

# BILBAO WAS THE IDEAL LOCATION FOR THE SPANISH IRON AND STEEL INDUSTRY

**Antonio Escudero**

University of Alicante. Department of Applied Economic Analysis

## RESUMEN

Los estudiosos de la siderurgia española han sostenido que Vizcaya fue el lugar idóneo para ubicar la moderna industria del acero. Sin embargo, Stefan Houghton publicó en 2002 un artículo donde sostenía dos conclusiones tan novedosas que me permito calificar de revolucionarias: a) Gijón —y no Bilbao— hubiera sido el lugar idóneo para ubicar la siderurgia española y b) las fábricas de Vizcaya alcanzaron la hegemonía frente a las de Asturias no por razones de ventaja comparativa, sino institucionales (protección arancelaria y cartelización del sector).

Este trabajo es una réplica al del profesor Houghton. En el primer apartado, ofrezco la información sobre los costes de las fábricas siderúrgicas españolas que encontré en 2004 en el Archivo Histórico del Crédit Lyonnais de París. Esta información choca con los resultados del modelo elaborado por Houghton porque es meta-histórico (apartado segundo). El trabajo concluye con un tercer apartado en donde, basándome en los costes y en la tecnología, sistematizo las razones por las que la siderurgia vizcaína fue más competitiva que la asturiana y en donde también critico que ello derivara del proteccionismo o de la cartelización.

**Palabras clave:** Industrialización, localización, siderurgia, Bilbao.

## ABSTRACT

In 2002, Stefan Houghton published an article about the Spanish iron and steel industry between 1880 and 1936. There he argued that Bilbao was not the ideal location for that

---

Fecha de recepción: octubre 2006.

Fecha de aceptación: septiembre 2007.

industry and explained that, despite this, the factories located in the province of Biscay had reached the hegemony over those located in Asturias due to institutional causes (tariff protection and cartelisation of the sector). This paper is a reply to Professor Houpt's article. I firstly offer some new evidence about Spanish iron and steel factories found at the Historical Archive of Crédit Lyonnais in Paris in 2004. This information allowed me to identify the true reasons for Biscay's hegemony and also to question the model elaborated by Stefan Houpt for its meta-historical nature. The present paper additionally criticises the assumption that the greater level of competitiveness achieved by Bilbao-based factories derived from protectionism or cartelisation.

**Key words:** Industrialization, localization, iron and steel industry, Bilbao.

## INTRODUCTION

The experts in the Spanish iron and steel industry have for long argued that the province of Biscay was the ideal location for the modern steel industry<sup>1</sup>. However, in 2002 Stefan Houpt published an article called «Putting Spanish steel on the map: The location of Spanish integrated steel, 1880-1936», in which he reached such a novel two conclusions that I allow myself to qualify them as revolutionary: a) Gijón —and not Bilbao— was the ideal location for the Spanish iron and steel industry and b) the factories located in the province of Biscay reached the hegemony over those located in Asturias due to institutional causes (tariff protection and cartelisation of the sector)<sup>2</sup>.

This paper is a reply to Professor Houpt's article. I firstly offer some information regarding the costs in the iron and steel factories found at the Historical Archive of Crédit Lyonnais in Paris in 2004. This information is at odds with the results from the model by Houpt because of its meta-historical nature (section two). The paper concludes with a third section in which, on the basis of costs and technology, I systematise the reasons why the iron and steel industry was more competitive in the province of Biscay than in Asturias. In this section I also criticise the idea that this higher competitiveness derived from tariff protectionism or cartelisation.

I find appropriate to present this paper in English language to facilitate its reading by foreign colleagues. This is also the reason why I have included some maps of a very elementary nature for Spanish colleagues, but maybe necessary for their foreign counterparts.

### I. THE COSTS OF SPANISH IRON AND STEEL FACTORIES (1890S-1912)

Map 1 shows the location of the seven largest iron and steel enterprises existing in 1899<sup>3</sup>. Four of them were in Asturias (*Mieres, La Felguera, Moreda y Gijón* and *Compañía de Astu-*

---

1 Nadal (1975), Fernández de Pinedo (1983, 1985, 1988, 2001), González Portilla (1981), Ojeda (1985) y Bilbao-Fernández de Pinedo (1988).

2 Houpt (2002).

3 In addition to the factories appearing on the maps, seven small iron and steel companies existed in the Basque Country and Navarre.

rias) and three in Biscay, close to the Ría de Bilbao (*San Francisco*, *Altos Hornos de Bilbao* and *La Vizcaya*). In Map 2 can be seen those existing in 1912 – seven again. Three of them were in Asturias (*Mieres*, *Moreda y Gijón* and *Duro Felguera*, the result of the merger of *La Felguera* and *Compañía de Asturias*)<sup>4</sup>; two in Biscay (*San Francisco* and *Altos Hornos de Vizcaya*, merger of *Altos Hornos de Bilbao* and *La Vizcaya*)<sup>5</sup>; the sixth one was in Málaga (*Hauts Fourneaux*, *Forges et Aciéries de Málaga*); and the seventh one in Cantabria (*Nueva Montaña*). The last two enterprises had started their production in 1899 and 1900 respectively. The percentages of pig iron obtained in each province between 1881 and 1913 appear below the map 2: 76% in Biscay; 18% in Asturias; 4% in Cantabria; and 2% in Málaga.

I found some unknown documents about the Spanish iron and steel industry in the Historical Archive of Crédit Lyonnais in Paris. They are reports written by engineers who worked for the bank's Financial Studies Service after visiting the factories located in Asturias and Biscay in 1899 and 1912. The Financial Studies Service of Crédit Lyonnais was created in 1871 with the aim of providing this institution with national and international information about enterprises, public debt, the Stock Exchange and exchange rates. The purpose of the Service, its highly qualified staff and the fact that the reports were made *in situ*, consulting even manufacturing books, guarantee the reliability of this source<sup>6</sup>. Although some works about the Spanish iron and steel industry are available in which costs appear, none of them offers such valuable information as this one, as it shows the costs of pig iron, Bessemer steel, Martin Siemens steel as well as those of semi-elaborated and finished products, broken down and by factories. I will first refer to the costs of pig iron, after which those of Bessemer steel, Martin-Siemens steel and semi-elaborated and finished products will be dealt with.

### ***The costs of pig iron***

The costs of pig iron for the factories located in Asturias and Biscay in 1899 and 1912 can be found in the Appendix (Tables A and B). Iron ore and coke expenses represented 80% of the costs on average, with great differences between enterprises, while the other items (limestone, wages/salaries, maintenance, repairs, overheads and repayments) amounted to 20% and showed only small differences across factories. Cost inequality was therefore mainly associated with iron ore and coke expenses. The information collected in those tables reveals the reasons for Biscay's hegemony over Asturias<sup>7</sup>. With this purpose, I elaborated Table 1, which shows the average iron ore and coke costs per ton of pig iron in these two provinces in 1899.

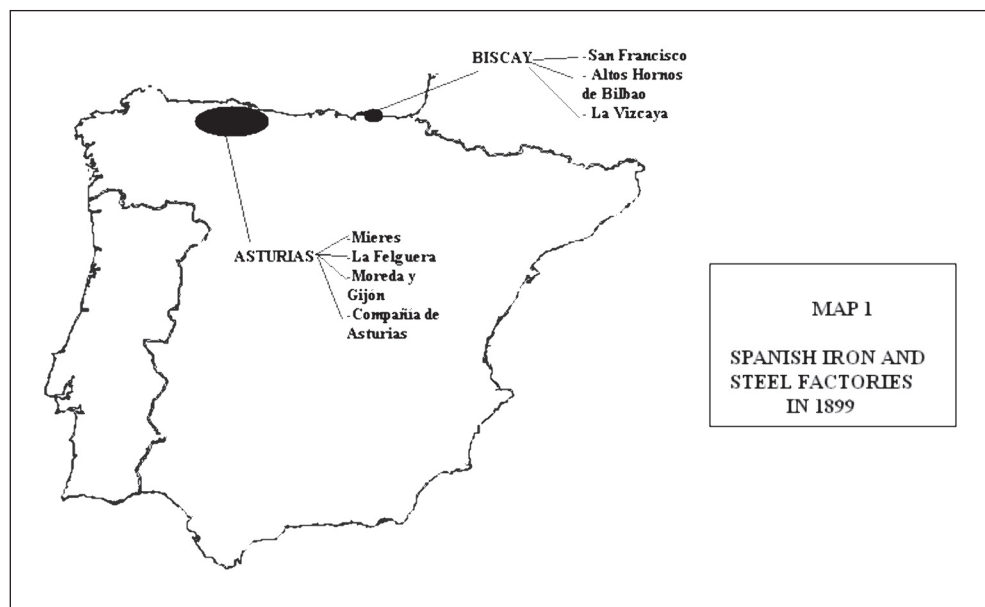
---

4 About the history of the iron and steel industry in Asturias between the 1850s and 1913, see Nadal (1975) and Ojeda (1985, 2000).

5 About the history of the iron and steel industry in Biscay between the 1880s and 1913, see Nadal (1975), Fernández de Pinedo (1983, 1988, 2001), González Portilla (1985), Bilbao (1988) and Bilbao & Fernández de Pinedo (1988).

6 About the Financial Studies Service of Crédit Lyonnais, see Bouvier (1961, pp. 287-294) and Fandreau (2003).

7 As can be seen in Tables A and B of the Appendix, all the factories in Biscay were more competitive than those located in Asturias. A study about the competitiveness of each enterprise is offered in Escudero (2005).



**Table 1**  
AVERAGE IRON ORE AND COKE COSTS PER  
TON OF PIG IRON IN BISCAY AND ASTURIAS. YEAR 1899 (PESETAS)\*

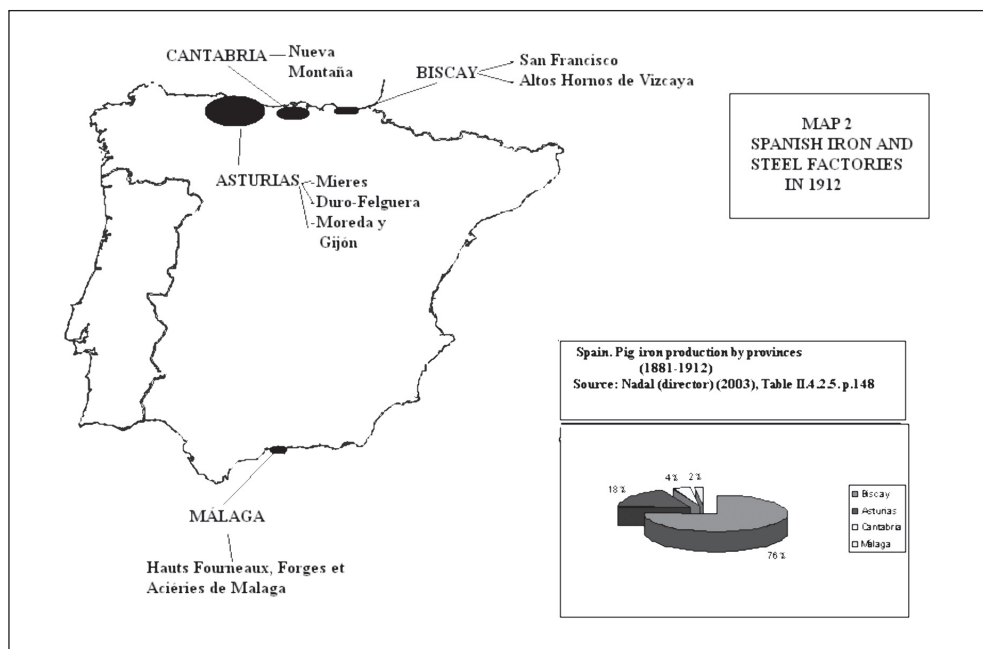
Province	Iron ore			Coke			Total cost
	Price	Quantity	Cost	Price	Quantity	Cost	
Biscay	9	2,000	18	35	1,114	39	57
Asturias	16.1	2,500	40.2	21.6	1,533	33.1	73.3

— Prices: pesetas per ton. Quantity: kilos.

\* Prices and quantities are the arithmetic mean of those corresponding to the factories in Biscay (*Altos Hornos de Bilbao, La Vizcaya and San Francisco*) and to those located in Asturias (*La Felguera, Mieres and Moreda y Gijón*). Source: Table A in the Appendix.

The comparative analysis of costs in Biscay and Asturias requires some previous comments about the prices of both raw materials and about the quantities used in the blast furnaces. The three factories in Biscay had vertically concentrated iron mines from the Bilbao area, which explains why they paid 9 pesetas per ton for their iron supply when the average f.o.b. price of the iron ore from Biscay in 1899 was 15.2<sup>8</sup>. Two of the Asturias-based facto-

8 For a study of the vertical concentration of the Bilbao mines with the iron and steel factories in Biscay, England, Belgium and Germany, see Escudero (1998 a, pp. 182-194 and 1998 b).



ries— *La Felguera* and *Mieres* – had also vertically concentrated iron mines in that province, but they mixed these poor minerals that were taken to the blast furnace at 13 pesetas per ton with the richest and most expensive ones coming from Bilbao (22 pesetas in 1899). The *Moreda y Gijón* factory had not vertically concentrated iron mines; instead, it acquired minerals from Asturias and Biscay that were available in the market. Therefore, the purchase of minerals from Bilbao to mix them with the Asturian ones justifies why the average price in Asturias was 16.1 pesetas per ton. As for the quantities used, the three factories located in Biscay consumed an average 2,000 kilos using minerals that had a richness of 50%, whereas those in Asturias consumed 2,500 kilos, mixing minerals from Bilbao with other poorer ones from Asturias (between 30 and 45% Fe).

Nearly all the coke consumed by the factories located in Biscay was produced with English hard coal that paid customs duties. The prices of coke were lower in Asturias because it was obtained with coal from the province (21.6 pesetas per ton as opposed to 35 in Biscay). *La Felguera* bought it from a mining enterprise; the *Mieres* factory produced it with coal from its own mines; and *Moreda y Gijón* bought it from *Mieres*. The quantities of coke used by the enterprises in Biscay (1,114 kilos) are in keeping with the European and North-American standards of the time. Instead, those used in Asturias (1,533 kilos) were, as the engineers of *Crédit Lyonnais* said, «*unacceptable in modern factories, even though their coke was cheap*». The engineers mentioned three reasons for that high coke consumption: 1) the use of Asturias iron ores with a highly siliceous cementation (greater hardness) and hardly reducible (too compact); 2) the medium-quality coke that was obtained using Asturian coal, which

had a poor calorific power and was not hard and porous enough due to its ashes and volatile materials; 3) the obsolete blast furnaces (small furnaces with blowing machines that injected air with little pressure and drying chambers that produced moderate temperatures).

After referring to the prices and to the quantities of iron ore and coke consumed, I am going to draw a comparison between the costs in these two provinces. Iron ore costs in Asturias reached 40.2 pesetas while those in Biscay amounted to 18 (a 22.2 pesetas difference). However, Biscay spent 39 pesetas in coke while Asturias only spent 33.1 (a 5.9 pesetas difference this time). Therefore, Biscay's higher competitiveness had to do with the lower iron ore costs. The question is, though, did it have to do with prices or with the quantities used? The table shows that both aspects were relevant, although the advantage achieved by Bilbao was largely related to prices (9 pesetas as opposed to 16.1, i.e. 79% cheaper) and not to quantities (2,000 kilos as opposed to 2,500, 25% less). Two conclusions can consequently be drawn from the cost analysis. First, that the vertical concentration of the iron ore consumed by the Bilbao factories and its richness justify the lower costs of their pig iron; and second, that the lower cost of coke in the factories located in Asturias did not compensate their higher iron ore costs.

In the light of the information provided so far, one can wonder if an opposite situation of advantage in pig iron costs by factories in Asturias could have taken place during the 1880s and the 1890s, when coke consumption had been notably reduced as a result of the technological changes introduced in blast furnaces<sup>9</sup>. I do not think so, and I am going to explain why. As seen above, the weaknesses of Asturias were the prices of the iron ore bought in Bilbao; the greater quantity of iron ore used mixing it with poorer minerals from Asturias; and the consumption of larger quantities of coke. Let us imagine a situation of technological equality: Asturian blast furnaces have the same technology and size than Basque ones. The first weakness could then have been corrected if they had exclusively used Asturian iron ore, which would be cheaper than that bought in Biscay. The second weakness could be corrected using less iron ore —necessarily from Bilbao, due to its greater richness. As for the third weakness, it could be corrected through the reduction in the quantity of coke derived from consuming only minerals from Bilbao, which were softer and easier to reduce —I do not consider the possibility of using less coke making it with English hard coal, because the price would have been twice as high as that of Asturian coke, and therefore would have not compensated the higher performance of 'English' coke. In other words, two counterfactual situations must be considered in a hypothetical situation of technological equality in blast furnaces: 1st) consumption of iron ore and coke from Asturias; and 2nd) consumption of iron ore from Biscay and coke from Asturias.

The first one offers the following results. The most favourable prices of iron ore in 1899 would have been ca. 13 pesetas per ton, which was the average price of the mineral vertically concentrated by *La Felguera* and *Mieres* factories that year. However, this would have meant using over three tons given the poor quality of these minerals, as a result of which costs would have gone up to at least 39 pesetas (13 x 3). In turn, the most favourable price of Asturian coke in 1899 would have been 17 pesetas (that produced by the *Mieres* factory with

---

<sup>9</sup> The main cause of the decrease in the consumption of coke in blast furnaces was the replacement of cold air by that previously heated in drying chambers. However, other factors played a significant role in coke saving (namely, iron ore and coke quality; blowing machine efficiency; and blast furnace size and shape).

coal from its own mines), but its consumption would have never gone below 1.3 tons given its medium quality and the hardness and limited reduction capacity of Asturian iron ore —i.e. costs would have been 22 pesetas (17 x 1.3). Therefore, 39 pesetas of iron ore costs plus 22 of coke make 61 pesetas, a figure well above the 57 pesetas of Biscay (Table 1). Neither would the second counterfactual have resulted in an advantage for Asturias. Using only iron ore from Biscay, the quantity would have gone down to 2 tons, but at 22 pesetas (costs of 44). As for coke, some more coke would have been used than in Biscay due to the worse quality of Asturian coke compared to ‘English’ coke. Say 1.2 tons at 17 pesetas (costs of 20.4). The sum of both costs (64.4 pesetas) once again exceeds Biscay’s 57 pesetas.

Therefore —and after the technological changes operated in blast furnaces reduced coke consumption to a great extent— I think pig iron cheaper than that from Biscay could not be produced in Asturias because, even imagining a hypothetical technological equality in the blast furnaces of both provinces, the three already- mentioned factors, i.e. the low prices of the mineral ore vertically concentrated by Bilbao factories; the lower quality of Asturian iron ore; and the poorer quality of Asturian coke made it impossible.

I could now include a study about pig iron costs in 1912 based on the information contained in Table B of the Appendix, but I prefer not to do it because the results obtained do not alter the conclusions drawn from the analysis corresponding to 1899.

### ***The costs of Bessemer steel***

The iron ore from Bilbao did not contain phosphorus, whereas that from Asturias was phosphorous. Asturias-based enterprises did not make Bessemer steel because it required phosphorus-free pig iron, and as they would have had to produce it using only minerals from Biscay, its costs would not have been competitive in comparison with factories in Bilbao. As for Thomas steel, Asturian companies did not produce it either due to the impossibility to obtain basic pig iron that was cheaper than acid pig iron from Bilbao. The factories located in Biscay therefore enjoyed a monopoly position in some goods where Bessemer steel replaced puddled iron (rails, billet, beams and straps).

Table C in the Appendix shows the costs of Bessemer steel in 1899 and 1912 in the only factories that produced it: *Altos Hornos de Bilbao* and *La Vizcaya* in 1899 and *Altos Hornos de Vizcaya* —merger of the two companies— in 1912. As can be observed in the table, the Bessemer steel produced by *Altos Hornos de Bilbao* was cheaper than that produced in *La Vizcaya*. This was so because the former produced pig iron at a lower cost.

### ***The costs of Martin-Siemens steel***

Tables D and E in the Appendix provide the costs of Martin-Siemens steel for the factories located in Biscay and Asturias in 1899 and 1912. The expenses associated with pig iron, scrap metal and hard coal represented 81% of the costs on average, although significant differences existed across enterprises, while the rest of items (ferromanganese, iron ore, labour, material, repairs, overheads, repayments) amounted to 19% and only revealed small differences across factories. The comparison between the costs in both provinces must consequently focus on the expenses related to pig iron, scrap metal and hard coal:

**Table 2**  
**COSTS OF PIG IRON, SCRAP METAL AND HARD COAL PER TON OF**  
**MARTIN-SIEMENS STEEL. YEAR 1899.**  
**(PESETAS PER TON)**

Region	Pig iron			Scrap metal			Hard coal			Total
	Price	Quantity	Total	Price	Quantity	Total	Price	Quantity	Total	
Biscay	71.56	540	38.64	82	540	44.28	25	750	16.5	99.42
Asturias	86.75	575	49.88	91	475	43.22	15	800	12	105.10

- Price: pesetas per ton. Quantity: kilos.

\*The costs in Biscay are the mean of those corresponding to *Altos Hornos de Bilbao* and to *La Vizcaya*. Those in Asturias are the mean of the costs of *La Felguera* and *Mieres*. Source: Table D in the Appendix.

It can be checked that Biscay's costs were below those in Asturias, but the difference (5.68 pesetas) was not smaller than in the case of pig iron (16.3 pesetas —Table 1—); in fact, a sort of 'rapprochement' took place from Asturias toward Biscay. I will firstly analyse the reasons for Biscay's higher competitiveness level and then those which justify the said 'rapprochement'. The advantage achieved by Bilbao was based on the lower pig iron costs (38.64 pesetas as opposed to 49.88; a 11.24 pesetas difference), as the lower costs associated with scrap metal (1.06 pesetas) and hard coal (4.5) in Asturias did not suffice to tip the balance in its favour. Concerning the 'rapprochement', it took place because the manufacture of Martin-Siemens steel mitigated the weakness of Asturias —pig iron costs— and accentuated its comparative advantage in coal. In relation to the first aspect, the replacement of 50% of the pig iron with scrap metal reduced the distance due to a question of relative prices —it can indeed be verified that the difference in pig iron prices between the two provinces amounted to 15.19 pesetas, while that corresponding to scrap metal prices was only 9 pesetas, also favourable to Biscay<sup>10</sup>—. In addition to that, the consumption of 750-800 kilos of Asturian hard coal which was cheaper than that imported to Bilbao from England reduced the distance again.

I could include a study of Martin-Siemens steel costs in 1912 based on the information collected in Table E of the Appendix, but I am not going to do it because the results are identical to those derived from the analysis corresponding to 1899.

### *The costs of semi-elaborated and finished products*

The information supplied by the French engineers is not so abundant in this case, as costs do not appear disaggregated and references are confined to the two most important enterprises in only two years (*Duro-Felguera* in 1909 and 1912 and *Altos Hornos de Vizcaya* in 1912). Moreover, the report about *Duro-Felguera* says that the 1909 costs were

<sup>10</sup> The factories located in Biscay and Asturias used their own waste as scrap metal. Therefore, the price of the latter which appears in Table 2 corresponds to the costs of that waste. That explains why scrap metal was cheaper in the factories located in Biscay.



obtained from its manufacturing books, while those corresponding to 1912 were provided by the enterprise manager. As can be seen in Table 3, the 1912 costs are below those corresponding to 1909, which led the French engineers to write the following comment: «We thus believe that if the 1909 costs have been really improved, those of 1912 are a bit optimistic though»<sup>11</sup>.

**Table 3**  
COSTS OF SEMI-ELABORATED AND FINISHED PRODUCTS IN ALTOS HORNOS DE VIZCAYA AND DURO-FELGUERA. YEARS 1909 AND 1912 (PESETAS PER TON)

Products	<i>Altos Hornos de Vizcaya</i> (1912)	<i>Duro Felguera</i> (1912)	<i>Duro-Felguera</i> (1909)
Square	142	150	?
Flat	145	152	?
Commercial steels	195	204	230
Straps	192	?	?
Rails and beams	175	181	201
Heavy plates	200	212	226
Sheets	215	226	253

Sources: Historical Archive of Crédit Lyonnais (Paris): *Altos Hornos de Vizcaya. Rapport de mission*. 1913. Box 21,153. ACL: *Sociedad Metalúrgica Duro Felguera. Rapport de mission*. 1913. Box 21,148.

Despite the deficiencies mentioned above, two relevant conclusions can be drawn from Table 3: all the products were cheaper in *Altos Hornos de Vizcaya* than in *Duro Felguera* and, unlike what happened with Martin-Siemens steel, Asturias again «drifted apart» from Biscay, since if the difference in cost for this steel was 6 pesetas in 1912 (see Table E in the Appendix), that corresponding to semi-elaborated and finished products was higher.

It goes without saying that, in the case of products manufactured with Bessemer steel, the ‘deviation’ was partly due to the fact that the costs linked to this type of steel were lower than those of Asturian Martin-Siemens steel. However, the information contained in Table 3 stands in contrast with what happened during the first decade of hegemony of Biscay (1880-1890). According to *La Reforma Arancelaria y los tratados de comercio*, the cost of Martin-Siemens steel from Biscay was below that of Asturian Martin-Siemens steel between 1886 and 1890, but the costs of the semi-elaborated and finished products obtained using this steel were higher in Biscay as a result of the increased consumption of coal in the ingot reheating furnaces and in the steam machines which drove rolling trains<sup>12</sup>. The reports elaborated by the French engineers tell us why that situation changed since the mid-1890s. What happened was that firstly *Altos Hornos de Bilbao* and *La Vizcaya* and

11 «Nous croyons donc que si les prix de revient de 1909 ont été réellement améliorés, ceux de 1912 sont par contre un peu optimistes». Historical Archive of Crédit Lyonnais: *Sociedad Metalúrgica Duro-Felguera. Rapport de mission*. 1913. Box 21,148.

12 *La Reforma arancelaria y los tratados de comercio* (1890, pp. 401-403).

then *Altos Hornos de Vizcaya* introduced a technological change that saved coal in three ways: 1) the use of gases from blast furnaces in the reheating tubs; 2) the use of these same gases in the steam machines; and 3) the replacement of steam energy by electric power in some stages of the production chain. Instead, the description of the rolling workshops in *Duro-Felguera* carried out by the French engineers does not mention these innovations and finishes with a text that I am going to reproduce because it reveals a situation of technological obsolescence:

*«Except for the small-section train, the machine of which is new, it can be said that all the material is old and defective. The driving machines are all too weak; the cylinders, manufactured in the factory, are useless; finally, the ingot reheating furnaces are insufficient and not very economical from the point of view of coal»<sup>13</sup>.*

## II. A META-HISTORICAL MODEL

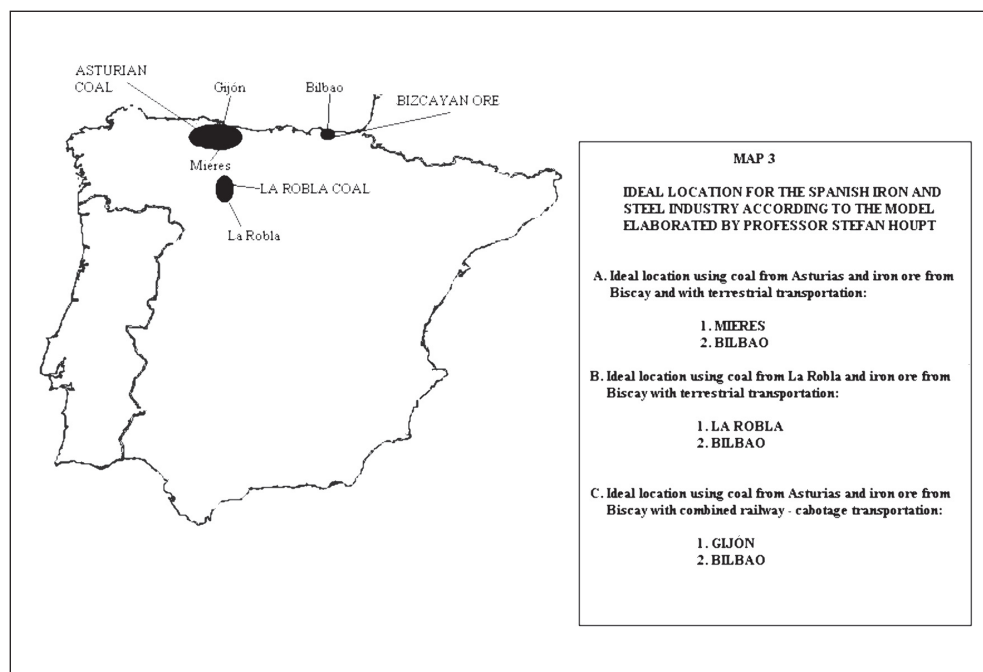
In Issue No. 6 of the *European Review of Economic History*, Stefan Houpt presented a model for the ideal location of the Spanish iron and steel industry that was based on the already classic model proposed by Alfred Weber<sup>14</sup>. The model operates with three variables: quantities of iron ore and coal; costs related to the transportation of both inputs to factories; and costs linked to transportation of iron and steel goods to consumption centres. A first exercise carried out assuming exclusively the existence of terrestrial transportation provides these results (see Map 3): using coal from Asturias and iron ore from Biscay, the ideal place is Mieres (Asturias), and then Bilbao. A second exercise which also assumes exclusively the existence of terrestrial transportation, but using coal from La Robla and iron ore from Biscay this time, places La Robla in the lead, followed by Bilbao. Finally, a third exercise which operates with combined railway-cabotage combined transportation costs using coal from Asturias and iron ore from Biscay situates Gijón in first place before Bilbao. Taking into account that this last exercise is the one which minimises transportation costs, Houpt argues that Gijón was the ideal place to set up the Spanish iron and steel industry and that its location in Bilbao had very negative consequences for Spain's national economy (loss of welfare; slowing down industrial development; and the impossibility to export iron and steel goods on a large scale).

The conclusion stands in radical contrast with the costs I have offered. And it does so because this is a meta-historical model which does not consider two factors related to Biscay's hegemony: the vertical concentration of iron ore and the importation of English fuel.

---

13 *«Sauf le train à petits profilés, dont la machine est neuve, on peut dire que tout le matériel est ancien et défectueux. Les machines motrices sont toutes trop faibles; les cylindres, fabriqués à l'usine, ne valent rien; enfin, les fours de réchauffage sont insuffisants et peu économiques du point de vue des frais du charbon»*. *Historical Archive of Crédit Lyonnais: Sociedad Metalúrgica Duro Felguera. Rapport de mission*. 1913, Box 21,148. The report about the *Mieres* factory in 1913 specifies neither the costs of Martin-Siemens steel nor those of semi-elaborated and finished products, but it does describe the rolling workshops in the factory, which are catalogued as obsolete too.

14 Houpt (2002).



The vertical integration of iron mines located near the Bilbao factories proved more efficient than the market. A proof of it is that, between 1880 and 1895, these factories obtained iron ore that was 34% cheaper than that sold at f.o.b. market prices and also that, between 1896 and 1913, when the prices of the mineral from Bilbao rose considerably as a result of the growth of external demand, that difference reached 44%<sup>15</sup>. As for the importation of fuel from Great Britain, it also turned out to be more efficient than the meta-historical situation with which the model operates, characterised by the absence of foreign trade. During the 1880s, the factories located in Biscay imported English coke because it was cheaper and had better quality than Asturian coke. Then, they decided to produce it with hard coal from England instead of Asturias because, although prices were somewhat higher, the performance of ‘English’ coke at the blast furnace compensated it<sup>16</sup>. Something else that reinforces the contrast between what is meta-historical and historical is the fact that the *Moreda y Gijón* factory— located in Gijón, an ideal place according to Professor Houpt – was the least competitive one because it concentrated vertically neither iron mines nor coal mines (see the costs in Tables A and B of the Appendix).

<sup>15</sup> An analysis of the vertical concentration of iron mines in Bilbao from the perspective of the Transaction Cost Theory can be found in Escudero (1998 b).

<sup>16</sup> *La Vizcaya* installed coke furnaces in 1889; *San Francisco* did so in 1891, and *Altos Hornos de Bilbao* in 1898.

### III. THE CAUSES OF BISCAY'S HEGEMONY

As shown in Table 4 below, Biscay not always had the hegemony in the iron and steel industry:

**Table 4**  
 SPAIN. PIG IRON PRODUCTION BY PROVINCES  
 (1862-1913) (AVERAGE TM PER THOUSAND IN EACH PERIOD)

Periods	Asturias	Biscay	Cantabria	Málaga	Total
1862-1880	23.9	13.9		4.8	42.6
1881-1890	39.6	163.5			203.1
1891-1900	57.1	241.6			298.7
1901-1913	70.9	285.7	33.9	14.8	405.3

\*\* The 4,800 tons of the Málaga province were produced at the Manuel Agustín de Heredia factory. This enterprise closed in the 1880s and its facilities were later bought by *Hauts Fourneaux, Forges et Aciéries de Málaga*, which started producing in 1899.

Source: Nadal (director) (2003), Table II.4.2.5. p. 148.

It can be observed that Asturias produced more pig iron than Biscay during the 1860s and 1870s. This was so because the factories located in Asturias had coal available nearby, while those in Biscay were forced to buy the hard coal in Asturias or in England<sup>17</sup>. Towards 1865, for example, coke cost 79 *reales* (old Spanish coin equivalent worth a quarter of a peseta) in Asturias, whereas in Biscay, Asturian coke cost 217 *reales* and English coke was even more expensive because it carried heavy duties and high freight costs. However, the iron ore cost 35 *reales* in Biscay and 59 in Asturias, but this difference did not compensate the previous one<sup>18</sup>. The advantage of Asturias increased at the pig iron refinement stage as each ton of puddled iron required some five tons of hard coal.

If the hegemony of Asturias during the 'age of puddled iron' derived from the availability of coal, that of Biscay was related to Henry Bessemer's discovery and to the possibility of importing English coke at a good price. A ton of Bessemer steel required 1.1 of pig iron made with phosphorus-free iron ore and 0.3 of hard coal, since unlike puddling furnaces, Bessemer converters used little coal. Biscay was consequently an ideal place to locate the new iron and steel industry because the richest and most abundant phosphorus-free iron ore deposits in Europe were very close to factories. However, there was still the problem of the coal needed for the production of pig iron, but this was solved thanks to the reduction of import duties on English fuel and to the considerable decrease in freight costs from Great Britain to Bilbao. In 1869, the customs duties on hard coal and coke from England were

<sup>17</sup> About the hegemony of Asturias, see Nadal (1975), Fernández de Pinedo (1985), Ojeda (1985) and Bilbao y Fernández de Pinedo (1988).

<sup>18</sup> Bilbao & Fernández de Pinedo (1988, p. 165).

substantially reduced, and after the end of the Carlist War in the Basque Country (1876), a massive exportation of iron ore from Biscay to England started, which created a return navigation through which the Newcastle–Bilbao freight costs passed from 22.5 pesetas in the 1860s to only 8–9 pesetas in the early 1880s<sup>19</sup>. Thus –as all the experts in the Spanish iron and steel industry have maintained– the existence of rich and abundant phosphorus-free iron ore along with the possibility of importing English coal at a good price laid the foundations for Biscay’s hegemony in the iron and steel industry<sup>20</sup>.

The reports of *Crédit Lyonnais* confirm the above and make possible a more in-depth analysis of the reasons why Biscay came to be the most competitive region in all the iron and steel goods:

- 1) The analysis of pig iron costs demonstrates that the advantage achieved by Biscay was based on the iron ore costs that were much lower than those in Asturias, a difference that could not be compensated by the lower coke expenses in the latter province. This analysis additionally reveals that iron ore costs in the Bilbao factories were low for two reasons: (a) they used vertically concentrated mineral at below-market prices; and (b) the richness of that mineral allowed them to consume less than their counterparts in Asturias. In fact, the factories located in Asturias found three problems which prevented them from producing pig iron at costs below those in Biscay: the low costs of the iron ore concentrated vertically by Bilbao firms; the lower quality of Asturian iron ore; and the poorer quality of Asturian coke.
- 2) The factories located in Asturias produced neither Bessemer steel nor Thomas steel because, due to the differences in cost between their pig iron and that from Biscay, they would have become much more expensive than the Bessemer steel from Bilbao. Thanks to this, Biscay-based factories achieved a ‘monopoly’ position in the production of goods made with this type of steel (rails, billet, beams and straps).
- 3) In order not to be confined to the production of puddled iron –the demand for which was replaced by Bessemer steel in the products mentioned above and by Martin-Siemens steel in naval machinery and shipbuilding– Asturias-based companies chose to manufacture Martin-Siemens steel<sup>21</sup>. This decision proved right as, although the costs associated with this steel were lower in Bilbao thanks to the lower pig iron costs, costs in Asturias came closer to those in Biscay for two reasons: (a) the considerable reduction in the consumption of pig iron mitigated the weakness of Asturias; and (b) the added use of 700–800 tons of coal reinforced its advantage.
- 4) The costs of semi-elaborated and finished Martin-Siemens steel products in Asturias during the 1880s were lower than in Biscay as a result of the increased consumption of coal in the ingot reheating furnaces and in the steam machines that drove roll-

---

19 Nadal (1975, p. 137 y 142) and Escudero (1998, p. 199 y ss).

20 Nadal (1975), Fernández de Pinedo (1983, 1985, 1988, 2001), Ojeda (1985), González Portilla (1985), Bilbao (1988) and Bilbao & Fernández de Pinedo (1988).

21 Because of its hardness and low costs, Bessemer steel replaced puddled iron in the construction of rails, artillery, beams, bridges and straps, but not in naval machinery and shipbuilding, since puddled iron was more plastic, i.e. malleable and ductile. Instead, Martin-Siemens steel was more plastic than puddled iron.

ing trains. However, from the 1890s on, those products became cheaper in Biscay because Asturian companies did not adopt the innovations that allowed those in Biscay to save fuel in the rolling process. The hegemony that one Basque company (*Altos Hornos de Vizcaya*) achieved in all the steel-derived products was not only based on the lower costs of pig iron and the low cost of Bessemer steel, but also on an innovative capacity —favoured by its greater profits— which also made it more competitive in products made with Martin-Siemens steel (the province of Biscay produced 72% of the Spanish pig iron and 74% of the steel<sup>22</sup>).

These are the reasons explaining Biscay's hegemony in the iron and steel industry according to the «*rappports de mission*» elaborated by the engineers of Crédit Lyonnais, a source that provides a wealth of information about costs and technology. Nevertheless —after arguing that Biscay was not a suitable place to locate the iron and steel industry— Stephan Houpt wonders why that province reached hegemony and finds the answer not in the input prices and in technology, that is, in costs, but in two institutional events: (a) the influential iron and steel entrepreneurs from Bilbao persuaded the authorities to grant them tariff protection; and (b) these same entrepreneurs imposed the cartelisation of the sector and benefited from it<sup>23</sup>. Protectionism and cartelisation were undoubtedly crucial issues in the history of the Spanish iron and steel industry but they were not directly responsible for Biscay's hegemony, as I am going to try to explain below.

In order to protect factories in Biscay to the detriment of the Asturias-based ones, the 1891 tariff would have had to be discriminatory, i.e. it would have had to establish low import duties on the most competitive products made in Asturias at the time (puddled iron-derived products and Martin-Siemens steel) and high duties on those manufactured in Biscay (Bessemer steel-derived products). On the other hand, Asturian companies would have opposed that tariff. None of this happened, though, because both Asturias factories and those located in Biscay acted jointly seeking to achieve a tariff that could protect everything they produced. The *Asociación de la Industria Siderúrgica* (Iron and Steel Industry Association) —a lobby formed by both Asturias-based and Biscay-based factories in 1890— was indeed successful, as the 1891 tariff kept the import duties on all the iron and steel goods high and increased considerably the duties on those produced by the metal-mechanical industry so that, by replacing imports, the latter could grow and draw iron and steel production with it<sup>24</sup>. It must be highlighted in this respect that the *Asociación de la Industria Siderúrgica* participated in the protectionist campaigns that led to the end of the commercial treaty with Germany in 1894 and to the abolition of the special tariffs for railway material imports in 1896<sup>25</sup>. Professor Houpt's theory thus clashes with reality, since all Spanish iron and steel

22 Nadal (director) (2003, p. 144 and Table II.4.2.10).

23 Houpt (2002, pp. 216 and 217).

24 A recent study about the 1891 tariff can be found in Sáez (2005 b). See also Fernández de Pinedo (1983, 2001) and Serrano Sanz (1985).

25 Ojeda (1985, pp. 280-286).

companies supported a policy of protectionism which turned out to be practically prohibitive for all iron and steel as well as metal-mechanical products<sup>26</sup>.

Three iron and steel cartels existed in Spain between 1880 and 1913. The first one was created in 1886 for the sale of pig iron and the three Biscay-based factories formed part of it. This syndicate broke up in the 1888-1895 period but resumed its activity in 1896 and continued to work until 1913<sup>27</sup>. Why did Biscay already produce 80% of Spanish pig iron before the constitution of the cartel in 1886? Why did Asturian companies not gain market share between 1888 and 1895 —when the syndicate broke up—? The problem lies in that the pig iron costs of Asturias-based factories were substantially higher than those of factories located in Biscay, as a result of which Asturian enterprises could not compete when the market was open and did not have the negotiation capacity to join the syndicate either.

The second cartel was an agreement for the sale of three products made with Bessemer steel (rails, billet and beams) signed by *Altos Hornos de Bilbao* and *La Vizcaya* in 1895 which was in force until 1901, the year in which both companies merged under the name of *Altos Hornos de Vizcaya*<sup>28</sup>. Due to reasons that have already been explained, Asturias produced neither Bessemer steel nor Thomas steel. So its rails, billet and beams were manufactured with puddled iron and/or Martin-Siemens steel at costs that exceeded those in Biscay. This is why Asturian factories were not able to compete in this range of goods before 1895 —when the market was free— and neither could they join the syndicate later.

The third cartel has been recently studied by Miguel Ángel Sáez<sup>29</sup>. It was formed in 1889, and the Asturian factories, not the Biscay-based ones, were the ones that started the negotiations. It was a syndicate for the sale of commercial irons which included all the enterprises that produced them<sup>30</sup>. The syndicate broke up in 1891, but in 1893, *La Felguera* and *Altos Hornos de Bilbao* persuaded the other companies to sign a new agreement that, with the exception of 1896, continued to work until 1904. Because the differences between the costs of commercial irons both in Asturias-based and Biscay-based factories were small in the 1890s, no leading firm or firms existed in this range of goods, which is why the distribution of the market was equitable: the same 16.27% market share for *Altos Hornos de Bilbao*, *La Vizcaya*, *La Felguera*, *Mieres* and *Moreda y Gijón* and the rest —18%— corresponding to another seven small factories. *Altos Hornos de Vizcaya* broke the cartel in 1904 —when it had already become the leading company in all iron and steel goods—, and this provoked a drop of prices which placed Asturian enterprises in a critical situation. They reacted negotiating a new agreement with *Altos Hornos de Vizcaya* which was signed in 1907. The syndicate was renamed as *Central Siderúrgica*; it cartelised not only commercial irons but also

---

26 Although the new 1909 tariff reduced the import duties on some products (pig iron, steel ingots, rails, bars and plates) in return for increasing those on railway machinery and material, protectionism continued to be practically prohibitive. French engineers wrote the following about this issue in 1913: «*Customs duties are nearly prohibitive and limit imports almost exclusively to special products*» («*Les droits douaniers sont à peu près prohibitifs et limitent l'importation presque exclusivement aux produits spéciaux*»). Historical Archive of Crédit Lyonnais: *Altos Hornos de Vizcaya. Rapport de mission. 1913*. Box 21,153.

27 González Portilla (1985, pp. 191-208).

28 González Portilla (1985, pp. 208-215).

29 Sáez (2005 a).

30 The name 'commercial irons' was used to refer to small-section rolling products like rods, squares, straps, tires, flat bars ... and to hammering products like grating for ploughs and cart arbour.

other products and, logically, the leading company achieved greater market shares<sup>31</sup>. *Duro-Felguera* ranked second and was very satisfied with the agreements, because thanks to them, this company was able to overcome the critical situation it had gone through between 1904 and 1907<sup>32</sup>.

The evolution of Spanish iron and steel cartels contradicts Professor Houpt's hypothesis. Biscay's hegemony did not result from collusion; it is the hegemony of costs in Biscay that explains the creation of syndicates favourable for the leading enterprises in this province, one of which also turned out to be beneficial to Asturias-based factories.

31 These were the market shares established by *Central Siderúrgica* in 1907:

	Commercial irons and steels	Beams and sections	Plates
<i>Altos Hornos de Vizcaya</i>	49%	45%	56.40%
<i>Duro-Felguera</i>	13%	31.85%	27.60%
<i>Mieres</i>	13%	2.50%	6%
<i>San Francisco</i>	6%	10%	10%
Other small factories	19%	10.65%	-

Source: Saéz (2005 a).

32 Saez (2005 a) and Ojeda (1985, p. 320).



## APPENDIX

**Table A**  
**COSTS OF PIG IRON FOR FACTORIES IN ASTURIAS AND BISCAY. YEAR 1899**  
**(PESETAS PER TM)**

	IRON ORE			COKE			LIMESTONE			Maintenance and repairs	Overheads	Repayment	Total
	Quantity*	Price*	Total	Quantity*	Price*	Total	Quantity*	Price*	Total				
<i>Altos Hornos de Bilbao</i>	1,804	8.54	15.40	1,000	34.68	34.68	360	5	1.80	7	3	66.88	
<i>La Vizcaya</i>	2,040	9.75	19.89	1,143	35	40	530	5	2.65	6.70	2	76.24	
<i>San Francisco</i>	2,000	9	18	1,200	35	42	800	5	4	7	2	77	
<i>La Feiguera</i>	2,200	15.95	35	1,700	20	34	544	3.5	1.90	6	3	84.40	
<i>Mieres</i>	2,801	16.64	46.60	1,500	17	25.50	600	3.5	2.1	6	5	88.70	
<i>Moreda y Gijón</i>	2,500	15.80	39.50	1,400	28	39.20	500	5	2.5	7	5	97.20	

\*Quantities: kilos.

\*Prices: pesetas per ton at the blast furnace.

Source: Historical Archive of Crédit Lyonnais (Paris). *Métallurgie dans le nord de l'Espagne. Rapport de mission. 1900.* Box 11.847/1. Elaborated by the author.

**Table B**  
**COSTS OF PIG IRON FOR FACTORIES IN ASTURIAS AND BISCAY.**  
**YEAR 1912 (PESETAS PER TM)**

	IRON ORE		COKE		LIMESTONE			Wages/Salaries	Maintenance and repairs	Overheads	Repayment	Total
	Quantity*	Price*	Quantity*	Price*	Quantity*	Price*	Total					
<i>Altos Hornos de Vizcaya*</i>	1,900	12	1,000	36	360	4.75	1.70	6	2,5	3	2	74
<i>San Francisco</i>	2,000	10	1,100	37	694	4.75	3.30	6	2	2	2	76
<i>La Felguera*</i>	2,600	14.67	1,650	19	860	3.5	3	6	3	2.5	2	86
<i>Moreda y Gijón</i>	2,000	15.97	1,527	26	600	5	3	6	4	2.75	2	89.39

\*Quantities: kilos.

\* Prices: pesetas per ton at the blast furnace.

Source: Historical Archive of Crédit Lyonnais (Paris): *Rapport de mission* of each company. Year 1913. Boxes 21,148, 21,150/1, 21,152 and 21,153. Elaborated by the author.

**Table C**  
**COSTS OF BESSEMER STEEL IN BISCAY**  
**(1899 AND 1912). (PESETAS PER TM)**

Factory and year	Pig iron			«Spiegel»		Coal			Coke		Wages/Salaries	Maintenance and repairs	Overheads	Repayment	Total	
	Quantity*	Price*	Total	Quantity*	Price*	Quantity*	Price*	Total	Quantity*	Price*						Total
<i>Altos Hornos de Bilbao (1899)</i>	1,100	66.88	73.4	6	150	9		200	25	5						98.95
<i>La Vizcaya (1899)</i>	1,100	76.24	83.86	6	150	9		200	25	5		3.75		2	0.7	109.6
<i>Altos Hornos de Vizcaya (1912)</i>	1,100	74	81.4	6	150	9		200	22	4.4		4		2	0.7	106.3

\*Quantity: kilos.

\*Prices: pesetas per ton.

Source: Historical Archive of Crédit Lyonnais (Paris): *Métallurgie dans le nord de l'Espagne. Rapport de mission. 1900. Box 11,847/1. Altos Hornos de Vizcaya. Rapport de mission. 1913. Box 21,153.* Elaborated by the author.

**Table D**  
**COSTS OF MARTIN-SIEMENS STEEL IN SPAIN (1899). (PESETAS PER TM)**

Factory	Pig iron		Scrap metal		Hard coal		Iron ore		Ferromanganese		Wages/ Salaries	Maintenance and repairs	Overheads	Repayment	Total		
	Q*	P*	Q*	P*	Q*	P*	Q*	P*	Q*	P*						Total	Total
<i>Altos Hornos de Bilbao</i>	540	66.88	540	80	43.2	700	25	17.5	100	8.5	0.85	12	300	3.6	2	1	117.25
<i>La Vizcaya</i>	540	76.24	540	84	45.36	800	25	20	100	9.75	0.97	15	300	4.5	2	1	125.99
<i>La Felguera</i>	550	84.80	450	90	40.5	800	16	12.8	100	22	2.20	15	300	4.5	3	2	126.64
<i>Mieres</i>	600	88.70	500	92	46	800	14	11.2	100	22	2.20	15	300	4.5	2	2	135.22

\*Q = Quantities (kilos).

\*P = Prices (pesetas per ton).

Source : Historical Archive of Crédit Lyonnais (Paris): *Métallurgie dans le nord de l'Espagne. Rapport de mission. 1900.* Box 11,847/1. Elaborated by the author.

**Table E**  
**COSTS OF MARTIN-SIEMENS STEEL IN SPAIN (1912). (PESETAS PER TM)**

Factory	Pig iron		Scrap metal		Hard coal		Iron ore		Ferromanganese		Salaries	Maintenance and repairs	Overheads	Repayment	Total			
	Q*	P*	Q*	P*	Q*	P*	Q*	P*	Q*	P*						Total	Total	
<i>Altos Hornos de Vizcaya</i>	540	74	39.96	540	80	43.20	700	22	15.40	100	10	1	300	12	3.60	7	3	116.16
<i>Duro Felguera</i>	550	86	47.3	450	91	40.9	800	12.5	10	100	24	2.4	300	15	4.5	9	4	122.1

\*Q = Quantities (kilos).

\*P = Prices (pesetas per ton).

Sources: Historical Archive of Crédit Lyonnais (Paris): *Altos Hornos de Vizcaya. Rapport de mission. 1913.* Box 21,153. ACL: *Sociedad Metalúrgica Duro Felguera. Rapport de mission. 1913.* Box 21,148. Elaborated by the author.

## SOURCES AND BIBLIOGRAPHY

### SOURCES:

Historical Archive of Crédit Lyonnais (Paris). Reports elaborated by the Financial Studies Service about Spanish iron and steel factories. Years 1900 and 1913.

### BIBLIOGRAPHY

- BILBAO, L.M. (1988): «La primera etapa de la industrialización en el País Vasco, 1800-1880: cambio tecnológico y estructura de la industria siderúrgica». In Fernández de Pinedo, E. & Hernández Marco, J.L. (eds.): *La industrialización en el norte de España*. Barcelona. Crítica, pp. 222-251.
- BILBAO, L. & FERNÁNDEZ DE PINEDO, E. (1988): «Artesanía e Industria». In Artola, M. (ed.): *Enciclopedia de Historia de España. I. Economía y Sociedad*. Madrid. Alianza, pp. 105-190.
- BOUVIER, J. (1961): *Le Crédit Lyonnais de 1863 à 1882. Les années de formation d'une banque de dépôts*. Paris. S.E.V.P.E.N., 2 volumes.
- ESCUADERO, A. (1998 a): *Minería e industrialización de Vizcaya*. Barcelona. Crítica.
- (1998 b): «Concentraciones verticales en las minas de Vizcaya». *Revista de Historia Económica*. Spring-Summer, No. 2, pp. 489-521.
- (2005): «La hegemonía siderúrgica de Vizcaya: un análisis de costes (1890-1913)». *Revista de Historia Industrial. Economía y Empresa*, No. 28, pp. 47-79.
- FERNÁNDEZ DE PINEDO, E. (1983): «Nacimiento y consolidación de la moderna siderurgia vasca (1841-1913): el caso de Vizcaya». *Información Comercial Española*, 598, pp. 9-19.
- (1985): «Avances técnicos y consecuencias económicas en la siderurgia española del siglo XIX». In Peset, J.L. (ed.): *La ciencia moderna y el nuevo mundo*. Madrid. CSIC, pp. 39-53.
- (1988): «Factores técnicos y económicos en el origen y desarrollo de la moderna siderurgia y la flota vizcaína, 1880-1899». In Fernández de Pinedo, E. & Hernández Marco, J. L. (eds.): *La industrialización del norte de España*. Barcelona. Crítica, pp. 252-280.
- (2001): «De la primera industrialización a la reconversión industrial: la economía vasca entre 1841 y 1990». In Germán, L., Llopis, E., Maluquer, J. & Zapata, S. (eds.): *Historia Económica regional de España, siglos XIX y XX*. Barcelona, Crítica, pp. 95-124.
- FLANDREAU, M. (2003): «Le Service des Études Financières sous Henri Germain». In Desjardin, B. & Lescure, M. (eds.): *Le Crédit Lyonnais (1863-1986). Études historiques*. Paris. Librairie Droz, pp. 270-301.
- GONZÁLEZ PORTILLA, M. (1985): *La siderurgia vasca (1880-1901). Nuevas tecnologías, empresarios y política económica*. Bilbao. Universidad del País Vasco.
- HOUPT, S. (2002): «Putting Spanish steel on the map: The location of Spanish integrated steel, 1880-1936». *European Review of Economic History*, 6, pp. 1913-220.
- NADAL, J. (1975): *El fracaso de la Revolución Industrial en España, 1814-1913*. Barcelona. Ariel.

- NADAL, J. (director): *Atlas de la industrialización de España, 1750-2000*. Fundación BBVA. Crítica.
- OJEDA, G. (1985): *Asturias en la industrialización española*. Madrid. Siglo XXI.
- (2000): *Duro-Felguera. Historia de una gran empresa industrial*. Oviedo. Grupo Duro-Felguera S.A.
- SÁEZ GARCÍA, M.A. (2005a): «Hacia un cártel perfecto. Los acuerdos colusivos en el sector siderúrgico español (1871-1907)». *Investigaciones de Historia Económica*, 1, pp. 131-164.
- (2005b): «Aranceles e industria. El arancel de 1891 y sus repercusiones sobre el desarrollo de la industria española». *VIII Congreso de la Asociación Española de Historia Económica*. Sesión B.3. Available in <http://www.usc.es/es/congresos/histeco5/indez.jsp>.
- SERRANO SANZ, J.M. (1987): *El viraje proteccionista de la Restauración. La política comercial española, 1875-1895*. Madrid. Siglo XXI.
- WITHOUT AUTHOR (1890): *La reforma arancelaria y los tratados de comercio*. Madrid, 2 volumes.