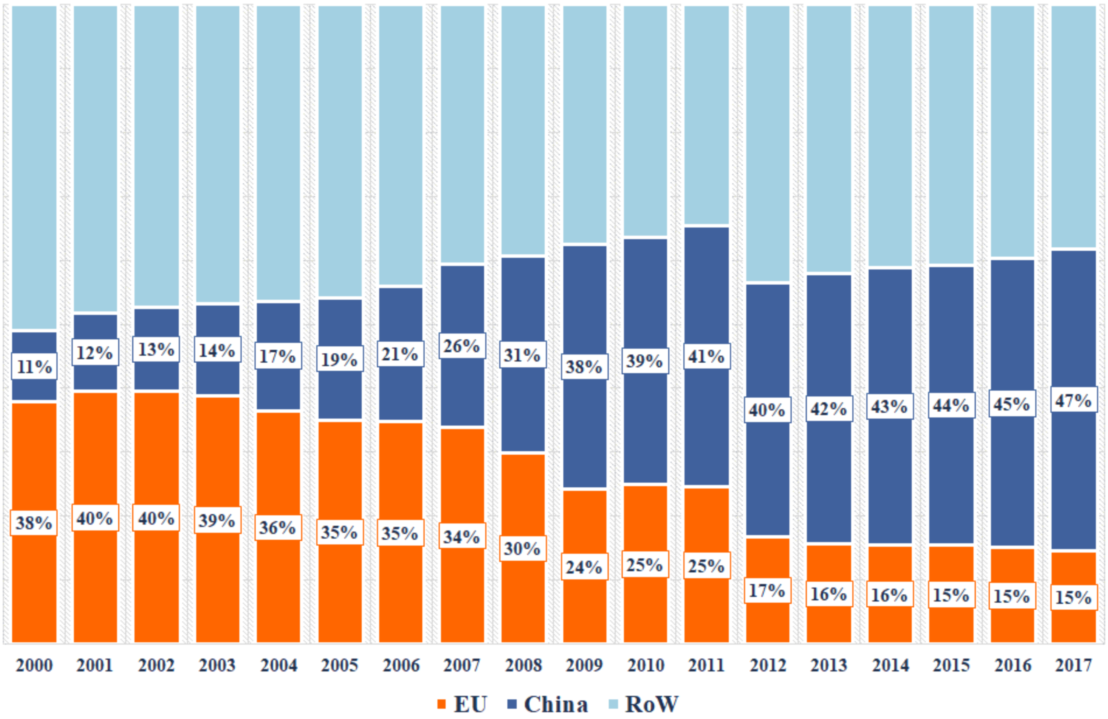
Region/Country	2012	2013	2014	2015	2016	2017	Δ 12-17	CAGR
North America	9,885	10,175	10,804	11,281	11,547	11,874	20%	3.7%
USA	*7,879*	*8,029*	*8,489*	*8,858*	*9,046*	*9,269*	*18%*	*3.3%*
Mexico & Canada	*2,006*	*2,145*	*2,314*	*2,423*	*2,501*	*2,605*	*30%*	*5.4%*
EU	9,780	9,845	10,301	10,594	10,869	11,318	16%	3.0%
Germany	*3,209*	*3,236*	*3,461*	*3,552*	*3,585*	*3,590*	*12%*	*2.3%*
Italy	*1,483*	*1,454*	*1,466*	*1,515*	*1,530*	*1,633*	*10%*	*1.9%*
Other Europe	1,508	1,577	1,407	1,303	1,270	1,396	-7%	-1.5%
Russian Federation	*975*	*978*	*890*	*795*	*769*	*836*	*-14%*	*-3.0%*
Total Asia	34,455	37,793	40,573	42,384	45,333	49,807	45%	7.6%
China	*23,425*	*26,414*	*28,706*	*30,165*	*32,633*	*36,664*	*57%*	*9.4%*
Japan	*3,271*	*3,245*	*3,322*	*3,234*	*3,316*	*3,431*	*5%*	*1.0%*
India	*1,645*	*1,610*	*1,680*	*1,814*	*1,934*	*1,982*	*20%*	*3.8%*
Rest of Asia	*4,105*	*4,391*	*4,559*	*4,707*	*4,868*	*4,965*	*21%*	*3.9%*
Middle East	*2,009*	*2,132*	*2,307*	*2,464*	*2,582*	*2,765*	*38%*	*6.6%*
Australasia	444	448	439	443	439	382	-14%	-3.0%
Africa	1,145	1,237	1,236	1,245	1,246	1,185	4%	0.7%
Central & South America	1,487	1,563	1,551	1,543	1,532	1,630	10%	1.9%
Total	58,701	62,563	66,312	68,793	72,235	77,592	32%	5.7%

Product	2012	2013	2014	2015	2016	2017	Δ 12-17	CAGR
Extrusions	22,537	24,421	25,826	26,724	28,192	29,768	32%	5.7%
Flat-Rolled Products	20,485	21,694	23,021	24,059	25,130	26,026	27%	4.9%
Castings	15,679	16,447	17,465	18,010	18,913	21,798	39%	6.8%
Total	58,701	62,563	66,312	68,793	72,235	77,592	32%	5.7%

Source: CRU Group

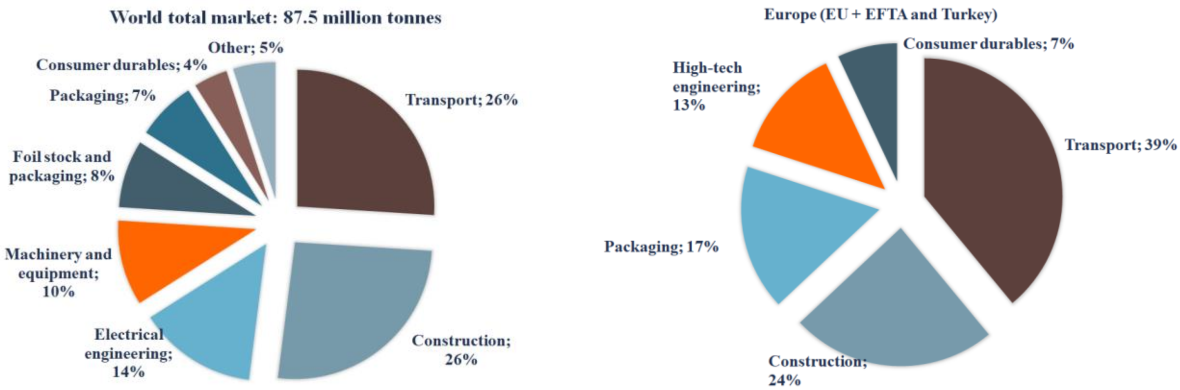
In 2017, the semi-finished products produced by all the downstream segments of aluminium market (thus including wire and cable production) were primarily purchased by the transport sector (26%) and building and construction (26%), followed by packaging (15%), electrical engineering (14%), machinery and equipment (9%), consumer durables (5%), and other sectors (5%). As far as Western Europe is concerned (specific data on EU member states is not available), the transport sector (42%) is the single largest end-user sector, followed by construction (23%) and packaging (17%); together, these three sectors accounted for more than 80% of all wrought aluminium products consumed in Europe in 2017 (see Figure 2.27).

Figure 2.26: EU share of global production of semi-finished aluminium products (percentage)



** Aluminium castings data are not available for the period 2000-2011.*
Source: CRU Group

Figure 2.27: Global demand for semi-finished aluminium products in 2017, by sector



Source: authors' elaboration based on Götz (2018) and Norsk Hydro ASA (2018)

In the broader period between 2000 and 2017, EU demand for semi-finished aluminium products increased by a CAGR of 1.7%, mainly driven by demand for aluminium castings (+40%) and by demand from the automotive and aerospace sectors, which are the largest consuming end-use markets for these product categories (see Table 2.10). Apart from Germany, the trend in aluminium semis consumption was substantially flat or even negative in all the major EU markets, including France (0.6%), Italy (-0.2%), Spain (-0.2%), and UK (0.7%). In 2017, Germany's demand for aluminium semis was 3.6 million tonnes, and represented ca. 31% of the EU28's total consumption. In the same period, other EU member states' share of total consumption also increased (from 26% in 2000 to 32% in 2017); Poland's share of both flat-rolled products and aluminium castings especially increased.

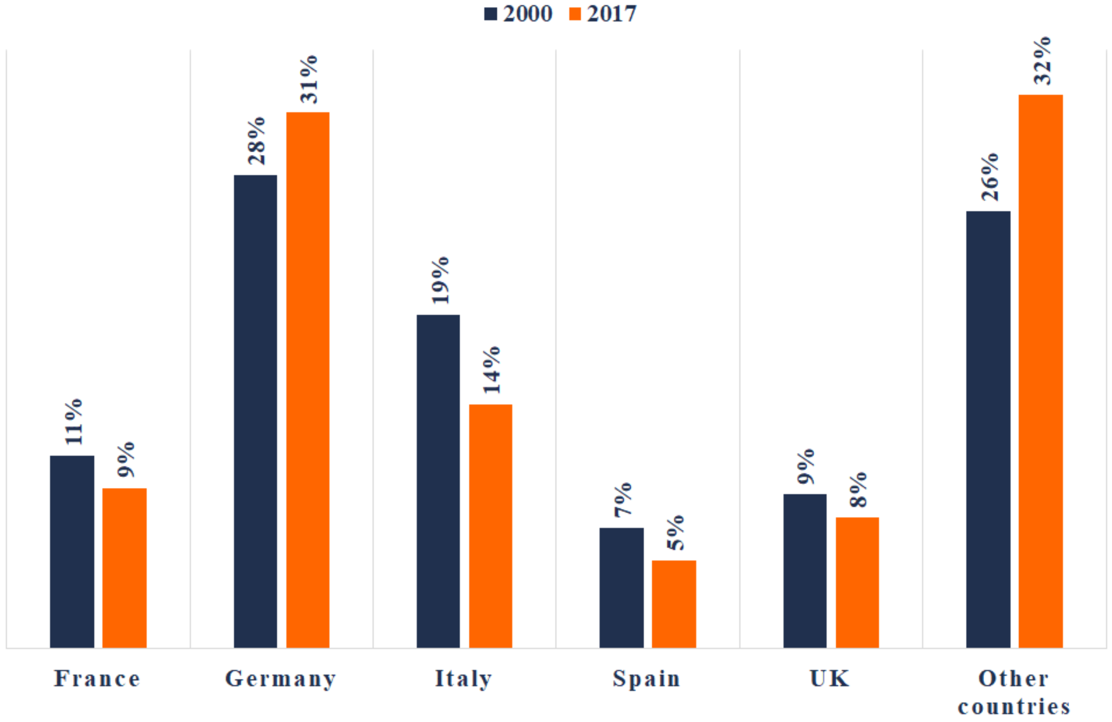
Table 2.10: EU Consumption of semi-finished aluminium products, by countries and product categories, 2000, 2007, 2012– 17 (thousand tonnes)

Country	2000	2007	2012	2013	2014	2015	2016	2017	Δ 00-17	CAGR
France	971	1,032	1,055	1,012	1,011	1,011	1,042	1,074	11%	0.6%
Germany	2,386	3,321	3,209	3,236	3,461	3,552	3,585	3,590	50%	2.4%
Italy	1,680	2,000	1,483	1,454	1,466	1,515	1,530	1,633	-3%	-0.2%
Spain	605	876	410	423	438	485	534	585	-3%	-0.2%
UK	776	837	706	743	805	836	864	872	12%	0.7%
Other countries	2,205	3,142	3,040	3,104	3,252	3,336	3,458	3,711	68%	3.1%
Total	8,622	11,209	9,904	9,971	10,433	10,735	11,012	11,465	33.0%	1.7%

Product	2000	2007	2012	2013	2014	2015	2016	2017	Δ 00-17	CAGR
Extrusions	2,349	3,431	2,821	2,769	2,885	2,856	2,913	3,087	31%	1.6%
Flat-Rolled Products	3,650	4,466	4,081	4,174	4,323	4,465	4,595	4,707	29%	1.5%
Castings	2,624	3,312	3,002	3,028	3,225	3,413	3,505	3,671	40%	2.0%
Total	8,622	11,209	9,904	9,971	10,433	10,735	11,012	11,465	33.0%	1.7%

Source: CRU Group

Figure 2.28: EU consumption of wrought aluminium by countries (percentage)



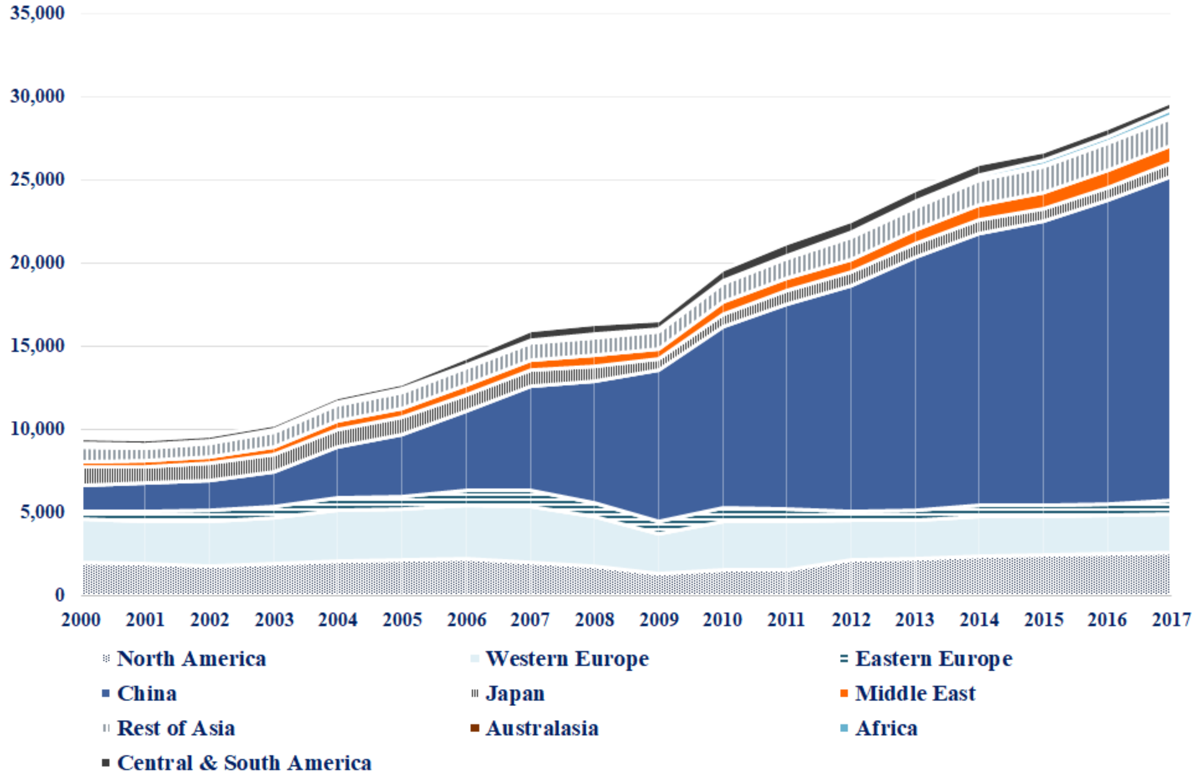
Source: CRU Group

1.4.3. Aluminium extrusions

Building and construction, transport, machinery, consumer durables drive growth in the demand for extrusions. Global production of aluminium extrusions (bars, rods, profiles, and tubes) amounted to roughly 29.7 million tonnes in 2017—almost 6% more than the previous year. As shown in Figure 2.24, production of aluminium extrusions more than tripled based on 2000 levels, largely as a result of the dramatic increase in Chinese production.

The aluminium extrusions produced in China now account for two-thirds of the total production of extrusions, which rose from 1.6 million tonnes in 2000 to 19.5 million tonnes in 2017. Output growth has also been very impressive in Middle Eastern countries, which tripled their production. More generally, manufacturing of aluminium extrusions increased in all regions with the exception of Western Europe, Japan and Australasia. Production of aluminium extrusions in Western Europe was 10% lower in 2017 than it had been at the turn of the millennium, but the fall has been even more marked in Japan, where production of aluminium extrusions fell from 1.1 million tonnes in 2000 to 0.8 million tonnes in 2017 (-28%).

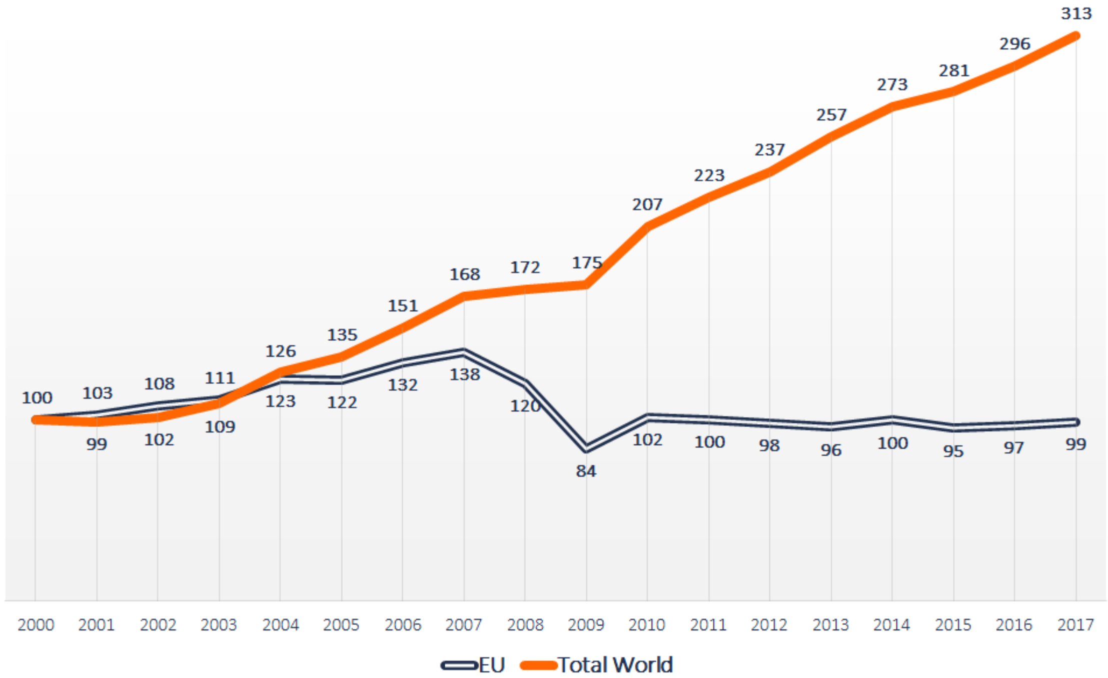
Figure 2.29: Global production of aluminium extrusions, 2000-2017 (thousand tonnes)



Source: CRU Group

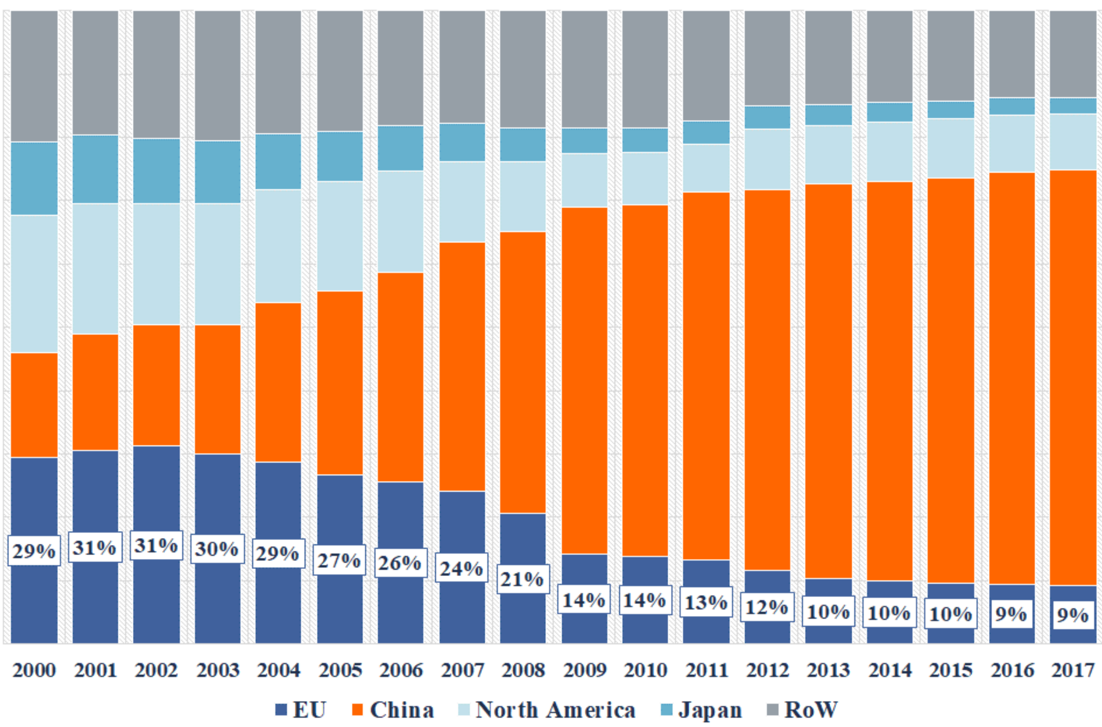
Over the period 2000-2017, production of extruded products in the EU remained relatively stable, amounting to slightly more than 2.7 million tonnes in 2017, an average contraction of 0.1% (total output was 2.8 million tonnes in 2000). As a consequence, in spite of the strongly positive trend in the global production of aluminium extrusions, the share of production taking place in the EU has dramatically decreased. As a matter of fact, almost one third of the world production of aluminium extrusions took place in the EU between 2000 and 2003. Since then, this share has dropped, hitting 9% in 2017. This significant drop in the European Union's share of production stems from the large investments that took place in countries outside the EU, especially China and countries in the Middle East.

Figure 2.30: Production of aluminium extrusions in EU (2000=100)



Source: CRU Group

Figure 2.31: EU share of the global production of aluminium extrusions, 2000-2017 (percentage)



Source: CRU Group

The rapid growth of the period 2000-2007 was reversed by the economic downturn, and even the temporary uptick following the crisis was restricted to a few countries—to Germany, Italy and Spain in particular. As a matter of fact, some leading countries, such as France and the UK, have drastically reduced their production in the last few years. Germany, Italy and Spain, which in 2000 together accounted for 46% of the EU's total output, are now responsible for about 58% of total aluminium extrusions manufactured within the EU.

Furthermore, during the narrower period between 2009 and 2017, production of aluminium extrusions grew by 32% in Germany and by 30% in Italy. Currently, as a consequence of this trend, almost one in two extruded products are manufactured in Germany or Italy. France and UK progressively reduced their share of total output, from 7% to 5%, respectively, and their share of the EU's total output from 7 to 3% of EU total output. Among the other leading producers, Spain increased its share of total EU production by upping its aluminium extrusion production by 23% between 2000 and 2017.

Table 2.11: EU production of aluminium extrusions, by countries, 2000, 2007, 2012– 17 (thousand tonnes)

Region/Country	2000	2007	2012	2013	2014	2015	2016	2017	Δ 2000-2017	CAGR
France	190	137	139	130	144	150	149	150	-21%	-1.4%
Germany	484	615	536	540	574	570	570	584	21%	1.1%
Italy	481	567	543	500	487	523	549	607	26%	1.4%
Spain	310	491	396	370	347	362	387	381	23%	1.2%
UK	184	114	86	89	89	78	78	84	-54%	-4.5%
Other countries	1,148	1,927	922	890	944	893	925	927	-19%	-1.3%
Total	2,797	3,850	2,622	2,519	2,585	2,576	2,658	2,733	-1%	-0.1%

Source: CRU Group

Table 2.12: Aluminium extrusion plants and production capacity in EU

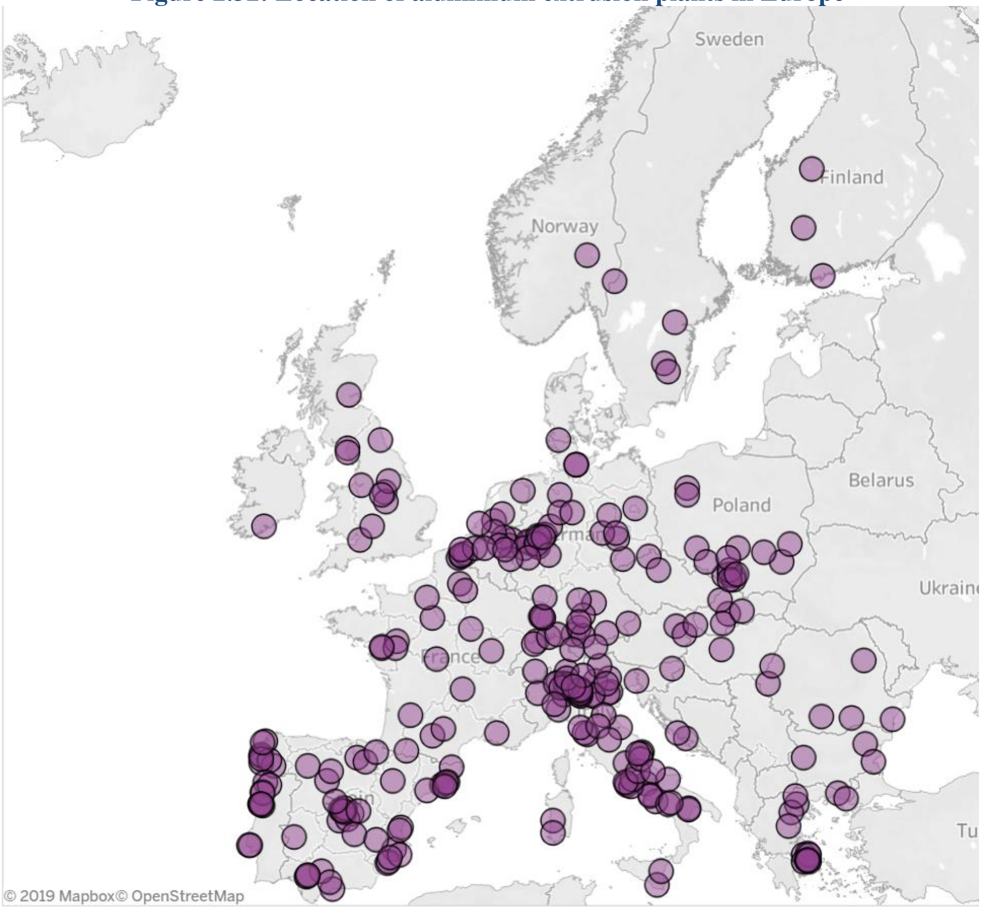
Country	Number of plants	Production capacity			
		2015	% of total	2018	% of total
Spain	44	608,900	16.3%	659,600	17.4%
Italy	43	640,550	17.1%	648,200	17.1%
Germany	35	646,050	17.3%	540,529	14.3%
Poland	14	209,900	5.6%	275,800	7.3%
France	18	195,000	5.2%	254,500	6.7%
Greece	17	217,900	5.8%	201,986	5.3%
Belgium	10	168,000	4.5%	179,500	4.7%
Austria	6	155,000	4.1%	152,000	4.0%
Portugal	9	119,000	3.2%	136,500	3.6%
Netherlands	8	146,990	3.9%	135,670	3.6%
UK	13	137,550	3.7%	130,400	3.4%
Sweden	3	75,500	2.0%	73,000	1.9%
Finland	3	90,500	2.4%	70,500	1.9%
Other countries	23	331,950	8.9%	331,260	8.7%
Total EU28	246	3,742,790	100.0%	3,789,445	100.0%

Source: our elaboration based on CRU Group

As of 2018, 170 companies have at least one extrusion plant in the European Union. The estimated total number of extrusion plants installed in the EU28 is 246. Data on production capacity is not fully reliable.

CRU Group estimated that the total installed production capacity for aluminium extrusions in the EU is 3.8 million tonnes. Though there are marked divergences between countries, roughly 27% of production capacity is unexploited, with particularly high levels of unused capacity in Italy and Spain.

Figure 2.32: Location of aluminium extrusion plants in Europe



Source: European Aluminium Statistics (accessed March 6, 2019)

The segment's fragmented structure makes it difficult to establish a ranking of EU extrusion manufacturers by capacity. Figure 2.32 shows the location of aluminium extrusion facilities in Europe. About half of the plants and production capacity in the EU are located in just three countries (Spain, Italy, and Germany).

Although aluminium extrusion is not a concentrated industry, the largest company (Hydro Aluminium - Extruded Solutions, which is now fully owned by Norsk Hydro ASA) owns and operates over 34 production facilities located in fifteen different countries, representing about 16.3% of the total production capacity in EU. It is worth noting that this production capacity is more than six times higher than that of the second largest manufacturer, Grupa Kety S.A., whose share of the total installed production capacity was 2.4% in 2018. (see Table 2.13). Most of the companies in the top twenty are specialised in aluminium extrusions. Examples include the largest Italian companies: Eural S.p.A., Metra S.p.A., All.Co. S.p.A. and Indinvest LT S.r.l..

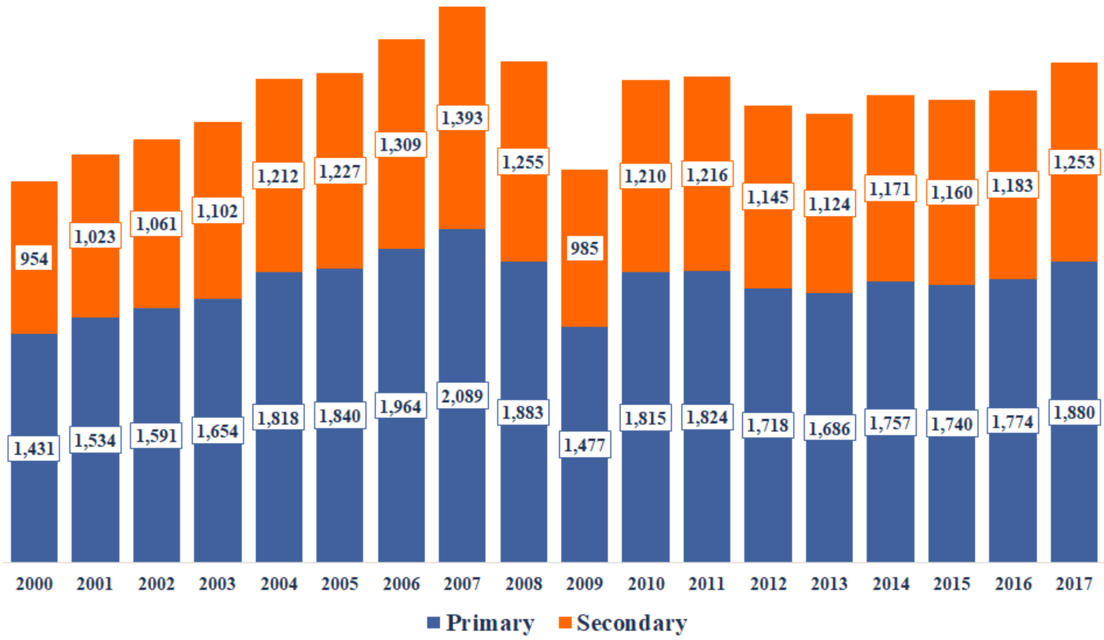
Table 2.13: EU top 20 aluminium extrusion companies (ranking by production capacity)

N.	Company	Number of plants	Capacity 2018 (thousand tonnes)
1	Hydro Aluminium - Extruded Solutions	34	631
2	Grupa Kety S.A.	2	94
3	Sankyo Tateyama K.K.	4	89
4	Aluminios Cortizo S.A.	6	86
5	Industrija Metalnih Polizdelkov d.d. [Impol]	2	75
6	Eural Gnutti S.p.A.	1	75
7	Hammerer Aluminium Industries GmbH [HAI]	3	69
8	Metra S.p.A.	3	64
9	Extrusion y Lacados Benavente, S.A. [Exlabesa]	5	64
10	All.Co. S.p.A.	4	62
11	Otto Fuchs Metallwerke K.G.	1	60
12	Alumil S.A.	3	60
13	apt Hiller	2	60
18	Alco Hellas S.A.	6	54
15	OpenGate Capital LLC	2	45
16	Constellium	3	45
17	BOAL B.V. [BOAL Profielen]	3	45
18	Indinvest L.T. S.r.l.	1	42
19	Estral S.p.A.	1	40
20	Richter Aluminium GmbH	2	40
Total EU		246	3,867

Source: CRU Group

Unwrought aluminium (both primary and secondary) is a fundamental input for the extrusion production process. Its share of total production costs is estimated at more than 60% (GRIF, 2015). Besides the contraction of 2008-2009, demand for unwrought aluminium by EU extruders has increased by 31% in the period 2000-2017. In 2017, the consumption of unwrought aluminium measured 3.1 million tonnes. Extruders mostly used primary aluminium, which represents on average about 60% of the total aluminium consumed.

Figure 2.33: Primary and secondary unwrought aluminium demanded by EU extruders



Source: authors' elaborations on CRU Group and A&L

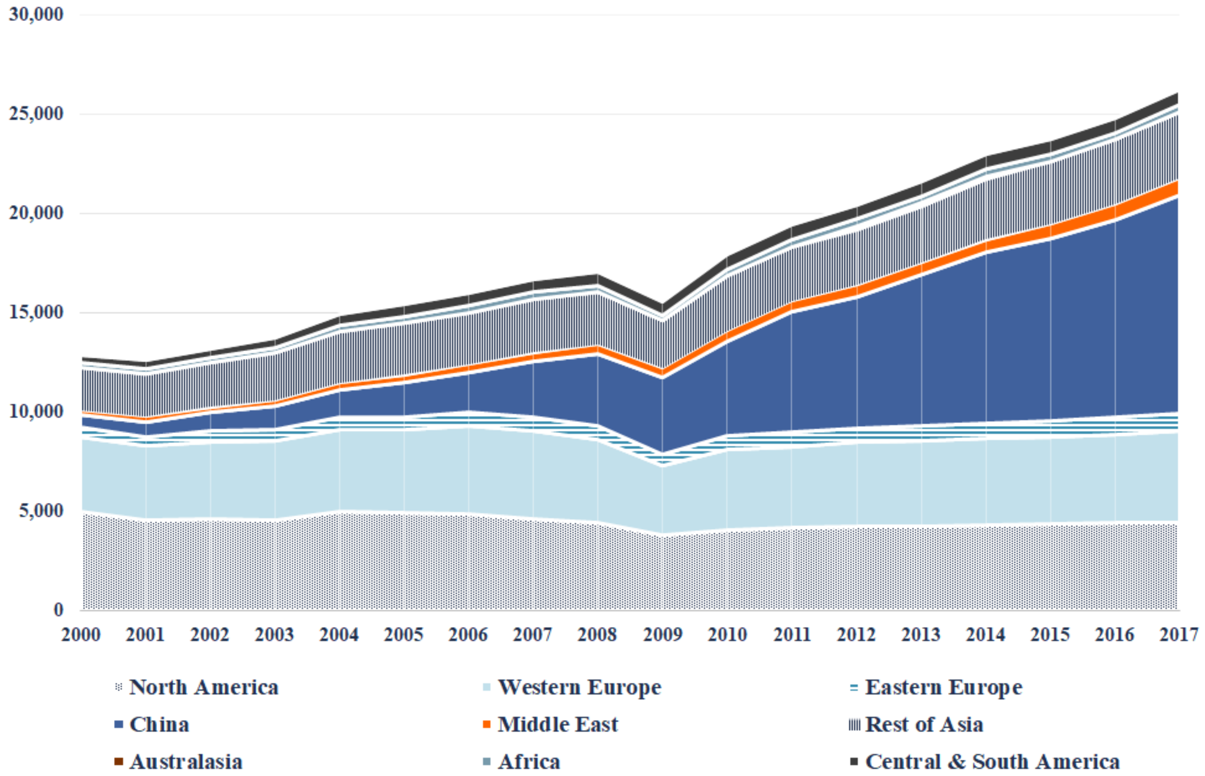
1.4.4. Aluminium flat-rolled products

The global output of aluminium FRPs has more than doubled in the period 2000-2017 from 12.9 to 26.2 million tonnes (+ 104%), increasing at a compound annual growth rate of 4.3%. As shown in Figure 2.34, production of aluminium FRPs increased in all regions, with the exception of North America (-11%).

Conversely, the production of aluminium FRPs in China increased from 0.6 million tonnes in 2000 to 11.0 million tonnes in 2017. As a result, China now accounts for roughly 42% of global production (compared with 5% in 2000). Production levels have increased also in the other Asian countries, as well as in the Middle East; these two regions together now account for 16% of the world's production of aluminium FRPs.

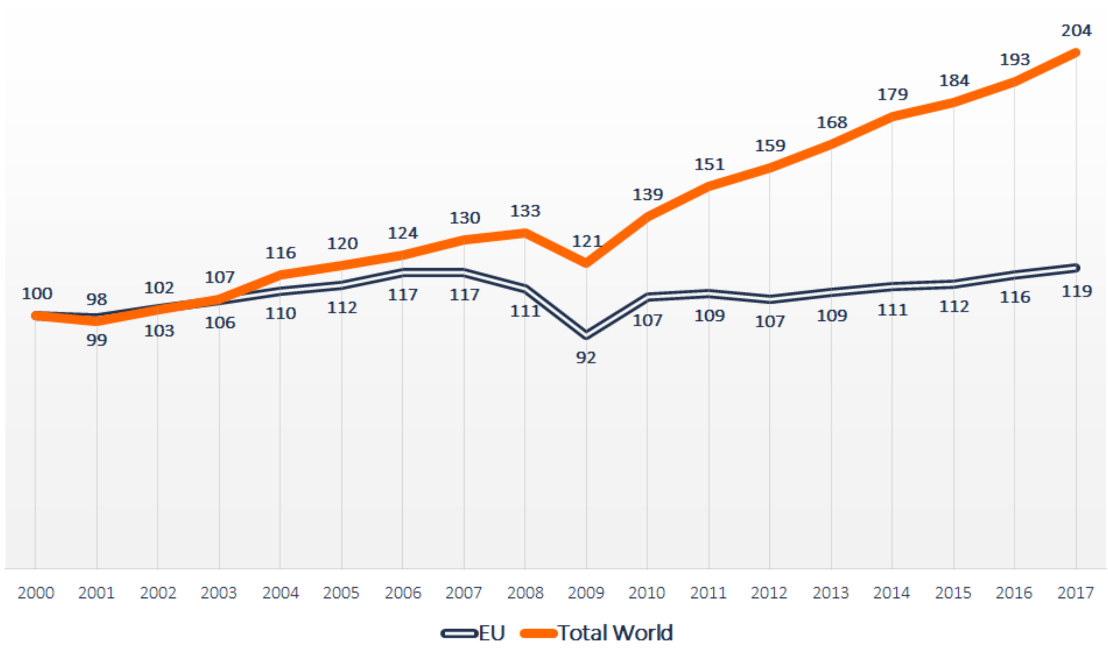
Over the period 2000-2017, production of FRPs in the EU increased by 19%, adding up to about 4.5 million tonnes in 2017 (see Figure 2.35). It is worth noting, however, that current production levels are only slightly higher than those recorded prior to the economic crisis. Notwithstanding the increase in total production, EU member states' share in global production of aluminium FRPs has rapidly decreased (see Figure 2.36).

Figure 2.34: Global production of aluminium FRPs, 2000-2017 (thousand tonnes)



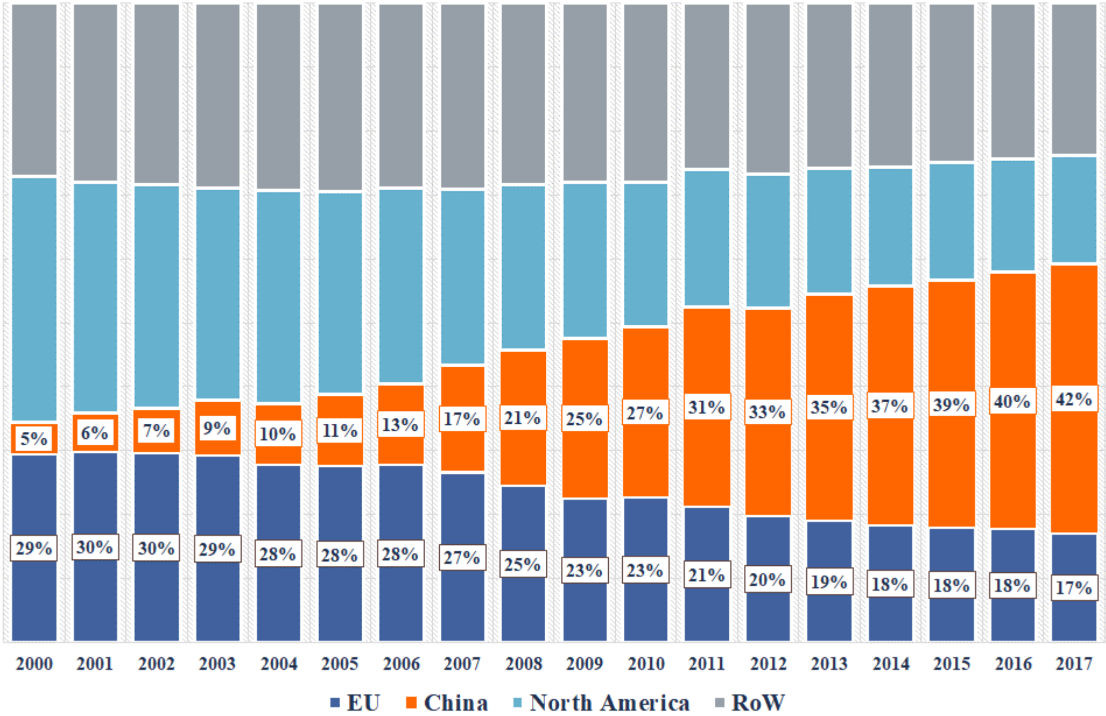
Source: CRU Group

Figure 2.35: Production of FRPs in EU, 2000-2017 (2000=100)



Source: CRU Group

Figure 2.36: EU share of the global production of aluminium FRPs (percentage)



Source: CRU Group

In 2017, the EU member states accounted for about 17% of the world's production of aluminium FRPs compared with 29% in 2000. This negative trend was even more pronounced in North America, whose share of global production dropped from 39% in 2000 to almost 17% in 2017.

In 2017, roughly 68% of EU flat-rolled products were manufactured in just three countries (France, Germany, and Italy). That same year, Germany alone accounted for 41% of EU production, with many facilities producing flat-rolled products for the transportation industries (both automotive and aerospace manufacturers), as well as the building sector. Conversely, the UK has drastically reduced its role as a leading producer in the EU (- 51%), from 319,000 tonnes produced in 2000 to 157,000 in 2017. Greece and Italy experienced sustained growth—especially after the economic crisis— expanding their production volumes of aluminium FRPs by 73% and 59%, respectively, in the period 2000-2017 (see Table 2.14). Contrary to what has been noted regarding aluminium extrusions, production in the other EU member states has remained relatively stable over the last few years, at a level of around 15% to 17%.

As of 2017, 43 companies have at least one rolling plant in the EU (see Table 2.15). Data on FRPs is in general more reliable, as the segment is significantly more concentrated than extrusions and castings.

According to estimations by CRU Group, there are a total of 56 plants installed within the EU, mainly located in Germany (14), Italy (11), France (6), and Spain (6). The number of companies involved remained stable between 2000 and 2013, and there were no important geographical shifts, as these plants are quite big and characterised by important economies of scale entailing significant, indivisible initial investment and high sunk costs.

Table 2.14: EU production of aluminium FRPs, by countries, 2000, 2007, 2012– 17 (thousand tonnes)

Country	2000	2007	2012	2013	2014	2015	2016	2017	Δ 00-17	CAGR
Greece	137	192	204	206	215	215	235	237	73%	3.3%
France	485	550	529	538	552	560	586	590	22%	1.2%
Germany	1,503	1,903	1,762	1,778	1,784	1,782	1,812	1,824	21%	1.1%
Italy	416	405	620	642	627	623	650	663	59%	2.8%
Spain	220	252	245	247	250	252	260	252	15%	0.8%
UK	319	230	95	120	121	121	131	157	-51%	-4.1%
Other countries	716	908	590	604	679	713	731	781	9%	0.5%
Total EU	3,796	4,440	4,044	4,136	4,228	4,264	4,406	4,503	19%	1.0%

Source: CRU Group

Moreover, it is important to recall that FRPs (i.e. sheets) can be easily shipped. As a result, they can be moved in large quantities without incurring significant transport costs: rolling plants can easily serve countries around the world.

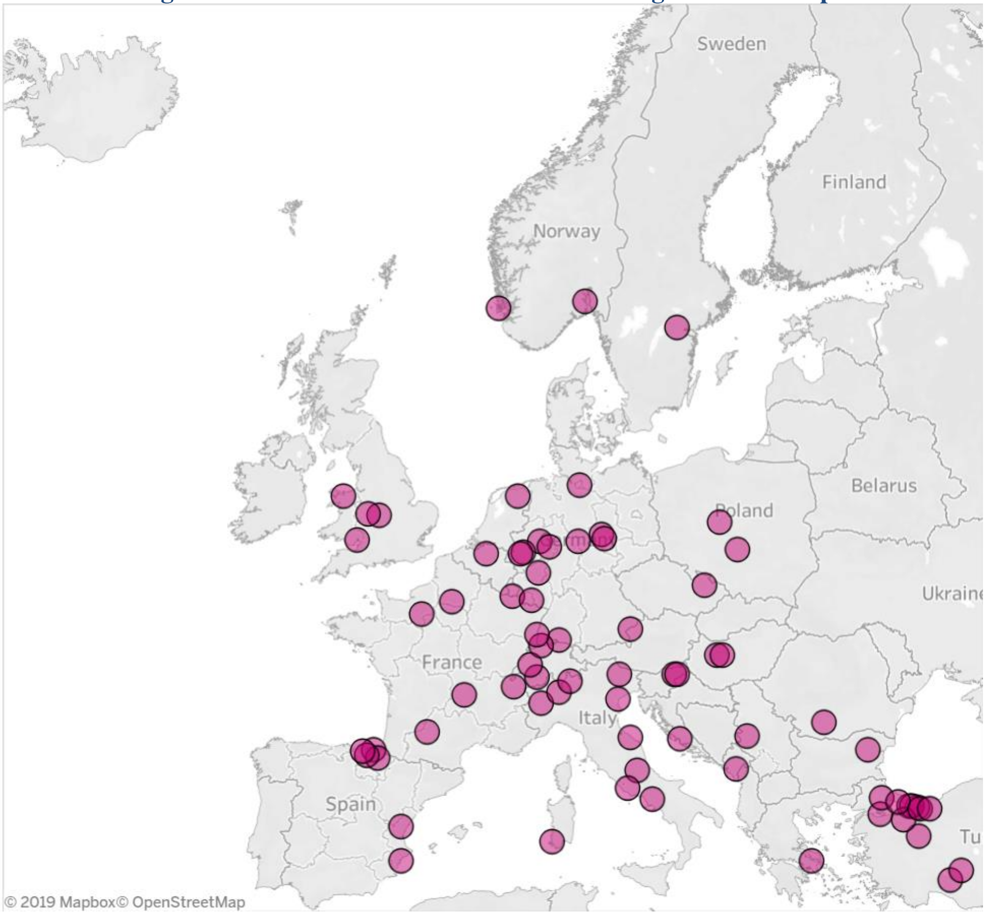
The installed production capacity for aluminium FRPs was 5.8 million tonnes in 2017; it slightly increased over the last two years as a consequence of the rise in demand for aluminium products. Consequently, the average capacity utilization in leading producing countries can be estimated to be around 84%. Figure 2.38 shows the location of aluminium FRPs facilities in the EU.

Table 2.15: Aluminium rolling plants and production capacity in EU

Country	Number of plants	Production capacity			
		2015	% of total	2017	% of total
Germany	14	2,158	38.5%	2,158	37.2%
Italy	11	754	13.4%	784	13.5%
France	6	678	12.1%	698	12.0%
Spain	6	305	5.4%	298	5.1%
Greece	1	260	4.6%	280	4.8%
Austria	2	240	4.3%	265	4.6%
Belgium	1	260	4.6%	260	4.5%
UK	2	146	2.6%	186	3.2%
Hungary	2	165	2.9%	165	2.8%
Poland	2	97	1.7%	135	2.3%
Croatia	1	90	1.6%	110	1.9%
Sweden	1	100	1.8%	100	1.7%
Romania	1	85	1.5%	85	1.5%
Other countries	6	271	4.8%	281	4.8%
Total EU	56	5,609	100.0%	5,805	100.0%

Source: CRU Group

Figure 2.37: The location of aluminium rolling mills in Europe



Source: European Aluminium Statistics (accessed March 6, 2019)

As just noted, the EU's aluminium rolling downstream sector is much more concentrated than the extruding industry, with several multinational firms, such as Constellium, the US-based producer Novelis, and Norsk Hydro; the latter two also operate a joint venture entitled AluNorf. AluNorf owns and operates two production facilities located in Germany, representing about 21% of the EU's total production capacity (see Table 2.16). More generally, the top ten producing firms controlled nearly 70% of the total installed production capacity in 2017.

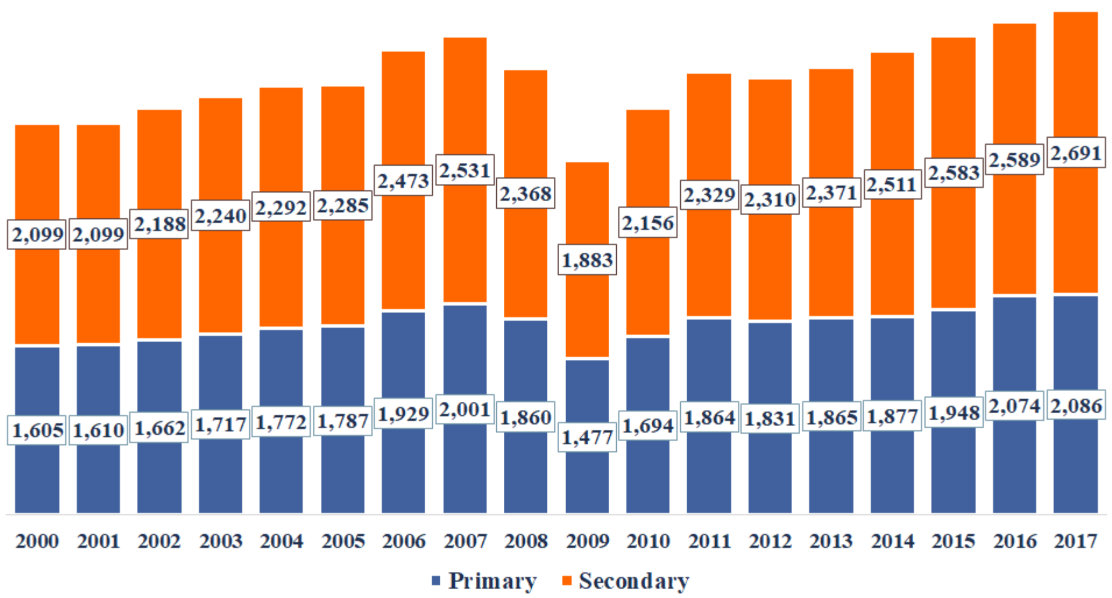
As for the inputs used in the sector, rolled product companies used both primary and secondary aluminium depending on the desired types, use, and quality of the output. Unwrought aluminium is the largest component of costs for manufacturers of FRPs. On average, purchases of primary and secondary aluminium represent around 60% of these manufacturers' total costs. In 2017, the total consumption of unwrought aluminium amounted to 4.8 million tonnes (+ 29% compared to the level in 2000). As can be seen from Figure 2.39, the share of secondary unwrought aluminium remained relatively stable in the period from 2000 to 2017, averaging 56% of total unwrought aluminium demand.

Table 2.16: Top 20 aluminium rolling companies in EU (ranking by production capacity)

N.	Company	Number of plants	Capacity 2015	Capacity 2017
1	Novelis/Hydro Aluminium	2	1,250	1,250
2	Constellium	3	800	820
3	Novelis	3	340	340
4	Elval	1	260	280
5	Aleris Rolled Products	1	260	260
6	AMAG	2	228	253
7	Aludium	3	225	248
8	Hydro Aluminium	2	215	215
9	SLIM Aluminium	2	202	202
10	Arconic	2	186	186
11	Aleris	1	180	180
12	Laminazione Sottile	1	140	170
13	Profilglass Aluminium	1	150	150
14	Bridgnorth Aluminium	1	110	150
15	Impol TLM	1	90	110
16	Gränges	1	100	100
17	Eurofoil	2	96	96
18	Huta Aluminium Konin	1	87	95
19	Alro/Vimetco	1	85	85
20	Impol Seval	1	60	70
Total EU		56	5,609	5,805

Source: CRU Group

Figure 2.38: Demand for primary and secondary aluminium for FRPs

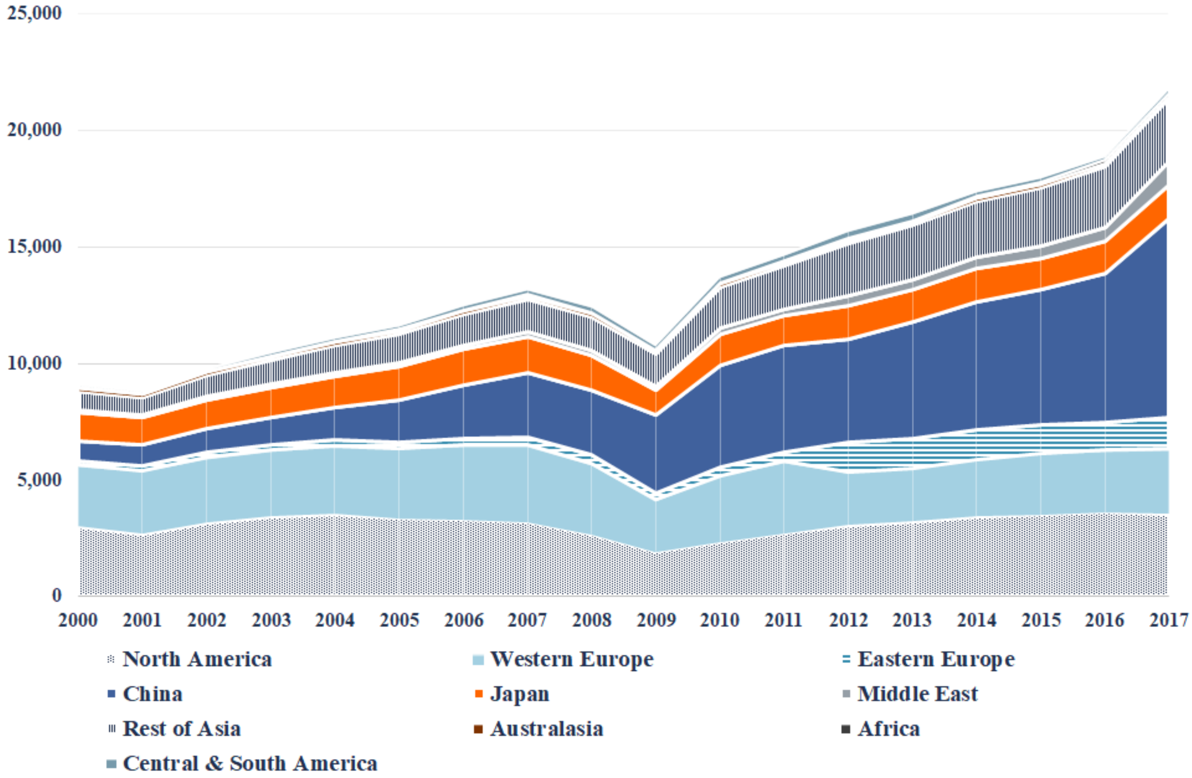


Source: CRU Group

1.4.5. Aluminium castings

Aluminium castings represented about 28% of total wrought aluminium produced in 2017. Aluminium castings are manufactured in a wide range of shapes and alloys for an equally wide variety of applications. As already noted, the automotive industry is the largest market for aluminium casting products, followed by the manufacturing sector— especially consumer durables, electrical, machinery and equipment applications— and the construction sector. Nowadays, more than half of the aluminium used in cars is made from castings, a percentage which is likely to increase due to both technological development and energy efficiency requirements.

Figure 2.39: Global production of aluminium castings, 2000-2017 (thousand tonnes)



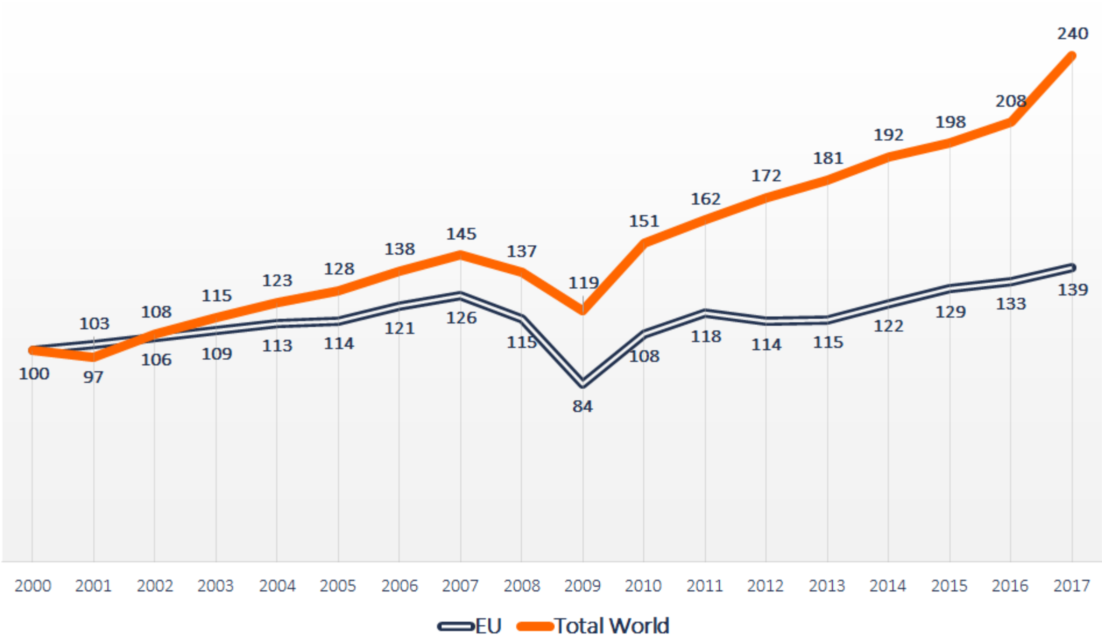
Source: CRU Group

Global production of aluminium castings has more than doubled in the period 2000-2017, rising from 9.1 to 21.8 million tonnes (+140%). As for other semi-finished products, most of the growth in this category has come from within China, which increased the production of aluminium castings by a factor of ten, from 0.8 to 8.5 million tonnes. In 2017, China accounted for almost 39% of the world production of aluminium castings, compared with only 9% in 2000 (see Figure 2.39).

Remarkable growth rates were also recorded in the Middle East and Eastern Europe over the last few years. In the Middle East in particular, the production of aluminium castings increased at a CAGR of 13.3% from 2000 to 2017; the region's manufacturing of aluminium castings now represents some 5% of global production (it was 1% in 2000). On the contrary, Western Europe, North America and Japan all experienced modest growth, with their total production of aluminium castings increasing between

2000 and 2017 by 6%, 18%, and 20%, respectively. During the narrower period from 2012 to 2017, the production of casting products accelerated in Western Europe (+20%) and North America (+16%), while continuing to grow at a slower pace in Japan (+4%).

Figure 2.40: Production of aluminium castings in EU, 2000-2017 (2000=100)



Source: CRU Group

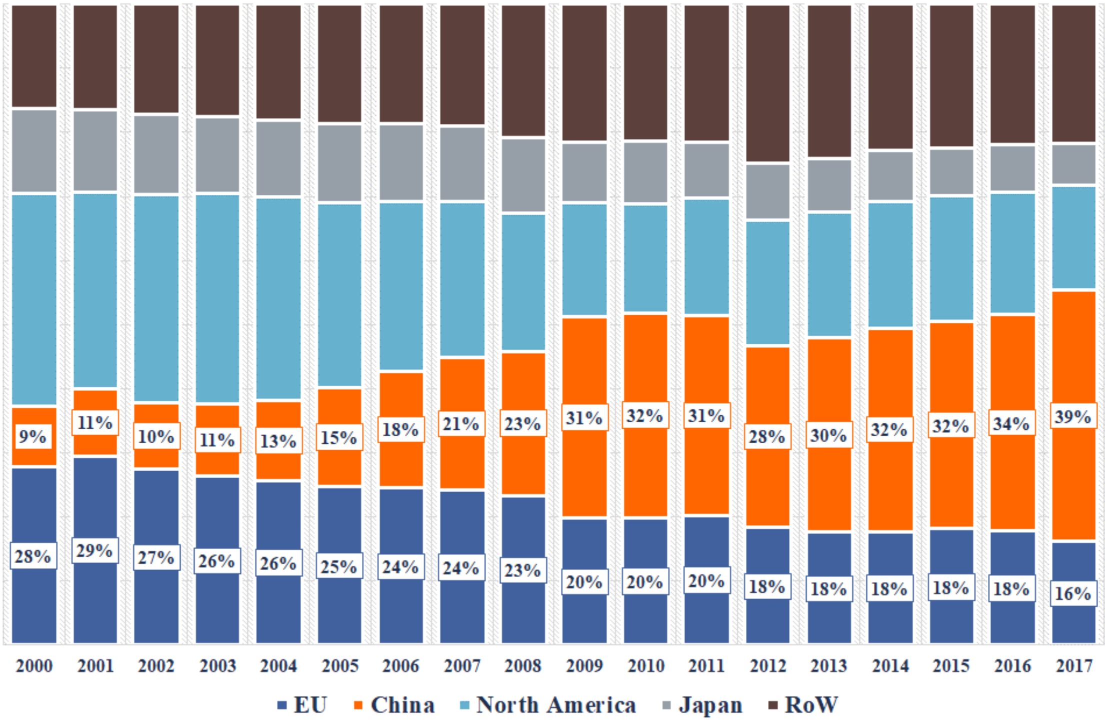
As of 2017, the EU produced roughly 3.5 million tonnes of aluminium castings. As shown in Figure 2.41, the EU has increased its manufacturing by 39% over the period 2000-2017, though at a considerably lower pace compared to that of global production. As a result, EU member states' share of the global production of aluminium castings has thus drastically decreased. In 2017, the EU member states accounted for almost 16% of the world's production of aluminium castings, compared with 28% in 2000.

As highlighted above, North America and Japan experienced a similar trend, now collectively representing roughly 23% of global production, while almost half of aluminium castings were manufactured in these two regions at the beginning of the century. Other than China and the aforementioned regions, other countries now account for 22% of the world's production of aluminium castings.

In 2017, about 75% of EU aluminium castings were manufactured in just four countries (France, Germany, Italy, and Poland). Germany remains the leading producer in the EU, accounting for about one third of total production. Moreover, Germany has strengthened its position over the period 2000-2017 by increasing its production volumes by 73%. Likewise, Poland has experienced similar growth (73%), meaning that it has the third highest production volume in the EU28. Notwithstanding an increase in production of 13% between 2000 and 2017, Italy has lost its leading role in the EU as its share of total production has decreased from 29% in 2000 to 23% in 2017 (see Table 2.17).

As previously mentioned, aluminium casting is a fragmented sector which is much less concentrated than the other downstream segments. This makes it difficult to attempt to inventory and rank companies in a systematic and comprehensive fashion. Furthermore, aluminium castings are also produced in-house by large aluminium end-user manufacturers.

Figure 2.41: EU share of the global production of aluminium castings, 2000-2017 (percentage)



Source: CRU Group

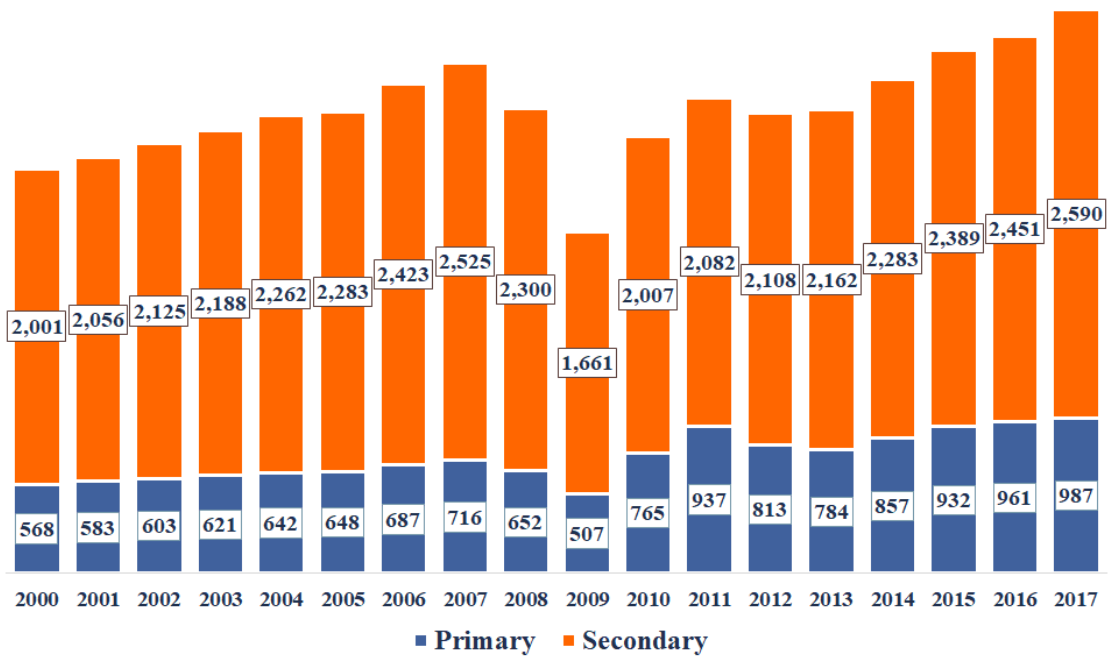
Table 2.17: EU28 production of aluminium castings, by countries, 2000, 2007, 2012– 17 (thousand tonnes)

Country	2000	2007	2012	2013	2014	2015	2016	2017	Δ 00-17	CAGR
France	308	275	325	291	297	317	332	337	10%	0.5%
Germany	646	834	847	883	994	1,066	1,096	1,119	73%	3.3%
Italy	730	815	717	696	710	761	770	826	13%	0.7%
Poland	220	238	331	340	364	335	345	376	71%	3.2%
Spain	102	155	112	111	116	126	128	131	28%	1.5%
UK	135	114	101	102	108	110	116	115	-15%	-0.9%
Other countries	887	1,034	1,184	1,238	1,312	1,288	1,325	1,428	61%	2.8%
Total EU	2,531	3,193	2,878	2,902	3,093	3,272	3,361	3,524	39%	2.0%

Source: CRU Group

There are an estimated 2,100 aluminium casting plants, mainly located in Italy, Germany, France and the UK. As in other sectors, the increasing competitive pressure coming from extra-EU manufacturers, combined with the huge drop in demand which occurred after the economic crisis of 2008, has provoked overcapacity problems and caused financial difficulties, including for European casters. Several plants in the EU have been closed as a result, while new investments in aluminium casting have been concentrated outside Europe—driven in part by growing investments from the end-use industries, especially the automotive sector.

Figure 2.42: Demand for primary and secondary aluminium for casted products



Source: CRU Group

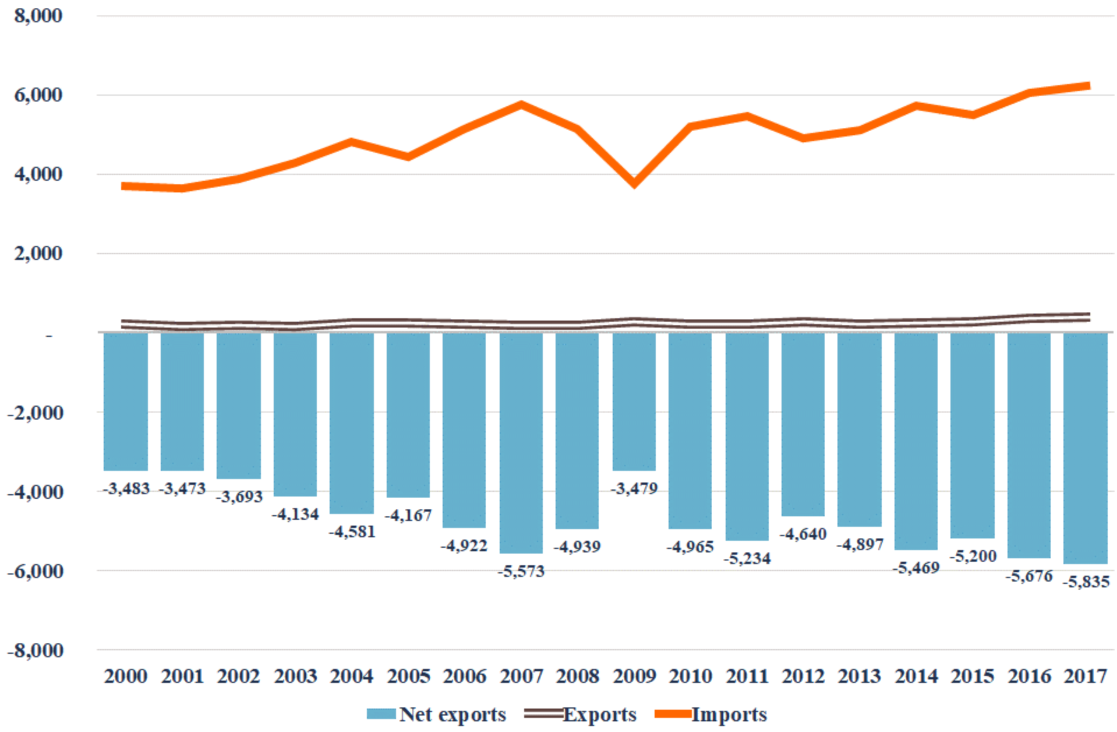
Casters used both primary and secondary aluminium depending on the desired types, use, and quality of the output. The cost structure of single casters may vary substantially. Generally speaking, aluminium and/or aluminium alloys are the major driver of cost. The value of this cost item, in percentage of the total cost, ranges from 50 to 65%. Where possible, casters might try to reduce the burden of aluminium and/or aluminium alloys costs by melting— at least partially— their own scrap instead of purchasing pre-made, already-alloyed, foundry ingots from the market. The greater the share of the scrap and the larger the range of aluminium alloys that single casters may use in their production process, the lower aluminium's effect on the total cost. On average, about 75% of unwrought aluminium demand by EU casters is of secondary production (See Figure 2.42). The share of primary production has, however, increased in recent years, primarily as a consequence of aluminium's increasing penetration in the car wheels segment, as well as new applications for aluminium in the body in white (BIW) and chassis segments of the automotive industry.

3. Overview of unwrought and wrought aluminium EU Trade

3.1. Trade flows of unwrought aluminium

In 2017, the EU imported more than 6.2 million tonnes of unwrought aluminium, including both primary and secondary production[25], from extra-EU countries (see Figure 3.1). In the same year, the EU exported a mere 384,000 tonnes of unwrought aluminium to extra-EU countries.

Figure 3.1: EU imports and exports of unwrought aluminium, in thousand tonnes, 2000-2017



Source: Authors on Eurostat ComExt database

[25] The following product categories are included in unwrought aluminium: unwrought, not alloyed, aluminium (CN Code 76.01.1000); unwrought aluminium alloys in the form of slabs or billets (CN Code 76.01.2020); unwrought aluminium foundry alloys (CN Code 76.01.2080); Not alloys wire rods, dia > 7 mm (CN Code 76.05.11.00); Alloys wire rods, dia > 7 mm (CN Code 76.05.12.00); Unwrought primary aluminium alloys (CN Code 76.01.2010); Unwrought secondary aluminium alloys, in ingots or in liquid state (CN Code 76.01.2091); Unwrought secondary aluminium alloys, excl. in ingots or in liquid state (CN Code 76.01.2099).

EU imports increased significantly during the period 2000-2017. In particular, imports in 2017 were 68% higher than in 2000. Overall, more than 88 million tonnes of unwrought aluminium were cumulatively imported into the EU between 2000 and 2017, though the economic crisis significantly reduced imports, especially in 2009. Although exports of unwrought aluminium have demonstrated a significant upward trend in the last ten years (from 213,000 to 360,000 tonnes), they constitute a negligible amount of overall EU trade flows, corresponding on average to roughly 4% of imports. Furthermore, between 2000 and 2017, the trade deficit of unwrought aluminium has steadily worsened.

3.1.1. Imports of unwrought aluminium

The Russian Federation and Norway are the leading exporters of unwrought aluminium to the EU markets, totalling about 46% of total EU imports (see Table 3.1).

The Russian Federation accounted for almost 38% of the EU's imports of unwrought, not alloyed, aluminium tin 2017 (see Figure 3.2), while Norway covered about 43% of the EU's imports of unwrought aluminium alloys. Both the Russian Federation and Norway have reduced their share of total EU imports; this shift has mainly benefitted Mozambique and Iceland for exports of unwrought, not alloyed, aluminium and the United Arab Emirates in terms of exports of unwrought aluminium alloys. The Russian Federation and Norway represent about 30% and 26%, respectively, of the EU's total imports of wire rods.

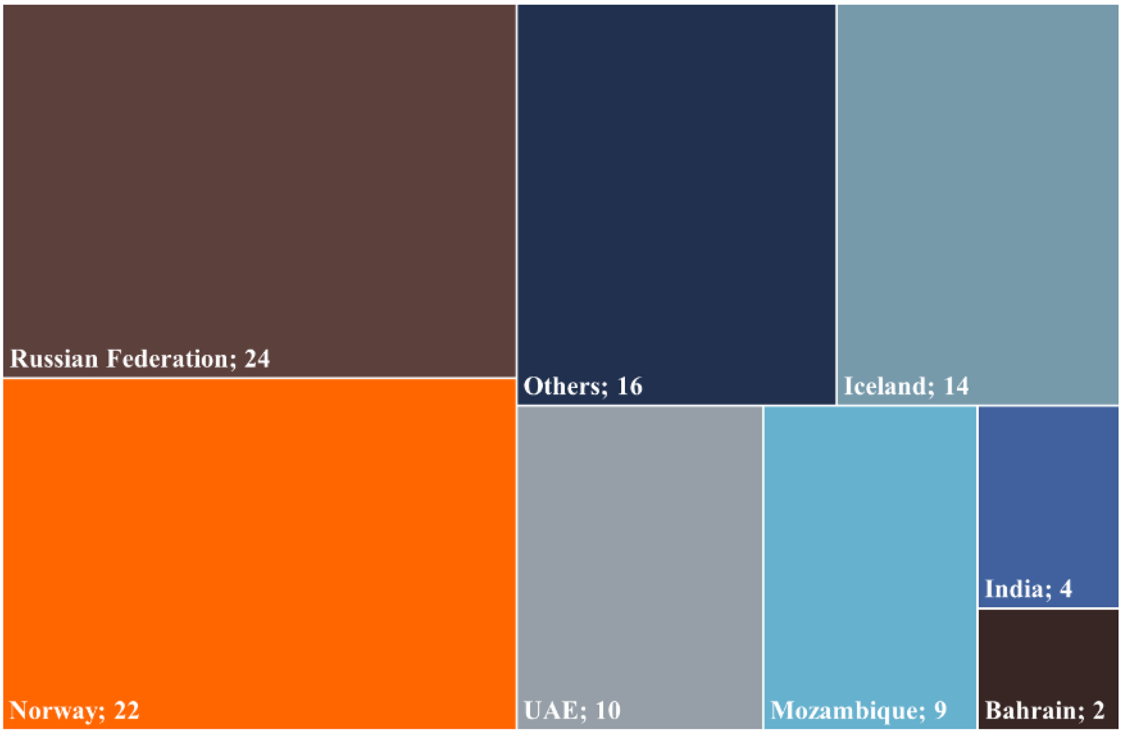
Table 3.1: EU Imports of unwrought aluminium, by country of origin (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
Russian Federation	1,195	908	795	1,295	1,481	1,476
Norway	1,131	1,551	1,507	1,270	1,362	1,387
Iceland	199	260	828	379	762	870
UAE	108	108	207	564	615	613
Mozambique	12	568	659	492	534	533
India	0	0	4	52	45	220
Bahrain	9	18	126	61	76	132
Egypt	48	82	85	106	119	123
South Africa	24	46	26	69	54	110
Bosnia and Herzegovina	73	132	122	72	105	95
Others	898	752	836	1,131	883	659
Total	3,697	4,425	5,196	5,490	6,036	6,219

Source: Authors on Eurostat ComExt database

Other major exporters to the EU were Mozambique (17%) and Iceland (16%) for unwrought, not alloyed, aluminium (see Table 3.2), and the United Arab Emirates (18%) and Iceland (11%) for unwrought aluminium alloys (see Table 3.3). Iceland is also a leading exporter of wire rods, making up 21% of total EU imports in 2017, followed by Mozambique (9%). Figure 3.3 shows EU imports of unwrought, not alloyed aluminium (CN Code 76.01.1000) by country of origin. Figure 3.4 and Figure 3.5 present, respectively, imports of unwrought aluminium alloys in the form of slabs and billets (CN Code 76.01.2020) and unwrought aluminium foundry alloys (CN Code 76.01.2080) by country of origin.

Figure 3.2: EU Imports of unwrought aluminium by country of origin (percentage, 2017)



Source: Authors on Eurostat ComExt database

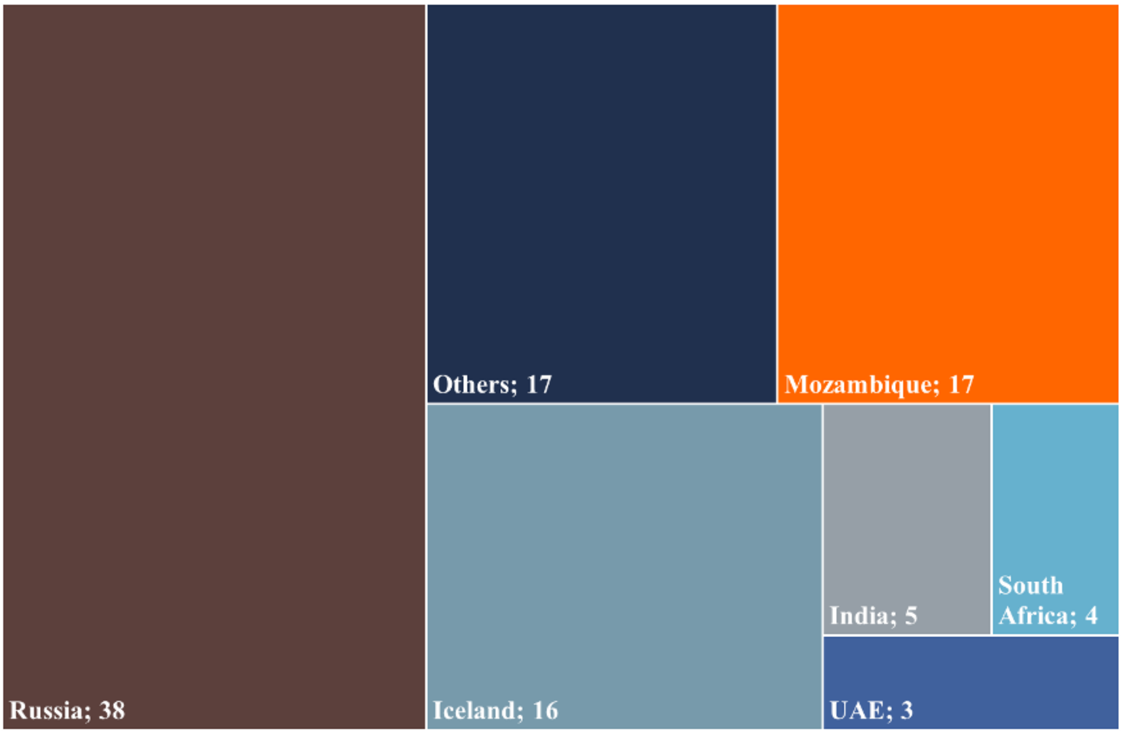
Table 3.2: EU Imports of unwrought, not alloyed, aluminium (CN Code 76.01.1000) by country of origin (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
Russian Federation	1,051	706	637	1,004	1,160	1,147
Mozambique	12	536	659	488	519	510
Iceland	130	126	632	49	437	482
India	0	0	3	42	36	146
South Africa	24	30	26	69	53	110
UAE	27	5	29	114	121	105
Kazakhstan	0	-	6	7	82	89
Norway	269	262	81	56	73	63
Cameroon	70	61	46	58	59	58
Egypt	23	13	20	34	44	44
Others	655	577	604	810	508	271
Total	2,261	2,316	2,743	2,731	3,093	3,025

Source: Authors on Eurostat ComExt database

Three out of four aluminium slabs and billets imported into the EU in 2017 come from just three countries: Norway, the United Arab Emirates, and Iceland. These three countries also represent around 64% of EU imports of foundry alloys in 2017. The Russian Federation is another major exporter of foundry alloys, accounting for about 16% of total EU imports. Bahrain (5.7%), Egypt (4.8%) and Qatar (1.4%) cumulatively made up slightly more than 12% of the EU's imports of other aluminium alloys in 2017.

Figure 3.3: EU Imports of unwrought, not alloyed, aluminium (CN Code 76.01.1000) by country of origin (percentage, 2017)



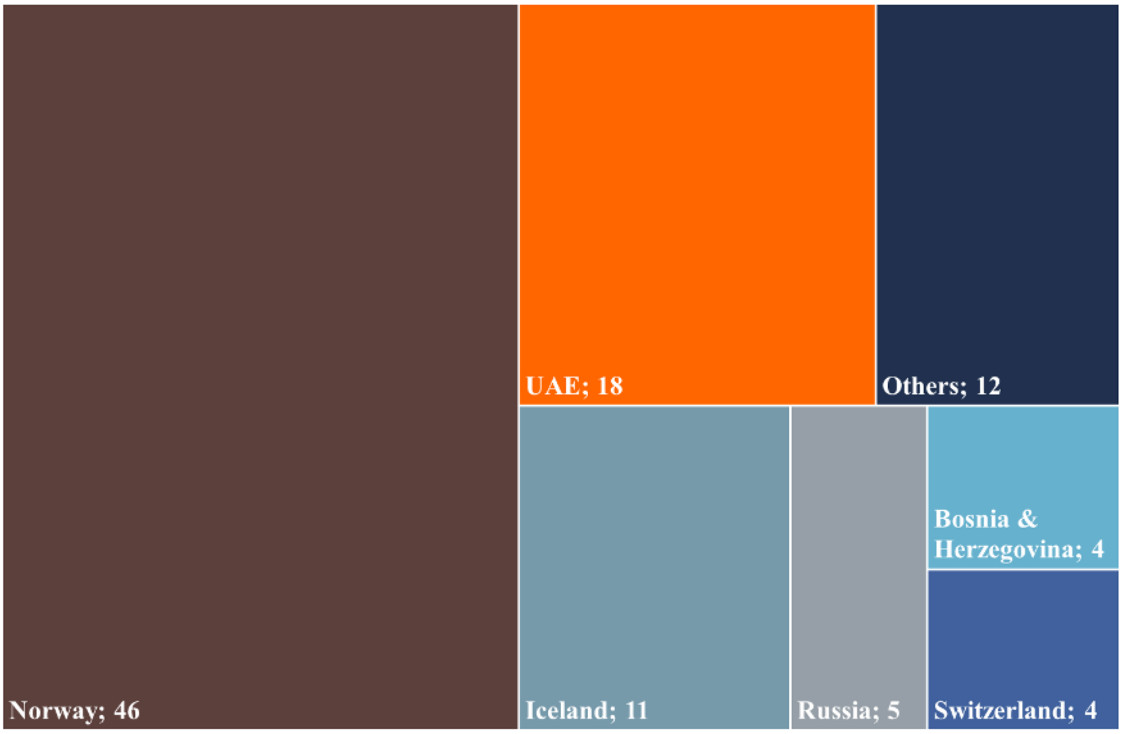
Source: Authors on Eurostat ComExt database

Table 3.3: EU Imports of unwrought aluminium alloys in the form of slabs or billets (CN Code 76.01.2020) by country of origin (Ranking 2017 by thousand tonnes)

Country	2013	2014	2015	2016	2017
Norway	936	986	718	896	944
UAE	247	274	318	345	361
Iceland	163	197	186	190	222
Russia	77	100	105	111	111
Bosnia and Herzegovina	56	59	59	84	79
Switzerland	37	25	43	74	78
India	2	6	10	8	75
Bahrain	49	29	30	34	57
Egypt	42	40	24	26	29
Serbia	8	4	4	6	17
Others	65	79	82	58	70
Total	1,681	1,799	1,577	1,832	2,042

Source: Authors on Eurostat ComExt database

Figure 3.4: EU Imports of unwrought aluminium alloys in the form of slabs or billets (CN Code 76.01.2020) by country of origin (percentage, 2017)



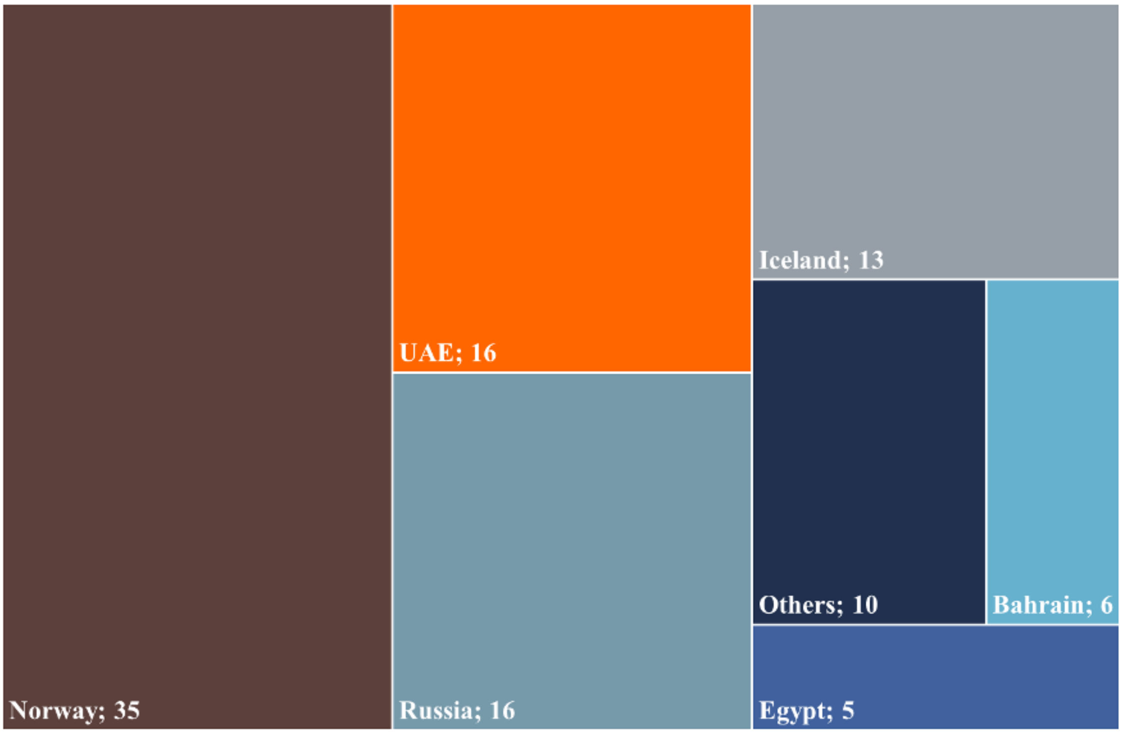
Source: Authors on Eurostat ComExt database

Table 3.4: EU Imports of unwrought aluminium foundry alloys (CN Code 76.01.2080) by country of origin (Ranking 2017 by thousand tonnes)

Country	2013	2014	2015	2016	2017
Norway	294	259	435	334	314
UAE	126	152	132	147	147
Russian Federation	75	77	120	128	144
Iceland	89	65	70	62	113
Bahrain	56	54	29	36	51
Egypt	41	40	33	39	43
Qatar	0	13	8	3	13
Malaysia	0	5	14	2	12
Albania	3	4	5	8	10
Tunisia	3	7	8	9	8
Others	69	53	61	71	46
Total	757	729	914	839	902

Source: Authors on Eurostat ComExt database

Figure 3.5: EU Imports of unwrought aluminium foundry alloys (CN Code 76.01.2080) by country of origin (percentage, 2017)



Source: Authors on Eurostat ComExt database

3.1.2. Exports of unwrought aluminium

As for exports, Switzerland and Norway are the countries to which most EU exports of unwrought aluminium are addressed. In 2017, about 25% of exports were shipped to those countries.

Table 3.5: EU Exports of unwrought, not alloyed, aluminium (CN Code 76.01.1000) by country of destination (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
Switzerland	2.7	7.6	6.2	0.7	2.3	2.7
Norway	0.4	0.8	0.9	0.7	1.2	1.8
Japan	3.0	1.8	1.2	0.3	0.5	0.8
Turkey	0.0	0.1	0.1	0.3	0.2	0.7
United States	33.2	19.0	4.5	0.5	0.5	0.6
China	0.1	0.1	0.0	0.4	0.5	0.4
Taiwan	0.1	0.1	0.3	0.3	0.2	0.4
India	0.1	0.0	1.4	0.0	0.0	0.3
Australia	0.3	0.0	0.0	0.0	0.0	0.3
Kazakhstan	-	-	-	0.2	0.1	0.2
Others	3.0	4.2	2.1	2.4	1.3	0.7
Total	43.0	33.7	16.7	5.7	6.8	8.9

Source: Authors on Eurostat ComExt database

Other important destinations include Japan (9%), the United States (7%), San Marino (5%), and Turkey (4%). Table 3.5, Table 3.6 and Table 3.7 show the EU exports of unwrought, not alloyed, aluminium, aluminium slabs and billets and foundry alloys by country of destination, respectively,.

As illustrated, export volumes are trivial for unwrought, not alloyed, aluminium amounting to just 9 thousand tonnes in 2017. EU exports of unwrought aluminium mainly refer to slabs and billets and to foundry alloys, with exports of the former increasing substantially over the last few years. In light of the small quantities involved, the composition of exports in terms of destination countries remains rather volatile and erratic over the years.

Table 3.6: EU Exports of unwrought aluminium alloys in the form of slabs and billets (CN Code 76.01.2020) by country of destination (Ranking 2017 by thousand tonnes)

Country	2013	2014	2015	2016	2017
Switzerland	27	29	61	111	104
United States	0	15	13	7	12
San Marino	4	4	4	7	9
Serbia	6	7	6	7	7
Morocco	2	3	4	7	5
Albania	4	4	3	4	4
Bosnia and Herzegovina	5	5	7	3	3
Turkey	0	0	3	3	3
Norway	1	1	2	4	3
Israel	4	1	3	3	1
Others	6	4	7	5	3
Total	58	73	112	162	153

Source: Authors on Eurostat ComExt database

Table 3.7: EU Exports of unwrought aluminium foundry alloys (CN Code 76.01.2080) by country of destination (Ranking 2017 by thousand tonnes)

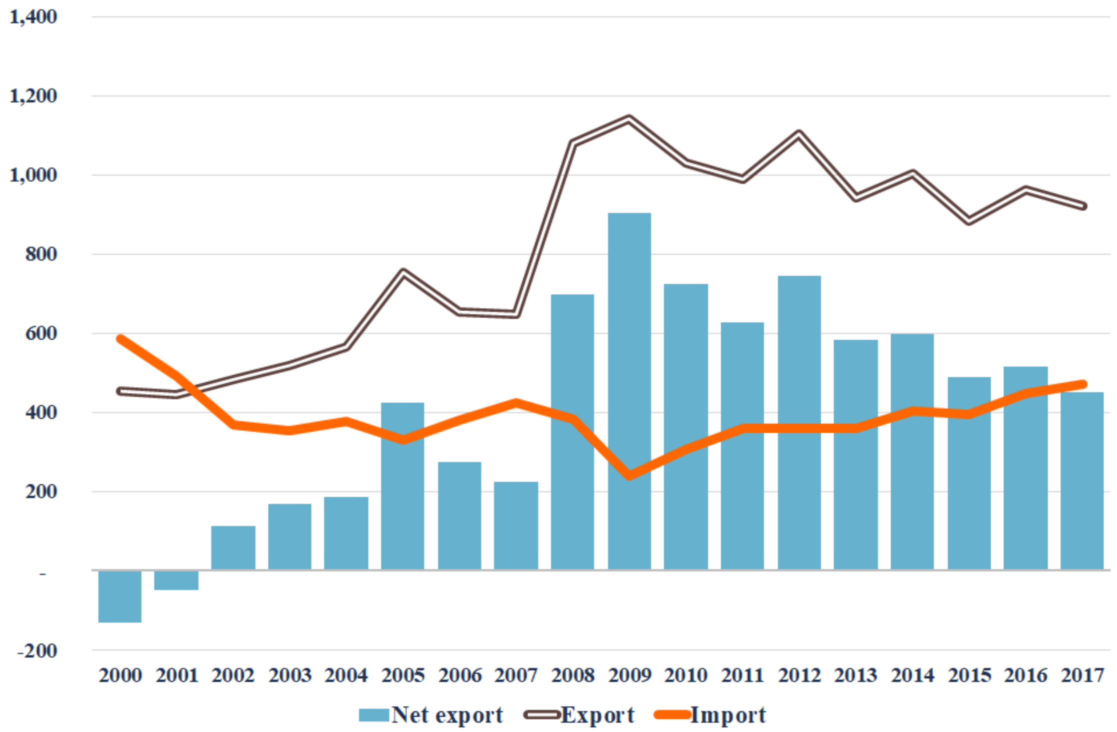
Country	2013	2014	2015	2016	2017
Switzerland	17	31	47	55	62
United States	6	22	9	30	32
Turkey	7	6	8	7	11
Thailand	2	4	6	6	8
Japan	16	3	4	4	7
Brazil	0	3	7	4	6
Ukraine	2	1	3	4	5
Serbia	9	8	7	5	5
Norway	2	2	3	2	4
Argentina	3	4	3	3	4
Others	40	29	25	25	29
Total	103	112	122	144	173

Source: Authors on Eurostat ComExt database

3.2. Trade flows of aluminium waste and scrap

The EU trade balance for aluminium waste and scrap has constantly exhibited a surplus over the whole period from 2002 to 2017 (see Figure 3.6). The trade surplus has even increased over the last few years. In particular, Asian countries, such as China, India, and South Korea, are markets to which an increasing quantity of waste and scrap has been exported over the last few years.

Figure 3.6: EU net exports of aluminium waste and scrap, in thousands of tonnes, 2000-2017



Source: Authors on Eurostat ComExt database

Table 3.8: EU imports of aluminium waste and scrap (HS 76.02.00) by country of origin (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
Switzerland	76	98	109	132	136	149
Norway	23	23	25	25	33	33
UAE	4	3	5	15	19	31
Ireland	18	17	15	18	22	25
Israel	6	7	7	18	19	22
Australia	3	11	4	12	15	18
Saudi Arabia	4	22	20	7	19	16
Russia	246	25	23	18	15	16
Morocco	8	5	4	10	12	16
United States	9	10	10	15	13	13
Others	189	109	84	124	143	133
Total	585	330	307	395	447	472

Source: Authors on Eurostat ComExt database

It is worth noting that waste and scrap are typically used as input for secondary production of unwrought aluminium, which is regarded as the most energy efficient method of producing aluminium, especially for countries with high energy and carbon costs and significant availability of second raw material. Therefore, the positive EU trade balance should be interpreted as an outflow of raw materials that will be used as production input for secondary aluminium by importing countries.

In 2017, the EU imported around 472,000 tonnes of aluminium waste and scrap from extra-EU countries. In the same year, the EU imported aluminium waste and scrap, primarily from Switzerland which represents about 31% of total imports (see Table 3.8). Other notable exporters to the EU include Norway (7%) and UAE (7%), Ireland (5%), and Israel (5%).

Since 2002, the EU has been a net exporter of aluminium scrap. The main destinations for the EU's exports of aluminium waste and scrap are India and China, which represent about 58% of the total exports in 2017, or roughly 922,000 tonnes. This represents a slight decrease of 4.3% compared to 2016 (see Table 3.9). In 2017, 7% of exports were shipped to Switzerland, and Pakistan and South Korea both received 6% of exports. It is worth noting that EU exports mainly refer to the so called ZORBA, a mix of shredded and pre-treated non-ferrous scrap metals consisting primarily of aluminium (as well as some copper, lead, brass, magnesium, nickel, tin and zinc), originating from End-of-Life Vehicles (ELVs) and Waste Electrical and Electronic Equipment (WEEE). These are low quality scraps, very expensive to sort and process, that cannot be efficiently used in countries with high labour costs.

Table 3.9: EU exports of aluminium waste and scrap (HS 76.02.00) by country of destination (Ranking 2017 by thousand tonnes)

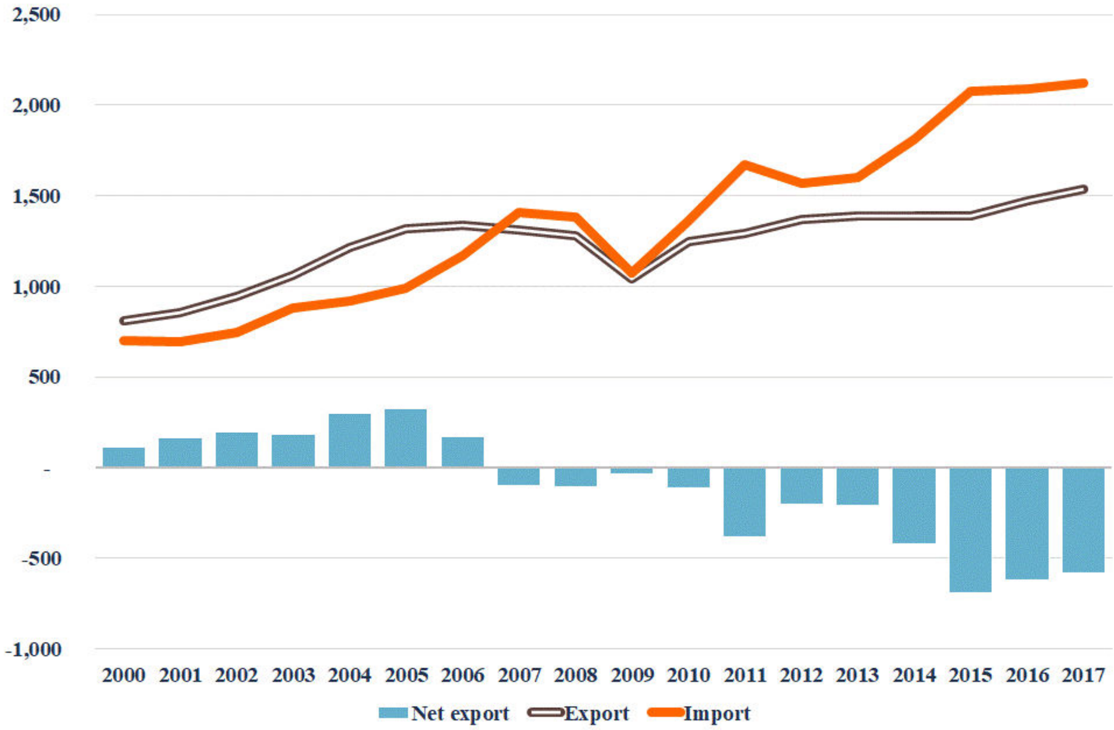
Country	2000	2005	2010	2015	2016	2017
India	31	137	227	247	249	298
China	122	378	441	322	363	233
Switzerland	20	31	36	49	51	63
Pakistan	21	40	50	59	71	56
South Korea	17	32	65	50	51	51
Hong Kong	10	10	32	19	32	37
Turkey	3	3	11	16	19	34
United States	24	8	8	12	16	25
Norway	58	9	27	20	22	24
Indonesia	16	4	12	19	19	23
Others	132	102	123	69	72	79
Total	453	754	1,031	882	963	922

Source: Authors on Eurostat ComExt database

3.3. Trade flows of wrought aluminium

As noted, wrought products comprise a very broad group of goods, from highly engineered and differentiated products to more standardized (commodity) products. The EU is structurally a net importer of wrought aluminium (see Figure 3.6). The EU's trade deficit has increased over the last few years, with imports growing by a factor of 2.6 in the period 2000-2017.

Figure 3.6: EU net exports of wrought aluminium, 2000-2017 (in thousand tonnes)



Source: Authors on Eurostat ComExt database

The vast majority of the EU's imports are made up of FRPs (amounting to 1.3 million tonnes in 2017, about 62% of the EU's total imports). More specifically, aluminium plates, sheets and stripes account for about 49% of the total. As can be seen in Table 3.10, aluminium extrusions represent slightly less than a quarter of the EU's total imports, while castings account for 15%. Among extrusions, around 91% of total imports is made up of bars, rods and profiles.

Table 3.10: Imports of wrought aluminium, by product, 2000, 2005, 2010-2017 (in thousand tonnes)

Product	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Aluminium wires	11	13	11	12	13	12	8	8	9	8
Extrusions	192	230	362	393	379	340	414	473	467	481
Bars, rods, and profiles	*181*	*210*	*323*	*350*	*340*	*302*	*375*	*431*	*424*	*438*
Tubes and pipes	*11*	*20*	*40*	*42*	*39*	*38*	*39*	*42*	*42*	*43*
Rolled products	484	624	800	1,034	951	1,016	1,128	1,305	1,301	1,304
Plates, sheets, and strip	*393*	*496*	*639*	*827*	*748*	*795*	*888*	*1,043*	*1,032*	*1,028*
Foil	*92*	*128*	*161*	*207*	*203*	*221*	*240*	*263*	*269*	*276*
Castings	12	127	190	230	227	232	261	292	315	325
Road wheels	*n.a.*	*100*	*147*	*178*	*179*	*179*	*196*	*235*	*259*	*261*
Total	699	993	1,364	1,668	1,571	1,600	1,811	2,079	2,091	2,119

Source: Authors on Eurostat ComExt database

Reported trade flows of castings include aluminium road wheels, traditionally regarded by industry practitioners as one of the main product categories among aluminium castings. The Harmonized System (HS) tariff nomenclature classified aluminium road wheels among parts and accessories of motor vehicles (HS Code 8708) and, more specifically, among Road wheels and parts and accessories thereof (CN Code 87087050). Road wheels account for 80% of total imports of aluminium castings.

Finally, imports of wires of both not alloyed aluminium and aluminium alloy, having a maximum cross-sectional dimension of ≤ 7 mm, represent a very small fraction of total EU imports (0.4%), amounting to 8000 tonnes in 2017.

Much of the growth of the EU's imports of wrought aluminium can be explained by the concurrent increase in Chinese exports to the EU. In 2017, imports from China were about 36 times higher than in 2000 for aluminium extrusions, 20 times higher for FRPs, and 78 times higher for aluminium castings (including road wheels). As noted, China's industrial policies were deliberately aimed at reducing the prices of raw material for semi-finished products by extensively supporting primary aluminium production.

FRPs represent about 79% of the total exports towards extra-EU countries (see Table 3.11). The remaining portion of the total exports consists of aluminium extrusions (17%), aluminium castings (3%), and aluminium wires (1%).

Table 3.11: Exports of wrought aluminium, by product, 2000, 2005, 2010-2017 (in thousand tonnes)

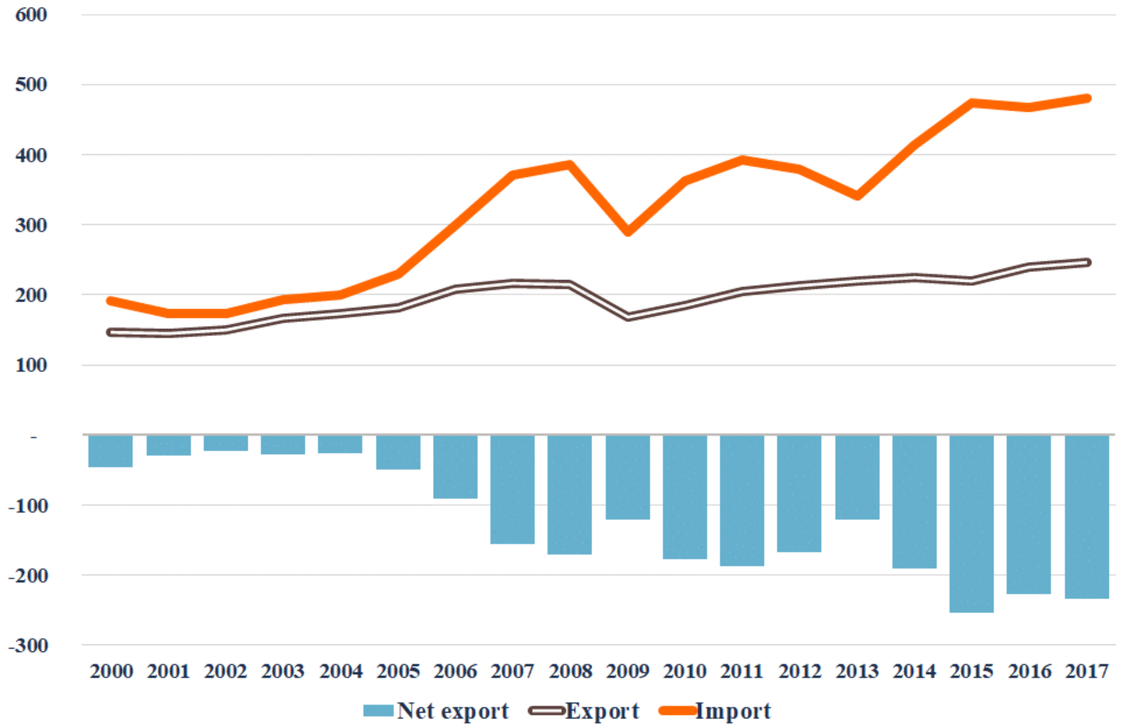
Product	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Aluminium wires	7	7	9	10	10	11	12	11	12	13
Extrusions	146	181	185	204	213	220	224	219	239	247
Bars, rods, and profiles	*129*	*153*	*160*	*176*	*186*	*190*	*195*	*194*	*213*	*220*
Tubes and pipes	*17*	*27*	*26*	*28*	*27*	*30*	*29*	*25*	*26*	*26*
Rolled products	648	1,055	969	973	1,035	1,048	1,034	1,053	1,118	1,155
Plates, sheets, and strip	*390*	*746*	*699*	*705*	*761*	*789*	*765*	*782*	*845*	*879*
Foil	*258*	*309*	*270*	*269*	*274*	*259*	*268*	*271*	*273*	*276*
Castings	11	74	87	103	113	111	117	108	105	121
Road wheels	*n.a.*	*50*	*47*	*59*	*70*	*66*	*69*	*66*	*64*	*76*
Total	812	1,317	1,250	1,290	1,371	1,390	1,388	1,391	1,474	1,536

Source: Authors on Eurostat ComExt database

3.3.1. Extruded products

The EU is a net importer of aluminium extrusions. As can be seen in Figure 3.7, the EU's trade balance has constantly been negative over the period 2000-2017. However, the EU's reliance on imported aluminium extrusions has grown rapidly in recent years. In 2017, EU net imports amount to 235,000 tonnes, more than five times higher than in 2000 (when net imports were only 45,000 tonnes). This notable worsening of the trade deficit was caused by a large increase in imports (+ 151%). This trend suggests that, especially after the deep recession that hit the global economy in 2007-2008, the EU member states have gradually begun to substitute internally-produced extrusions with imported extruded products, mainly from China and Turkey. The concurrent growth of exports (+ 68%) did not compensate for the increase in imports which this study has described .

Figure 3.7: EU net exports of extrusions, 2000-2017 (in thousands of tonnes)



Source: Authors on Eurostat ComExt database

Table 3.12: EU imports of aluminium extrusions by country of origin (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
China	4	22	85	126	130	146
Turkey	22	48	91	89	88	97
Russia	35	35	31	31	38	45
Switzerland	38	36	50	41	36	39
Norway	38	25	24	38	27	27
Iceland	0	0	0	0	0	26
Bosnia and Herzegovina	0	3	17	18	18	21
United States	6	7	7	11	11	13
Serbia	-	1	2	9	9	11
Egypt	3	3	5	7	6	9
Others	47	49	50	103	104	47
Total	192	230	362	473	467	481

Source: Authors on Eurostat ComExt database

In 2017, slightly more than half of the EU's total imports of aluminium extruded products came from two countries, China (30% of total imports) and Turkey (20%). Other major exporters to the EU included Russia (9%), Switzerland (8%), and Norway (6%). It is important to emphasize the increasing share of Chinese exports to the EU over the period 2000-2017. As a matter of fact, in 2000 China accounted for less than 2% of total exports to the EU, while in 2017 its share of exports has reached 30%. Turkey's share has also increased over the period from 2000 to 2017, although at slower pace than China. Turkey and China's expanded role in exporting extruded products to the EU has taken place at the expense of other exporters: namely Switzerland, Russia, and especially Norway. Finally, it is worth noting the increase of imports from Iceland that takes place in the last year (2017). Iceland now accounts for a market share of 5% in the EU aluminium extruding market.

As for exports, Switzerland, United States and Norway are the top destination countries for exports of aluminium extruded products from the EU (see Table 3.13). In 2017, 43% of the EU's total exports were thus shipped to these countries. However, while exports directed towards the American and Norwegian markets continued to grow over the period 2000-2017, EU exports to Switzerland remained largely stable. As a result, the share of exports directed toward Switzerland decreased from 33% in 2000 to 21% in 2017. Other significant destinations include Serbia (6%), Norway (4%), and Israel (3%).

Table 3.13: EU exports of aluminium extrusions by country of destination (Ranking 2017 by thousands of tonnes)

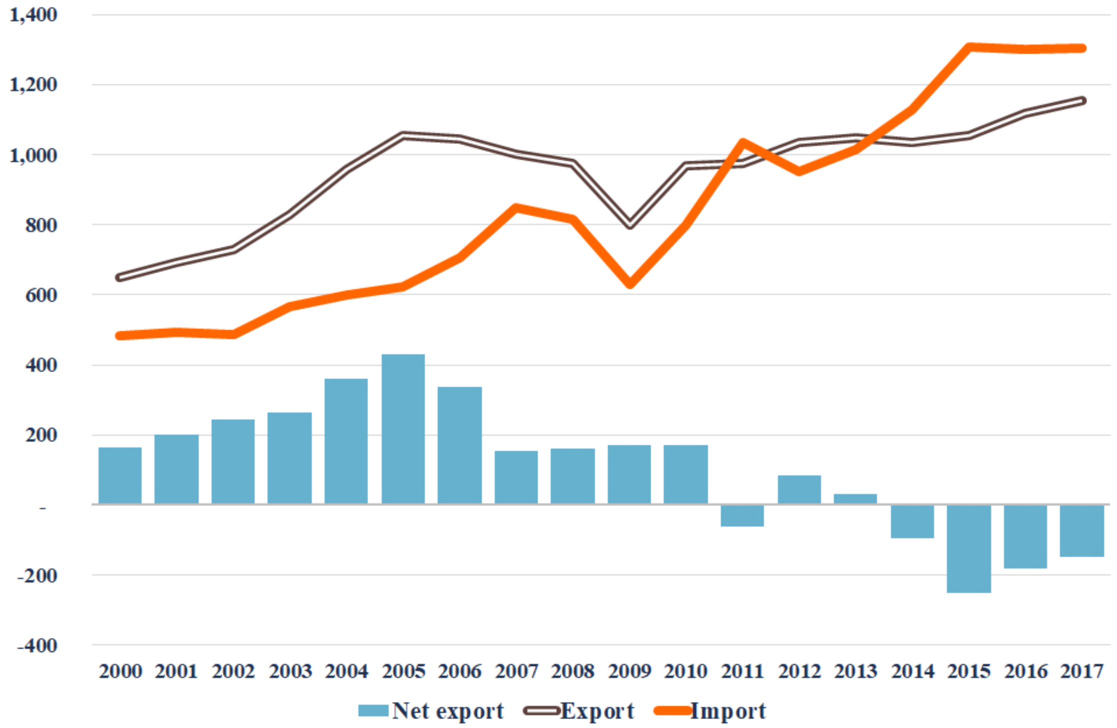
Country	2000	2005	2010	2015	2016	2017
Switzerland	49	45	53	51	50	52
United States	17	24	18	27	33	32
Norway	13	13	16	18	19	21
Serbia	-	3	8	9	16	16
Turkey	7	7	6	10	11	11
Israel	3	2	1	5	7	8
China	1	3	7	6	7	8
Mexico	1	1	2	5	6	8
Morocco	1	3	4	7	7	8
Russia	6	15	7	5	6	7
Others	49	65	64	77	78	77
Total	146	181	185	219	239	247

Source: Authors on Eurostat ComExt database

3.3.2. Flat-rolled products

Structurally a net exporter of aluminium FRPs (foils, plates, sheets, and strips), the EU has experienced an increasing trade deficit in the last four years (see Figure 3.8). As observed in the extrusion sector, the EU trade balance started worsening in 2007-2008, recording its first negative result in 2011 and averaging nearly 170,000 tonnes of deficit from 2014 to 2017. While both imports and exports have increased over the period from 2000 to 2017, imports grew substantially more than exports. As a matter of fact, imports have almost tripled in size from 2000 to 2017, whereas exports increased by 78% over the same period. In 2017, the EU imported 1.3 million tonnes of aluminium FRPs and exported 1.1 million tonnes of rolled products to extra-EU countries, with a negative balance of around 200,000 tonnes.

Figure 3.8: EU net exports of FRPs, in thousands of tonnes, 2000-2017



Source: Authors on Eurostat ComExt database

Table 3.13: EU imports of aluminium flat-rolled products by country of origin (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
Switzerland	112	106	138	258	298	323
China	12	12	97	303	259	241
Turkey	29	58	126	213	238	224
Norway	115	128	120	130	143	147
Russia	57	82	66	79	56	73
United States	56	78	42	79	60	65
Egypt	37	36	52	45	50	53
South Africa	3	19	31	29	42	40
Serbia	-	18	44	51	47	36
South Korea	1	1	6	26	23	21
Others	63	86	77	91	86	82
Total	484	624	800	1,305	1,301	1,304

Source: Authors on Eurostat ComExt database

In terms of country of origin, much of the increase of the EU imports can be explained by Chinese exports to the EU's twentyfold growth over the period 2000-2017. As a matter of fact, in 2000 China accounted for slightly less than 3% of total exports to the EU, while in 2017 its share of exports reached 18%. Turkey's share also increased between 2002 and 2013, although at a much slower pace than China (from 6% in 2000 to 17% in 2017). However, about a quarter of total imports come from Switzerland, which still remains one of the major exporters to EU markets with a volume of approximately 323,000 tonnes in 2017. Other notable exporters to the EU include Norway (11%), Russia (6%), and the United

States (5%), though these countries' share in the EU's total imports of flat-rolled products has constantly declined over 2000-2017 (see Table 3.13).

As for exports, the United States and Switzerland are by far the top destination countries for EU exports of aluminium FRPs. Together, they roughly account for 36% of the EU's exports of FRPs: In 2017, 19% of exports were shipped to Switzerland and 17% to the United States (see Table 3.14). It is worth noting that the share of exports to the United States has significantly decreased (from 21% in 2000), whereas a significant increase was registered in exports to Mexico, which now accounts for a 5% market share for EU exports (it was 1% in 2000). Turkey's weight has also increased especially in the last few years, now reaching 10% of the EU's total exports. Other major destinations for EU-produced FRPs include Saudi Arabia (4%), as well as Serbia, South Africa, China, and South Korea. The latter countries all have a share of about 3% of total EU exports.

Table 3.14: EU exports of aluminium FRPs by country of destination (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
Switzerland	92	109	118	134	180	216
United States	134	248	175	178	192	197
Turkey	30	55	67	104	109	114
Mexico	7	22	24	35	49	59
Saudi Arabia	31	59	53	77	60	41
Serbia	-	6	19	33	33	39
South Africa	3	11	6	21	25	39
China	20	75	67	44	38	38
South Korea	22	35	34	34	36	34
India	3	9	26	22	26	27
Others	305	426	380	371	370	350
Total	648	1,055	969	1,053	1,118	1,155

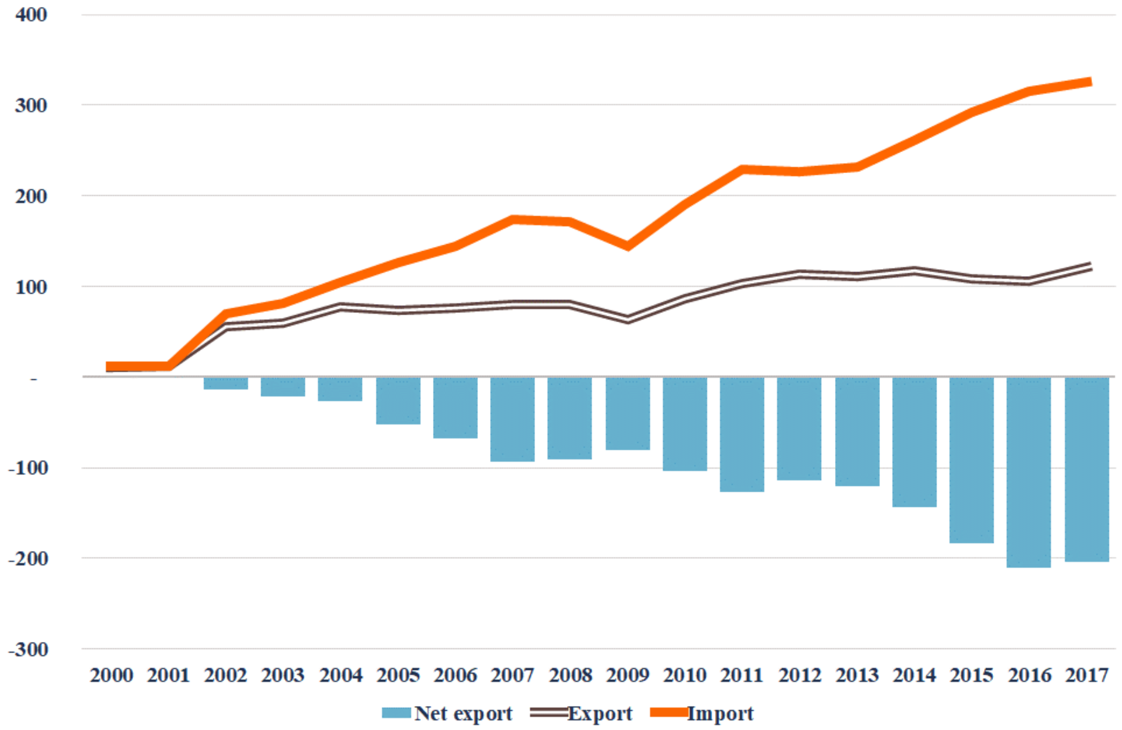
Source: Authors on Eurostat ComExt database

3.3.3. Castings

Although trade volume in aluminium castings (including aluminium road wheels) has substantially increased in the last few years, it has been historically lower than the trade volume for other aluminium semi-finished products.

In 2017, the EU imported 325,000 tonnes of aluminium castings and exported 121,000 tonnes of casted products to extra-EU countries. As a result, the EU is currently a net importer of aluminium casted products. The EU has seen both imports and exports increase over the period 2000-2017. However, the wedge between imports and exports has become wider from 2009 on. As Figure 3.9 illustrates, the trade balance has consistently been negative over the period 2000-2017. In particular, the trade deficit was equal to 204,000 tonnes in 2017 while it was equal to 14,000 tonnes in 2002 (data on trade flows of aluminium road wheels is not available for years prior to 2002).

Figure 3.9: EU net exports of aluminium castings, in thousands of tonnes, 2000-2017



Source: Authors on Eurostat ComExt database

Table 3.15: EU imports of aluminium castings other than road wheels by country of origin (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
China	1	9	27	37	39	46
Turkey	2	2	6	8	8	8
Tunisia	0	0	0	1	1	2
India	0	1	2	3	2	2
Switzerland	2	3	3	3	1	1
United States	1	3	1	1	1	1
Malaysia	0	0	0	0	0	1
Republic of Macedonia	0	0	1	1	1	1
South Korea	1	2	1	1	0	0
Thailand	0	0	0	0	0	0
Others	4	5	2	2	3	3
Total	12	26	43	57	57	65

Source: Authors on Eurostat ComExt database

Trade volume in aluminium castings other than road wheels has been negligible in the period 2000-2017. The increase of imports between 2000 and 2017 coincided with the growth of imports from China (from 1000 tonnes in 2010 to 49,000 tonnes in 2017). The share of Chinese exports to the EU over the period 2000-2017 has thus dramatically increased. As a matter of fact, in 2000 China accounted for 8% of total exports to the EU, while by 2017 its share of exports reached 71%. Other noteworthy countries of origin for EU imports include Turkey (13%), Tunisia (3%), India (3%), Switzerland (2%), and United States (1%). The share belonging to other top trading partners has remained largely stable, save for a notable increase of imports from Tunisia and a consistent decline of imports coming from Switzerland and the United States (see Table 3.16).

Table 3.16: EU exports of aluminium castings other than road wheels by country of destination (Ranking 2017 by thousand tonnes)

Country	2000	2005	2010	2015	2016	2017
United States	2	3	3	7	7	7
Russia	0	3	13	5	6	6
Switzerland	3	4	6	7	5	6
China	0	1	2	4	4	5
Serbia	-	0	2	2	2	3
Algeria	0	1	0	2	2	2
Mexico	0	2	1	1	1	2
India	0	0	0	1	2	2
Turkey	0	1	1	2	1	1
Lebanon	0	0	0	1	1	1
Others	4	9	12	10	9	11
Total	11	24	40	42	41	45

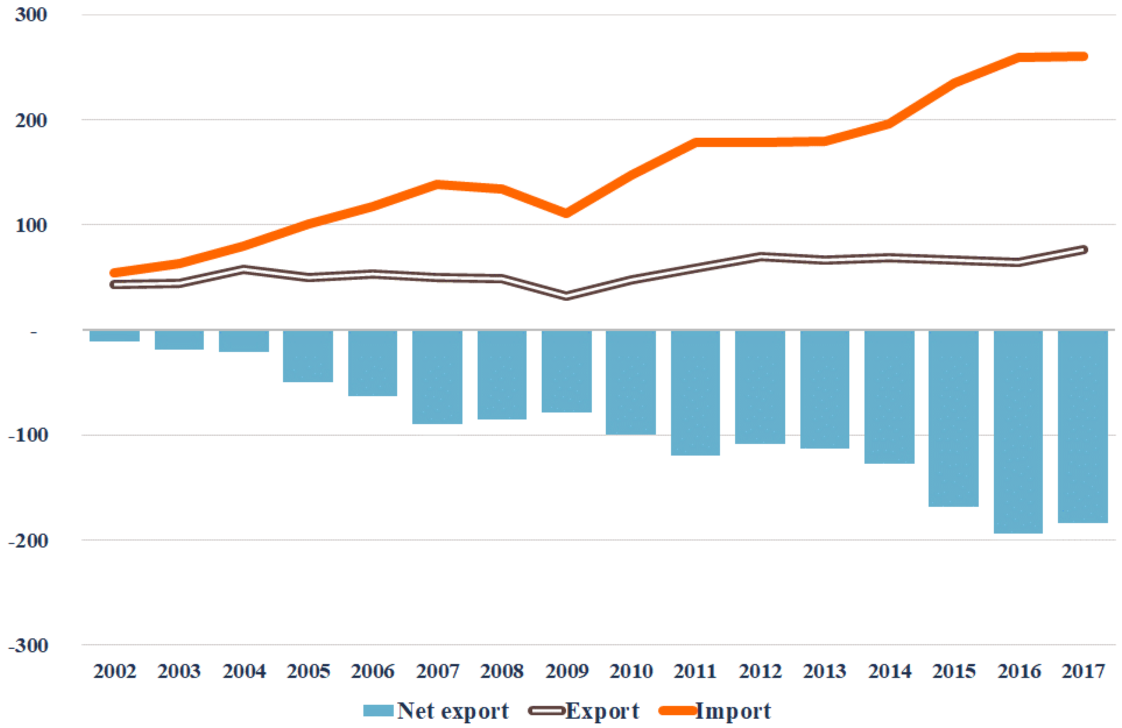
Source: Authors on Eurostat ComExt database

As for exports, the United States (16%), Russia (13%), Switzerland (12%), and China (11%) are the top destination countries for exports of aluminium casted products from the EU. While the share of exports to Switzerland substantially declined over the period 2002-2013, the weight of China and Russia has significantly increased especially from 2007 on (see Table 3.17).

As mentioned, the EU trade balance in aluminium castings (and in wrought aluminium in general) significantly worsens when aluminium road wheels are considered. Indeed, the EU is currently a net importer of aluminium road wheels, having imported 261,000 tonnes in 2017 compared to only 76,000 tonnes of exports in the same year. Moreover, while imports of aluminium road wheels more than doubled in the period 2002-2017, exports only increased by 53%. Imports of aluminium road wheels sharply increased in last few years, especially since the start of the 2008 economic crisis.

In 2017, about 39% of aluminium road wheels were imported from Turkey, which in recent years has hosted important production facilities from leading wheel manufacturers, such as Maxion Wheels. Imports from Turkey increased fivefold between 2002 and 2017, from 19,000 tonnes to over 100,000 tonnes. Other major exporters to the EU include South Korea (15%), China (12%), and Thailand (11%). As for exports, the United States, Russia and Switzerland are the top destination countries for EU exports of aluminium road wheels; together these three countries account for roughly 34% of total exports.

Figure 3.10: EU net exports of aluminium road wheels, in thousands of tonnes, 2002-2017



Source: Authors on Eurostat ComExt database

4. EU trade policies on unwrought aluminium and their impact on prices

4.1. EU policies on import tariffs for unwrought aluminium

According to EU legislation (article 28 of the TFEU, the Treaty on the Functioning of the European Union), the Common Customs Tariff (CCT)[26] provides for the application of different ad valorem custom duties for aluminium products (Bartels, 2007; Nilsson, 2011; Woolcock, 2005).

As regards unwrought aluminium (both not alloyed and alloyed), the Most Favoured Nation (MFN) applied tariff—that is, the highest, most restrictive, tariff which in principle World Trade Organisation (WTO) members charge one another— is 6%. Three suspensions of these normal customs duties have been established, enabling EU-based companies to import unwrought aluminium at a lower duty rate than that established by the CCT.

Council Regulation (EC) No 501/2007 autonomously suspended the EU conventional customs duty rate on unwrought, not alloyed, aluminium (*CN Code* 76.01.1000) from 6% to 3%. The autonomous partial suspension of the custom duty for unwrought, not alloyed, aluminium— instead of the total abolition of this duty— has been justified by the Council on the grounds of balancing the conflicting economic interests of the various aluminium operators— on one side, the positive effects on the competitiveness of independent small- and medium-sized aluminium consumers and, therefore, on the competitiveness for semi-finished and finished aluminium products in the single market; on the other side, the negative impact on the profitability of the production manufacturing plants which exist within the EU and countries with a preferential tariff arrangement with the EU[27].

In January 2014, two further autonomous tariff suspensions entered into force on the basis of a proposal from the European Commission through Council Regulation (EC) No 1387/2013, recently amended by Council Regulation (EU) 2016/2390. The first suspension concerns alloyed slabs and billets (*CN Code*

[26] The CCT is common to all EU members, but different duty rates are applied based on the kind of product that is imported and the origin of the import. Hence, the tariff is the name given to the combination of the nomenclature, which is a systematic list of commodities that serves to classify the imported goods, and the duty rates which apply to each class of goods. Furthermore, the tariff includes all other EU legislation that affects the level of customs duty payable on a particular import, e.g. the country of origin. All the measures relating to the CCT as well as EU commercial and agricultural legislation are collected in the TARIC database (http://ec.europa.eu/taxation_customs/dds2/taric/taric_consultation.jsp).

[27] More specifically, the Council noted: "This situation has to be weighed against the impact of a customs duty suspension on the manufacturing plants of not alloyed aluminium which still exist within the Community and in countries with a preferential tariff arrangement with the European Union. Almost all these plants belong either directly or indirectly to major industrial holdings located outside the European Union. The aluminium produced in these plants and supplied duty free is mainly used for further transformation within companies linked to these holdings. Only a relatively small share of duty free non alloyed aluminium is made available to independent SME. Nevertheless taking into account the relative high level of the conventional rate of customs duty of 6 % the autonomous partial suspension of this duty will have an impact on the profitability of the production and the subsequent transformation operations of these companies due to an increased price pressure on the products resulting from transformation as well as on the raw aluminium sold on the open market to independent companies".

76.01.2020), whose conventional customs duty rate was temporarily reduced from 6% to 4%. The second autonomous tariff suspension applies to the residual category of aluminium slabs and billets containing lithium (*CN Code* 76.01.202010) by lowering the conventional rate of customs duty from 6% to 0%. To other aluminium alloys (*CN Code* 76.01.2080), a 6% custom duty still applies.

Suspensions can only be granted on a temporary basis, and only for specific economic reasons in the general interest of the EU. Such reasons may include ensuring a sufficient and uninterrupted supply of products which are unavailable in the EU, as well as, more generally, stimulating economic activity within the Union, improving the competitiveness of EU businesses, and creating jobs. A review of existing regulation on alloyed slabs and billets of unwrought aluminium was expected by the end of 2018. Indeed, Council Regulation (EU) 2018/2069 of 20 December 2018 amended Regulation (EU) No 1387/2013, confirming the current duty rate of 4% and postponing the date foreseen for mandatory review to December 2023.

Table 4.4 outlines the EU import tariffs for unwrought aluminium products.

Table 4.1: MFN import tariffs for aluminium and articles thereof in the EU (2018)

Product category	CN Code	Code description	MFN Applied tariff (%)	EU law (Regulation No.)
Unwrought aluminium	76.01.100000	Aluminium, not alloyed	3	R0705010
	76.01.202010	Aluminium alloys, Slabs and billets, Slabs and billets containing lithium	0	R1623900
	76.01.202090	Aluminium alloys, Slabs and billets, Other	4	R1623900
	76.01.208000	Aluminium alloys (other)	6	R9720860

Source: Authors based on European Commission, Market Access Database (accessed September 5, 2018) and WTO Tariff Download Facility (accessed September 5, 2018)

The MFN import tariffs for other aluminium products in the EU are reported in Table 4.2. As can be seen, whereas no import tariffs apply to aluminium waste and scrap (*HS Code* 76.02.00), meaning that these products can be imported duty-free from all WTO countries, a 7.5% MFN tariff generally applies to semi-finished aluminium products, except for powders and flakes (5%), backed aluminium foils (10.0%), and tube or pipe fittings (5.9%).

Table 4.2: MFN import tariffs for aluminium and articles thereof in the EU, 2018

Product category	CN Code	Code description	MFN Applied tariff (%)	EU law (Regulation No.)
Aluminium waste and scrap	76.02.001100	Waste: Turnings, shavings, chips, milling waste, sawdust and filings; waste of coloured, coated or bonded sheets and foil, of a thickness (excluding any	0	R9822610

Product category	CN Code	Code description	MFN Applied tariff (%)	EU law (Regulation No.)
		backing) not exceeding 0,2 mm		
	76.02.001900	Waste: Other (including factory rejects)	0	R9822610
	76.02.009000	Scrap	0	R9822610
Aluminium powders and flakes	76.03.100000	Powders of non-lamellar structure	5	R0218320
	76.03.200000	Powders of lamellar structure; flakes	5	R0218320
Aluminium bars, rods and profiles	76.04.101000	Of aluminium, not alloyed; Bars and rods.	7.5	R9822610
	76.04.109000	Of aluminium, not alloyed; Profiles.	7.5	R9822610
	76.04.210000	Of aluminium alloys; Hollow profiles.	7.5*	R9822610
	76.04.290000	Of aluminium alloys; Other.	7.5*	R9822610
Aluminium Wire	76.05.000000	Aluminium Wire	7.5*	R9822610
Aluminium plates, sheets and strip, of a thickness exceeding 0.2 mm	76.06.110000 - 76.06.120000	Rectangular (including square)	7.5*	R9822610
	76.06.910000 - 76.06.920000	Other	7.5	R9822610
Aluminium foil of a thickness not exceeding 0,2 mm	76.07.110000 - 76.07.190000	Not backed	7.5*	R9822610
	76.07.200000	Backed	10.0*	R9431150
Aluminium tubes and pipes	76.08.100000	Of aluminium, not alloyed	7.5	R0517190
	76.08.200000	Of aluminium, not alloyed	7.5*	R0517190
Aluminium tube or pipe fittings	76.09.000000	Aluminium tube or pipe fittings (for example, couplings, elbows, sleeves).	5.9*	R0607110
Aluminium structures and parts of structures	76.10.100000	Doors, windows and their frames and thresholds for door	6	R0218320
	76.10.900000	Other	6-7	R9431150 / R9822610
Aluminium casks, drums, cans, boxes and similar containers, for any material, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.	76.12.100000	Collapsible tubular containers	6	R9822610
	76.12.900000	Other	6	R9822610
Aluminium containers for compressed or liquefied gas	76.13.000000		6*	R9822610
Stranded wire, cables, plaited bands and the like, of aluminium, not electrically insulated.	76.14.000000		6	R9822610
Table, kitchen or other household articles and parts thereof, of aluminium; pot scourers and scouring or polishing pads, gloves and the like, of aluminium; sanitary ware and parts thereof, of aluminium.	76.15.000000		6	R9822610

Product category	CN Code	Code description	MFN Applied tariff (%)	EU law (Regulation No.)
Other articles of aluminium	76.16.000000		6*	R9822610

*Note: * On the following CN Codes an erga omnes 0% duty rate applies as a result of autonomous duty suspensions adopted in Council Regulation (EU) 2016/2390: 76.04.210010; 76.04.299030; 76.04.291010; 76.04.291040; 76.05.190010; 76.05.290010; 76.06.129920; 76.07.119040; 76.07.119060; 76.07.199010; 76.07.209010; 76.08.208930; 76.13.000020; 76.16.991030; 76.16.999015; 76.16.999025; 76.16.999070; 76.16.999075.*
Source: Authors based on European Commission, Market Access Database (accessed September 7, 2018) and WTO Tariff Download Facility (accessed September 5, 2018)

Finally, finished aluminium products are subject to a 6% custom duty, with the only exception being a small set of aluminium structures and parts of structures, for which a 7% tariff is in force. It is worth noting that an *erga omnes* 0% duty rate currently applies to selected semis as well as finished products as a result of autonomous duty suspensions adopted in Council Regulation (EU) 2016/2390 (see note in Table 4.5 for further details for the relevant *HS Codes*).

Table 4.7 provides a comparison of the import tariffs applied in the EU with the corresponding tariffs in force in the USA, Japan, China, India, and Russia. As for unwrought, not alloyed, aluminium—apart from the 3% import tariff applied by the EU and the 5% tariff applied by India and China—countries such as the United States and Japan have generally allowed duty-free imports.

Table 4.3: Applied MFN import tariffs for aluminium products in selected countries, 2017 (in percentage)

HS Code	Code description	China	EU	India	Japan	Russia*	USA*
	Unwrought aluminium						
760110	Aluminium, not alloyed, unwrought	5	3	5	0	0	0-2.6
760120	Unwrought aluminium alloys	7	4-6	5	0	0-5	0-2.6
	Waste and scrap						
7602	Aluminium waste and scrap	1.5	0	2.5	0	0	0
	Semi-finished products						
7603	Aluminium powders and flakes	6-7	5	5	3	10	3.9-5
7604	Aluminium bars, rods and profiles	5	7.5	5	7.5	12	1.5-5
7605	Aluminium wire	8	7.5	5	7.5	9-10	2.6-4.2
7606	Aluminium plates, sheets and strip, of a thickness exceeding 0.2 mm	6-10	7.5	5	2	14-16.3	3-6.5
7607	Aluminium foil of a thickness not exceeding 0.2 mm	6	7.5-10	5	7.5	14-15	3.7-5.8
7608	Aluminium tubes and pipes	8	7.5	10	7.5	12	5.7
7609	Aluminium tube or pipe fittings	8	5.9	10	3	10	5.7
	Finished products						
7610	Aluminium structures and parts of structures; aluminium plates, rods, profiles, tubes and the like, prepared for use in structures.	6-25	6-7	10	0-3	14-15.2	5.7
7611	Aluminium reservoirs, tanks, vats and similar containers, for any material, of a capacity	12	6	10	3	10	2.6

HS Code	Code description	China	EU	India	Japan	Russia*	USA*
	exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.						
7612	Aluminium casks, drums, cans, boxes and similar containers, for any material, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.	12-30	6	10	3	10	2.4-5.7
7613	Aluminium containers for compressed or liquefied gas.	12	6	10	3	10	5
7614	Stranded wire, cables, plaited bands and the like, of aluminium, not electrically insulated.	6	6	10	3	9-10	4.9-5.7
7615	Table, kitchen or other household articles and parts thereof, of aluminium; pot scourers and scouring or polishing pads, gloves and the like, of aluminium; sanitary ware and parts thereof, of aluminium.	18	6	10	0	9-10	3.1-3.8
7616	Other articles of aluminium.	10-15	6	10	3	0 - 10	2.5-6

** Data are 2016.*
*** Data do not include recent changes in import tariff imposed by U.S. Administration.*
Source: Authors based on WTO Tariff Download Facility (accessed September 5, 2018)

More specifically, unwrought, not alloyed, aluminium can be imported duty-free into Japan. As previously mentioned, Japan has decided to permanently stop producing primary aluminium and to focus on secondary production. Until last year, the US also applied a 0% import tariff on imported unwrought, not alloyed, aluminium, except for imports of coils with uniform cross section throughout their length (the lesser cross-sectional dimension of which is not greater than 9.5 mm), which products are subject to a 2.6% custom duty. As of August 2018, every country (except for Argentina and Australia) is subject to a 10% tariff on unwrought aluminium imported into the United States. Temporary exemptions were granted to the EU, Canada and Mexico, but these temporary exemptions expired on June 1.

Japan also applies a 0% import tariff to unwrought aluminium alloys. Unwrought aluminium alloys can be also imported duty-free to US, with the minor exception of the aforementioned coils (subject to a 2.6% custom duty) and unwrought aluminium alloys containing 25% or more of silicon (subject to a 2.1% tariff). As previously mentioned, the EU duty is 6% with two exceptions: that of slabs and billets that are subject to a 4% duty, and that of the remaining slabs and billets containing lithium, which are not subject to any duty. As a result, the EU applies import tariffs higher than the USA and Japan, including for unwrought aluminium alloys. In China, the duty for unwrought aluminium alloys is 7%, in India 5%, and in Russia 5%.

All of the above countries allow duty-free imports of waste and scrap, and all of them apply a duty, of varying levels, on imported semis and finished aluminium products. In the case of the US and Japan, it is worth noting that import tariffs on aluminium semis are still positive even when unwrought aluminium can be imported on a duty-free basis (at least until last year in the US).

4.2. Preferential Trade Agreements on import tariffs for unwrought aluminium and the inward processing trading regime

As observed, the MFN import tariffs are the most restrictive tariffs applied between WTO members. Lower tariffs, including zero tariffs, are often offered by WTO members to their trade partners under free trade agreements (Rodrik, 1995). These trade pacts are called Preferential Trade Agreements (PTAs) and include Generalized System of Preferences (GSP) schemes, which are programmes in which developed countries grant preferential tariffs to imports from developing countries, as well as non-reciprocal preferential schemes (Maggi, 2014).

The EU has concluded many PTAs with other countries and regions, which often contain specific rules for aluminium products. Based on these agreements, unwrought aluminium can be imported into the EU duty-free from foreign countries that are part of the European Economic Area (EEA), the Caribbean Forum (CARIFORUM) , the African, Caribbean, and Pacific (ACP) regions, and from other countries linked to the EU by bilateral PTAs such as Bosnia and Herzegovina, Chile, Colombia, Switzerland, Turkey, and many others. Unwrought aluminium products are also covered by the Generalised Scheme of Preferences (GSP) for less developed countries (SPGA), which allows 49 countries to export their aluminium duty-free into the EU.

The GSP-SPGA also applies to aluminium semis. Similarly, this group of products is also subject to other zero-duty PTAs with countries that are part of the EEA, the CARIFORUM, and the ACP regions. In addition, the majority of semi-finished aluminium products can be imported duty-free from 16 additional countries that are involved in the programme to incentivize sustainable development and good governance under the GSP-SPGE system. Furthermore, many developing countries (excluding China) can export aluminium semis to the EU under a lower tariff according to the GSP-SPGL system. Imports of finished aluminium products are also included in a large number of PTAs and are covered by the GSP-SPGL system.

EU trade policy also offers interested companies the option of processing trade, through which companies temporarily import raw materials or semi-manufactured goods from various countries and then assemble or transform them inside the European Union customs territory, destined for final consumption in third markets. When interested companies comply with the specific set of rules and procedures governing inward processing, the imported intermediate goods are not subject to import duty, or to other taxes related to their import, such as VAT and/or excises, and commercial policy measures (Cernat and Pajot, 2012).

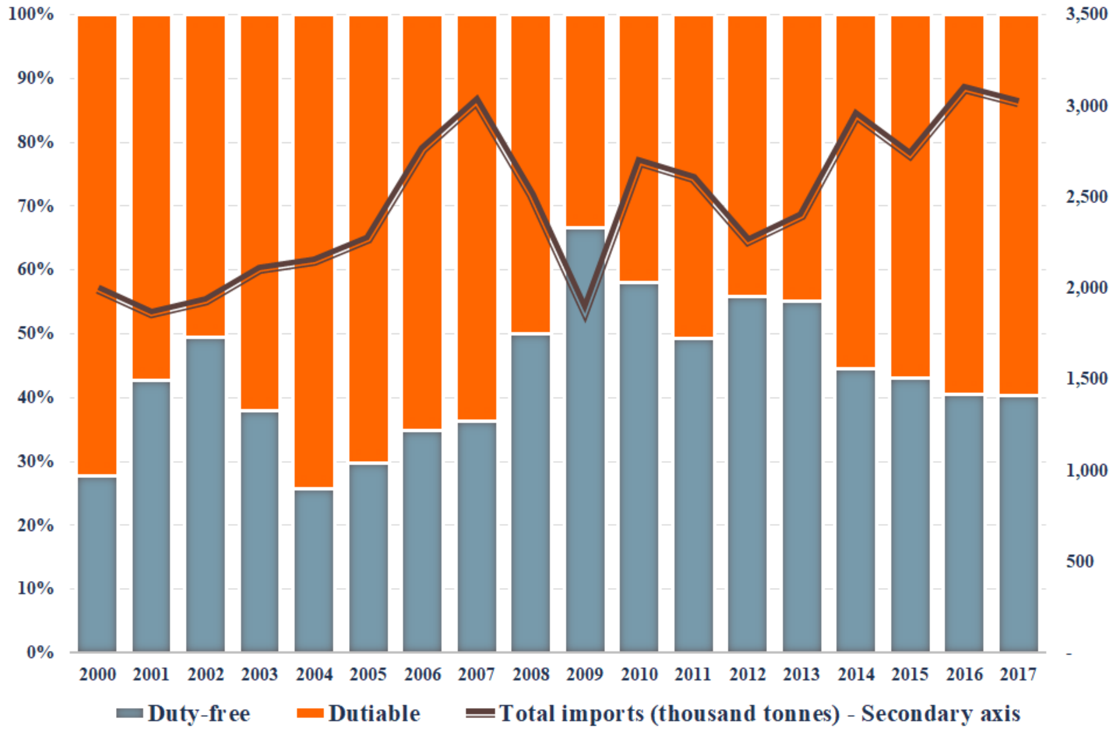
The rationale behind the inward processing procedure is rooted in the desire to promote the competitiveness of EU companies— especially large exporters—by reducing their trade costs, especially in highly integrated industrial processes across the globe. Intermediate inputs imported from outside the customs union can be processed even before companies decide— according to logistical, commercial or other conditions— whether to sell the finished products inside or outside the European Union. Needless to say, when goods are released for free circulation in the European Union's customs territory, this implies the obligation to pay import duty and taxes, as well as the application of commercial policy measures. Furthermore, the inward processing trade regime can be used for those goods which merely require processing operations intended to preserve them, improve their appearance or marketable quality or prepare them for distribution or resale.

4.3. Unwrought aluminium trade flows by tariff regime

4.3.1. Unwrought, not alloyed, aluminium

The relative share of duty-free imports of unwrought, not alloyed, aluminium has risen after the introduction of the autonomous tariff suspension in 2007, averaging 50% in the period 2008-2017 (it averaged 36% from 2000 to 2008). This trend is rather surprising, since in principle one would expect to see an increase of dutiable imports as a result of the tariff suspension implemented in 2007, as dutiable imports became comparatively more competitive than in the past. It is worth noting that the autonomous tariff suspension coincided temporally with the beginning of the economic crisis and the ensuing contraction in total imports of unwrought, not alloyed, aluminium. As a matter of fact, the share of duty-free imports increases in periods in which the overall quantity of imports is substantially lower. Indeed, EU total imports declined to 3.5 million tonnes in 2009 and then increased again to slightly less than 6 million tonnes in 2017 (see Figure 4.1).

Figure 4.1: EU imports of unwrought, not alloyed, aluminium (CN Code 76.01.1000), percentage by tariff regime, 2000-2017

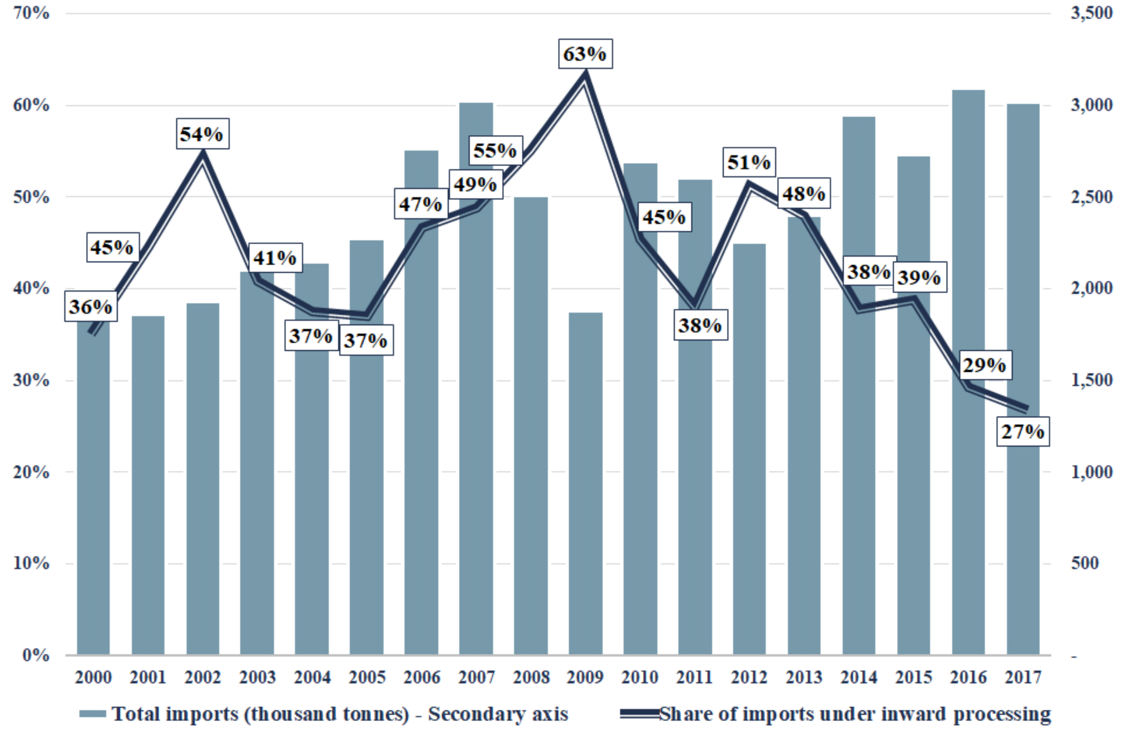


Source: Authors on Eurostat ComExt database

In 2017, about 486,000 tonnes of dutiable unwrought, not alloyed, aluminium was imported under the inward processing procedure (27% of the total quantity of dutiable imports). As a result, in 2017, approximately 44% of the total imports entering the EU internal market were obliged to pay duty.

In the wider period between 2000 and 2017, the inward processing procedure was extensively used by EU companies; the procedure was employed for an average of 43% of the total dutiable imports of unwrought, not alloyed, aluminium (see Figure 4.2).

Figure 4.2: EU imports of unwrought, not alloyed, aluminium under inward processing procedures (CN Code 76.01.1000)



Source: Authors on Eurostat ComExt database

Table 4.4: EU Imports of unwrought, not alloyed, aluminium (CN Code 76.01.1000) by country of origin (Ranking 2017 by percentage of the total)

Country	Tariff regime	2000	2005	2010	2015	2016	2017
Imports (ktonnes)		2,261	2,316	2,743	2,731	3,095	3,025
Russia	Dutiable	46.5	30.5	23.2	36.8	37.5	37.9
Mozambique	Duty-free	0.5	23.1	24.0	17.9	16.8	16.9
Iceland	Duty-free	5.8	5.4	23.0	1.8	14.1	15.9
India	Dutiable	0.0	0.0	0.1	1.5	1.2	4.8
South Africa	Dutiable	1.1	1.3	1.0	2.5	1.7	3.6
UAE	Dutiable	1.2	0.2	1.0	4.2	3.9	3.5
Kazakhstan	Dutiable	0.0	-	0.2	0.3	2.7	2.9
Norway	Duty-free	11.9	11.3	2.9	2.1	2.4	2.1
Cameroon	Duty-free	3.1	2.6	1.7	2.1	1.9	1.9
Egypt	Duty-free	1.0	0.6	0.7	1.2	1.4	1.5
Brazil	Dutiable	8.5	8.5	4.7	1.3	4.1	1.4
Canada	Duty-free*	6.1	1.7	6.8	4.4	2.3	1.2
Saudi Arabia	Dutiable	-	-	-	2.0	2.3	1.0
New Zealand	Dutiable	-	0.5	0.9	1.3	0.9	0.9
Ghana	Duty-free	4.0	0.2	-	0.9	0.9	0.8
Rest of the World		10.3	14.0	9.6	19.7	5.9	3.7

** Duty-free from 2017*

Source: Authors on Eurostat ComExt database and European Commission, Market Access Database (accessed September 7, 2018)

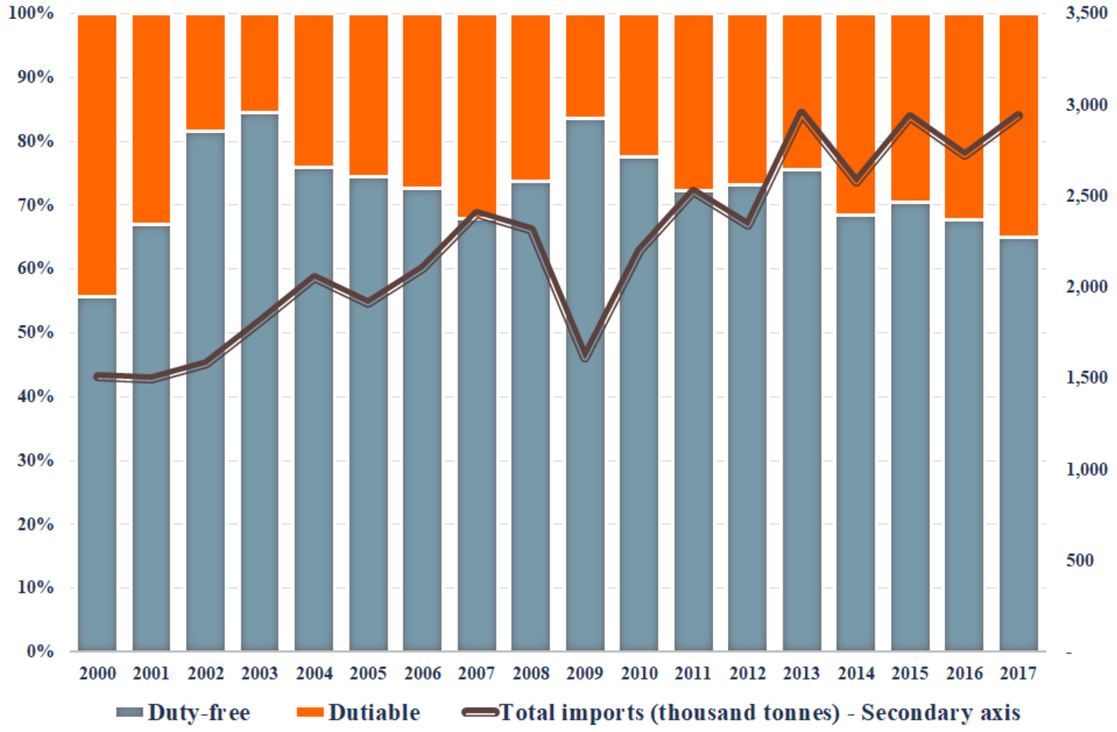
Table 4.4 shows the top exporting countries of unwrought, not alloyed, aluminium (CN Code 76.01.1000) to the EU according to different import tariff regimes. Seven out of the EU's fifteen main trading partners are countries that can export their aluminium duty-free to the EU. Among dutiable countries, Russia accounts for slightly less than 38% of the EU's total imports of unwrought, not alloyed, aluminium; Russia also represents about 63% of the EU's total dutiable imports. Conversely, Mozambique (17%) and Iceland (16%) are the main exporters among countries with duty-free access to the EU.

4.3.2. Unwrought aluminium alloys

As for unwrought, not alloyed, aluminium, the share of duty-free imports is much higher than for unwrought, alloyed, aluminium. On average, about three out of four tonnes of unwrought, alloyed, aluminium were imported into the EU duty-free during the period 2000-2017 (see Figure 4.3).

The percentage of imports entering the bloc duty-free has slightly decreased after the autonomous tariff suspension was introduced in 2013, averaging 68% in the period 2014-2017 (after averaging 74% in previous years).

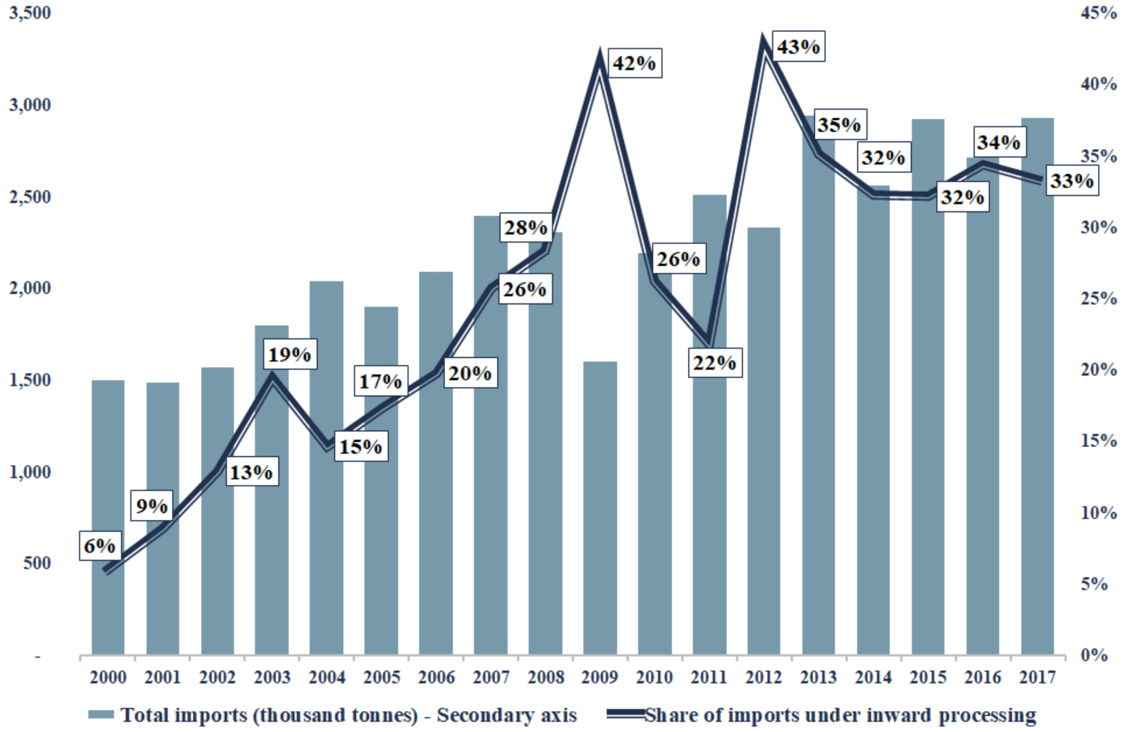
Figure 4.3: EU imports of unwrought aluminium alloys, by tariff regime, 2000-2017



Source: Authors on Eurostat ComExt database

Moreover, the inward processing tariff regime has been increasingly used for dutiable imports of aluminium alloys in the form of slabs and billets, as well as foundry alloys. In fact, the volume of unwrought, alloyed, aluminium for which EU aluminium transformer companies requested inward processing increased from 40,000 tonnes in 2000 to 344,000 tonnes in 2017, representing 33% of the total dutiable imports (compared to 6% in 2000). As a result, last year approximately 23% of the total imports entering the EU customs territory had an obligation to pay the import duty (see Figure 4.4).

Figure 4.4: EU imports of unwrought aluminium alloys under inward processing procedures (CN Code 76.01.2000)



Source: Authors on Eurostat ComExt database

Table 4.5: EU imports of unwrought aluminium alloys in the form of slabs and billets, CN Code 76.01.2020, by country of origin and tariff regime (Ranking 2017 by percentage of the total)

Country	Tariff regime	2013	2014	2015	2016	2017
Imports (ktonnes)		1,681	1,799	1,577	1,832	2,042
Norway	Duty-free	55.7	54.8	45.5	48.9	46.2
UAE	Dutiable	14.7	15.2	20.1	18.8	17.7
Iceland	Duty-free	9.7	11.0	11.8	10.4	10.9
Russia	Dutiable	4.6	5.6	6.6	6.0	5.5
Bosnia and Herzegovina	Duty-free	3.3	3.3	3.8	4.6	3.9
Switzerland	Duty-free	2.2	1.4	2.7	4.1	3.8
Bahrain	Dutiable	0.1	0.3	0.6	0.5	3.6
Egypt	Duty-free	2.9	1.6	1.9	1.9	2.8
Turkey	Duty-free	2.5	2.2	1.5	1.4	1.4
United States	Dutiable	0.5	0.2	0.2	0.3	0.8
Malaysia	Dutiable	0.7	0.7	1.3	0.7	0.8
Saudi Arabia	Dutiable	-	0.3	0.4	0.6	0.7
Serbia	Duty-free	0.7	0.5	0.6	0.6	0.5
Albania	Duty-free	-	-	0.0	0.0	0.3
Tunisia	Duty-free	0.0	0.1	0.4	0.4	0.3
Rest of the world		2.4	2.8	2.5	0.8	0.8

Source: Authors on Eurostat ComExt database and European Commission, Market Access Database (accessed September 7, 2018)

Table 4.5 and Table 4.6 show, respectively, EU imports, by country of origin and tariff regime, of unwrought aluminium alloys in the form of slabs and billets (CN Code 76.01.2020) and foundry alloys (CN Code 76.01.2080).

Among the countries with duty-free access to the European Union customs territory, Norway and Iceland are by far the leading exporters, together accounting for 57% of the EU's imports of aluminium alloys in the form of slabs and billets and for 47% of the EU's imports of foundry alloys. Nine out of the EU's fifteen main trading partners can export their unwrought aluminium alloys duty-free to the EU.

Among dutiable countries, the UAE accounted for slightly less than 18% of the EU's total imports of alloys in the form of slabs and billets in 2017 (equivalent to about 55% of the total dutiable imports that year) and 16% of the EU's total imports of foundry alloys (about 39% of the total dutiable imports that year).

Table 4.6: EU imports of unwrought aluminium foundry alloys, CN Code 76.01.2080, by country of origin and tariff regime (Ranking 2017 by percentage of the total)

Country	Tariff regime	2013	2014	2015	2016	2017
Imports (ktonnes)		757	729	914	839	902
Norway	Duty-free	38.9	35.5	47.6	39.8	34.9
UAE	Dutiable	16.6	20.9	14.5	17.5	16.3
Russia	Dutiable	9.9	10.6	13.1	15.3	16.0
Iceland	Duty-free	11.7	9.0	7.7	7.3	12.5
Bahrain	Dutiable	7.4	7.4	3.1	4.3	5.7
Egypt	Duty-free	5.5	5.5	3.6	4.6	4.8
Qatar	Dutiable	0.0	1.8	0.8	0.4	1.4
Malaysia	Dutiable	0.0	0.7	1.5	0.2	1.3
Albania	Duty-free	0.4	0.6	0.6	1.0	1.1
Tunisia	Duty-free	0.4	0.9	0.9	1.1	0.9
Bosnia and Herzegovina	Duty-free	3.2	1.4	0.8	1.4	0.7
Cameroon	Duty-free	0.0	0.0	-	0.1	0.6
Ukraine	Duty-free	0.8	0.5	0.7	0.4	0.6
Serbia	Duty-free	0.3	0.4	0.3	0.5	0.4
Turkey	Duty-free	0.8	0.8	1.3	0.7	0.3
Rest of the world		4.0	4.1	3.5	5.3	2.5

Source: Authors on Eurostat ComExt database and European Commission, Market Access Database (accessed September 7, 2018)

4.3.3. Trade flows between duty-free and duty-paid countries

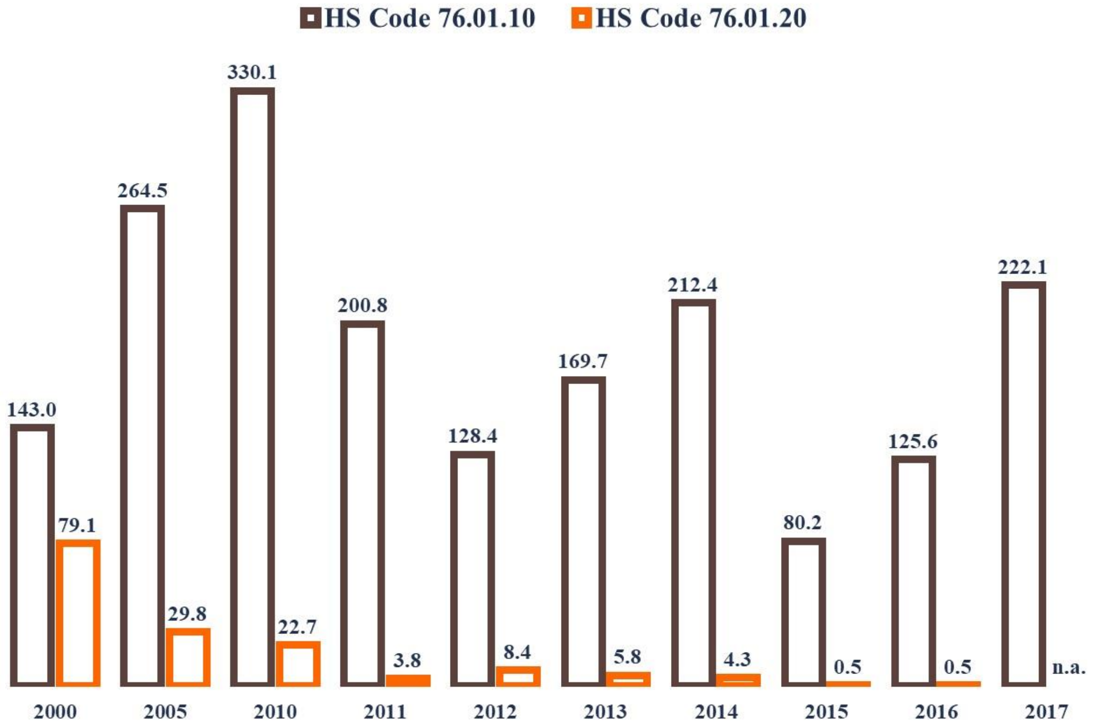
Overall trade flows between countries are often difficult to fully depict at global level. In considering the role of countries with duty-free access to the EU, one should also take into account that global firms have the opportunity to import unwrought aluminium products (i.e. commodity ingots) from one country and to process them internally to produce value-added products (such as slabs, billets, foundry alloys, and wire rods) which are then exported to another country.

The trade flows of unwrought, not alloyed, aluminium between Norway and the Russian Federation are particularly notable. Conversely, trade flows between Iceland and the Russian Federation are negligible.

Data on trade flows between the main duty-free exporters to the EU (Norway and Iceland) and other large dutiable exporters to the EU (i.e. Mozambique and India) is not available.

As mentioned, Norway historically imports large volumes of unwrought, not alloyed, aluminium from the Russian Federation (see Figure 4.5). In 2017, Norway imported from the Russian Federation a quantity of unwrought, not alloyed, aluminium (about 222,000 tonnes) equal to almost one fifth of the EU's total 2017 imports of unwrought, not alloyed, aluminium from the Russian Federation. Net imports of aluminium alloys are significantly lower, and in fact have been negligible in last few years, despite the fact that Norway is the leading exporter of aluminium alloys to the EU. Norway currently applies a 0% MFN import tariff to both unwrought, not alloyed, aluminium and unwrought aluminium alloys.

Figure 4.5: Norwegian net imports of unwrought aluminium from the Russian Federation (in thousands of tonnes)



Source: Authors on UN Comtrade Database

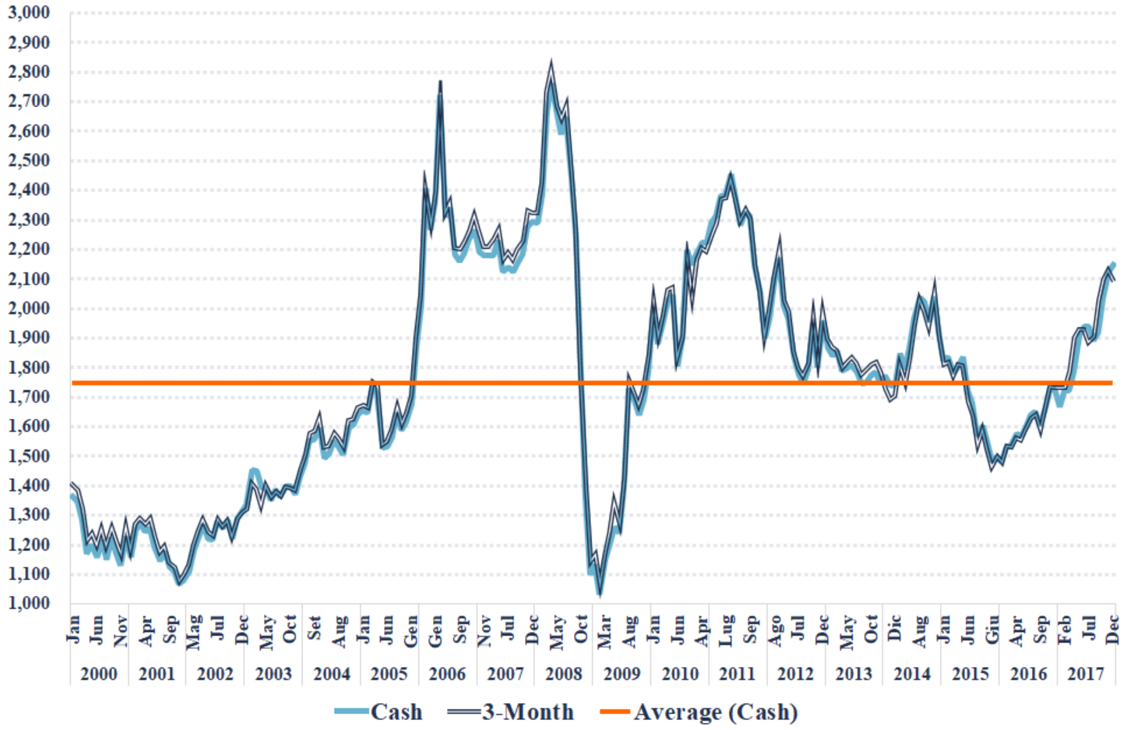
4.4. Impact of import tariffs on EU market prices

According to economic theory, the introduction of import tariffs is expected to increase the prices of both imported and domestic goods (Brander, 1995, 1986; Krugman et al., 2015). With reference to unwrought aluminium, import tariffs affect prices both of aluminium originating from dutiable countries and aluminium made either in the EU or in countries that entered into zero-duty PTAs with the EU. Generally speaking, the magnitude of the price increase for domestic consumers depends on the economic characteristics of the specific sector considered, including structural elements and competitive practices, as well as rules governing price formation[28].

[28] For a comprehensive analysis of how aluminium prices are set and of potential competitive issues regarding the aluminium industry, see GRIF (2015).

From this perspective, the final or full price of unwrought aluminium products is the sum of two components. The first is the LME price as determined by the London Metal Exchange (LME), the world's largest market on base and other metals, including aluminium. The LME platform sets the base metal price for 99.7% (high grade) aluminium ingots in warehouse, which reflects global supply and demand. The LME price is usually regarded as a basic component for any commercial agreement between suppliers/traders and non-integrated downstream producers. Commercial agreements usually include the LME price, referring to the quote of the day in which the contract is signed, to the average quotes from the month of delivery, or to the average quotes from the month prior to delivery. The aluminium price based on LME high grade primary aluminium averaged 1,688 euros per tonne in the period 2000-2017, in real terms (see Figure 4.6). In the narrower period from 2014 to 2017, the aluminium price on average was 1,563 euros per tonne, after reaching the value of 2,333 euros per tonne in 2007 (in real terms).

Figure 4.6: LME High grade primary aluminium ($/tonne, monthly average), 2000-2017



Source: Authors on CRU Group

A premium (or regional premium) is then added to the LME price to reflect the local peculiarities of geographical aluminium markets, which can vary depending on the relevant characteristics of unwrought aluminium products, such as duty, cutting, alloying, transportation costs from the warehouse to the plant, aluminium grade, and time of delivery. The largest aluminium companies set the regional premiums for unwrought aluminium products (ingot, slab, billet, foundry, alloy, etc.) in their negotiations with their customers based on the LME price which refers to high purity aluminium. Information on regional premiums are published on a weekly basis by different experts (Metal Bulletin, Harbor, etc.), and quoted as ingot, billet, alloy etc. in warehouse, even if they are based upon numerous telephone calls to producers.

From an economic point of view, there is no incentive for domestic unwrought aluminium producers to not align their prices to the highest possible level—that is, the duty-paid price. Moreover, given the regional market conditions and structural characteristics of the EU aluminium industry, EU primary producers and primary producers with duty-free access to the EU market know that the quantity of duty-free unwrought aluminium is consistently lower than the EU's apparent consumption, implying that a portion of the demand of downstream transformers will necessarily be met by duty-paid unwrought aluminium. The theoretical predictions were confirmed by the empirical evidence reported in a number of studies focusing on the aluminium industry (see, for instance, Ecorys, 2011). Furthermore, in our previous report (GRIF, 2015), representatives of several non-integrated downstream transformers based in the EU have confirmed that the price their companies have paid for unwrought aluminium products does not reflect the duty-free or dutiable nature of the countries of origin. As a matter of fact, EU market prices for unwrought aluminium always include the customs duty.

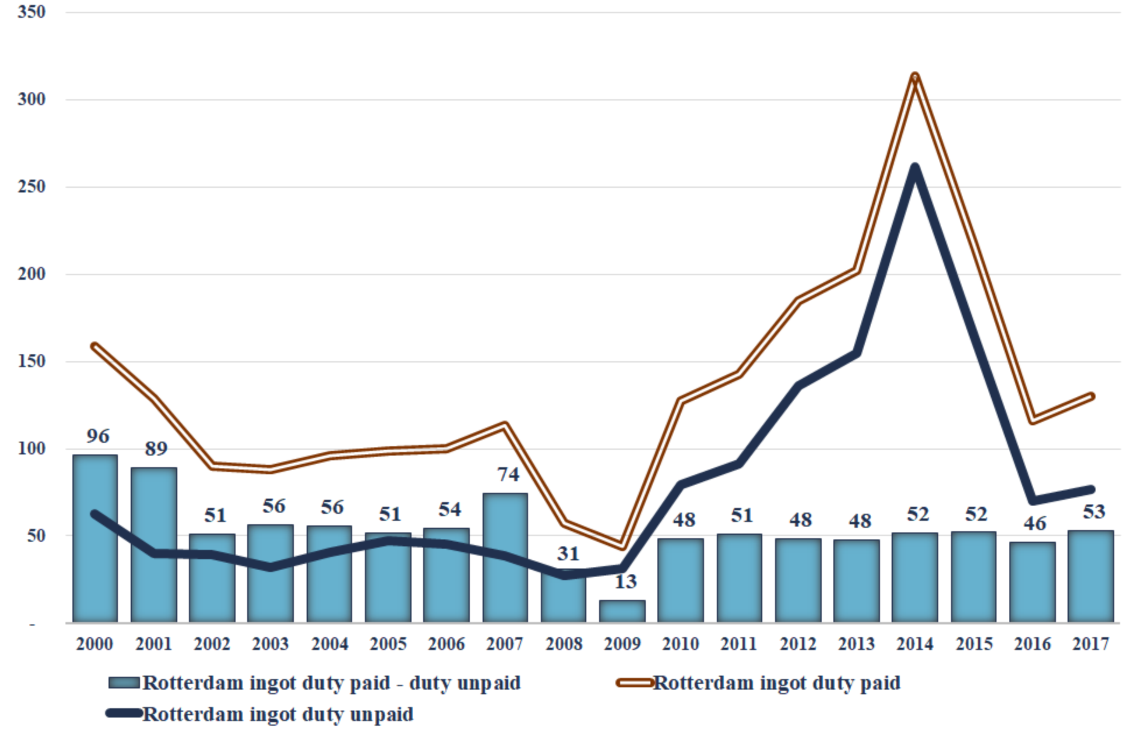
4.4.1. Unwrought, not alloyed, aluminium

To estimate the price increase stemming from the EU import tariff applied on unwrought unalloyed aluminium, it is first worthwhile to investigate the existing difference between the Rotterdam Ingot Duty Paid and the Rotterdam Ingot Duty Unpaid premium series (see Figure 4.7). Additional costs deriving from import tariffs averaged 54 euros and 50 euros per tonne over the periods 2002-2006 and 2010-2017.

The difference between the average yearly premiums for high purity aluminium ingots sold in the EU decreased during the early years of the economic crisis, as demand dropped, generating more intense competition between duty-free and duty-paid imports. In contrast with the hikes registered in 2000-2001 and 2007, the impact of the duty remained substantially steady from 2013 to 2015, a period when global premiums surged as industrial demand remained positive and surplus supply markets either tightened or went into outright deficit due to shut downs and production curtailments and smelters' use of the metal in financing deals.

As can be seen in Table 4.7, the duty has led to a price increase of slightly less than 3% since 2010. More in general, the difference between duty-paid and duty-free premiums has usually been lower than the import tariff rate applied to unwrought unalloyed aluminium, as part of the duty is potentially borne by suppliers (Ecorys, 2011). Since the 2007 autonomous suspension, which reduced the import tariff on unalloyed aluminium from 6% to 3%, there has been downward pressure on the prices paid by downstream transformers for high purity ingots, even if market premiums have registered a steep upsurge.

Figure 4.7: Rotterdam ingot premiums: duty-paid vs. duty-unpaid (€/tonne, annual average), 2000-2017



Source: Authors on CRU Group

Table 4.7: Impact of the duty on premiums for unwrought, not alloyed, aluminium as a share of the price before duty (€/tonne, annual average), 2000-2017

	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
A. LME High grade primary aluminium cash + Rotterdam Ingot Duty Unpaid	1,742	1,571	1,718	1,815	1,708	1,544	1,666	1,663	1,519	1,786
B. Rotterdam Ingot Duty - Duty Unpaid	96	51	48	51	48	48	52	52	46	53
B/A (in%age)	5.5	3.3	2.8	2.8	2.8	3.1	3.1	3.1	3.0	3.0

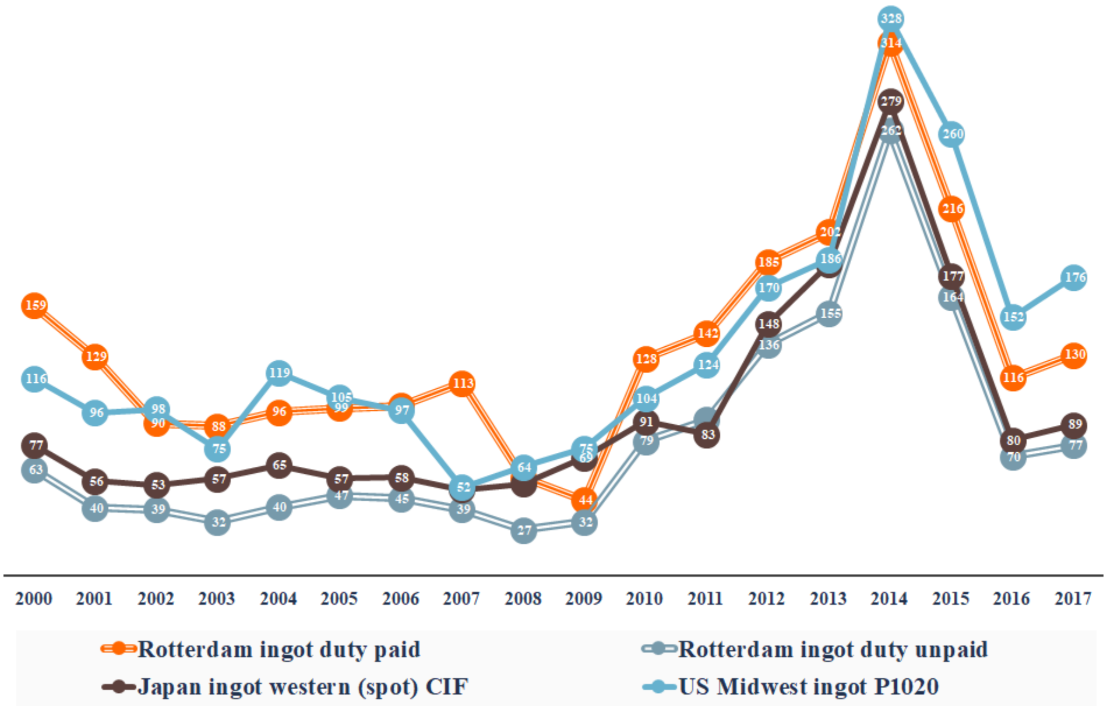
Source: Authors on CRU

The EU import tariff on unwrought, not alloyed, aluminium also has the effect of raising the premium for high purity ingots in the EU market above comparable premiums in other regions of the world—except in the last four years, when the US Midwest ingot P1020 premium has been consistently higher than all other premiums due to policy debates surrounding the intension to implement taxes on aluminium imports. As can be seen in Figure 4.8, while the Rotterdam ingot duty unpaid premium is generally lower than the premiums applied in the USA and Japan for the same category of products, the duty shifts the EU premium upwards, to a level similar to the US premium and higher than that in Japan[29].

[29] Note, however, that the Japanese premium excludes delivery expenses by complying with the so-called "Cost, Insurance, and Freight" (CIF) trade terms. Rotterdam ingot and US Midwest ingot P1020 premiums include the costs to deliver ingots to the buyer's premises.

Although import tariffs are only one among many factors affecting regional prices, which also reflect other differences in regional market conditions, the duty makes the EU market less attractive for foreign producers than other regions that are structural net importers of aluminium. To find supplying the EU market profitable, smelters based outside the EU are required to negotiate higher premiums.

Figure 4.8: A comparison of international premiums for high purity ingots (€/tonne, annual average), 2000-2017



Source: Authors on CRU Group

4.4.2. Unwrought aluminium alloys

The assessment of the impact of the EU import tariffs on the prices of unwrought aluminium alloys is more complex. In contrast with the situation for unwrought, not alloyed, aluminium, an official duty-unpaid premium series is not available.

The price for unwrought aluminium alloys is key for the competitiveness of the EU aluminium downstream industry. As a matter of fact, the EU market price for unwrought aluminium alloys represents the opportunity cost of the aluminium inputs used by non-integrated EU downstream transformers. As semi-finished aluminium products are mostly made from unwrought alloyed aluminium, downstream transformers can either source unwrought aluminium alloys on the market and transform them into semi-finished products—or they can purchase commodity ingots, extrusion ingots and foundry alloys of unwrought, not alloyed, aluminium, process them in their own cast-house facilities to get the alloys required for their production process, and then transform this alloyed aluminium into semi-finished products. Setting aside any strategic consideration, the decision of which of these two routes to pursue is based on a cost comparison between purchasing unwrought aluminium alloys on the market and purchasing unalloyed aluminium plus alloying it internally. As unwrought, not alloyed, aluminium, the representatives of several non-integrated downstream transformers based in the EU stressed that the price for unwrought aluminium alloys is always at its duty-paid level irrespectively of the actual origin of the purchased products.

Based on GRIF (2015), Table 4.8 shows the duty-paid price for primary unwrought aluminium alloys imported from extra-EU dutiable countries in the period 2000-2012, calculated by adding the customs duty to the pre-duty price. The duty-unpaid price series can be proxied by the average (per tonne) value, before duty, of unwrought alloyed aluminium derived by COMEXT data on the statistical value of imports originated from dutiable countries[30].

Table 4.8: Estimate of the impact of the duty on prices for primary unwrought aluminium alloys, CN Code 76.01.2010 (€/tonne, annual average)

	(A)	(B)	(A+B)
	Price before duty for primary unwrought alloyed aluminium imported from extra-EU dutiable countries	6% customs duty (A*0.06)	Duty paid price for primary unwrought alloyed aluminium imported from extra-EU dutiable countries
2000	1,853	111	1,964
2001	1,893	114	2,007
2002	1,610	97	1,706
2003	1,416	85	1,501
2004	1,488	89	1,577
2005	1,625	97	1,722
2006	1,979	119	2,097
2007	2,111	127	2,238
2008	1,941	116	2,058
2009	1,373	82	1,455
2010	1,759	106	1,864
2011	1,933	116	2,049
2012	1,810	109	1,919

Source: Authors on Eurostat ComExt database

As mentioned, the conventional rate of customs duty for alloyed slabs and billets (CN Code 76.01.2020) was temporarily reduced from 6% to 4% in 2013, while a 6% customs duty is still applied to foundry alloys (CN Code 76.01.2080). Table 4.9 reports the estimated duty-paid price for primary unwrought aluminium alloys in the form of slab and billets imported from extra-EU dutiable countries in the period 2013-2017. Note that, since 2013, the distinction between unwrought aluminium of primary and secondary production no longer applies in either the Harmonized System or the Combined Nomenclature codes. Accordingly, the estimates refer to unwrought aluminium alloys in the form of slabs and billets of both primary and secondary production. Finally, Table 4.10 shows the estimated duty-paid price for primary unwrought aluminium foundry alloys (CN Code 76.01.2080) imported from extra-EU dutiable countries in the period 2013-2017, upon which a 6% customs duty is imposed.

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[30] The statistical value is the value calculated at national frontiers. It is a CIF value for imports/arrivals: it therefore includes only incidental expenses (freight, insurance) in the part of the journey located outside the territory of the Member State which imports the goods. The statistic value is generally based on the customs value in the case of extra-EU trade, thus excluding, i.a., import duties or other Community taxes on the import or sale of goods.

Table 4.9: Estimate of the impact of the duty on prices for unwrought aluminium alloys in the form of slabs or billets, CN Code 76.01.2020 (€/tonne, annual average)

	(A)	(B)	(A+B)
	Price before duty for unwrought aluminium alloys in the form of slabs and billets imported from extra-EU dutiable countries	4% customs duty (A*0.04)	Duty paid price for primary unwrought alloyed aluminium imported from extra-EU dutiable countries
2013	1,742	70	1,811
2014	1,778	71	1,849
2015	1,985	79	2,064
2016	1,686	67	1,753
2017	1,958	78	2,036

Source: Authors on Eurostat ComExt database

Table 4.10: Estimate of the impact of the duty on prices for unwrought aluminium foundry alloys, CN Code 76.01.2080 (€/tonne, annual average)

	(A)	(B)	(A+B)
	Price before duty for unwrought aluminium alloys in the form of slabs and billets imported from extra-EU dutiable countries	6% customs duty (A*0.06)	Duty paid price for primary unwrought alloyed aluminium imported from extra-EU dutiable countries
2013	1,746	105	1,851
2014	1,708	103	1,811
2015	1,917	115	2,033
2016	1,638	98	1,737
2017	1,892	114	2,005

Source: Authors on Eurostat ComExt database

4.4.3. Unwrought aluminium of secondary production

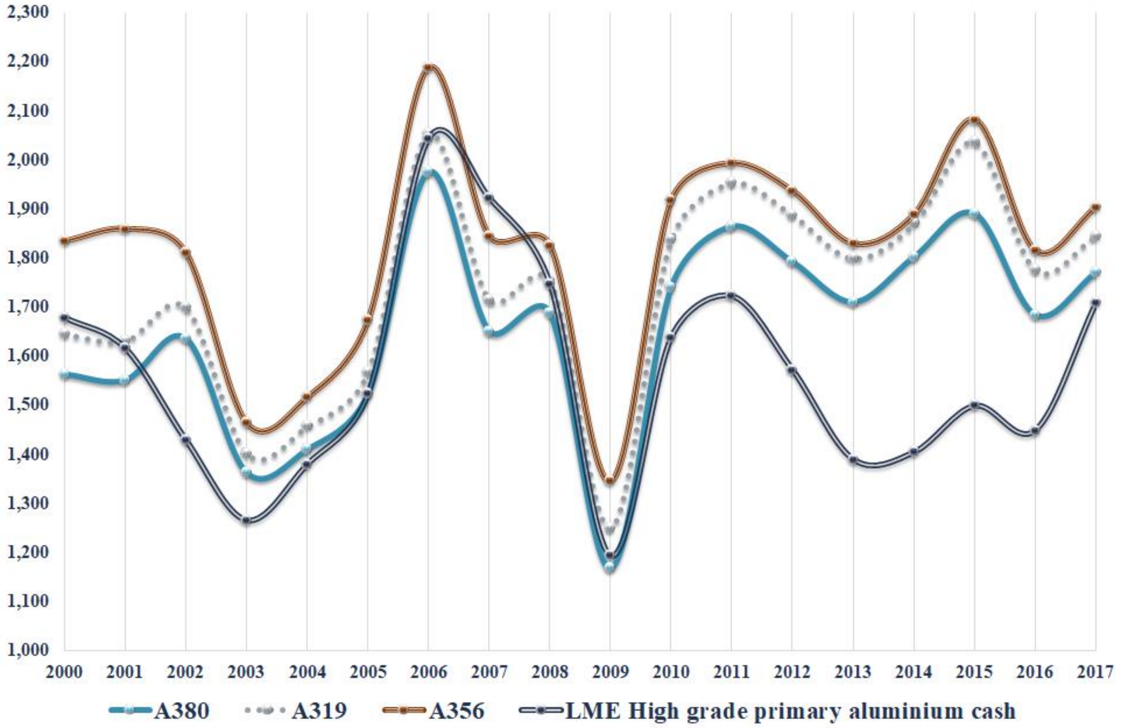
Unwrought aluminium of primary and secondary production is—at least to some extent— substitutable for a wide range of alloyed products (Ecorys, 2011; OECD, 2017). Hence, the prevalent price for primary aluminium strongly affects the market price for unwrought secondary aluminium, as confirmed by Figure 4.9, which reveals the strong correlation (with a correlation coefficient equal to 0.64 on average) between the LME high grade primary aluminium price series and the prices of A380, A319, and A356 aluminium alloys. The higher the price for primary aluminium, the higher the price for secondary aluminium will be, as the competitive pressure exerted by the primary producers on secondary producers would consequently be lower (Blomberg and Söderholm, 2009). Although primary and secondary aluminium are near-perfect substitutes for each other, at the same price, downstream transformers would always prefer primary over secondary metal production for its better performance and properties.

As noted, the Harmonized System Codes, on which virtually all countries base their tariff schedules, have made no distinction between unwrought aluminium of primary and secondary production since

2013. In 2012, EU imports of secondary aluminium amounted to 119,000 tonnes— about 3.7% of EU internal production, though only 2.5% of the estimated demand that year.

In the following section, unless otherwise specified, we assume that any variation in the market price for primary aluminium is able to affect the price for secondary alloys. More specifically, we argue that customs duty paid on primary aluminium puts upward pressure on the premiums for secondary alloys, thus further harming EU downstream transformers' cost competitiveness.

Figure 4.9: Prices for unwrought primary and secondary aluminium (€/tonne, annual average), 2000-2017



Note: LME: 99.7% purity high-grade aluminium, P1020 Aluminium Association specification; A-380: 8-9.5% Si, 1% Fe, 3-4% Cu, 0.5% Mn, 0.1% Mg, 0.5% Ni, 2.9% Zn, and 0.35% Sn; A-319: 5.5-6.5% Si; 0.8% Fe, 3.0-4.0% Cu; 0.50% Mn, 0.10% Mg, 0.35% Ni; 1.0% Zn, 0.25% Ti; A-356: 6.5-7.56% Si; 0.50% Fe; 0.25% Cu; 0.35% Mn; 0.25-0.45% Mg; 0.35% Zn; 0.25 Ti.
Source: Authors on CRU Group and HARBOR data

5. Estimates of the impact of import tariffs on unwrought aluminium on the aluminium industry value chain

5.1. Introduction

This section draws on data from the past four years to update the quantitative assessment of the impact of import tariffs on unwrought aluminium on the EU aluminium industry value chain made in the first GRIF Report (GRIF, 2015).

The extra costs import tariffs impose on EU downstream transformers represent a net transfer of financial resources to upstream activities and, as such, they correspond to extra revenues for primary and secondary producers, as well as for EU customs authorities. Those additional financial resources should, in principle, be used by EU primary and secondary aluminium producers to compensate for cost differences between them and extra-EU competitors, as well as to invest in improving their products and production technologies (especially in the area of energy efficiency and environmental technologies) in order to increase their competitiveness.

Downstream transformers' profits can be significantly affected by their ability to pass through fluctuations in the price of unwrought aluminium to end customers. Extra costs imposed on EU downstream transformers by import tariffs can be passed through depending on different factors, including market power, elasticities of demand, the elasticity of domestic supply and the elasticities of foreign supply[31].

In any case, partial or full cost pass-through rates would still result in higher prices for semi-finished products, to the detriment of EU end-user industries and final consumers. However, increasing international competition from developing countries and limited bargaining power vis-à-vis their customers substantially limits the ability of EU downstream producers to directly transfer import tariffs. As costs related to unwrought aluminium constitute a substantial percentage of total costs, import tariffs on unwrought aluminium are progressively squeezing EU downstream transformers' margins, putting further pressure on these firms' survival, particularly for SMEs.

The following section provides estimates of the extra costs imposed on EU downstream transformers by import tariffs, taking into account the inward processing of unwrought aluminium. Two different scenarios are taken into account, in order to perform a sensitivity analysis and deliver more robust results.

[31] Cost pass-through describes what happens when a business changes the prices of the products or services it supplies following a change in the costs it incurs in producing them (RBB Economics, 2014).

5.2. Methodology and main assumptions

5.2.1. Scenario

Based on the International Standard Cost Model (SCM) methodology (SCM Network, 2004)[32], our study presents estimates for two core scenarios, which are differentiated primarily by their underlying assumptions about the quantity of unwrought aluminium affected by the duty impact on prices and the magnitude of the duty impact on prices paid by downstream manufacturers (see Table 5.1).

Table 5.1: Scenarios for estimating the impact of duties on revenues and costs

		Magnitude of the duty impact on prices	
		Rotterdam ingot duty paid – Rotterdam ingot duty unpaid	Rotterdam ingot duty paid – Rotterdam ingot duty unpaid
Quantity of unwrought aluminium affected by the duty impact on prices	EU primary and secondary aluminium apparent consumption	Lower bound	
	EU primary and secondary aluminium consumption by downstream transformers		Upper bound

Source: Authors' own elaboration.

Lower Bound Scenario

The *Lower Bound Scenario* is based on the following two assumptions:

i) the impact of the EU import tariffs on unwrought aluminium prices paid by downstream manufacturers is equal to the difference between the Rotterdam ingot duty paid premium and Rotterdam ingot duty unpaid premium (see Section 4.5.1);

ii) the price increase affects both primary and secondary unwrought aluminium (both alloyed and unalloyed) consumed in the EU; this quantity is measured in terms of "apparent consumption", i.e. EU production of unwrought aluminium plus unwrought aluminium imports minus primary aluminium exports.

In a nutshell, as import tariffs are also expected to inflate the EU market price for secondary alloys, in the *Lower Bound Scenario*, the price increase is assumed to impose extra costs on downstream transformers when they purchase unwrought aluminium (both primary and secondary); therefore, the EU apparent consumption (production plus imports minus exports) of secondary aluminium is computed by quantifying the duty's impact on production costs and revenues.

However, note that, from 2012 onwards, there is no available data on trade flows of unwrought aluminium of secondary production. This means that it's no longer possible to estimate the apparent consumption of secondary aluminium by relying on imports and exports. As mentioned, the Harmonized

[32] The SCM Method is a widely applied methodology for measuring administrative costs with the aim to support policymakers in ensuring that both existing regulation and new regulation does not impose unnecessary administrative burdens to businesses. The SCM Method envisages collection of at least 5 data points per question and requires further interviews only if discrepancies occur.

System (HS) of tariff nomenclature simply distinguishes between unwrought, not alloyed, aluminium (*HS Code* 760110) and aluminium alloys (*HS Code* 760120). For the latter product category, two additional sub-headings are identified in the Combined Nomenclature (CN) used in classifying goods when they are declared to customs in the EU: unwrought aluminium alloys in the form of slabs or billets (*CN Code* 76012020), and unwrought aluminium alloys, excluding slabs and billets (*CN Code* 76012080).

Since 2012, the current tariff nomenclature does not take into account the distinction between unwrought aluminium of primary and secondary production, meaning that imports and exports of unwrought aluminium alloys will be categorized, for the sake of simplicity, under the apparent consumption of unwrought aluminium of primary production.

The *Lower Bound Scenario* is thus the most conservative one, as the methodology adopted does not account for the magnitude of the impact of the EU import tariffs on the price for unwrought aluminium alloys. More specifically, the impact of the EU import tariffs is quantified as equal to the difference between duty-paid and duty-unpaid premiums for high purity aluminium ingots, that is for unwrought, not alloyed, aluminium.

As extensively discussed, unwrought, not alloyed, aluminium (*CN Code* 76.01.1000) has been subject to a 3% customs duty since 2008. Conversely, existing conventional customs duty rates are higher for aluminium alloys: as of January 2014, a 4% custom duty applies to alloyed slabs and billets (*CN Code* 76.01.2020), while a 6% customs duty still applies to other aluminium alloys (*CN Code* 76.01.2080). This implies that the *Lower Bound Scenario* makes the assumption that the price increase deriving from the lowest custom duty affects the EU's total apparent consumption of unwrought aluminium.

Upper Bound Scenario

The *Upper Bound Scenario* relies on the following two assumptions:

i) the duty led to an upward movement of the EU market price for unwrought aluminium alloys by an amount equal to the customs duty (see Section 4.5.2);
ii) the price increase due to the EU import tariffs on unwrought aluminium alloys has an impact on all aluminium alloys of both primary and secondary production consumed by EU downstream transformers.

The *Upper Bound Scenario* thus explicitly takes into account the potentially different impact on EU market prices thanks to differences in conventional customs duty rates applying to unwrought, not alloyed, aluminium and unwrought aluminium alloys.

As explained in Section 4.5, the price increase stemming from the EU import tariff on unwrought aluminium alloys can be proxied by using COMEXT data on the statistical value of imports originated from dutiable countries and by identifying the price component related to custom duty over the entire period 2000-2017.

Note that the conventional customs duty rate for alloyed slabs and billets (*CN Code* 76.01.2020) was temporarily reduced from 6% to 4% in 2013, while a 6% customs duty is still applied to foundry alloys (*CN Code* 76.01.2080). As specific data on downstream transformers' consumption of slabs and billets and foundry alloys is not available, a conservative assumption is made by applying the lower value, that of a 4% custom duty, to aluminium alloys from 2014 onwards.

As for unwrought aluminium consumed by EU downstream transformers, the *Upper Bound Scenario* considers indirect estimates of the unwrought aluminium of primary and secondary production derived from the EU’s total production of semi-finished products, including wire and cable, powder, and forging producers. Effective consumption does not necessarily correspond to apparent consumption, as some of the unwrought aluminium could be imported and stored at warehouses for financing purposes (GRIF, 2015).

Table 5.2 summarises the main assumptions for each scenario. A more detailed description on assumptions, variables, definition of variables, data sources and method can be found in the Annexes A.1.

Table 5.2: Main assumptions by scenario

	Impact on unwrought aluminium price	Unwrought aluminium affected		Measures of the unwrought aluminium affected	Data sources
		Primary	Secondary		
Lower bound	Equal to the difference between the Rotterdam ingot duty paid premium and Rotterdam ingot duty unpaid premium	Total primary aluminium (both alloyed and not-alloyed) consumed in the EU	Total secondary aluminium consumed in the EU	Apparent consumption	CRU, Eurostat ComExt database
Upper bound	Equal to the difference between the Rotterdam ingot duty paid premium and Rotterdam ingot duty unpaid premium	Total primary, not-alloyed, aluminium consumed by downstream transformers	Total secondary aluminium consumed by downstream transformers	Estimates on extruders, rollers, casters, as well as wire and cable, powder, and forging producers’ aluminium consumption	CRU, Eurostat ComExt database, EEA
	Equal to 6% of the price before duty of alloyed aluminium imports from dutiable country (4% from 2014 onwards)	Total primary aluminium alloys consumed by EU downstream transformers			

Source: Authors' own elaboration

5.2.2. Information and data sources

Estimates are based on publications and archives of secondary sources.

Primary and secondary unwrought aluminium industry statistics and data about regional aluminium premiums, as well as monthly aluminium and aluminium alloy prices, have been sourced from CRU Group, a London-based international consultancy specializing in the global mining, metals, and fertilizer industries. Estimates on downstream manufacturers’ aluminium consumption have been sourced from CRU Group and European Aluminium.

Historical data for aluminium imports and exports by country of origin and by tariff regime are drawn respectively from the EU trade since 1988 by CN8 (DS-016890) European Union ComExt database (http://epp.eurostat.ec.europa.eu/newxtweb/) and from the Adjusted EU-EXTRA Imports by CN8 (DS-059042) European Union ComExt database (http://epp.eurostat.ec.europa.eu/newxtweb/).

5.3. Results

5.3.1. *Lower Bound Scenario*

Over the period 2000-2017, the apparent consumption of unwrought aluminium of primary and secondary production in the EU amounted to 189.6 million tonnes (see Table 5.3).

Table 5.3: Extra costs for the EU aluminium downstream industry stemming from EU import tariffs on unwrought aluminium

	(A)	(B)	(A×B adjusted for inflation)
	EU28 Primary and secondary aluminium apparent consumption	Rotterdam ingot duty paid premium – Rotterdam ingot duty unpaid premium (annual average)	Extra-costs for the EU aluminium downstream industry based on apparent consumption of primary and secondary aluminium
Unit	thousand tonnes	€/tonne	mln € (real 2018)
2000	9,179	96	937
2001	9,517	89	894
2002	9,888	51	527
2003	10,308	56	605
2004	11,092	56	647
2005	10,745	51	577
2006	11,588	54	660
2007	12,246	74	947
2008	11,128	31	353
2009	8,558	13	112
2010	10,491	48	520
2011	10,952	51	566
2012	9,916	48	483
2013	10,135	48	482
2014	10,882	52	563
2015	10,643	52	554
2016	11,107	46	512
2017	11,221	53	593
Total	189,596		10,532

Source: Authors on CRU Group and Eurostat ComExt database

When assuming that the EU import duty shifted the price of all primary and secondary aluminium consumed within the EU upward by an amount equal to the difference between the Rotterdam ingot duty paid and duty unpaid premium series, the extra costs sustained by EU aluminium downstream industry can be estimated at some €10.5 billion (2018 real Euro).

Table 5.4: Extra revenues for EU and extra-EU primary and secondary aluminium producers stemming from EU import tariffs on unwrought aluminium – Lower bound "plus" scenario

	(A)	(B)	(C)	(D)	(E)	(A x E adjusted for inflation)	(B x E adjusted for inflation)	(A × C adjusted for inflation)	(D x E adjusted for inflation)
	Difference between	Duty free primary	Difference between	Duty free secondary	Rotterdam ingot duty	Extra-revenues	Extra-revenues	Extra-revenues	Extra-revenues

	primary aluminium production and exports	aluminium imports (estimate)	secondary aluminium production and exports	aluminium imports (estimate)	paid minus ingot duty unpaid premium (annual average)	for EU primary producers	for primary producers with duty free access to the EU	for EU secondary producers	for secondary producers with duty free access to the EU
Unit	thousand tonnes	thousand tonnes	thousand tonnes	thousand tonnes	€/tonne	€ mln (real 2018)	€ mln (real 2018)	€ mln (real 2018)	€ mln (real 2018)
2000	2,838	1,288	2,645	104	96	290	132	270	11
2001	2,934	1,683	2,940	113	89	276	158	276	11
2002	2,945	2,037	3,067	209	51	157	108	163	11
2003	3,008	2,103	3,003	223	56	177	123	176	13
2004	3,075	1,974	3,198	137	56	179	115	187	8
2005	3,097	2,017	3,224	79	51	166	108	173	4
2006	2,929	2,345	3,524	142	54	167	133	201	8
2007	2,975	2,594	3,517	131	74	230	201	272	10
2008	2,957	2,868	3,036	92	31	94	91	96	3
2009	2,012	2,540	2,803	61	13	26	33	37	1
2010	2,186	3,171	3,109	101	48	108	157	154	5
2011	2,471	3,032	3,018	73	51	128	157	156	4
2012	1,974	2,905	3,030	67	48	96	142	148	3
2013	1,844	3,551	3,174	-	48	88	169	151	-
2014	1,798	3,076	3,373	-	52	93	159	175	-
2015	1,851	3,245	3,302	-	52	96	169	172	-
2016	1,840	3,097	3,232	-	46	85	143	149	-
2017	1,751	3,129	3,250	-	53	92	165	172	
Total	44,483	46,656	56,447	1,532		2,548	2,464	3,127	92

Source: Authors on CRU Group and Eurostat ComExt database

Over the same period, the duty resulted in about €2.3 billion customs revenues for the EU.

This value does not take into account the inward processing procedure requested by EU companies when importing unwrought aluminium from duty-paid countries with the aim to assemble or transform it for final consumption in markets outside EU custom territory. However, a share of EU customs revenues has been returned to (or not collected at all from) downstream manufacturers deciding to inward process unwrought aluminium.

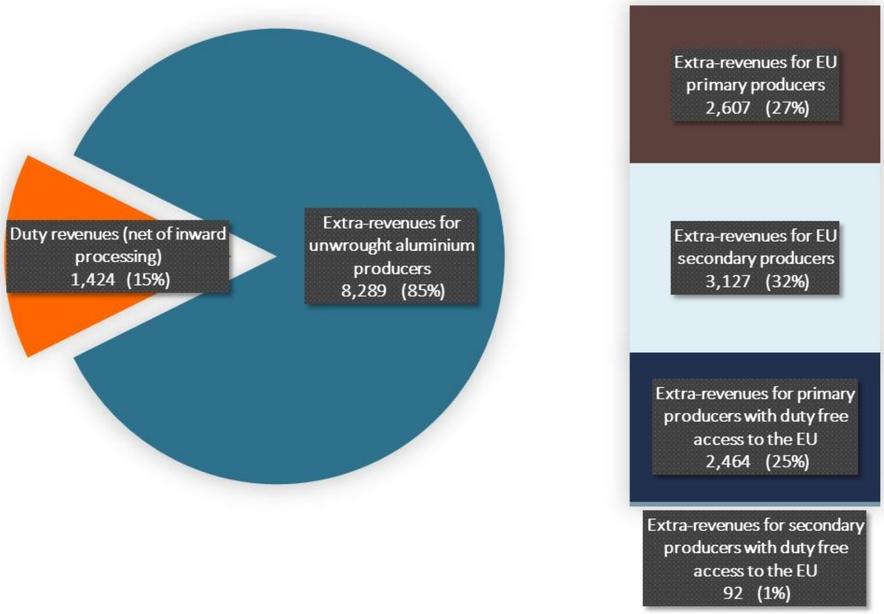
The inward processing procedure was extensively used by EU downstream companies over the period 2000-2017, being used for roughly 38% of the total dutiable imports of unwrought aluminium. Accordingly, cumulative additional customs revenues for the EU can thus be estimated at slightly more than €1.4 billion. Total extra costs sustained by the downstream aluminium industry in the EU, net of inward processing, thus amounted to some €9.7 billion in the period 2000-2017, averaging €540 million per year.

The largest share of the extra costs translated into extra revenues for EU-based remelters and refiners producing secondary aluminium (€3.1 billion, corresponding to 32% of the total extra costs; see Table 5.4).

The price increase due to the EU import tariffs also led to extra revenues equal to €2.6 billion (27% of total extra costs) for EU smelters and to €2.5 billion (25% of total extra-costs) for primary producers based in countries from which primary aluminium can be imported on a duty-free basis (see Table 5.4 and Figure 5.2). Extra revenues for foreign producers of secondary aluminium were negligible, as between 2000 and 2012 imports of this category of products accounted for a marginal share of the EU's total apparent consumption of unwrought aluminium. Furthermore, the distinction between primary and secondary production of unwrought aluminium no longer applied in the current tariff nomenclature after 2013.

Figure 5.1 reports the breakdown of the extra-costs for the EU aluminium downstream industry stemming from EU import tariffs on unwrought aluminium between 2000 and 2017.

Figure 5.1: Lower Bound Scenario. Breakdown of the extra revenues for EU and extra-EU primary and secondary aluminium producers stemming from EU import tariffs on unwrought aluminium (2000-2017, € million – real 2018 percentages)



Source: Authors on CRU Group and Eurostat ComExt database

5.3.2. Upper Bound Scenario

Over the period 2000-2017, around 188 million tonnes of unwrought aluminium were processed by extruders, rollers, casters, and other downstream transformers based in the EU (see Table 5.5). This value is only slightly less than the apparent consumption estimated under the previous scenario (189.6 million tonnes).

Table 5.5: Extra costs for the EU aluminium downstream industry stemming from EU import tariffs on unwrought aluminium – Upper bound scenario

	(A)	(B)	(C)	(D)	(A×C+B×D adjusted for inflation)
	Primary and secondary aluminium consumption by downstream	Primary not alloyed aluminium consumption by downstream	Cost of the duty	Rotterdam ingot duty paid minus ingot duty unpaid premium (annual average)	Total cost of the duty for the EU aluminium downstream industry

Unit	transformers (estimate*) thousand tonnes	transformers (estimate*) thousand tonnes	€/tonne	€/tonne	€ mln (real 2018)
2000	9,197	459	105	96	1,066
2001	9,427	475	107	89	1,108
2002	9,735	492	93	51	979
2003	10,009	510	83	56	898
2004	10,451	543	87	56	976
2005	10,518	548	96	51	1,081
2006	11,193	589	118	54	1,419
2007	11,634	619	124	74	1,546
2008	10,749	567	116	31	1,310
2009	8,539	447	83	13	735
2010	10,112	531	105	48	1,117
2011	10,691	558	115	51	1,281
2012	10,385	537	109	48	1,165
2013	10,451	537	105	48	1,120
2014	10,902	550	70	52	792
2015	11,190	558	78	52	906
2016	11,445	582	67	46	789
2017	11,883	600	77	53	924
Total	188,510	9,700	-	-	19,212

*Note: *Primary and secondary aluminium consumption by downstream transformers is estimated on CRU data for extruders, rollers, and casters; in addition, wire and cable, powder, and forging producers are assumed to process about 1 million tonnes per year in line with estimate presented by European Aluminium; the consumption of secondary aluminium by wire and cable, powder, and forging producers is missing.*
Source: Authors on CRU Group, European Aluminium and Eurostat ComExt database

Provided that the duty paid on imports from dutiable countries translates into higher prices for all primary and secondary aluminium traded in the EU market, the extra costs for the EU downstream aluminium industry stemming from the EU import tariffs on unwrought aluminium amounted to some €19.2 billion in the period covered by the present analysis.

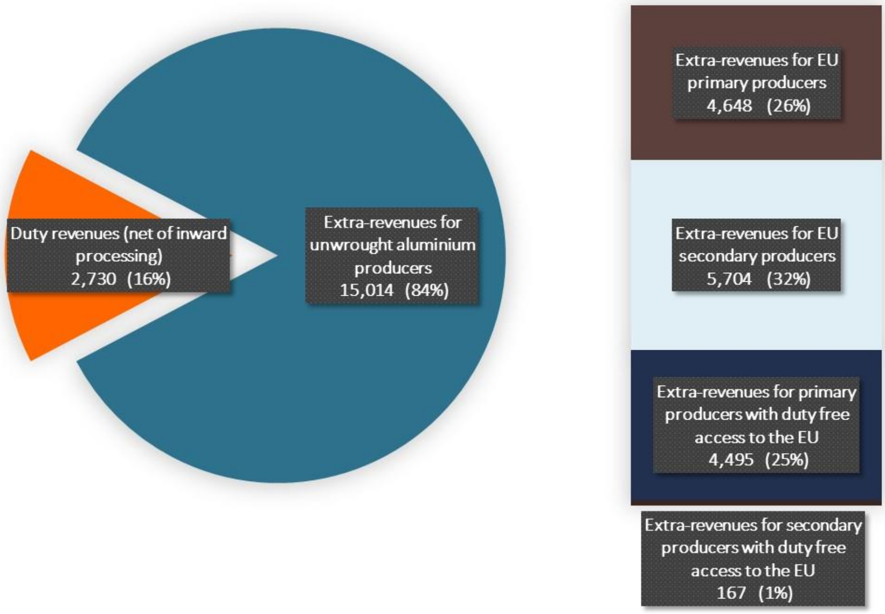
Available data on effective consumption does not allow us to take into account the share of different primary and secondary aluminium producers. By assuming a percentage breakdown similar to the one presented in the previous scenario, the extra costs stemming from the EU import tariffs on unwrought aluminium translated into about €3.8 billion additional customs revenues collected by EU member states.

However, the estimated amount of resources related to the inward processing procedure must be subtracted from this value of additional customs revenues, to take into account the fact that some downstream companies have not actually paid the custom duty. Over the period 2000-2017, the obligation to pay duty has concerned, on average, approximately 62% of the total imports of unwrought, not alloyed, aluminium and aluminium alloys entering the EU customs territory.

As a result, cumulative additional customs revenues for the EU can thus be estimated at less than €2.4 billion, while the total extra costs sustained by the downstream aluminium industry in the EU— net of inward processing—thus amounted to some €17.8 billion in the period 2000-2017, averaging almost €1 billion per year.

As explained previously, this estimate of the extra costs provoked by the duty is likely to be fairly conservative, as it is calculated by applying the lower customs duty to imports of aluminium alloys from extra-EU dutiable countries, since with presently available data, we are unable to further distinguish between slabs and billets alloys (CN Code 76012020) and foundry alloys (CN Code 76012080).

Figure 5.2: Upper Bound Scenario. Breakdown of the extra revenues for EU and extra-EU primary and secondary aluminium producers stemming from EU import tariffs on unwrought aluminium (2000-2017, € million – real 2018)



Source: Authors on CRU Group, European Aluminium and Eurostat ComExt database

Figure 5.2 assumes a similar breakdown of extra costs in terms of customs revenues and extra revenues for producers of unwrought aluminium. The extra costs stemming from the EU's import tariffs on unwrought aluminium translated into about €5.8 billion of extra revenues for EU secondary producers. Moreover, the extra costs imposed on downstream manufacturers contributed to the increase in revenue for both EU smelters (€4.8 billion) and foreign smelters based in countries that have zero-duty PTAs with the EU customs union by zero-duty PTAs (€4.6 billion). Extra revenues for extra-EU secondary producers are marginal amounting in about €170 million over the period 2000-2017.

5.3.3. Total extra-costs imposed by the EU import tariffs

Table 5.6 compares the results of the two different scenarios by also showing the breakdown of the extra costs imposed on main economic actors along the aluminium industry value chain, as well as those benefiting from the custom duty in terms of higher revenues (excluding secondary producers with duty-free access to the EU).

Table 5.6: Total extra costs imposed by the EU import tariffs on unwrought aluminium on EU downstream transformers over the period 2000-2017 (€ billion - real 2018)

Scenario	Cumulative extra-costs for EU downstream transformers	Duty revenues (net of inward processing)	Extra revenues		
			EU primary producers	Primary producers with duty free access to the EU	EU secondary producers
Lower bound	9,7	1,4	2,6	2,5	3,1
Upper bound	17,8	3,9	4,8	4,6	5,8

Source: Authors' own elabouration.

6. Assessing EU trade measures on unwrought aluminium from an industrial policy perspective

6.1. Introduction

Most of the extensive debate on the competitiveness of the aluminium industry has focused on energy and carbon costs, and to a lesser extent on labour costs. Likewise, most attention has been paid to upstream segments mainly because of concerns about fair competition in the global economy, especially regarding the role of governmental support in explaining firms' investment decisions and fundamental changes which the aluminium industry has undergone in the last few years.

Nonetheless, recent studies on the aluminium industry have argued strongly for a comprehensive industrial policy, able to look at the entire value chain and at complex interactions between upstream and downstream activities (European Aluminium, 2018; GRIF, 2015; OECD, 2019; U.S. Department of Commerce, 2018).

Under such a holistic policy approach, measures affecting the sector— such as export bans and taxes, import tariffs, energy subsidies, etc.—should be analysed based on their overall impact on the competitive conditions of firms that operate at different stages of the aluminium value chain, as well as on the competitiveness of major industries using semi-finished products in manufacturing processes (automotive, transport, building, etc.).

To be effective, trade policy measures should be situated in a broader industrial policy framework and considered in view of expected costs and benefits in terms of growth, jobs, investment and competitiveness along the entire value chain, including to end-user industries as well as to final European consumers (Cassetta and Pozzi, 2016).

At the EU level, the task of supporting the aluminium industry has mainly relied on trade rules and the use of import tariffs has served as the main measure of industrial policy. National measures have been primarily aimed at supporting existing upstream activities by reducing their energy costs as part of a wider regulatory intervention for energy-intensive sectors. Moreover, national governments were also left to deal with the shutdown of smelting facilities and the economic and social consequences of these closures, which have been particularly severe in less developed regions.

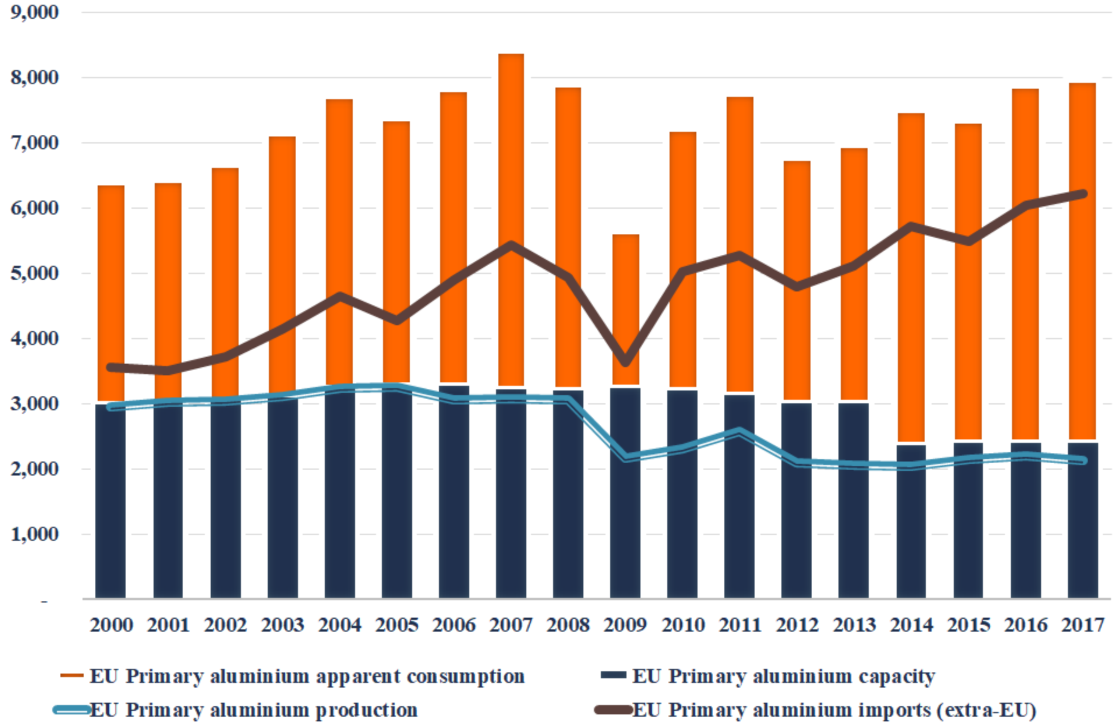
Focusing on EU trade policy, data available from the past few years makes it an opportune time to take stock of the overall effects achieved by the customs duty on unwrought aluminium. To this end, it is worthwhile first of all to take stock of the EU's trade policy to assess how and to which extent the import tariffs have contributed to change its structure and the competitive behaviour of aluminium companies all along the value chain. In a global market economy, any policy intervention must be proportionate and coherent with the objectives to be achieved, rather than producing distortive outcomes or even outcomes contrary to the aims inspiring the measures.

6.2. The EU primary aluminium deficit

As highlighted in the previous sections, the EU's primary aluminium production has declined over the past few years. As a result, imports from third countries are becoming more and more important in satisfying the EU's demand.

In 2017, the EU's production of primary aluminium was about 27% of its apparent consumption of primary aluminium, defined as primary aluminium production plus imports minus exports (see Figure 6.1).

Figure 6.1: Apparent consumption, installed capacity, production, and imports of primary aluminium in the EU (in thousand tonnes)



Source: Authors' own elaboration on CRU and COMEXT data

In 2017, as a consequence of significant disinvestment and the closure of several smelters since 2008, the EU's total installed smelting capacity was 30% of the EU's apparent consumption of primary aluminium. Accordingly, the capacity utilisation of the EU's smelting facilities can be estimated at around 88% in 2017, signalling that the production capacity of primary aluminium firms in the EU is nearly fully exploited and the resulting idle capacity is lower[33].

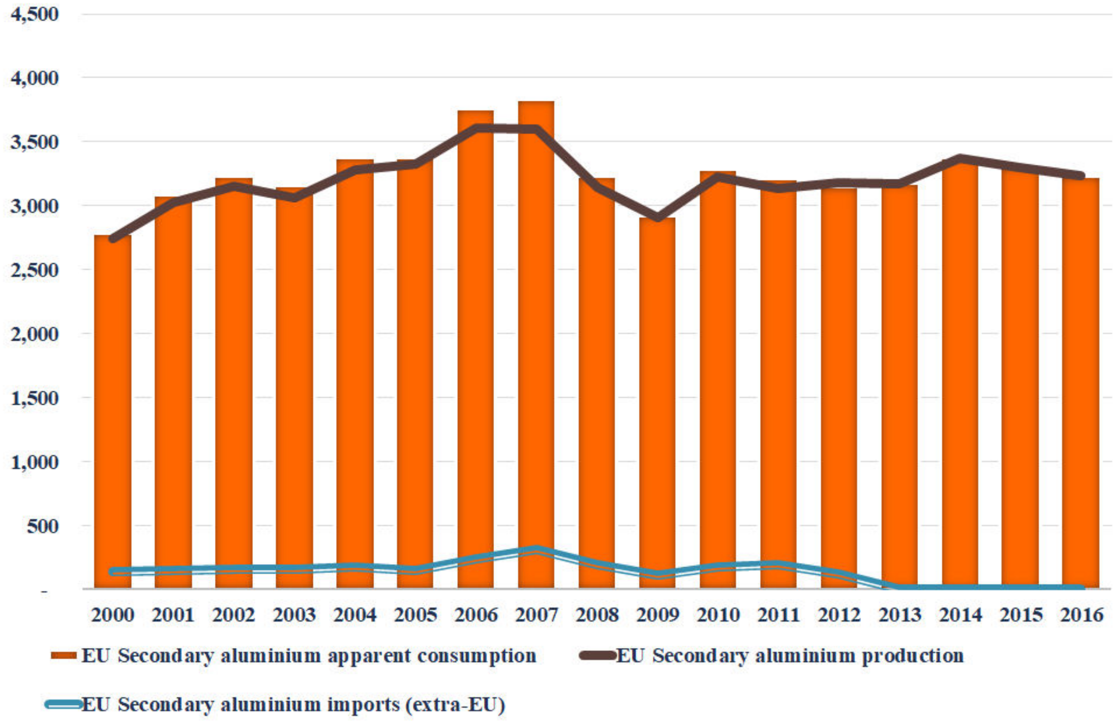
According to European Aluminium, the number of smelters in operation in the EU decreased by 38% in the period from 2002 to 2016, while the 16 smelters (down from 26 in 2002) still working are experiencing financial difficulties and curtailments. This trend further worsened the EU primary unwrought aluminium deficit as the bloc's apparent consumption slightly increased in the same period, while remaining below pre-crisis levels in 2017. As a matter of fact, the recent increase in apparent

[33] The idle capacity is the portion of a facility's production capacity that is curtailed while the remaining capacity is still actively in production.

consumption has not been accompanied by an increase in production, but has mainly been due to increased imports. Furthermore, the closure of two of Alcoa's three smelters in Spain at the end of last October and the announcement that the remaining plant will shut down unless the Spanish government takes specific regulatory measures to reduce energy costs are bound to further aggravate the EU's dependency on imported unwrought aluminium.

The EU's secondary production of unwrought aluminium, i.e. manufactured by recycling and remelting aluminium-bearing scrap and/or aluminium-bearing materials, has grown only slightly over the period 2000-2017 (+18%).

Figure 6.2: Apparent consumption, imports, and production of secondary aluminium in the EU (in thousands of tonnes)



Secondary aluminium production capacity not available. Source: Authors' own elaboration on CRU and COMEXT data

In contrast with primary production, secondary production of unwrought aluminium is not declining. Figure 6.2 presents the EU's production of secondary aluminium in relation to its apparent consumption of secondary aluminium. It is worth noting that in the period 2000-2012 (data on secondary aluminium imports and export is no longer available after 2013), the EU's production of secondary aluminium has largely satisfied the EU's apparent consumption, implying that growth in demand was de facto met by corresponding increases in production.

6.3. The rationale behind EU import tariffs on unwrought aluminium

As just noted, the rationale behind single trade policy measures must first be considered within the specific context in which these policy measures are applied.

According to EU legislation (articles 31-32 TFEU), the Common Customs Tariff duties are set by the Council following a proposal from the European Commission.

The European Commission acts taking into account:

(a) the opportunity to promote trade between member states and third countries;
(b) developments of competitive conditions within the EU, in so far as the effect of tariffs is to increase the competitive capacity of European companies;
(c) the requirements of raw materials and semi-finished products, ensuring that the competitive conditions between member states in the finished products would not be distorted;
(d) the need to avoid serious disturbances in the economies of member states and to ensure rational development of production and an expansion of consumption within the Union.

In the context of these overall targets, the European Commission has primarily justified the adoption of a system of tariffs for both unwrought, not alloyed, aluminium and unwrought aluminium alloys by the importance of maintaining the presence of this segment of the aluminium industry in the EU (European Commission, 2010).

The unwrought aluminium manufacturing plants operating within the Community need support on the grounds that they suffer from higher structural costs (especially electricity costs, which form a major part of their production costs) with respect to many other countries and regions around the world. Without a customs duty on imports to the EU, domestic smelters would have progressively decided to reduce their production or even shut down their facilities, eventually moving them to countries with low energy and labour costs, as well as lax environmental regulations. This would make it more difficult for EU-based producers of semi-finished products and end-user industries to reliably and competitively gain access to unwrought aluminium and aluminium products. In this sense, while import tariffs directly subsidise upstream activities, they would indirectly confer support to downstream activities, such as the production of semi-finished products of aluminium.

Furthermore, the European Commission has justified the maintenance of a customs duty on imports of unwrought, not alloyed, aluminium as a commercial response particularly aimed at third countries not offering reciprocal measures, such as countries applying export restrictions on aluminium scrap (European Commission, 2010). There is a certain lack of transparency regarding export restrictions, as there is no formal mechanism for reporting these restrictive measures. Nonetheless, according to the OECD's *Inventory on export restrictions on Industrial Raw Materials*[34], among the limited number of countries which applied export restrictions to aluminium scrap in 2014, only Russia is a significant primary aluminium exporter to the EU.

As mentioned in Section 4.5, the introduction of a duty inevitably leads to an artificial increase in prices whenever raw materials and goods can be sourced from other countries at lower cost (Krugman et al., 2015). As a corresponding increase in production costs is expected for EU companies producing aluminium semi-finished products and finished industrial goods, import tariffs must also be introduced for aluminium semi-finished products and finished goods, so as to not unduly distort competitive conditions in these markets within the EU and as to not adversely affect the situation of the downstream users vis-à-vis their competitors in third countries.

The higher the import tariffs on unwrought aluminium, the higher the import tariffs that will be required to protect other segments further down the value chain. Indeed, a complex system of tariffs currently

[34] It contains information on export regulations in the raw materials sector, namely minerals, metals and wood. It records measures known to restrain export activity from 2009-2014 at the 6-digit level of HS2007 classification (see https://qdd.oecd.org/subject.aspx?Subject=ExportRestrictions_IndustrialRawMaterials).

applies to aluminium semi-finished products and finished goods, with the exception of aluminium waste and scrap (see Section 4.2).

Intuitively, an effective system for protecting downstream production would necessitate that unwrought aluminium be sourced at the lowest possible costs, aside from any aspects related to security and continuity of supply. The adoption of an import tariff on unwrought aluminium works exactly in the opposite direction by increasing downstream transformers' overall production costs and by potentially counteracting, especially when price competition is fierce, the effects of trade policies in those segments, including the adoption of import tariffs.

6.4. The structural changes induced by import tariffs

Although it is always difficult to isolate the relative effects of different factors, the customs duty on imports of unwrought aluminium has not generated the results in the aluminium industry that the European Commission was seeking.

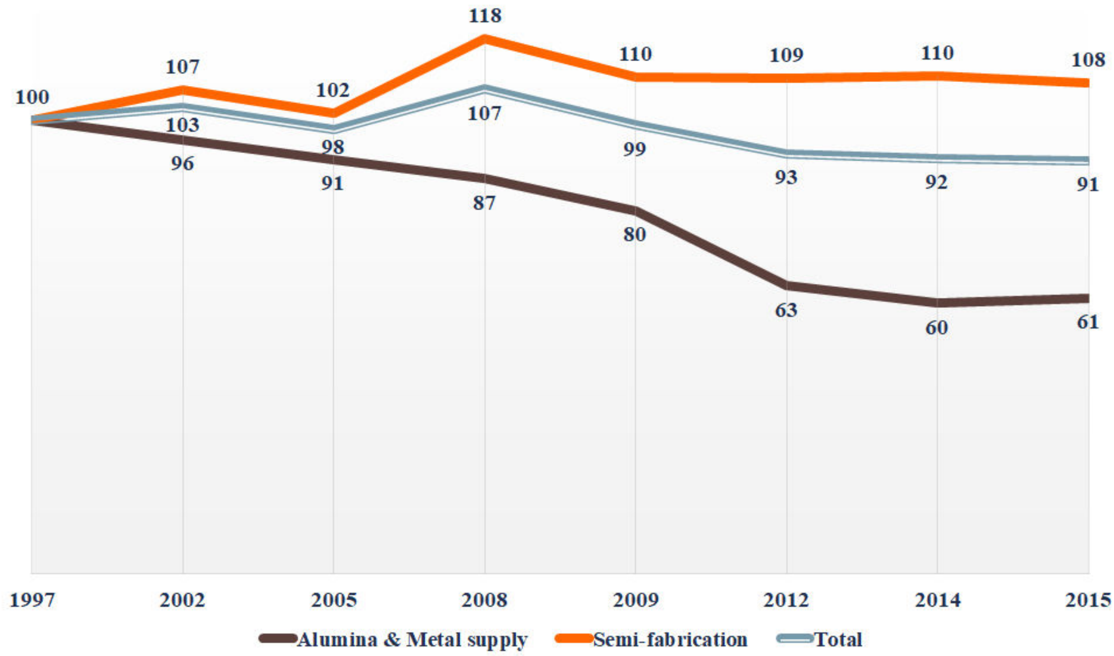
The increase in EU market prices has not promoted domestic production of unwrought aluminium and new investments, nor has it prevented further shutdowns of already operating smelters and the inevitable consequences of such shutdowns in terms of employment. The structural changes in the aluminium industry, which the import tariffs have contributed to, can be easily summarized.

6.4.1. The upstream segment

First of all, the production of primary aluminium in the EU decreased significantly as a result of numerous EU smelters' major reductions in production, as well as the shutdown of some smelters. Since 2008, primary production of unwrought aluminium shrank by 30%. According to European Aluminium, the number of smelters in operation in the EU decreased by 38% from 2002 to 2016, further increasing market concentration at the European level.

As can be seen in Figure 6.3, the market development described naturally had an impact on employment in the upstream segment, including the supply of alumina and metal; the metal suffered the loss of more than 11,300 jobs in the period 2002-2015 (European Aluminium, 2017).

Figure 6.3: Trends in aluminium industry employment (1997=100)



Source: European Aluminium (2017)

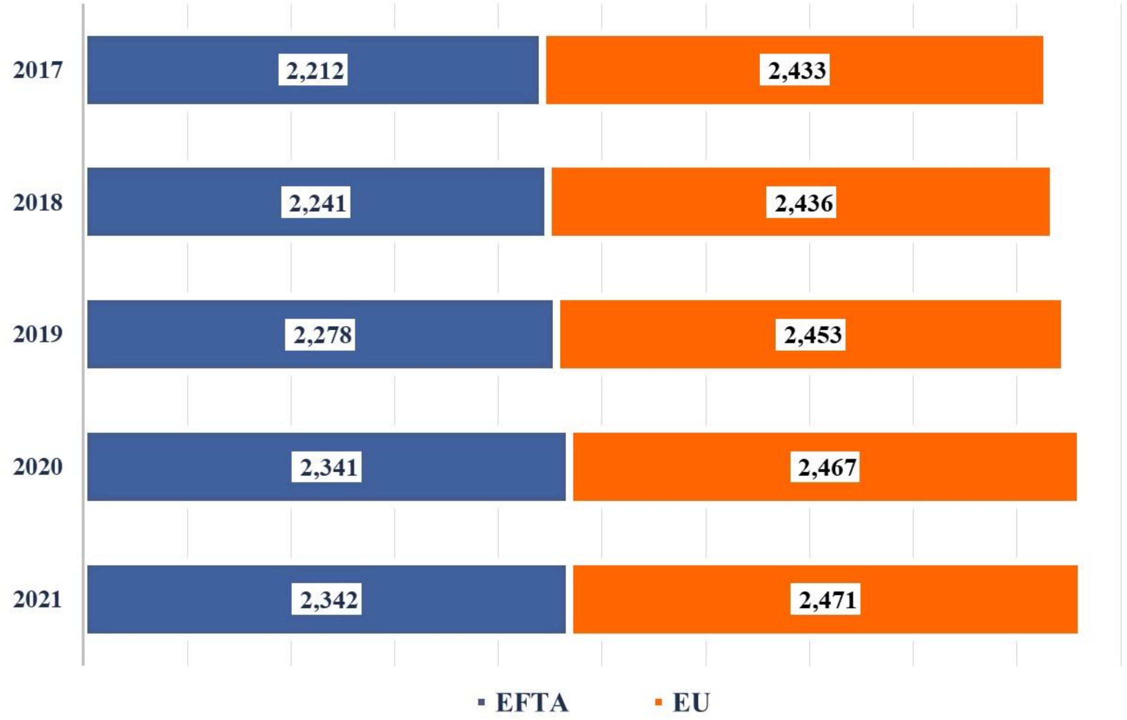
Furthermore, the EU's trade deficit with regards to primary aluminium has considerably worsened in recent years, albeit in a context of low demand growth by major aluminium customers in the EU, such as the automotive and construction sectors. According to European Aluminium, there are no significant increases in production capacity, nor any new entries in the unwrought aluminium industry, expected in the EU member states over the next few years. Figure 6.4 clearly shows that any increases in production capacity expected over the next five years (up to 2021) would result from new investments taking place in EFTA countries.

Concurrent changes in the institutional framework at a global level have favoured a geographical shift of primary production of unwrought aluminium, rooted in the opportunity to benefit from lower costs in terms of energy, raw material processing, and transportation. Many smelters have thus made greenfield investments to cut production costs, to increase their output by leveraging captive, self-generated electric power and to expand their presence in the value-added products element of the industrial value chain.

Such investments have also resulted from extensive governmental interventions to influence production decisions, in particular through concessional financing and energy subsidies (OECD, 2019).

Regarding energy subsidies specifically, governments have often lowered electricity costs (or energy costs more broadly) through a variety of different measures, including direct budgetary transfers, tax revenue foregone, other government revenue foregone, or induced transfers. Those measures contributed towards making the production of primary aluminium even cheaper in some regions than it would otherwise have been. In many cases, such as in China, these strategies were deliberately conceived as a way to move up the aluminium value chain given the underlying assumption that processing increasingly sophisticated and high-value products further downstream would improve the overall economic performance of the country (OECD, 2019; U.S. Department of Commerce, 2018).

Figure 6.4: Forecasted production capacity of unwrought aluminium in Europe, 2017 and 2018-2021



Source: European Aluminium

The EU has undoubtedly been penalized by the changes described above, as well as by ensuing market developments. The EU's smelters are generally characterized by higher production costs than competitors located in other countries. Numerous studies have tried to estimate the cost differentials in the production of unwrought aluminium in various geographical areas (CEPS, 2013), as well as to investigate the risk of carbon leakage from the aluminium sector under current environmental legislation (Sartor, 2013).

CRU recently estimated that production weighted average site costs, that is the costs necessary to transform raw materials into final products, are 9.7% higher in Europe (including EFTA countries) than in the rest of the world (excluding China), being close to 1,700 euros per tonne. In 2017, about 80% of European smelters were beyond the median site cost. Cost differentials are mainly explained by higher carbon (related to the stringency of environmental policies)[35] and labour costs. As the recent cases in Spain unfortunately demonstrated, unless national governments adopt specific measures for reducing costs, it is likely that EU smelters will continue to further curtail their production or even shut down their primary aluminium plants.

As a consequence of the trends described above, the EU's market share of global production of unwrought aluminium is expected to shrink further, from 3.4% currently to 2.9% in 2021. The EU's secondary production of unwrought aluminium, i.e. manufactured by recycling and remelting aluminium-bearing scrap and/or aluminium-bearing materials, which benefits from high primary aluminium prices, has grown only slightly over the period 2000-2017 (18%), notwithstanding the increasing EU deficit in primary production.

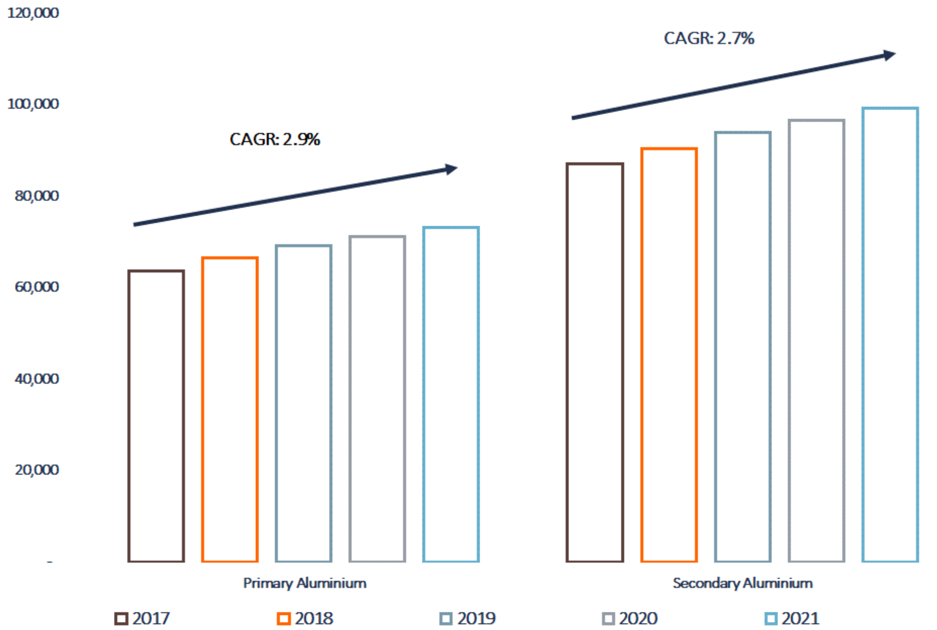
35 As is already known, aluminium production is included in the EU Emission Trading Scheme for emissions related to carbon dioxide (CO_2) and perfluorocarbons (PFCs). See https://ec.europa.eu/clima/policies/ets_en

This is rather surprising, as secondary production is often regarded as the most energy efficient method of producing aluminium, especially for countries with high electricity and carbon costs and significant availability of second raw material. Furthermore, an increasing quantity of waste and scrap has been exported over the last few years to countries such as China, India, and South Korea, signalling that the EU's potential for secondary production has been largely exploited.

As mentioned, the EU's primary aluminium production capacity is operated by a few large companies. The first six companies (Trimet Aluminium SE, Alcoa, Alcan, ALRO SA, Aluminium de Greece, and Norsk Hydro) controlled approximately 76% of the EU's total production capacity. The same companies also have about 80.5% of the total European (including EFTA countries, namely Iceland, Liechtenstein, Norway and Switzerland) primary aluminium production capacity; Norsk Hydro and Alcoa together control slightly more than 48% of Europe's output capacity (respectively 26.2% and 22.3%)[36].

On the other hand, unwrought aluminium consumption is expected to grow in the next few years, though at a slower pace than in the past. Overall, CRU estimated a global growth in demand for unwrought aluminium at a compound annual rate of 2.9% for primary production and 2.7% for secondary production in the period 2017-2021 (see Figure 6.5).

Figure 6.5: Global demand of unwrought aluminium of primary and secondary production, 2017 and 2018-2021 (forecast)



Source: CRU Group

[36] This share would be greater if the Norsk Hydro binding offer to acquire Rio Tinto's 100% share of Icelandic aluminium plant ISAL had indeed been carried out. However, Norsk Hydro and Rio Tinto have recently signed an agreement to end the acquisition process, which was initially expected to be finalized in the second quarter of 2018. See https://www.hydro.com/en/press-room/Archive/2018/hydro-and-rio-tinto-end-acquisition-process-for-icelandic-aluminium-plant-isal/

The need to move to a low carbon economy and increasing regulation worldwide to reduce emissions and make several sectors more efficient (transport, construction, packaging, electrical and others) will be the main drivers of aluminium demand over the next few years (Götz, 2018).

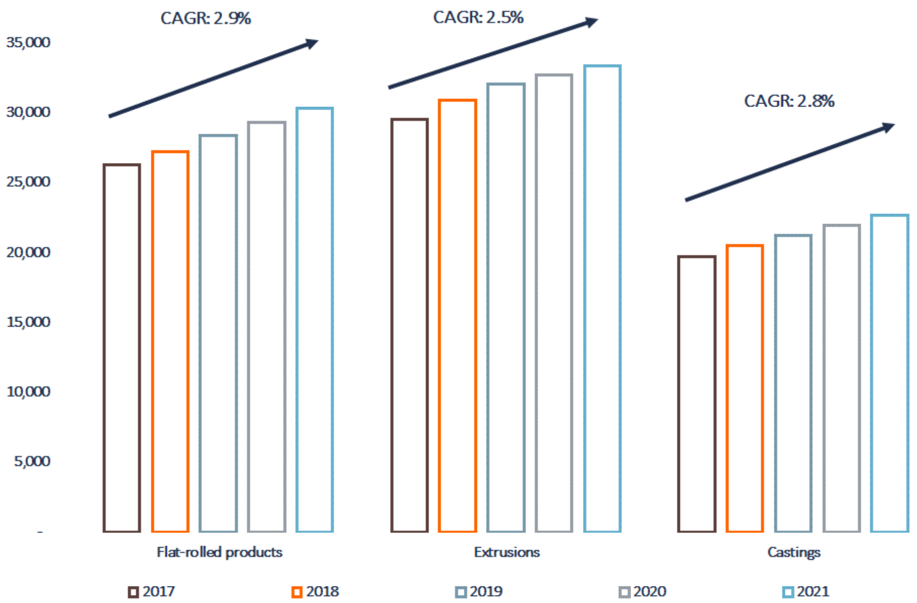
Figure 6.6 shows the forecasted global demand for aluminium semi-finished products by product category in the period 2017-2021. All product categories are set to maintain positive growth, especially flat-rolled products and castings and to a lesser extent extrusions, as aluminium is projected to gain market share from its main substitutes (steel and copper), mainly due to the increased use of aluminium in the transport sector.

The increase in aluminium demand is largely driven by consumption growth in China and India, as well as by the increasing use of aluminium semi-finished products in transport and machinery and equipment.

Both China and India are currently characterised by lower aluminium per capita consumption compared to the level of developed countries. Figure 6.7 shows the aluminium stock in-use (per capita) in different regions and countries, varying between approximately 270-420 kg/capita in Europe, Japan, and North America and below 170 kg/capita in China and in other developing countries. However, China has increased its aluminium in-use stock sevenfold between 2000 and 2017.

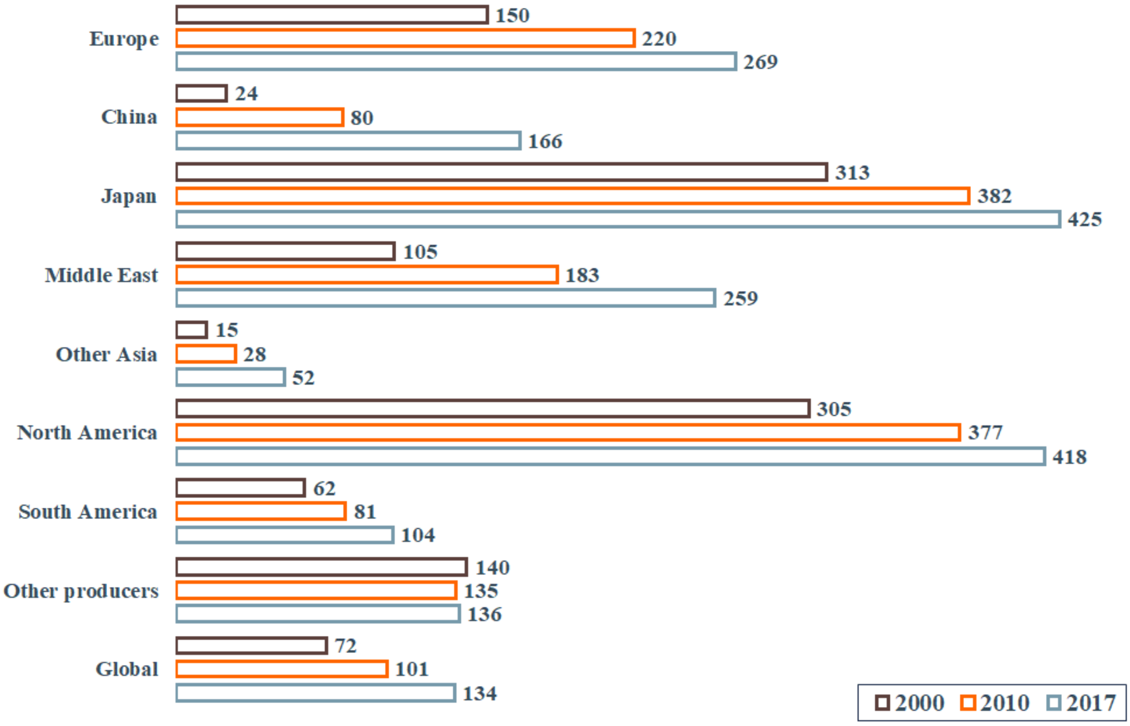
While emerging economies' rapid development and urbanization will be the primary driver of growth of aluminium consumption over the next decade, the demand for aluminium in mature economies is being fuelled mainly by the transport sector and by the trend towards lightweight construction in the automotive industry. The growing global aluminium in-use stock also has relevant implications for future recycling opportunities.

Figure 6.6: Forecasted global demand of aluminium semi-finished products, 2017 and 2018-2021 (in thousands of tonnes)



Source: CRU Group

Figure 6.7: Stocks in use (kg per capita), 2000, 2010, and 2017



Source: International Aluminium Institute

According to CRU Group, a slightly positive market balance is expected for years 2019 and 2020 at the global level, as production is projected to be high in China (see Table 6.1). However, the global market balance is forecasted to turn negative again in 2021 (about 233,000 tonnes)

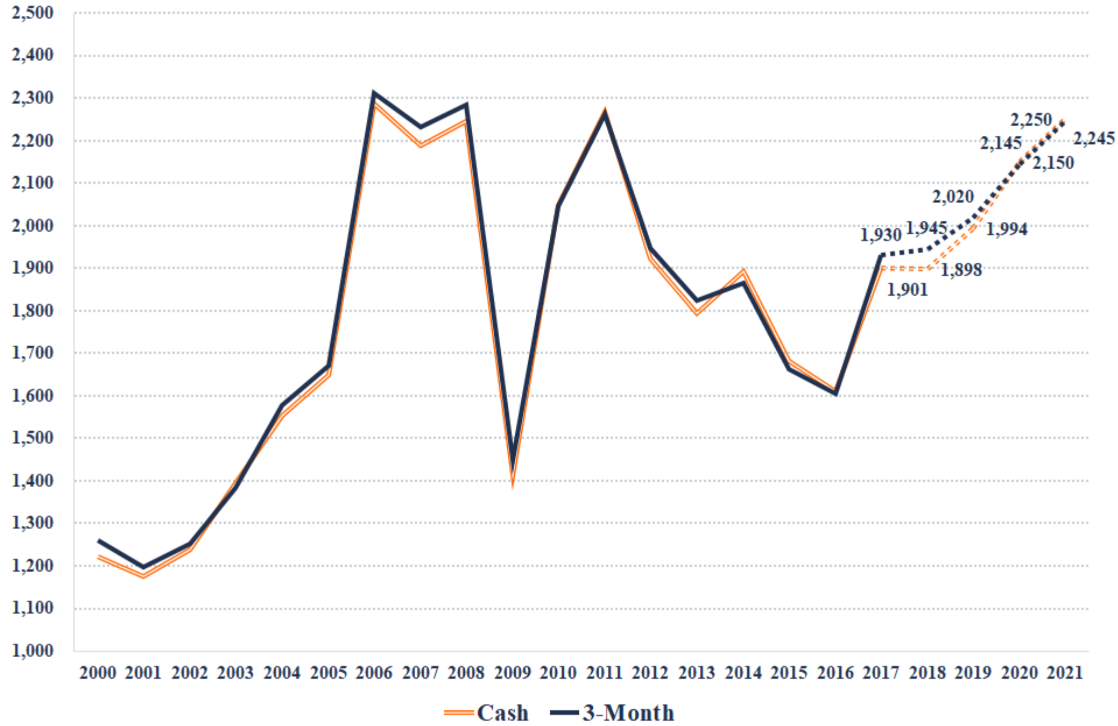
Table 6.1: Forecasted aluminium global market balance, 2017 and 2018-2021 (in thousands of tonnes)

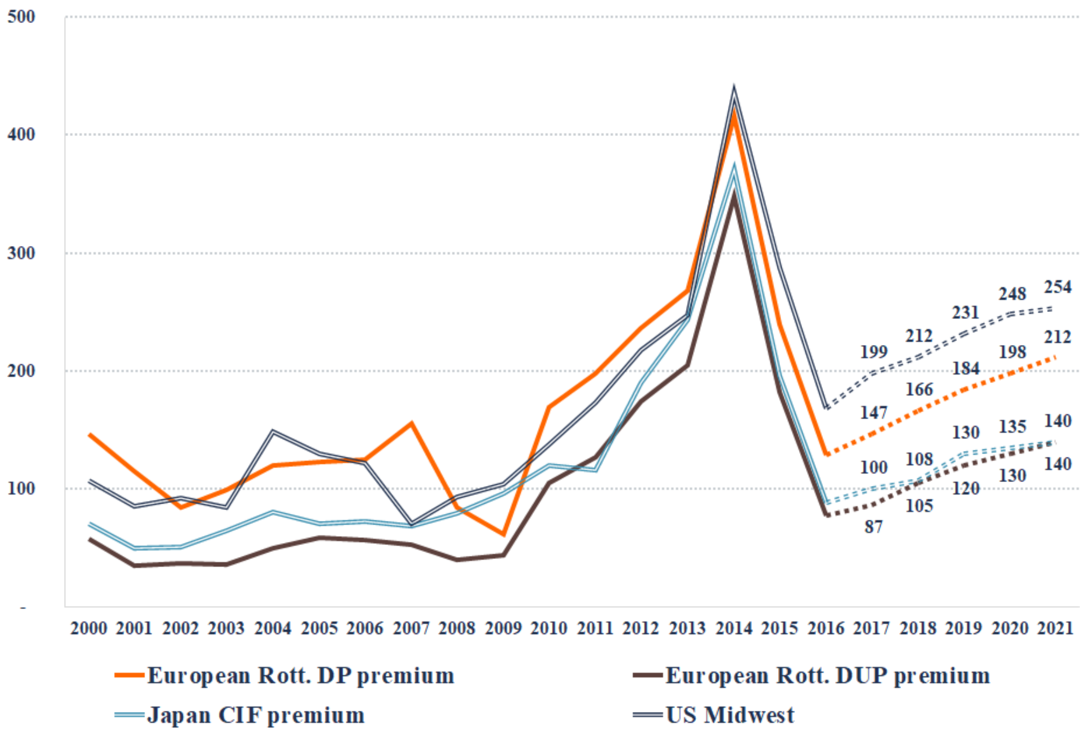
	2017	2018	2019	2020	2021
Consumption	63,589	66,431	69,097	71,175	73,194
Production	63,285	66,105	69,324	71,372	72,961
Balance	- 304	- 326	227	197	- 233

Source: CRU Group

As a consequence of the trends described in this study, primary aluminium prices, as measured by the LME high grade, as well as regional premiums are expected to rise to pre-crisis levels of 2011, from 1,901$/tonne in 2017 to 2,250 $/tonne (see Figure 6.8). Duty-paid regional premiums in EU are currently estimated to be lower than in the US, mainly because of the US administration's decision to impose additional import tariffs on aluminium products.

Figure 6.8: Forecasted prices and premiums of unwrought aluminium, 2017 and 2018-2021





Source: CRU Group

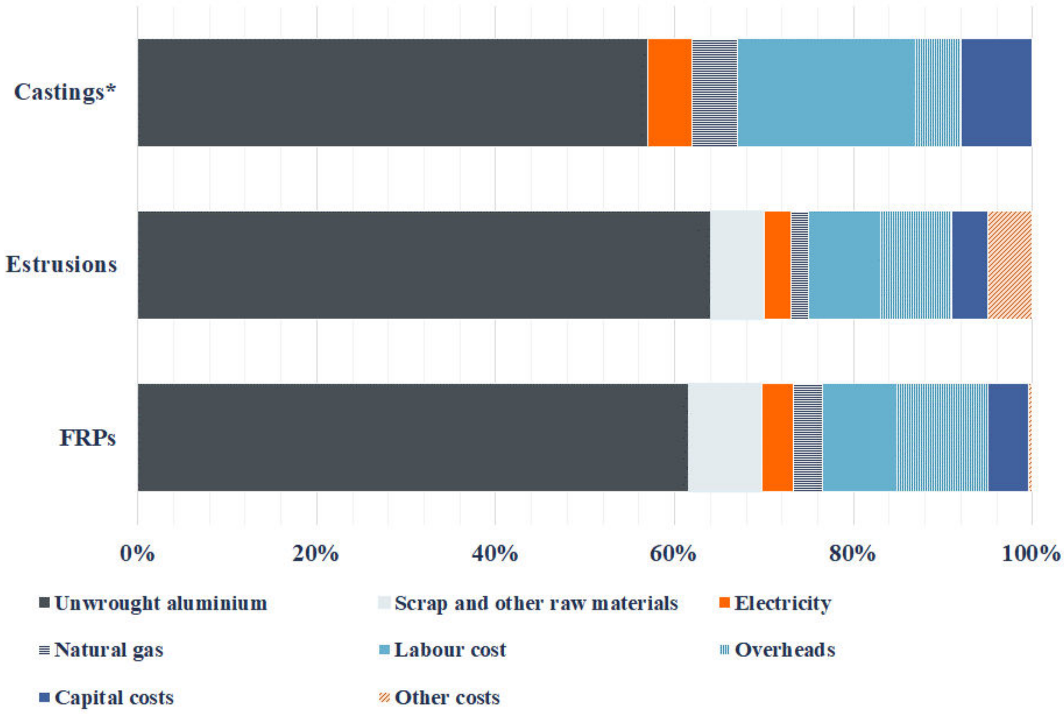
6.4.2. The downstream segment

As highlighted by the OECD (2019), governmental and regulatory interventions in upstream activities need to be understood in the context of the entire value chain, while particularly keeping in mind these interventions' effect on downstream production. Given that import tariffs failed to sustain production of unwrought aluminium in the EU, it is thus fundamental to assess how tariffs on unwrought aluminium have affected the other segments of the value-added industrial chain, especially downstream users.

The choice to maintain an import tariff on unwrought aluminium has undoubtedly induced a series of changes in the industrial structure of the downstream markets.

As the purchase of unwrought aluminium makes up at least 50% of downstream transformers' total production costs, the provision of primary aluminium is crucial for the competitiveness of downstream operators (see Figure 6.9). The higher price for unwrought aluminium induced by import tariffs has negatively affected the downstream users, especially small- and medium-sized companies. Those negative effects have been comparatively greater for downstream companies, which operate in national and international markets where price competition is fierce. Conversely, firms producing highly engineered and differentiated semis, competing primarily on their specific physical and performance characteristics, have suffered less. At the same time, the opportunity to pass through the additional production costs, if any, has been increasingly prevented by growing competition from developing countries and by the limited bargaining power vis-à-vis many customer industries.

Figure 6.9: The cost structure of typical downstream producers



** Figures refer to the typical cost structure of car wheels manufacturers. However, the cost structure of single casters may vary substantially. The weight of unwrought aluminium costs, in percentage of the total cost, ranges from 50% to 65%.*
Source: Authors' based on GRIF (2015)

Furthermore, the impact has varied depending on the dimension of semi-finished producers, with small- and medium-sized companies inevitably suffering more given the structural characteristics of the EU aluminium industry.

First, the existence of firms with different degrees of vertical integration, meaning those operating in both unwrought aluminium and semi-finished product segments, creates the opportunity for firms— especially for those located in countries with PTAs with the EU— to avoid the cost of customs duties. Moreover, large downstream companies might also have benefited from the option of the inward processing customs procedure, through which companies temporarily import raw materials or semi-manufactured goods from various countries, assemble or transform them within the EU customs territory and subsequently re-export the processed products for final consumption in third markets.

As a matter of fact, the import tariffs have provided an incentive for firms to move towards vertical integration, especially for companies already involved in the primary and secondary production of unwrought aluminium. Those firms, profiting from additional revenues thanks to the import tariff, found it convenient to further expand their operation in the production of semi-finished products in order to fully take advantage of their different degree of vertical integration. This trend of growing market concentration has been particularly noteworthy in the extrusion and rolling industries. In the extrusion sector, the largest company (Hydro Aluminium - Extruded Solutions, which is now fully owned by Norsk Hydro ASA) owns and operates over 34 production facilities located in fifteen different countries and represents around 16% of total production capacity in the EU. In the aluminium rolling industry, the leading company Aluminium Norf GmbH, a joint venture between Norsk Hydro and US-based company Novelis, operates about 21% of the production capacity installed in the EU. In addition, Norsk Hydro and Novelis accounted for more than 31% of the production capacity of aluminium rolling in the EU, while the top ten companies operated almost 70% of the installed capacity in 2017[37].

On the other hand, independent small and medium-sized users of unwrought aluminium have been negatively affected by the described changes. As highlighted in previous sections, as well as in other similar studies carried out recently (Ecorys, 2011; GRIF, 2015), they faced increasing difficulties in reliably and competitively accessing unwrought aluminium. The resulting increase in production costs, together with the competitive pressure exerted both internally by vertically-integrated European producers and externally by producers in third countries (in particular in China), has progressively harmed the competitiveness of an increasing number of companies, especially in activities with a lower added value where industrial relationships with final customers are less significant and price competition is fierce.

The overall effects are clearly visible. In 2017, the EU's production of aluminium extrusions was slightly below its 2000 levels, although global production has tripled over the same period. As a matter of fact, almost one third of the world's production of aluminium extrusions took place in the EU between 2000 and 2003. Since 2003, this share has dropped, hitting 9% in 2017. Production has increased in the EU's aluminium rolling and aluminium casting industries since 2000, but at a significantly slower pace than at the global level. As a result, the EU's share in global manufacturing of semi-finished aluminium products has consistently declined, dropping from 29% in 2000 to 14% in 2017. Between 2000 and 2017, the EU's trade balance has consistently worsened in all sectors of aluminium semi-finished products.

[37] Novelis has also recently decided to acquire Aleris to increase its share in high-value products and to exploit long-term relationships with blue-chip customers, especially in the production of aerospace plate and sheet.

Some companies have performed better, usually those firms characterized by long-standing customer relationships—based on geographical proximity, flexibility and customization—with end-user industries. This led to a change in the geographic breakdown of the production of semi-finished products. Germany has further consolidated its role as a leading producer in all semi-finished segments, mainly driven by the German manufacturing base in many end-user industries—such as, inter alia, the automotive, machinery, consumer durables, and building sectors. Other major producing countries, in particular the UK and to a lesser extent France, have experienced a major slowdown, especially in the extrusion sector. Conversely, countries such as Poland and Spain, characterized by price competitiveness in some segments as well as consolidated and growing relationships with the automotive sector and with the German industrial system, have gradually increased their share of the EU's production of semi-finished products.

Finally, the maintenance of the import tariff on unwrought aluminium has led to a massive transfer of resources—estimated in this study to fall within the range of €9.5 and €17.8 billion according to different hypotheses—from producers of semi-finished aluminium products to primary and secondary producers of unwrought aluminium operating both within the EU customs territory and in countries with a preferential tariff agreement with the EU. This transfer of resources has not only radically changed power dynamics to the benefit of companies operating in the upstream component of the value chain, but more importantly did not produce the desired results in terms of slowing down the decline in domestic unwrought aluminium production. Instead, it ended up reducing the competitiveness of downstream aluminium industries by increasing their unit costs compared to international competitors. The opposite has been the case in China, as well as in GCC countries, where industrial policies and different measures (from direct and indirect subsidies to export restrictions in upstream activities) were directed at making unwrought aluminium cheaper and at conferring a cost advantage on Chinese manufacturers of semi-finished products.

6.4.3. The (in-)effectiveness of the autonomous customs duty suspension

As early as 2007, on the basis of a proposal from the Commission, the Council, through Regulation 501/2007, autonomously suspended the conventional customs duty rate on unwrought, not alloyed, aluminium (CN Code 76011000) from 6% to 3%. The Commission then decided in 2010 to maintain the autonomous customs duty suspension. Later on, the Council, through Regulation 1387/2013, also autonomously suspended the conventional customs duty rate on slabs and billets of unwrought aluminium alloys (CN Code 76012020) from 6% to 4%. Council Regulation (EU) 2018/2069 of 20 December 2018 amended Regulation (EU) No 1387/2013, confirming the current duty rate of 4% and postponing the date foreseen for mandatory review to December 2023.

The autonomous custom duty suspensions were considered the most appropriate responses to the EU aluminium industry's difficulties, while balancing the reductions in aluminium producers' production and downstream users' increasing difficulty competing with foreign firms, especially Chinese producers.

More specifically, the autonomous partial suspension of the customs duty on unwrought, not alloyed, aluminium was justified by the European Commission on the grounds of needing to support the competitiveness of small and medium-sized enterprises using unwrought aluminium for the production of semi-finished and finished industrial goods, as well as promoting competition for those products in the single market.

The European Commission recognised that the survival of small and medium-sized enterprises and independent downstream users had been jeopardised by increased costs for raw materials and by the difficulty of accessing unwrought, not alloyed, aluminium produced by companies located in countries with a preferential tariff agreement with the EU (mainly Norway, Iceland and Mozambique), whose supply is principally intended for their subsidiaries that export aluminium to the EU.

The temporary autonomous suspension of the conventional customs duty rate was thus intended to reduce input costs for downstream aluminium users and to significantly improve their competitiveness. At the same time, the maintenance of a customs duty rate of 3% was deemed to be necessary to avoid creating excessive competitive pressure on unwrought aluminium producers as well as vertically-integrated companies still operating within the Union, which benefit from higher prices of unwrought aluminium within the internal market.

As noted, although dutiable imports are more competitive than in the past, the weight of duty-free imports of unwrought, not alloyed, aluminium in EU has risen after the introduction of the autonomous tariff suspension in 2007, averaging 50% over the period 2008-2017. Similarly, even looking at this restricted time period, it is clear that the share of duty-free imports of slabs and billets of unwrought aluminium alloys has slightly decreased after the introduction of the autonomous tariff suspension in 2013, averaging 68% in the period 2014-2017 (74% in the previous years).

Furthermore, in 2017, more than a quarter of EU imports of unwrought, not alloyed, aluminium and one third of imports of unwrought aluminium alloys took place under the inward processing tariff regime. Although specific data is not available on the companies authorized to use this procedure, it is reasonable to assume that this procedure has been used to a greater extent by larger companies, firms typically characterized by a greater degree of internationalization and by a larger share of turnover realized abroad.

As a matter of fact, the partial reductions of EU tariffs on import of unwrought, not alloyed, aluminium and certain forms of unwrought alloyed aluminium did not produce the intended positive effects on the competitiveness of independent small and medium-sized enterprises using unwrought aluminium for the production of semi-finished and finished industrial goods. Those firms, which rely heavily on international markets to purchase their fundamental inputs, continue to be penalized by current EU trade policy.

On the one hand, although data is not available on companies importing under the inward processing scheme, these companies are excluded to a very large extent from duty-free purchases of unwrought aluminium. In this regard, it should be noted that most of the production of unwrought aluminium in duty-free countries, in particular Norway and Iceland, is attributable to three large vertically-integrated groups with international operations (Norsk Hydro, Alcoa Corp. and Rio Tinto Alcan). On the other hand, while having relatively high exposure to foreign competition, independent small and medium-sized enterprises may have limited access only to the inward processing regime, as they are mainly oriented towards the internal market.

This explains why EU trade policy has not been effective in improving downstream users' competitiveness, while favouring further market concentration and mainly benefiting vertically-integrated companies and firms able to avoid the cost of the customs duty. In any event, these partial tariff reductions are widely known to be the result of difficult compromises between various industry segments of the aluminium value chain.

7. Policy recommendations for the competiveness of the EU aluminium industry

The aluminium industry has always been present in the European Union, with a large range of activities along the entire value-added industrial chain. While the upstream activities have been historically characterized by strong industrial concentration, often explained by their specific economic and technological features, especially its huge capital outlays, the downstream segments have traditionally included both large vertically-integrated companies and a number of small and medium-sized enterprises.

The competitive advantage in the aluminium value chain in the EU undoubtedly lies in the technological leadership of the downstream activities. Extruders, rollers, and some casters rely on modern technologies and are currently able to achieve the highest international standards in terms of the quality of both products and production processes, thus ensuring timely, reliable, and customised supply for many manufacturing processes and end-user industries.

The downstream aluminium sector has progressively become a beacon for the entire aluminium value chain, in particular when accounting for the downsized role of primary producers. Furthermore, the downstream aluminium sector (including manufacturers of extruded, rolled and cast aluminium, as well as producers of foil, wire, slug, and powder, lacquers and anodisers, and other applications) accounts for nearly 92% of total employment in the whole EU aluminium industry, compared to 5% for the primary segment and 2% for the secondary segment. Accordingly, it is essential to provide sufficient support to maintain this leadership and possibly to reinforce the economic and industrial competitiveness of firms producing semi-finished products.

At the same time, it is fundamental to rebuild widespread manufacturing competences throughout the entire EU, thus reversing the current path of industrial desertification that has particularly affected those territories in weaker geographical proximity to the end-user industries as well as those with fiscal constraints that substantially limit public investments. Those objectives are also in line with the new directions of the EU's industrial policy—more specifically with the European Commission's objective, announced in the Communication "For a European Industrial Renaissance" (COM(2014) 0014) of January 2014[38], to reverse industrial decline and to ensure that 20% of GDP comes from manufacturing activities by 2020. As the European Commission pointed out: "*As a key driver of productivity and innovation, industry has always been a cornerstone of economic prosperity in Europe. We can rely on a strong industrial base, but important efforts are needed by Member States, EU institutions and most importantly industry itself to maintain and reinforce Europe's industrial leadership in the age of globalisation, sustainability challenges and rapid technological change. […] Europe is the global leader in many industries, especially in high value added, low carbon and sophisticated products and services. […] However, major efforts are needed to adjust to the challenges and reap the vast*

[38] See also, inter alia, Council of the European Union Conclusions on "An EU industrial policy strategy", 12 March 2018; European Commission State of the Union 2017 – Industrial Policy Strategy: Investing in a smart, innovative and sustainable industry, 18 September 2017.

opportunities of the new industrial age (European Commission, 2017b)". The Council of the European Union has recently reiterated the importance of mainstreaming industrial policy across all EU strategic initiatives to create a favourable environment and to reduce cumulative regulatory costs in order to stimulate investments and innovation (The Council of European Union, 2018a).

Trade policies will play a key role in preserving the EU's global industrial competitiveness, particularly given that strengthening the industrial base will be a key component of EU's future and that industry in the EU continues to be a major driver for productivity, growth, innovation and employment. As increasingly recognised by European institutions, more consistency between trade policy and industrial policy is critical in order to prevent incoherence, which could lead to relocations and further deindustrialisation[39]. A robust trade policy and a truly level playing field are fundamental to facilitate the integration of European companies in global value chains, also in a long-term competitiveness perspective (The Council of European Union, 2018b). Global industrial overcapacity in raw material sectors such as the steel and aluminium sectors, among others, has been acknowledged as one of the main causes explaining the recent surge in protectionist trade measures and a geopolitical context less conducive to multilateral governance and a rules-based international order. Against this background, the European Parliament continues to urge multilateral cooperation in order to address the structural concerns behind overcapacity (The European Parliament, 2019, 2018).

Harmonising industrial policy across all the EU's strategic initiatives is particularly important for SMEs, which have suffered the most from EU trade measures on unwrought aluminium. Contrary to expetations, the partial suspension of the customs duty for non-alloyed aluminium has not improved the competitiveness of SMEs neither improved the competitiveness of semi-finished and finished aluminium products on the internal market. Developing a strong and sustainable industrial base able to compete globally would require an industrial policy improving the business environment, especially for SMEs. In the following section, some policy recommendations will be made based on this report's overall findings.

Abolishing import tariffs on unwrought aluminium to reduce downstream costs without bias to the upstream production

Lacking raw materials, with a minimum output of alumina and with a production of unwrought aluminium which has strongly declined in recent years, the EU aluminium industrial value chain strongly depends on foreign production of metal.

Imposing a customs duty on unwrought aluminium has the effect of increasing unitary production costs of downstream companies that use unwrought aluminium to produce a plethora of semi-finished products. In markets open to international competition, import tariffs inevitably confer a cost disadvantage on EU manufacturers of semi-finished products compared to foreign competitors.

A coherent policy would require the opposite strategy. By reducing the price of unwrought aluminium and by widening the sources of supply, the abolition of import tariffs can improve the competitiveness of downstream producers and, as a consequence, can eventually reinforce the market position of end-user industries. As matter of fact, many countries have adopted industrial policies aiming at sustaining aluminium smelting, primarily in the form of energy subsidies and concessional financing, as a way to provide cheaper raw materials to downstream users (i.e. producers of semis), thus increasing their domestic production and exports thanks to lower unit costs.

[39] See European Parliament resolution of 5 July 2017 on building an ambitious EU industrial strategy as a strategic priority for growth, employment and innovation in Europe (2017/2732(RSP)).

As extensively explained in this report, imposing a customs duty on unwrought aluminium has not succeeded in increasing the EU's production and exportation of primary aluminium, nor in protecting unexploited local production capacity. Meanwhile, it has had the unfortunate side effect of generating increasing difficulties for downstream companies. EU trade policy did not, in turn, protect those firms sufficiently from international competition. On the contrary, the effects of import tariffs implemented on semi-finished aluminium products were in fact offset by the incoherent decision to maintain customs duties on unwrought aluminium.

This report's findings strongly support the case for the suspension of tariffs on unwrought aluminium products. The customs duty of unwrought aluminium should not be regarded as the right policy instrument, as it artificially raises downstream costs without offering any appreciable results in supporting upstream production.

The maintenance of the primary production of aluminium can only be justified for strategic reasons

As import tariffs on unwrought aluminium have substantially failed both to protect unexploited local primary production capacity and to favour an increase in the EU's production and exportation of primary aluminium, one can question which policies should be adopted with regards to upstream activities.

Empirical evidence and recent market developments clearly indicate that, in the EU context, the preservation of primary production is not possible except for at a level which is a low share of the total apparent consumption. Moreover, recent debates in the United States also highlight the increasing importance of investigating alternative remedies for dealing with dependency on imports in strategic industries, such as the aluminium industry, especially in a context characterised by a broad variety of measures taken by the government. Indeed, government interventions, primarily in the form of energy subsidies and concessional financing, are relatively large in primary aluminium, thereby influencing the entire value chain.

The lack of raw materials, the scarcity of low-cost energy resources and more ambitious targets in terms of reducing carbon emissions inevitably lead to a significant disadvantage in many energy-intensive operations, including the production of unwrought aluminium. Fundamental differences in national institutional frameworks and welfare systems, both inside and outside the European Union, make it more difficult to compare labour costs. In any case, it is difficult to imagine how further steps could be taken to reduce labour costs without compromising current welfare levels.

In the context described above, closing the gap in competitiveness can only be achieved by choosing to efface part of the cost differential by directly or indirectly subsidizing the production of primary aluminium. This would require an EU competition policy decision to provide a block exemption for the aluminium industry from EU state aid rules.

The strategies espoused by many European companies to increase their share of higher added-value productions (typically aluminium alloys) can offer a lasting solution only if they are accompanied by vertical integration and by long-term partnerships with the end-user industries— on the condition that they also improve their performance and maintain their role as drivers of sustainable growth and employment in Europe.

Given this context, taking action to preserve primary production of aluminium can thus only be justified by recognising its strategic value and its instrumental role for the entire EU economy. Government intervention, including in the form of state ownership, may be required to ensure that the EU is not totally dependent on imports. Such intervention, in turn, involves making a preliminary decision on the desired share of total apparent consumption which would be satisfied by domestic production. Yet, any policy measures taken should be consistent with WTO safeguard measures, and should be taken pursuant to the provisions of the relevant EU trade defence legislation.

Import tariffs on unwrought aluminium should not be regarded as the right instrument to support secondary production

The promotion of secondary production of unwrought aluminium is highly desirable as a method of meeting the EU's demand for metal, while ensuring lower energy consumption and carbon emissions, as well as offering a potential example of a more circular economy.

EU secondary aluminium producers have significantly benefitted from the higher prices for primary aluminium induced by import tariffs. Indeed, a very large share (ranging from 3.1 to 5.8 billion euros, depending on the scenario considered) of the duties paid by EU downstream manufacturers has been transferred to EU secondary aluminium producers. While primary aluminium also constitutes a fundamental input of secondary production (about one third of the metal used comes from primary production), the higher the price for primary aluminium, the higher the price for secondary aluminium. This relevant transfer of resources has not prevented the EU from becoming a net exporter of aluminium waste and scraps (exports of aluminium waste and scrap have almost doubled from 2000 to 2017), signalling that the potential of secondary aluminium production has probably been fully exploited.

The deployment of the circular economy paradigm opens new opportunities in the aluminium industry for further enhancing recycling across the value chain. Innovative sorting and separation technologies, as well as consistent product design both in downstream and end-user segments, can further improve the uptake of used materials in EU and promote secondary aluminium production. However, taking into account the useful life of aluminium products, these improvements will likely require many years to implement.

Secondary aluminium production should be encouraged through appropriate support schemes, rather than customs duties, which are actually generating significant rents to the detriment of the downstream segment and end-user industries. If possible, those support schemes should also be linked with economic incentives ensuring that the secondary raw material (that is aluminium waste and scrap) produced in the EU would be increasingly recycled and reused domestically rather than exported abroad. Such incentives should be adapted to the relevant EU legislation on state aid.

Improving industrial competitiveness of downstream sector through innovation, research and resource efficiency

Metalworking has a long-established tradition in the EU. The majority of downstream players have been operating in this industry for many years and can rely on unique know-how and significant learning economies. Moreover, innovative strategies and investments in new technologies have enabled downstream manufacturers to improve the quality of their products and to specialise in supplying premium market segments, by also exploiting long established partnerships with customer industries based on close geographic proximity, flexibility, and product customisation. Finally, downstream producers have consistently reduced the overall environmental impacts of the aluminium production carried out in the EU, by minimizing waste production at different levels of the value chain and by increasing the use of secondary aluminium.

As a result, EU downstream producers were able to partially offset the growing competitive pressure exerted by foreign producers and to keep the EU industry profitable despite cost disadvantages. However, the industrial policies of many emerging economies are deliberately aimed at scaling up the aluminium value chain, by moving from upstream to downstream activities and to more efficient and high-value solutions.

Maintaining the technological leadership and possibly reinforcing the competitiveness of EU firms producing semi-finished products would thus require government interventions aside from simply reducing the costs these firms incur to procure the inputs and intermediates they need (i.e. by abolishing tariffs on raw materials). Sectoral policies and incentives should be primarily directed at supporting downstream activities in their efforts to expand their innovative, research and technological capacities and to continuously develop high-performance solutions for end-user industries.

Specific measures should also be directed at encouraging improvement in sustainability, resource efficiency and environmental performances both to reduce the carbon content of aluminium products and at facilitating the subsequent recycling and reuse of aluminium waste in a circular economy perspective. The particular attention paid by the EU to the circular economy has recently been concretized in several EU measures, among which the most relevant are those included in the Circular Economy Action Plan[40].

The suspension of import tariffs on unwrought aluminium would generate additional financial resources (from 0.5 to 1 billion euros per year) for EU downstream manufacturers, revenue which can be directed towards increasing their competitiveness by either reducing market prices for semis or investing in the technological improvement of products and production processes.

The industrial competitiveness of EU downstream sector depends on the relationship with the major end-user industries

Finally, coherent and coordinated policies are required in end-user markets to improve the economic and industrial competitiveness of firms producing aluminium semi-finished products.

An effective industrial policy for the aluminium industry must take into account the entire value chain from the end-user industries to the upstream activities, as well as the interactions between measures in different areas, such as energy, trade, research, raw materials, and public administration. In the context described above, improving the competitiveness of the aluminium value chain requires enhancing, including with the tools of the so-called fourth industrial revolution, the collaboration and the relationships with relevant industries that extensively and increasingly use extrusions, flat-rolled products and aluminium castings in their production processes. The contraction of these industries which has taken place in many European Union member states (particularly in the automotive, transport, machinery and construction sectors) has in fact left many independent downstream companies without their captive demand, thus forcing them to compete in a wider—generally global— competitive context, one which is not always characterized by equal competitive conditions.

Improving the understanding of the aluminium industry

The increasing number of studies on the aluminium industry is a clear sign of the demand for a better understanding of the complexity of international production and how competitive conditions in raw materials and in non-ferrous metal industries in particular can affect single economies.

When responding to this need, researchers must cope with a lack of reliable data and economic statistics, particularly in relation to downstream activities. Although progress have been made, especially

[40] See http://ec.europa.eu/environment/circular-economy/index_en.htm.

regarding attempt to go beyond the NACE classification and to include relevant data for different activities in the value chain, economic statistics still remain largely incomplete for downstream segments. This is particularly evident for aluminium casting activities, characterised by a large number of SMEs and by unclear boundaries with other light metals casting operations.

To improve policymaking, reliable data and economic statistics are necessary, thus allowing policymakers to better take into account the overall impact of proposed measures all along the value chain and, ultimately, on European consumers.

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Annexes

A.1. Main assumptions by scenario

Table A.1: Lower bound

Assumptions	Variable	Definition	Data	Source	Method
Quantity of unwrought aluminium affected	EU28 primary and secondary aluminium apparent consumption	EU28 production of primary and secondary aluminium + primary and secondary aluminium imports - primary and secondary aluminium exports	EU28 production of primary aluminium (not alloyed + alloys)	CRU	
			EU28 production of secondary aluminium (not alloyed + alloys)	CRU	
			EU28 primary aluminium imports	Estimated on ComEXT	Imports related to HS codes 76.01.1000 and 76.01.2010. Imports related to HS codes 76.01.2020 and 76.01.2080 are included in primary aluminium
			EU28 primary aluminium exports	Estimated on ComEXT	Exports related to HS codes 76.01.1000 and 76.01.2010. Exports related to HS codes 76.01.2020 and 76.01.2080 are included in primary aluminium
			EU28 secondary aluminium imports	Estimated on ComEXT	Imports related to HS codes 76.01.2091 and 76.01.2099. Imports related to HS codes 76.01.2020 and 76.01.2080 are included in primary aluminium
			EU28 secondary aluminium exports	Estimated on ComEXT	Exports related to HS codes 76.01.2091 and 76.01.2099. Exports related to HS codes 76.01.2020 and 76.01.2080 are included in primary aluminium
Impact of the EU import tariffs	Price difference between duty paid and duty unpaid regional premium	Rotterdam ingot duty paid premium - Rotterdam ingot duty unpaid premium	Rotterdam ingot duty paid premium	CRU	Import tariff inflates the price of all the primary aluminium consumed in the EU28 (not alloyed and alloys)
			Rotterdam ingot duty unpaid premium	CRU	Import tariff inflates the price of all the primary aluminium consumed in the EU28 (not alloyed and alloys)

Table A.2: Upper bound

Assumptions	Variable	Definition	Data	Source	Method
Quantity of unwrought aluminium affected	Total EU28 primary and secondary unwrought aluminium alloys consumption	EU28 primary unwrought aluminium alloys consumption by downstream transformers	EU28 primary unwrought aluminium alloyed consumption by extruders	Estimates on CRU and representatives	
			EU28 primary aluminium consumption by rollers	Estimates on CRU and representatives	
			EU28 primary aluminium consumption by caster	Estimates on CRU and representatives	
			EU28 primary aluminium consumption by wire and cable, powder, and forging producers	EA	Wire and cable, powder, and forging producers are assumed to process about 1 million tonnes per year in line with estimate presented by the European Aluminium Association (EA).
		EU28 secondary unwrought aluminium alloys consumption by downstream transformers	EU28 secondary unwrought aluminium alloys consumption by extruders	CRU	
			EU28 secondary unwrought aluminium alloys consumption by rollers	CRU	
			EU28 secondary unwrought aluminium alloys consumption by caster	CRU	
Impact on the EU market price for unwrought aluminium alloys	Duty paid price for primary unwrought alloyed aluminium imported from extra-EU dutiable countries	Price before duty of alloyed aluminium imports from dutiable country (6% duty before 2014 and 4% thereafter)	Price before duty of alloyed aluminium imports from dutiable country	Estimates on Comext	The statistical value is the value calculated at national frontiers. It is a CIF value for imports/arrivals: it therefore includes only incidental expenses (freight, insurance) in the part of the journey located outside the territory of the Member State which imports the goods. The statistic value is generally based on the customs value in the case of extra-EU trade, thus excluding, i.a., import duties or other Community taxes on the import or sale of goods.
			Custom duty	EU law Regulation No. R1623900 and R9720860	