The Impact of Mining Prices in the Localization of Industry in Chile, 1895 - 1967

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Abstract
The different mining cycles have had an enormous impact in the evolution of the localization of economic activity, and in particular, of industry in Chile. In the first place, the nitrate cycle was characterized by a labour-intensive extraction process and activity which was geographically very concentrated (Tarapacá and then in Antofagasta). Both initially, when it existed alongside nitrate mining and later alone, the copper cycle is geographically much more disperse and its activity, very capital intensive.

Nitrate and copper mining also had a very unequal impact on industry. During the nitrate cycle as a result of growing demand, there is significant industrial development in these provinces led by the industrial sectors that produced non-durable consumer goods. As a result of this growth in industrial employment in these mining provinces, the highest levels of industrial dispersion in the country are registered. This expansion impacted in the industrial thrust of the province itself, within the domestic market, in those provinces with sufficient response capacity. During the copper cycle the result is not as clear. The impact in industry is much more limited to those sectors most closely linked to mining production, more capital-intensive (equipment goods). This means that the greater dispersion of mining during the copper cycle does not have the same backward link, and growth in industrial employment is far more limited. In this context, there are other factors which boost growth in industrial employment (agglomeration economies). These factors bring about a period of maximum concentration of industry due to the expansion of Santiago.

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1. Introduction

The aim of this paper is to study the impact of mining in the concentration of economic activity, particularly industrial activity, in the Chilean economy\(^1\). For this reason we have studied the two mining cycles that started in 1880: the first was characterized by nitrate exportations and ended with World War I and the second featured copper exportations, starting at the moment of the decline of nitrate mining and lasting from the War of 1914 until the 1970s.

The hypothesis that we defend here is that the nitrate cycle boosted economic activity in the provinces in the north of Chile to the point that this brought about a period of relative dispersion of economic activity, with special impact on industrial activity. That is, at the end of the 19th century and beginning of the 20th century, the provinces of Tarapacá and Antofagasta attracted industrial investments to the region (mainly non-durable consumer goods, with a significant proportion in textile and food, beverage and tobacco industries), which led to a period of maximum territorial dispersion of industrial activities. The rise of nitrate prices on international markets, at the end of the 19th century and beginning of the 20th century, favoured this trend. World War I meant a change in the trend and marked the start of a fall in mineral prices, and simultaneously, the decline in the economic activity of the mining region began, affecting especially industrial activity, and causing its wealth and diversity to decline. The delocalization of the textile industry and the lack of alternative industrial investment left the north of Chile with only those activities which were able to take advantage of their proximity to consumers, that is, food and beverage production.

Fortunately for the Chilean economy, the nitrate crisis was relieved by the boom of the “new copper economy”. A new mining cycle began at the height of World War I. In 1915 work began at the Chuquicamata mine, located in the province of Antofagasta (previously a nitrate region), and that same year mining began at the El Teniente mine, in the central zone, a few kilometres south of Santiago.

Unlike the nitrate cycle, which was labour-intensive, the copper cycle was capital-intensive. Copper, being territorially more dispersed and with less of the population dependent on its activities, was not a strong pull factor for primary commodity industries though it did attract technology-intensive mining-related activities. During this period, which was dominated by policies of State promotion of the industry, Santiago became the great hub of industrial activity.

Only at the end of the period studied, do we notice a change in the trend of concentration of industrial activity. The industrial census of 1967 shows a timid process of dispersal, but this time it is not the mining industry that explains why. On this occasion, it is the State policy of industrial promotion which generates a trend towards territorial dispersion. The Free Trade Zones which were set up in the far northern and southern provinces of Chile opened up the map of industrialization to the territories furthest from the capital and the large concentrations of consumers.

2. The evolution of mining prices and the localization of mining activity

Chile’s identity as a mining economy was consolidated no earlier that at the end of the 19th century. First there was the great nitrate cycle first, and then the copper cycle which turned Chile into a country highly specialized in mining activity. During colonial times, the small territory occupied by the Spanish between the Copiapó and Bio-bio rivers never produced precious metals (gold and silver) to the extent that they did in the viceregal centres of Mexico and Peru. During the colonial centuries, where the Chilean economy excelled was in its agricultural exportations to Upper Peru (Carmagnani, 2001). Chilean cereals covered part of the

\(^1\) For greater detail on the determinants of the localization of industrial occupation in Chile, see Badia-Miró (2008), chapter IV.
food demands of the zones of Cusco and Potosí, which established its marginal position within the Spanish colonial system. The copper and silver export cycles of the early decades of the Republic (Méndez Beltrán, 2004) began to incline the Chilean economy towards mining, but agricultural production retained its dominant position until the mid 19th century (Robles Ortiz, 2003). Until 1881 agricultural production exceeded mining production (the former at 17.5% of total production and the latter, 14.9%); and agricultural exportations represented more than 30% of total Chilean exportations in the 1870s, reaching 48.4% in 1874 (Braun et al, 2000).

In Chile, real mining hegemony takes off in the decade of 1880 with the nitrate boom following the War of the Pacific, 1879-1881. Graph 1 shows how, as from 1880 mining exportations exceed 80% of total Chilean exportations and for the first time, reach the 93% mark in 1906. Simultaneously, mining production exceeds agricultural production and for the first time hits the 20% mark in 1888 and 30% in 1917 at the height of World War I. At that time, mining was the economic heart of Chile and extractions from the subsoil marked its heartbeat.

The outcome of the War of the Pacific was a decisive factor in the mining success of Chile. The jump in nitrate production from 1879 to 1882 as seen in Graph 2 is only possible because of the annexation of the old Peruvian and Bolivian provinces into Chilean sovereignty. The 50 year-long nitrate cycle (Cariola and Sunkel, 1992), gave Chile a monopoly position in world markets of natural mineral fertilizers. It is from this moment onwards, that the annexed provinces in the northern territory became a centre of activity ranging from mining to transportation, services and industrial activity in the province itself, and simultaneously propelled, through channels of demand, production in other zones of the country (Pinto and Ortega, 1990).
Before the decline of the nitrate cycle at the end of the 1920s, copper had entered a new expansive cycle. Chile, in reality, had been producing copper since the colonial period (Méndez Beltrán, 2004), but until the end of the 19th century rudimentary techniques were used for exploitation and international demand remained at moderate levels (Valenzuela, 1995). As from 1915, due to foreign investment (from the United States in particular), “new copper mining” experiences its definitive boom, replacing nitrate as the main mining activity in both production and in exportation, widening the geography of mining from the north to the central zone of the country (Sutolov, 1975).

The mining map of Chile is completed with the production of fossil fuels. Exploitation of coal in the zone of Concepción and Arauco, in the south, began in 1844 and continued steadily until the 1970s (Ortega, 1998 and 2005). Chilean production was almost entirely destined for the local market (which had to be complemented with importations from Britain), and was destined particularly to boost technologically modern activities, such as the railway, foundries, or industrial activities which used the steam engine for motive power. In the 1960s, fossil fuel production was complemented by petroleum production in the southern region of Magallanes. Unlike other mining activities referred to earlier, petroleum extraction had no historical precedents. This was a totally new phenomenon, with very particular geographic localization and production that barely covered a minimum of local needs. Although fuels were important for the economic development of the country, they never marked an era in the economic history of Chile, in the way that exportations of nitrate and copper did.

The relation between the mining cycles of the Chilean economy, particularly those of nitrate and copper, and the evolution of international prices of both raw materials differs according to the period studied. The periods of rising prices definitely stimulated the increase in the production of both nitrate and copper. This is particularly marked in the case of nitrate between 1900 and 1917 and also for copper from 1947 onwards. However, it was not only climbing prices that stimulated nitrate and copper mining. During the downward trend of nitrate prices from 1880 to 1899, production and exportation did not stop growing - except the serious dip

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2 Copper was used basically to cover the hulls of wooden ships, in the era of the great sailing ships, just before steam technology became dominant in navigation – see Pascual 2008. The success of electricity and the electrical components industry of the early 20th century revalorized copper in world markets and revolutionized copper extraction and melting techniques.

3 The thesis of Yañez and Jofré (2009) points to the availability of coal as a decisive factor in the economic modernization of Chile in the 19th century.

4 The evolution of nitrate and copper prices shows similar behaviour until 1950, when the copper price recovers, unlike nitrate which stagnates for the rest of the period (see Graph 3).
during the Great Depression in the early thirties. Likewise, when nitrate prices fell from 1922, there was no way of recovering the nitrate economy, which fell into a long decline and never again recovered.

Graph 3 – Evolution of international nitrate and copper prices

![Graph 3](image)


The Chilean mining economy, determined by natural resource endowment, had limited options for dealing with cycles of falling prices, and had to redouble its productive efforts in order to maintain revenues. During the first two decades of the nitrate cycle, 1881-1900, for example, when prices were on the upswing, the sector responded by increasing the workforce involved in extraction and increasing investment in activities of transformation and commercialization, which led to greater consumption of coal for the production of nitrates and for the railways that transported the mineral to the ports of Iquique and Pisagua. Both trends were accentuated during the great cycle of expansive prices at the beginning of the 20th century. The increase in international demand for nitrogenated fertilizer in the golden years of the first globalization occurred when the nitrate economy was sufficiently capitalized to be able to respond to the opportunities of the cycle of climbing prices.

The nitrate-rich regions in the north of Chile experienced their period of greatest abundance. The population grew with the arrival of workers from the central region of the country, the port towns of Iquique first and Antofagasta later became hubs of industrial activity and services; and the State accentuated its presence in the provinces annexed after the War of the Pacific.

The end of the nitrate cycle, during the First World War, coincided with falling international prices caused by the appearance of a chemical substitute for natural fertilizers. The Chilean monopoly on nitrate minerals then entered a cycle of decline which lasted several decades. Efforts to gain competitiveness through low salaries and technical innovations did not prevent the final crisis, although they did delay the definitive collapse by a few decades.

The turning point for nitrates occurred simultaneously to the boom in copper mining. The technological cycles are key to understanding what was happening, given that while in industrialized countries the trend was to go without natural nitrates which were substituted by new chemical products, the demand for copper for the electrical industry augmented. The First World War was a catalyst which accelerated both processes.

Chile, which had had a cycle of copper exportation in the 1870s, was able to respond to the stimulus of international demand at the end of the 19th century due to its generous natural resource endowment. The so-called “commodity lottery” acted as a determinant in the localization of Chilean economic activity. Between 1894, year of historical minimum prices, and 1917 when the price was at a maximum not seen again until 1954, Chilean copper was still
extracted in a traditional manner: labour-intensive in extraction and capital-intensive in melting. But the new cycle which opened up for copper mining with the start of mineral exploitation in “El Teniente” (1915), in the Andes zone, was to have its own identifying features. This time, foreign investment from the United States was predominant and technical innovations were implemented in mineral extraction as well as in melting. The “new copper mining” was born at a juncture when prices were unfavourable, which made foreign investment in technical advances indispensable. It is remarkable to see how copper production grew in Chile between 1917 and 1945 in a context of very low international prices, and overcame the difficult 1930s (of historically low prices) in a relatively short time.

Between one cycle and the other, the Chilean economy adapted to at least three structural changes. It moved from nitrate mining to copper mining; it moved from labour-intensive mining to capital-intensive mining; and finally it moved from geographically dispersed mining to more dispersed localization in the territory.

If we observe the index of concentration of mining activity from data on regional mining GDP, see Graph 4, we see that the mining cycles have different effects on the localization of mining activity. While the nitrate cycle shows some elevated concentration indexes, given that the extraction of this mineral was located exclusively in the provinces of the Norte Grande (first in Tarapacá and then in Antofagasta); the copper cycle boom marked a progressive deconcentration which was heightened by the appearance of petroleum in the southern zone. We find copper mines, of greater or lesser significance, in Atacama, Coquimbo, Aconcagua, Santiago, Valparaíso, Antofagasta and O’Higgins (the mines located in the latter two provinces were of particular relevance),

Graph 4 - Theil index regional mining GDP, 1890-1967

Source: Own elaboration using Badia-Miró 2008

3. The impact of the localization of mining activity on industry

Chile underwent its first experience of industrial development around the 1850s (Ortega, 2005). This industrial development was limited in intensity and duration, and coincided with the boom period for exportations of both agricultural products (wheat to Australian and Californian markets) and mining products (silver and copper). Chile’s advantageous location on the Pacific and its generous natural resources endowment, including coal mines, allowed Chile to start up its first railways, to mill its wheat and to melt its metals using modern, industrial, coal-intensive

5 Coal production, although spatially concentrated, did not affect the evolution of the localization of mining because its production remained at similar levels throughout the period of analysis. In this sense, the orientation of a sizeable proportion of its production towards the domestic market meant that coal production was not so affected by the evolution of prices on international markets.

6 We obtained mining concentration from the Theil indexes of regional mining GDP obtained from Badia-Miró (2008).
methods. Several kilometres of railway lines, plus a limited number of productive plants for flour production and metal foundries, allowed the country to deal with international demand before the arrival of the boom of the first globalization. However, when new competitors entered international markets, Chile had difficulties retaining its markets\(^7\). The legacy of this early industrial experience consists of having, for the first time, forged a nexus between exportations and industrialization, while at the same time spreading modern production techniques across the territory. Though these modern production techniques were limited in number, they marked the destiny of the Chilean economy. It is of interest to highlight that these pioneering experiences were scattered throughout the territory, which resulted in a relatively low geographic concentration of modern activities. Wheat production was to be found in the valleys of the central zone, south of Santiago, and this is where milling activity was located; silver and copper mining were characteristic of the so-called “Norte Chico”, a region undergoing desertification to the north of Santiago; and in Concepción, 700 kilometres south of Santiago, where coal was extracted, highly specialized industries sprang up, such as those fabricating refractory bricks for the furnaces of metal foundries.

It was with this legacy, which was limited and somewhat diminished by the crisis of the seventies, that Chile faced its boom as a nitrate (saltpetre) exporter. The country had experienced industrialization without actually becoming industrialized. However, it had gained experience that would prove useful during the mining export boom which began in the 1880s.

Although nitrate production was far more labour-intensive than technologically-intensive (bear in mind that the mineral was exported with very little added value), the increase in mining production in the provinces of the “Norte Grande” led to the creation of a focal point of economic growth which impacted on industry in the country. Firstly, the provinces of Tarapacá and Antofagasta became focal points that attracted a workforce from the central regions of Chile. In the mines, known in the zone as “offices”, there was employment for tens of thousands of workers, who had to be imported from distant zones due to the low density of original local demographics. Additionally, the lack of local manpower and the need to import labourers kept salaries rising,\(^8\) which together had the effect of increasing the demand for manufactured goods in the region. The high levels of GDP per inhabitant in the provinces of Tarapacá and Antofagasta until 1930 are a good reflection of the market potential that these provinces had – see Table 1.

Table 1 - GDP per capita in the mining provinces 1880-1940 ($1995)

<table>
<thead>
<tr>
<th></th>
<th>1890</th>
<th>1900</th>
<th>1910</th>
<th>1920</th>
<th>1930</th>
<th>1940</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tarapacá</td>
<td>2.587</td>
<td>2.223</td>
<td>1.452</td>
<td>1.550</td>
<td>1.211</td>
<td>0.735</td>
</tr>
<tr>
<td>Antofagasta</td>
<td>0.950</td>
<td>1.210</td>
<td>2.594</td>
<td>1.975</td>
<td>2.077</td>
<td>1.980</td>
</tr>
<tr>
<td>Atacama</td>
<td>0.504</td>
<td>0.432</td>
<td>0.418</td>
<td>0.454</td>
<td>1.141</td>
<td>1.659</td>
</tr>
<tr>
<td>Valparaiso</td>
<td>0.505</td>
<td>0.529</td>
<td>0.742</td>
<td>0.659</td>
<td>0.635</td>
<td>0.752</td>
</tr>
<tr>
<td>Santiago</td>
<td>0.506</td>
<td>0.494</td>
<td>0.659</td>
<td>0.654</td>
<td>0.626</td>
<td>0.785</td>
</tr>
<tr>
<td>O'Higgins</td>
<td>0.541</td>
<td>0.449</td>
<td>0.453</td>
<td>0.826</td>
<td>0.923</td>
<td>1.247</td>
</tr>
<tr>
<td>Concepción</td>
<td>0.458</td>
<td>0.527</td>
<td>0.715</td>
<td>0.606</td>
<td>0.713</td>
<td>0.831</td>
</tr>
<tr>
<td>Magallanes</td>
<td>1.209</td>
<td>0.732</td>
<td>0.765</td>
<td>0.810</td>
<td>0.684</td>
<td>0.768</td>
</tr>
<tr>
<td>Country average</td>
<td>0.397</td>
<td>0.447</td>
<td>0.609</td>
<td>0.561</td>
<td>0.580</td>
<td>0.656</td>
</tr>
</tbody>
</table>

Source: own elaboration using Badía-Miró, 2008

The first response to the increase in buying power of the northern population was the importation of low quality manufactured goods, which propelled the integration of the national.

\(^7\) The impact of the economic crisis in the late 1870s in Chile has been extensively studied by Luis Ortega (2005).

\(^8\) It must also be said that in certain mining-related activities salaries were relatively high, such as the railways which connected the mining zones with the export ports, in related urban services such as foreign trade in the expanding cities like Iquique and Antofagasta, as well as in those more specialized functions in the nitrate industry where more skilled labour was required. (Pinto 1998 and Matus 2009).
market. But in the medium-term, industrial activities also appeared which were favoured by the distance of the suppliers and the advantage of production closer to the consumer. We should not forget that Iquique, the number one mining city in the north, was situated more than 1,500 kilometres from Valparaíso, probably the main manufacturing centre in Chile at that time. Apart from the production of consumer goods for the mine-labourers, there was also the need to manipulate and commercialize the nitrate, which gave rise to secondary activities linked to mining and transport. The mechanization of mills and packaging systems, as well as the spreading of the railways as a means of transport, lent a more upbeat pace to industrial activities in the mining zone.

Certainly part of the imported manufactured goods came from abroad, which reduced the backward-link of mining on national industry. Whilst Europe (and particularly the United Kingdom) was the main destination of exportations, imported products benefited from the comparative advantage of cheap freightage. The First World War (1914-1918) marked a change in this respect. Trade data show, for the first time, a divergent development between importations of manufactured goods and mining exportations. That is to say, it is from that moment when signs appear of the end to the restriction that foreign trade had imposed on industrial development. The increase in coastal shipping trade acted as a response on the part of the domestic market to this expansion of demand due to the price increases of exported goods and due to the reduction of importations as a result of restrictions in world trade. Manufacturing production in expansion was focused on the domestic market, in a context where buying power remains steady and importations remain very restricted as a result of the collapse of trade, due to the First World War. In the 1920s 60% of domestic consumption of manufactured non-durable consumer goods is satisfied by domestic production (Palma 1984).

During the period of economic growth based on nitrate exportations, Chilean industrial activity was spatially quite disperse – see Graph 5. This was a reflection of the legacy of the mid 1800s plus the effect of the dynamism of the nitrate provinces, which had added new territories to Chilean industrial activity in the north and came to represent more than 6% of total production.

The purchases made by the mining regions in the national market went from inputs for mining, such as coal which arrived after long sea voyages from Arauco (more than 2,500 kilometres down the coast) and sacks for packing the mineral which came from the central zone; to construction materials (mainly timber), and consumer goods such as flour and wine for consumption and leather and textiles for the miners’ clothes.

The ships which usually arrived at Piñagua, Iquique or Antofagasta to export the mineral, arrived loaded with ballast (generally wood) to fill up their cargo capacity, since the volume of importations was significantly lesser than that of exportations. Consequently, transport costs of importations were relatively low.

Palma (1979) shows how the initial big divergences between the evolution of exportations and industrial production are observed in the 1920s, given that production is not tied to foreign inputs as a fundamental part of the production process.

Another indicator of the importance that industry began to gain in this period was the visible increase in importations of raw materials and fuels (Muñoz Goma, 1968).
employment in industry; and the renewed strength with which the zones of Concepción and Valdivia, in the south, activated their industries\textsuperscript{13}. Only Valdivia represented a little more than 12% of total industrial employment in 1911, a situation which compensated for the sharp fall seen in Valparaíso\textsuperscript{14}. In this sense, we can affirm without doubt, that this was a period in which mineral exportations helped to increase the dispersion of industrial activity in the country.

The nitrate mining crisis changed this abovementioned tendency. The loss of protagonism of nitrate exportations by the provinces of the north as from the 1914 War, negatively affected mining itself as well as those activities that depended on it, predictably including industry. From 1920 onwards all signs point to a strong increase in the concentration of industrial activity which lasts until 1945, clearly seen in Graph 5\textsuperscript{15}.

The change in economic policies which occurred in this period, a move from a relative liberalism to determined State intervention\textsuperscript{16}, coincided with the mining cycle of copper, which was not capable of generating new geographic focal points of industrial activity, as nitrate mining had done before. Copper mining, far more capital-intensive than labour-intensive, and founded on more advanced technological bases, neither generated new population nuclei to attract industrial activities for consumption by the workforce, nor did it stimulate the appearance of industrial activities associated with mining activity, apart from metal foundries. Consequently, the geographic dynamic of the industrialization was subject to the political economy of the time. It was, therefore, the State-directed industrialization that favoured the concentration of industrial activity in Santiago, political capital of the state and main population nucleus.

The strong concentrating trend we see between the two World Wars was due to greater growth of industrial employment in Santiago, which grew faster than the rest of the provinces, in a context of intense industrial growth in the country as a whole. This implies that the relative weight of Santiago within the sum total of industry in the country jumped from 33% in 1911 to more than 56% in 1945\textsuperscript{17}. For this reason the concentration during the interwar period can be explained, largely, by the growth of Santiago, but also by the diminishing of the weight of some of the northern provinces like Tarapacá, which coincided with the end of the richest mining deposits. This is also the moment when Antofagasta and Atacama take over in terms of mining exports, with some impact on industry\textsuperscript{18}. Unlike what occurred in the previous period, the provinces surrounding Valdivia grow much more slowly, which will cause their relative weight to diminish to less than 10%. Similarly, the growth of industry in other important population centres is modest. Between 1911 and 1928 Concepción grows at 1.3% annually and Valparaíso

\textsuperscript{13} The data from the industrial census prior to 1937 underestimate the presence of industry in the rural zones, and thus, the levels of entropy of industrial activity would be even greater, reinforcing our argument (Palma 1984).

\textsuperscript{14} The decline in the importance of Valparaíso with relation to the country as a whole can be explained by the stagnation of industrial employment. If in the census of 1894/5 there were 12,000 people employed, this figure had not increased in 1911.

\textsuperscript{15} The 1920s were years of the settling of industry in the country. It is a period of deep structural change in industry. Not only did the production of non-durable consumer goods increase, reducing importations of the same, but production of capital goods also increased. There is significant capital formation in the manufacturing sector (Muñoz Gomá, 1977). All these changes are accentuated after the Great Depression and industry becomes the driving force for the development and transformation of the country's economy.

\textsuperscript{16} The decades of 1840 and 1950 are those of maximum expansion of industry in a context of significantly intense GDP growth. The reorientation of the economy towards the domestic market and the total immersion in State-directed industrialization (SDI from now on), in a context of policies encouraging the substitution of a major part of importations, once more, has a great impact on the economy of the country. During this period there was a public organism which embodied the State’s active stance: CORFO: Corporación de Fomento de la Producción, (Ortega et al, 1989). This organism became one of the main economic agents, not only with regards industry, but it also played a decisive role in the development of the energy sector, the modernization of mining and the promotion of agriculture.

\textsuperscript{17} If we look at the evolution of population in the province of Santiago, it goes from 17% of the total population in 1907 to close to 30% in 1952, that is to say, there is also an increase in the concentration of the population, but to a lesser degree.

\textsuperscript{18} The growth of industrial employment in Antofagasta and Atacama is at the same rate or above that of Santiago. We have already observed this fact in the data for domestic and foreign trade per province.
at 1.8%, very far from the values of the more dynamic zones of Antofagasta and Santiago (above 3% annually). In the 1930s, Concepción joins the group of provinces with the greatest growth. Between 1937 and 1945, the concentration of industry in Santiago augments due to the fall in industrial employment in the mining provinces of the north and the stagnation of the same in Concepción. In 1957, Santiago already represents 60% of total industrial employment in the country, coinciding with the moment of greatest geographic concentration of Chilean industrial activity.

A new change in trend can be observed at the end of the period studied. The information of 1967 reflects a light dispersion in the context of the expansion of industrial employment. This deconcentration occurs despite the substantial growth of Santiago (with annual rates of close to 5%)
and is a result of the greater growth of the northern zones, especially Tarapacá (which coincides with the height of the Free Trade Zone of Arica after its creation in 1958)
, and Concepción, where the steel industry had strong public backing.

4. Mining cycles and patterns of industrial activity

Mining not only influenced the localization of industrial activity, but also influenced the characteristics of industrial activity itself. In order to analyze this influence, we now study the patterns of industrial employment in the main mining provinces of Chile: Tarapacá, representative of the nitrate cycle; Antofagasta, which took over from Tarapacá in the production of nitrate and then played a central role in the copper cycle; and O'Higgins, where the El Teniente mine can be found and which owes its mining strength exclusively to copper – see Graphs 6, 7 and 8.

Based on this evidence, what we observe is that during the peak of the nitrate cycle, the provinces where this activity was concentrated generated significantly diversified industrial activity, where the industry of primary commodities (generally non-durable goods) combines with that of intermediate goods and equipment goods. Mining activity itself, as well as the new concentration of population stimulated by mining and the geographic isolation of the northern provinces, help to explain this diversified structure of industry. However, as the nitrate cycle went into crisis and industrial activity diminished as a result of lessened mining activity,
diversity gave way to a greater concentration of industrial activity in one or two sectors linked to the consumption of primary commodities (food, beverages and tobacco) – see the information on Tarapacá and Antofagasta in 1945. The nitrate mining crisis, consequently, destroyed particularly industrial activity that was more technically demanding and with added value, from non-durable consumer goods (such as textiles) to equipment goods (like the machinery and transport sector).

This contrasts with what can be observed in the province of O'Higgins - graph 11. In the centre of Chile, the copper-mining boom left a very different mark from that left by nitrate mining in the north. Copper mining in this period did not require new agglomerations of population, hence it was not an incentive for the consumer goods industry, although it did attract industries that supplied the mining activity itself. Additionally, the fact that the natural resources of the zone were more varied, with important agricultural activity (impossible to imagine in the desert

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19 In contrast, in previous periods the weight of Santiago dropped from 61% to 58% between 1957 and 1968.
21 This analysis is carried out using the information of the Chilean industrial census of 1911, 1928, 1937, 1945 and 1967.
22 The enormous mineral deposits at Chuquicamata, the biggest open-pit copper mine in the world, located in the province of Antofagasta, were first exploited in 1915.
23 Note that between 1911 and 1945 workers in the industry diminished by close to 50% in Tarapacá and in Antofagasta the same happened between 1937 and 1945, when nitrate-related mining activity came to an end.
regions of the north) and a close proximity to Santiago and Valparaíso, favoured greater specialization and thus a lesser diversification throughout the period studied.

**Graph 6 – Industrial employment by sectors in Tarapacá, 1911-1967**

![Graph 6](image)

Source: Own elaboration using Badia-Miró 2008.

**Graph 7 – Industrial employment by sectors in Antofagasta, 1911-1967**

![Graph 7](image)

Source: Own elaboration using Badia-Miró 2008.
Tarapacá, specifically, started off in 1911 with an important textile industry which gradually weakened until it almost disappeared in 1945. The clothing manufactured in the region was gradually substituted by products coming from the central zone, which arrived by coastal shipping (Badia-Miró, 2008). This space was growingly taken up by those industrial activities that were more difficult to delocalize and that enjoyed the advantage of proximity to consumers. The sector of food, beverage and tobacco, thus went from representing a quarter of industry in Tarapacá, to representing two thirds of the industrial activity. If in 1911 this sector occupied an important second position in the industrial structure, in 1928 it was first and in 1945 it had no competitors. At this point the machinery and transport equipment sector had disappeared, as had the metal industries. Printing industries (linked to local newspapers) survived with difficulty as did timber industries which processed raw materials imported both from abroad and from the south of Chile.

The recovery of industrial activity in Tarapacá occurred thanks to the industrialist policies promoted by the State. The industrial census of 1967 showed that industrial employment had tripled between 1945 and 1967 and that a new sector of machinery and transport made up more than 40% of industry. The explanation for this industrial boom is no longer mining. The real protagonist of this period is the industrialist policy of the State, which favoured the setting up of automobile industries by foreign capital with fiscal and customs tariff privileges linked to the Free Trade Zone of Arica.

Antofagasta in the industrial census of 1911 and 1928 does not differ much from Tarapacá – see Graph 7. While nitrate was the predominant mining activity, textile, food and beverage industries had their place. The exception lay in the chemical industry, closely related with the techniques for copper production. In this sense, Antofagasta was favoured in that it combined nitrate and copper mining for a few decades, although the former was in decline. In 1945 the basic commodities industry and the chemical industry together represented more than 80% of industry in the province, mirroring Tarapacá with regards loss of industrial diversity. This may be so, but the industrial recovery of Antofagasta in 1967, which increased industrial employment by 2.5 compared to 1945, must be related with the new diversification of the productive structure of industry, combining the traditional industry of non-durable consumer

24 The industrial policy related with fiscal customs tariff stimuli typical of Free Trade Zones, was applied by Chile to the far northern and southern regions of its territory. Arica and Punta Arenas, located at the extreme north and south respectively, had obvious localization disadvantages with regards the national market. In a territory such as Chile’s, more than five thousand kilometres long, the extreme zones ran the risk of being marginalized by a policy of industrialization supported by the national market. The Free Trade Zones aimed to mitigate this disadvantage, which is why Arica received important investment in the form of automobile assembly.
goods (food and beverage) with the chemical, metal and machinery industries – these latter all complementing copper mining.

The industrial structure of the province of O'Higgins – see Graph 8, as we affirmed before, shows a greater specialization in the sector of food production. The fertile lands of the Central Valley of Chile, ideal for the cultivation of cereals, fruit and for viticulture gave the province a comparative advantage for the production of basic consumer goods with abundant markets in the neighbouring provinces of Santiago and Valparaiso. Added to this is the “great copper mining” of the El Teniente mine which also attracted activities like those of Antofagasta: chemical, metal and machinery industries. However, these latter industries in terms of employment, never threatened the supremacy of the traditional sectors of basic consumer goods, which is why the diversification of the industrial structure came up against an insurmountable barrier.

5. Conclusions

After reviewing the Chilean mining cycles after 1880 and their relation with international prices of nitrate and copper, and relating these with the information which comes out of the Chilean industrial census between 1911 and 1967, we conclude that during the period dominated by nitrate exportations the industry followed a decentralizing impulse territorially speaking, at the same time as the industrial structure in the nitrate provinces maintained a highly diversified pattern. When copper replaced nitrate as the main export product, the capacity for attracting industrial activities producing non-durable consumer goods disappeared, and was replaced by an industry that was oriented towards intermediate goods and equipment goods which supplied mining activities themselves.

Between nitrate and copper, the Chilean economy adapted to at least three structural changes: that which involved the change from nitrate mining to copper mining; that which brought an important change from labour-intensive mining to capital-intensive mining; and lastly, that which transformed geographically concentrated mining into one that was more disperse in the territory. The industry of the mining zones adapted to these changes. The nitrate provinces, particularly Tarapacá, suffered the effects of deindustrialization, losing part of their structural diversity. By contrast, copper mining brought other industry, related with chemical, machinery and transport equipment. These industries were more technologically-intensive than labour-intensive, which meant they had a weaker impact on the employment structured of the provinces where they were located.

6. Bibliography


