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ede@econ.uchile.cl
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Badia-Miró, Marc
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The evolution of the location of economic activity in Chile in the long run: a paradox of extreme concentration in absence of agglomeration economies*

La evolución de la localización de la actividad económica en Chile en el largo plazo: la paradoja de un caso de extrema concentración en ausencia de fuerzas de aglomeración

Marc Badia-Miró**

Abstract

Chile is characterized as being a country with an extreme concentration of the economic activity around Santiago. In spite of this, and in contrast to what is found in many industrialized countries, income levels per inhabitant in the capital are below the country average and far from the levels in the wealthiest regions. This was a result of the weakness of agglomeration economies. At the same time, the mining cycles have had an enormous impact in the evolution of the location of economic activity, driving a high dispersion at the end of the 19th century with the nitrates (very concentrated in the space) and the later convergence with the cooper cycle (highly dispersed). In that context, this article describes the evolution of the location of economic activity in the long run, showing the tensions among Heckscher-Ohlin and New Economic Geography forces. I also offer a deeper analysis of the main drivers of this spatial distribution, focusing in the economic structure of the regions, the productivity levels of each specific economic sector and the evolution of market potential.

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** Departament d'Història i Institucions Econòmiques, Facultat d'Economia i Empresa. Universitat de Barcelona. Spain. E-mail: mbadia@ub.edu. Centre d'Estudis 'Antoni de Capmany' d'Economia i Història Econòmica. Xarxa de Referència d'R+D+I en Economia i Polítiques Públiques.

Key words: *Regional economics, Agglomeration economies, New Economic Geography, Heckscher-Ohlin, Regional convergence.*

JEL Classification: *R11, N96.*

Resumen

Chile se caracteriza por ser un país con una concentración extrema de la actividad económica alrededor de Santiago. A pesar de ello, y en contraste con lo que se encuentra en muchos países industrializados, los niveles de ingreso por habitante de la capital están por debajo de la media del país y lejos de los niveles de las regiones más ricas. La explicación radicaría en la debilidad de las economías de aglomeración en estas zonas. Al mismo tiempo, los ciclos mineros han sido determinantes en la evolución de la localización de la actividad económica, provocando una alta dispersión al final del siglo XIX con el surgimiento de los nitratos (muy concentrados en el espacio) y la convergencia posterior con la aparición del ciclo del cobre (mucho más disperso). En el presente artículo se describe la evolución de la localización de la actividad económica en el largo plazo, confrontando las tensiones existentes entre las fuerzas Heckscher-Ohlin y las de la "Nueva Geografía Económica". También se ofrece un análisis más profundo de los principales impulsores de esta distribución espacial, centrándose en factores relacionados con la estructura económica de las regiones, los niveles de productividad de cada sector económico específico y la evolución del potencial de mercado de las regiones.

Palabras clave: *Geografía económica, economías de aglomeración, Nueva Geografía Económica, Heckscher-Ohlin, convergencia regional.*

Clasificación JEL: *R11, N96.*

1. Introduction

Chile is characterized as a country with an extreme concentration of economic activity around Santiago, the administrative capital. In spite of this, and in contrast to what is found in most of the industrialized countries, income levels per inhabitant in the capital have been below the country average and far from the levels in the wealthiest regions. In this context it is relevant to understand the evolution and the dynamics that lie behind both results, in a country where agglomeration economies seem to have had a marginal impact and where natural resource endowments have been crucial to explain the spatial location of the economic activity (the nitrate mining cycle was extremely concentrated in space whereas the copper mining has been much more disperse). Other elements to bear in mind are the impact of regional development policies around the 1960s, or the role played by infrastructures such as the railway through the *Valle Central* in boosting Santiago as a trade centre.

This article describes the impact that all of these and other elements had on the present-day layout of the country. Moreover, it also measures the real impact

that these and other factors could have to answer some of the relevant questions, which arise, such as, Was the effect of the capital, and the enormous market potential of the central region of the country the real driver of spatial distribution in the 20th century Chilean economy? What was the spatial impact of the persistently high transport costs in domestic and foreign trade? Furthermore, the relevance of the Chilean case increases if we take into account the non-existence of studies on the evolution of location of economic activity, in the long run, in developing countries, where industry played an absolutely secondary role in the transformation of these economies.

The Chilean case is also interesting because the study of the spatial distribution of the economy goes beyond mere description and the article focus on the determinants behind this long term performance. For this reason, it determines the importance of the interrelation between primary factors, following the models of Heckscher-Ohlin of comparative advantage, and comparing them with the factors of the New Economic Geography (NEG), which emerge around the effects derived from the market potential and the agglomeration economies.

When (Sala-i-Martín 1996) presented the existence of β-convergence in most of the European regions and in the United States, from 1960 onwards, he did not consider the fact that much of the initial divergence of per capita GDP among the regions occurred around the transition to the 20th century. During those years, the impact of the agglomeration economies, due to the industrial revolution, was more intense.[1] Those results clearly followed the predictions of the Solow model, where the comparative advantage determines the location of the economic activity.[2]

Considering this long term view, an inverted-U evolution fitted perfectly with the predictions of (Williamson 1965) and (Krugman 1991) and the NEG: pushed by the existence of scale economies, a reduction of transport costs favoured first the increase and then the reduction of regional inequality, in presence of agglomeration economies.[3] Recent studies for most of the European countries clearly show the existence of this curve, during the early years of industrialization, such as in England before 1910 (Crafts 2005), France during the period 1860-1930 for the manufacturing and services sectors (Combes *et al.* 2011), and in Spain for the same period (Rosés *et al.* 2010) and for Portugal from 1970 (Badia-Miró *et al.* 2012).

However, the Chilean case does not show the same pattern observed for these countries. Despite the fact that a process of concentration of economic activity took place around Santiago and Valparaíso, neither industry nor services benefited excessively from the emergence of agglomeration economies in these leading regions. The lack of such spatial forces would explain why the reduc-

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1 The introduction to the book by (Combes *et al.* 2008) makes a thorough review of the impact of industrialization as the main driver of the generation of regional inequalities during the industrial revolution. Other references to bear in mind when considering the evolution of regional income inequality are: (Barro and Sala-i-Martin 1992, Fujita *et al.* 1999, Fujita and Krugman 2004).

2 (Barro and Sala-i-Martin 1992).

3 The integration of domestic markets and the opening of the economy to international markets explain most of the reduction in transports costs during the late 19th century and the beginning of the 20th century.

tion of inequality, observed in the long run, was the result of counterbalancing forces. On the one hand, the increase in the dispersion of regional income related with the existence of several mining cycles (first nature or H-O forces). On the other hand, the reduction in regional dispersion, in parallel to the expansion of industry and services in the capital (second nature or NEG forces).

The evidence around what happens in less developing countries (and non-industrialized countries) is scarce, with the exception of the recent works focused in Mexico (Aguilar-Retureta, in press) or India (Caruana-Galizia 2013). It is in that context where the analysis of the Chilean case goes beyond another case study and becomes interesting. To go further in that direction, in addition to testing the existence of first nature forces, the article goes deeper testing the reliability of the predictions of the NEG framework, specifically the interaction between trade policies and the spatial dynamic of economic activity, through its impact on transport costs. In the Chilean case, the orientation of trade policy also significantly marked the country's economic outcome in the 20th century. An initial stage of export-led growth during the First Globalization was pushed by two mining cycles (nitrate and copper). A second stage was shaped by the drastic protectionist shift, which influenced efforts to industrialize the country during the period of Import Substitution Industrialization (ISI), coinciding with the emergence of the copper cycle, until the 1970s. Subsequently, a third stage was characterized by a marked trade openness post-1973, leading to a strong de-industrialization, in parallel to economic expansion driven by mining and agro-industrial exports.

In order to answer all these questions, I have estimated values for the regional per capita GDP of the 25 Chilean provinces, for the period 1890-1973, combining the results obtained using the methodology proposed by (Geary and Stark 2002) and refined in (Geary and Stark 2015) with direct estimations of sectorial regional product. I have grouped these taking into account the 13 present-day regions in order to be able to link with the official estimations, from 1960 onwards. At first glance, the new evidence shows that, in contrast to many of the developed countries, Chile shows a clear tendency to the reduction of GDP per capita concentration, only interrupted shortly by the expansion of Magallanes in 1960 due to the discovery of oil into that region. This tendency runs in parallel to the reinforcement of a process of extreme spatial concentration of the national GDP around Santiago (about 50% of the total GDP).

This article is organised in the following manner. The second part shows the evolution of regional location of the economic activity in the long run. The third section analyses the impact produced on the spatial distribution of the economy, due to changes in the economic structure of the regions, to productivity levels and the evolution of market potential. The final part presents the main conclusions.

2. Regional GDP evolution in Chile in the long run: 1890-2000

In the mid-19th century, before the expansion of Chile towards the mining regions of the North and the settlement of the southern regions, the country was divided into three big regions. The *Norte Chico* was specialized in mining and agriculture boosted by the expansion of Peruvian and European demand. In the centre of the country, around Santiago and the *Valle Central*, there was

also agricultural production and mining. The third region, in the south, around *Concepción*, was a region specialized in agricultural production and livestock. This distribution already showed the existence of high levels of spatial inequality. Its roots were at the end of the colonial period, with the expansion of the agricultural sector in the *Valle Central*, particularly based on flour production, driven by foreign demand.[4] At the same time, much of the country's mining exportation was concentrated in the port of *Valparaíso*, in addition to most of the commercial and financial activity of the country.[5] In the North, the export boom also lay behind the emergence and expansion of an important number of metal smelting plants and forges, which transformed the minerals for subsequent exportation, propelling their economic and demographic growth. This expansion lasted until the end of the 19th century, when the richest veins of minerals came to an end, and new competitors emerged on international markets. At that moment, mining emerged strongly in the South around *Concepción*, parallel to the region's manufacturing specialization in the textile sector, particularly wool. Together with these changes, Santiago grew and reinforced its role as the capital of the country, taking advantage of the benefits of the export cycle, which covered the costs of urban expansion and the development of the service industry.[6] In the 1860s, there was a point of inflection in the location of economic activity. Growth based on the expansion of exports ended. Simultaneously, the country began to expand in the *Araucanía*, occupying vast fertile expanses of the South. Towards 1880, Chile also occupied the Bolivian and Peruvian mining provinces in the Atacama Desert, in the *Norte Grande*, an area with vast nitrate deposits. The economic expansion along the "new" Chilean regions and the expansion of the railway network propelled the expansion of the manufacturing sector, particularly in relation with the intensive mining activities in the North, favouring the integration of the domestic market.[7]

From this moment onwards, the new quantitative evidence provided enables us to understand the behaviour of location of economic activity throughout most of the 20th century. At this point, I follow the seminal work of (Gwynne 1984) which analyses the evolution of the location of industry during the 20th century, and (Gómez 1974) that delves deep into the evolution of industry from 1957 to 1970, focussing his work on the regional impact of regional development policies. Subsequently, during the 1980s, new studies emerged, focussing on the study of the impact of policies of trade deregulation, being applied after the 1973 Coup.[8]

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4 (Carmagnani 1998) and (Palma 1979) state that this expansion was driven by the growth of the demand from the United States East Coast and ended with the emergence of Australia as the main wheat producer of the Pacific.

5 Valparaíso had become the headquarters of the main trading companies, while simultaneously it was the point where most of the products entered and left the country (Estrada 1987, Pinto Vallejos 1987, Cavieres Figueroa 1988, Coudyoumdjan 2000, Carmagnani 2001).

6 (Hurtado Ruiz-Tagle 1966, p. 89).

7 (Badia-Miró 2008).

8 Gwynne's initial articles analyse the economic impact of the de-industrialization after 1973 (Gwynne 1984, 1986). His subsequent articles focus on the economic development of specific sectors such as forestry or viticulture, and their industrialization process (Gwynne 1999, 2003, 2006).

A third set of studies concentrated on analysing concrete areas of the country, especially in studies of the capital, such as (Odeplan 1978, Daher 1993) and the official estimations published by the Central Bank of Chile from 1980 onwards[9], in order to check the possible existence of long-term convergence.[10] In this sense (Echeverria 2006) did some remarkable work on the evolution of the economic concentration of industry, and he relates it with the production of primary products and their competitiveness on domestic and international markets. He also offers an analysis of the economic convergence of the regions in the second half of the 20th century.

2.1. Estimation of the Chilean provincial GDP for the period 1890-1973

One of the aims of this study is to fill in the holes of the regional GDP pc data between the War of the Pacific, when Chile established its present-day borders, and the 1960s. In order to do this, I have combined several strategies to distribute the sectorial GDP among the different provinces. The national data used comes from (Díaz *et al.* 2007), correcting his industrial data with new estimations offered by (Ducoing and Badia-Miró 2013).[11] We split the national GDP considering:

$$GDP = \sum_i GDP_i \tag{1}$$

Where GDP_i is the GDP of region i and the sum of all this regional GDP is the national GDP. Considering eq. (1), we have also split each sectorial GDP for each region. To obtain each GDP for every sector and region, we have adopted different strategies. We define the regional GDP for the agricultural sector and for the industrial sector according the methodology proposed by (Geary and Stark 2002)[12] as it can be observed in eq. (2). For the mining sector, we have considered the production approach. For the other sectors, we have approximated the regional value added by a set of representative variables.

$$GDP_i = \sum_j gdp_{i,j} L_{i,j} \tag{2}$$

Where the gdp_{ij} is the average added value per worker in region i and in sector j, and $L_{i,j}$ is the number of workers in the same province and in the same sector. In this case, it is assumed that differences among the regional GDPs of the provinces are related with the differences among the productivities of one

9 The Central Bank of Chile offers annuals data for the regions from 1985: http://www.bcentral.cl/publicaciones/estadisticas/actividad-economica-gasto/aeg07.htm.

10 An example of this is the work of (Aroca and Bosch 2000, Duncan and Fuentes 2006, Atienza and Aroca 2012).

11 A detailed description of the reconstruction of the regional GDP of Chile can be found (Badia-Miró 2008).

12 Apart from these, other authors such as (Crafts 2005, Rosés *et al.* 2010, Buyst 2011, Felice 2011, Henning *et al.* 2011, Badia-Miró *et al.* 2012) have used this approach for their regional GDP estimations.

sector among these same regions and that, at the same time, this is reflected in the wages of workers in the following manner (see eq. (3)):

$$GDP_i = \sum_j \left[gdp_j \beta_j \left(\frac{w_{i,j}}{w_j} \right) \right] L_{i,j} \tag{3}$$

where $w_{i,j}$ is the wage paid in region i in sector j and w_j is the average national wage of this sector, and β is a scalar that makes it possible to maintain the absolute GDP level nationally. The integration of the labour market in the agricultural sector was low and agricultural wages could not be representative per each province. To solve this, I have approximated the economically active population to the gross production of these representative products and I have used production per unit area (as a proxy for productivity) for these same years.[13] For the provincial GDP of the industrial sector we do have salary data to obtain the differentials of productivity among the provinces, as well as the data of the sectorial labour force for each industrial sector.

For the mining sector, the estimation was carried out using two types of data: on the one hand, and with the intention of reflecting export-oriented mining, I have considered total provincial exportations due to the enormous predominance of this sector over total national exportations. In parallel, we must consider mining production destined for domestic consumption (particularly coal and oil), absent from export statistics. In order to obtain the contribution of the exterior sector, we have taken exportations at the value of the mining provinces (*Tarapacá, Antofagasta, Atacama, Coquimbo, Valparaíso*, *Aconcagua, Santiago, O'Higgins* and *Aysén*), and I have calculated the percentage that the sum of these, represent over the total.[14]

The relative value obtained through exportations was applied to the total mining GDP in order to obtain the provincial mining GDP. Bearing in mind that I have not considered coal, I have corrected the GDP value, deducting the

[13] We have considered those products with which we can explain almost 80% of the total product, that is, cereals, vines, potatoes and cattle. For more information, see (Badia-Miró 2008).

[14] In the mining provinces of the North I have confirmed that most of mining production destined for exportation, is produced in the same province from which it is exported to the exterior (Badia-Miró 2007, 2008). This is also valid for the province of *Aysén*. The main difficulty would seem, as it has been indicated, assigning exportations from the central zone of the country. It is difficult to assign total exportations from this zone to the province of real production. Though it appears clear that the production of *Aconcagua* and *Valparaíso* would leave the country via *Valparaíso*, we do not know what part of the production of the mines in the province of Santiago would leave the country via the neighbouring province. The same occurs with the O'Higgins region (take into consideration that the port of *San Antonio* started to be important in the 1960s and 1970s). This obliges to entertain an adjustment in the determination of the percentage of exportations from the central region, assigning certain percentages of the total to each of the four provinces that have mining production for exportation. In order to assign the proportions I have relied on the data of mining production per province. Although these data are easily available from 1930 onwards, the years prior to this present some difficulties and the only information accessible is broken down into products (making data collection very difficult).

percentage represented by coal in total production. I did the same for oil, but in this case, only the data post-1960 was affected. Throughout most of the period analysed, coal production was around 10% of the total. Thus, with exportation data I can assign the provincial weight for approximately 90% of the mining GDP, until 1960.

Coal has a significant contribution in regional GDP, not so much for its total weight in total national mining, but rather because it is concentrated in few provinces, and thus its impact on these provinces is striking. Only four provinces have coalmines and in two of these, the production is almost token. The main productive provinces are *Concepción* and *Arauco*, with more than 95% of total production. The provinces of *Valdivia* and *Magallanes* follow at a considerable distance. In order to distribute the value of coal production per province, I have considered gross coal production per province, some benchmarks. With these data, I have constructed series of percentages of participation of these provinces over the national total and I have applied these values to the aggregated series of coal production. The percentages applied prior to 1900 are those of that year.

Between the years for which we do have data, I consider constant growth of the percentages, and from 1949 onwards, I use the percentages obtained for 1949 for that year. The coal production data was obtained from (Díaz *et al.* 1998), although they only provide data for the period 1860-1940. For the rest of the period I have applied the relative prices used by Díaz in 1940 and gross mining production data (in weight) from (Braun *et al.* 2000) for the period 1941-1973.

Finally, something similar to what occurs with coal also occurs with oil, and therefore, not counting it may generate important imbalances in the province of *Magallanes*, given that oil production is concentrated there. The main problem lies in the fact that in (Díaz *et al.* 1998), they do not count the contribution of oil in the total products used to obtain the mining GDP. This impedes from using the same methodology used for coal. Oil production in Magallanes started at the end of the 1950s, beginning of the 1960s. I have used the sectorial GDP data generated by ODEPLAN (National Planning Office) of 1960, to obtain the percentage that *Magallanes* represents over the total mining GDP. Using this data, the rest of the mining product of 1960 has been redistributed, according to the percentages obtained without considering oil. Between 1960 and 1973 coastal shipping departures in this province are very important and quite steady, clearly responding to the beginning of oil exploitation. Based on these data I consider that the percentage of the province over national mining production remains steady until the end and hereby I recalculate the values for the remaining provinces. To this end, it has been assumed that the volume of total mining production without oil does not change during the period 1960-1973.

In order to construct the regional GDP of government services I obtained the value based on the percentage represented by each province over the total national population. Although this is a very rough approach, it does not appear absurd to consider that State spending in each of the provinces is proportional to the population.[15]

[15] I am aware that with this approach I underestimate spending by the administration on administrative centres such as the capital or in areas with more commercial customs traffic. However, this approach would not take into account State spending on the railways either,

The part of the GDP corresponding to the remaining items has been assigned considering the provincial percentage for the urban population of the entire country. The explanation is that much of what comprises this sector is made up of services, commerce and other products closely related with economic activity in the cities.

In 1973, Chile modified the administrative division and what were 25 provinces became 13 regions.[16] The official data of ODEPLAN and the Central Bank of Chile offer estimations for the regions. I have reconstructed historical data for the provinces, which subsequently I have transformed into regions to permit comparability for the entire period.[17] For the new equivalences, see the Table 1.

TABLE 1
EQUIVALENCES BETWEEN THE ADMINISTRATIVE DIVISIONS IN CHILE, 1890-2005

Provinces (around 1945)	Regions (2000)
Tarapacá	I de Tarapacá
Antofagasta	II de Antofagasta
Atacama	III de Atacama
Coquimbo	IV de Coquimbo
Aconcagua	V de Valparaíso
Valparaíso	
Santiago	Met. de Santiago[18]
O'Higgins	VI de O'Higgins
Colchagua	
Curicó	VII del Maule
Talca	
Maule	
Linares	
Ñuble	VIII del Biobío
Concepción	
Arauco	
Biobío	
Malleco	IX de La Araucanía
Cautín	
Valdivia	X de Los Lagos
Osorno	
Llanquihue	
Chiloé	
Aysén	XI de Aysén
Magallanes	XII de Magallanes

concentrated in the southern provinces of the country, during much of the period under consideration.

16 That is assuming that the GDP per capita of Santiago is the same as that observed for the Metropolitan Region of Santiago, despite the differences that exist between the two administrative divisions.

17 The results of the robustness test between own figures and official sources was so good. Rank analysis confirm the same analysis and we could identify the main differences obtained in Santiago, due to the impact of being the administrative capital of a country.

18 As it has been said, there were not an exact coincidence between the two administrative divisions. *San Antonio* belongs to Santiago province as well as the V Region.

A next step has to be considered in order to improve the series. Although, the different regional prices levels distort regional GDP figures, this goes beyond the scope of this work. In that sense, it is assumed that the per capita GDP figures are higher in regions specialized in natural resources due to this fact and, in some cases, regional inequality has been overestimated.

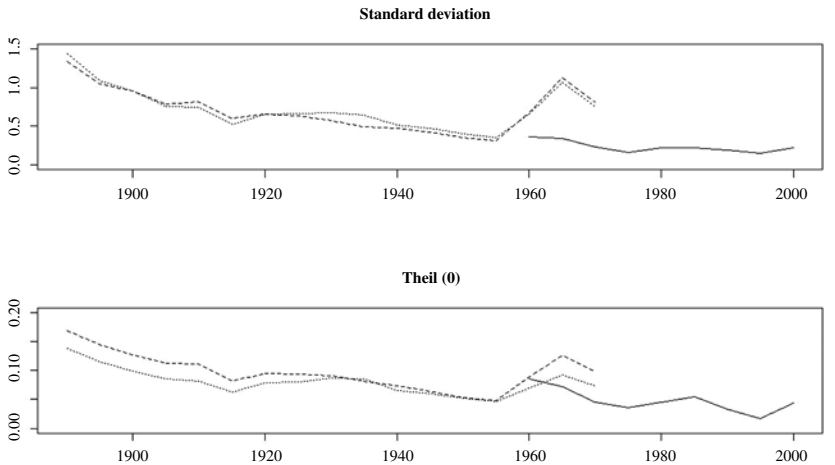
2.2. The evolution of per capita GDP levels in the provinces in Chile: 1890-2000

This new data figures enables to observe in detail, the spatial evolution of economic activity in the long run, starting from the observation of the behaviour of certain indicators. Following (Sala-i-Martín 1996), the reduction of the differences between regions in the long run, can be observed through the behaviour of the β-convergence and the σ-convergence due to the impact of technological diffusion and the diminishing capital returns. For the period 1890-1970, (Badia-Miró 2008) found β-convergence although at levels below the world average. Furthermore, the author found marked differences between what occurred before 1930 and after. For the first period, β-convergence is significantly greater. In parallel, (Duncan and Fuentes 2006) found the existence of β-convergence for the period 1960-2000, although at lower levels than those by (Badia-Miró 2008). Figure 1 confirmed these results. It shows a clear σ-convergence in the per capita GDP dispersion throughout the entire period analysed, accompanied by a reduction in the levels of inequality of per capita GDP , according to the observation of Theil (0). Both are measurements of dispersion and their evolution enables to confirm the reduction of the differences between the levels of income in the provinces in the long run.

This result confirms the hypothesis proposed by (Sala-i-Martín 1996) and would contradict NEG's postulates. One plausible reason for this result, and therefore the convergence observed, lies in the existence of great differences in the starting point around 1890. These differences appeared with the emergence of the nitrate cycle and the extreme concentration of mining exports in few provinces, whereas others continued to have traditionally based economies, with a subsistence agricultural sector, which retained an important weight.[19] The collapse of nitrate exports after the First World War, added to the appearance of the copper cycle, much more spatially dispersed, propelled the reduction in dispersion until the 1990s when this indicator stagnated. Only the discovery of oil-deposits in *Magallanes* during the 1960s changed this story, although only in a temporary manner. What is clear is that, unlike what had been observed for other countries, the exploitation of the natural resources would explain a significant part of the regional differences in terms of per capita GDP among the Chilean provinces, during the 20th century.

[19] Mainly in *Tarapacá*, province in the North of the country which was recently incorporated into Chile because of the War of the Pacific.

FIGURE 1
GDP PC STANDARD DEVIATION AND THEIL (0) FOR THE CHILEAN REGIONS AND PROVINCES, 1890-2000



Dotted line: data by provinces, own elaboration. Dashed line: data by regions, own elaboration. Continuous line: data by regions, official sources.

Although inequality data enable us to offer an initial perspective on the economic behaviour of the provinces, it is also true that they have some limitations. A way of refining the analysis and deepening our understanding of what is occurring in the sample, would involve observing the evolution of the distributions of density of GDP pc, of all of the provinces in the sample. Following the methodology proposed by (Quah 1997), we obtain different density functions for all of the provinces (see figure Figure 2) for different time data (1890, 1910, 1930 and 1970). That shows us clearly the existence of regions with extreme values at the start of the period (around 2.5 times the national average per capita GDP).[20] This was the consequence of the unequal spatial distribution of natural resources and specifically the consequence of the nitrate cycle, which affected the regions of the *Norte Grande*. The figure also shows that the great majority of provinces, which have a far more traditional economic structure, are situated significantly below the average (around 0.25 times this value). It was precisely this extreme concentration of provinces with similar income levels, which explains the low value of the amplitude of the function (0.10), coexisting alongside the nitrate provinces of the North, which pushed up the national average per capita GDPc. The result of this extreme distribution was the appearance of a twin peak in 1890. This remains for as long as the nitrate cycle lasts (confirming the impact they have on the provinces with mineral deposits),

[20] Part of these higher values comes from an overvaluation of the figures, because I have not corrected it with the differences in regional prices. Natural resources regions have higher prices than the other parts of the country.

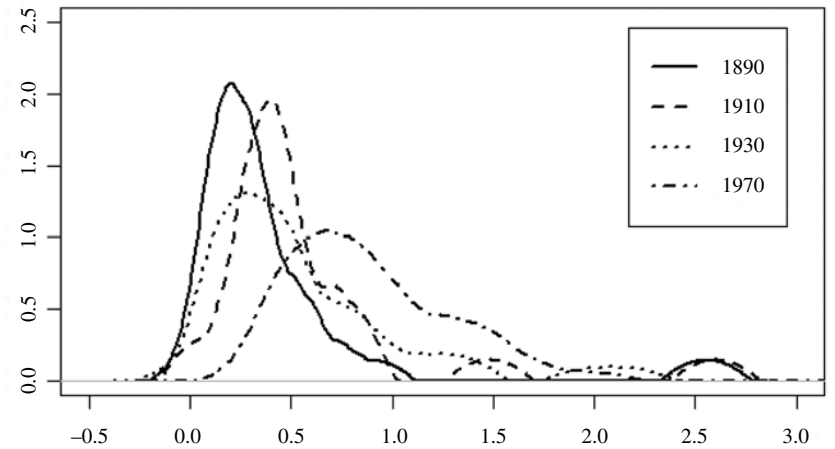
and gradually disappears as the nitrate mines enter in crisis. The dispersion in the location of copper exploitations prevents this double peak from remaining and in 1930, it ends, and distribution is close to normal. In turn, the amplitude of the function increases; reflecting less polarization, a greater dispersion and a uniform distribution around the average (see Table 2). Despite this, most provinces remain below the average.

TABLE 2
BANDWIDTH FOR THE DENSITY FUNCTION, 1890-1970

	1890	1910	1930	1950	1970
BW	0.099	0.098	0.150	0.155	0.199

Source: Developed by the author taking into account *Epanechnikov smoothing* and the package *density* in R-project.

FIGURE 2
DENSITY FUNCTION FOR THE PER CAPITA GDP FOR THE CHILEAN PROVINCES, 1890-1970



Source: Developed by the author taking into account *Epanechnikov smoothing* and the package *density* in R-project.

Broadly speaking, we can glimpse the drivers, which lie behind this spatial configuration of the economy. The first stage being one of strong dispersion in levels of per capita GDP occurs in the heat of the discovery and exploitation of nitrate and the economic expansion of the provinces of the *Norte Grande*. During the nitrate cycle, an extreme concentration of nitrate deposits caused a great dispersion of the regional GDP pc. The same occurs with the start of the oil cycle, although the impact is far less due to its short duration and it lesser impact on the economy as a whole. In contrast, the impact of the copper cycle performs differently. In this

case, a greater dispersion of copper deposits in four or five provinces (including the capital) reinforced economic convergence in the long run.

Together with a greater or smaller concentration, what also appears relevant is the capacity to generate forward and backward linkages, in the sense of (Hirschman 1958), of greater or lesser intensity. Both the copper and the nitrate cycle boosted the economic growth of other regions, due to the demand for non-durable consumer goods in the leading regions. What differentiates the two is the magnitude of this impact. Whereas nitrate mining was labour intensive (and therefore boosted consumption which was largely not satisfied by local production[21]), the copper cycles were far more capital-intensive. For copper mining, the most intense linkages functioned in terms of the demand for intermediate goods on the part of the mining industry itself. In parallel, migratory movements went in the opposite direction and tended to reduce the difference between levels of per capita GDP since people abandoned the poor regions (increasing their per capita GDP) towards the rich regions (decreasing those levels of per capita GDP).

Density functions have made possible to incorporate some nuances into the conclusions drawn from the studies of economic convergence for Chile.[22]. Basically, they emphasize that much of the accentuated spatial dispersion of economic activity around 1890 was directly related with the differences in natural resources endowments. However, this explanation does not appear sufficient to understand the behaviour of dispersion throughout the 20th century, and its underlying factors. An approach to that question can be to analyse the behaviour of the mining provinces and the non-mining separately. To do that I have applied the same strategy proposed by (Zhang and Kanbur 2001) to analyse the effect of polarization on income inequality.[23]

The impact of natural resources on spatial inequality of per capita GDP seems clear, at least during the nitrate cycle. What is not so clear is whether these differences are due only to the differences between the mining and non-mining provinces, or rather that the situation is more complex.[24] This polarization index appears to be a good indicator to solve this doubt. This indicator was obtained through the decomposition of the Theil index. We define the Theil index (0) as:

$$T(0) = \frac{1}{N}\sum_{i=1}^{n}\left(\frac{\mu}{x_i}\right) \tag{4}$$

Where i is the region, n is the total number of regions, x_i is the GDP pc for each region and μ is the per capita GDP of the whole country. From eq. (4), we decompose Theil (0) as:

21 (Cariola Sutter and Sunkel 1983, Badia-Miró 2008, Badia-Miró and Yáñez 2015).

22 (Aroca and Bosch 2000, Duncan and Fuentes 2006).

23 Other authors have used the same strategy when studying inequality in income and in space and its determinants, such (Duclos *et al.* 2004, Esteban *et al.* 2007, Esteban and Ray 2011) among others.

24 I have assumed that the mining provinces are those where the mining sector has a weight of more than 20% of the total product, during much of the period studied.

$$T(0) = T(0)_{within} + T(0)_{Between} = \sum_{j=1,2} \frac{n^j}{N} T(0)^j + \sum_{j=1,2} \frac{n^j}{N} \ln\left(\frac{\mu}{\mu^j}\right) \quad (5)$$

Where N is the total number of regions, $j=1,2$ tells us whether a province belongs to one group or another, μ is the per capita GDP for the whole country and μ^j is the average GDP pc in each group.

The polarization index is obtained by dividing the components $T(0)_{within}$ and $T(0)_{between}$ obtained from eq. (5).

$$Polarization = \frac{T(0)_{within}}{T(0)_{Between}} \quad (6)$$

The results of the components $T(0)_{within}$ and $T(0)_{between}$ and of the polarization index can be seen in Figure 3. It is surprising to note how in the mining and non-mining industries the spatial inequality within both groups is greater than between the two groups. The explanation of this result lies in the different mining specializations in the provinces. Whereas the coal provinces show lower levels of productivity in the mining sector and thus have a negative impact on the per capita GDP , the nitrate and copper provinces show higher levels of productivity and this sector explains a significant part of the higher level of per capita GDP . These differences are accentuated when one looks in detail at the group of non-mining provinces. The significant differences in the economic structure where modern economic sectors coexist, together with provinces with little economic dynamism, explain this fact.

This result indicates that most of the economic differences among the regions are not related with a greater or lesser presence of the mining sector, but rather with the presence or not of a dynamic sector, that sustains high productivity levels. In order to confirm this result I repeat the exercise considering two new groups: rich provinces and poor provinces.[25] Moreover, this result exposes the need to undertake a more detailed study on the productivity differentials among provinces and sectors.

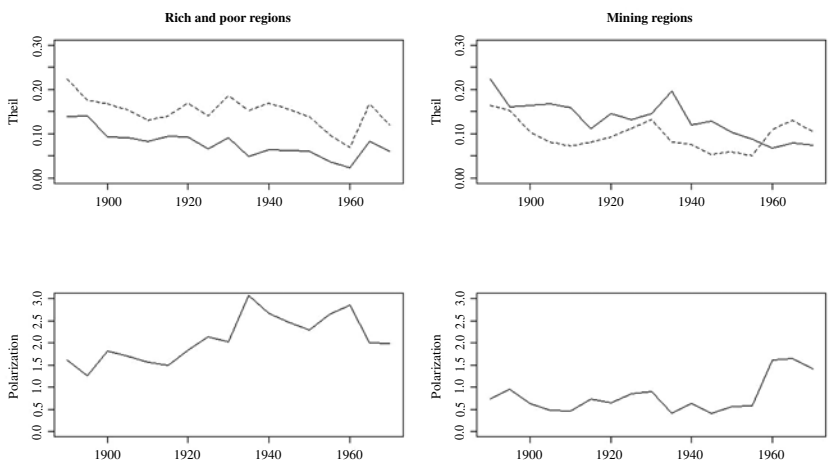
In this case, the results fit better than the expected results (see figure Figure 3). Differences within each group are smaller than differences between the groups. Specifically, we can state that much of the spatial inequality (around 60% in 1925 and around 70% in 1930 and 1970), is due to differences between the groups. That is, differences between the rich provinces and the poor provinces explains much of the existence of this twin peak in the function distribution. If we examine carefully the provinces, which constitute each group, we find most of the export-oriented mining provinces, those with higher productivity levels. This completes the perspective described above.

The polarization indexes of both groups of provinces confirm what it has been already predicted (see Figure 3). For the mining provinces, the levels of polarization are slightly below one, a sign that the differentiation between the

[25] For this we will consider those provinces that are above or below the national average.

mining provinces is not a good approximation to understanding the spatial behaviour of economic activity. In the mining provinces, there are distortions due to the great differences that exist within this sector, especially between export mining and that which is oriented towards the domestic market. When we repeat the calculations dividing the provinces into rich and poor ones, the polarization data shows better the duality of the country, which we had suspected from the data on distribution functions. On the one hand, there are very productive regions oriented towards exportation and, on the other hand, low productivity regions where most of the population is involved in subsistence economy or production oriented towards the domestic market. The list of the members of the select group of rich provinces confirm this point: the mining provinces of *Tarapacá*, *Antofagasta*, *Atacama* and *Concepción* (but not *Arauco* or *Coquimbo* as in the previous division, which were specialized in coal production and low-productivity coal mining), together with the provinces of *Valparaíso, Santiago* and *Magallanes* (where the mining sector is somewhat important, but the economic structure was much more diversified). These results show a strong polarization that increased from the 1930s onwards, coinciding with the ISI period and the protectionist shift. These levels remain high until the 1970s, showing the maintenance of the differences between rich provinces and poor ones, in a context of the reduction of levels of aggregated inequality and in spite of the existence of intense regional development policies. In this sense, these higher levels of polarization refuted the existence of any impact related with the emergence of these policies.

FIGURE 3
THEIL (0) DECOMPOSITION AND POLARIZATION IN CHILE, 1890-1970
FOR VARIOUS GROUPS OF PROVINCES



Source: Own elaboration. Continuous line: *Theil (0)*$_{between}$. Black line: *Theil(0)*$_{within}$. A mining region is defined as those provinces with a mining PIB with more than a 20% over the whole GDP. The richer provinces (poorer) were those with a per capita GDP above (below) the average.

To go one-step further in the study of the spatial distribution of the Chilean provinces, involves looking at how each of the provinces behaves related to the income level group to which they belong. One way of doing this is by checking the persistence of the classifications, throughout the period under consideration. To do that, I carry out several tests of ranking correlation (ρ-*spearman* or τ-*khendal*). The resulting values would confirm the non-existence of changes in the classifications during the period 1890-1973.[26]

A more complex study of individual behaviour of the provinces according to their income level, needs to define income levels and assigning the provinces according to their relative income at each time sample (high income, middle-high income, middle income, middle-low income and low income), instead of considering the provinces in an isolated manner. Once these ranges are defined, we check the persistence of each of the provinces at a certain level or we trace its mobility towards other levels over time. In this case, following the work of (Quah 1993, Fingleton 1999, Epstein *et al.* 2003) and the state of the question presented by (Islam 2003), I have obtained Markov's transition matrices, which enable to identify the probabilities of permanence or transition among the different levels of per capita GDP . If we consider that:

$$F_{t+s} = M^s F_t \tag{7}$$

Where F_{t+s} is the distribution matrix of the provinces among the different levels of per capita GDP in the period $t+s$, M is Markov's transition matrix, s are the years between the two periods and F_t is the distribution matrix of the provinces at the starting point. To obtain Markov's transition matrix for the period between t and $t+s$, we have to consider from equation (7):

$$M_{t,t+s} = \prod_{t}^{t+s} M_{t,t+1} \tag{8}$$

Where $\Pi_{t,t+1}$ is the transition matrix for the period between t and $t+1$. The analysis of the results shows that for the entire period, there is a marked stability. The results can be seen in Table 3. They show how all the categories remained stable and in the 90% of the cases, except for the interval of medium-income provinces, with a little bit lower values around an 80%. Thus, a rather stable persistence of the provinces among the different income levels, with the exception of those provinces that are in the intermediate levels, can be stated. In the intermediate levels, there is a greater transition towards neighbouring levels, whether middle-high income or middle-low. These results enable to confirm that, most of the provinces with high incomes were able to link several mining cycles.

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[26] ρ-*Spearman*=0.74 (p-value:0.000) and τ-*Khendall*=0.53 (p- value:0.000). Spearman's index oscillates between $-1 < \rho < +1$. Values around ± 1 are indicators of a high correlation between the positions held by the provinces (totally perfect or totally imperfect), while values around 0 are indicators of the non-existence of correlation between the different time data. Finally, for τ-*Khendal*, we have the same range and the same interpretation.

As a result, those regions remained among the group of the richest provinces of the country during most of the period. By contrast, those provinces with less-developed economic structures were incapable of generating enough synergies to be able to leave their relative backwardness. Those middle-income provinces (with a more diversified economic structure) show greatest mobility. In that case, their slight improvement or worsening would be related with the existence of more or less favourable economic cycles; although these have not involved dramatic changes, (movements were only towards nearby income levels).[27]

TABLE 3
MARKOV'S TRANSITION MATRIX FOR THE PROVINCIAL PER CAPITA GDP IN CHILE: 1888-1973

	High	Medium-high	Medium	Medium-Low	Low
High	0.936	0.064	0.000	0.000	0.000
Medium-high	0.064	0.860	0.074	0.002	0.000
Medium	0.000	0.089	0.815	0.095	0.000
Medium-Low	0.000	0.000	0.074	0.867	0.060
Low	0.000	0.005	0.000	0.055	0.940
Ergodic	0.208	0.208	0.168	0.208	0.208

Table 3 shows this reduced long-run mobility, but it hides the differences between the different sub-periods, due to variation in the economic climate. When dividing the entire period into three sub-periods: 1888-1920 marked by the nitrate cycle, 1920-1940 for the inter-war period, profoundly influenced by the depth of the Great Depression and, thirdly, the period 1940-1973 corresponding to the ISI, the presence of a greater mobility arises. In order to confirm this, I calculate the Shorrocks index, which is defined as:

$$S = \frac{(n - tr[M])}{n - 1} \tag{9}$$

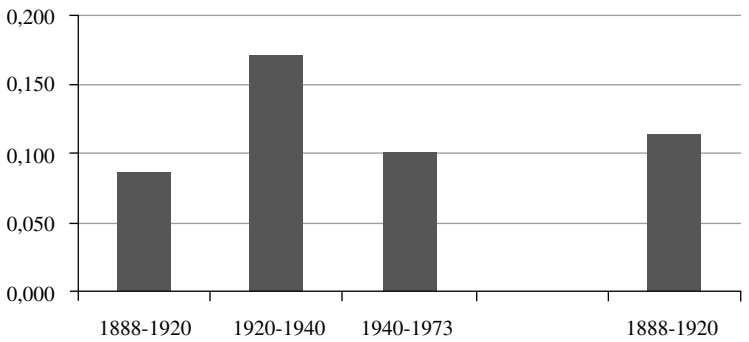
Where n is the total number of observations of the sample and $tr[M]$ is the trace of Markov's transition matrix (see eq. (8)). This index ranges between 0 when there is total stability and $n/n\text{-}1$ when there is no stability at all. For the entire period, I obtain a value of S=0.11 and I confirm the non-existence of high mobility, just as indicated by the high probabilities of persistence of the levels. Figure 4 shows how during much of the inter-war period, mobility between levels of categories of the provinces was greater than in other periods.[28] The reason for these changes is that, whereas in the third period, there is a little more transition

[27] Some of the provinces with the greatest industrial tradition benefited from the policies of industrial promotion during the ISI but, at the same time, they were affected by the policies of economic openness in the 1970s.

[28] Despite everything, the percentage of the transition for each category remains at quite high levels, above 75%.

of provinces towards higher income levels, in the second period there is greater transition of the provinces towards lower levels (in the first period the number of transitions towards higher and lower levels is the same). In the long run, the observed tendency in this distribution of probabilities shows a slight bi-modality, with an elevated concentration at the extremes, that is, greater permanence of those provinces that are at high levels or low levels of income. This result confirms what was previously noted, the rich provinces are lucky enough to string together successful mining cycles (in terms of the "commodity lottery"), while those provinces with a backward economic structure, do not manage do find a way out of this "underdevelopment trap" in which they find themselves.

FIGURE 4
SHORROCKS INDEX FOR THE CHILEAN PROVINCES, 1888-1973



Source: Derived from equation 9.

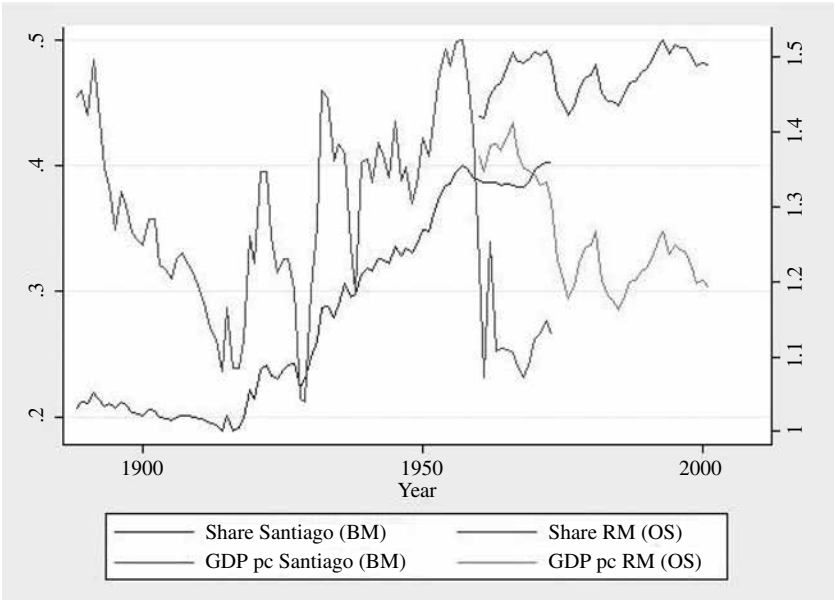
2.3. The spatial distribution of economic activity in Chile: 1890-2000

Up to this point, I have focused on understanding the evolution of the income levels per inhabitant in the regions of Chile. The next step aims to understand the behaviour of the spatial distribution of the economy in absolute terms. To do that we will compare what we have observed for the evolution of per capita GDP levels in the provinces, with the high concentration of economic activity in Chile, particularly from the 1930s.

What first draws our attention is the role that Santiago gradually acquires within the Chilean economy. As can be seen in Figure 5, the weight of the economy of Santiago over the entire country went from 20% at the end of WWI to 40-50% of the total towards the end of the 20th century. Contrary to our expectations, given the NEG predictions and the positive impact of the agglomeration economies, this did not result in an increase in income levels of the province, nor in the improvement of productivity levels. On the contrary, the evolution of the per capita GDP during the period studied remained quite steady, around 1.2 times the country average. In spite of the fact that the ISI policies coincided with the reinforcement of the concentration of the economy in the centre of the

country, this did not affect the taking advantage of positive externalities of the market potential or of scale economies in industry or services. As a result we did not observe any improvements in the productivity levels of these sectors, in the central regions of the country.

FIGURE 5
PERCENTAGE OF THE REGIONAL GDP OF SANTIAGO OVER THE TOTAL GDP AND REGIONAL PER CAPITA GDP OF SANTIAGO AND THE METROPOLITAN REGION



Source: Theil (BM) and GDP pc (BM) come from own estimations did by (Badia-Miró 2008). Theil data come from official sources.

The Hirschman-Herfindal index enable to observe in more detail how this process of extreme concentration behaved, from a global perspective, beyond that of simple observation of the percentages represented by each of the provinces over the total. The index is defined by:

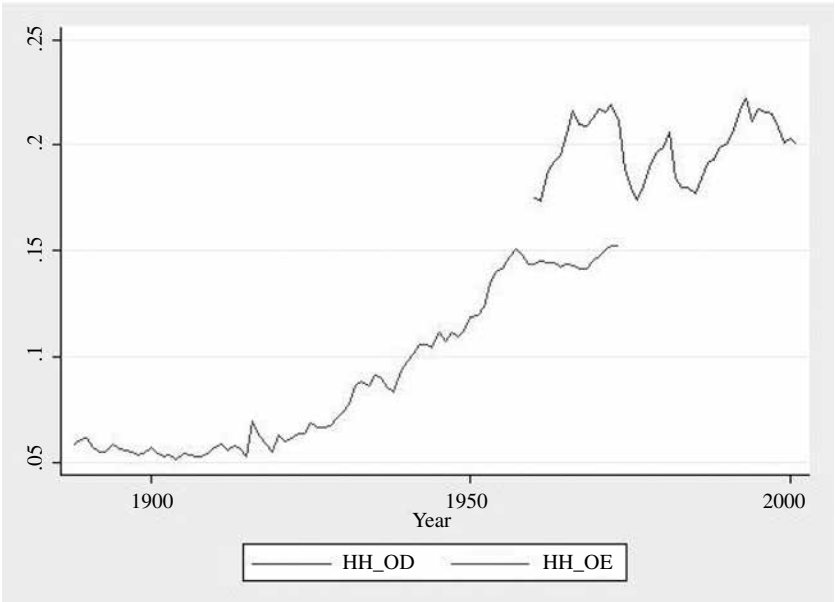
$$H_j^C = \sum_{i=1}^{N} \frac{X_{i,j}}{\sum_{i=1}^{n} X_{i,j}} \tag{10}$$

Where $X_{i,j}$ is GDP for the region i and the sector j. The index is limited between 1, when all the activity is concentrated in one region and *1/N* when the economy is equidistributed among all the regions. Comparing Figure 5 and Figure 6 it can be deducted that much of the extreme concentration experienced by the Chilean economy is related with the boost of the country's capital from

1920 onwards. Only the stagnation of this growth towards the 1970s stopped this trend, turning it to a stable trend.

A more detailed observation allows confirming that Santiago starts to gain weight in the whole of the economy some forty years previously. The reason is related with the fact that in the decades of the 1920s the nitrate and copper cycles coexist, which maintains the dynamism of several of the mining provinces, and therefore delays the growth of the H-H index. What appears clear is the importance that the ISI period had in reinforcing these trends. The import substitution policies, due to the protectionism increase of these years, ended up propelling these indicators and only with the end of protectionism was this rising trend detained. Furthermore, it also puts of the failure of the policies of regional development (particularly active in this period) as possible drivers of a spatial redistribution of economic activity. These policies, which on most of the cases relied on the impulse of manufacturing production, did not generate enough sustained linkages towards the rest of the regional economy, for these to initiate a process of lasting self-sustained economic growth. Once the period of intervention was over, the effects faded and the concentration of economic activity around the capital continued. Later on, it was the change of economic model in 1973 and the subsequent liberalization of the economy that altered this trend. It is then, when the H-H index stagnates, principally because of the process of de-industrialization, which the country goes through, in the context of drastic liberalization of the economy. This did great damage to the evolution

FIGURE 6
HIRSCHMAN-HERFINDAL INDEX FOR CHILE, 1895-1970



Source: GDP data comes from (Badia-Miró 2008) from 1890-1973 and official sources from 1960-2000.

of the capital and allowed that, again, those regions, which could take advantage of a better natural resources endowment, experience some recovery, based on the boost from exportations of natural products and semi-manufactured goods.

In summary, this set of indicators of the spatial distribution of economic activity in Chile, in the long run, point to several key points. First, there is a clear reduction in per capita GDP inequality among the regions and the provinces, disrupted only by the punctual expansion of some mining booms (nitrate and oil). This disruption is only circumstantial, and resumes the long-term path described above. In this sense, the non-existence of an inverted U-curve makes it necessary to find a different explanation to what can be observed for most industrialized countries.

Differences between mining and non-mining provinces do not generate conclusive results. The explanation seems to lie in the diversity of economic structures related with whether they are export-oriented mining provinces or domestic market-oriented. On the contrary, if we divide the provinces into rich and poor provinces (using the country average as an indicator separating the two groups), we observe some relevant results. On the one hand, it appears that the group of rich provinces behaves in quite a homogeneous way, as does the group of poor provinces. This would explain the existence of a certain polarization between the more productive provinces oriented to the exportation of natural products and semi-manufactured products, together with the provinces with an important agricultural sector coexisting with manufacturing industry, mining and low productivity services, oriented mainly to the domestic market. This viewpoint is confirmed by the graphs of the distribution functions, where a large concentration of provinces at values that are appreciably below the country average, and the presence of certain concentrations of extremely high values, can be observed.

Furthermore, we must not lose sight of the fact that the concentration of economic activity was accentuated during the central period of our study, particularly in the 1930s and 1960s. Though this process does indeed coincide with one period, that of the ISI, when industry came to acquire a relevant role. It is also certain that it never reaches levels high enough to be capable of generating linkages, which pull along the whole of the economy towards higher levels of development. This is what occurs in many of the studies about industrializing countries, and it is related to the process of increasing spatial inequalities. As it has been pointed out, we do not observe signs of the increase in the spatial dispersion of the economy in the period, and neither do we observe increase in the GDP per employed worker in the industrial sector. The levels of per capita GDP in the region where much of the economic activity is concentrated do not grow either. In the face of these results, it becomes necessary to look at which are the elements that reinforce this process of concentration of economic activity.

3. Conclusions

A detailed analysis of the evolution of the spatial location of the economic activity in Chile enables to understand a good deal of the processes that have reinforced the emergence of an extreme concentration of economic activity around the capital. The natural resource endowment and the dynamics that

emerge around the administrative capital, linked to its political role, as well as being a centre of high demand, predominate over the agglomeration economies, which could have emerged around the more dynamic sectors of the economy. This pattern contrasts head-on with what it has been found in several similar studies, for industrialized countries. In these, the agglomeration economies and the impact of the market potential are determinants during the process of industrialization. It appears that this is not the norm in un-industrialized countries.

Bearing in mind these elements as well, we need to consider that mining does not always have the same impact on the location of economic activity. What is determinant in this sense it is the location of this sector in space and the level of modernization of the sector, in different periods. On the one hand, nitrate mining had a specific impact which generated dynamics of dispersion of the economic activity due to the impact of the dimension of the market potential. In contrast, copper mining, much more disperse in space had a lower demand potential although it generates greater linkages towards the rest of the economy. Finally, coal mining, linked to less-modern sectors, although concentrated in space, was not capable of boosting the demand or dragging along the other sectors of the economy. The analysis of the differences in productivity among the provinces reinforces this last argument.

In a similar way, it has been identified the impact of "modern" mining on the level of productivity of the province (and therefore, also on the income level), which drives to understand what lies behind the low-income levels of the capital. In this case, the reason is twofold. On the one hand, the economic structure of Santiago shows a greater level of specialization in low-productivity sectors, and in turn, these sectors show productivity levels below the sector average. Behind these elements lie the causes of the incapacity of these sectors to generate agglomeration economies, which drive sustained growth in the long run.

4. References

Aguilar-Retureta, J. (In press). "The GDP per capita of the Mexican regions (1895-1930): new estimates", *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*.

Aroca, P.; M. Bosch (2000). "Crecimiento, convergencia y espacio en las regiones chilenas: 1960-1998", *Estudios de Economía*, Vol. 27; 199-224.

Atienza, M.; P. Aroca (2012). "Concentración y crecimiento en Chile: una relación negativa ignorada", *EURE* (Santiago), Vol. 38 (114); 257-277.

Badia-Miró, M. (2007). "The Ports of Northern Chile: A mining history in a Long-run Perspective", In: T. Bergholm, L.R. Fischer, and M.E. Tonizzi, eds. Making Global and Local Connections: Historical Perspectives on Ports. Research in Maritime History series, 35. Country: St. John's. Newfoundland, 153-170.

Badia-Miró, M. (2008). La localización de la actividad económica en Chile, 1890-1973. Su impacto de largo plazo. PhD. Thesis. Universitat de Barcelona, Spain.

Badia-Miró, M.; J. Guilera, P. Lains (2012). "Regional Incomes in Portugal: Industrialisation, Integration and Inequality, 1890-1980", *Revista de*

Historia Económica-Journal of Iberian and Latin American Economic History, Vol. 30 (02); 225-244.

Badia-Miró, M.; C. Yáñez (2015). "Localization of industry in Chile, 1895-1967: mining cycles and State Policy", *Australian Economic History Review*.

Barro, R.J.; X. Sala-i-Martin (1992). "Convergence", *Journal of Political Economy*, Vol. 100; 223-251.

Braun, J.; M. Braun, I. Briones, J. Díaz, R. Lüders, G. Wagner (2000). "Economía chilena 1810-1995: Estadisticas históricas", Documentos de Trabajo-PUC, (187).

Buyst, E. (2011). "Continuity and change in regional disparities in Belgium during the twentieth century", *Journal of Historical Geography*, Vol. 37 (3); 329-337.

Cariola Sutter, C.; O. Sunkel (1983). Un Siglo de historia económica de Chile 1830-1930: dos ensayos y una bibliografía. Madrid: Cultura Hispánica.

Carmagnani, M. (1998). Desarrollo industrial y subdesarrollo económico: El caso chileno (1860-1920). Santiago de Chile, Chile: Ediciones de la Dirección de Bibliotecas, Archivos y Museos.

Carmagnani, M. (2001). Los mecanismos de la vida económica en una sociedad colonial. Chile 1680-1830. Dirección de Bibliotecas, Archivos y Museos. Chile.

Caruana-Galizia, P. (2013). "Indian regional income inequality: estimates of provincial GDP, 1875-1911". *Economic History of Developing Regions*, Vol. 28 (1); 1-27.

Cavieres Figueroa, E. (1988). Comercio chileno y comerciantes ingleses 1820-1880: (un ciclo de historia económica). Valparaíso, Chile: Universidad Católica de Valparaíso, Instituto de Historia.

Combes, P.P.; M. Lafourcade, J. F. Thiesse, J. C. Toutain (2011). "The rise and fall of spatial inequalities in France: A long-run perspective", *Explorations in Economic History*, Vol. 48 (2); 243-271.

Combes, P.P.; T. Mayer, J. F. Thiesse (2008). Economic Geography: The Integration of Regions and Nations. New York, USA: Princeton University Press.

Coudyoumdjan, J.R. (2000). "El alto comercio de Valparaíso y las grandes casas extrangeras: 1880-1930, una aproximación", *Historia*, Vol. 33; 63-99.

Crafts, N. (2005). "Regional GDP in Britain, 1871-1911: some estimates", *Scottish Journal of Political Economy*, Vol. 52 (1); 54-64.

Daher, A. (1993). "Santiago estatal, Chile liberal", *Revista Interamericana de Planificación*, Vol. 101/1002; 43-62.

Díaz, J.; R. Lüders, G. Wagner (2007). "Economía Chilena 1810-2000. Producto Total y Sectorial. Una Nueva Mirada", Documentos de Trabajo-PUC (315).

Díaz, J.; R. Lüders, G. Wagner (1998). "Economía chilena 1810-1995: evolución cuantitativa del producto total i sectorial", Documentos de Trabajo-PUC, (186).

Duclos, J.Y.; J. Esteban, D. Ray (2004). "Polarization: Concepts, Measurement, Estimation", *Econometrica*, Vol. 72 (6); 1737-1772.

Ducoing, C.; M. Badia-Miró (2013). "El PIB industrial de Chile durante el ciclo del salitre, 1880 -1938", *Revista Uruguaya de Historia Económica*, Vol. III (3); 11-32.

Duncan, R.; R. Fuentes (2006). "Regional Convergence in Chile: New Tests, Old Results", *Cuadernos de Economía*, Vol. 43 (127); 81-112.

Echeverria, R.A. (2006). Essays on productivity, economic geography and trade: the case of Chile. PhD. Thesis Oregon State University. USA.

Epstein, P.; P. Howlett, M. S. Schulze (2003). "Distribution dynamics: stratification, polarization, and convergence among OECD economies, 1870-1992", *Explorations in Economic History*, Vol. 40 (1); 78-97.

Esteban, J.; C. Gradín, D. Ray (2007). "An Extension of a Measure of Polarization, with an application to the income distribution of five OECD countries", *The Journal of Economic Inequality*, Vol. 5 (1); 1-19.

Esteban, J.; D. Ray (2011). "Linking conflict to inequality and polarization", *American Economic Review*, Vol. 101 (4); 1345-1374.

Estrada, B. (1987). "Valparaíso y el proceso de industrialización en Chile a fines del siglo XIX", In: B. Estrada, ed. Instituto de Historia Universidad Católica de Valparaíso. Valparaíso: Ediciones Altazo; 135-150.

Felice, E. (2011). "Regional value added in Italy, 1891-2001, and the foundation of a long-term picture", *The Economic History Review*, Vol. 64 (3); 929-950.

Fingleton, B. (1999). "Estimates of Time to Economic Convergence: An Analysis of Regions of the European Union", *International Regional Science Review*, Vol. 22 (1); 5-34.

Fujita, M.; P. Krugman (2004). "The new economic geography: Past, present and the future", *Papers in Regional Science*, Vol. 83; 139-164.

Fujita, M.; P. Krugman, A. Venables (1999). The Spatial Economy: Cities, Regions and International Trade. Wiley Online Library.

Geary, F.; T. Stark (2002). "Examining Ireland's Post-Famine Economic Growth Performance", *The Economic Journal*, Vol. 112 (482); 919-935.

Geary, F.; T. Stark (2015). "Regional GDP in the UK, 1861-1911: new estimates", *The Economic History Review*, Vol. 68 (1); 123-144.

Gómez, A. (1974). "El proceso de localización industrial en chile: Análisis y políticas", *EURE: Revista Latinoamericana de Estudios Urbano Regionales*, Vol. 3; 9-56.

Gwynne, R.N. (1984). Geografía Industrial. In: Geografía de Chile. Santiago de Chile, Chile: Instituto Geográfico Militar.

Gwynne, R.N. (1986). "The Deindustrialization of Chile, 1974-1984", *Bulletin of Latin American Research*, Vol. 5 (1); 1-23.

Gwynne, R.N. (1999). "Globalisation, Commodity Chains and Fruit Exporting Regions in Chile", *Tijdschrift voor Economische en Sociale Geografie*, Vol. 90 (2); 211-225.

Gwynne, R.N. (2003). "Transnational capitalism and local transformation in Chile", *Tijdschrift voor Economische en Sociale Geografie*, Vol. 94 (3); 310-321.

Gwynne, R.N. (2006). "Export-orientation and enterprise development: a comparison of New Zealand and Chilean wine production", *Tijdschrift voor Economische en Sociale Geografie*, Vol. 97 (2); 138-156.

Henning, M., K. Enflo, F. Andersson (2011). "Trends and cycles in regional economic growth: how spatial differences formed the Swedish growth experience 1860-2009", *Explorations in Economic History*, Vol. 48 (4); 538-555.

Hirschman, A. O. (1958). The Strategy of economic development. New Haven: Yale University Press.

Hurtado Ruiz-Tagle, C. (1966). "Concentración de población y desarrollo económico: el caso de Chile", Documentos de Trabajo-PUC (89).

Islam, N. (2003). "What have We Learnt from the Convergence Debate?", *Journal of Economics Surveys*, Vol. 17 (3); 309-362.

Krugman, P. (1991). "Increasing returns and economic Geography", *Journal of Political Economy*, Vol. 99; 484-499.

Odeplan (1978). Regionalización gasto del producto geográfico bruto a precios constantes del año 1965. 1960-1976.

Palma, J.G. (1979). Growth and structure of Chilean manufacturing industry from 1830 to 1935. PhD. Thesis. Oxford University. United Kingdom.

Pinto Vallejos, J. (1987). "Valparaíso. metrópoli financiera del boom del salitre", In: *Valparaíso 1536-1986: Primera Jornada de Historia Urbana*. Valparaíso, Chile: Instituto de Historia Universidad Católica de Valparaíso. Valparaíso: Ediciones Altazo; 119-134.

Quah, D.T. (1993). "Empirical cross-section dynamics in economic growth", *European Economic Review*, Vol. 37; 426-434.

Quah, D.T. (1997). "Empirics for Growth and Distribution: Stratification, Polarization, and Convergence Clubs", *Journal of Economic Growth*, Vol. 2; 27-59.

Rosés, J.R., J. Martínez-Galarraga, D. Tirado-Fabregat (2010). "The upswing of regional income inequality in Spain (1860-1930)", *Explorations in Economic History*, Vol. 47 (2); 244-257.

Sala-i-Martín, X. (1996). "Regional cohesion: evidence and theories of regional growth and convergence", *European Economic Review*, Vol. 40 (6); 1325-1352.

Williamson, J.G. (1965). "Regional inequality and the process of national development: a description of the patterns", *Economic Development and Cultural Change*, Vol. 13 (4); 1-84.

Zhang, X.; R. Kanbur (2001). "What Difference Do Polarisation Measures Make? An Application to China", *Journal of Development Studies*, Vol. 37 (3); 85-98.