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**The geographical concentration of industry across Spanish
regions, 1856-1995⁺**

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Abstract:

New economic geography models show that there may be a strong relationship between economic integration and the geographical concentration of industries. Nevertheless, this relationship is neither unique nor stable, and may follow a Ω -shaped pattern in the long term. The aim of the present paper is to analyze the evolution of the geographical concentration of manufacturing across Spanish regions during the period 1856-1995. We construct several geographical concentration indices for different points in time over these 140 years. The analysis is carried out at two levels of aggregation, in regions corresponding to the NUTS-II and NUTS-III classifications. We confirm that the process of economic integration stimulated the geographical concentration of industrial activity. Nevertheless, the localization coefficients only started to fall after the beginning of the integration of the Spanish Economy into the international markets in the mid-70s, and this new path was not interrupted by Spain's entry in the European Union some years later.

Resum:

Els models de la nova geografia econòmica mostren que pot existir una forta relació entre la integració econòmica i la concentració geogràfica de les indústries. Tot i així, aquesta relació no és ni unidireccional ni estable i pot seguir un patró en forma de Ω en el llarg termini. L'objectiu d'aquest article és analitzar l'evolució de la concentració geogràfica de la indústria en les regions espanyoles durant el període 1856-1995. Es construeixen diversos índexs de concentració geogràfica per diferents moments al llarg d'aquests 140 anys. L'anàlisi es duu a terme a dos nivells d'agregació, NUTS-II i NUTS-III. L'estudi confirma que el procés d'integració econòmica va estimular la concentració geogràfica de la producció industrial. Tot i així, els coeficients de localització només començaren a caure després de l'inici de la integració de l'economia espanyola en els mercats internacionals a mitjans dels 70, i aquesta nova tendència no canvia amb l'entrada a la UE.

Key words: geographical concentration, economic integration, Spanish regions

JEL: N63, R12

1. Introduction

The current processes of globalization have stimulated the theoretical and empirical analysis of the effects of economic integration on industrial location. From a theoretical point of view, “new economic geography” – a new approach, albeit rooted in the neoclassical economics tradition – has made an important contribution to the analysis of this problem. New economic geography models show that there may be a strong relationship between economic integration and the geographical concentration of industries. Nevertheless, theoretical models teach us that this relationship may be non-monotonous and may change as a particular economy becomes integrated in the long term.

Unfortunately, most of the original empirical work dealing with this subject has been based on short-term evidence. Most of these studies, such as those by Brülhart and Torstensson (1996), Amiti (1999) and Brülhart (2001), are centered on the effects of European integration and have reported moderate increases in the geographical concentration of industries in Europe during the second half of the 20th century, especially during the first decades of the period, and some support for the existence of a Ω -shaped relationship between the degree of regional integration and spatial integration predicted by the models. In the Spanish case, contrary to our expectations, Paluzie *et al.* (2001) found no evidence of an increase in industrial concentration at the regional level following Spanish entry in the EU in 1986.

In fact, the non-monotonicity in the relationship between trade costs and agglomeration, with early stages of integration causing differences in production structures and later stages leading to convergence, means that long-term empirical studies are required

if we want to identify the turning points in the dynamics of the process. This is precisely our aim in this paper: by analyzing a 140-year period in Spanish economic history, we aim both to identify the different phases in the relationship between economic integration and industrial agglomeration and to link these different phases with the changing behavior of specific variables such as labor mobility which have been identified by theoretical models as key determinants of the relationship.

Kim (1995) conducted a long-term analysis of this kind for the U.S. economy. Studying U.S. regional manufacturing structure between 1860 and 1987, he showed that the relationship between economic integration and geographical concentration of industry followed a Ω -shaped pattern in the long term, in which the first steps in economic integration led regions to increase their productive specialization while further reductions in transaction costs caused the diversification in the productive structure of regions and, consequently, a decrease in the geographical concentration of industrial activities.

The aim of the present paper is to analyze empirically the evolution of the geographical concentration of manufacturing across the Spanish Regions during the 140-year period between 1856 and 1995. The economic integration (both external and internal) of Spanish regions is a well-known historical process and can be considered an ideal case study for the analysis of the effects of globalization on the patterns of industrial location in the long term.

The article is organized as follows. In section 2 we review recent theories of location that can help us to understand the trends observed in the evolution of regional inequalities in Spain. Section 3 discusses the data sources and the geographical concentration indices used in this study. In Section 4, we carry out the empirical analysis of

the changes in the location of Spanish industry during the period 1856-1929. Section 5 is devoted to the analysis of the period 1955-1995. Finally, Section 6 summarizes the main conclusions.

2. Trade costs and industrial location: a Ω -shaped relationship in the long term

In a globalizing economy, trade costs, transport costs and all kinds of barriers to border-crossing activities are gradually reduced. International exchange is stimulated, resulting in a general increase in growth and welfare. However, one of the possible effects of economic integration is an increase in the spatial concentration of activities, and thus an increase in economic disparities between regions. The “new trade” and the “new economic geography” literatures, which emerged at the end of the 20th century, have provided theoretical analyses of these questions, though no firm conclusions have been reached. It may be that the relationship between integration and industrial concentration follows a Ω -shaped path, in which the first stages of integration lead industries to concentrate in a few industrialized areas, and the last stages stimulate a dispersion of economic activities. In what follows, we review these theoretical predictions in detail.

The so-called “new trade theory” of the 80's offered a new explanation for the existence of trade and gains from trade.¹ Scale economies give countries an incentive to specialize and trade even in the absence of differences in their technology or factor endowments. Equilibrium in these models is affected by market size: a larger market is held to allow the survival of more firms than a smaller market. Therefore these models have a

¹ The main models of the “new trade theory” can be found in Helpman and Krugman (1985).

locational implication derived from this “home market” effect, that is the tendency to concentrate production near larger markets.

This locational implication was formalized by Krugman and Venables (1990) who proposed a model with two regions – a large core region and a small peripheral region – in order to analyze the effects of a reduction in trade costs. They assume that there are two factors of production, which are mobile across sectors but immobile across regions. The core region has larger factor endowments than the peripheral region, although both have the same relative endowments, so there is no comparative advantage. This difference in absolute endowments aims to reflect the fact that the core region has better access to markets. Each region has two sectors: a perfectly competitive sector that produces a freely tradable homogeneous good, and an imperfectly competitive sector in which firms produce differentiated manufactures under increasing returns to scale.

At equilibrium the core has a larger manufacturing sector than the periphery but, more interestingly for finite positive trade costs, its share of industry is larger than its share of endowments. Thus, the core is a net exporter of manufactures. Furthermore each region’s share of industry changes non-monotonically with trade costs. In figure 1 we plot the share of industry in each region against trade costs (where zero represents free trade and one autarky). For the core region, we observe a Ω -shaped relationship between trade costs and the region’s share of industry.

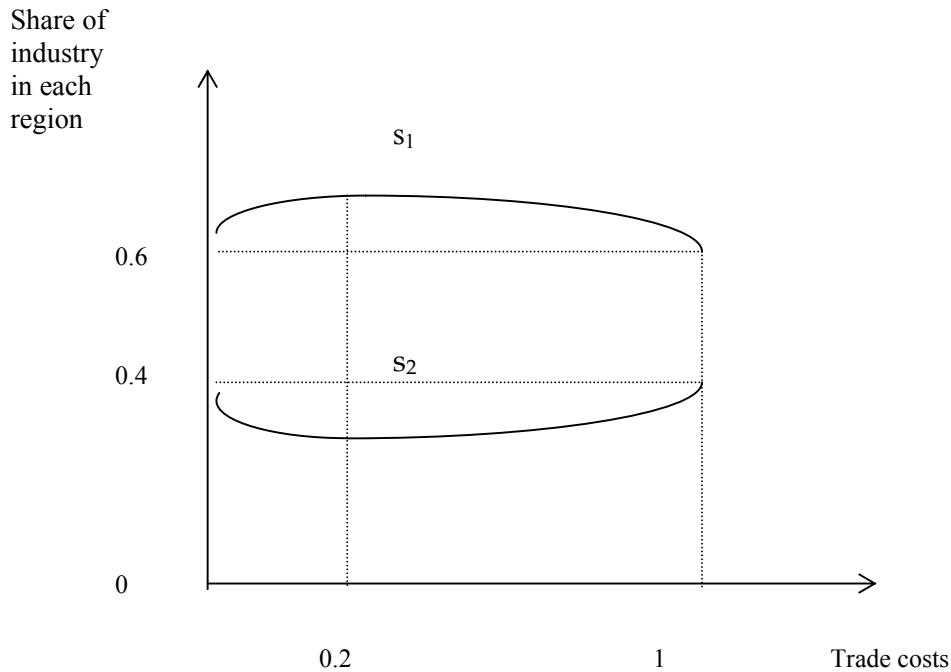


Figure 1. Trade costs and location in Krugman and Venables (1990)

In the autarky or high trade costs case, each region has a share of industry equal to its share of world endowments. Firms sell mainly in their local market. If a region has many more firms relative to its market size than the other region, the greater competition of the market will induce some local firms to leave. Economic integration increases the share of sales that each firm makes in the other region, weakening the effect of the higher number of local competitors. Increasing returns imply that the larger sales of firms producing in the core give them higher profits. If, in response to those profits, more firms enter, the size of industry in the core rises above its share of world endowments. The centripetal force is the access to a larger market, the so-called “home market effect”. But this tendency to locate in

the larger market is stronger for intermediate trade costs; when trade costs are lower, labor costs act as a centrifugal force to disperse economic activity. As the size of industry in the core increases, so does demand for local factors. For low trade costs, rising factor prices start to drive some firms out of the core. As the two regions approach costless trade, it is increasingly factor price differences that determine location and each region's share of industry tends to return to its share of world endowments.

This model highlights the existence of a non-monotonous relationship between economic integration and geographical concentration of industries. But the problem with this kind of trade model with imperfect competition is that it assumes from the beginning the existence of large and small markets, but does not explain this initial division. The evolution of these models towards a formalization of the cumulative causation mechanism that explains the existence of agglomerations has given rise to a new field: "new economic geography", led by Paul Krugman.² This field has connections with new trade and new growth theories and also with industrial organization and regional economics.

In "new economic geography" models, trade costs and increasing returns interact in a monopolistic competition framework to explain the settlement of industrial agglomerations. The mechanisms that give rise to the endogenous formation of center-periphery structures are the centripetal forces, the forward and backward linkages that reinforce an industrial agglomeration once in place. These models also pose directly the question of the possible effects of economic integration on industrial location.

The first formal model is Krugman (1991). It is a regional model, that is, a model that explains the establishment of a center-periphery structure within a country or within any other kind of border that allows labor mobility. Krugman shows that the interaction

between labor mobility, increasing returns and trade costs creates a tendency for firms and workers to concentrate. The trade liberalization associated with the process of economic integration brings about the establishment of center-periphery patterns with all industry concentrated in one region. Labor mobility acts as the destabilizing force that generates the linkages causing the cumulative causation process.

In an international context, barriers to labor mobility may limit the role of migration as the centripetal force that favors agglomeration. International models (Krugman and Venables, 1995; Krugman and Venables, 1996) do not allow for labor mobility between countries, and it is the existence of input-output linkages between firms that creates the tendency for manufacturing agglomeration. In this kind of model, the integration process is held to have two different stages: an early stage of growing world inequality with a core-periphery pattern that forms spontaneously, and a second stage of convergence in real incomes, where continuing reductions in trade costs eventually lead to a reindustrialization of the low-wage region. Labor immobility and therefore the possibility of wage differentials between regions is the key to this non-monotonic process.

This Ω -shaped relationship between transport costs and agglomeration is analyzed by Puga (1999) with a unified framework in which both interregional migration and input-output linkages may drive agglomeration. The comparison of outcomes with and without interregional migration shows that agglomeration is reinforced with the relocation of workers towards locations with higher real wages, while the lack of interregional mobility postpones agglomeration in a process of regional integration and weakens it when it happens. In the latter case, wage differences persist and act as a dispersion force. Thus, the

² For a recent survey of the “new economic geography”, see Neary (2001).

lack of mobility introduces non-monotonicity in the relationship between trade costs and agglomeration which is illustrated in Figure 2.

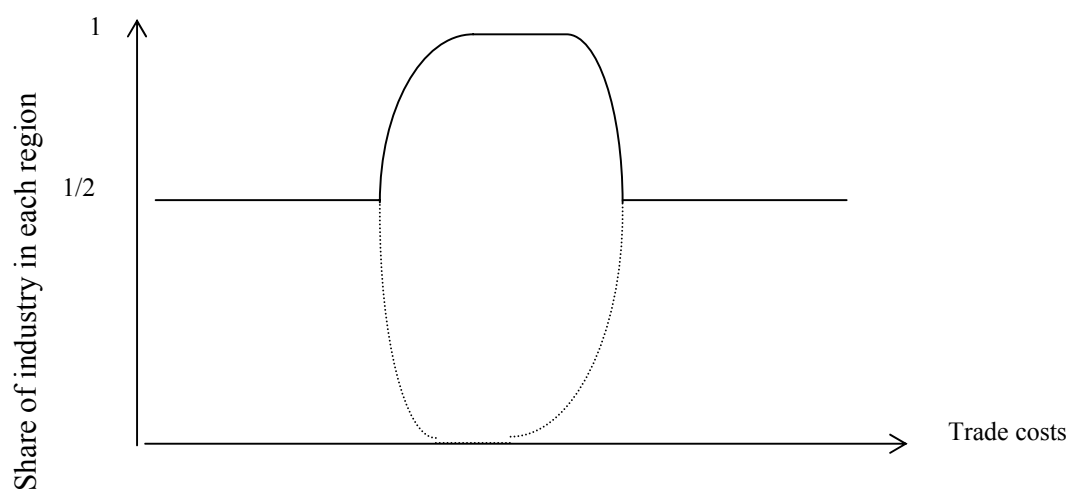


Figure 2. Trade costs and location in Puga (1999)

As illustrated in Figure 2, for high trade costs, firms are split between the identically endowed regions to meet final demand; for intermediate trade costs, regional disparities arise as some regions attract more industries than others; for low trade costs, dispersion takes place as the share of industry in regions with lower wages gradually increases.

More recently, Tabuchi and Thisse (2001) provide other theoretical foundations for the bell-shaped hypothesis. They do so by combining a model of economic geography following Ottaviano, Tabuchi and Thisse (2002) with a discrete choice model of migration. They consider that it is implausible that all potentially mobile individuals will react in the same way to a given “gap” between regions. In fact, once individuals have reached certain living thresholds, they are less willing to trade their family and social environment against more individual consumption. So their model introduces heterogeneity in migration

behavior. A second assumption is that amenity levels need not be the same across regions. The models shows that taste heterogeneity is a strong dispersion force that gives rise to a bell-shaped relationship between the spatial concentration of industry and the level of transport costs. The dispersed equilibrium is generally asymmetric and the region with the high level of amenity is larger than the other one. The global economy is taken to follow a three-stage process, involving dispersion, agglomeration, and re-dispersion, which is continuous with respect to variations in transport costs.

The predictions of these models have important policy implications, especially for the processes of economic integration. The main prediction is an increase in regional inequalities. Yet this prediction depends crucially on the assumption of labor mobility. The absence of labor mobility weakens agglomeration in the process of regional integration. In addition, if migration does not eliminate wage differentials, the latter act as a dispersion force in favor of regional convergence.

The majority of empirical tests that have been performed are centered on the analysis of industrial specialization and geographical concentration of industries. The line of research conducted by Kim (1995), Amiti (1999), Haaland *et al.* (1999), Midelfart-Knarvik *et al.* (2001) and Brühlhart (2001) uses summary measures (concentration indices) to describe the evolution of industrial specialization and the geographical concentration of industries across European countries or U.S. regions. But with the exception of Kim (1995), these analysis are short-term studies, and may therefore fail to show the long-term evolution in the relationship between trade costs and industrial location.

This is not the case of Kim (1995) which analyses long-run trends (1860-1987) in regional specialization in the U.S. He shows that the increase in industrial regional specialization occurred before the First World War, while the U.S. was becoming an

integrated national economy. Since the 30's, regional specialization has been falling. So, in the U.S. case, the relationship between trade costs and industrial agglomeration shows a Ω -shaped pattern.

In the case of Spain, several studies (Fluvià and Gual, 1994, Herce *et al.*, 2002, Paluzie *et al.*, 2001) analyze short-run trends in the evolution of industrial agglomeration in recent decades. Similarly, Tirado *et al.* (2002) and Pons *et al.* (2002) analyzed the determinants of the increase in industrial concentration during the second half of the 19th century. These analyses provide us with a case study of the first phase of the Ω -shaped curve: an integration process accompanied by an exceptional increase in the levels of geographical concentration of industries. However, a long-term analysis of the process that would give us a complete vision is still missing. In the following sections, we will analyze the evolution in the geographical concentration in Spain during a 140-year period that will allow us to characterize the relationship between trade costs and industrial agglomeration in the long term and to identify some of the key intervening factors in the relationship.

3. Specialization and industry characteristics: data sources and measures

To see how specialization has changed in Spain during the last 140 years, we construct two geographical concentration indices for each industrial sector. Specifically, we calculate Gini and Hirschman-Herfindhal industrial concentration indices for seven sectors and the whole industry. The geographical concentration indices indicate which industries are the most concentrated and the evolution of global industrial concentration during the period considered. Therefore, movements in these indices indicate changes in the spatial distribution of the industries.

Ellison and Glaeser (1997) and Maurel and Sédillot (1999) have noted recently that the size of firms is extremely relevant to an explanation of the territorial concentration of activity. Nevertheless, in our study we have not calculated the index suggested by these authors because no data are available on the size of each firm considered in the analysis for the whole period, and it has not been possible to proxy it.³ If we had been able to calculate these indices, we would have used them; Gini and Hirschman-Herfindhal indices are sometimes not particularly informative because they do not allow a clear view of the whole distribution of the industries. Nevertheless, by comparing the evolution of these two measures we can be reasonably confident about the results obtained.

The Gini index for each productive sector i (and also the global Gini index) is obtained from the following expression:

$$G_i = \frac{1}{2 \cdot \mu} \sum_j \sum_k p_j \cdot p_k \cdot |PR_j - PR_k|$$

where PR_j (PR_k) is the production in each of the geographical areas, p_j (p_k) is the area's share of production in the sector considered (or the whole industry) and μ the weighted average of the variable analyzed. The values calculated for this index, which vary between 0 and 1, can be illustrated with the Lorenz curves, given that the Gini index is equivalent to twice the area between the Lorenz curve and the 45° line (perfect equality). If the production is divided equally between the different areas the index will take value 0, while in the maximum inequality case, when all the production is concentrated in one area, it will take value 1.

³ An application of this kind of index for a shorter period in the Spanish case can be found in Alonso *et al.* (2001).

With the Hirschman-Herfindhal index we try to measure the degree of concentration of the production in the different geographical areas considered. The index is calculated as follows:

$$HH_i = \sum_j \left(\frac{PR_{ij}}{\sum_j PR_{ij}} \right)^2$$

where PR_{ij} is the production of sector i in region j . This index takes values between $1/J$, where J is the number of geographical areas, the minimum concentration case, and 1 when all production is concentrated in a single geographical area.

The data used to construct these indicators come from two sources. First, to construct the indicators used for the period 1856-1929 we use fiscal information. The indicators for 1856 and 1893 are constructed from the information on the province's share in the tax payments corresponding to the *Contribución Industrial y de Comercio*, tarifa 3ª (Industrial and Commercial Contribution, third tariff) given by the *Estadística Administrativa de la Contribución Industrial y de Comercio*. In the absence of alternative data, fiscal sources have frequently been used by historiographers as a proxy for relative industrial output in Spanish regions.⁴

This source gives provincial and sectoral information. However the level of sectoral desaggregation is not the same in all the periods considered. We therefore homogenize the data in order to break down the industrial sector into seven large aggregates that are the same throughout the period analyzed.⁵

For the indicators in 1913 and 1929, in addition to the data from *Estadística Administrativa de la Contribución Industrial y de Comercio* we use information provided

⁴ As an example, see Nadal (1985).

by the *Contribución de Utilidades*, a compulsory new tax on industrial corporations introduced in 1909.⁶ The use of these fiscal sources is a limitation in our analysis: we do not have information for the whole Spanish territory given that the Basque Country and Navarre had their own fiscal system and did not pay the *Contribución Industrial*.

For the period following the Civil War, we use the series of Spanish National Income constructed by the *Fundación BBV*, the source that gives homogeneous information for the longest period, i.e. for the period 1955-1995. Other sources are arguably richer but would not allow us to cover such a long period.⁷

In our analysis we choose the following option. Even though the data from fiscal sources and from direct estimates of gross value added are not directly comparable, we calculate the indicators with the same sectoral and territorial disaggregation, that is to say, we construct indices that cover a 140-year period for the whole of Spain (except the Basque Country and Navarre) and seven homogeneous industrial sectors.

Given the differences in the sources used, we divide the presentation of the results into two blocks, and analyze the tendencies within each. So we do not link the two sub-series but analyze the evolution of the indicators within each series.⁸ In the following section we analyze the results obtained for the first period.

⁵ The entries that form each industrial aggregate considered are available upon request.

⁶ Data on the provincial returns of this tax are misleading because they reflect the fiscal addresses of the firms, which did not always coincide with the location of the factories. Accurate data are only available for 1913 and 1929, thanks to Concepción Betrán's research: Betrán (1995).

⁷ In Paluzie *et al.* (2001) a similar exercise is carried out using data from the Industrial Survey (*Encuesta Industrial*) for the period 1979-1992.

⁸ However, given what we know qualitatively and quantitatively about the evolution of the Spanish industry from 1935 till the mid-fifties, it is quite realistic to assume that the geographical distribution of industry in 1955 was not very different from that of 1929. For a more detailed analysis of the early francoism see Catalan (1995). Using a less reliable fiscal source, we calculated the Gini indices for 1945 and 1950: they remained almost unaltered over the period (0.54 in 1945, 0.53 in 1950). In fact, not until 1955 did the economy recover the 1935 levels of industrial production; industrial investment was very low in the forties and early fifties. Therefore, the geographical distribution of activity could not change much (Carreras, 1990).

4. The first stages of Spanish industrialization: 1856-1929

In this section we present evidence of the patterns of regional specialization and geographical concentration of Spanish industry during the second half of the 19th century and the first decades of the 20th. First, we analyze the indices of geographical concentration in 1856, 1893, 1913 and 1929. These indices give, for each sector, a measure of the inequality in the regional distribution of the production with respect to a hypothetical homogeneous distribution of the activity in the territory.

In Table 1 we present the evolution of a global Gini and H-H indices for the industry as a whole throughout the period considered. In addition, these indices have been constructed at two different levels of regional aggregation, NUTS-II (*Comunidades Autónomas*, in Spanish terminology) and NUTS-III (*Provinces*).

Table 1. Global concentration, 1856-1929

	1856	1893	1913	1929
GINI NUTS III	0.44	0.60	0.68	0.78
GINI NUTS II	0.59	0.65	0.65	0.73
H-H NUTS III	0.06	0.13	0.15	0.24
H-H NUTS II	0.15	0.20	0.20	0.27

The first feature to highlight in the analysis of the indicators' evolution is the growth in the geographical concentration of industrial production during the period. The

various theoretical models signal the forces that could have stimulated this process. For example, in “new economic geography” models the interaction between increasing returns, labor mobility and transaction costs creates a tendency for firms and workers to concentrate.

In Spain, the beginning of the industrialization process was characterized by the spread of production techniques that marked the first technological revolution and hence by the appearance of internal and external scale economies. The existence of scale economies stimulated the initial agglomeration of industrial activities. Later, the inter-war period represented the beginning of the spread of the technologies typical of the second technological revolution, which favored the proliferation of large industrial companies – both new companies and old companies that merged. Furthermore, during this period the Spanish internal market became increasingly integrated due to strong investment in railway infrastructures, the unification of the monetary system around the peseta and financial innovations such as the system of free transfers between the branches of the Bank of Spain. Market integration favored the reduction in transaction and transport costs between the various regions. Moreover, until the 1890’s this integration of the internal market was accompanied by the increasing openness of the Spanish economy which also contributed to the process of industrial concentration.⁹ Finally, interregional migrations acted as a centripetal force that compensated for the congestion costs that might appear in the regions where industry was agglomerating, principally Catalonia.¹⁰ Table 2 shows the evolution in Spain during the period 1856-1929 of three indicators that proxy some of the forces that

⁹ A specific analysis of the determinants of the increase in the geographical concentration of the industry during this period can be found in Tirado *et al.* (2002).

¹⁰ A recent analysis of the internal migrations and its determinants can be found in Silvestre (2001).

stimulated agglomeration: the degree of openness of the economy, the relative stock of infrastructures, and labor mobility.

Table 2. Openness, infrastructures and labor mobility in Spain, 1856-1929.

	1856	1893	1913	1929
(X+M)/GDP (%)	11.40	20.68*	23.90	17.98
Net Stock of Infrastructures/ GDP (%)	12.11	23.79	28.40	27.68
Internal Migrants/ Population (‰)	1.28	3.08	2.72	3.26

* Value in 1890.

Sources.- Tena (1989, 1997), Serrano Sanz (1997), Herranz (2001), Mikelarena (1993) and Nicolau (1989).

Tables 3 and 4 show the Gini and Hirschman-Herfindhal indices of geographical concentration of industries by sectors. All sectors, with the exception of wood/furniture and paper, show an increase in the concentration during the period 1856-1929.

Table 3. GINI indices of geographical concentration by sectors, 1856-1929

NUTSIII	1856	1893	1913	1929
Foodstuffs	0.34	0.43	0.55	0.65
Textile Leather	0.73	0.87	0.91	0.94
Metallurgy	0.71	0.79	0.83	0.89
Chemicals	0.61	0.66	0.73	0.87
Paper	0.76	0.70	0.75	0.85
Glass Ceramics	0.48	0.54	0.66	0.78
Wood and furniture	0.86	0.72	0.67	0.65

NUTSII	1856	1893	1913	1929
Foodstuffs	0.57	0.55	0.59	0.62
Textile Leather	0.77	0.89	0.88	0.91
Metallurgy	0.64	0.70	0.67	0.79
Chemicals	0.57	0.62	0.66	0.80
Paper	0.69	0.66	0.70	0.77
Glass Ceramics	0.57	0.56	0.56	0.66
Wood and furniture	0.82	0.68	0.52	0.58

Initially the most concentrated sector was textile and leather, the leading sector in the process of Spanish industrialization. However, by the end of the period sectors such as metallurgy and chemicals were approaching the levels of concentration of the textile and leather sector. At the opposite end the most dispersed sector was foodstuffs, but even there the degree of geographical concentration increased.

Table 4. H-H of geographical concentration, 1856-1929

NUTSIII	1856	1893	1913	1929
Foodstuffs	0.03	0.04	0.07	0.11
Textile Leather	0.28	0.52	0.56	0.67
Metallurgy	0.07	0.18	0.18	0.30
Chemicals	0.06	0.10	0.15	0.34
Paper	0.10	0.12	0.16	0.26
Glass Ceramics	0.04	0.05	0.09	0.16
Wood and furniture	0.25	0.10	0.08	0.10

NUTSII	1856	1893	1913	1929
Foodstuffs	0.15	0.14	0.14	0.16
Textile- Leather	0.37	0.57	0.61	0.70
Metallurgy	0.17	0.21	0.19	0.30
Chemicals	0.14	0.16	0.20	0.35
Paper	0.18	0.18	0.20	0.28
Glass Ceramics	0.13	0.13	0.13	0.18
Wood and furniture	0.31	0.19	0.12	0.15

These indicators support the theory proposed by Spanish historiography: that territorial inequalities in industrial production increased over this period. In addition, the chronological evolution of the concentration of economic activities in Spain coincides with that of other economies (the U.S. for example) in which the increase in specialization and geographical concentration of production during the first phases of market integration has been confirmed. So Spain was not an exception.

5. From autarky to European Integration: 1955-1995.

Both the theoretical models described in Section 2 and the few empirical studies of the long-term evolution of the geographical concentration of production indicate that the process of increasing specialization tends to reverse once a given threshold in the dynamics of the reduction of transaction costs is reached. This new dynamics seems to be favored in some cases by the rise in congestion costs in the most developed areas. In addition, if interregional wage differentials are permitted, they will act as a dispersion force. So we would expect to be able to identify a particular point in the 20th century as the beginning of the decrease in the Ω -shaped relationship between the levels of geographical concentration of industries and transaction costs. In the case of the U.S, this turning point was the beginning of the Post-war period.

Table 5. Global concentration, 1955-1995

	1955	1965	1975	1985	1995
GINI NUTS III	0.64	0.67	0.68	0.65	0.63
GINI NUTS II	0.59	0.61	0.62	0.59	0.57
H-H NUTS III	0.13	0.14	0.13	0.13	0.10
H-H NUTS II	0.18	0.18	0.18	0.16	0.15

Table 5 shows the Gini indices of geographical concentration of industries in 1955, 1965, 1975, 1985 and 1995. What stands out is the absence of significative changes during this period as compared with the dramatic changes that occurred in the previous period. In fact, on average, the Gini concentration index decreased by only 1% during this period for

NUTS-III groups and by 2% for NUTS-II groups. The same evolution can be observed in the HH indices.

Nevertheless, we can divide this evolution in two periods. During the Francoist regime there was a slight increase in the geographical concentration of the industry, but once the process of European integration and industrial restructuring began, the geographical concentration of industrial production tended to fall.

At the sectoral level, we again observe an absence of radical changes along the period in correspondence with the evolution at the aggregate level. Tables 6 and 7 present this evidence.

Table 6. GINI by sectors, 1955-1995

NUTSIII	1955	1965	1975	1985	1995
Foodstuffs	0.42	0.43	0.47	0.49	0.46
Textile Leather	0.77	0.75	0.75	0.75	0.75
Metallurgy	0.80	0.82	0.79	0.75	0.74
Chemicals	0.72	0.75	0.76	0.75	0.75
Paper	0.77	0.78	0.76	0.78	0.77
Glass Ceramics	0.61	0.59	0.59	0.57	0.59
Wood	0.55	0.54	0.57	0.57	0.56

NUTSII	1955	1965	1975	1985	1995
Foodstuffs	0.48	0.46	0.47	0.47	0.46
Textile Leather	0.71	0.70	0.69	0.69	0.70
Metallurgy	0.67	0.72	0.68	0.62	0.63
Chemicals	0.63	0.67	0.69	0.69	0.70
Paper	0.70	0.70	0.68	0.69	0.69
Glass Ceramics	0.55	0.52	0.54	0.54	0.57
Wood	0.49	0.49	0.52	0.52	0.51

However, there are some small divergences between the sectoral and aggregate behaviors. In some cases, such as textiles or glass and ceramics, the expected increase in concentration between 1955 and 1975 is not observed. In the case of textiles, the high levels of concentration already reached in the 19th century may be reason. However, in other cases, such as the chemical industry, the increase between 1955 and 1975 is so strong that in spite of the subsequent reduction in the value of the indicators the final value remained above the 1955 levels.

Table 7. H-H by sectors, 1955-1995

NUTSIII	1955	1965	1975	1985	1995
Foodstuffs	0.04	0.04	0.05	0.05	0.05
Textile Leather	0.26	0.21	0.17	0.15	0.15
Metallurgy	0.18	0.21	0.19	0.20	0.14
Chemicals	0.16	0.18	0.18	0.21	0.17
Paper	0.17	0.19	0.17	0.19	0.19
Glass Ceramics	0.09	0.08	0.07	0.07	0.07
Wood	0.06	0.06	0.07	0.07	0.07

NUTSII	1955	1965	1975	1985	1995
Foodstuffs	0.12	0.11	0.11	0.11	0.11
Textile- Leather	0.30	0.26	0.23	0.21	0.22
Metallurgy	0.21	0.24	0.21	0.17	0.18
Chemicals	0.20	0.29	0.23	0.23	0.23
Paper	0.21	0.22	0.21	0.22	0.22
Glass Ceramics	0.14	0.13	0.13	0.13	0.14
Wood	0.12	0.12	0.13	0.13	0.12

What stands out from this evidence is the slow, late reduction in regional differences in industrial location in Spain as compared to the theoretical predictions and the

experiences of other countries. The decreasing section in the Ω -shaped curve does not begin till the seventies and cannot be observed in all sectors.

It is not hard to find the reasons for this evolution. First, the Spanish economy was strongly protected during the Francoist period.¹¹ This could have favored the industrial agglomerations already established by reinforcing the importance of proximity to domestic suppliers. Second, hardly any attempt was made to reduce transport costs: until the late sixties the railway network remained untouched and the motorway network had not been started.¹² Furthermore, even though production processes typical of the second technological revolution were introduced before the Civil War (1936), they did not become widespread in Spain until long afterwards: some 20 years later than in other economies such as the U.S.. Therefore, between 1955 and the late sixties industrial growth was dominated by the behavior of sectors characterized by scale economies. Moreover, the tendency towards the geographical concentration of industrial activity was reinforced by the strong interregional migratory movements of the time.

Table 8 shows the evolution in Spain between 1955 and 1995 of the same three indicators constructed for the first period to proxy some of the forces that stimulated agglomeration: the degree of openness of the economy, the relative stock of infrastructures, and labor mobility. First, though the degree of openness of the economy increased over the period, it was very low in the fifties. As for the infrastructure stock as a % of the GDP, it actually fell between 1955 and 1965, then increased moderately in the early seventies and rapidly from the 80's onward. Finally, migration movements reached their peak in the sixties; they started to decline in the seventies.

¹¹ On Spanish trade policy during this period a classical reference is Viñas *et al.* (1979).

¹² On the evolution of the railway stock in Spain during these years, see Cucarella (1999).

Table 8. Openness, infrastructures and labor mobility in Spain, 1955-1995

	1955	1965	1975	1985	1995
(X+M)/GDP (%)	8.80	17.18	23.75	34.07	44.00
Net Stock of Infrastructures/GDP (%)	33.13	29.37	32.53	41.19	56.17
Internal Migrants/Population (‰)	n.a	9.00	6.20	4.20	4.60

Note.- n.a stands for not available.

Sources.- Tena (1997), Serrano Sanz (1997), Mas *et al.* (1995/1998), Ródenas (1994) and Ródenas and Martí (1997).

So the changes in all these factors at the beginning of the seventies explain the beginning of the fall in the geographical concentration of industry observed in the indicators since 1975. On the one hand, the Spanish economy became more strongly integrated in the international economy.¹³ This was reinforced by a reduction in internal transport costs, thanks to high public and private investment in infrastructures.¹⁴ Finally, internal migration had previously acted as a centripetal force; with the advent of the welfare state and the introduction of policies of territorial equilibrium in the mid-seventies, migration began to decline.¹⁵ In addition, the industrial model typical of *desarrollismo* (the Spanish process of development in the sixties) went into crisis and the new industries typical of the third technological revolution did not favor industrial agglomeration to the same extent, at least from a purely technological perspective.

¹³ Though the process can be said to date from the Spanish agreement with the IMF and the OECD in 1959, the Preferential Agreement signed with the EEC in 1970 and the agreements signed in the Tokyo Round of the GATT and the Agreement with EFTA (1979) marked the beginning of a process of openness that has been irreversible since the mid seventies (Alonso, 1989).

¹⁴ See Mas *et al.* (1995/1998).

¹⁵ Bentolila (1997, 2001).

However, this reduction in the geographical concentration of industries from 1975 onwards is relatively moderate and was not greatly affected by Spain's entry to the E.U. According to the theoretical predictions, the low interregional labor mobility in Spain combined with an increasing integration both internally (stimulated by the jump in the investment in infrastructures) and externally (due to European integration) should have caused regional convergence in terms of production structures. But, as Puga (2001) suggests, in countries like Spain, minimal interregional migration did not lead to interregional wage differentials because wages were set at the national level. Clearly, if wage levels do not respond to regional economic conditions, an important dispersion force is lost.

6. Conclusions

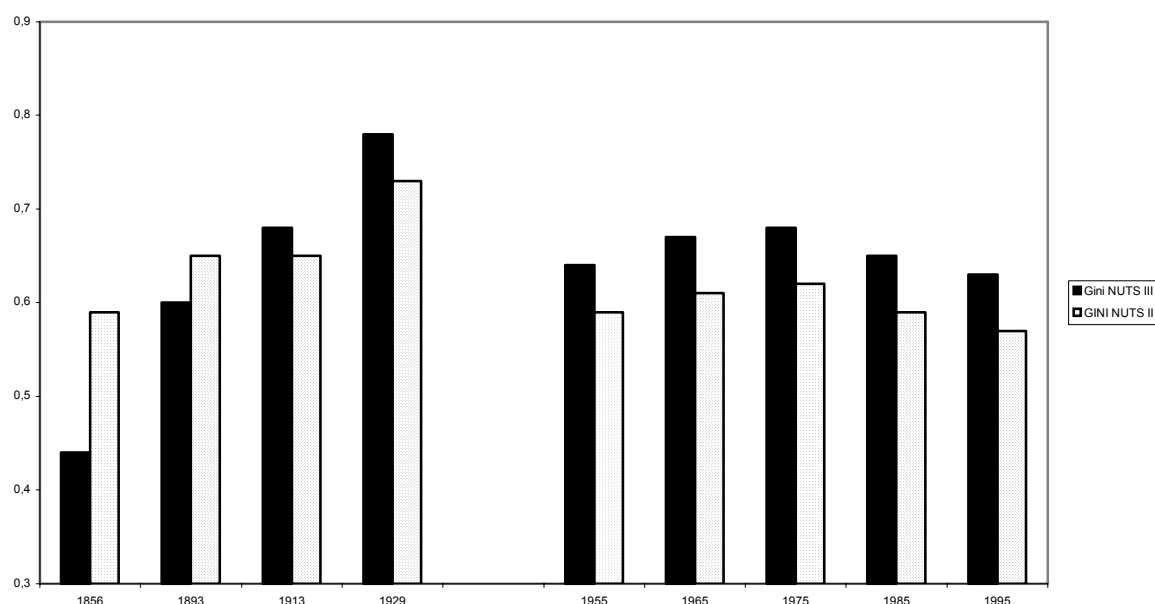
The geographical concentration of industry is higher in Spain than in other economies. This situation has been analyzed by several studies, but its roots are to be found in the beginning of the Spanish industrialization process.

In this paper we have shown that if a Ω -shaped pattern characterized the dynamics of industrial concentration in a limited number of regions, Spain would follow the standard evolution in the increasing section of the curve. However, the Civil War and the first two decades of the Francoist regime delayed the end of a process of increasing concentration which, in other economies, ended at the beginning of the forties.

Figure 3 shows that the Francoist policies had costs in terms of territorial inequalities, whose magnitude can be only evaluated if we compare them with that of other

economies in the same period. At a time when geographical concentration of industries in the U.S was already falling, in Spain it was still increasing. Spain seems to have entered the decreasing segment of the Ω -shaped curve very late, and this delay goes some way to explaining the high current geographical concentration of the Spanish industry.

Figure 3 Global concentration. GINI Indices, 1856-1995



Source.- Tables 1 and 5.

The analysis also helps to understand some of the mechanisms at work in the competing models that explain determinants of industrial agglomerations. On the one hand, we confirm that the relationship between the reduction in transport costs and geographical concentration of activity is not monotonous. Protectionism may put a brake on the concentration process if the economy is in the rising phase of the Ω -shaped curve, and can

generate the opposite effect if applied when the economy is in the second phase, i.e. in the falling segment of the Ω -shaped curve.

This exercise also draws attention to two elements that have been largely neglected by the theoretical literature. The first is time, a factor necessary to permit the adjustments in the economy that receives the impulse. The second is the technological paradigm within which the various productive sectors develop. In this respect, it is worthwhile remembering that both the first and second technological revolution favored productive concentration, while the third technological revolution favored the growth of a group of productive sectors for whom scale economies are less relevant.

Finally, the Spanish experience signals an additional point. Though we confirm the existence of a Ω -shaped relationship between integration levels and the geographical concentration of industrial activity, the movement along the increasing segment of the curve seems to have been easier than along the decreasing one. This may have been due to the institutional conditions of the Spanish labor market.

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