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The European response to the challenge of the Japanese steel industry (1950–1980)

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ABSTRACT
Between 1950 and 1980, the European delay with respect to Japan and the relative loss of competitiveness in the integrated steel industry was due to an institutional, geographical and economic logic based largely on historical factors. Europe had a long steel-making history that was closely related to its sources of raw materials. The new technological paradigm turned this former advantage into a clear disadvantage, while the large investments made in the Thomas and open hearth processes and the affordable price of scrap delayed the adoption of the Basic Oxygen Furnace (BOF) until its superiority had been clearly demonstrated. The European steel industry was not at the forefront of the transformation, but merely adapting to the changes, pushed by the threat of a new uncomfortable competitor.

KEYWORDS
European Coal and Steel Community (ECSC); Japanese innovation; coastal steelworks; raw materials; Open Hearth Furnaces (OHF); Basic Oxygen Furnace (BOF); scrap; world steel market; international competitiveness

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During the three and a half decades following the Second World War, the world steel industry experienced unprecedented growth together with structural changes in the overall way that steel was produced. In the integrated steel industry, which accounted for the majority of total steel production, a series of successful interrelated innovations gave rise to a huge increase in productivity.[1] The most relevant included the transfer of the factories to the coast, the fall in freight rates, the discovery of enormous deposits of raw materials, the improvements made in the blast furnace process, the substitution of the open-hearth furnaces with oxygen converters and, subsequently, the adoption of continuous casting. The leading role played by Japan in this paradigm shift has been extensively studied by different authors. They have partly attributed Japan's success to the specific circumstances of the nation after its defeat in the Second World War and the North American imposition of the market economy and its opening up to international trade. Other factors contributing to Japan's success were the sustained increase in domestic demand, the government's support of industrialisation and exports through the Ministry of International Trade and Industry (MITI), the business initiative, the qualifications and working spirit of its labour force and last but not least, the investment effort which gave a huge boost to innovation.[2]

This article has two objectives: first, to study the response of the European authorities, specifically the European Coal and Steel Community (ECSC) to the Japanese challenge. The

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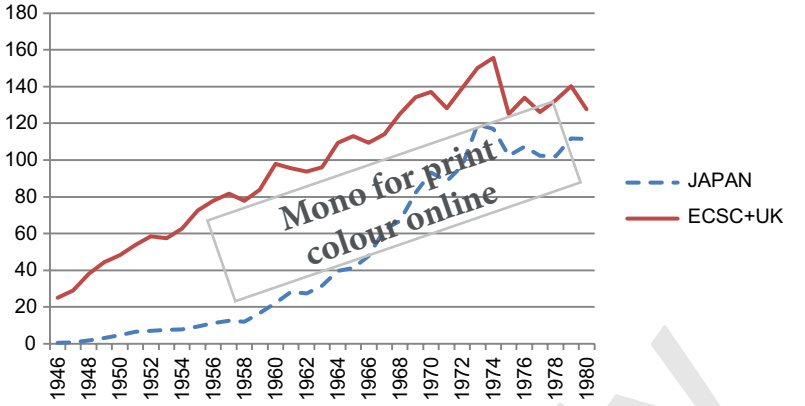

Figure 1. Japan vs. Europe. Steel production (1946–1980) (million tonnes of crude steel). Sources: Ceab 8/610, 831, and 1530; Federal Trade Commission, *United States steel*; World Steel Association, *Statistics archive*. http://www.worldsteel.org/statistics/statistics-archive.html.

documents drawn from the ECSC archives in the European University Institute of Florence reveal that the European authorities were highly concerned about the emergence of the new Asian power and provide a relatively unknown perspective of the Japanese reality, confirming the claims of some authors: the independence of the steel companies with respect to government directives in the 1960s and the ineffectiveness of the state in imposing its decisions on the sector.[3] This would render the efforts of the ECSC to reach an agreement with Japan useless.[4] The second objective is to compare some of Japan's success factors with the circumstances prevailing in the European steel industry to gain a better understanding of the reasons why Europe was not at the forefront of the transformation, but merely adapting to the changes, pushed by the threat of a new uncomfortable competitor that, in a short period of time, had become able to offer steel of a similar quality at a lower price to world markets. Between 1950 and 1980, Japan had become more competitive than Europe and took its place as the leader of domestic and foreign markets. Europe had to respond by recurring to the support of public finance. Japan innovated and Europe was obliged to adapt to this innovation, managing to close the technological gap in the 1970s that had opened in the previous decade.

The article is structured in the following way. The first section contemplates the emergence of Japan as a new world steel power and the production and organisational innovations that made this possible, two of which are particularly significant: the transfer to the coast and the Linz-Donawitz (LD) converter or Basic Oxygen Furnace (BOF). The second section studies the initial European response to the Japanese challenge in the 1960s. The third part analyses Europe's late adaptation to the Japanese innovations in order to close the technological gap that had arisen. The conclusion addresses the differences in the factors that influenced the capacity to innovate of the two world regions and a final interpretation regarding the role played by the ECSC in some of these factors.

1. The emergence of the Japanese problem in the world steel industry

After its defeat in the Second World War, Japan was subjected to the administrative pattern of the US which imposed a new, more democratic political and economic structure that was

less corporate and more open to the rest of the world. After the difficult post-war years, the Korean war at the beginning of the 1950s represented the first major opportunity for the resurgence of Japanese industry, due both to the North American decision to convert Japan into its ally in the Cold War and the possibility of benefitting from the increase in demand for its products as a result of a war nearby. From this point, the ambitious industrial plans of the MITI assigned the steel industry a leading role due to its relevance as a supplier to other industries and as a sector capable of increasing exports and therefore earning foreign currency that was essential for recovery. The large Japanese steel-making companies were soon able to increase their production, expand their markets and compete on a global level with the traditional steel producers. As Figure 1 illustrates, from a modest beginning, Japan became one of the world's leading steel producers with a level of output that was very close to European production. At the beginning of the 1970s its crude steel production surpassed one hundred million tonnes after a period of explosive growth during the previous decade. Its production exceeded that of France in 1959, of the UK in 1961 and Germany in 1964. For the whole period between 1950 and 1980 the average annual variation rate of crude steel production was 4.5% for the whole world, 3.3% for Western Europe and 11% for Japan. Consequently, Japan's share of the world steel industry grew from 9% in 1960 to 24% in 1980, while Western Europe's share dropped from 45% to 35% in the same period.[5]

The majority of this production remained in the domestic market in order to supply the car factories, shipyards and other sectors that demanded steel. The increase in steel production responded to the growth of internal demand: during the 1950s, while in Japan the apparent consumption of steel grew at an annual rate of 17.3%, in the ECSC countries it grew at a rate of 8.3% and in the UK by 3.3%; in the 1960s, the growth rates were 13.1%, 5.6% and 2.5% respectively. Between 1955 and 1974 (the year before the major crisis in the sector), the apparent consumption of crude steel multiplied by 10.5 in Japan, by 2.4 in the ECSC countries and by 1.23 in the UK.[6] This was the era in which steel was known as the rice of industry due to its importance as an input in Japanese industrial production. However, an increasing percentage of the country's steel output was exported to markets which, until then, had been supplied by North American and European companies. In 1955, Japan's share of world steel exports accounted for 6.6%. In 1973, this share had risen to 28.6%, making it the world's largest exporter.[7] The countries affected by the emergence of Japan did not take long to react. In 1959, the US shifted from being a net exporter to a net importer of steel and its steel imports continued to rise during the following decade. In 1968, Japan exported seven million tonnes to the profitable North American market.[8] In response, the US imposed the Voluntary Restraint Agreements (VRA) that temporarily slowed the growth of imports.[9] The crisis of the 1970s and the resurgence of Japanese sales gave rise to accusations of dumping, lobbying practices by the affected steel companies demanding protection and allegations of Non Tariff Barriers (NTB), which supposedly obstructed the access of Western companies to the domestic Japanese market.[10] In Europe, however, the Japanese problem had different connotations than in the US. The concern of the UK and the ECSC countries was not caused by Japan's sudden gain of market share in the domestic market. It was due to the growing competitiveness of Japanese steel in foreign markets that traditionally purchased from Europe. Steel formed part of a general trend in the economic relations between Europe and Japan which included several other sectors such as the car industry or shipbuilding, characterised by its qualified workforce, high value added and capital intensive production. After its rapid industrialisation process, Japan was no longer a complementary player alongside Europe in world markets; they were now competitors.[11]

However, despite the complaints of the countries affected by the emergence of the new competitor and the allegations of dumping, the Japanese success in steel markets was due to its ability to offer high quality products at lower prices than its traditional competitors. These attractive prices were possible thanks to the relative fall in production costs. This is the conclusion reached by the Federal Trade Commission in 1977 in an exhaustive report for the US government analysing five possible causes of the behaviour of the steel market during the 20 preceding years. After contemplating the subsidies granted in the different countries, low profits, possible price manipulation by companies, government price control and production costs, it concluded that the only valid explanation was the latter.[12] In 1958, before the innovations, the total operating costs of a tonne of cold rolled sheet were 128 dollars for Japan and 114 for the US. Japan had an advantage of 22 dollars in labour costs (21 as opposed to 43 in the US), but it paid a lot more for materials (107 as opposed to 71 in the US). Coal cost 84% more, iron 38% more and scrap 27% more. The key to becoming competitive resided in reducing the prices of these materials or their consumption. The Japanese did both. They reduced the price of iron and coal by transferring the steel industry to the coast. They lowered the consumption of coal by improving the blast furnaces and the consumption of scrap by adopting the BOF. While the costs of iron ore practically remained stable during the following two decades, in Europe they almost doubled. In 1980, the iron ore that was sent from Australia to Japan was cheaper than that consumed by the American and European factories.[13] Moreover, the Japanese advantage with respect to labour costs in 1950 was due to the very low wages rather than productivity: wages were the equivalent of one sixth of American wages but a worker in the US produced triple the amount of a Japanese worker. This also changed with the strong capital investments: between 1956 and 1976, Japanese labour costs per tonne produced increased by only 35% compared to the 265% in the US. In short, Japan saved mainly in the price of iron ore, the consumption of scrap and labour costs and almost matched America in the cost of coal. As a result, the total steel costs in Japan increased by 70% while in the US they were multiplied by 2.4 and in Europe they tripled.[14]

The relative improvement in the costs of producing steel in Japan was the result of adopting a series of innovations which gradually increased the levels of productivity in Japanese factories. It constituted a new technological paradigm which would permanently change the way steel was produced in integrated steel plants throughout the world. This new paradigm was formed by a constellation of innovations that affected all the stages of the steel production process, including the acquisition, reception and processing of raw materials, their melting in blast furnaces, their subsequent conversion into steel, rolling and finally sale and transport to the different markets. Although it is impossible to address all of these innovations in this article, it is worth highlighting two of them due to their capacity, by themselves, to alter the whole production process. These two innovations were: first, the construction of greenfield steelplants on the coast instead of close to the raw material extraction sites usually located inland; second, the substitution of old Thomas steel converters (Basic Bessemer) and Martin steel converters Open Hearth Furnaces (OHF) with new oxygen converters (LDs or BOFs).

Transferring the integrated steel plants to the coast was the result of a decision taken in 1950 by Yataro Nishiyama, the president of Kawasaki Steel Co., then a small non-integrated company detached from its zaibatsu by order of the US government. Nishiyama ignored the recommendations of the MITI to carry out a prudent renovation of the facilities and decided

to revive an old and ambitious expansion project which did not have the support of the government or the leading Japanese steel companies. This plan consisted in increasing the production capacity of the company through the construction of new integrated facilities in Chiba, in Tokyo Bay. One of Nishiyama's primary objectives was to ensure the production of pig iron through the construction of his own blast furnaces, given the difficulty of acquiring it during the post-war period. To do this he needed to import iron ore and coal. The Japanese steel sector had accumulated a long list of problems after the Second World War, including the elimination of the zaibatsus and military industry by the US, the loss of its colonies and consequently the traditional supply of carbon and iron ore, the difficulty in acquiring scrap at a reasonable price and the prohibition of the tariff barriers policies and subsidies. It was even believed that the best option was for Japan to do away with its own steel industry, import the steel that it needed and to specialise in light industry. However, there was another option which was the one that Nishiyama implemented with his Chiba Works: transforming the industry and preparing it to compete in international markets. All initiatives had to focus on innovation if the Japanese steel industry wanted to survive.[15]

The leading steel companies followed Kawasaki's model and designed projects for new plants on the coast. From 1955, world demand gave rise to more ambitious projects that rendered those of 1950 obsolete. Five more greenfields on the coast adding to the pioneering Chiba Works were announced for 1960. The large size of the new factories, their location on the coast, the radical reduction in transport costs thanks to the increased size of the new vessels and the discovery of enormous coal and iron ore mines in different parts of the world, particularly Australia and South America, made the Japanese steel revolution possible.[16] The costs of shipping coal and iron ore fell by 70% between 1957 and 1969.[17] The large capital investment in the new plants and processes resulted in a significant increase in the minimum efficient scale (MES). The annual production capacity of each blast furnace increased to three million and that of each converter to three or four million, and to avoid complications that would hinder production, both installations were duplicated. Therefore the MES grew from between 1 and 2.5 million in the 1950s to 6–7 million in the 1970s, making the most of the economies of scale of the integrated steel industry.[18] In 1965, with their greenfields and their BOFs in full operation, the six leading steel companies in Japan (Yawata, Fuji, Kokan, Kawasaki, Sumitomo and Kobe), held a 73% share of the domestic market.[19] In 1975, sixteen coastal steelworks produced 82% of Japanese steel whereas only 10% of production was manufactured by coastal steelworks in the US and 24% in Europe.[20]

In the spring of 1963, a large group of representatives of the British steel industry visited the facilities of the six largest Japanese steel companies and several research centres. In their special report of the trip they analysed all of the technical aspects that had enabled the Japanese steel industry to become the most efficient in the world. They concluded that as well as automation, the more efficient use of gases and the larger size of the blast furnaces, the main advantage of the Japanese steelworks was their location on the coast. This had enabled them to bring down the cost of importing raw materials and greatly reduced the cost of internal transport. The British representatives reported that between 1951 and 1962 the amount invested in the steel industry had been similar in Britain and Japan, around 4 billion dollars, but while the British had used it to renovate the existing facilities, the Japanese had invested in constructing new coastal steelworks while reducing costs to a minimum. Until 1959, the ports could receive vessels of 18,000 tonnes (33 feet deep). The Ministry of Transport and the steel industry jointly developed and financed a drainage programme

which increased the depth (39 feet) of the ports so that they were able to receive vessels of 40,000 tonnes. In 1964–65 a new programme was implemented to further increase the capacity of the ports to accommodate vessels of 80,000 tons (49 feet). The steel companies together with the shipyards built new larger vessels to ship the iron ore from South America and Africa. With 15-year-long contracts, Japan brought the iron ore that it needed from Malaysia, India, Chile and Peru, the coal from the US and Australia and the scrap also from the USA.[21] A year after the British report, the *Bulletin Quotidien of the ECSC* also referred to the advantages of the coastal steelworks adding that thanks to all the innovations, the need for coke per tonne of pig iron in Japan had fallen from 840 kg in 1953 to 520 kg in 1963, and concluded that the accusations of dumping were false and that the increase in Japanese exports were due to the increase in its competitiveness.[22]

The first steps taken in implementing the oxygen converter were slow and began at around the same time as the transfer of the large Japanese steelworks to the coast after Kawasaki had demonstrated the success of this strategy. The main advantage of the new converter was that it drastically reduced the consumption of scrap needed by the open hearth converter, which was interesting for all those countries and companies that had difficulties in acquiring this raw material. But in the early days this new converter also had some weaknesses that raised doubts as to its feasibility until they were resolved by the improvements introduced by those first to adopt it. After recovering the patents issued prior to the Second World War, in 1952 the first two BOFs were built in Austria. Five years later, there were only four in the world, although another six had been commissioned; some by Yawata and Nippon Kokan of Japan. The problems of the new oxygen converter were that it was highly contaminating and that its bricks had to be repaired frequently so it was better to have two to ensure that at least one was working. Furthermore, until the mid 1960s, the doubts regarding the quality of the resulting steel persisted. The general opinion was that the OHF had prevailed for many years and they were continued to be built. However, the Japanese made improvements, increasing the performance of the firebricks, reducing pollution and applying computerised control systems. The BOFs became widespread after the second half of the 1960s.[23]

In countries with established steel industries, the first companies to adopt the BOF were not sector leaders. This was the case of the Canadian company, Dofasco and the American company, McLouth. They became interested in the new converter due to the scarcity of scrap in the whole of North America and the increase in demand after 1950. They made several attempts, they visited Austria in 1953 (the Japanese went in 1951), and in 1954 they constructed the prototype plant. They did not have OHF converters and therefore there was no need to wait to receive a return on their investments and there was no internal resistance to overcome. In both cases, the initial problem that they had to resolve was the scrap issue.[24]

In short, the pioneer idea of this small producer, Kawasaki, which either had to innovate or die given the difficult post-war circumstances, was successful and was quickly adopted by the rest of the steel producers with the support of the Japanese government once its initial resistance had been overcome. There was an explosive domestic demand behind the boom in the Japanese steel sector. The need to obtain currency to import basic goods and materials transformed steel into a product aimed at both the domestic market (the rice of industry) and foreign markets. Furthermore, the shortage of scrap led Japanese companies to search for technological alternatives to the OHF and they found it in the new BOF converter that was being developed in Austria. Between 1957 and 1962, all the large Japanese steel

companies adopted the BOF following their transfer to the coast.[25] Consequently, these two innovations played a significant role in converting the Japanese steel industry into the most competitive in the world.

2. Europe's concern and the independence of Japanese industry

In order to understand Europe's initial reaction to the Japanese challenge in world steel markets and the attitude of its main players, we should examine the institutional situation of the continent. After the Schuman declaration of March 1950, and the signing of the Treaty of Paris in 1951, several countries had taken the steps necessary to create a customs union in the coal and steel sectors which was implemented on 23 July 1952 under the name of the ECSC. These countries were Germany, France, Italy, The Netherlands, Belgium and Luxembourg, while the UK decided not to join. The Treaty of Paris established the High Authority which was authorised to make decisions on a variety of aspects in both sectors, particularly those relating to investment, agreements between companies, mergers, acquisitions and foreign relations. However, from the outset, both the companies affected and the member countries were distrustful or even opposed to this new principle of *supranationality*, which in practice, carried the risk of undermining their power to make strategic decisions. The new High Authority of the ECSC, with the first president, Jean Monnet at the helm, took the functions assigned by the Treaty very seriously and carried them out with enthusiasm, although to do this it had to fight against the opposition of the governments and companies of the member countries. At least until 1967, when the ECSC were dissolved into the broader institutions of the European Economic Community, the High Authority played a key role in Europe's response to the problems in the world steel market and in the internal measures to organise and rationalise the European steel market according to how the ECSC understood it. However, the real power of the High Authority to impose its decisions on the steel sector was severely limited due to the opposition of the governments and a highly cartelised industry. Furthermore, it had no influence over the British steel sector, the largest in Europe after the Second World War, which had not participated in the foundation agreement and did not join the EEC until 1973.[26] AQ4

Until the 1970s, the Europeans did not seriously fear the influx of Japanese products that was taking place in the US.[27] However, already in the 1960s, the authorities of the Community were highly aware of the growing threat that Japan represented for the continent's steel industry. According to an internal report issued in 1963, the Community was concerned about its exports, which fell from 13.7 million tonnes in 1961 to 12.4 million in 1962. The fall in export earnings led to a fall in investments and the subsequent risk of losing competitiveness. The Japanese producers forced this reduction in European exports by lowering prices, seriously weakening 'the traditional positions of the Community in Asian countries and South American regions.'[28] As well as transferring to the coast, the implementation of the BOF freed them from their dependence on scrap imports necessary for the OHFs.[29] Three years later, an independent study also concluded that a tonne of BOF steel cost between 58.5 and 67 dollars as opposed to 84.5–91 for a tonne of OHF steel. In other words, it represented a saving of 30%.[30] Also in 1966, in a secret report written by F. Peco for the High Authority after a trip to Asia, the representative of the ECSC concluded that Japan was closing the gap with Europe in terms of relations with the Far East and that the Vietnam War constituted an opportunity for the development of the Japanese steel industry.[31] A German report issued in 1970 also came to the same conclusion.[32]

The evolution in the trade of steel between Japan and Europe was an issue that was among the competences assigned by the Treaty of Paris to the High Authority. As could be expected, the High Authority representatives were intrigued by Japan's boom in the steel markets and requested a meeting with the Japanese authorities in 1963. A delegation from the ECSC led by the managing director of steel, Tony Rollman, and the director of foreign affairs, Charles Reichling, travelled to Tokyo between the 30 May and 1 June. After meeting with the authorities they visited the Kawasaki facilities in Chiba. Later, Tony Rollman wrote, 'I was very much impressed with what I saw'.[33] In their interview with the Japanese government and sector leaders, the Europeans expressed their concern because some of the steel products exported to the ECSC countries (especially coils) were cheaper than those produced in Europe. They informed them of their suspicion that Japan was engaged in dumping practices and threatened to impose the safeguard clause, but first they wanted to talk to the Japanese to try to find another solution. The Europeans expressed their desire to 'avoid useless confusion in the market and to establish and efficient system that would allow orderly export and import of steel products', and offered a pact similar to the agreement that they had signed with Austria. The Japanese denied any dumping activity and explained that steel-making costs had reduced dramatically in recent years. At first they seemed open to the idea of an agreement in the market and the Europeans believed they had the intention to agree to it. However, the Japanese government backed down, saying that it did not have the resources to impose any kind of industrial agreement.[34]

The steel market recovered during 1964, but the ECSC authorities were concerned by the excess capacity of the sector (aggravated by further plans to increase the capacity in many countries around the world) and did not abandon their quest to reach an agreement with Japan that would help avert future crises. The next relevant contact between the two parties occurred during the celebration of the 50th Anniversary of the Iron and Steel Institute of Japan held in Tokyo in the spring of 1965. In his speech on behalf of the ECSC, Charles Reichling underlined the need to reach some type of agreement with Japan similar to the one signed with Austria to which the UK had also joined (its main suppliers of steel products from abroad), based on the exchange of information, consultations regarding price agreements and everything related to the trade of steel. In the event of a crisis (slump in demand or shortage), the collaboration would ensure that trade restrictions were not introduced without prior consultation of the other part and would 'stabilise the market'. Reichling believed that Japan and the ECSC, as the world's leading exporters of steel products, should be equally interested in avoiding the dangers surrounding the sector due to the overcapacity and therefore he considered it best for both parties to 'establish a basis of co-operation with a view to bringing the world steel market on to a more even keel'.[35]

But they were not all in agreement. In a secret report taken by Reichling to the High Authority, the ECSC envoy wrote that there was a clear disagreement between the opinion of the Japanese government and the steel industry with respect to the issue of the price and production agreement. The large Japanese steel-makers did not want to be tied to agreements at the height of their export growth. However a majority opinion in the Japanese government claimed that the agreement could be a way of avoiding the opposition from importing countries, in this case the members of the ECSC. The Japanese Vice-Minister of Foreign Affairs had confidentially informed them that his government was in favour of signing a treaty similar to the pact with Austria and the UK, but beforehand, the two most influential figures of the Japanese steel sector had to be persuaded: Nagano, President of

the Federation of Producers (and of Fuji Steel), and Inayama, president of the Association of Exporters (and of Yawata Steel). Only in this way could the MITI accept this proposal. When the Europeans met with the ministries of Foreign Affairs, MITI and Finance, the dominant theme was the need for a better organisation of the world market: 'The Foreign Affairs point of view can be summarised in one word: convince the industry and this will convince the MITI and Foreign Affairs is already ready to enter into an agreement with the ECSC'.[36]

According to a confidential note from the foreign relations department in 1965, due to the difficulties that Japan had caused the ECSC during the last crisis in its foreign markets (although also in its domestic market, particularly with coils), the objective of the High Authority was to gather as much information as possible on the Japanese steel industry and establish a permanent relationship with Japan in order to implement and coordinate fast measures if necessary. Japan's intentions were completely unknown due to the country's impenetrability. The economic information written in Western languages was scarce and superficial. If the High Authority wished to obtain a complete picture it needed direct contact with representatives from the Japanese government, with an exchange of information based on reciprocity. On the other hand, Japan was interested in shaking off its reputation for dumping and incorrect practices in world trade and this is why Europe believed that Japan would willingly accept a commission that would address conflictive issues behind closed doors. Although it rejected the proposal to sign a price agreement similar to the one signed with Austria and the UK a mutual consultation agreement would be favoured by Japan which sought to improve its image in the world in the light of the growth of its trade.[37]

In fact, Japan rejected the price agreement alluding to the safeguarding clause defended by France and the Benelux, although the real reason resided in the logical growth expectations of its leading steel companies thanks to its undeniable competitiveness which had been witnessed by the European representatives. Neither these representatives nor the Japanese government were able to convince the Japanese steel industry of the virtues of an agreement that would restrict its capacity to expand in the future. As pointed out by O'Brien, in the 1960s, the capacity of the MITI to influence the decision of companies was weakening because they no longer needed to recur to government bodies for the capital required for their investments as they were able to obtain it in the market thanks to their earning capacity.[38] In other words, the political objectives of the government did not always prevail over those of the economic sectors. Due to this relative independence, the final result of the negotiations between the High Authority and the Japanese government was meagre in content as it was limited to establishing biannual informative meetings. A mixed Commission was created for exchanging points of view on the steel industry composed of five experts from each party. This commission collected data and opinions on the evolution of the world market, the raw materials and technical innovations. The Japanese distrust dissolved when they saw that the Europeans had abandoned their most ambitious objectives. At least six meetings were held between September 1965 and April 1968, the year in which the functions of the ECSC were absorbed by the EEC.[39] In short, the official objective of the meetings was the exchange of information regarding techniques, products and markets. But the hidden objective of the Europeans (according to the documents in the ECSC archive), was to attempt to reach agreements regarding price controls and the sharing of international markets. From the outset, the Japanese were uneasy about the Europeans' attempts to go further and were only appeased once they saw that the Europeans had given up their

ambitions. Finally, the real content of the conversations corresponded to the initial official objective as requested by the Japanese.

In addition to the accusations and contact with the Japanese authorities, the European business world and politicians soon realised the need to travel to Japan to see at first hand the reasons for the success of its steel industry. The celebration of the 50th anniversary of the Iron and Steel Institute of Japan in the spring of 1965 was the moment when a change occurred in the objectives of these trips. Two qualified experts sent by the ECSC in the summer of the same year who visited 10 coastal steelworks were initially surprised by the confidence that the top Japanese executives transmitted with respect to their future (they interviewed 57 presidents and general managers), but after visiting the factories they understood this assurance.[40] Obviously, this foreign interest did not go unnoticed by the Japanese. *Yawata News*, the official journal of Yawata Iron & Steel, referred to it, remembering that until 1964 the foreign experts visited Japan to control sales and install Western equipment, but after 1965 the purpose of their trips changed: 'For as the Japanese steel industry reached top world technological levels through its own research, here began a series of visits of inspection, to study Japanese iron and steel-making methods'.[41]

We have a list of the foreign visitors to the facilities of Yawata in 1966 and 1967. In total, 1101 people visited different Japanese steelworks in 1966 (248 more than the previous year), of which 320 (124 more) came from Europe: including Klöckner and Thyssen from Germany, Sollac and Sidelor from France, Italsider from Italy, several British companies, Sidmar from Belgium, a Swiss delegation and the Chambre Syndical de la Siderurgie Française. The majority of them represented companies, but authorities from the OECD and ECSC also went. In 1967 the trips continued: 1548 visitors (447 more than in 1966), of which 433 came from Europe, including Uninsa from Spain, Sollac and Usinor from France, Krupp from Germany and Stewards & Loyds from Britain, as well as other representatives from Britain and Euratom.[42] This boom in trips to Japan to learn about the development of the innovations preceded their adoption in European countries during the following decade.

3. The adoption of the major innovations in Europe

In the second half of the 1960s, the majority of the directors of steelworks in Europe knew why Japan had been able to drastically reduce its relative production costs and therefore grow in international steel markets at the cost of other producers including the traditional European steel sector. In a secret note sent to the members of the High Authority in 1966, the Directorate General of Economy and Energy of the ECSC acknowledged that the falling prices of steel in the markets of third countries represented a critical situation for the Community's steel industry. According to the report, the new production techniques constituted a revolutionary phenomenon that had never arisen in this way and had altered 'the normal competitive game'.[43] They also knew what these techniques were and were aware of the main innovations in the production process of the integrated steel industry and for some time had been focusing on transferring factories to the coast and the new BOF together with the improvements and enlargements of the blast furnaces and other innovations.

However, knowing the causes of the problems of the European steel industry's competitiveness with respect to Japan was very different to facing the consequences of the decisions that had to be taken to resolve them. In the 1960s, the European steel sector had inherited the post-war situation. The majority of traditional steel-making regions were

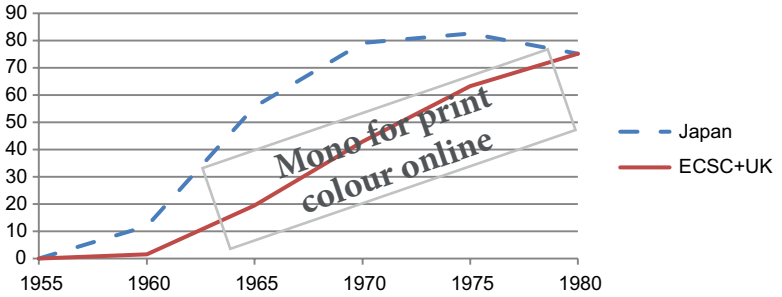

Figure 2. Japan vs. Europe. Adoption of the BOF, 1955–1980 (% of total crude steel). Sources: Adams and Dirlam, "Big Steel: Reply," 478; Carlsson, "Structure and Performance," 143–145; Barnett and Schorsch, *Steel. Upheaval*, 55; Hasegawa, *Steel Industry*, 228.

concentrated in a strip which, from north to south, covered the Walloon region of Belgium and the north of France, Luxembourg, the Lorraine region of France and the German state of Saarland, as well as the Ruhr valley, in line with the historical logic of the proximity of iron ore or coal in the same way as the British steel-making regions. Therefore, Europe's situation was the opposite of Japan's: a steel sector tied to the old deposits of raw materials. Since the mid 1950s, it had invested a large amount of money in improving the efficiency of its plants through renovating equipment and building new infrastructures. In the middle of the following decade, the Rhine was able to allow large vessels to ship cheap and high quality iron ore to Ruhr, and the new Moselle canal was used to transport iron ore from Sweden, Africa and Brazil to the producing areas of France and Luxembourg which until then had depended on low quality local iron ore. Although not to such a high degree as Japan, the renovation of the blast furnaces had reduced the need for coal.[44] Japan's investment in the steel industry was equal to that of the USA and the EEC between 1956 and 1976 but with very different results: Japan had used this investment to increase its production with its new coastal steelworks, the USA to maintain its production by renovating its existing industry and Europe was somewhere in between, investing in both the renovation of existing plants and the creation of new ones.[45]

The Japanese case became an example for the whole world with regards the effectiveness of certain innovations to increase productivity, reduce unit costs, lower prices and gain market share. The European steel industry (companies, governments and the ECSC) was convinced that it needed to implement the innovations following Japan's lead. Significantly, The Netherlands, a country without a steel-making tradition due to its lack of mining resources, had become a new player in the integrated steel sector thanks to its creation of the new coastal greenfield of Ijmuiden, close to Amsterdam, through the company Hoogovens. Founded in 1918 with private capital and state subsidies, its location near deep water and good transport conditions made it possible in the 1930s to become the world's biggest exporter of pig iron. Subsequently, it expanded its production capacity as of 1950 by applying the public–private collaboration model.[46] At the end of the 1950s, Italy began to implement an ambitious plan of investing public money through the company Finsider with the aim of becoming a leading European steel-maker, comparable with France and Germany, two of the ECSC's heavyweights, when this company was founded. In the 1960s, it created two integrated plants in Cornigliano and Taranto (to add to those already existing in Bagnoli and Piombino), and after 1971 its plans focused on increasing the production

capacity of the steelcoast of Taranto to 10 million tonnes which it achieved in 1975, and to create a coastal greenfield in Naples to replace the old plants of Bagnoli and Cornigliano. This project was indefinitely suspended due to the crisis of the second half of the decade.[47]

Belgium and Luxembourg, two small countries with a high industrial specialisation within the steel sector also tried to adapt to the new paradigm. In 1962, they created Sidmar in Zelzate, near Ghent, with easy access to the sea. In 1966, it began to produce flat steel. The Luxembourg company Arbed gradually acquired shares in Sidmar until it controlled 84% of its capital in 1975. Meanwhile, the factories located inland fell into decline and successive restructuring programmes were implemented due to an accumulation of losses. As in other countries, the attempts by the State to avoid the definitive closure of the plants led to their nationalisation in the beginning of the 1980s.[48] Arbed, on the other hand, combined its strategy to control the coastal plant of Sidmar with the establishment of new operations in the German steel sector. This country chose a different strategy to its neighbours.

Although the operating cost advantage of coastal steelworks is undeniable, the fact that steelworks already existed made it a difficult decision to make. The coastal plants were ideal for Japan and the Netherlands as these countries did not have any existing steelworks and no raw materials. However, there was also a strong argument for locating the factories close to the mines provided that the deposits could be exploited on a large scale. In the case of Germany, there was cheap transport, an outlet to the sea, geographical opportunities for expansion and proximity to clients. The large German companies, such as Krupp, Hoesch, Thyssen and Mannesmann opted for a strategy of vertical integration which enabled them to offer consumer products to the market, and to do this they invested capital in their facilities seeking to modernise and rationalise them without the need to transfer them to the coast. All of the above-mentioned elements could improve the competitiveness of a European steel factory in a traditional location. Although the Japanese saving was sufficiently large as to compete advantageously with the old European factories beside the mines, this did not mean that in all cases the latter had to close down. The factories located on the banks of the Rhine were in a position to receive raw materials from the rest of the world and integrate with the powerful German car and electrical appliance industries. In 1979, seven large groups, four of which were located on the Rhine in the region of Duisburg, Essen and Dortmund, produced 94% of German crude steel amounting to 46 million tonnes.[49] The survival of the Ruhr steel companies constituted an exception in the European panorama and not even other German regions with a long tradition of steel-making, such as the Sarlaand, could imitate it. This exception was possible thanks to three factors: the supply of foreign iron ore thanks to the access to the sea via the Rhine, the closeness to the final customers (manufacturers of cars and electrical material) and the large scale of the coal deposits. These three factors together were not present in any other European region.

In general terms, the European steel industry was faced with the same problem as the US. The new facilities that had to be built to imitate the Japanese model required a large investment of capital which the private shareholders were not willing to provide due to the low estimated return. The underlying reason for the enormous growth of the Japanese steel industry was the increase in its domestic demand driven by its rapid industrialisation.[50] Both the European and US markets were mature compared to the Japanese market that was experiencing explosive growth. Furthermore, the transformation of the European steel sector and its transfer to the coast was mostly carried out with public investment or an extension of state subsidies during the 1970s.[51] This was the case of France and the UK. France built two coastal

steelworks: one in the north in Dunkirk, through the private company Usinor, which in 1970 decided to increase its capacity from 3.6 million tonnes of steel to 8 million; and another in the south, the Fos-sur-Mer plant in Marseille, through the holding company Solmer and with a third of the investment derived from public funds.[52] In Britain, the large capital investments in the steel industry had to wait until the 1970s after the first investment effort in 1960–1962. When the British steel sector was nationalised in 1967, 21 integrated plants became part of the British Steel Corporation, together with 200 or subsidiary factories. Between 1970 and 1980 the Japanese model of coastal steelworks was implemented with a production capacity of between three and six million tonnes and most of the investment was used to modernise and expand five large steel plants: Port Talbot, Llanwern, Scunthorpe, Lackenby and Ravenscraig.[53]

In the second half of the 1970s, with a deepening economic crisis, the protests against the invasion of Japanese products extended throughout Europe. Steel represented 10% of Japanese exports to the EEC and in Germany and other member countries the accusations of dumping and non-tariff barriers intensified. There was a temptation to restrict the entry of Japanese steel, and a boycott was called for. After 1977 antidumping measures were applied in Britain against the steel imported from Japan. Meanwhile, Commissioner Davignon announced that the European steel industry was to undergo a profound transformation and that in the process it did not wish to be hindered by Japanese competition in its own territory.[54] The protection granted was intended to support investments in long-term coastal projects and deter other projects of questionable feasibility. The onset of a new economic crisis in 1980 required a greater injection of public capital and reductions in production capacities throughout the whole continent. In France, the state transformed the loans to the steel companies into capital so that it became the owner of the companies. It finally understood that it had to sacrifice the traditional steel industry of the Lorraine and commit almost exclusively to the coastal plant of Dunkirk while the second phase of the Marseille plant was postponed until more favourable times.[55] In Britain, the structural crisis of the sector after 1976 caused the initial ambitious objectives of the first half of the decade to be moderated. The new crisis that arose in 1980 reduced even further the demand expectations and the future steel investment and production plans. But throughout the crisis the strategy to close the old production centres and reinforce new coastal factories was supported.[56]

The adoption of the BOF within the European integrated steel industry was directly influenced by the specific moment when the investment decisions were made with regard to the new coastal steel industry in each country. In the first half of the 1960s, the majority of the countries that constructed the new steelworks opted for conventional, albeit improved, systems that used Thomas and open hearth processes. The Thomas process was faster than the OHF but the latter was superior in terms of quality and flexibility which made it ideal for ship plate. All the doubts related to the superiority of the new converters had still not been dispelled and as the price of scrap in Europe was moderate there was no incentive to look for alternatives. In the second half of the 1960s the problems relating to the quality of the product made with the BOF were resolved. The superiority of the BOF over Thomas and OHF became apparent, due to its lower operating costs and on the whole the new greenfield projects adopted the new converters.[57] As we can observe in Figure 2, Europe experienced a process of technological convergence and at the end of the 1970s had matched Japan in terms of the percentage of output produced with the BOF system, around 75% of total crude steel production. This was just after Japan's percentage had begun to decline, after peaking in 1975, due to the increasing use of electric furnaces.

Bearing these factors in mind, the Italian integrated steel industry opted for OHFs in its investment plans at the end of the 1950s and beginning of the 1960s. In 1964 only 2.4% of its steel was produced with the BOF method as opposed to 49.9% with the open hearth system and 43.2% with electric furnaces (thanks to non-integrated companies called Bresciani). In Belgium and Luxembourg, the percentage was also very small: 6.8% in 1964 which was not corrected until the 1970s when the old Thomas converters were replaced. The percentage of production produced with the BOF system in France and Britain was also low, although not as low as the afore-mentioned countries: 11.4% and 10.5% respectively in 1964 and 18% and 24% in 1968. The Dutch company Hoogovens was the exception: from the outset, between 1955 and 1958, it adopted the BOF process in its new plant in Ijmuiden, which was implemented alongside the OHF.[58] In 1964 it was the ECSC country with the highest percentage of steel produced with the new system: 70%. The advances made in Germany's restructuring process were evident in its adoption of BOF in the 1960s: the percentage of steel produced with the new converters grew from 14% in 1964 to 37% in 1968, but it was still much lower than in Japan.[59] In the 1970s, France adopted the new system in its coastal plants in Dunkirk and Marseille, and in Britain the adoption of the new converters was extended through the modernisation and rationalisation programmes of the British Steel Corporation. In 1970 it produced a third of its total crude steel output with this system and by 1980 it was producing 59% (below the European average) with the new converters in the modern steelworks at Ravenscraig, Port Talbot and Lackenby.[60] In short, the delay suffered by Europe with respect to Japan in adopting the new converter was corrected with the abundant input of public capital in a period of between 10 and 20 years in the majority of the countries except the Netherlands and Germany. The technological gap that had opened in the 1960s closed at the end of the 1970s.

With respect to the late adoption of the BOF in Europe it is worth making a final comment about the role played by the ECSC. Since its foundation, the steel and coal industries were sectors subject to intervention: the decisions remained in the hands of the companies but some of them had to be approved by the High Authority, especially those concerning investment and alliances. Many of the latter, those relating to market share, were not approved in an attempt by the ECSC to avoid concentration in the belief that maximum competition in the sector was beneficial to offer steel consumers the best prices. Multi-level decision-making was applied to innovation: companies, governments (who provided support and subsidies) and European institutions were all involved. At least until 1967, when the functions of the High Authority were integrated into the EEC institutions, and as a consequence of the principle of supranationality established in the Treaty of Paris, the ECSC intervened in the scrap market in different ways. First, it banned the export of scrap to third countries (in the UK a similar decision was made[61]); second, it established maximum prices; third, in response to the shortage of scrap due to the steel boom of 1954, the High Authority approved a compensatory mechanism in July 1955 whereby the imported scrap would be sold to the steel-making companies at the same price as domestic scrap, subject to maximum prices. In this way, scrap became a subsidised input. Furthermore, the High Authority exercised its supranational authority on several occasions, such as when it stopped a manoeuvre by the French Government in 1955 which entailed French scrap merchants committing to the steel companies in their country to guarantee their supply before exporting to other countries of the ECSC. This commitment prevented the free movement of steel products within the ECSC and would have led to the restriction of the supply of scrap in the community.[62] These

measures adopted by the ECSC were relatively successful and contributed to maintaining scrap at affordable prices in Europe.[63]

Achieving this objective was important so that the ECSC could justify its usefulness to the steel sector and the appropriateness of the consultation policy, as scrap was a fundamental raw material in the open hearth process and the companies needed to keep its cost under control. But we should remember that one of the reasons for the fast adoption of the BOF in Japan was the high price of scrap in that country. Until 1957, the price of scrap in Japan was higher than $70 per tonne ($84 in 1958) while the decisions made by the ECSC ensured that it did not exceed $50. In the following years until the mid 1960s, the price of scrap in Japan was always between 25% and 50% higher than the price of scrap in Europe.[64] It was the search for alternatives to scrap that led the Japanese steel business leaders to travel to Austria at the beginning of the 1950s and to resolve the problems of the new converter in the subsequent years. In the wake of these events, the actions of the ECSC may seem contradictory: seeing that its policy to keep the price of scrap low had been relatively successful, the High Authority delayed the introduction of the BOF in Europe.[65] Although the price of scrap was not the only factor to be taken into account when adopting the new converter it was one of the most important. With less pressure with respect to the price of scrap, there was no urgency to change the system that had until then clearly proved to be superior. In the 1960s, the decision of European companies to maintain the OHF was rational. As Lynn points out (1982, p. 116), 'the later the adoption, the lower the uncertainty, and the lower the costs of development'. As this article makes clear postponing this decision not only resulted in lower uncertainty and costs, but also in a lower competitiveness of the companies involved.

4. Conclusion

According to Barnett and Schorsch, 'between 1960 and 1975, the Japanese revolutionised the perception of the world steel market in terms of economies of scale. All the pieces of the productivity puzzle seemed to fit together in Japan between 1959 and 1972'.[66] The following elements came into play: foreign imposition of opening the economy to the outside together with the shortage of raw materials which obliged them to import; sustained growth of domestic demand for steel; high price of scrap which led them to finding alternatives to the open hearth converters; loss of protection of vested interests (in steel) or absence of them (coal); and the existence of a qualified workforce with motivated leaders. The business factor has also been highlighted by some authors (particularly Yonekura, 1994), as well as the independence of the decisions of the sector with respect to the Japanese government guidelines from the 1960s. The documents that we have consulted corroborate this independence of the sector with respect to the MITI that was incapable of curbing the expansionist ambitions of its business leaders.

Paraphrasing Barnett and Schorsch, we could say that, on the contrary to what happened in Japan, the pieces of the productivity puzzle did not fit together in Europe between 1950 and 1980, at least not entirely. The European delay with respect to Japan and the relative loss of competitiveness in the integrated steel industry was not due to a lack of investment or the absence of an entrepreneurial spirit, but to an institutional, geographical and economic logic based largely on historical factors. First, Europe had a long steel-making history that was closely related to its sources of raw materials. The new technological paradigm turned this former advantage into a clear disadvantage. In those countries that did not have their own natural resources, such as the Netherlands and Italy, the integrated steel industry

could be located on the coast (from the 1930s in the Netherlands) in a much shorter period of time and did not have to face the resistance encountered by the traditional regions in Belgium, Luxembourg, Germany, France and the UK. Second, the large investments made in the Thomas and open hearth processes and the affordable price of scrap delayed the adoption of the BOF until its superiority had been clearly demonstrated. The new system of producing steel followed the installation of the new coastal steelworks which were supported by a considerable amount of public capital due to the withdrawal of private interests given the enormous capital needs of the new plants and the low expected return.

As the documentation consulted reveals, the European authorities reacted to the Japanese threat by protesting against the fall in steel prices, accusing Japan of dumping practices and even threatening to restrict imports. When they were unable to achieve price agreements with Japan, they focused on getting closer to the Japanese leaders to learn more about the new industrial phenomenon, establishing relations, making study trips and exchanging very useful information to prepare for the inevitable technological adaptation. But the results of the ECSC's actions with respect to the European integrated steel industry remain inconclusive due to the possible negative influence of its decisions on the sector's capacity of technological adaptation. After its partial success in maintaining the prices of scrap stable (although volatile), the High Authority contributed to delaying the adoption of the new and more productive BOF. This late European adaptation with respect to Japan in the phase of converting pig iron into steel opened a technological gap that could only be closed one and a half decades later thanks to the generous injection of public money.

Notes

1. The integrated steel industry accounted for ninety per cent of European production of crude steel in 1952 and 77% in 1980. The rest corresponded to the electric furnaces. Eurostat, *Iron and Steel Yearbook*, 21.
2. Among others, Kawahito, *The Japanese Steel Industry*; Mueller and Kawahito, *Steel Industry Economics*; Hanabusa, *Trade Problems*; O'Brien, "Industry Structure"; Yonekura, "The Postwar Japanese" and *The Japanese Iron*; Yonekura, "Industrial Associations"; Herrigel, *Manufacturing Possibilities.*
3. O'Brien, "Industry Structure."
4. In this respect, due to the richness of the information that they contain, we can highlight the reports of the trips made to Japan by the European authorities who visited the new coastal facilities there.
5. D'Costa, *The Global Restructuring,* 3.
6. Barnett and Schorsch, *Steel*, 23; Federal Trade Commission, *The United States* , 199.
7. Yonekura, *The Japanese Iron,* 2.
8. Kawahito, *The Japanese Steel Industry*, 149–151.
9. Barnett and Schorsch, *Steel*, 239.
10. For more on NTB see Little, who concluded that the NTB did not explain the US deficit with Japan. Little, *The Japanese Non-Tariff*.
11. Wilkinson, *Japan Versus Europe*, 215.
12. Federal Trade Commission, *The United States*, 521–530.
13. Barnett and Schorsch, *Steel*, 299–303.
14. Federal Trade Commission, *The United States*, 113–118; Mueller and Kawahito *Steel Industry Economics*, 18–20; Mueller, "Factors Determining Competitiveness," 14; Lieberman and Johnson, "Comparative Productivity," 7–17; Barnett and Schorsch, *Steel,* 61.
15. O'Brien, "Industry Structure," 140–142; Yonekura, *The Japanese Iron*, 189–211; Herrigel, *Manufacturing Possibilities*, 72–73.

16. Kawahito, *The Japanese Steel Industry*, 14–22, 44–56; Barnett and Schorsch, *Steel*, 212.
17. Gold, "Evaluating Scale Economies," 13.
18. O'Brien, "Industry Structure," 130–131. Cockerill gives a figure of eight million and other authors of up to 10. Cockerill, *The Steel Industry*, 83; Stegemann, *Price Competition*, 263–265.
19. Herrigel, *Manufacturing Possibilities*, 74–75.
20. Mueller and Kawahito, *Steel Industry Economics*, 8.
21. The Iron and Steel Industry in Japan, March-April 1963: Special Report, 11–14, 22–24, 33–35, 40–48. Historical Archives of the European Union, CECA Haute Autorité – CEAB08 Marché et problèmes industriels: acier (hereafter Ceab 8/1107).
22. *Bulletin Quotidien of the ECSC*, Columeta-Luxembourg, 26 and 28.09.1964. Ceab 5/1489.
23. Adams and Dirlam, "Big Steel" ; Lynn, *How Japan Innovates*, 17–34, 110–112; Oster, "The Diffusion," 46–47. AQ5
24. Lynn, *How Japan Innovates*, 72–73, 145–152.
25. Ibid., 100.
26. Diebold, *The Schuman Plan*; Burn, *The Steel Industry*; Gillingham, *Coal, Steel*; Spierenburg and Poidevin, *The History*; Mioche, *Los Cincuenta*; Ranieri and Tosi, *La Comunità*. AQ6
27. Japanese exports to Europe multiplied tenfold between 1970 and 1980 in current dollars. Wilkinson, *Japan Versus Europe*, 173.
28. In 1960, Europe's trade with Asia was double that of Japan. In 1970 Japan had overtaken Europe and in 1980 its trade with Asia was 50% larger than that of the nine countries of the EEC. Wilkinson, *Japan Versus Europe*, 151.
29. Document of the Foreign Affairs Department, 17 May 1963, titled "Japan. Elements of a negotiation dossier regarding the problem of steel product imports to the ECSC". Ceab 5/1489.
30. Adams and Dirlam, "Big Steel," 179. AQ7
31. Secret report of 12.05.66 signed by F. Peco on a trip to Japan and Asia between 19 April and 5 May 1966. Ceab 8/1529.
32. Rothacher, *Economic Diplomacy*, 189.
33. Letter of 27 June 1963 from Tony Rollman to Yoshihisa Uayama, General Manager of Chiba Works, Kawasaki Steel Corp. Ceab 5/1489.
34. Confidential report of the interview held in Tokyo with the Government and Japanese industry for the High Authority dated 4 June 1963; *The Japan Economic Journal*, 28 May 1963; *The Japan Times*, 1 June 1963. Ceab 5/1489.
35. Luxembourg, 25.03.65. Preparation of the speech in Tokyo by Charles Reichling. Ceab 5/1490.
36. Secret report on the trip to Japan, 9.4.65. Ceab 5/1490. On the importance of industry associations as sources of information for the MITI, as intermediaries between the MITI and the companies and as a channel for developing the action proposals planned by the MITI, see Yonekura, "Industrial Associations," 35–51; and Tilton, *Restrained Trade*, 2–21.
37. Foreign Relations Department. Confidential note of 2.2.65 regarding collaboration with Japan to maintain the price of steel. Ceab 5/1490.
38. O'Brien, "Industry Structure." The coordination continued but it was directed after that by the industry, not the MITI. Self-regulation was applied: the directors of the leading companies met each month in the Japan Iron & Steel Federation in order to coordinate their investment plans.
39. Foreign relations department. Reserved project, 26 July 1965. Minutes of the first meeting between the High Authority and the Japanese government, 23-24 September 1965. Ceab 5/1491. Minutes of the sixth meeting of the Japan-EEC Mixed Commission, Tokyo, 4 and 5 April 1968. Ceab 5/1494.
40. Secret report of 9 August 1965 for the High Authority of the ECSC on the visit to Japan between 12 July and 6 August by Jacques Cros, assistant to the Director General of Economy and Energy and E. Schneider, from the General Directorate of Steel. Ceab 5/1491.
41. *Yawata News*, 1966–68. Ceab 5/1495.
42. *Yawata News*, 1966–68. Some of these visits were concerned with long-term collaborations with these companies: Finsider in Italy and a new LD plant for the Steel Company of Wales at its Abbey Works (UK). *Yawata News*, vol. 4, nº 12, March 1966. Ceab 5/1495.
43. Directorate General of the Economy and Energy. Secret note to the members of the High Authority of 21 March 1966. Ceab 5/1492.

44. Luxembourg, 25.03.65. Preparation of the speech in Tokyo by Charles Reichling, 4–5. Ceab 5/1490.
45. Mueller and Kawahito, *Steel Industry Economics*, 5–6.
46. Kipping, Ranieri, and Dankers, "The Emergence," 77; Schenk, "A 'Dutch Miracle'," 87.
47. Capanna, "Steel in Southern Italy"; Sabatino, "Problems of Italian Steel"; Kipping et al.,, "The Emergence."
48. Evans, "Aspects of the Steel Crisis"; Capron, "The State," 694–697.
49. Messerlin, *The European*; Esser and Väth, "Overcoming the Steel Crisis," 631.
50. Hasegawa, *The Steel Industry*, 21–22.
51. Barnett and Schorsch, *Steel*, 201–202.
52. Hudson and Sadler, *The International Steel Industry*, 83.
53. Hasegawa, *The Steel Industry*, 155–163.
54. Rothacher, *Economic Diplomacy*, 126–129, 185–188, 220–236, 278–281. From 1975, the EEC pressured the Japanese authorities to come to voluntary restriction agreements with respect to foreign sales. Stegemann, *Price Competition*, 285–286.
55. Daley, *Steel, State, and Labor*, 123–131.
56. Department of Trade and Industry, *British Steel Corporation* (1973), 9; *British Steel Corporation* (1978), 2–5; Bryer, Brignall, and Maunders, *Accounting for British Steel*; Dudley and Richardson, *Politics and Steel*, 12–55.
57. The reduction in operation costs varied between 4 and 9 dollars per tonne, to which we must add the lower cost of production which could add a further 18 dollars per tonne to the operating costs. Oster, "The Diffusion," 46–47.
58. Dankers and Verheul, *Hoogovens*, 170–172.
59. Cockerill, *The Steel Industry*, 17.
60. Hasegawa, *The Steel Industry*, 159.
61. Hudson and Sadler, *The International Steel Industry*, 57.
62. All the decisions made by the High Authority can be found in the following documents: Secret report of 9.11.1955, Ceab 8/287; Report on scrap metal, 16.09.1965, Ceab 8/1530; and Press release, 22.10.1954, Ceab 8/1564.
63. On everything related to price policies in the steel industry of the ECSC, see Stegemann, *Price Competition*, 1–11; for a history of the ESCS see Spierenburg and Poidevin, *The History*. Also see Kipping, Ranieri, and Dankers, "The Emergence," 80–83. AQ8
64. Report on scrap, 16.09.1965. Ceab 8/1530. Federal Trade Commission, *The United States*, 117.
65. Lynn, *How Japan Innovates*, 39–47.
66. Barnett and Schorsch, *Steel.*

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