
The role of economic policy and foreign investment: product innovation in the Spanish metalgraphic industry (1959-1975)

● JESÚS GIRÁLDEZ RIVERO

Universidade de Santiago de Compostela
<http://orcid.org/0000-0003-1735-6823>
jesus.giraldez@usc.es

● PEDRO VARELA-VÁZQUEZ

Universidade de Santiago de Compostela
<http://orcid.org/0000-0002-9276-669X>
pedro.varela.vazquez@usc.es

ABSTRACT

The stabilization and liberalization of the Spanish economy, a period of external openness and structural change, stimulated the process of rationalization of canning processes. The penetration of foreign capital and companies with more efficient technologies than those existing in Spain led to far-reaching changes in canning techniques. In this regard, we show how changes in economic policy and foreign direct investment can lead to sectoral and industrial structure upgrading. This article focuses on the manufacture of metal packaging, specifically on the so-called “liquid rubber”, a key input for the automation of its production and the tightness of its closure; a successful case of imitation of foreign techniques and adaptation to the characteristics of the Spanish market, but also of linkage to the international packaging oligopoly and internationalization.

KEYWORDS: packaging industry, product innovation, industrial policy, foreign direct investment.

JEL CODES: N24, N64, O16, O33.

1. Introduction

The expansion experienced by the Spanish economy in the 1950s accelerated after the Stabilization Plan of 1959. The new economic model implemented, characterized by its openness and liberalization, allowed Spain to experience intense growth and structural transformation, favouring its convergence with the most advanced economies of Europe. This development was accompanied by a process of “Americanization”, i.e., the “diffusion of standardiza-

Received: 8 March 2022 – Fecha de recepción: 8 de marzo de 2022

Accepted: 7 October 2022 – Fecha de aceptación: 7 de octubre de 2022

Revista de Historia Industrial – Industrial History Review. Vol. XXXII, no. 87, March 2023. 111-144
ISSN: 1132-7200. DOI: <https://doi.org/10.1344/rhihr.39163>

tion, mass production and distribution from the technological matrix of the second industrial revolution, which required greater investment in capital and R&D” (Álvaro Moya 2012, p. 30; Puig 2003). One of the growth levers of the Spanish economy was foreign direct investment that not only helped finance the balance of payments and complemented domestic savings in financing investment, but also, in the words of Maluquer (2014, p. 331), became the “main channel for disseminating technological innovations”, contributing to the expansion of the domestic production base and the enhancement of its international competitiveness. Other authors have insisted on the importance of “carrying out highly disaggregated studies” to assess the true importance of direct investment as a technology transfer channel (Martín and Rodríguez 1977, pp. 142-151).

In this regard, food products made a decisive contribution to the export orientation of the Spanish economy during the period under study. In 1960, the “Canned food and Beverages” and “Other Food Products” sectors represented 26.11% of total exports and, in 1975, they still accounted for 11% (Viñas et al. 1979, p. 1331). This study focuses precisely on the role played by foreign investment in the technical transformation of the auxiliary canning industries. In fact, at the beginning of the 1960s, the return of Spanish canned food to international markets prompted a reduction in the production costs of the activity. The vegetable and fish canning industries adopted new organizational methods, based on the Scientific Organization of Work, which increased mechanization, productivity and tended to reduce labour costs (Muñoz 2010, pp. 166-173; Manzanares 2003). The rationalization of processes in the canning industry had an impact on the production of packaging, one of the main inputs that was fundamental in the configuration of the cost of the final product. The vertical disintegration into which the production process tended to be divided made it possible to obtain productivity gains which spread in both segments due to the complementarities of supplies. The penetration of European and American packaging multinationals, with the incorporation of modern production technologies that allowed them to exploit large economies of scale, caused substantial changes in the structure of the sector.

The main objective of this article is to shed light on this process of change by analyzing the fundamental auxiliary activity of canning production, the metalgraphic industry, and the use of the designated “liquid rubber”, a key input in the automation of canning. The study is organized in three large blocks: in the first, we examine the origins and conditioning factors of the metalgraphic industry; in the second, we analyze its sector development in Europe from the end of the Second World War, especially from the beginning of the Spanish economic stabilization and liberalization process; and, finally, in the third, we study the importance of liquid rubber on packaging production, guidelines and dissemination framework.

2. The metalgraphic industry: origins and determining factors

The metalgraphic industry was born very connected with modern mass production and distribution, specifically with products packaged in tin cans or boxes, with a lithographed branding. In Galicia, the main canning region for fish in Spain, the production of modern food packaging has undergone notable development since the last decade of the 19th century. If, in the beginning, the metallurgical establishments were related to the graphic arts, since their goal was that of the “illumination” of the tinfoil, varnishing, priming and lithography of the decoration and information related to the brand, it did not take long to take over the construction of metal package containers. This allowed them to assimilate a large part of the demand from the larger canneries, which produced their own cans in the so-called vacuum sections and would also supply smaller companies. The most important enterprises continued to maintain these sections, not only due to their production volume but also to ensure the availability of cans, especially during the characteristic peak times of canning activity. However, from the early years of the 20th century, the spread of various mechanical machinery for the manufacture of cans contributed to the replacement of manual welders – permanent, skilled and expensive male workers – with unskilled labour – mostly women and children on much cheaper temporary contracts. This not only compensated for the investment in new equipment, but also made it possible to deal with the great irregularity of canning production, avoiding an increase in costs and consequent repercussion on prices (Muñoz 2010, pp. 69-77; Giráldez and Muñoz 2007; Hession 1971).

Various authors have highlighted for the USA (McKie 1959; Hession 1971; Hennart 1986), Great Britain (Reader 1976), France (Hernández 1994) and Germany (Wagner 1980) the peculiar relationships between the different phases of this activity (tin production, tinfoil, metal industry and canning industry), highlighting the existence of monopolies, bilateral oligopolies, and actors with great market power (Hession 1971). In fact, the main canneries in Galicia, in order to ensure adequate conditions in the supply of tinfoil, participated in the creation of La Basconia, one of the two Spanish companies that manufacture this product. In 1900, when Vigo became the main Galician canning nucleus, La Metalúrgica SA, dedicated to lithograph printing and can production, was founded. This initiative allowed them to have their own plant and break the production monopoly held in Galicia by La Artística-Suárez Pumariega de A Coruña. The reaction of this company was to set up a subsidiary in Vigo, La Artística SL, which allowed it to expand its market share and force restrictive agreements on competition, which soon spread to other areas (Carmona and Nadal 2005; Giráldez 2010). In the following decades, this company diversified its production, supplying canneries with

welding tape and mastic rings for canning, crown caps for bottles, containers for chemists, cosmetics or drugstores, to which it also provided compressible tubes. It even created a new company, Alonarti SA, dedicated to the production of diverse machinery for the canning industry (Giráldez 2010).

During the first third of the 20th century, Spanish metalgraphic companies were located either in those fishing or agricultural areas that supplied raw materials to canners or where the industries demanding tinsplate (cosmetics, pharmaceuticals, etc.) were based. The location closely related to the cost of transportation. The high cost of shipping large volumes of empty cans over long distances by rail, with a high risk of damage, and its impact on the canner's production costs, impacted the decision to transport lithographed tinsplate, except when transport offered substantial advantages (Hession 1971). In short, as Wagner (1980) pointed out, "economies in transportation costs provided the incentive for the emergence of plants of limited size, geographically dispersed and located close to customers". The elevated ratio between transport costs and packers' production costs gave the metalgraphic plants a positional income, with considerable market power, which points to the proximity-concentration hypothesis proposed by Markusen and Venables (2000). The creation of the Spanish Metalgraphic Association in 1927 institutionalized this territorial distribution in a monopolistic or oligopolistic regime, consolidating a cartelized structure in the whole of the State and agreements on prices of cans, crown caps or mastic rings were generalized (Giráldez 2010).

The Franco regime did not substantially alter this situation, but it complicated the activity of the canning industry and its auxiliary, the metalgraphic industry, due to the multiplicity of regulations and inspection institutions. In fact, the industry was particularly subject to the Tinsplate and Tin Union Committee, the Metal Production Regulatory Commission and the Tin Union Service, integrated into the Metal Union (BOE, 20-XII-1938; 17-XI-1939; 30 May 1956). Created at different times, their function was to centralize supplies, and establish and distribute tinsplate quotas, granted based on production from the early 1930s. However, the collapse of exports prevented the import of this material. The temporary admissions regime, which before the war covered almost half of the sector's needs, was affected by the lack of foreign exchange and the difficulty in reimbursing the rights derived from the amounts not re-exported in previous periods. Tinsplate consumption was less than 10% of that of 1935 (Carmona 2004). In addition, the problems with the national tinsplate production forced its substitution with black steel plate, also with important supply problems, and the quotas were generalized for the range of products used in metalgraphic companies: lead, tin, varnishes, inks and rubber.

Labour Regulations in the Metalgraphic Industry and the Construction of Metal Packaging of 1942 tried to hinder competition in the canning mar-

ket between metal companies and large canneries, forcing them to have in their vacuum workshops, for their own use or that of others, a “fixed work force for all areas of work which could not be extinguished or modified due to seasonality” (art. 56). With this the attempt was made to “avoid the illicit competition that supposes that equal industries work in unequal conditions of production expenses”. However, the measure had hardly any success since very soon the temporary hiring of workers was authorized again, provided that the vacuum workshops were ancillary to canning and were exclusively for internal consumption. This ban on sales abroad, under threat of sanction, reinforced production in metalgraphic companies and larger canneries (BOE, 16-I-1939; 5-10-1942; 19-XI-1942).

Thus, the changes introduced by the new regime did not substantially alter the industrial structure. In fact, the Metalgraphic Association, provisionally reorganized in 1937, and definitively three years later, practically kept the same partners over the years. However, like similar entities such as the Union of Canning Manufacturers, it steadily lost its employer character and progressively took on functions of cooperation and commercial management (Carmona 2004). A corporate character that was reinforced in 1953 with its integration into the Metal Union and its constitution as MetalGraphic Commercial Service, which companies dedicated to lithography on metals could join. Among its purposes were to distribute the quotas of raw materials among its members, and intervene before the administration to manage imports or hold collective representation. However, it did not completely renounce its origin and tried to maintain its status as a cartel. Thus, together with the functions of “coordinating and governing the interests of its associates from the point of view of commercial and industrial relations, studying the special conditions of foreign markets”, it maintained that of “establishing uniform sales rates to avoid ruinous competitions” and that of “protecting and defending their legitimate interests, preventing secrecy and illicit competition in the exercise of activities”.¹ In fact, at various times it settled the hiring of specialized personnel for some companies by others and set prices for the different areas.²

For its part, Galician canned food experienced a sharp contraction in their exports after the war. The scarcity of raw materials and the development of a black market made it direct its sales towards a restricted and undemanding domestic market. In addition, between 1945 and 1955, the acute shortage of sardines, the main canned species, plunged in production. The lack of incen-

1. Archive of the Asociación Metalgráfica Española and Servicio Comercial Metalgráfico (hereafter AME), volume I, p. 96, session 29, 17-18 February 1955.

2. Book of minutes of the Governing Board of AME, session of 17 December 1956, p. 6, and session of 7 June 1963, p. 21. However, price agreements were difficult to maintain and were broken more than once.

tives caused a sharp reduction in investment in the sector, a lack of capital combined with excess capacity. If a certain number of companies had an appropriate average size and were technically well organized, the majority were very small in average size and could be classified as “infra-marginal” due to their obsolete techniques, excessive use of manual labour, clearly distorted cost structures and low profits, characteristics that remained unchanged well into the 1960s (Presidencia del Gobierno 1967, pp. 101-105; Carmona and Nadal 2005, pp. 263-270; Carmona and Fernández 2001).

The Galician metalgraphic industry, like the Spanish as a whole, was affected by the situation of the canning industry it served. During the 1940s and 1950s, the main business concerns were repeatedly in the area of supplying the essential raw materials in order to maintain production. Rubber blankets, inks, varnishes, India paper, zinc, tin for soldering, and, above all, tinfoil, due to insufficient national production, suffered a marked shortage due to the blockade of imports, limited temporary admissions, and insufficient quotas. The metalgraphic companies were forced to work almost exclusively with the tinfoil provided by the clients themselves, because the official quotas were not being served.³

On the other hand, the obsolescence of industrial equipment was evident. In 1957, a study by the AME concluded that the renovation of the main equipment in the industry would require five hundred reblading machines and three hundred gluers, preferably liquid rubber. As for electric welding machines, they would not reach one hundred, considering only one per container manufacturer, which would allow the elimination of generalized manual welding and the multiplication of production by twelve, considerably reducing the number of workers. Flat lithograph machines also needed to be replaced by rotary ones, which would allow production to be raised six to seven-fold at the same time.⁴

The same problems that affected the entire canning industry involved the machinery companies. Although in Spain there was a certain production capacity with foreign patents for some machines for package production, it was limited by financial difficulties and foreign exchange earnings. The specific case of Alonart SA, manufacturer of machinery for the canning industry, is illustrative: during the 1940s and 1950s, the lack of orders caused its activity to languish and it only maintained its production by covering the needs of its compressible tubes section and those of its parent company, La Artística SA (Giráldez 2010). In short, by the end of the 1950s, the auxiliary canning industry evidenced a continuance of outdated techniques, outdated equipment,

3. Board of Directors de La Artística SA (hereafter ALA), 3-IV-1960.

4. Minutes of the General Assembly of AME, session 31, 19-II-1957. The same thing happened with inks and varnishes, irregular supply and quality.

a limited scale of establishments and multiple problems derived from the lack of raw and intermediate materials.

3. The metal packaging industry: the European framework and the Spanish economic liberalization process

From the end of World War II onward, the European packaging industry experienced important changes due to economic recovery, reflected in the expansion of demand due to growth in personal income and rates of consumption. After the formation of the European Economic Community, prospects became more attractive, encouraged by economic development that lasted until the early 1970s. Throughout those decades, the large multinational tinplate packaging companies tended to diversify into new materials (plastics, paper, aluminium or composites, glass and tin, aluminium and plastic), and intensified their international expansion. The “gentlemen’s agreements” that had been maintained before the war for the exchange of technical information came to an end, participating jointly and exchanging shares in various national companies, packaging or machinery. The core of the industry lay in the alliance of the British Metal Box and the North American company Continental Can.⁵

In fact, they signed various agreements referring to commercial matters, such as the one between Sóbemi and Metal Box, in 1946, on cooperation in the Belgian market, and the one between Carnaud and Metal Box, in 1949, for the regular exchange of information, but without trade restrictions. The usual purpose of these agreements was not the establishment of a monopoly but the limitation of the number of competitors, to avoid price deterioration due to the competition of small manufacturers. In this way, the distribution of the market brought together a nucleus of large companies with a number of smaller producers (Wagner 1980). This process of business concentration encouraged many canners to bond with a single supplier, both for security in the supply of packaging containers and for price stability, guaranteed throughout the entire canning season. Apart from the average price, the canners highly valued having prior information on the prices of their packaging and having its stability guaranteed (Hernández 1994, pp. 80; McKie 1959, pp. 226).

Business collusion agreements through the distribution of territories were frequent. In France the market was divided between Carnaud and Ferembal,

5. This dates back to 1929. The establishment in the United Kingdom of the world’s leading can company, the North American Can Company, led Metal Box to establish an alliance with Continental Can, the main competitor of that company (Wagner 1980; Pearson 2016).

with independent areas of action, and, from 1960 onward, the informal agreements between managers of the main companies under the assistance of Continental Can took shape directly in the Mediterranean markets; Carnaud was awarded those for Spain, Portugal and Lebanon, while Metal Box was awarded those for Italy and Greece (Hernández 1994, pp. 80-81; Reader 1980, pp. 199-201). Initially, these territorial agreements focused on the granting of licenses for the use of patents, knowledge and technical assistance granted by Continental Can and referring to manufacturing techniques, the sale of packaging and closing systems, or the construction of the corresponding machinery. The licensee could sell their production outside their territory, but was generally required not to do so, unless given permission from Continental Can (*Journal Officiel des Communautés Européennes*: 8.1.72 - 17/25)

The existence of a highly concentrated industrial structure subordinated to the large multinational companies in Europe conditioned, from the economic outset, the evolution of the Spanish packaging industry. As we have seen, the metalgraphic industry was fully aware of the consequences of the “technological blackout of Francoism” (Fernández Prieto 2007), which had dismantled the canning sector and its auxiliary industry. Thus, from the end of the 1950s, it insistently demanded solutions regarding the obsolescence of its lithography and packaging production equipment, concessions of industrial credits under favourable conditions, access to patents for foreign machinery for its manufacture in Spain, and security in the supply of raw materials.

From the mid-1950s, the permits for the creation of new metalgraphic companies have caused great unease in the sector as they are “a protective dependency of the Presidency of the Government”, being linked to the provincial development plans of Badajoz and Jaén, favoured in the delivery of quotas of raw materials and attracting skilled labour from other establishments. First, it was that of Felipe Corchero Jiménez, located in Las Vegas Bajas del Guadiana for the production of canned vegetables and integrated into the INI in 1961 (Barciela, López and Melgarejo 1998; 2004); later, Oleometalgrafica del Sur SA (Olmesa), located in Linares, with a capital investment of seventeen million pesetas, dedicated to lithography and the manufacture of containers for olive oil and olives (BOE, 26-I-1955; 21-V-1956; Gallego 2012). This discomfort evidenced the great rigidity in which the activity developed, with insufficient allocations of tinsplate, varnishes or inks, and an interventionist industrial policy that limited its development by restricting the granting of foreign exchange and import permits for machinery essential for the modernization of its processes.⁶

After the promulgation of the Stabilization Plan in 1959, the change in the economic climate highlighted the possibilities of sector expansion. Many

6. AME, 23-3-1958; AME, 17-12-1956.

metalgraphic companies, aware of the benefits derived from the liberalization of the tins trade, expected not only an “increase in the consumption of tins packaging which would compensate for the withdrawal of the first phase of stabilization”, but also saw as promising signs the “intentions of foreign firms to establish themselves in Spain”.⁷ However, the new economic policy also illustrated the problem of the small size of Spanish industrial enterprises. Starting from the basis that limited business size prevented economies of scale and significant cost reductions, penalizing productivity and competitiveness, the State intervened to increase their size through concentration processes (Buesa and Pires 2002; Braña et al. 1984, pp. 164-167). In the case of the metalgraphic activity, this implied a radical transformation in its industrial structure, which had remained almost unchanged since the first third of the 20th century. For businessmen, this process of concentration required a triple-action approach: firstly, economic aid for the renovation of machinery, low-interest loans, access to essential foreign currency, and reduction of tariffs on equipment; secondly, a guaranteed supply of raw materials, and, finally, standardization of packaging formats, because, although the canners considered them a differentiating brand element, they constituted a roadblock to the rationalization of production (Massó 1967; Enseñat 1964; Pérez de Zabala 1971).

The packaging manufacturers were pressured by the process of economic liberalization and the State’s permissiveness with foreign interests, whose presence was becoming more and more intense. In this regard, various authors point to the strengthening of technological entry flows and the promotion of endogenous capacities as useful tools for the catch-up processes undertaken by developing countries (Fan and Watanabe 2006). This was verified in 1959 with the concession of the extension of Olmesa (BOE, 26-I-1959). The company increased its capital to seventy-five million pesetas, with the participation of the Continental Can Company, Carnaud & Forges de Basse-Indre, Metal Box and International Machinery Corporation of Belgium, which also provided licenses and technical assistance. The new plant, inaugurated in 1961, had packaging manufacturing machinery using continuous and semi-continuous processes and modern offset lithograph procedures, capable of printing 15,000 tin plates per hour. Among its objectives was the production of glass containers with “Twist-Off” caps; precisely in order to standardize this type of packaging among canned vegetables, Olmesa set up, in association with Saint Gobain, the main glass producer in Spain, the International Packaging Company (Cidesa), with a plant in Quart de Poblet, Valencia (BOE, 27-IV-1961, Sánchez 2011). Its fully automated factory was considered the first of “large assembly lines” in the manufacture of

7. AME, 17-18-IX-1959; AME, 23-12-1959.

containers, with an annual production capacity of 100 million units (Pérez Buendía 1961).

The entry into Spain on the part of the large packaging multinationals had direct repercussions on the sector. On the one hand, it opened up a period of diffusion of new techniques and manufacturing processes, accompanied by the training of the corresponding technical personnel – a flow of engineers, chemists and qualified workers joined the continuous training teams of Continental Can, Carnaud and Metal Box (Pérez Buendía 1961). On the other hand, it inaugurated a profound transformation in the structure of the industry by integrating a whole series of small establishments. A second movement crystallized on 11 October 1961, when a group of fourteen large Galician canning companies formed, together with Etablissements J.J. Carnaud et Forges de Basse Indre, the company Carnaud-Galicia SA, with the aim of modernizing the production of packages (Desnøes, Gautier and Rousselot 1999; Hernández 1994).⁸ In fact, they stated that the main motivation consisted of greater productive efficiency and would allow unit costs to be reduced by not depending on the small workshops of each canning company, and economies of scale would increase, assuming the renovation of industrial equipment.

The initial capital was set at 44 million pesetas, with 66% contributed by canners and the rest by Carnaud et Forges de Basse-Indre, whose participation became the majority four years later (Doval 1994, pp. 378). The plant project contemplated an annual production volume of one hundred million club-type, rectangular, and oval cans, that is, the most common, with a *decolage* opening system. This step involved greater modularization or standardization of the value chain, since a large part of the knowledge was likely to be codified through technology transfer channels (purchase of machinery and technical assistance) and local production capacities, taking into account the moderate complexity of the products produced (Gereffi, Humphrey and Sturgeon 2005). The main canning workshops in Vigo transferred their workers to the new facilities, while Carnaud provided two modern automatic lines, with a production capacity of 190 cans per minute, which soon increased to 220, quadrupling that of the old Lubin trains from the canners (Carmona 2011; Costas 2011; Leiceaga 1993, pp. 29-31).

In 1966, its production of cans reached two hundred million, compared to the fifteen million produced by the other three existing metalgraphic com-

8. Associated canning companies were Bernardo Alfigeme SA; Hijos de Carlos Albo SA, Gándara y Haz, SA; Thenaisie Provoté SA; Comercial Vigo SA; Conservas Cerqueira SA; J.L. Valcárcel SA; JR Curbera SA; Massó Hermanos SA; Antonio Alonso SA; Figueroa y Cia SA; Conservas La Guía SA; Pita Hermanos SA y Daniel Vázquez. Some of the participating canning businessmen, in the case of Massó, maintained a direct relationship with Carnaud before and after the civil war (Muñoz 2010).

panies in Vigo, and grew in the following years: 331 million cans in 1969, and 450 in 1973 (Costas 2011, pp. 28). That year, its market share in canned fish packaging represented close to 60% of the Galician market and 50% of the Spanish market as a whole. Its production was destined mainly to the partners-customers themselves, who in 1969 accounted for 54% of the total, absorbing 30% from the Canary Islands market and the rest from other Spanish regions; in 1973 the partners still represented 45%, while the Canary Islands and the other regions shared the remaining percentage equally.

The need to lithograph tinplate led Carnaud-Galicia to establish a supply agreement with La Artística SA., which found in it “a new client for our lithography section and one of considerable importance”.⁹ The strong growth in production and the fact that more than two thirds of the lithograph production of La Artística was destined for Carnaud, prompted, in 1970, the creation of a joint company between La Artística SA and J.J. Carnaud-Forges de Basse Indre, called La Artística-Carnaud SA Lithograph (Artiscar SA). Most of its capital (50 million pesetas) remained in the hands of La Artística SA (84%) and the rest in the hands of Carnaud, who provided the photo-mechanical and metal printing techniques used in France and the essential technical assistance.

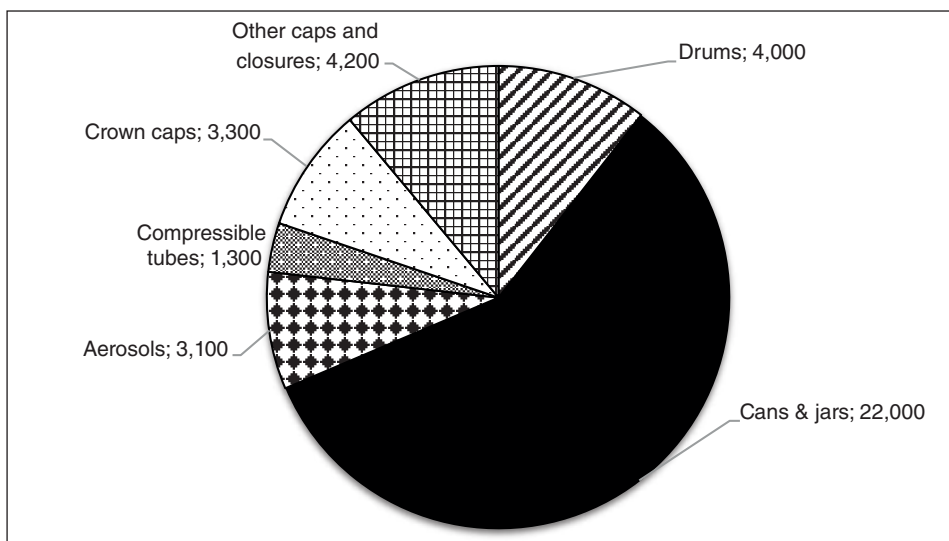
The data from the Servicio Sindical de Estadística (1972) allow us to estimate the situation of the metalgraphic industry at the beginning of the 1970s. This inventory poses significant problems when analyzing the size and concentration of companies, since it only records the name, location and number of workers, and does not indicate anything regarding sales or capital, nor about companies with several plants. All in all, it shows us how, out of 44 registered companies, 10 of them (23%) had between 200 and 550 workers, another 21 (48%) had between 100 and 199, and 13 (30%) had between 50 and 99.

That being the case, at the beginning of the 1970s, a continuous process of concentration began. In 1972, Olmesa, which headed the sector ranking with 937 workers and an income of 825 million pesetas, was absorbed by Cidesa, which went on to have 1,077 workers and 1,076 million income. The process culminated in 1974 with the merger of Carnaud-Galicia, with 482 workers in its workforce and 960 million in revenue, with Cidesa, giving birth to Envases Carnaud SA, the main metal packaging company in Spain (Envases Carnaud 1975). Almost 80% of its capital was in the hands of the large companies that dominated European markets: Carnaud et Forges de Basse Indre, Continental Can, Metal Box and Otto Wollfag (Roldán and Serrano 1978, pp. 397). This facilitated the merger and also gave it a strong capitalization, while allowing greater automation and access to the most modern technolo-

9. ALA, 4-IV-1962.

gies.¹⁰ Its expansion strategy followed the pattern of the large companies, multiplying its facilities, and placing them in close proximity to areas of consumption due to the high cost of transporting empty containers. Its five plants, in Valencia, Linares, Seville, Logroño and Vigo, operated in the main segments of the packaging market: cans for canned vegetables and fish, general cans, beverages, aerosols, “Twist-Off” caps and crown caps.¹¹ In 1974, with 1,577 workers, it was the leading consumer of tinfoil in Spain, transforming 60,000 tons per year, with growing sales of 2,327 million pesetas in 1973, 3,297 million in 1974 and 3,889 million in 1976. Envases Carnaud SA became the main Spanish metal products packaging company, both heavy and light, the main production of the sector in Spain (Figure 1).

FIGURE 1 • Production of the metal packaging industry in 1979 (millions of pesetas)



Source: AME (1980).

Thus, driven by foreign capital from the large multinational packaging companies, a process of business concentration took place. If in 1970 it could be stated that “just nine or ten companies produced around 70% of the containers” (Pérez de Zabalza 1971),¹² by the end of the decade the concentration

10. In 1974 they installed “the first easy-open lids equipment in Vigo; an assembly line for a new type of lid for baby food in Seville, and a new line of aerosols in Valencia”, while working on a new factory in Logroño (Envases Carnaud 1975).

11. AME (1980).

12. Other multinationals also participated in the light packaging segment. Thus, Metalinas SA, the main manufacturer of crown corks, was formed from the alliance of various in-

had increased: although the sector was made up of 90 companies, four of them represented 40% of the total; a concentration highlighted by the fragmentation of the market derived from its productive specialization (Table 1).

TABLE 1 - *Leading metal packaging companies in 1979*

	Sales	Workforce	number of Plants	Production
Envases Carnaud SA	8,725	1,850	5	Cans, jars and varied production
Femba, SA	2,400	400	7	Drums
Metalinas SA	1,700	350	2	Crown caps and aerosols
Llamas SA	1,400	350	1	Cans, jars and crown caps

Source: AME (1980).

However, despite the increased concentration of the metal packaging industry, in terms of employment, the size of the workforce is far removed from that of the main countries. Table 2 reveals how Spanish companies were limited in size. In fact, the first quartile does not exceed 92 employees, less than half that of the other countries; the median is also well below the others, the same as the third quartile, which is not even half of the first quartile of Germany or the United States, and less than a quarter of that of Great Britain. This sizing is related to the smaller size of the market, the regional productive specialization, the lower technological level and the possibilities of transport.

dustrialists with Crown Cork & Seal, one of the main North American packaging companies, with its Spanish subsidiary Corchera Internacional SA (García Ruiz 2003; Álvaro Moya 2012, pp. 52). Femba SA, a leading company in the production of drums, owned by the North American Rheem Manufacturing Co. W.R. Grace, with 246 employees and belonging to the chemical industry, also one of the world's leading producers of sealing compounds for tinplate containers and as we will see, fundamental in the Spanish market. American Can, another of the largest American companies, participated with a substantial percentage (33%) in Tuboplast Hispania SA, dedicated to the production of plastic tubes for toothpaste, cosmetics, etc., being the majority in Europack SA, dedicated to packaging of paper and paperboard.

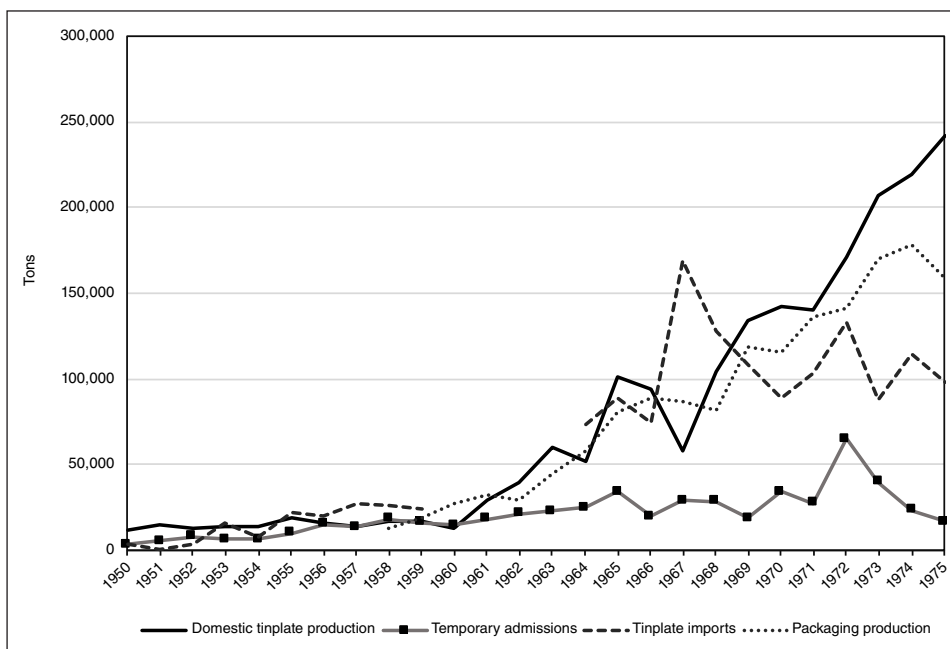
TABLE 2 - *Plant sizes in the metal container manufacturing industry according to number of employees in 1970*

	Great Britain	Germany	United States	Spain
First quartile	410	190	200	92
Median	730	440	430	119
Third quartile	1,100	910	810	179

Source: Own work based on Wagner (1980) and Servicio Sindical de Estadística (1972).

To a large extent, the changes in the metalgraphic industry were conditioned by the availability of tinplate. In the 1960s, its supply increased when coke tinplate, produced hot and in packages, was replaced by electrolytic tinplate, produced in coils, which provided substantial technical advantages to the manufacture of containers and substantially lowered its price (McKie 1959, pp. 270-274; López Capont 1958). After 1964, the inauguration of new cold rolling mills and systems by Altos Hornos de Vizcaya made it possible to produce large quantities of coils destined for the manufacture of tinplate through the electrolytic tin plating process, whose demand grew strongly. Later, other companies, such as Esteban Orbeagozo, would also incorporate hot

FIGURE 2 - *Tinplate availabilities in Spain*



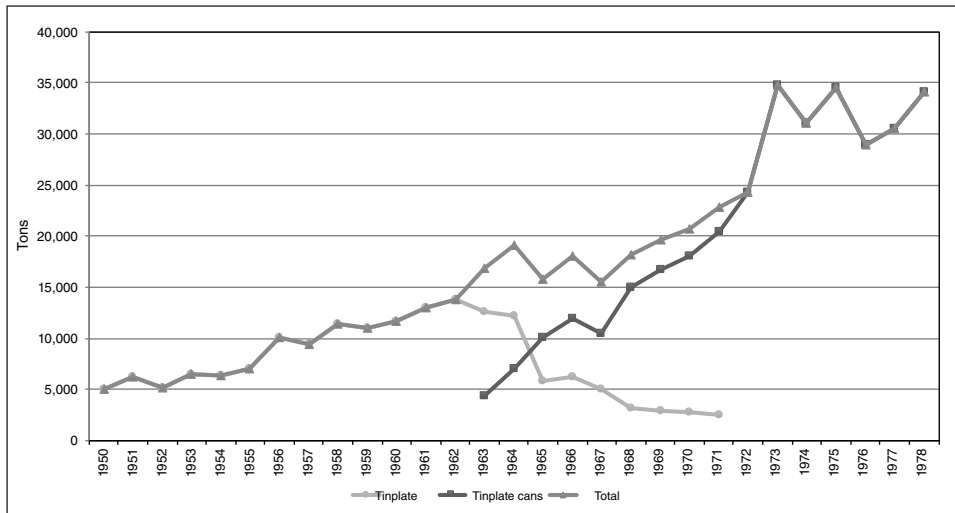
Source: INE (1939-1980) and Dirección General de Aduanas (several years).

and cold rolling mills into their facilities, intended for the production of tinfoil.¹³

Tinplate supply increased from the early 1960s. However, the growing national production was unable to supply the intense expansion in demand, forcing companies to resort to large imports that were only curtailed at the end of the decade, when domestic production increased.

The publication *Fishery derived industries (FDI)* compiled the tons of “Tinplate” and “Tinplate containers” consumed (Figure 3), allowing us to see how the consumption of raw tinplate collapsed around the beginning of the 1960s, with packaging containers taking off. That is to say, it reflects how canners stopped buying tinplate sheets to transform them in their workshops, and went on to acquiring pre-manufactured containers. There was a progressive disappearance of the vacuum sections in the canning factories that allowed the canners to outsource the production of cans and free up resources (Escudero and López Losa 2011; Muñoz 2010; López Losa 1997).

FIGURE 3 • Tinplate and tinplate containers consumed by the fish canning industry in Spain



Source: INE (1939-1980), INE (1953-1978).

Fundamental to this transformation was the increase in supply, which affected all regions. In the case of Galicia, the same process is observed. On the one hand, the arrival of Carnaud, with a progressive increase in its automated production lines in the most demanded of formats, and, on the other, the

13. Consejo de Minería de España (several years); Hoare (1965); AME (1985).

construction of new plants: in 1961, Metalgrafica Malagueña SA was set up in Vilagarcía de Arousa; in 1963, various canners from the Ría de Arousa created Talleres Envases Reunidos Sociedad Anónima (Tersa), in Santa Uxía de Ribeira, and, in 1965, Metalgrafica Látex began operating in A Coruña. Finally, the existing companies (La Artística SA, La Metalúrgica y Núñez, in Vigo, and La Artística-Suárez Pumariega in A Coruña) undertook the renovation of their means of production.

The increase in supply gave rise to intense competition, rendering price agreements useless.¹⁴ However, this did not cause an immediate closure of metalgraphic companies, thanks to the increase in the demand for containers, the increase in canning production and the prices of tinplate containers, and also due to their scant normalization. In fact, canned food was characterized as being packaged “with complete freedom, in accordance with business initiative, in a multitude of containers” (Pérez de Zabalza 1971, pp. 95). The standardization process was an old request from certain industrial and business organizations in the sector, as it would allow packaging manufacturers to increase the magnitude of production, resulting in a reduction in costs and the “possibility of having packaging at lower prices” (Pérez de Zabalza 1971, pp. 95).

At the same time, greater transparency could be obtained in the offer, a key issue in a situation of the return of Spanish canned food to international markets. In fact, the decree on “standardization of canned and semi-preserved fish containers” (BOE, 7-II-1966) recalls the importance not only of obtaining “advantages in cost reduction”, but also in improving the “labeling” and “names of contents of containers”.

Large organizations soon specialized in a few types of packaging produced in large quantities. The rest of the formats remained for the rest of the companies, which by improving their equipment were able to survive given a more diversified product base. However, the trend was towards the reduction of formats and automation of processes.

4. W.R. Grace and La Artística SA: liquid rubber and its diffusion in Spain

In the different phases of the construction of tin cans, the union of the welded bodies with bottoms and lids by means of sewing, constituted one of the most delicate since it required a mastic rubber ring to guarantee the hermetic nature of the container. Its elaboration was carried out mechanically by means of a mixture of natural rubber, without vulcanizing, and an inor-

14. AME, 22-III-1964; AME, 29-X-1964.

ganic filler. These rings were bulky, difficult to place, sensitive to aging and did not always ensure complete sealing of the container (Hernández 1994, pp. 59). However, from the end of the 19th century, the evolution of rubber underwent a substantial improvement after the appearance of the so-called “liquid rubber” in the United States. Its invention and improvement are related to the North American chemical company Delwey & Almy, which began manufacture in 1919 of rubber-based products for the packaging industry to replace lead solder: adhesives, dispersants, sealing compounds in liquid form and vulcanizing cements. Later, in 1954, it was acquired by W.R. Grace.¹⁵ In the 1920s it arrived in Europe imported by Carnaud, but the skill required in sewing delayed its diffusion until the following decade. It was then that the first machines that used it arrived in Galicia, thanks to Alonarti SA and the canning company Massó Hermanos. The war events in Spain and Europe and the subsequent post-war period interrupted its diffusion and with it the possibility of obtaining high production rates (Pearson 2016, pp. 169-171; Hernández 1994, pp. 59; Giráldez 2010).

It was not until the end of the 1950s that liquid rubber began to spread in Spain, a product based on a colloidal dispersion of natural or synthetic rubber in an aqueous medium, subsequently stabilized by means of various additives. Its application was made on the border of the lid or bottom to be sewn, either by mechanical injection, or by the buffering system, then placed in an oven to dry. This system made it possible to automate the gluing procedure, save work and considerably increase productivity in the construction of the container and its closure. By applying it to the entire edge of the lid, not only to the top as in the case of rings, it obtained greater tightness in the closure. In addition, its smaller volume, the greater uniformity of the gasket, its insolubility in oil, resistance to attacks by various liquids and acids and its lesser aging made it more resistant to the alterations caused by the substances contained in the can and offered a greater safety for preserved foods. And, since it was intended for the closure of food packaging, the packaged product should not extract anything from the applied rubber, so it had to be “neutral”; this required a “continuous control” of its quality, dosage, storage, application and drying. In fact, liquid rubber was and is a key input in the process of automating the manufacture of containers and the closing of cans. It is a technological innovation located at an inter-industry level, closely related to certain branches of the chemical industry and the capital goods production sector (Rosenberg 1993); and an intermediate input that

15. Its penetration in Spain from the 1960s responded mainly to the need to supply the large packaging production centers in Spain, of which it was a supplier and collaborated with its parent companies in the European market. Likewise, this strategy was driven by the need to expand the market for its new plastic materials.

allowed increased productivity both in the manufacture of packaging and in the canning industries as a whole. Hence, we can consider its diffusion as an indicator of technical change in both sectors, which reflects the importance of economies of scale.

La Artística SA, one of the main manufacturers of mastic rings for the canning industry, began to feel the competition of liquid rubber in the Portuguese market, where it had had a factory since the end of the 1920s (Giráldez 2010). Since 1953, liquid rubber had been revealed as a clear threat; that year they already observed its use “in some canning factories and packaging production workshops” and in the following years they confirmed that their “most important clients have decided on liquid rubber”. In subsequent years, sales of rubber rings fell steadily.¹⁶ As Langlois and Robertson (2000, pp. 78-79) point out, the stages of maturity and decline in the life cycle of a product are perceived not so much by the consumer as by the manufacturers of individual inputs, making it difficult for them to maintain their leadership in moments of significant change. In this sense, Menzel and Fornahl (2009) underscore the need to adapt technological trajectories, in order to avoid a sector decline derived from a lock-in process, based on the dependence of a small number of sources of knowledge. The innovative process of La Artística in relation to the adoption of liquid rubber through collaboration with international suppliers is a good example of this strategy, which resulted in a renewal and strengthening of its business.

The diffusion of liquid rubber in Spain was delayed due to greater isolation from the international market. Difficulties in importing and the lack of renovation of the canning industry’s industrial equipment made it possible to continue maintaining the mastic ring market, giving La Artística precious time to develop the new sealing rubber. The first trials at the Vigo factory began in 1955, but the local production fabric showed a total lack of capacity to assimilate this technical innovation. This prompted La Artística to establish a pattern of innovation, following Pavitt’s taxonomy (1984), based on suppliers (mainly capital goods), initiating a close collaboration to research the dispersion of rubber in water. Thus, a learning pattern based on experimentation with suppliers was established, constituting another way of gaining knowledge based on the dynamics of learning-by-doing (Bell 1984; Kristinsson and Rao 2008).

The task was not easy given its technical complexity, inexperience in the techniques of colloid dispersion of rubber in water and, above all, due to the lack of experimental laboratory machines, materials and products in Spain. This brought about the decision to transfer the work abroad through Baker Perkins, an American company that produces machinery for the food

16. ALA, 7-III-1954; 19-IV-1959.

industry, with plants in the United Kingdom (Muir 1968). The Vice Manager of La Artística went to the company's headquarters, in Michigan, to visit its facilities, review its operations and purchase a suitable colloid disperser. Meanwhile, the company's chemist and Baker Perkins' technicians carried out laboratory work in London; relationships with colleagues from various British companies allowed him access to the "National College of Rubber Technology", where he was able to obtain the base products and the necessary materials to carry out the rubber dispersion tests in water. On 4 May 1956, he recorded the success of the experiments.¹⁷

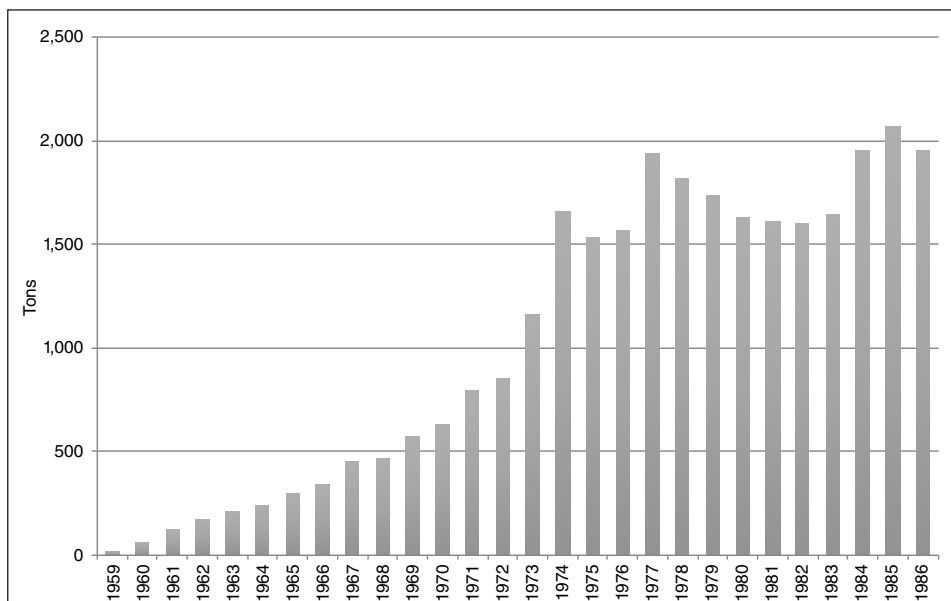
For its part, the trip to the Baker Perkins headquarters was only a partial success; the machine tests were satisfactory, but it was discovered that the company's chemists lacked the necessary experience with dispersions of the type of synthetic rubber that La Artística required. By the end of 1956 the results had improved, and, in 1957, they were able to sell small quantities for experimental purposes. Nevertheless, its production and industrial diffusion raised the need to have injection machines for the application of liquid rubber. For this reason, technicians from the engineering department of its machinery construction subsidiary, Alonarti SA, visited different European businesses, including Carnaud, to learn about existing machinery for handling, applying, and drying liquid rubber. In 1958, they presented the first machine with a gumming capacity of 60 caps per minute; soon manufacturing continuous ovens for drying bottoms were built.

The production of liquid rubber began to take off in the early 1960s, both for round containers, put into place by means of injectors, as well as for rectangular and oval containers, assembled by means of the buffering system. At the same time, they were complemented by the production of flux materials, salts and fluxes for soldering tinplate, lubricants for punching, and so on. Although its manufacture was reinforced with imported equipment, its diffusion depended on "the canning industry modifying its facilities to be able to use this gumming system".¹⁸ In the following years, the growth of the production of liquid rubber was continual (Figure 4).

The technical development of liquid rubber by La Artística SA, prior to the establishment of Grace in Spain, allowed it to argue against its request to operate. First, because there was already a national manufacturer of liquid rubber, with sufficient capacity to supply the national market and even to direct part of it to exports. Second, due to the limitation of the market, since it being a product that could be manufactured with few mechanical elements

17. La Artística Productos Químicos SAU. (hereafter LAPQ). Miscellaneous folders: Chemistry Session.

18. ALA, 15-V-1959; Minutes of the Board of Directors and General Meeting of Talleres Mecánicos Alonarti SA (hereafter ALO), 10-V-1959.

FIGURE 4 • Sales of liquid rubber by La Artística SA

Source: own elaboration LAPQ, diverse folders.

meant that in almost all countries there were barely one or two factories dedicated to its production. Thirdly, because of the quality of national production, which were similar to Grace's, this allowed it to compete in Portugal, where they had a large market share. Fourth, due to the recent importation of machinery which ensured sufficient capacity to supply the future of the national market. Fifth, for the other products offered by the company, such as flux materials or flux for welding, lubricants for stamping and punching, which they and other Spanish manufacturers produced, as well as sealing compounds, liquid rubber variants for glass knobs, bottles, barrels or drums. Sixth, because they provided a free technical service like the one offered by the Americans. Finally, because in Spain there were various manufacturers of machinery to apply sealing articles and ovens for drying, since "any workshop can manufacture them and whose design is practically universal".¹⁹

These allegations reflected the orientation of the chemical section of La Artística towards new techniques required by the automation processes of canning, but they did not prevent the arrival of Grace, which began its production in 1962. The obstacles that La Artística faced in order to compete in a rapidly growing market were multiple. On the one hand, the economies of scale in production, research, related diversification, marketing and after-sales

19. ALA. Folder allegations to the installation of W.R. Grace (January 1961).

service. On the other, more unfavourable costs due to disadvantages in the learning and experience curve. Finally, due to a question of brand or product differentiation, with Grace being the dominant company in the production of liquid rubber (Porter 1999, pp. 26-32).

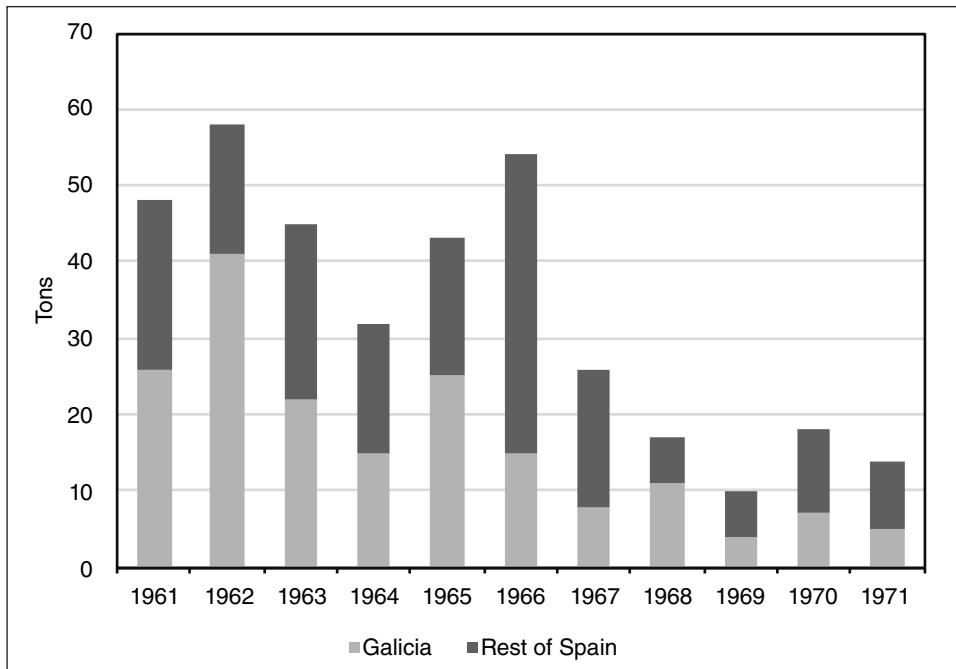
All in all, La Artística did not take long to exhibit signs of its competitive capacity. New directors agreed to take on management roles and undertook profound changes in the administration of the business. They also hired a new chemist with extensive work experience in liquid rubber acquired from the French factory of Grace. The new formulas that he developed allowed the company to diversify its manufacturing range, from canned food to aerosols for insecticides, deodorants, lacquers, spots for crown caps, etc., products that experienced strong growth in Spain in the 1960s. This forced them to purchase equipment with greater capacity and to refurbish all their facilities. At the same time, taking advantage of their knowledge of the market and their close relationships with their customers, they intensified their commercial activity, focused on the main areas of consumption, and personalized attention and the resolution of after-sales problems. In this sense, it should be emphasized that the application of liquid rubber was carried out in each company with machinery from different manufacturers which was not interchangeable, and which increased the importance of after-sales service. At the same time, they closely monitored the productive and commercial activities of their competitor through industrial espionage.²⁰

The decline in demand for mastic rings in the canning industry and the spread of liquid rubber ran parallel to the changes in its organization. Figure 5 shows how the use of mastic rings steadily reduced throughout the 1960s, especially in Galicia, the main canning region for fish. A decline driven by the increase in direct consumption of containers and lids with liquid rubber by canning companies (Figure 6). The substitution of tinplate purchases for containers began in 1961, after the appearance of Carnaud, and continued over the following years. As early as 1959, La Artística dealt with a progressive decrease in its production of mastic rings, although, as they did not fail to point out, “as recompense we have the compensation in the manufacture and sale of liquid rubber”.²¹ Production was maintained until 1987, becoming less important year after year.

20. This included customs control of the products imported by Grace and the hiring of detectives to spy on the salespeople (LAPQ, Miscellaneous folders: Chemical Section).

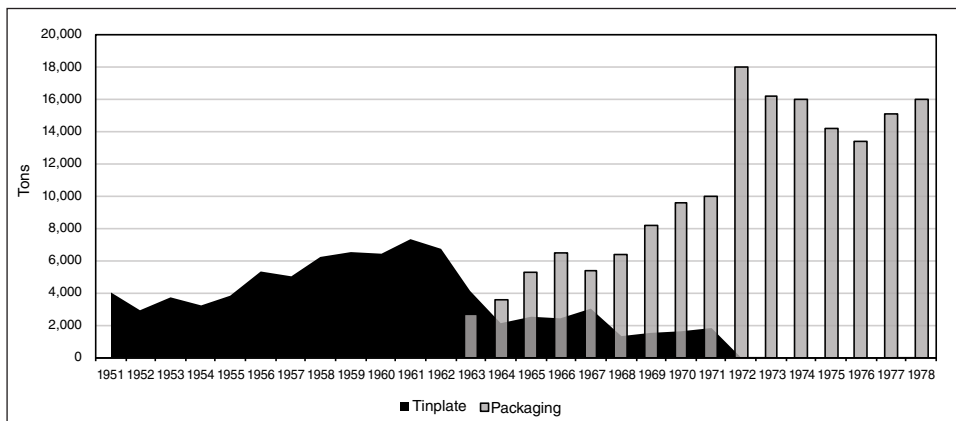
21. ALA, 1963.

FIGURE 5 • Mastic rings consumed in the fish canning industry



Source: INE (1939-1980), INE (1953-1978).

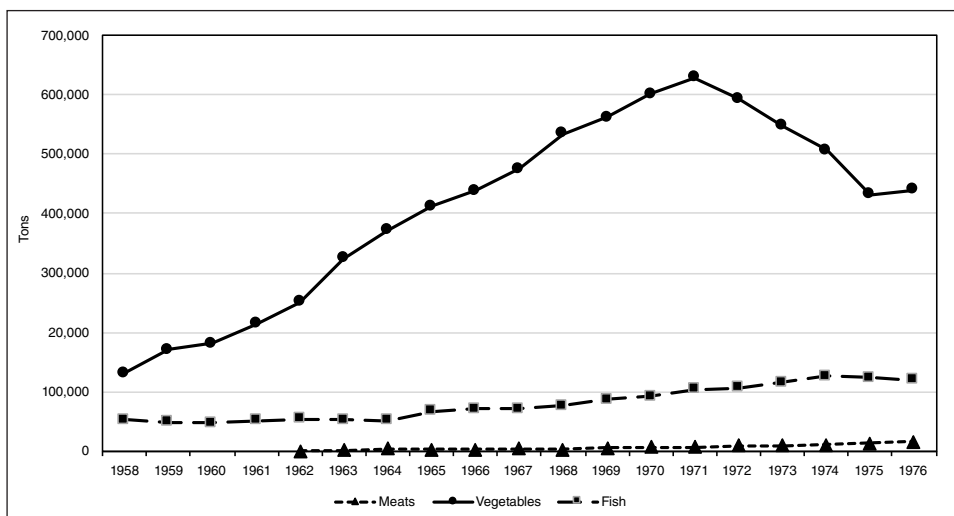
FIGURE 6 • Consumption of tinplate and packaging by the fish canning industry in Galicia



Source: INE (1939-1980), INE (1953-1978).

In short, in the first half of the 1960s, a large part of the canners who were faced with the dilemma of “producing or buying” containers, opted for the second option. The risk of the high initial investment in the new equipment meant that only an adequate annual production volume and regularity justified the integration of its production (Hession 1971, pp. 314-315). The purchase of containers from the metalgraphic companies became widespread, encouraged by close proximity to canning areas to avoid the problem of the cost of “empty” transport. In these early years, driven by the spread of the consumption of cans and the new containers for vegetable preserves, glass jars with rubberized tin lids, La Artística’s production of liquid rubber multiplied by ten. In 1965, according to a nominal list, its liquid rubber clients added up to thirty-two, which included all the Galician metal companies, the main Spanish ones and some large canning factories. Its main buyers were the vegetable canning industry in La Rioja and Murcia, with much more intense growth than the other branches of the canning industry (Figure 7). In Galicia, its importance was less. The situation in the fish canning industry was clearly adverse: “downtime in the industry was inevitable, specialization was impossible, production scales were reduced, and investment in capital goods was an adventure”. Only after the mid-1960s, the change in canned species opened up a more favourable situation for the sector and greater deseasonalization of the activity (Carmona 2017). Hence, the search for cost reductions, the displacement of demand for packaging towards the metalgraphic companies, a movement favoured by the advent of new enterprises in areas of great can-

FIGURE 7 • Canning production in Spain by large groups, 1958-1976



Source: INE (1939-1980).

ning activity, as in the case of the Arousa estuary. In fact, in Galicia, except for a few companies such as Massó, Calvo or Hermanos Valeiras, the main clients of La Artística's liquid rubber were the metalgraphic companies. Apart from Carnaud-Vigo, a firm closely linked to La Artística due to its lithography section and mutual clients, the main companies mass producing cans and jars in the rest of Spain had not yet begun to use its liquid rubber. In 1969, the areas of canned vegetables still maintained their importance, representing 50% of sales; in fact, only two firms, Derivados de Hojalata, in Murcia, and Hernández Pérez Hnos., in Molina de Segura, acquired 15% of the total, an amount greater than the consumption of Galicia.

In the second half of the 1960s, a very rapid change in packaging and its production techniques took place. The connection with the companies linked to the European oligopoly organized around Continental Can was made through Carnaud. The visit made in the last quarter of 1966 to the venues of this company in France and the tests carried out with rubber by La Artística led to the conclusions that: firstly, "all consumers of liquid rubber have a huge interest in having a second supplier"; secondly, "the packaging manufacturers are following the government policy that consists of a general grouping under the control of the main companies. At present, the French market is controlled by Carnaud and Ferembal, with B.M.A. being independent and Embamet, although with capital des Forges de Basse-Indre", and thirdly, "according to the manufacturers, this grouping will affect Spain and Portugal in a few years".²²

The new framework responded to the policy implemented after the creation of the European Common Market that prohibited monopolies, but which was also induced by the large companies seeking to clean up the market, avoid excessive competition and slow down the fall in prices. In addition, they sought to better face the pressure of the American multinationals (Continental Can and American Can) in their expansion strategy in Europe, while promoting the development of their own European technology, especially the Carnaud and MetalBox groups (Reader 1976, pp. 92; Hernández 1994, pp. 80-82). In fact, from 1969 onwards, the agreements between Carnaud and Continental Can began to weaken; the financial compensation required by the American partners became an excessive burden, as they did not provide the new techniques required by the changes in the packaging market, especially beverage cans.²³

22. LAPQ, Miscellaneous folders: Chemical Section.

23. However, only the break with Continental Can at the end of the seventies allowed the consolidation of a strong alliance between Carnaud and MetalBox. Carnaud needed a partner on a European scale to access new technologies, in particular beverage cans produced by the draw-drawing system. The break with Continental Can allowed them to create Carnaud Emballage; Carnaud holding, with 80% of the capital, reserved the European market while

In the second half of the 1960s, La Artística normalized its contacts with Carnaud, Ferembal, until 1989 technically linked to the American Can Company, and other European companies to understand the problems posed by the use of its rubber, the difficulties of its adaptation to different machinery, and the training required by the workers at the different plants.²⁴ These relationships already included various Grace chemists, with whom they dealt with matters relating to rubber, varnishes, etc. The preserved correspondence shows that, in addition, La Artística benefited from technology transfer from the main company through the groups allied to Continental Can, given that we must believe that the Carnaud group worked with its licenses.

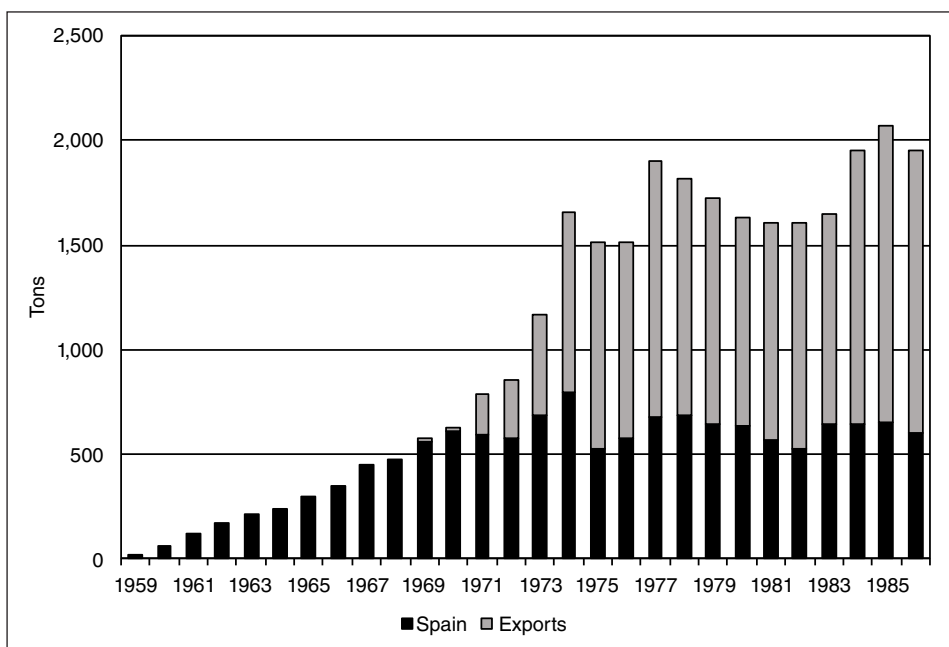
Continental Can and Metal Box operated in Europe participating in different national companies and were at the head of a group of companies that were intricately interrelated. In fact, in March 1962, J.A. Schmalbach AG, Thomassen & Drijver and Sobemi, Superbox and Carnaud jointly set up a company in Paris called Europemballage SA, considered to be the European holding company for Continental Can, although each with indirect links to Metal Box. However, by the end of 1969, under application of the antitrust legislation of the EEC, Europemballage had to stop activities, being declared illegal in 1972 (Reader 1976, pp. 201; Wagner 1980; Journal Officiel des Communautés Européennes 1972).

This initiative and the common market policy of stimulating competition forced American companies to rethink their strategy in Europe. Allies became competitors and European companies began various actions to prevent the penetration of larger companies, while the division of the French market between Carnaud and Ferembal remained. The concentration process favoured canners who tended to be linked to one single supplier. These changes also affected La Artística. The importance of the Spanish regions in which its liquid rubber had taken off declined compared to foreign markets; the crisis that began in 1973 in Murcian canned vegetables, which lasted well into the 1980s, had a direct impact on the sales of La Artística (Manzanares 2003).

Undoubtedly, the link to the largest European companies at a time of transformation of the structure of the packaging container industry in Europe contributed to the internationalization process of La Artística (Figure 8). Sales to Europe exceeded half its sales in 1974, later reaching between 60% and 70%. As we have already pointed out, the main clients of La Artística were Carnaud and Ferembal. However, from that moment in time the intense expansion process of Carnaud, after the acquisition of different

MetalBox, with a contribution of 20%, developed in the rest of the world. In 1979 it installed a line of beverage cans in Spain (Hernández 1994, pp. 91).

24. In the 1960s and 1970s, Ferembal rationalized its plants in France and gained a larger share of the European market through various mergers and acquisitions (Hernández 1994, pp. 94).

FIGURE 8 • *Distribution of liquid rubber sales by La Artística*

Source: LAPQ, various folders.

companies, and the growth of Ferembal, with the creation of new plants in France and the takeover of others in Italy, increased its demand.²⁵ In La Artística's client lists, these two companies are seen boosting sales, representing year after year over a third of the total. Keep in mind, these percentages do not include all the companies in the group, if they bought directly or because they were subsidiaries located outside of France. In any event, the connection with the large European packaging groups and the specialization of La Artística in liquid food gum for canned fish, vegetables or juices was decisive for its diffusion in the Carnaud plants located in the former French colonies: Tunisia, Morocco, Senegal, Ivory Coast and Madagascar (Hernández 1994, pp. 73-74).

5. Conclusions

From the end of the 1950s, the Scientific Organization of Labour began to spread in the Galician canning industry – the most important area in Spain

25. In 1972, Boîte Métallique d'Arvor (BMA) became a subsidiary of Carnaud and that same year acquired Wendel's shares in the Roux de Brive company; finally, in 1977, it acquired the Belgian company Eurocan, which also supplied the markets of Holland, France and Germany.

concerning such production. The rationalization of work processes was presented as an essential objective to increase its competitiveness. Greater business control of the production process led to the implementation of new organizational methods, which contributed to increased productivity and reduced labour costs. The rationalization of labour, with the simplification of operating modes, meant an elimination of downtime and an intensification of work rhythm based on the cadence of the machines (Muñoz 2010). Companies supplying capital goods contributed to increased productivity, allowing a greater degree of mechanization of production by eliminating manual tasks (Rosenberg 1993, pp. 83). In this sense, the metalgraphic companies played an essential role by lowering the price of packaging, one of the main cost items of preserves.

The pressure for economies of scale came at a time of opening up in the Spanish economy. The liberalization of foreign trade allowed the importation of energy products, raw materials and capital goods, while profound changes in foreign investment regulations favoured a massive inflow of capital and new techniques. The changes in economic policy encouraged an accelerated process of structural change, which translated into a profound industrial modernization. Foreign companies, with their technological innovations, burst into various sectors, and the packaging sector was no exception. The incorporation of multinationals linked to the world oligopoly of package container production was favoured by the State, which helped spread new production technologies at low unit costs due to their large-scale production methods. The creation of joint ventures between foreign companies and Spanish businessmen was decisive in their market dominance strategy. In fact, it has been pointed out how the Spanish partners, in exchange for financial and technological support, facilitated their access to the local market (Álvaro Moya 2012, pp. 83); the case of Carnaud-Galicia being a good example.

Driven by the construction of the new plants, the structure of the metalgraphic industry was transformed into one of dual configuration (Piore and Sabel 1990). On the one hand, a group of “large and medium-sized companies” that, seeking to reduce unit costs and obtain economies of scale throughout the value chain, used the most advanced technology of continuous performance, were owned by foreign capital and benefited from their technology transfer. On the other hand, the vast majority of companies, with “out-dated” equipment, maintained a production system in batches or small assembly lines. Contributing to the latter’s survival were, on the one hand, the poor standardization of packaging, which maintained a market for small scale manufacturing, and, on the other hand, the increase in demand and prices, which sustained production by these firms in peaks of activity in the canneries. This pattern was due to the concentration of raw material, and, finally,

the continuance of the local manufacture of cans, due to the problems and savings in delivery costs, which furthered the concentration of metalgraphic companies in the main market areas.²⁶

In this regard, the increase in productivity and the reduction of costs in the canning industry cannot be evaluated without taking into account the relationships established with its auxiliary industries, among which the metalgraphic industry is situated. The spread of liquid rubber in the manufacture and closure of containers, which allowed greater sealing and preservation of the content, reflect this type of inter-industrial relations that drove the inseparable technological changes and reorganization of work. The product innovation that led to the development of liquid rubber by La Artística SA constitutes a clear example of the need to incorporate a technology that spread in Europe after World War II. At the same time, it shows the business effort to compete with the leading companies, despite the limitations in terms of availability of inputs or absorption capacity of the market; in fact, the weak demand from the Galician canning industry, its main market, forced its orientation towards that of canned vegetables, a branch in rapid expansion.

The development of liquid rubber by La Artística could be considered a minor innovation in the process of technological change, as it is an intermediate input located in an intersectional sphere. However, its adoption demonstrates the importance of applied research work oriented towards “achieving improvements and adaptations of processes and products” and its role in innovation (Braña et al. 1984, pp. 266). The capacity to assimilate and improve technologies incorporated into imported capital goods has been pointed out precisely as one of the “traditional sources of innovation in Spanish industry” (Barceló and Solé 1993). However, it also required certain strengths, from the point of view of technical and strategic capacity or knowledge of the market. That is, an innovative effort, from whose learning qualitative changes were derived that generated export behaviours (Braña et al. 1984). As such, the relationships established by La Artística with the European packaging multinationals, linked to an international oligopoly, not only contributed to a continuous improvement of the product, but also to its internationalization process, when the expansion of domestic demand was reaching its limit.

26. AME (1980).

Acknowledgements

We thank the Romero Fadrique family and Teresa Ramos, as well as all the workers of La Artística SA for their support in the preparation of this work. We are grateful for the anonymous reviewers and the editorial team for their attentive reading and comments, which have undoubtedly contributed to improve the final version of this text. Errors and omissions are our sole responsibility. This work has been funded by the Ministerio de Ciencia, Innovación y Universidades de España, under the project entitled “Pesca, conserva y congelado: frontera. organización, instituciones y tecnología en la historia reciente de la pesca española” [HAR2017-881128-R], and for Xunta de Galicia, Consolidación y Estructuración de Unidades de Investigación Competitivas, project ED431B 2019/31.

Author contribution statement

Jesús Giráldez Rivero: framework, methodology, formal analysis, investigation, dataset, writing, visualization, supervision.

Pedro Varela-Vázquez: framework, methodology, writing, visualization, supervision.

References

- ÁLVARO MOYA, Adoración. 2012. *La inversión directa estadounidense en España. Un estudio desde la perspectiva empresarial (c. 1900-1975)*. Madrid: Banco de España.
- ASOCIACIÓN METALGRÁFICA ESPAÑOLA. 1980. ‘El sector de envases metálicos y la entrada de España en la Comunidad Económica Europea’. Mimeo.
- BARCELÓ, Miquel, and Francesc SOLÉ. 1993. ‘Epílogo: Algunas consideraciones sobre la Caja Negra Española’. In *Dentro de la caja negra: tecnología y economía*, edited by Nathan Rosemberg, 289-302. Barcelona: La Llar del Llibre.
- BARCIELA, Carlos, M^a Inmaculada LÓPEZ, and Joaquín MELGAREJO. 1998. ‘Autarquía e intervención: El fracaso de la vertiente industrial del Plan Badajoz’, *Revista de Historia Industrial*, 14: 125-171.
- BELL, Martin. 1984. ‘Learning and the accumulation of industrial technological capability in developing countries’. In *Technological capability in the third world*, edited by Martin Fransman and Kenneth King, 187-209. London: Macmillan.
- BOLETÍN OFICIAL DEL ESTADO (1959-1986). Madrid: Imprenta Nacional.
- BUESA, Mikel, and Luis E. PIRES. 2002. ‘Intervencionismo estatal durante el franquismo tardío: la regulación de la inversión industrial en España (1963-1980)’, *Revista de Historia Industrial*, 21: 159-198.

- BRAÑA, Francisco J., Mikel BUESA, and José MOLERO. 1984. *El Estado y el cambio tecnológico en la industrialización tardía. Un análisis del caso español*. Madrid: Fondo de Cultura Económica.
- CARMONA, Xoán. 2004. 'Desarrollo industrial y asociacionismo empresarial en la historia de la industria conservera gallega'. In *Cien años de unión conservera*, edited by Anfac, 91-132. Vigo: Asociación Nacional de Fabricantes de Conservas.
- CARMONA, Xoán. (ed.) 2011. *Las familias de la conserva*. Pontevedra: Anfac-Cecopesca and Deputación de Pontevedra.
- CARMONA, Xoán. 2017. 'Crisis, reconversión y concentración: la atunización de la industria española de conservas de pescado (1959-2007)', XII Congreso de la Asociación Española de Historia Económica (Salamanca).
- CARMONA, Xoán, and Ángel FERNÁNDEZ. 2001. 'Demografía y estructura empresarial en la industria gallega de conservas de pescado del siglo XX', VII Congreso de la Asociación Española de Historia Económica (Zaragoza).
- CARMONA, Xoán, and Jordi NADAL. 2005. *El empeño industrial de Galicia. 250 años de historia, 1750-2000*. A Coruña: Fundación Barrié de la Maza.
- Consejo DE MINERÍA DE ESPAÑA (several years). *Estadística Minera y Metalúrgica de España*. Madrid: Consejo de Minería de España.
- COSTAS, Javier. (coord). 2011. *1961-2011. De Carnaud a Crown Cork. 50 años haciendo latas*. Vigo: Instituto de Estudios Vigueses.
- DESNÖES, Claude, Raymond GAUTIER, and Pierre ROUSSELOT. 1999. *Basse-Indre, du fer puddlé aux aciers pour emballage*. Indre: Usinor.
- DIRECCIÓN GENERAL DE ADUANAS. 1939-1975. *Estadísticas Comercio Exterior de España (ECEE)*.
- DOVAL, Antonio. 1994. *Capital estranxeiro e empresas multinacionais en Galicia: 1906-1991*. Santiago: Xunta de Galicia
- ENSEÑAT, Alfonso. 1964. 'La industria de fabricación de botellas en España', *Economía Industrial*, 12: 129-158.
- ENVASES CARNAUD, SA. 1975. *Memoria ejercicio 1974*.
- ESCUADERO, Luis J., and Ernesto LÓPEZ LOSA. 2011. 'Los Serrats. El triunfo del esfuerzo'. In *Las familias de la conserva. El sector de las conservas de pescados a través de sus sagas familiares*, edited by Xoán Carmona, 220-245. Pontevedra: Anfac-Cecopesca and Deputación de Pontevedra.
- FERNÁNDEZ LEICEAGA, Xoaquín. 1993. *Capital estranxeiro e industrialización en Galicia*. Vigo: Xerais.
- FERNÁNDEZ PRIETO, Lourenzo. 2007. *El apagón tecnológico del franquismo. Estado e innovación en la agricultura española del siglo XX*. Valencia: Tirant lo Blanch.
- GALLEGO, Vicente. 2012. *El Plan Jaén de 1953 y sus antecedentes: una oportunidad perdida para el desarrollo de la provincia de Jaén en el siglo XX*. Jaén: Universidad de Jaén.
- GARCÍA RUIZ, José Luis. 2003. 'Estados Unidos y la transformación general de las empresas españolas', *Cuadernos de Historia Contemporánea*, 25: 131-153.

- GEREFFI, Gary, John HUMPHREY, and Timothy STURGEON. 2005. 'The governance of global value chains', *Review of International Political Economy*, 12: 78-104.
- GIRÁLDEZ, Jesús. 2010. 'Las empresas metalgráficas en Galicia (1890-1936)', *Investigaciones de Historia Económica*, 6 (17): 119-148.
- GIRÁLDEZ, Jesús, and Luisa MUÑOZ. 2007. 'Making cans for the fish canning industry', *Deutsches Schifffahrtsarchiv*, 30: 7-23.
- HERNÁNDEZ, Luis. 1994. *100 ans d'emballage métallique alimentaire. De Jules Joseph Carnaud à Carnaud Metalbox*. Nantes: Carnaud Metalbox,
- HENNART, Jean-François. 1986. 'Internalization in practice: Early foreign direct investments in Malaysian tin mining', *Journal International Business Studies*, 17 (2): 131-143.
- HESSION, Charles H. 1971. 'Metal container industry'. In *The Structure of American Industry*, edited by Walter Adams, 302-335. New York: Macmillan.
- HOARE, William, E. 1965. 'Tendencias y usos en la fabricación y usos de la hojalata'. Servicio Comercial Metalgráfico. Mimeo.
- INSTITUTO NACIONAL DE ESTADÍSTICA. 1939-1980. *Anuario Estadístico de España*. INE: Madrid.
- INSTITUTO NACIONAL DE ESTADÍSTICA. 1953-1978. *Estadísticas Industriales. Industrias Derivadas de la Pesca (1953-1978)*. INE: Madrid.
- JOURNAL OFFICIEL DES COMMUNAUTÉS EUROPÉENNES (8-I-1972). Décision de la Commission du 9 décembre 1971 relative à une procédure d'application de l'article 86 du traité CEE (IV/26811-Continental Can Company).
- KRISTINSSON, Kari, and Rekha RAO. 2008. 'Interactive learning or technology transfer as a way to catch-up? Analysing the wind industry in Denmark and India', *Industry and Innovation*, 15 (3): 297-320.
- LANGLOIS, Richard, and Paul ROBERTSON. 2000. *Empresas, mercados y cambio económico: una teoría dinámica de las instituciones empresariales*. Barcelona: Proyecto A.
- LÓPEZ CAPONT, Francisco. 1958. 'Envases y defectos del cierre'. Lecture given on the First Canning Days. *Boletín Informativo del Centro de Investigación de Frutos y Conservas*, 1-27.
- LÓPEZ LOSA, Ernesto. 1997. 'Escabeche, salazón y conserva. Una primera aproximación a la transformación de pescado en el País Vasco (1795-1975)'. In *Las conservas de pescado en el País Vasco*, VV.AA., 80-131. San Sebastián: Museo Naval.
- MALUQUER, Jordi. 2014. *La economía española en perspectiva histórica, siglos XVIII-XX*. Barcelona: Pasado y Presente.
- MANZANARES, Domingo A. 2003. 'Las etapas de desarrollo de la industria de conservas vegetales en la región de Murcia, 1890-2000'. In *Las industrias agroalimentarias en Italia y España durante los siglos XIX y XX*, edited by Carlos Barciela and Antonio Di Vittorio, 103-137. Alicante: Universidad de Alicante.
- MARKUSEN, James R., and Anthony VENABLES. 2000. 'The theory of endowment, intra-industry and multinational trade', *Journal of International Economics*, 52 (2): 209-234.

- MARTÍN, Carmen, and Luis RODRÍGUEZ. 1977. 'Cambio técnico y dependencia tecnológica. El caso de España'. *Programa de Investigaciones Económicas*. Serie E, 11. Madrid: Fundación del Instituto Nacional de Industria.
- MASSÓ, Gaspar. 1967. 'Industria conservera de pescados'. In *Galicia y su desarrollo económico*, edited by Banco de Vizcaya, 111-125. Bilbao: Banco de Vizcaya.
- MCKIE, James. 1959. *Tin cans and tin plate: A study of competition in two related markets*. Cambridge: Harvard University Press.
- MENZEL, Max-Peter, and Dirk FORNAHL. 2009. 'Cluster life cycles-dimensions and rationales of cluster evolution'. *Industrial and Corporate Change*, 19 (1): 205-238.
- MUIR, Augustus. 1968. *The History of Baker Perkins*. Cambridge: Baker Perkins Holding Ltd.
- MUÑOZ ABELEDO, Luisa. 2010. *Género, trabajo y niveles de vida en la industria conservera de Galicia 1870-1970*. Barcelona: Icaria / Universidad de Barcelona.
- ROLDÁN, Santiago, and Ángel SERRANO. 1978. *La internacionalización del capital en España, 1959-1977*. Madrid: Edicusa.
- PAVITT, Keith. 1984. 'Sectoral patterns of technical change: Towards a taxonomy and a theory', *Research Policy*, 13 (6): 343-373.
- PEARSON, Gregg S. 2016. 'The Democratization of Food: Tin Cans and the Growth of the American Processing Industry, 1810-1940'. PhD thesis, Leigh: University of Leigh.
- PÉREZ BUENDÍA, Manuel. 1961. 'Decisiva evolución con la constitución de la oleometalgráfica del Sur, Olmesa, del Plan Jaen'. *ABC*, 25 June 1961.
- PÉREZ DE ZABALZA, José. 1971. 'Problemática del envase en la industria conservera', *Economía Industrial*, 89: 67-73.
- PIORE, Michael J., and Charles SABEL. 1990. *La segunda ruptura industrial*. Madrid: Ariel.
- PORTER, Michael E. 1999. *Ser competitivo. Nuevas aportaciones y conclusiones*. Deusto: Ediciones Deusto.
- PRESIDENCIA DEL GOBIERNO (COMISIÓN DE PESCA MARÍTIMA). 1967. *II Plan de Desarrollo Económico y Social. Pesca Marítima*. Madrid: Imprenta Nacional del BOE.
- PUIG, Nuria. 2003. 'La ayuda económica norteamericana y los empresarios españoles', *Cuadernos de Historia Contemporánea*, 25: 109-129.
- READER, William J. 1976. *Metal Box. A history*. London: Metal Box-Heinemann.
- READER, William. J. 1980. *Fifty years of Unilever, 1930-1980*. London: Unilever-Heinemann.
- ROSENBERG, Nathan. (1993). *Dentro de la caja negra: tecnología y economía*. Barcelona: La Llar del Llibre.
- SÁNCHEZ, Esther. 2011. 'Un siglo de vidrio francés: Saint Gobain en España, de 1905 a la actualidad', *Investigaciones de Historia Económica*, 7: 395-407.
- SERVICIO COMERCIAL METALGRAFICO. 1965. 'El abaratamiento de los envases metálicos en España'. Mimeo.

- SERVICIO SINDICAL DE ESTADÍSTICA. 1972. *Directorio de empresas con más de 50 productores*. Servicio Sindical de Estadística: Madrid.
- VIÑAS, Ángel, Julio VIÑUELA, Fernando EGUIDAZU, Carlos FERNÁNDEZ PULGAR, and Senén FLORENSA. 1979. *Política Comercial Exterior en España (1931-1935)*. Madrid: Banco Exterior de España.
- WAGNER, Karin. 1980. 'Competition and productivity: A study of the metal can industry in Britain, Germany and the United States', *The Journal of Industrial Economics*, 29 (1): 17-35.



El paper de la política econòmica i la inversió exterior: innovació de producte en la indústria metal·logràfica espanyola (1959-1975)

RESUM

L'estabilització i la liberalització de l'economia espanyola, una etapa d'obertura exterior i de canvi estructural, va estimular el procés de racionalització dels processos conservers. La penetració de capitals i empreses estrangeres amb tecnologies més eficients que les existents a Espanya va provocar canvis de gran abast en les tècniques d'envasament. Aquest article se centra en la fabricació d'envasos metàl·lics, concretament en l'anomenada «goma líquida», un element clau per a l'automatització de la producció i l'hermeticitat del tancament. És un cas exitós d'imitació de tècniques estrangeres i adequació a les característiques del mercat espanyol, però també de vinculació a l'oligopoli internacional de l'envàs i d'internacionalització.

PARAULES CLAU: indústria de l'emalatge, indústria conservera, innovació de producte, transferència de tecnologia.

CODIS JEL: N24, N64, O16, O33.



El papel de la política económica y la inversión exterior: innovación de producto en la industria metalgráfica española (1959-1975)

RESUMEN

La estabilización y la liberalización de la economía española, una etapa de apertura exterior y de cambio estructural, estimularon el proceso de racionalización de los procesos conserveros. La entrada de capitales y empresas extranjeras con tecnologías más eficientes que las existentes en España conllevó cambios trascendentales en las técnicas de envasado. De este modo, mostramos cómo los cambios en la política económica y la inversión extranjera directa pueden conducir a la modernización sectorial y de la estructura industrial. Este artículo se centra en la fabricación de envases metálicos, concretamente en la denominada «goma líquida», un elemento clave para la automatización de su producción y la hermeticidad de su cierre. Un exitoso caso de imitación de técnicas extranjeras y adecuación a las características del mercado español, pero también de vinculación al oligopolio internacional del envase y de internacionalización.

PALABRAS CLAVE: industria del envase, innovación de producto, política industrial, inversión extranjera directa.

CÓDIGOS JEL: N24, N64, O16, O33.



This document is under a Creative Commons Attribution 4.0 International License. To see a copy of this license click here <https://creativecommons.org/licenses/by/4.0/>.