An historical test of industrial relocation - The formation of the Portuguese Core Industrial Region (1890-1950s) [1]

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Abstract:

This paper examines the spatial location of industrial activities in the twentieth century and tests for the reasons that led industry to leave the interior of the country and cluster in the coastal strip between Oporto and Setúbal, (just to the south of Lisbon). The paper discusses the role of railways, among several other factors, in explaining regional industry delocalization in Portugal.

Spatial analysis may be useful to historians too. This paper provides an analysis of Portuguese industrial delocalization as a case study that may shed light on Economic Historians' debates on industrial location.

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Introduction

Economists and economic historians have long discussed the role of geographical aspects on industrial activities. The Portuguese historical experience analyzed here, from 1890-1950s, is particularly interesting, as the national rail network was completed at the beginning of this period. The decades 1860s through 1890 were marked by the huge investment effort to build it. Both private capital and government subsidies were required for the project. At the same time the government was also making a great effort to build a road network and improve ports.

These infrastructures were regarded as public goods necessary to stimulate growth and industrialization. As public deficits resulting from these high public expenditures were financed through the issuing of public debt bonds in domestic and foreign markets, the service of the public debt led to a partial government bankruptcy in 1892. The idea that economic growth fostered by the use of these collective infra-structures would result in new tax revenues sufficient to pay the public debt interest and capital, did not occur. Following the bankruptcy, no further foreign loans were granted in the financial markets, which explains the small number of rail lines built thereafter.

Road transport infrastructures, too, have seen little improvement until very recently. Even after the public budget equilibrium was achieved in the late 1920s, the only improvement through investment during the twentieth century was to pave the available

roads, in response to the new technologies of the time and the requirements imposed by growth in automobile traffic in the 1930s and 1940s, under the Salazar government.[4]

So, by looking at the changes in industrial location between 1890 and the 1950s, we will be able to see how the railways and roads built at the beginning of the period influenced the location choices of firms throughout the country thereafter. The newly achieved geographical profile of the industrial network would support the acceleration of the path of modern economic growth in Portugal, in the following decades.[5] At the same time, the exercise may reveal something about the interaction of firms' location choices with the development of a new network of transport services, given the unchanged transport infrastructures.

Section 2 will frame the theoretical aspects that support the inquiry performed in this paper, along with other factors and variables that have been considered as relevant explanations for *delocalization*. Section 3 presents the historical sources for data and Section 4 describes what changes occurred in industry location. Section 5 explores the model used, whose estimations are commented on in Section 6. Conclusions are drawn at the end.

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[4] *Relatórios*, several issues. Vieira, 1980.

[5] Amaral , 2003.

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1. The theoretical framework

The interest of social scientists in the location of cities is more than a century old. It originated with Cantillon and continues to the present day. Von Thünen's theory of spatial patterning of land uses, which dates from 1826[6], constituted the base of the 'location theory' that would be developed later on, through the works of Weber (1909), Christaller (1933), and Lösch (1939). Weber's theory aimed to explain industrial location as a decision regarding the minimization of transport costs in terms of both suppliers and markets. Christaller studied the location and relationships among cities in southern Germany and believed that there were systematic patterns. A regional city and its manufacturing factories would supply a crown of satellite cites that stocked the manufacturing goods in warehouses for distribution locally and to retail distributors in its own crown of towns. In this way, cities form a hierarchy of nested market areas. Lösch demonstrated that producers would cluster into hexagonal market areas.

Even though Lösch's work had been the inspiration for two separate disciplines, 'regional science' and 'economic geography',[7] his wish for the creation of a new structured field of 'spatial economics' was not achieved. In fact, for many years economists showed something less than consistent interest in the subject.

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[6] "Der Isolierte Staat (The Isolated State)"

[7] See Martin, 1999, for further details on the difference between these disciplines.

More recently, in the 1990s, when mainstream economists rediscovered increasing returns and markets characterized by imperfect competition, new theoretical approaches were made available. This new movement has come to be known as 'New Economic Geography', an expression introduced by Krugman to designate a "style of economic analysis which tries to explain the spatial structure of the economy using certain technical tricks to produce models in which there are increasing returns and markets characterized by imperfect competition" (Krugman, 1998, p. 7).

The idea that increasing returns to scale promote spatial agglomeration is not new, however. Urban and regional economics, which fit into the 'regional science'[8], had long recognized this relationship (Hanson, 2001)[9]. In fact, the existence of what is now called agglomeration economies (local external economies) was already acknowledged by Marshall (1890). He was the first to advance the three, now classical, reasons why firms cluster – specialized labor market pooling, increased provision of non-traded input specific to an industry (economies of scale in the some particular infrastructure or benefits from the greater availability and efficiency of local services), information and technological spillovers (also referred to as pure external economies).

[8] Developed by authors such as Isaard, in the 50s, and Alonso.

[9] Quigley, 1998, and Brakman, Garretsen, Marrewijk, 2001, for a survey of the literature.

Thus, the novelty of the 'New Economic Geography' lies in the integration of these spatial issues into general equilibrium models[10]. Important non-convexities have blocked substantial progress for many years. The New Economic Geography has swept away most of these difficulties by reconsidering agglomeration economies under the combined modeling of increasing returns and imperfect competition.

It is a fact that economic activities are concentrated in areas of high population density. As people concentrate where employment opportunities are, it is then necessary to study location choices of firms in order to understand the location of cities. It is in this context that scale economies in production become so important in understanding the creation and growth of cities: "Without scale economies, there is no role for the city at all"[11]. Apart from the external scale economies, internal scale economies also cause firms to concentrate their production in one or few places, preferably near their demand. Of course, not all demand is concentrated in a single place, and the distance to suppliers is also important. So, transport costs play a decisive role in this story. In fact, for "the prolific and often controversial Krugman"[12] the industrial cluster's location is determined by the interaction between

[10] See Krugman's chapter "Where is the 'New Economic Geography'?" in The Oxford Handbook of Economic Geography".

[11] Quigley, 1998, p 130.

[12] Boddy, 1999, p. 811.

agglomeration economies and transport costs (Krugman, 1991) - when transport costs are high they will act as a dispersion force, and when they are low they will reinforce agglomeration economies. Furthermore, if transport costs were to decline “the economy would spontaneously organize itself into a core-periphery geography (…) with manufacturing concentrating in a ‘core’ while the ‘periphery’ is relegated to primary production” (Krugman, 1998, p. 12, p. 14). Once established, this regional pattern is sustained by a ‘lock-in’ or path dependence. According to Martin (1999) this is an application of ‘economics of qwerty’ to industrial location. There is a cumulative process by which firms tend to cluster where markets are larger and markets tend to be where firms are working. Which region turns into the core and which into the periphery is determined by an historical accident that makes a region benefit from better access to both demand and suppliers. It is a neat way to deal with the fact that the models of this ‘New Economic Theory’ are indeterminate regarding the places where industry clusters, that is, there could be multiple equilibrium solutions.

Krugman suggests that there are also ‘self-reinforcing advantages of market access via transportation networks - “a location that for whatever reason has a concentration of production will tend to become ‘central’ in terms of the transport network, which will reinforce its advantage as a production location, and so on” (Krugman, 1998, p. 19). This process can then be used to explain why one or two regions can turn into the main or the two main poles of a country. Mori and Nishikimi (2002) elaborate on this issue and show that economies of

transport density can be the primary source of industrial location. They define economies of transport density as a mechanism of circular causation: frequent transport services in a given link will attract users, which in turn, will stimulate the supply of these services. According to these authors, it is the size and spatial distribution of demand for manufactured goods that determine the structure of the transport network. A transport hub will develop where regions are relatively close to one another. Otherwise the scale of density economies is limited by the size of transport demand. U-shaped relationships between the decrease in transport costs and spatial agglomeration are also available.[13]

Rosenthal and Strange (2003) prefer to use natural advantages such as natural harbors, coal availability and climate as well as economic variables such as fiscal policies or wage rates to explain the birth of new establishments.

It is within this Economics' theoretical framework that we will try to explain the changes that occurred in the location profile of Portuguese industrial activities from the end of the nineteenth century to the middle of the twentieth century[14] .

As for Economic History, it is only fair to say that geographical or local aspects have always deserved the attention of historians, as time and space are the two coordinates of any

[13] Krugman; Venables, 1995.

[14] See also Figueiredo and Woodward, 2000, for the 1980s-1990s in Portugal, and Hanson, 2001, for a survey on recent empirical work on the geographic concentration of economic activity.

historical fact.[15] Pollard (1981) studies the location of European industry and concludes that modern industry was attracted to regions having long experience in traditional industry. In fact, the available nineteenth-century European historical experience shows that industrialization occurred mainly in regions that combined the so-called *domestic system* supplying industry with intermediate goods, or in regions where there was a long tradition in manufacturing production. In Mathias, 1969, Pollard, 1981 and Cameron, 1993, the local resources were pointed out as a main determinant for industrialization. Not only energy sources such as coal or water, but also raw materials' availability attracted industrial activities. Among resources, the location of human resources, in particular, deserved a special attention, as it was considered not only from a quantitative point of view but also from a qualitative perspective. In Cameron (1993), literacy and education in general have been elected as proxies for the human resources' quality and also as two pivotal elements in explaining successful locations for industry.

The support of financial institutions such as banking and insurance, as well as the role of some institutional aspects such as the enforcement of contracts, are two additional factors that can be found in the literature as possible explanations for some successful

[15] Landes, 1993.

industrialization experiences – North (1996) and Cameron (1967). We will consider these too in our regional analysis.

For historians it is impossible to ignore the importance of markets and the ease of access to them. We all know that medieval towns grew on river banks or as sea port cities. Most of the European cities are crossed by rivers, the same as we find elsewhere, throughout the world. A port city on the sea or a navigable river had easier contacts with foodstuff suppliers or raw material producers (Pounds, 1988). Cheaper transports and lower information costs have also been identified as relevant factors in explaining the successful location of industry, in studying the historical geography of Europe.

Historical studies have also paid attention to the lags between decreasing transport costs and industry location. For economic historians this is a decisive aspect. Not only is time a permanent issue in historical explorations, but also industrialization was preceded by a long period, of about half a century, during which national economies gathered a set of economic, social and institutional aspects as pre-conditions for a successful industrialization.[16] Time lags may be used in empirical tests to allow for the impact of such pre-conditions on regional industry location.

[16] Rostow, 1960.

2. Main sources

During the second half of the nineteenth century worries about the knowledge of economic indicators led investigators to collect data on industry. The Ministry of Public Works of Portugal made available a survey on industrial units working in the country in 1890, showing industry and industrial labor force distribution by *Concelhos*. According to the Administrative Code, Portugal is divided into smaller administrative regions called *concelhos,* which were grouped into 17 major administrative regions, the *distritos*.[17] Administrative changes from 1890 to the 1950s did not affect territorial boundaries of *Concelhos*. (The main administrative changes that occurred in the country are described in Appendix 1. There was also the division of the district of Lisbon into two, with the inclusion of *Concelhos* south of Lisbon in the newly-created district of Setúbal). Most of the available information was collected by the government. The creation of Statistical Offices for this purpose is an indication of how important this information was considered to be. By the middle of the twentieth century, a new industrial survey brought insight into the new distribution throughout the territory. This paper uses the regional variation in the number of industrial units in the period between 1890 and 1957, which reveals the changes in the location of industry and the industrial labor force in Portugal at the level of the *Concelhos*.

[17] M.O.P.C.I., 1890.

As civil society also felt the need for information on practical matters of everyday life, particularly in economic activities, the publication of an annual Commercial Compendium, *Anuário Commercial*, was undertaken and began to appear regularly in the 1880s. The first issues were rather poor, but with time it turned into an excellent source of information on the main features of Portuguese *Concelhos*. It provided news on selected aspects of commerce that were considered relevant for travellers, merchants, tourists or people in general. The *Anuário* provides the profile of each *concelho* including information on the distance to the administrative regional capital (*sede de distrito),* the presence of a railway station in that regional capital or the distance to the nearest railway station. It provides details on population, posts, saying if it was possible to send letters, postal packets, and/or postal orders. It is also possible to learn about the presence or absence of Courts, military regiments, banks or banking agents, insurance companies or their agents, local newspapers, schools, and professors teaching in the administrative center of the *Concelho*. Finally, cultural organizations are also referred to, including theaters, and any other cultural institutions.

The *Anuário Commercial* is a splendid database which was never used as such. Portuguese economic historians have used it frequently, but only for limited purposes.[18]

[18] Vieira, 1980, for studying the automobile diffusion; Mata, 1999, for economic activities in Lisbon; Mendes, 1984 for the Center of the country.

The data in the 1900 issue of the *Anuário Commercial*[19] are then joined with the data provided by the two surveys on industrial units, 1890 and 1957, to study the changes in the location of industry in Portugal by *Concelhos*.

3. The dynamics of industry location through the first half of the twentieth century

During the first half of the twentieth century, *Concelhos* along the Spanish border and in the interior of the country lost many industrial units. The greatest losses were in the *Concelhos* in the districts of Beja, Portalegre, Castelo Branco, Viseu, Guarda, Bragança and Vila Real. The delocalization led interior regions to lose most of their traditional industries.

Favored regions were *Concelhos* belonging to the Western Atlantic coastal districts (such as Aveiro, Leiria, Lisbon and Setúbal), as well as some *Concelhos* of the coastal strip of Algarve (belonging to the Southern Atlantic district of Faro). According to the data, the most favored was Lisbon, the capital, and its surroundings. Lisbon, which has always been a port city, had become a transport hub from the 1860s to the 1880s. Industry delocalized their units towards the coast along the railway lines, creating employment in these regions. Spreading from Lisbon in a star-shaped form, the Northern rail line, linking Lisbon to Oporto, the Eastern line along the Tagus valley, and the Southern line towards the port city of

[19] There is an 1890 issue but it is very incomplete. We decided therefore to use the 1900 issue.

Setúbal, increasingly attracted more factories and people. As in other countries, this also meant urban competition for industrial development. Lisbon and Oporto were now rival cities - from the eighteenth century on.[20] As Cheshire (1999) puts it for the USA, “The railroads were built on urban competition”. In the Portuguese case the railway removed obstacles to movement between the two main urban poles, generating new local opportunities for territories from the perspective of industry location. The capacity of territories around these cities and territories to attract industrial units is useful to the exercise of location analysis.

Map 1 illustrates this delocalization. The *Concelhos* where the number of industrial units decreased between 1900 and 1957 are shown in white and those where the number of units increased are in grey (the black spaces correspond to the *Concelhos* for which there are no data).

Map 1 about here

In the same way, employment in industry required a relocation of workers.

Since the 1980s the dominant thought among Portuguese historians has been that railways were responsible for the creation of only two industrial poles, one in Lisbon, the

[20] Mata, 1996.

other in Oporto, the second main Portuguese city. Justino, (1988, 1989) claims that railways made Portugal a bi-cephalic country from an urban point of view, precisely because of industry concentration during the second half of the nineteenth century. According to Map 1, fifty years later this regional profile was no longer to be found: the whole coastal corridor between Lisbon and Oporto, and not only the two cities, attracted industrial activities, and was much more dynamic than all the rest of the country. The whole rail line and the coastal road network were important attraction factors, to be sure, as decreasing transportation costs could compensate for growing prices of the urban real estate.

4. The model

According to Hanson (2001), p. 259, “theory pays relatively little attention to how the exogenous characteristics of regions influence where industry clusters arise (…)”. Like him “In taking theory to the data, we want to control for how the supply of exogenous site-specific resources might affect the location of economic activity”.

Therefore, we seek to explain firms’ location in 1890 using the *Concelhos*’ characteristics in the same year, provided by the *Anuário Commercial.* The idea was to do the same for 1957 and then, to compare the factors driving firms’ decisions at these two moments of time. However, when we first estimated the model for 1890 it showed a very low adjustment (R-squared and adjusted R-squared of about 0.15).

If one takes into account that localization at a given moment is the result of a cumulative process full of 'historical accidents' – as Krugman calls them – these results come as no surprise.

We therefore decided to consider a lag between industry location and *Concelhos*' characteristics. We did this using the characteristics of *Concelhos* in 1890 to explain the regional variation of the number of industrial units between 1890 and 1957. In fact, using the initial conditions is one of the approaches followed by some of the empirical studies on industry location. This time the results were better.

This means that lags really do matter. The formation of a *core* depends on pre-existing conditions, as economic historians have maintained.

The model makes use of several variables that reveal the *Concelhos*' characteristics at the beginning of the period to explain the regional variation of the number of industrial units between 1890 and 1957. Accessibility was proxied by the availability of ports and by physical distance by road and rail to the most important consumers' centers. Communication facilities, which result in low information costs, are proxied by the existence of postal services and telegraph. The local capacity to attract industrial activities is proxied by variables that express potential advantageous conditions for performing manufacturing and industry in general. Labor force to be used in production is therefore proxied by population, and experience is proxied by the weight of industrial activities in the past, as this indicator expresses local

know-how and the availability of specialized labor to perform some production activities. The number of professors teaching in the urban administrative centers of *Concelhos* was used as a proxy for the education level. The existence of financial services was also considered through the number of insurance and banking agencies or agents in the *Concelho*. Finally, it was recognized that industrial activity needs stability and law enforcement. Peace, defense, justice, property rights' enforcement and conflict arbitration may be determinant. These institutional aspects were proxied by dummy variables that express the presence or absence of a military regiment and the presence or absence of a Court with judicial authority.

As no estimates of regional GDP were produced for Portugal, local prosperity was proxied by the number of local theaters, recreational clubs, musical bands, the number of local newspapers or any other organization of this kind. Uallacháin and Satterthwaite (1992) even consider recreational amenities as a relevant variable *per se*. The number of industrial units working in the *Concelho* at the beginning of the period was also included to consider the influence of the regional distribution of industry at departure.

In short, [21]

[21] See Table 2 for variables' description.

$$VarUnit = \alpha + \beta_1 Rail + \beta_2 Rail * DistRail + \beta_3 DistRC + \beta_4 Pop + \beta_5 Banks + \\ + \beta_6 Ins + \beta_7 Court + \beta_8 Newsp + \beta_9 Leisure + \beta_{10} Teleg + \beta_{11} Milit + \beta_{12} Port + \\ + \beta_{13} \Pr of + \beta_{14} NumUnit^{1890} + \varepsilon$$

In order to match the data from the *Anuário Commercial* and the two industrial surveys we had to choose the *concelhos* that existed in all three databases. Inquiries could not provide data for some *Concelhos,* as Appendix 1 explains, and some others did not exist in 1890. For still others there is no available information, at all. As a result, the final sample we used includes 249 observations.

5. Estimated results

The results of the model are clear. According to the econometric estimations, transportation facilities were vital for industry localization throughout the *Concelhos* of the country. In fact, the presence of water transportation facilities (sea ports or river navigation) and railways were the two important factors explaining the variation in industry location between 1890 and the 1950s. Not only are these two variables significant, as they have the right sign, they contributed positively to attracting industry units to the *Concelhos* enjoying them. This means that during the first half of the twentieth century the Western border of Portugal and the region along the Tagus, the main navigable Portuguese river, became more industrialized and received a great deal of labor force from the interior, which means in turn

that the *Concelhos* that were better served by the transportation network were those that most increased the number of their industry units. On the other hand, the results also seem to show that transportation was the most important infrastructure for attracting firms to urban poles[22].

Curiously, the distance by road to the regional capital city is not significant. This result might be surprising, but in fact it is quite natural. Even though Portugal had received the first automobiles by the end of the nineteenth century, they were seen as luxury goods for upper class people. Circulation in the 1920s was comprised mostly of private cars and taxis[23]. But the railway network, which was completed in the 1890s, was operating at cruise-speed at this time. So, in a first stage railways came as a substitute for the horse and river transport. However, as time went on, road transport became increasingly more competitive. Throughout the period road transportation made connections between and to the large coastal urban centers much easier - particularly the connections to Lisbon and Oporto, but also to smaller coastal urban centers such as Aveiro and Setúbal. As stronger attraction effects towards the coastal urban centers were in motion, the connections to district capitals were no longer significant to industry location.

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[22] The leading urban centers along the Portuguese coast for industry attractiveness were Braga, Oporto, Aveiro, Coimbra, Lisbon and Setúbal.

[23] Tavares; Mata; Silva, 2003.

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Traditional historiography on Portuguese industrialization, based on imperialism and foreign dependency theses, supports the idea that railways contributed to the disappearance of industrial units in the interior of the country, mostly woollen industries situated in the North interior of the mainland (Bragança), in the center (Guarda) and in the interior South (Portalegre). Because of the presence of snow in the mountains and plateaus above 1500 meters, *water frame energy***,** shipyards and abundant wool as a raw material, these long-standing industries had flourished in locations far from the coast. Serrão,1978, says that railways killed this industrial network because it brought the competition of foreign textiles, particularly from the economical British cotton clothing that arrived in the interior of the country.

The estimated results support these theses but not Serrão's arguments. The estimated results suggest that the industry, which would be naturally attracted to the coast where the large urban centers and foreign markets (through ports) were located, delocalized when the railway network, and later the road transport, made it possible. Industries were thus reacting to the new circumstances rather than taking a passive attitude towards them. An East/West division of the territory seems to have prevailed, leading to migration and wider job opportunities towards the Atlantic border. In this dynamic setting, new establishments clustered according to a new pattern that reflected the benefits from agglomeration

economies resulting from coastal location under low transport costs for raw material provision and labor force delocalization.[24]

We have to say that the coefficients of 'rail' and 'port' may be upwards biased, as we did not really account for the surely positive impact of the road transport in this process. As mentioned above, from the 1930s onwards, the road transport was definitively winning the competition with rail, and therefore we cannot ignore its impact on industry location. This issue is even more important if we take into account that road transport is particularly flexible and thereby allows firms to locate in a given area but not necessarily in the large urban centers. One can say that road transport turns small distances, at least, less important

As for the lower information costs represented by the existence of telegraph (and postal facilities such as letters, packages and money orders), the econometric results show that this variable is not significant. It means only that telegraph, which was a substitute for physical proximity (and other such services, as well), spread all over the country, especially in the non-industrialized *Concelhos,* while industry concentrated in a small number of poles. So, the variable cannot explain the localization of industry.

[24] Rosenthal; Strange, 2001.

Available human resources also prove to be a significant variable. The estimated coefficient of 0.009 means that for each one thousand persons, nine industrial units delocalize, on average. This variable clearly reflects the effects of agglomeration economies.

The importance of financial support is established, however. Insurance services are a significant variable. However, while *Concelhos* that long had insurance services attracted the localization of industry units, if we include the variable banks in the model, the sign for the relationship with banks' services is an inverse relationship. One possible explanation for this may be the small role of banks in giving credit to industry in a small and traditional economy such as Portugal. Moreover, it seems that banks were large savings receivers everywhere in the country, using a network that was also spread over the non-industrialized *Concelhos*. The less industrialized *Concelhos* were the regions providing labor for emigration and benefiting from their remittances. Banks or their agencies were attracted to these less industrialized regions for this purpose.[25] This special factor reinforces the estimated connection. In this way it is possible to view the estimated result of the model as a proof of delocalization of industry towards concentration in some fewer *Concelhos*. The connection thus seems to be the inverse, as it is possible to conclude that it should be non-industrialized *concelhos* providing savings to the most industrialized ones. [26]

[25] Pereira, 1981.

[26] For a long trend overview since the Middle Ages, see Mendes, 1999.

The number of industrial units in 1890 is also a significant variable. However, because of the negative sign, Pollard's thesis does not apply to the Portuguese case during this period. In fact, from the 1900s to 1950s Portuguese industries were really experiencing a de-localization from traditionally industrialized regions to coastal areas where economic activities also included industry but were much more diversified, extending to services (mainly in the capital and other urban centers), foreign trade, fishing, and domestic commerce. By the middle of the twentieth century, industrial units had a very different localization in comparison with its spatial structure at the end of the nineteenth century.

Table 1 about here

Table 2 about here

The importance of Law Court's presence is not confirmed. The availability of justice for conflict settlement and enforcement of contracts at a local level was not positively influencing the localization of industrial units in the Portuguese case. The presence of a military regiment in a *Concelho* is also a non-significant variable. That is to say, the presence of troops does not influence industries' delocalization decisions. In fact, positive externalities coming from protection, justice, order and safety cover the whole territory, independently of their location.

Military regiments also do not mean large and potential local markets for industrial goods' consumption.

Last but not least, theaters or cultural activities are also non-significant. The most dynamic *concelhos*, from a cultural point of view, were not necessarily the most dynamic from an industrial perspective.

On the contrary, ports are a significant variable and their role is represented by a high coefficient. The low costs for water freight transportation can explain the preference for *concelhos* with seaport cities or a navigable river.

Professors are a significant variable, meaning that accumulated literacy over the span of about 60 years was a relevant variable to delocalize industries. According to Nunes (1993), a period of about 30 years is required in order for education to produce effects on Portuguese GDP, and a similar pattern seems to occur in Spain, "leaving room for defending the possible existence of an Iberian (or Mediterranean) pattern as opposed to a Northern European pattern" in Nunes (2003), p. 559. One should conclude that the same lag is required so that more literate *Concelhos* can attract industries and labor force.

A last remark is in order. If only the variation in the number of industrial establishments' localization were to be analyzed, results could be misleading. It could be argued that mergers or transformation of many small industries into fewer and larger units could have occurred within a region previously strong from an industrial point of view. To avoid falling into this trap,

we repeated the estimation, using the industrial labor force as the dependent variable, instead of the number of industrial units. Results are similar and confirm the earlier conclusions. R-squared and adjusted R-squared of about 0.91 indicate that the model is accurate in describing the reasons driving Portuguese industry delocalization during the period.

Disregarding the newspapers and telegraph that proved to be insignificant in the first regression and including the variable letters, a similarly good adjustment (R-squared and adjusted R-squared of about 0.91) can be obtained. In this case letters prove to be insignificant, as were newspapers and telegraph, leading to the conclusion that all of these variables were sufficiently dispersed throughout the territory that they do not explain the location of industry.

Thus, variables related to availability of ports (and water transports), rail transportation at decreasing cost, availability of labor force, education and institutional financial support, are the real factors that attracted industrial units to *Concelhos* in the first half of the twentieth century in both models. In Portugal, once more, clusters resulting from the availability of efficient low-cost transportation and financial facilities could give way to information flows, informal contact, inter-firm transactions or inter- firm labor migration, contributing for *evolving*

localized environments.[27] Externalities could be reaped from clustering (because of shared information or provision of intermediate goods among firms), and both scale economies and potential agglomeration economies could also result from greater efficiency, because of the availability of other infrastructure services, such as housing, electricity, banking, etc. There are "various ways in which business can benefit from the greater availability and efficiency of particular local services".[28] From this perspective, the model expresses that transports were the most important infrastructure for attracting firms to urban poles, according to the estimated results.[29]

Local dynamic learning capacities in coastal regions could have meant entrepreneurial energy and competitive advantages that may have been crucial for the excellent performance of the Portuguese economy in the period after World War II. Other variables (such as Courts, cultural activities, and military troops) only become significant in models revealing lower adjustment capacity. As lags prove to be important, we may conclude, as do Uallacháin and Satterthwaite (1992), that "small causes may have large effects many years later".[30]

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[27] For an application of these aspects to East Asia and China, see Fan; Scott, 2003.

[28] Ingram, 1998, Gordon; McCann, 2000, p. 517.

[29] cf. note 22

[30] P. 55.

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6. Conclusions and suggestions for future research

What credibility can we attribute to empirical analysis?

Let us recall skeptical opinions such as that of Grampp, 1965, who wrote on credibility of historical interpretation, three decades ago:

'The historians I have found most helpful are those who attend more to events than to their meaning, more to particular facts than to explaining them. (…) That is because I have found their interpretations are not always reliable'.[31] Of course, this argument may be applied to the presented exercise: interpretations may be not reliable.

However, facts do not speak for themselves. *New economic geography* provides a broad theoretical framework for the explanations for modern industry location. It also makes it possible to re-examine earlier theses. Negative opinions on the theoretical credibility of *New Economic Geography* also exist, particularly among some geographers. From the point of view of Ron Martin, "This 'New Economic Geography' is neither that new nor is it geography" (Martin, 1998, p. 65). He considers mathematical models as strait-jackets that "do not lend themselves easily to empirical estimation or application, since they are typically too abstract, over simplified and too idealised",[32] but that is, of course, an extreme position. According to Pinch and Henry (1998), the geographers' hostility towards Krugman's work was in part due

[31] Grampp, 1965, p. 132.

[32] P. 70.

to his patronizing attitude but also to a divergence upon what should be stressed when studying regional analysis. This hostility resulting from the idea that "Krugman is engaged in a form of neo-colonialism"[33] is vanishing and some geographers have even recognized the utility of Krugman's work when doing empirical studies on the British Motor Sport Industry: "How do they [hostile geographers] work in particular empirical settings (…)? "[34]

Although the methodology that was followed in this paper is closer to Regional Science, our empirical work aligns well with "the diversity of approach"[35] used in analytical frameworks based on location-allocation models advanced in the *New Economic Geography,* which is an attempt to rationalize and explain complex phenomena that include millions of private independent decisions on localization of economic activities and lead to social and spatial organization of the economy. As Gordon; McCann (2000) remarks on spatial clustering, "location is (…) part of a broader question of constructing the optimal relationship between the modern firm and its customers and suppliers".[36]

The Portuguese empirical evidence presented for the period studied here says that accessibility was the main force driving firms' decisions on location. Spatial clustering

[33] Boddy, 1999, p. 812.

[34] Pinch and Henry, 1998, p. 818.

[35] Parr; Reinolds-Feighan, 2000, p. 439.

[36] P.514.

occurred during the first half of the twentieth century, when embedded communication networks were provided by cheaper rail and road transportation. Moreover, firms headed to the regions that gathered more favorable conditions from the start. Integration increases externalities and labor mobility, making a divergence between the industrialized coast *core* and the less prosperous border with Spain. Explanations based on understanding this clustered industrial strip of the Portuguese coast as *innovative milieus* may also apply.[37] So, as Krugman (1998) suggests, those were the regions that became even more 'central' in terms of the transportation network.

A last remark deserves special note. According to the *New Economic Geography*, concentration and agglomeration may be reversed. If the decline in transport costs is such that the access to markets becomes less important, dispersion may occur. In the Portuguese case such a phenomenon is yet to be seen. According to Guimarães and Figueiredo (2000) the actual regional profile for Portuguese industry is still dominated by concentration. Our study indicates that such a profile is not recent, and was shaped in the first half of the twentieth century.

Is it possible to say something about the future? Following the suggestions of Mori and Nishikimi (2002), that smallness may induce a situation of only one or two places as core

[37] Gordon; McCann, 2000.

industrial regions, one might expect that in a country as small as Portugal, proximity may induce a situation of only one transport hub joining both poles. In this case agglomeration, as well as an asymmetric regional distribution of economic activities, would prevail over time. Figueiredo, Guimarães and Woodward (2002) added to this perpetuation argument by saying that “investors are willing to accept wages more than three times higher before becoming indifferent between moving and staying”.

It is also possible, though, that agglomeration diseconomies such as increasing prices for urban land, may induce a flight of industrial units and jobs further and further into the outskirts and beyond.[38]

[38] Tabuchi, 1997.

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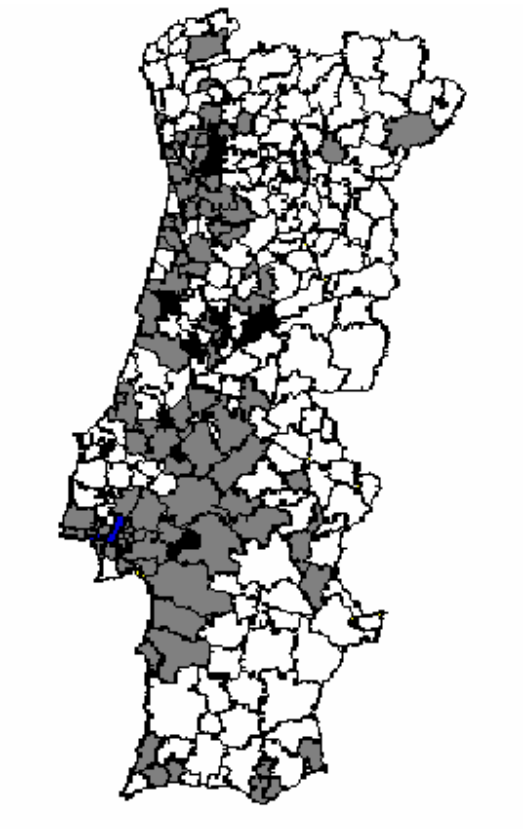

Map 1: Delocalization of industrial activities.

Table 1 – Estimated results for the presented model

Dependent Variable: VARNUNIT

Sample: 1,249

Included observations: 232

Excluded observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Rail	94.39237	22.63847	4.169557	0.0000
Rail*DistRail	-0.965823	0.356000	-2.712987	0.0072
DistRC	-0.374973	0.394545	-0.950394	0.3430
POP	0.008123	0.000693	11.72416	0.0000
Banks	-14.89572	4.427302	-3.364513	0.0009
Ins	10.74121	3.933445	2.730739	0.0068
Court	-26.97211	17.71152	-1.522857	0.1293
Newspaper	-4.665440	5.295084	-0.881089	0.3792
Leisure	4.171883	5.129587	0.813298	0.4169
Telegraph	-32.83030	26.72176	-1.228598	0.2206
Milit	-8.971181	18.50075	-0.484909	0.6282

PORT	65.12675	33.08120	1.968694	0.0503
PROF	8.039155	0.834531	9.633141	0.0000
NumUnit ^{1890}	-0.961531	0.033224	-28.94055	0.0000
C	-16.25516	29.53226	-0.550420	0.5826

R-squared	0.914811	Mean dependent var	-73.96121
Adjusted R-squared	0.909315	S.D. dependent var	352.5718

Table 2: Variables description

Varunit - variation of the number of industrial units between 1890 and 1957
Rail - dummy variable that assumes value 1 if rail is available at the beginning of the period
Rail*DistRail - distance by rail to the nearest regional capital (in the *Concelhos* served by rail at the beginning of the period)
DistRC - distance by road to the nearest regional capital at the beginning of the period
Pop - population in the *Concelho* at the beginning of the period
Banks - number of banks or banking agents in the *Concelho* at the beginning of the period
Ins - number of insurance companies or insurance agents in the *Concelho* at the beginning of the period
Court - dummy expressing the presence or absence of a Court at the beginning of the period
Newsp - number of local newspapers published in the *Concelho* at the beginning of the period
Leisure - number of local theaters, recreation clubs, musical bands or any other cultural organization in the *Concelho* at the beginning of the period
Teleg - dummy expressing the presence or absence of postal and telegraph facilities in the *Concelho* at the beginning of the period
Milit - number of military regiments in the *Concelho* at the beginning of the period
Port - dummy expressing the presence or absence of water transportation facilities at the beginning of the period
Prof – Number of professors teaching in the *Concelho* at the beginning of the period

NumUnit ^{1890} - number of industrial activities in the *Concelho* in 1890

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APPENDIX

1 – In this paper data from the *Inquérito Industrial* of 1890 was manipulated according to the following information*:*

- Montemor-o-Velho (district of Coimbra): “In this *concelho* the data-inquiry bulletin was organized, but the commission decided it should not be distributed, because there were no factories belonging to the definitions used in the instructions; only individual industrial professions such as shoemaker, tailor, barber,….”

- Pampilhosa da Serra (district of Coimbra): “In this *concelho* no commission was appointed and no inquiry was distributed, as the administrative authority said that there were no activities to be questioned”.

- Ancião (district of Coimbra): “The Commission verified that this *concelho* had no industries situated in factories, workshops or houses belonging to the categories mentioned in the inquiry instructions”.

- Penafiel (district of Oporto): “The service of the inquiry was made in a very peculiar way. The bulletins were distributed but not the inquiries, because, says the Commission, most of the owners of the industrial units cannot read, industries exist on a very small scale, using a very small number of workmen, who have an uncertain assiduity to labor”.

- Oliveira de Frades (district of Viseu): “The inquiry did not work in this *concelho* (…) The questionnaires were received blank, perhaps because of the difficulty people have in providing answers, fearing that they may incur tax increases”.

2 - The paper also considered the following administrative changes that occurred from the 1890s to the 1950s:

In the beginning of the period analyzed Espinho belonged to Feira; Murtosa belonged to Estarreja; S. João da Madeira belonged to Oliveira de Azeméis; Vale de Cambra was the previous name for Macieira de Cambra; Vizela belonged to Guimarães; Vila de Rei was the previous name for S. Vicente da Beira; Monsaraz was the previous administrative center for Reguengos; Alportel belonged to Faro; Bombarral belonged to Óbidos; Castanheira de Pera belonged to Pedrógão Grande; Nazaré belonged to Alcobaça; Marinha Grande belonged to Leiria; Amadora belonged to Oeiras; Loures belonged to Olivais; Odivelas belonged to Belém; Aldeia Galega was the previous name for Montijo; Bouças was the previous name for Matosinhos; Alcanena belonged to Torres Novas; Alpiarça belonged to Almeirim; Entroncamento belonged to Barquinha; Palmela belonged to Setúbal; Sines belonged to Santiago do Cacém. Vila Nova de Paiva belonged to Fráguas.

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