ALUMINUM IN BRAZIL: MAJOR CHANGES IN THE PAST 15 YEARS

By Marcelo Massarente, Antonio Serrano, Leticia Machado, Luciana Hara, and Victor Frazão

BAIN & COMPANY

Marcelo Massarente is a partner, Antonio Serrano is a manager, Leticia Machado is a consultant, and Luciana Hara and Victor Frazão are associate consultants at Bain in São Paulo.

Content and Design: Bain Brazil

Contents

1. Introduction

Over the last 15 years, few industries have undergone structural changes so powerful as the aluminum industry in Brazil. These shifts brought about a new reality on both the supply and the demand side.

Take the upstream segment. Brazil was once the world's sixth largest producer, a major player with an integrated chain from bauxite mining to primary aluminum production, or smelting. Alternatives to expand the smelting capacity were actively discussed, with a consistent focus on energy self-generation options to boost competitiveness.

Recycling was a big promise, mainly as a way to guarantee that often informal players could have access to the metal—or as an attempt by some players to hedge their costs consonant to their needs.

In downstream fabrication, the debate centered on how to boost demand, which for long seemed sluggish. Accordingly, there was research on technology developments for steel and plastic replacement, on how to foster can adoption in the beverage industry, and even on vertical integration options in consumer markets to encourage the use of the shiny metal.

Fifteen years later, we find an industry with a very different agenda. Discussions on how to bolster demand continue, but the focus now is on finding ways to go above and beyond Brazil's intrinsic potential. The debate has intensified around ways to ensure competitive supplies, particularly for two components of the aluminum chain: primary production and downstream fabrication.

This article will explore some of these shifts and advance a few predictions on Brazil's aluminum chain potential for value creation. We will also take a closer look at the challenges the industry will face if it is to realize that potential over the next decade.

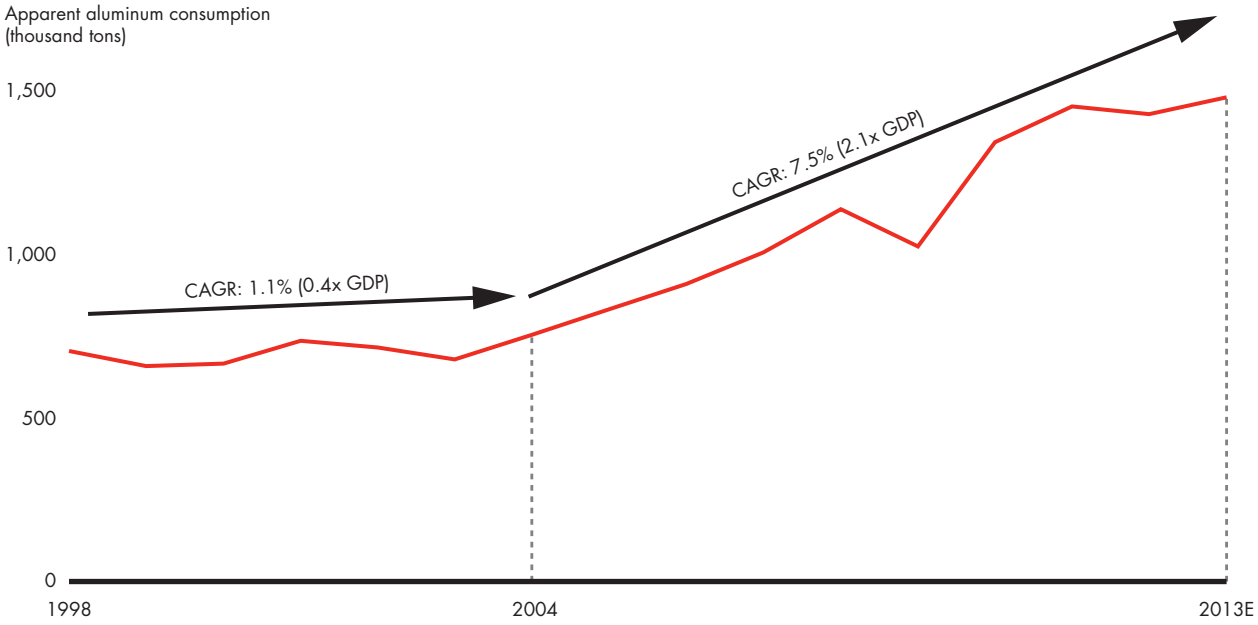
2. Aluminum demand: consumption history and outlook

Aluminum demand in Brazil has seen strong growth in recent years and should remain high in the near future. Although the competitive advantages of aluminum relative to steel and plastic—recyclability, corrosion resistance, mechanical strength with lower specific weight, and so on—have long been touted, aluminum was always perceived as an overly expensive material.

A combination of rising incomes and greater awareness of sustainability issues created the conditions for that demand to begin materializing. Accordingly, domestic demand in Brazil, which fluctuated between 650,000 metric tons and 750,000 metric tons from 1998 to 2004—with no actual growth—, effectively doubled in the following ten years, jumping to over 1.4 million metric tons in 2013 *(see Figure 1)*.

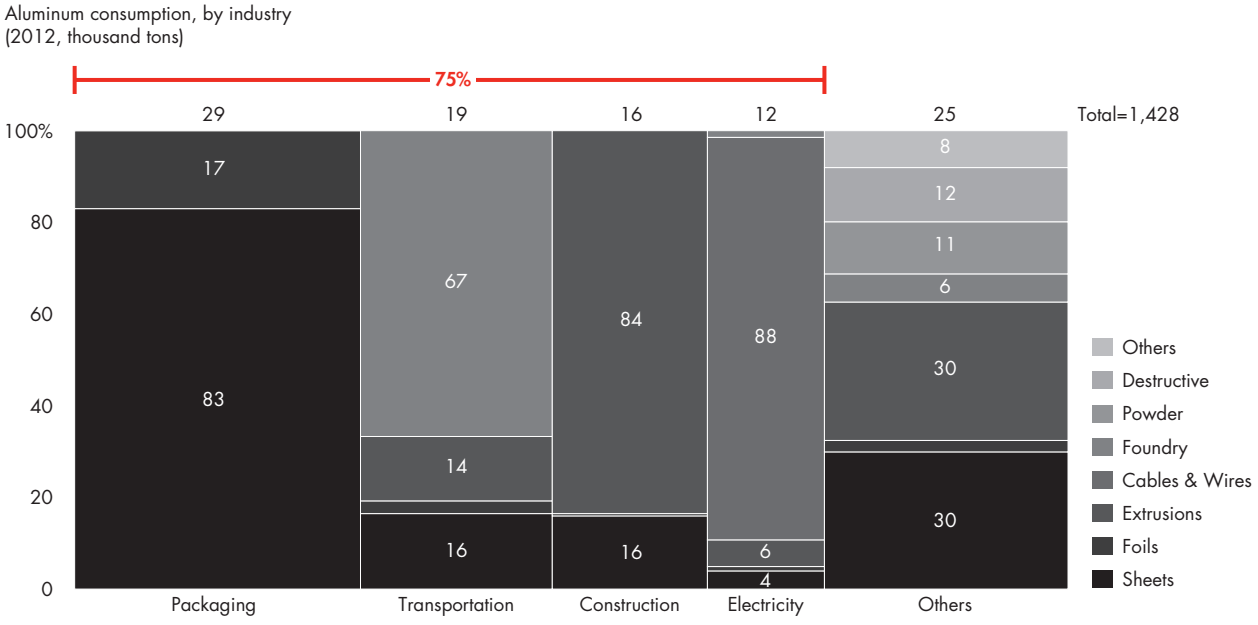
Today, four industries account for three quarters of aluminum consumption in Brazil (the same quartet behind most of the demand for the metal globally): Beverages (packaging), Transportation, Construction, and Electricity *(see Figure 2)*.

Figure 1: Brazil has seen strong growth in aluminum consumption in recent years



Source: ABAL, IBGE, press clippings

Figure 2: Four industries account for three quarters of aluminum consumption in Brazil



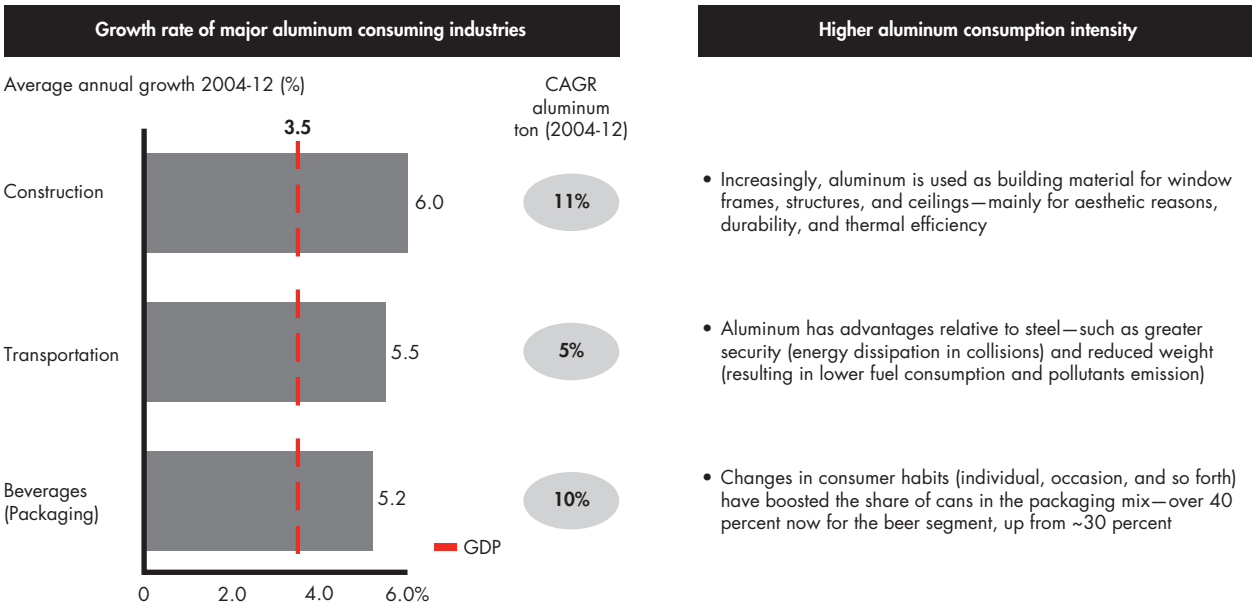
Source: ABAL Statistical Yearbook 2012

All four industries grew at a faster clip than the country's GDP in the period, and saw aluminum consumption grow (see Figure 3). Going forward, the outlook remains positive. Unlike steel and cement, widely used during a country's infrastructure build up, the growth curve of aluminum consumption x national GDP can often slow down, but won't revert past a certain level of economic development (see Figure 4).

Brazil should be no exception. The four industries that respond for the bulk of aluminum consumption in the country show very positive growth prospects. Also, in all of them there are forces pointing to a higher intensity of aluminum usage. For instance, in the Brazilian auto industry, the aluminum content per vehicle remains small relative to other countries. Also, emerging trends in these countries should further increase the potential demand of aluminum by the auto industry (see Table 1).

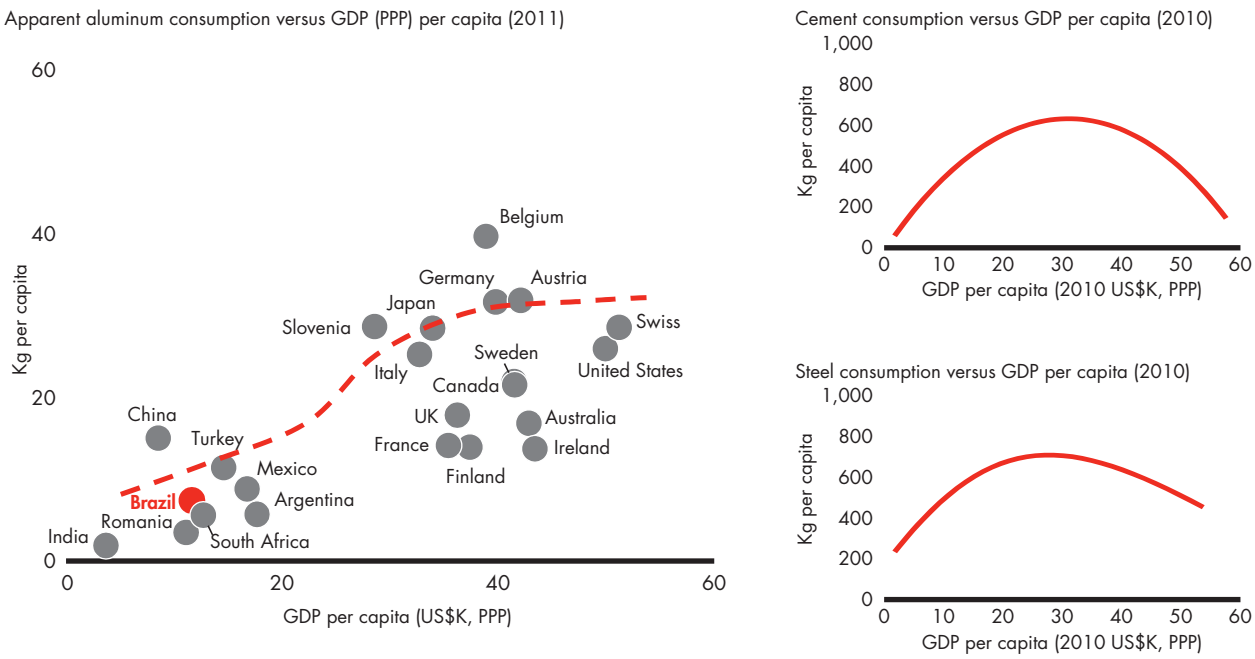
When all these drivers are factored in, it seems reasonable to expect a continuing growth of consumption at twice the GDP rate for some time. By our estimates, Brazil could already be consuming between 2.4 million tons and 2.8 million tons by 2020. Even at these levels, the country would still remain within the expected per capita consumption range, considering GDP forecasts at the end of the decade. While it took nearly 20 years to add 1 million tons to total consumption, it is now estimated it will take only seven years to add 1 million tons more (see Figure 5).

Figure 3: The industries below grew at a faster rate than GDP over the period, and saw aluminum relative consumption grow



Note: Construction: sales; Beverages: beer and soft drink sales, in R$; Transportation: number of vehicles manufactured
Source: Nielsen Tendências, ANFAVEA 2013 Yearbook, IBGE

Figure 4: Aluminum consumption should grow in Brazil as average income per capita rises



Source: ABAL, EIU, WorldBank, ABM, International Cement Review, SNIC, IMF, Bain analysis

Table 1: Automotive industry

Aluminum demand is about to rise in the auto industry, with plenty of benefits

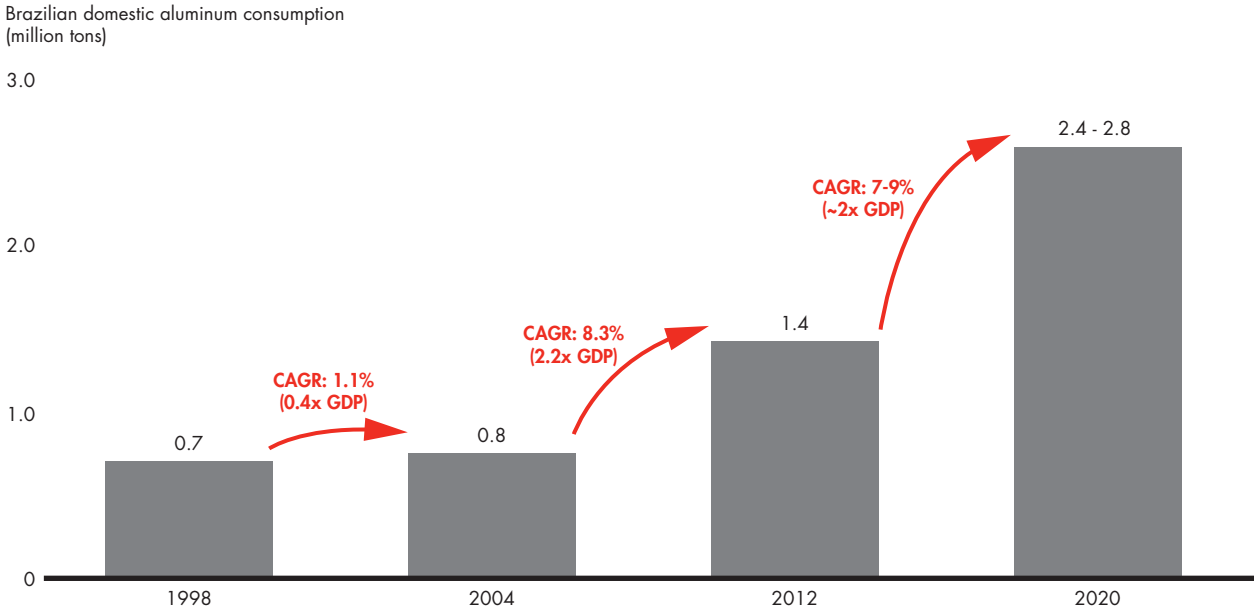
The auto industry is actively looking for solutions to improve the fuel efficiency of cars and reduce carbon emissions. In this scenario, aluminum will be a key material.

Luxury car makers already make all-aluminum cars (except for interiors)—think of the Audi A8, the BMW 6 Series, the Mercedes-Benz SLS, and the Range Rover Vogue. Now, the trend is also reaching basic models: the new generation of the F-150 truck introduced by Ford, leader in the full-size pickup segment in the U.S. market, will have an aluminum body.

Aluminum has plenty of room to grow in the Brazilian auto industry, where the average aluminum content per vehicle stands at around 110 pounds—whereas in the U.S. and Europe that figure exceeds 300 pounds. A new government program to boost vehicle technology innovation (Inovar Auto) should raise aluminum demand by the industry, as tax breaks for cars that reach a set level of energy efficiency should fuel the drive for lighter, more efficient vehicles—with lower carbon emissions to boot.

Source: *Exame* magazine, ABAL

Figure 5: Aluminum consumption should continue to grow at around twice the GDP rate in the coming years, and may reach 2.4-2.8 million tons/year by 2020



Source: ABAL, Bain analysis

3. Value creation potential in a scenario of locally met demand

Until now, demand has been met locally, with future growth prospects opening a huge value creation potential.

A closer look at capacity, output and trade balance data from different chain segments up to 2012 *(see Figures 6 and 7)* shows that Brazil...

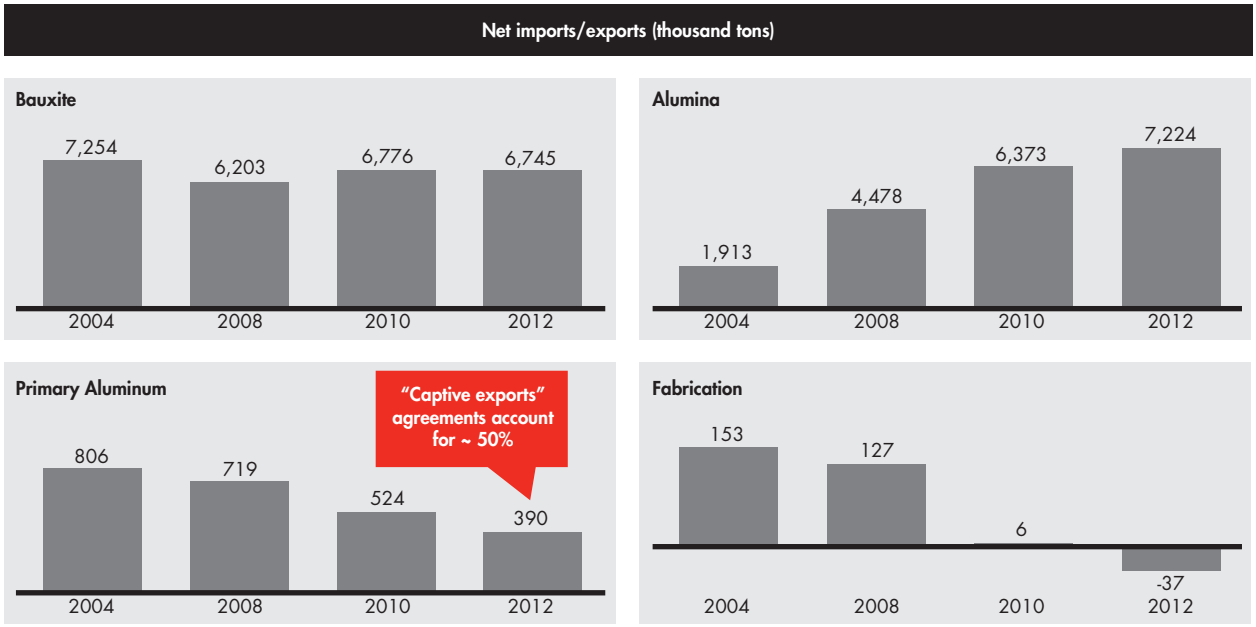
a) ...has easily satisfied the domestic demand and became a strong exporter of Bauxite and Alumina;

b) ...has met the demand of Primary Aluminum and became a net exporter, although the surplus is in steep decline;

c) ...has made the investments required to meet the demand of downstream Fabrication, but saw its trade balance enter negative terrain as competitiveness deteriorated.

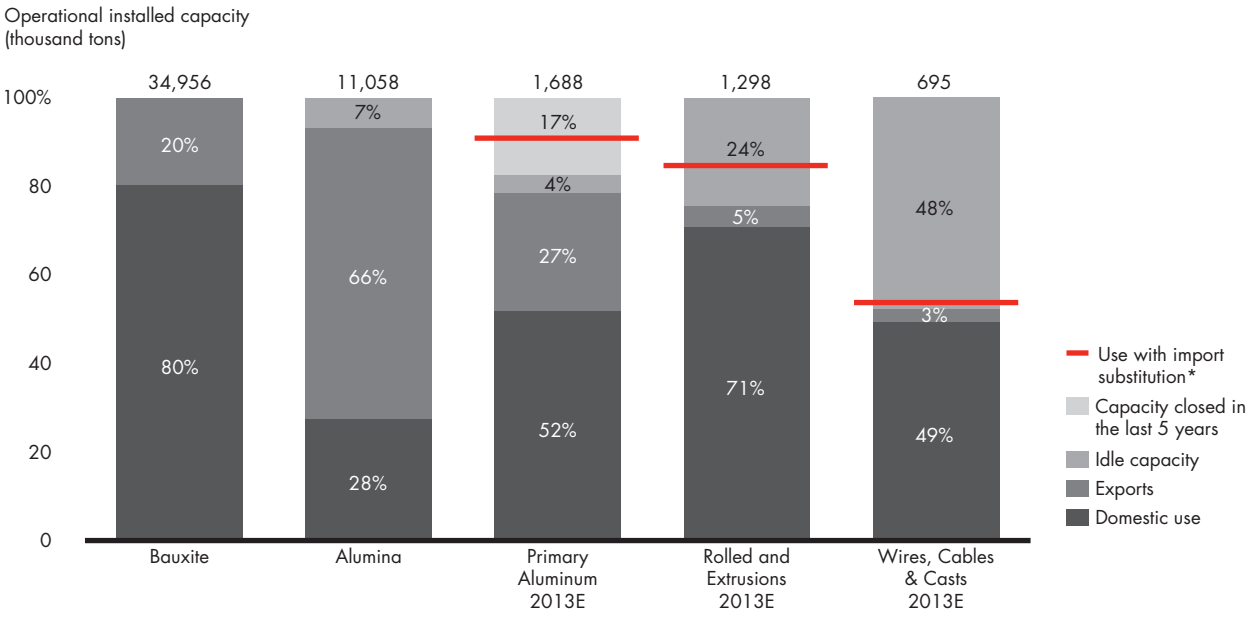
As a result, the Aluminum chain managed to add significant value domestically. Investments in the past five years exceeded the mark of **R$10 billion**, with over **R$20 billion** in tax receipts. In 2012, the chain had gross annual revenues of around **R$40 billion** (~ 4 percent of industrial GDP) and employed more than 200,000 workers in direct and indirect jobs.

Figure 6: Brazil met the demand in Bauxite, Alumina and Primary Aluminum, but saw the trade balance enter negative terrain in Fabricated products



Source: ABAL

Figure 7: Despite the negative trade balance, the downstream Fabrication segment in Brazil has installed capacity to meet all import needs



*Usage rate if imported material were locally produced
Source: ABAL, press clippings

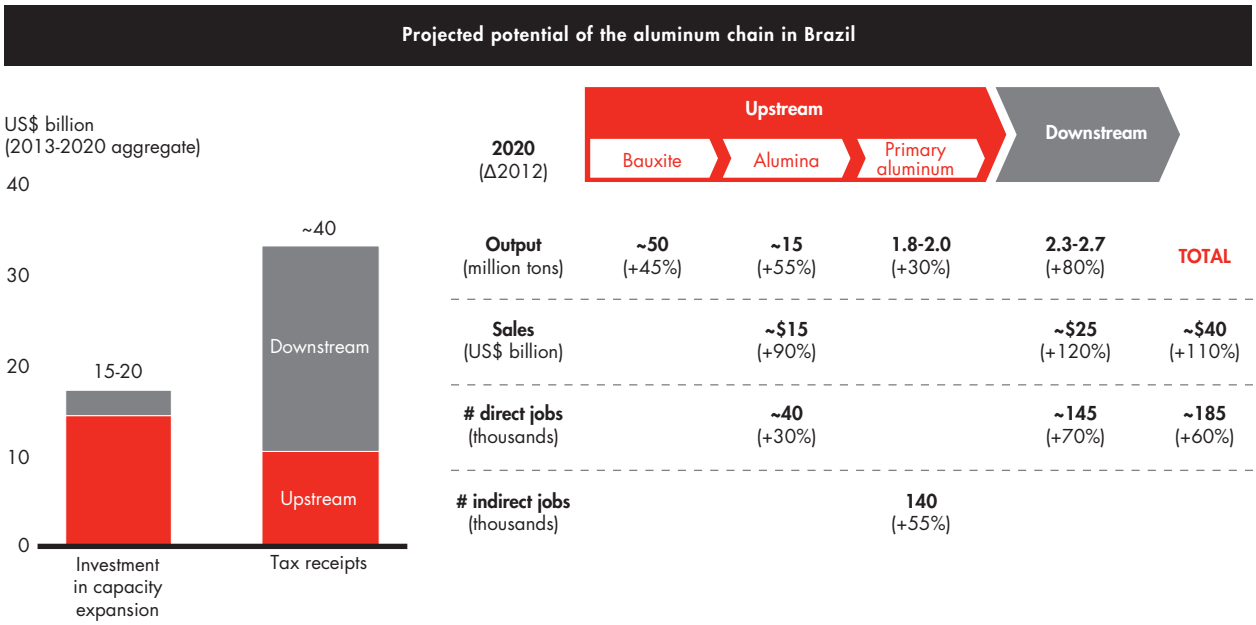
If the entire projected demand for 2020 could be continually met mainly by the domestic industry, and if all the for-export Bauxite and Alumina projects announced so far went ahead, Brazil could reap even better results *(see Figure 8)*:

a) investments of **~US$15 billion - US$20 billion** (2013-2020 aggregate);

b) **~US$40 billion** in tax receipts (2013-2020 aggregate);

c) over 100,000 new direct and indirect jobs created.

Figure 8: **Potential** value creation in Brazil's aluminum chain if the supply remained **largely local**



Note: 2020 figures estimates made with US$2.693/ton at the LME (WorldBank forecast)
Source: ABAL, CNI-ABAL, WorldBank, Bain analysis

4. The competitiveness challenge in some fronts and risks to the entire value chain

The problem is that, unlike in the early 2000s, the competitiveness of the Brazilian chain is now being questioned, and much of that potential outcome is at risk.

In the case of Bauxite and Alumina, the outlook remains mostly positive—the big question is when, and in which order, announced projects totalling almost **5 million tons/year** will be implemented. However, the same cannot be said of the Smelting component.

In recent years, Brazil dropped to 8th from 6th largest producer globally, and saw 18 percent of its installed capacity closed (*see Figure 9*). The main barrier in the Primary segment is poor competitiveness in the cost of electricity.

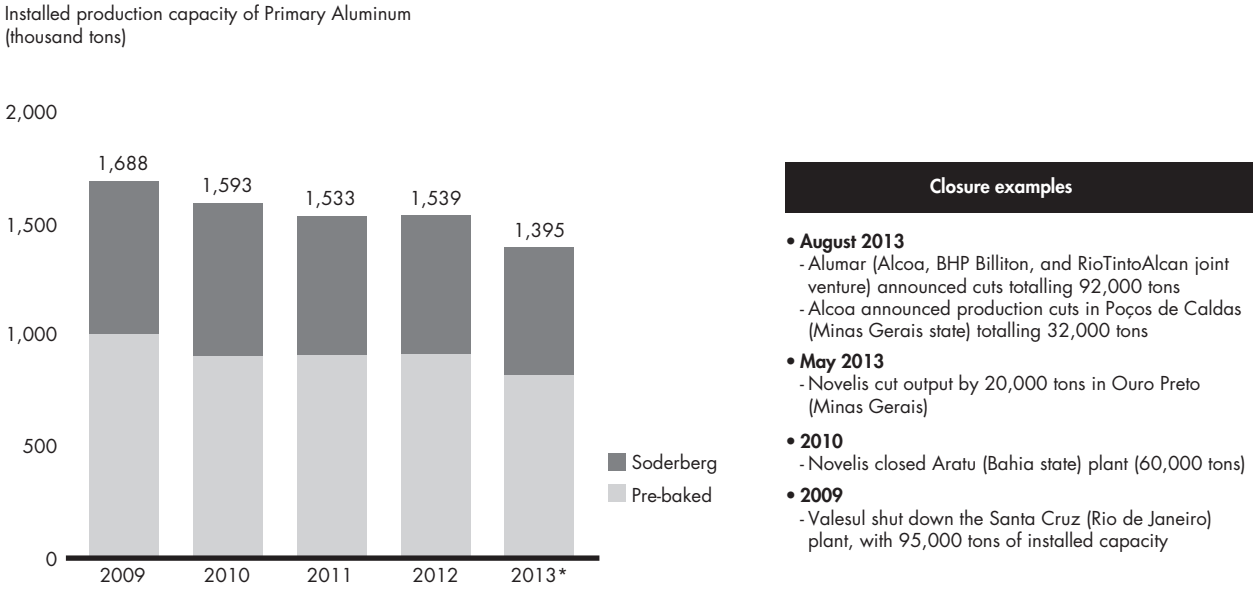
In the most competitive countries electricity accounts for less than a quarter of total production costs, with energy costs below US$35/MWh; in the new frontiers of Africa and the Middle East, that figure can drop to less than US$25/MWh. Meanwhile, in Brazil, according to ABAL's 2012 Sustainability Report, the average energy cost stands at US$68/MWh—accounting for over 40 percent of total production costs.

To make matters worse, a great chunk of the country's installed capacity operates on outdated technology (Soderberg, or Pre-baked with less than 180 kA), with higher specific energy consumption. With zero prospects of cheap energy, Smelting operations in Brazil not only fail to justify any investments in technology upgrades, but are also one of the first targets for closure when global companies are pressed to reduce costs.

Take the case of Alcoa, whose Brazilian operations represent around 10 percent of its global capacity. The company recently announced plans to shrink its global capacity by 11 percent. The closures in Brazil represent around a quarter of the overall cut, clearly demonstrating that the installed capacity in the country is not competitive when compared to Alcoa's remaining alternatives.

It's worth noting that China, the world's largest producer, has no cheap energy, and is one of the highest-cost producers in the current supply curve. But the difference is that, in China, the industry structure is actively managed by the central government, forcing the closing of less competitive capacity (by 2005 all Soderberg had been

Figure 9: In recent years, Brazil has seen the closure of 18 percent of its installed capacity for Primary Aluminum production



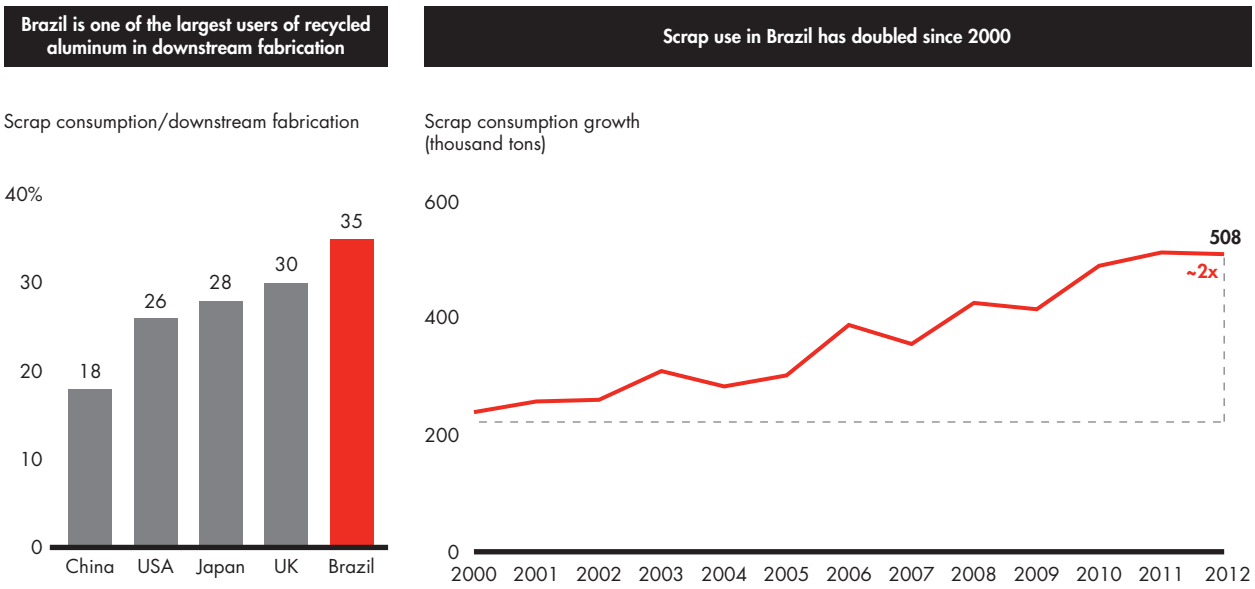
* As of August 2013
Source: ABAL, press clippings, Bain analysis

shut down) and encouraging the opening of new smelters with very high scale and technology (> 400 kA and scales of over 700,000 tons/year), with lower specific energy consumption and production costs, lessening the problem.

The loss of competitiveness in smelting operations, combined with growing demand, will mean that Brazil will, in short notice, become a net importer of aluminum. If we take the balance of exports minus imports from 2012 (390,000 tons), and consider that approximately 230,000 tons from that sum are captive exports from Albrás to Japan (due to the equity participation of the NAAC consortium in the company), and thus not available for local consumption, then add the approximately 140,000 tons of capacity closures seen at Novelis and Alcoa, it is easy to see that the country has no maneuver space left. All it takes for Brazil to become a *de facto* net importer as early as 2014 is some of the rumors about capacity closures at other players proving real.

It is worth noting that the use of scrap as a substitute for primary aluminum will not be able to solve that conundrum. Brazil has become one of the largest users of scrap; the country has now reached a level from which significant growth is a tough challenge *(see Figure 10)*. Short term scrap (cans) is now almost 100 percent recycled, while longer term scrap still reflects a period of sluggish demand, and will take some years to change levels. Importing scrap is an option, albeit one increasingly complicated. Many countries restrict the export of crude scrap (including South American neighbors), and many potential scrap consumers in Brazil are small businesses unlikely to have access to financing to bring in significant volumes.

Figure 10: Scrap use in Brazil doubled between 2000-2012, making the country one of the largest scrap consumers in the world



Note: fabrication output = scrap consumption + primary metal consumption
Source: ABAL, COMTRADE 2011

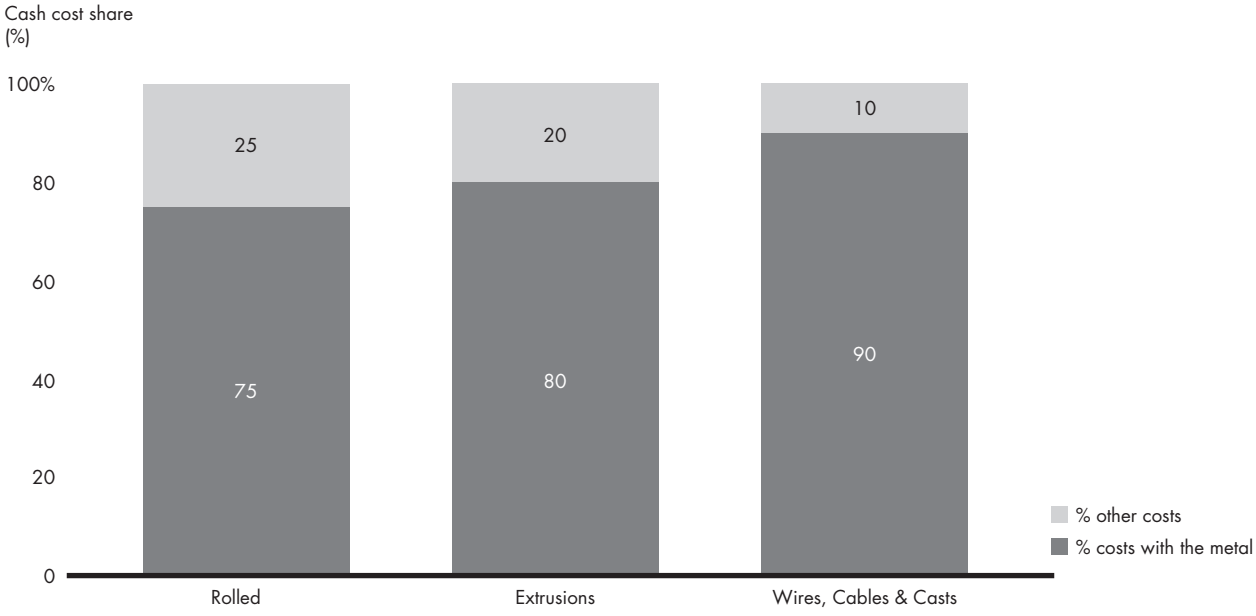
The current competitive outlook for downstream Fabrication is not shiny, either. As the country's employment rate and income grew, and the currency appreciated, Brazil has ceased to be a comparatively cheap-labor country. Manufacturers are also affected by costly energy (albeit in a much lesser degree than smelters).

Add to that the fact that a large portion of Brazilian manufacturing base is low scale or technologically outdated. There are a few exceptions, of course—including Novelis' plant in Pindamonhangaba (in São Paulo state) and some CBA assets, to name a few examples in Rolling. Extrusion is another case in point: while plants in Brazil often operate on one or two presses, with output of less than 10,000 tons/year (with only the top two or three reaching the 30,000 tons to 50,000 tons range), in China it is not uncommon to find plants with over 50,000/year output, and some have plans to surpass the 100,000/year mark very soon.

The impact of aluminum price on total costs varies for each segment of downstream Fabrication—but it is, at best, close to 75 percent of total *(see Figure 11)*. If a shortage of primary aluminum leads to a steep rise in prices, the impact on the entire chain could be brutal.

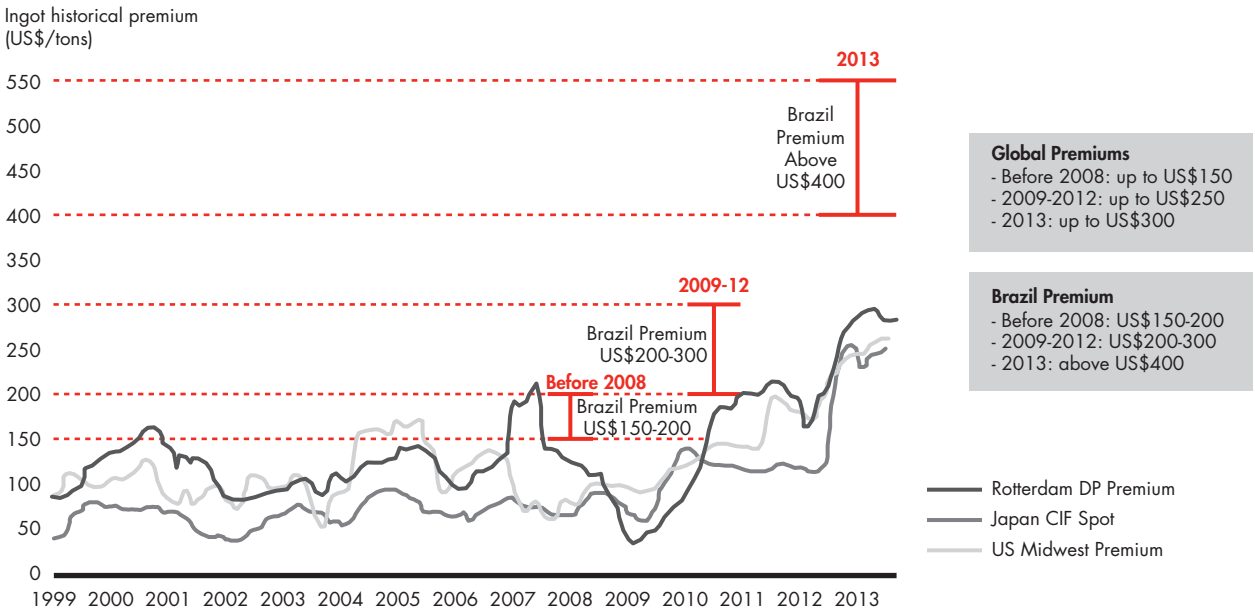
The need to import primary aluminum will bring additional challenges to the downstream industry. First, a longer chain increases the need for safety inventories, as well as the risk of a mismatch of base metal prices from the time of purchase to that of sale—amplified by the recent concerns over record volatility in global and local premiums *(see Figure 12)*. Second, the current market is quite unfavorable to physical flows of metal, with large inventories locked in dedicated warehouses to lend support to speculative moves encouraged both by low prices

Figure 11: The impact of aluminum price varies for each segment of downstream Fabrication; at best, it is close to 75 percent of total costs



Note: aluminum cost based on LME + premium
Source: Bain estimates

Figure 12: Local premium volatility is close to an all-time high



Source: CRU website, press clippings, interviews

on the LME and low interest rates. Last, we have the logistic infrastructure problems still plaguing international flows in Brazil, as well as import tariffs.

The continuing loss of competitiveness in downstream Fabrication would have different impacts on each of the segments in that chain. In Rolling mills, the most globalized segment of the downstream chain, the reduced competitiveness should be reflected in a strong increase in imports of Sheets and Foil.

Currently, we see capacity being installed beyond the domestic consumption potential in China and the Middle East, in large and modern facilities. If the primary aluminum premium in Brazil continues to rise, those new plants would become even more competitive relative to the Brazilian product, even when current import tariffs are factored in. This risk is amplified by China's decision to tax exports of Primary Aluminum, which guarantees the local industry artificially lower prices than in the global market, encouraging local processing for export. Recently, we've seen imports of rolled products rise in Brazil due to currency appreciation, with growth exceeding 20 percent in sheets, for instance.

We've also seen cases of large-scale imports of finished products to replace domestic production. For instance, air conditioners and pans, segments that traditionally consumed aluminum plates and sheets, are produced less and less locally.

Loss of competitiveness in the Extrusion segment should bring about another phenomenon: reduced demand and replacement by steel or plastic. Worldwide, except for high-performance extrusions or highly standardized product, this is a local, not global, market. The complexity involved by the sheer number of different items, combined with logistics inefficiencies to importing a less dense and more sensitive material, make imports almost unfeasible. As a result, even as higher costs will likely be reflected in higher prices and lower margins, the supply of extrusions should remain mostly local, albeit probably smaller.

Another potential impact in the Extrusion chain involves the supply of Billets, with its accompanying implications. A shortage of Primary Aluminum would most likely lead to imports of Billets, as opposed to Ingots for remelting. In spite of the availability of Billets in the global market, the extrusion industry in Brazil is highly fragmented and still makes ample use of Billets. In that scenario, we could see the disappearance of small players, or the emergence of a thriving business for importing and reselling Billets.

The Foundry segment should be more severely hit. The effect is quite straightforward: loss of competitiveness should lead to imports of finished products, especially auto parts. Already, the auto parts chain is struggling under competition in castings, a situation that will only worsen with shortages of local metal (see Table 2).

Table 2: Manufacturers's testimonies

Industries that rely on aluminum as a material input already feel the impact of lost competitiveness by the local industry
"We buy ingot and liquid aluminum from two major suppliers. As the production capacity of primary aluminum falls, and concerns over supply continuity rise, we've decided to greatly increase our inventories." — Manufacturing company
"Now we are working with lower levels of [ingot] inventories, but the price has been rising a lot. On the other hand, importing this type of product is very difficult, since that would require maintaining higher inventories (30 days, instead of the regular 2-3 days), plus all the logistical challenges (delivery delays, risk of port strikes, long waits for customs clearance, and so forth)." — Manufacturing company
"Since our customers are automakers, it is very difficult to pass the [cost] increase on, squeezing our margins." — Manufacturing company
"While [government incentive program] Inovar Auto encourages the use of aluminum in cars, the metal price is a challenge to the local auto parts industry. Since mid-2012, imports of engine blocks (semi-finished products) have grown, as local competitiveness fell." — Automotive industry expert

5. Foreseen impact on the aluminum industry and the Brazilian economy

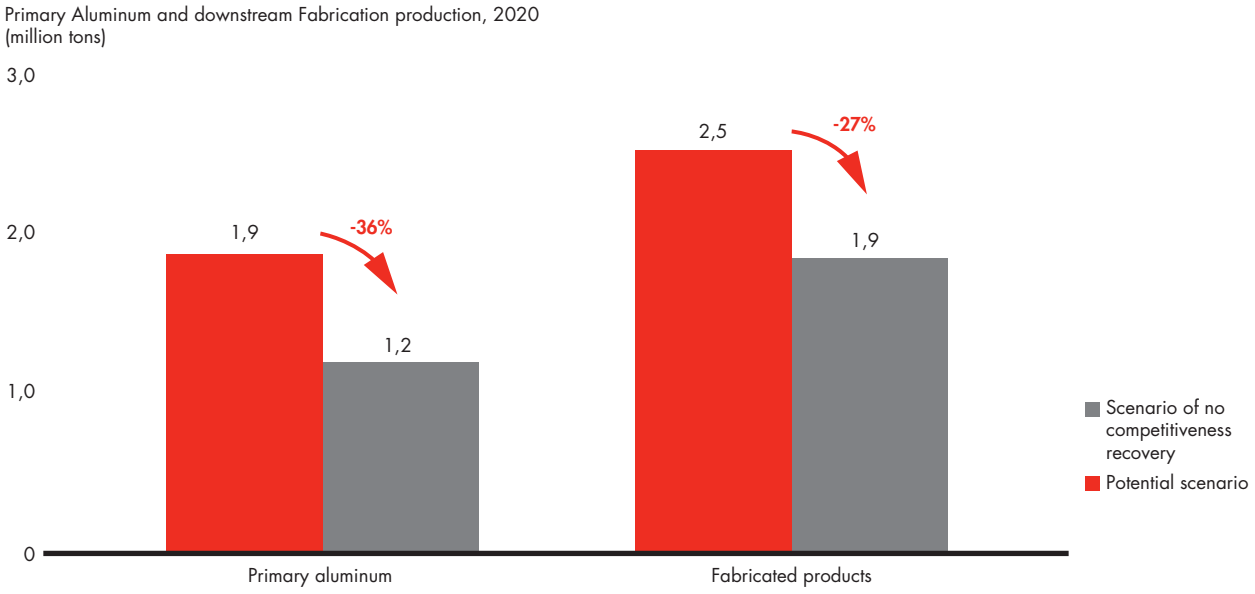
The **reduced competitiveness in both the Primary Aluminum and the Fabrication** segments will certainly have a **significant impact** on how much will be captured of the value creation potential discussed at the beginning of this report.

It is hard to predict the exact dimension of this impact, but it is reasonable to imagine a **Primary Aluminum** scenario in which not only the Brazilian industry does not add capacity, but **continues to see closures**. In that case, Brazil would preserve only the most up-to-date facilities, or the ones with a high proportion of self-generated energy. Also, the industry wouldn't see the required **large investments in Hot Rolling operations or additional capacity to billets remelting**. In a more pessimistic scenario, we wouldn't even see the investment needed to sustain the currently installed capacity in Fabrication, which would contribute to **a gradual fall in the local supply**.

A relatively straightforward simulation shows that scenario would result in a **loss of approximately 35,000 direct jobs; industry-wide revenues would fall around 20 percent**, with less investment and taxes collected. In addition, Brazil's trade balance would drop to around US$2.5 billion, from US$5 billion *(see Figures 13 and 14)*.

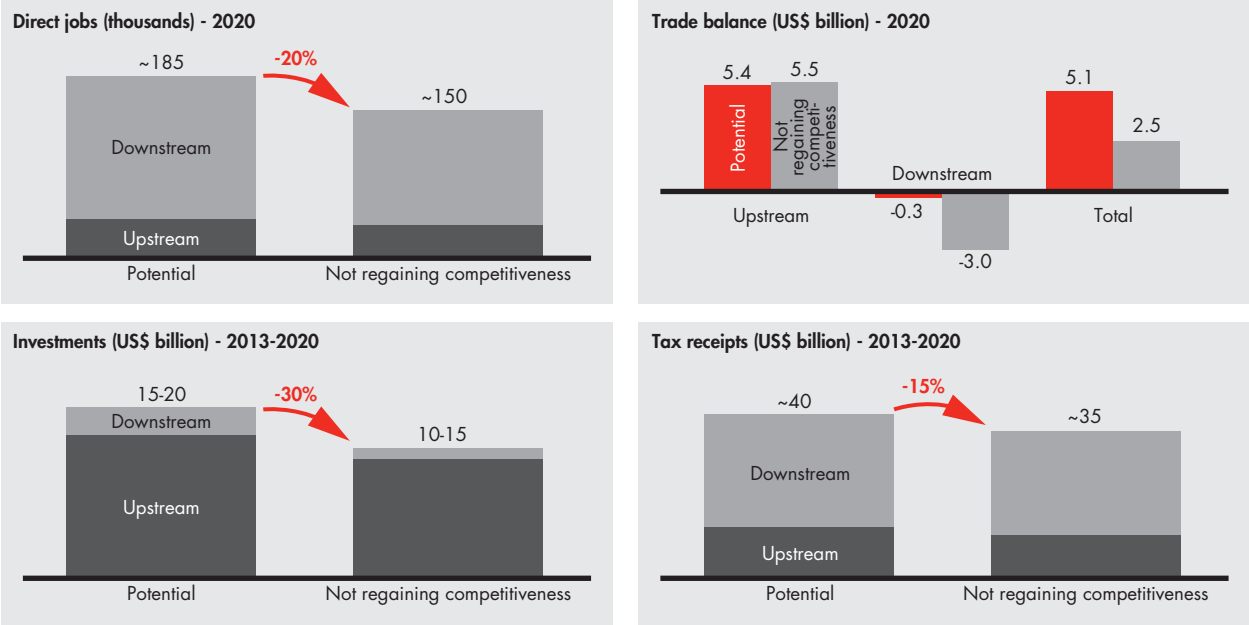
A major side effect would be **a reversal in the current trend of falling industry informality**. In the struggle for survival, it is not hard to fathom some players favoring the informality risks over the certainty of shutting down operations. The impact is clear: less tax receipts.

Figure 13: In a scenario of no competitiveness recovery, the Brazilian production of Primary Aluminum and Fabricated products would be below potential



Source: ABAL, CNI-ABAL, Bain analysis

Figure 14: Loss of competitiveness in the aluminum chain has substantial impact both on the industry and on the Brazilian economy



Source: ABAL, CNI-ABAL, WorldBank, Bain analysis

In the long run, it is paramount that Brazil regain its competitiveness in Primary Aluminum production. Policy-led incentives to the technological upgrading of facilities are needed, as well as investments in competitive energy self-generation, and reducing grid power costs. As stated before, ensuring competitiveness in the upstream chain would help keep downstream components healthy.

The Fabrication segment also needs boosting, either with structural changes in **conversion costs** (for instance, through incentives to upgrade the manufacturing base), or acting on certain drivers to prevent a shortage of Primary Aluminum to downstream fabrication short- and mid-term (for instance, by improving the importing logistics, encouraging the opening of LME warehouses in Brazil, working on import tariffs, and seeking tariff preference agreements).

A **case in point is Japan**. Once a major producer of Primary metal, Japan lost its competitiveness in this area—and with it, all manufacturing—, but managed to keep the Fabrication segment alive and competitive to this day. **South Korea** is another example. The country has no Primary production, but has significant activity in Fabrication. In a potential scenario for Brazil, the same would happen.

But even that would be an **unfortunate development**. Unlike Japan, Brazil has vast amounts of competitive feedstock (the country is home to the world's fourth largest Bauxite deposits). For a long time, it was not only self-sufficient, but an exporter up and down the value chain. When, at last, a solid and thriving demand has developed domestically, **Brazil may be doomed to become an exporter of Alumina, a major importer of Primary metal, and, in all likelihood, of Fabricated products.**

Shared Ambition, True Results

Bain & Company is the management consulting firm that the world's business leaders come to when they want results.

Bain advises clients on strategy, operations, technology, organization, private equity and mergers and acquisitions. We develop practical, customized insights that clients act on and transfer skills that make change stick. Founded in 1973, Bain has 49 offices in 31 countries, and our deep expertise and client roster cross every industry and economic sector. Our clients have outperformed the stock market 4 to 1.

What sets us apart

We believe a consulting firm should be more than an adviser. So we put ourselves in our clients' shoes, selling outcomes, not projects. We align our incentives with our clients' by linking our fees to their results and collaborate to unlock the full potential of their business. Our Results Delivery® process builds our clients' capabilities, and our True North values mean we do the right thing for our clients, people and communities—always.

For more information, visit **www.bain.com.br**

Amsterdam • Atlanta • Bangkok • Beijing • Boston • Brussels • Buenos Aires • Chicago • Copenhagen • Dallas • Dubai • Düsseldorf • Frankfurt
Helsinki • Hong Kong • Houston • Istanbul • Jakarta • Johannesburg • Kuala Lumpur • Kyiv • London • Los Angeles • Madrid • Melbourne • Mexico City
Milan • Moscow • Mumbai • Munich • New Delhi • New York • Oslo • Palo Alto • Paris • Perth • Rio de Janeiro • Rome • San Francisco • São Paulo
Seoul • Shanghai • Singapore • Stockholm • Sydney • Tokyo • Toronto • Warsaw • Washington, D.C. • Zurich