# LITERACY IN SPAIN IN THE 19TH CENTURY: AN ECONOMETRIC ANALYSIS

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## ABSTRACT

The aim of this paper is to identify variables that could explain Spanish urban literacy growth between 1860 and 1910. We have made use of census data and other public sources. One of the main obstacles is to find appropriate city definition criteria. We have addressed this issue by resorting to the relevant bibliography. A priori, expected key variables are the Church influence, whether or not the city is a provincial capital, the access to the railway system, the mining and industrial activity and, above all, the literacy programs undertaken by Liberal governments. Results of several econometric models –panel data based considering cross and time fixed effects– show firstly, that local idiosyncratic factors were sizeable. Secondly, in the literacy process the educational offer was more decisive than the personal economic incentives, especially among girls. And finally, that Church influence largely explains the literacy levels at the middle of 19th century, as well as its decline in the second half of that century.

**Keywords**: Literacy, Schooling, Church, Panel Data Models.

## RESUMEN

El propósito de este artículo es identificar las variables que explican la alfabetización en la España urbana entre 1860 y 1910. Para ello se sirve de información de carácter censal, así como de otras fuentes administrativas. Uno de los principales obstáculos es encontrar un criterio que delimite lo que era una ciudad en ese ámbito, para lo que nos servimos de la bibliografía existente. A priori, las variables relevantes en este puzle fueron la influencia de la Iglesia, la capitalidad provincial, la presencia del ferrocarril, la actividad industrial y minera y, sobre todo, los programas de alfabetización desarrollados por los gobiernos liberales. Los resultados obtenidos por medio de varios modelos econométricos – datos de panel con efectos temporales y fijos– indican: 1) que las variables locales tuvieron una considerable influencia en la reducción del analfabetismo; 2) que en el proceso de alfabetización la oferta educativa fue un factor más importante que los incentivos económicos individuales, especialmente entre las niñas; y 3) que el peso de la Iglesia es una variable relevante a la hora de explicar tanto la alfabetización de mediados del siglo XIX como la reducción del analfabetismo en su segunda mitad.

**Palabras clave**: Alfabetización, escolarización, Iglesia, modelos de datos de panel.

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## 1.- Introduction. The literacy process in Europe

There has been a long tradition of research on the effects of the education and training of human capital on economic growth. Many researchers have tackled this field from the works of Schultz (1961) and Becker (1963) to Barro (2001), not always producing similar results. In the case of Spain, Núñez (1992, 1997 and 2003). However, the reverse effect, that of economic growth on the training and education of human capital has been studied a lot less. This paper aims to explore this issue. Scholars have focused on the landowner structure or the inequality of land access. Basso (2014) and Beltrán and Martínez-Galarraga (2015) have found a correlation between these variable and the rates of literacy. Here we propose a different approach in a longer period.

Education is both a consumer item as well as a production factor. People demand to be educated in reading and basic arithmetic for different reasons: curiosity and personal satisfaction, social prestige and, above all, because it improves their chance of finding a good job. Nowadays primary education is considered essential for normal personal development, which is why in most parts of the world there is legislation that imposes compulsory schooling for minors. These laws were rarely established before the end of the 19th Century as until then being literate was not essential to lead an active and productive life. However, in North America and part of Europe most people learned to read and write long before compulsory education was approved.

Indeed, until the end of the 19th Century, European countries followed two different patterns in terms of literacy[1]. The most advanced, such as the Nordic countries, Germany, The Netherlands, and Switzerland, experienced early literacy during the Modern Age, and reached the 19th Century with rates over 40% (and sometimes a lot higher). Outside Europe, only the United States and Japan had comparable figures. With the notable exception of Sweden, all the literacy processes before the 19th Century lacked support from the State. Families and occasionally City Councils were the ones who promoted literacy in children. Some minorities, such as the Jews were particularly active. The attitude of many Protestant churches became equally important, for whom communication between man and God should be direct and carried

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[1] Cipolla (1970: 143-160) distinguishes three patterns corresponding to Northern, Central Southern and Eastern Europe. There is a problem derived from the lack of common statistics therefore comparisons are done by groups of countries and population census sources, such as examinations of recruits and the signatures of husbands. As pointed out by this author or for example, Lyons (2012: 179-189) these document sources have various interpretation problems.

out through the Bible (Eisenstein, 1968). Therefore, the highest literacy rates were reached among some Puritan religious groups (Cipolla, 1970: 115-117; Lyons, 2012: 195-197). In any case, in the North of Europe the cost of education of a large part of the population was absorbed early on by families.

The other pattern was followed by countries in Southern and Eastern Europe, where the literacy of a large part of the population started late and was in the hands of the State as a guarantor and provider of educational services. These countries had to face higher educational costs as they started off from a lower level, but illiteracy continued to be high until well into the 20th Century. The truth is that there are no obvious reasons that explain why the Countries of the South of Europe did not invest more in education. The governing elite in Portugal, Spain and Italy had a high opinion of education as an element for social progress and individual promotion. From the beginning, the aspiration of achieving an entirely literate society was part of the liberal agenda. Even more significantly: reactionary groups equally recognized the value of education; of course, within the dogma of the Church[2]. In short, there seemed to be very little resistance to the literacy programme. Even though the public spending needed to launch a programme of this kind was substantial, it was not at the same level as other areas such as paying off the debt or military costs. However, the benefits derived from this investment, although impossible to quantify, were deemed strong.

In any case, the involvement of European States in the literacy of children was very low until the late nineteenth century. But there was not a common history of the process of literacy. Let us to consider the cases of France and Italy. The history of France was a happy end story. In 1833 French government passed a law, the Guizot Act, which was less ambitious than, for instance, the Pidal Plan or the Moyano Act in Spain. It had the same basic shortcoming: the burden of educating children fell on municipal budgets. This deficiency only be resolved by Ferry Act of 1881 (Hage y Garnier, 157-158). Nevertheless, in the fifty years between 1833 and 1883 France took a giant leap in the instruction of its population. In 1910 primary schooling rates in France was 84.8%. Italy was the contrary case. In 1859, shortly before the Unification, the Casati Act was approved, which was reinforced in 1877 with the Coppino Act. These two laws established compulsory schooling for two/three years, and discharged into municipal budgets maintenance of schools and teachers. Only since 1911, with Credaro-Daneo Act, these expenses were paid by the State (Zamagni, 1993, Cappelli 2015: 49-54). Literacy in Italy, as in Spain, down very slowly in the 50 years following the Casati Act. In 1910 primary schooling rates in Italy was 44.6%, half to France (Lindert, 2004; Zamagni, 1993: 190-193).

The History of literacy process in Spain was similar to Italy. Perhaps the main difference was that, as consequence of the existence of a sole country, rulers soon became aware of the importance of the problem. The Constitution of 1812 devoted an entire title to the Public Education. Two years later, the Quintana Report proposed a public, universal and free education system. Political events –the coup d'état of 1814– did not allow its development; which, moreover, seems too advanced for its time. But with the return to power of Liberal Party in

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[2] On the other hand, there was the conviction that criminality and illiteracy were closely linked, so promoting education was a way of preventing crime. In the opinion of Cipolla (1970: 94) "Even the more staunch conservatives showed a fair amount of good will towards this argument."

1833 the literacy program was relaunched. In 1836 it was enacted the Rivas Plan, that organized the educational system and forced to all towns with more than a hundred neighbours to build and sustain a public school. This act had little echo and was abrogated early. But in 1845 was approved the Pidal Plan, which contained the essential aspects of the previous Rivas Plan. Other rules, as the Order of April 25, 1841, give rise the elaboration of the first statistics on literacy in Spain. Finally, in 1857 was enacted the most famous Spanish nineteenth century law of education, the Moyano Act, which basically collecting and systematizing the failed previous legislation.

However, this legislative and administrative display had very modest results. At mid-nineteenth century the enrolment rate of children aged 6 to 13 years was 34.1%, ten points above the late eighteenth century. The adoption of the Moyano Act in 1857 had positive but small effects in the literacy process. Throughout the nineteenth and early twentieth centuries, literacy rates in Spain grew slowly. It has been argued that the relative failure of the Moyano Act must be attributed to the limited state investment in public education. The law mandated compulsory schooling for all children from 6 to 12 years, it would also be free for those who could not afford it. But it loaded the burden of building schools and paying teachers mainly in the municipality budget. This situation changed in 1902, when the costs of primary education were included in the General State Budget. Until then, the Spanish municipalities pay out only a part of the cost of schooling children because they lacked resources. So, the "minimum" standards were fulfilled, such as the creation of an elementary school (nearly always for boys) in towns with more than 500 inhabitants (Rueda, 1999: 21-26). But the second or third level schools, or those which should have been established in smaller villages, took a long time to appear. Therefore, supposedly compulsory education only became so to the extent in which the municipal boards had enough resources to establish it. Therefore, it would widen the gap between the "rich and literate" Spain and the "poor and illiterate" one. (Núñez, 1992: 309-313).[3]

The question is: why similar laws had so different consequences in Italy/Spain and France? For Italy, Cappeli (2015: 50) argues that city councils had difficulty promoting the diffusion of schooling for two reasons. First, their balance sheets were constrained: investing in new infrastructures and enforcing compulsory education were costly, and second, schooling was not perceived as a valuable investment. Probably, the same explanations could be applied to Spain.

From the above two antithetical hypothesis could be drawn. The first is that, precisely because of the absence of incentives, the Spanish Public Administration should have made an extra effort on literacy for children. The lack of state financial support to schools was not a serious problem in the Guizot Act; but it was in the Moyano Act. Therefore, the Spanish State should have made an additional effort. But you can see the issue from another perspective. If the ineffectiveness of the Moyano Act is due to the absence of economic incentives, the solution should be generated them; for example, through the construction of transport infrastructure.

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[3] Chaudhary et al, 2012, explore this question from a different point of view, the capacity of local elites in decentralised systems to capture funds which potentially could to be diverged to educational aims. In sum, local income was a very important variable to explain the alternative use of resources, but other institutional factors, as "democracy" should be considered.

In short, the low literacy rates in Spain could have been due to a problem in supply or demand; in building schools, or creating incentives for literacy. The next section analyses the factors of supply (except schooling) and demand that could have an impact on literacy.

## 2.- Literacy in Spain: Conditioning factors

In a similar way to the national European literacy patterns, there were also regional literacy patterns in Spain. As in other countries of Southern Europe, in Spain in the middle of the 19th Century the level of basic education of the population was very deficient; but also irregular. According to census information, in 1850 illiteracy had reached 75% among the adult population, a percentage almost identical to that of Italy and only slightly better than Greece and Portugal. Similarities with Italy (less than with the other two countries) not only exist in the absolute figures, but also in the irregular distribution of illiterate people. Three Italian regions, Piamonte, Liguria and Lombardia, had illiteracy rates slightly over 50%. However, in the rest of the country and especially in the Mezzogiorno, it was around 80 and 90% (Zamagni, 1993; Cipolla, 1970: 101-103). Equally, the central-northern part of Spain, the provinces between Cantabria and Madrid, had relatively high literacy rates and comparable to those of North-East Italy; that is, slightly under 50% (and, according to the census of 1860, higher in Madrid and Alava). From this nuclear region literacy started to drop (although with a slight recovery in provinces such as Barcelona and Cadiz) so that Eastern Andalusia and the two Canary and Balearic archipelagos had rates comparable to those of Naples, Sicily or Sardinia (Núñez 1992: 91-103)

However, an important difference is perceived between Italy and Spain. In the former, the regions with higher literacy rates showed the greatest economic growth throughout the second half of the 19th Century. The more illiterate Italian regions underwent much slower development, which could only be partially corrected by emigration towards the richer regions of the North, or towards the United States and the Southern hemisphere. These patterns are different from Spain. Two provinces with average literacy rates, even good compared to the national average, Barcelona and Biscay, were the first to be industrialized. The economic development of Madrid was also satisfactory without being true industrialization. However, Alava remained "behind" in comparison with Biscay and, even Guipúzcoa. Whilst the Castilian provinces with higher literacy rates, Burgos, Palencia, Soria, Segovia and Valladolid, underwent poor economic development, which explains a constant migratory flow towards Biscay and Madrid. Although in the long term a relationship between literacy and economic growth can be identified (Núñez, 1992: 165-199) it is not perceived until well into the 20th Century.

If we combine the time perspective with the spatial one the result is very interesting[4]. In general, there were no important changes in the geographic distribution of illiteracy between the middle

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[4] It has been argued that before the 19th Century Spain had comparable literacy rates to other countries in Northern Europe; and it was during that century when the gap was created, both due to the increase in literacy in Northern and Central Europe, as well the drop in Spain. However, the interpretation drawn from available sources does not allow for a conclusion. Firstly, the arguments in favour of high literacy in Spain at the end of the 18th Century are

and end of the 19th Century. The literacy process advanced more or less in a uniform manner throughout the whole country, meaning that the provinces, which were at the head and tail in 1850 were still the same in 1900. However, the somewhat faster growth of the north of the peninsula is notable with regard to the south. Galicia, Aragon, Catalonia and the coastal provinces of the Basque Country progressed more quickly than the Canary Islands, Andalusia or Extremadura. In short, it was only in the 20th Century that a true convergence took place in literacy rates (Núñez, 1992), similarly to that of Europe, which at that time saw a convergence between the South and North of the continent.

There are various reasons that can explain the high literacy rates of the central-northern provinces of Spain. Firstly, the existence of good communication routes. There is a relative coincidence between the most literate provinces and those that had greater commercial activity (Pérez Moreda, 1997: 249). This can be measured through various imperfect indicators, of which yields from *portazgos* (internal tolls) may be the most adequate. The provinces crossed by the road from Madrid to the French border through Valladolid, Burgos and the Basque Country, as well as its secondary roads towards Cantabria and La Rioja, were the area that collected the biggest transport earnings in the first half of the 20th Century (Madrazo, 1984). This was probably not the same picture a century before. In the last third of the 18th Century the opening of the road of Reinosa towards Santander and Orduña towards Bilbao, allowed for the renewed export of wool and later on flour. The growth of Madrid from 1800 boosted the meat and wheat markets of the north of the Central Mountains. Other provinces with a certain amount of commercial activity such as Leon, Barcelona or Cadiz, also had literacy rates that were higher than average. However, the assumed relationship between commercial activity and literacy is far from being perfect. There are provinces –Guipúzcoa– with few literate people and a high level of commercial activity. The reverse situation also occurs in provinces such as Soria.

If there was a relation between transport-commercial activity and literacy, it is logical to suppose that the building of the railway network had a significant effect on literacy. As already mentioned, to fully take advantage of the possibilities of the new means of transport the traveller or carrier had to be able to understand the timetables and rates which were often very complicated. Obviously, working in the railways (not in its construction) also required being literate, as well as in many activities related to it. Also, the train and postal service promoted the penetration of books and regular publications (Botrel, 1993: 263-281). From a regional perspective, the expansion of the railway network was more homogeneous than would be expected from a country with such an unequal distribution of income like Spain. In general, the larger cities had earlier access to the train. The construction process of the Spanish Railway network continued for more than forty years, from the Railway Act of 1855 to the last

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weak. It's true that in the first third of the 19th Century and as a consequence of the war and the policies of Ferdinand VI, there was a regression in the level of education that was already low. However, for example, it's not clear whether this disentailment had a major negative effect on schooling rates. In any case, the hypothetical regression of the first third of the 19th Century was probably invested into the second third, which must attribute to the schooling programmes promoted by the Government (Viñao, 1998, Guereña, 1989).

amendments of the Act in 1877. The year in which the last provincial capital opened its train station, Teruel in 1901, could be considered the end of the process.

A second explanation would be the weight of the Church. The provinces with a relatively higher literacy rate were those in which we know there was greater religious sentiment. Or, in another sense, in which there was greater influence of the Church. The exceptions to this rule are apparently easy to explain through the influence of smaller external factors. In the case of Madrid, it was not a particularly religious province due to being the capital city. The exceptions of Navarre, and especially Guipúzcoa, which were very religious provinces with average and even low literacy rates, can be explained due to the continuity of the Basque language, which hindered literacy as it was only possible in a written language like Spanish.

The reasons that explain this positive relationship between faith and literacy in Spain can most certainly not be the same as in Protestant Europe. The religious hierarchy did not require their churchgoers to have in-depth knowledge of the Bible; in fact, this was not even desired, due to it was a possible source of heresy (Viñao, 1984: 153-154). However, the mere existence of religious sentiment increased, at the least, the offer of educational services. The ecclesiastical authorities seemed to have been especially concerned about guaranteeing the religious indoctrination of the population, which led to the building of a network of parishes assisted by the religious orders (Pérez Moreda, 1997: 249). This contributed to increasing the offer of educational services especially in the provinces with a greater presence of the Church. In these provinces, literacy was reinforced in various ways. Firstly, in the more pious provinces, there were a relatively high number of children sent to seminaries at an early age by their families. Many of them left before taking their vows, but still received a minimum level of education. Secondly, the stronger presence of priests facilitated the teaching of the alphabet in the parishes due to greater proximity. Relatives and friends of priests learnt the alphabet from them. Thirdly, when government schooling programmes were implemented, those areas with a greater number of clergy were able to reduce the cost of hiring teachers by employing nuns and priests. Fourthly, this religious community developed an industry of different products that required knowledge of the alphabet. The most obvious were religious books – missals, catechisms, prayer books, biographies of saints, as well as bibles, new and old testaments, gospels, and others-. In general, the religious world was more literate than the secular world.

There were other processes that contributed to literacy. Firstly, the consolidation of the territorial administrative structure created in 1833 by Javier de Burgos. In particular, the gradual centralization of public services in the provincial capital cities meant that they grew notably. The public administrations required employing people who were educated, so for the residents of those cities access to basic education was a clear mechanism of social promotion. In other words, the status of capital was an incentive to inhabitants of that cities to learn to read and write. All over the country, the main effect of the creation of an administrative structure forced literacy rates to be more uniform, as was the supply of administrative services provided by the State.

There is a fair amount of consensus that the main literacy force in the second half of the 19th Century was the approval by liberal governments on various literacy programmes for minors.

In particular, the Public Education Act 1857, known as the Moyano Act, has been reported as the bill most voted for and with the greatest consequences in the History of Literacy in Spain. In short, the Moyano Act established compulsory and free schooling (for those who could not pay for it) between the ages of six and nine; that is, the age at which the large majority of children learn to read and write. If it had been applied fully, Spain would have probably been a literate nation in only two generations. However, the Act had a notable drawback. It was not assigned a specific budget. Therefore, it wasn't until 1902 that the State did not include the expenses of primary schools in its budget, so their creation and management depended on the municipalities (Núñez, 1992: 216-224). This meant that, in general, the "minimum" standards were fulfilled, such as the creation of an elementary school (nearly always for boys), in towns with more than 500 inhabitants (Rueda, 1999: 21-26). But the second or third level schools, or those which should have been established in smaller villages, took a long time to appear. Therefore, supposedly compulsory education only became so to the extent in which the municipal boards had enough resources to establish it. Therefore, its effects on the harmonization of literacy in the country were contrary to those derived from the mere creation of the provincial administrative structure. That is, it widened the gap between the "rich and literate" Spain and the "poor and illiterate" one. (Núñez, 1992: 309-313)

Some cities had modest industries belonging to traditional sectors –textiles, soap, shoes, etc.– with deficient capitalization and backward technologies, so they did not require a specialized labour force; although perhaps some people in control posts. In the 19th Century, many of these industries prospered with the rise of demographic and economic growth, whilst others declined due to competition mainly originating from the Catalan textile industry. This modern industry had a much more expansive development (Silvestre, 2005). The cities it settled in grew rapidly; and the demand for a qualified labour force certainly fostered literacy. The appearance of a large steel industry in Asturias and especially in Biscay was the culmination of this process. The heavy industry sector made the development of the steel industries possible, which did require more human capital.

The Steel industry, in the same way as the emerging Chemical industry, was indebted to the mining industry which made Spain one of the biggest exporter countries of, among other products, pyrite, zinc, iron ore and lead. The combination of the industrial and mining industries helped some medium and large cities to grow; sometimes in a spectacular way such as in Bilbao, Barcelona, Linares or La Unión. In these new and old cities, literacy could have been easier due to the simple concentration of people and the existence of more resources and labour opportunities. However, the bad working conditions of many industrial labourers and, even more so of miners, were not the most adequate to achieve greater literacy.


To sum up, in Spain in the second half of the 19th Century we can identify various factors which seem to positively relate to literacy. Sometimes these were factors which existed before 1850 (although not necessarily a long time before), and which provided a strong starting point, such as the weight of the Church or an intense commercial industry. In other cases, they are independent processes to literacy but indirectly favoured it such as the railway, the

construction of a new territorial administrative structure and the development of industry or mining. We can only recognize one variable directly related to literacy: the establishing of schooling programmes. In any case, the existence of vernacular languages different to Castilian Spanish with little or no written tradition still being used in the 19th Century, specifically Basque, seems to have been an important obstacle to literacy.

From a spatial perspective the effect of these variables is not always known or significant. Therefore, it's clear that religious sentiment was more alive in some regions of the country, but there are problems in finding an adequate indicator. In any case, there is a variable lacking regional significance: Government measures. In one case the creation of a provincial administration because it was uniform. In the case of the literacy programmes it has to be noted that they were passive in nature, that is, they depended on municipal initiatives. Therefore, whichever evaluation we may wish to make of the literacy policies, there is no doubt that their aim was not to correct any regional imbalances.

### 3.- The limitations of documental sources

The information on the variable explained in this puzzle, that is literacy, is relatively abundant. In the second half of the 19th Century, various population censuses were carried out with information that in general does not contain any serious reservations (Cusido, 2012). Among the data included in these reports, there is information on the population who could read and write.[5] Excluding the more arguable censuses (and closer to other more reliable ones), and for the period we have analysed, we have five "snapshots" of literacy in Spain corresponding to 1860, 1877, 1887, 1900 and 1910. For each one of these years we have detailed information of literate people by sex, province and city. Given the limitations of the source, but also the general aim of this research, we will use information from the latter. That is, the variable explained is the percentage of the literate urban population in the last five years.

Unlike Beltrán and Martínez-Galarraga 2015, and Basso 2014, our unit of analysis is the city, not the province. There are two reasons. On the one hand, we assume that, whatever the causes of literacy process in Spain, it began in a urban context. There is huge evidence showing that the percentage of the literate population in the cities was significantly higher than in the country in all the periods. On the other hand, some of the hypotheses we want to test, as the influence of the railways network or the capital status, can only be studied from an urban perspective. Nevertheless, we will build some provincial models to solve some hypothetical objections.

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[5] Strictly speaking, the censuses distinguish three categories: "know how to read and write", "know how to read" and "don't know how to read". The second category is somewhat problematic. In any case it has a small and decreasing effect overall. As the census themselves of the 20th Century ended up doing, in this paper the semi-literate people have been included among the literate population, as it does not seem that their reading skills correspond to what is suggested by the statement "know how to read". (Gabriel, 1997b: 202-210)

Even though there is no reason to assume that there are errors or major problems of concealment, there are reservations on the significance of some of the data[6]. On the one hand, certain capital cities had a high number of young people entering the military service. In a context of increased schooling the literacy rate of these cities slightly increased. A similar effect would arise from temporary migrations, which affected men much more than women. Therefore, some towns, especially in the North East, had a small and elderly male population; and, therefore more illiterate people. The opposite occurred in towns receiving migrants. These problems lead us to think that the results offered by the models of women are, in principle, more reliable than those carried out with samples of men. In any case, and as we shall see, all the models have high determination coefficients.

The number of cities in the sample is variable. The first two censuses, those of 1860 and 1877, provide information on the population who knew how to read and write in each locality in the country. The other three only provide information on cities. In any case, the actual concept of "city" is subject to controversy. In comparative studies on urbanization in Europe, the only criteria used to establish a territory is size. Agglomerations over 5.000 inhabitants (and even 2.000) tend to be considered "cities" (Capel, 1975). Without a doubt, any criteria are arguable and its application has more or less sense bearing in mind the aim of the research or the historical period. The truth is that many Spanish historians have set higher thresholds, between 10.000 and 20.000 inhabitants (Rodríguez Osuna, 1985: 26-28; Reher, 1986). It is argued that many localities of the Mediterranean Arch were what David Reher called "agro-cities"; that is, nuclei of populations where the majority of the inhabitants had their main economic activity in agriculture. Also, in the North and North-east of the peninsula there were highly populated municipalities but which were very scattered and they should not be considered as real cities. However, it is not easy to deny certain small provincial capitals their condition of city, despite the fact that their population did not reach 10.000 inhabitants. The solution we have adopted has consisted of completing the population criteria with ones such as being the provincial capital or the suitability for housing construction and concentration of the population in one single urban area (Reher, 1986: 42-46; Luna, 1988: 4-7). Following the methodology of a previous study (Barquín, Pérez and Sanz, 2012), and based on the data from Luna (1988) we consider cities those that in 1887 had a metropolitan area of more than 5.000 inhabitants, as well as more than 8.000 inhabitants in the whole municipality. This allows us to eliminate both the problem of the agro-cities as well as the scattered municipalities of the North, leaving a fairly wide ranging sample.

Information concerning other explanatory variables does not pose major problems. Cities are either provincial capitals or they are not. Cities either have a railway station or they don't. With regard to the latter, it is essential to know when each station opens for service; or, when the city has access to the railway network. This information is easy to obtain from the existing bibliography, for example, García Raya (2006).

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[6] The most questionable data in the population census are those corresponding to the earlier ages, due to high mortality in the first months and years, even in the first 24 hours, which may not have been gathered with the best precision. Obviously this problem does not affect the literacy figures.

However, there are problems with another two variables. First of all there was the influence of the Church. For the reasons shown, the most significant ratio should be the number of priests/clergy for every thousand inhabitants in each city. This same distinction between priest and clergy is relevant as some members of religious orders such as the cloister monks and nuns, forcefully played a marginal role in the literacy process. However, the existence of Episcopal Sees, seminaries and other institutions in certain localities could introduce a bias. Of course, the presence of religious institutions should have had a positive effect on literacy. However, it's difficult to establish its intensity. In any case, it seems clear that it must have been very different depending on the type of institution.

The greatest difficulties almost certainly arise from the lack of detail in the ecclesiastic information. We have information on the number of members of religious orders in each province, but not in each locality. Therefore, we can assume that the presence of the Church in cities was similar to that of their respective provinces. Or, at least, that the order of that presence in the sample of cities used in the models corresponds to that of the provinces. In fact, this is reasonable. But even if that were the case, by homogenizing the presence of religious orders in all the cities in one single province, proceeding in this manner impoverishes the quality of the results. It is also doubtful that more precise information, of a more local nature, would really provide a "true measurement" of that presence.[7]

Similar problems occur with the variable used to measure the public effort to foster literacy. In a similar way to information on priests, we do not have disaggregated data at an inferior level to the provinces. Even the choice of the appropriate indicator is debatable. There are two possibilities: teachers and pupils who have received schooling. We have chosen the former both for documental reasons as well as conceptual ones. With respect to the latter, an initial problem arises from the fact that the 1877 census does not include information on pupils who have received schooling, as do other censuses. The statistical yearbooks are not useful as there are none close to that year. There are three reports entitled "General Statistics of Elementary Education" referring to the years 1871, 1881 and 1886, the second of which could be used for the data that is missing from the census of 1877[8]. In any case, we would have problems due to the heterogeneity of the sources. Therefore, the census of 1860 talks about "boys (or girls) who go to school"; the 1887, 1900 and 1910 ones refer to a population under the age of 12 who are studying; and the general statistics of 1880 distinguishes those who are "under the age of 6",

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[7] Other information from the censuses poses similar or greater problems. Therefore, we know the number of priests in each ecclesiastic province. As they are greater in number than for the civil population the information could be somewhat better; but not much better and there would be a problem of comparing data originating from different administrative units. There is also information on inhabitants in each parish; but this figure seems to be more conditioned by the type of settlement. There is also information on religious acts, but it is doubtful as to whether this variable really measures religious sensitivity.

[8] There is also a *Statistical Yearbook of Public Education* corresponding to the year 1900-1901 (and also for other years) which provides figures on public and private schools in each province, but not on pupils. School figures, which appear in some sources, but not in the population censuses, could be used as an indicator of the investment effort of the Public Administrations, even though they entail various problems such as not indicating the number of pupils per school or teachers per pupils. In any case, in view of the deficiencies of this source in various provinces, we would have to question whether it is of interest to probe into the number of pupils in the 19th Century when not even the information on schools in 1900 seems satisfactory.

"from 6 to 9" and "over the age of 9". These problems do not arise with the figures about teachers that always originate from the censuses and are comparable.

There are also two conceptual reasons for a preference for managing teachers instead of pupils. Firstly, for obvious reasons we can only use figures of priests, not churchgoers or, even less so, people (children or not) influenced by priests. Therefore, it's logical that we now use figures about teachers, which we can add to those who taught. The idea is that each teacher, similarly to each priest, achieved literacy in a certain number of children. However, if our aim is to measure the effort of the public administrations in favour of literacy, teachers would be more relevant than the actual pupils. There were probably municipalities who strictly complied with the Moyano Act by hiring one single teacher for all the children; however, others would have made a real effort to provide them with an education by hiring as many teachers as necessary.

The next table summarize and describe the variables of this paper. To sum up, we will use three variables to test the "economic incentives hypothesis", «railways», «capital » and «mining-industry». And two variables, «teachers» and «priest», to test the "educational investment hypothesis".

**Table 1**
**Variables related to literacy**

| Variable | Description | Type | Source |
|----------|-------------|------|--------|
| *Endogenous* | | | |
| Literacy | Percentage of literacy people in the town | Continuous | Census |
| *Exogenous* | | | |
| Railway | Existence of a railway station in the town | Idiosyncratic | Garcia Raya (2006) |
| Capital | Capital status (same for all the periods) | Idiosyncratic | Like today |
| Mining-Industry | Existence of mining or industry in the municipality or near (same for all the periods) | Idiosyncratic | Specialized literature |
| Priests | Percentage of clergy people in the province | Continuous | Census |
| Teachers | Percentage of teachers in the province | Continuous | Census |

Source: See text.

## 4.- Empirical analysis

With the aim of quantifying the influence of the indicated variables on literacy, we have used some econometric models. In each case we will use one single dependent variable, i. e. literacy rate, defined according to the possibilities of the sources mentioned in the previous section.

We begin by estimating standard OLS models for every available census. As we have seemed, the dependent variable «literacy» is defined as a rate, the proportion of literates in relation with the overall urban population. The variables «railway», «capital city» and «mining and industry» are *dummies* which take values 0 or 1 according to whether there is relevant access to the railway, the capital city and mining or industrial activity respectively. These three variables influenced urban growth in Spain in the 19th Century (especially the latter two), but only affect

a minor part of the sample (Barquín, Pérez and Sanz, 2012). The variables «priests» and «teachers» are, like the «literacy» variable, rates which reflect the proportion of each one of those groups within the locality, under the assumption as mentioned before, that this relationship may be adequately proven by provincial data. Results for men are presented in next table.

**Table 2**
**Literacy rates models, men**

|  | 1860 | 1877 | 1890 | 1900 | 1910 |
|---|---|---|---|---|---|
| Constant | 6.27*** | 3.62** | 6.26*** | 3.16 | 9.47*** |
|  | (1.77) | (1.79) | (1.88) | (2.25) | (1.99) |
| Priests | 0.40*** | 0.53*** | 0.45*** | 0.34*** | 0.35*** |
|  | (0.09) | (0.08) | (0.11) | (0.08) | (0.07) |
| Teachers | 0.50*** | 0.34*** | 0.54*** | 0.82*** | 0.60*** |
|  | (0.09) | (0.05) | (0.09) | (0.12) | (0.09) |
| Railway | 4.25** | 3.05** | 1.98 | 5.66*** | 6.65*** |
|  | (1.67) | (1.19) | (1.26) | (1.58) | (1.61) |
| Capital | 16.28*** | 17.30*** | 17.26*** | 16.57*** | 17.76*** |
|  | (1.60) | (1.56) | (1.63) | (1.70) | (1.66) |
| Mining-Industry | 4.48*** | 6.29*** | 7.23*** | 6.89*** | 8.90*** |
|  | (1.70) | (1.67) | (1.78) | (1.82) | (1.83) |
| $R^2$ | 0.67 | 0.72 | 0.70 | 0.71 | 0.72 |
| N | 215 | 215 | 215 | 215 | 215 |

Note: Standard errors in brackets. Three asterisk indicate significance at 1%, two asterisks at 5% and one asterisk at 10% in a two sided test.

All the explanatory variables are significant (the only exception is the train in 1890) and have the expected sign. Therefore, both demand and supply factors are important in order to explain education. In addition, capital inhabitants are expected to be more educated: the literacy rates in these cities are 16 percentage points higher being the coefficient quite stable in time[9].

Table 3 shows results for women. The picture is different here. In general terms it can be said that the magnitude of the coefficients are lower for women, as are their literacy rates. Supply factors are again positive (as expected) and significant. Capital status is also positive and significant. But the other demand side elements, Railway and Mining-Industry, become relevant for women only at the end of the period. It is not till the beginning of the 20th century that the train is clearly different from zero and even in this census, mining-industry remain irrelevant. It seems clear that women did not demand education in the same way that men at least till the 20th century, because the use of literacy for men and women has been very different. For this reason, a joint sample of men and women, although of interest for other uses, does not illustrate the problem as clearly as the separate samples do.

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[9] This results are coherent with Beltrán and Martínez-Galarraga (2015: 15-18). For example, in their models variables «priest » and «industrialisation» are very significant. But how the focus of this paper is the inequality of land access that relations are not explore in depth.

**Table 3**
**Literacy rates models, women**

|  | 1860 | 1877 | 1890 | 1900 | 1910 |
|---|---|---|---|---|---|
| Constant | 3.63*** | 2.88** | 1.38 | -2.06 | 3.53* |
|  | (1.22) | (1.32) | (1.46) | (1.87) | (1.85) |
| Priests | 0.11* | 0.23*** | 0.24*** | 0.24*** | 0.32*** |
|  | (0.06) | (0.06) | (0.09) | (0.06) | (0.07) |
| Teachers | 0.27** | 0.24*** | 0.47*** | 0.79*** | 0.57*** |
|  | (0.06) | (0.04) | (0.07) | (0.10) | (0.09) |
| Railway | 1.74 | 1.50* | 0.46 | 2.83** | 3.60** |
|  | (1.15) | (0.88) | (0.97) | (1.31) | (1.48) |
| Capital | 9.33*** | 10.94*** | 11.60*** | 12.93*** | 16.13*** |
|  | (1.10) | (1.16) | (1.26) | (1.41) | (1.54) |
| Mining-Industry | 0.17 | 0.31 | 1.40 | 2.19 | 4.92*** |
|  | (1.17) | (1.24) | (1.38) | (1.50) | (1.69) |
| $R^2$ | 0.53 | 0.62 | 0.66 | 0.69 | 0.70 |
| N | 215 | 215 | 215 | 215 | 215 |

Note: Standard errors in brackets. Three asterisk indicate significance at 1%, two asterisks at 5% and one asterisk at 10% in a two sided test.

From a qualitative point of view some of these results, when comparable, are similar to the ones obtained by other scholars. For instance, Cinnirella and Hornung (2013), found a positive influence of industrial share in Prussia for 1864, 1888 and 1896. They also found a positive coefficient for railway access in some of their regressions. Similar results for industry in England and Wales have been reported for Goñi (2013).

However, given the structure of our data set the usual framework of analysis is panel data models. In this way we can take into account the unobserved heterogeneity and address the issue of time invariant characteristics typical of every town or city and their effect on the dependent variable. Likewise adding time fixed effects we can also consider the effect of time. This procedure allows addressing some problems of omitted variables. For instance, we have pointed out above that the Moyano Act rely funding education on cities and it can be argued that the economic power of those cities has an idiosyncratic feature of any of them. In fact, using provinces teaching spending, we can see that the relative rank between 1870 and 1885, suffer only minor changes[10].

Table 4 show pooled model including the so-called *fixed temporal effects*, that is, the influence of time. We may consider these as if we had included a temporal *dummy* for each census period. Results for both men and women are quite similar to the previous ones: again all the variables are statistically significant and have the expected sign. The magnitudes are also coherent with those in tables 1 and 2; in fact, they are close to their time averages. For all the variables coefficients are higher for men as we have already seen in cross section models. The effect of Priests and Teachers is akin in both genders. If *teachers* increase by one percentage point, literacy grows around 0.48 percentage points for men and a 0.35 for women. The corresponding

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[10] For illustration: Valencia, Sevilla, Zaragoza, Jaén, Navarra, Valladolid, Castellón, Orense and Baleares, remain unchanged. Madrid and Barcelona alternate first and second position. Only Córdoba (+15), Burgos (+14), Vizcaya (+13), Huesca (-13) and Teruel (-13) move more than ten positions in the rank.

figures for *Priests* are 0.45 and 0.32. So the two supply factors have similar effects to literacy. The two demand factors are also positive and significant, but *Mining-Industry* significance is only marginal for women (*p-value* = 0.086). To have access to the railway increases the literacy rates by 4 percentage points for men and 2.25 for women. The F tests comparing these equations with a simple pooled model[11], show that time effects are statistically significant. On the other hand, the coefficient of determination is better (or at least equal) than the reported in tables 2 and 3. Besides the low time dimension (*T*=5), Durbin Watson statistic is not a problem since we have estimated robust standard errors.

**Table 4**
**Panel data models, Time Fixed Effects**

|  | Men | Women |
|---|---|---|
| Constant | 7.17*** | 2.59** |
|  | (1.34) | (1.02) |
| Railway | 4.06*** | 2.25*** |
|  | (1.00) | (0.83) |
| Priests | 0.45*** | 0.32*** |
|  | (0.07) | (0.06) |
| Teachers | 0.48*** | 0.35*** |
|  | (0.05) | (0.047) |
| Capital | 17.26*** | 12.11*** |
|  | (1.39) | (1.24) |
| Mining-Industry | 6.87*** | 2.02* |
|  | (1.56) | (1.17) |
| $R^2$ | 0.72 | 0,70 |
| NxT | 1075 | 1075 |
| D-W | 0.46 | 0,48 |

Note: Robust standard errors in brackets.

The main problem of the above models is that they do not bear in mind the actual heterogeneity or specificity of each one of the transversal entities; that is, of each locality. For example, in each one of them the educational services (and others) may be organized differently, in so much that these differences add specificity to each municipality, which makes it inappropriate to treat them in the same way. On the other hand, it is not difficult to imagine the existence of more specific factors of this type; for example, the existence of literacy schools for adults, which were very active in cities such as Barcelona. The technique of the *fixed transversal effects* allows for the measurement of the influence of the variables of interest on the endogenous variable once the effect of all the specific variables which do not change over time (a large part of them were not included in this model, giving rise to the well-known variable omission problem) have been taken into account. Given that the «capital» variable and, normally, the «mining and industry» variable are both of this nature (the provincial capitals have been the same since 1833, the cities which were mining/industrial in 1860 were still so in 1910), these

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[11] Not reported here

two variables are already included in the fixed effect term and for this reason they have been eliminated from the regression in models 1.2 and 1.4.

**Table 5**
**Panel data models, Transversal and Time Fixed Effects**

|  | Men | Women |
|---|---|---|
| Constant | 14.29*** | 26.87*** |
|  | (1.68) | (1.34) |
| Railway | 0.84 | 0.34 |
|  | (0.49) | (0.59) |
| Priests | 0.32*** | 0.27*** |
|  | (0.051) | (0.043) |
| Teachers | −0.005 | 0.069** |
|  | (0.044) | (0.033) |
| $R^2$ | 0.92 | 0.95 |
| NxT | 1075 | 1075 |
| D-W | 1.64 | 1.94 |

Note: Robust standard errors in brackets.

In these models the results change substantially. The influence of the railway is no longer significant in the case of men and only slightly in that of women. For men, «priests» and «teachers» maintain the expected positive signs and the statistical significance, but the magnitude of both has dropped: 0.45 to 0.27 for the former and 0.48 to 0.07 for teachers. The influence of the clergy has diminished a lot less than that of teachers, which implies that, overall, it is four times greater. In the case of women, the change is different. The influence of priests is maintained but that of teachers disappears (it is not different from zero in statistical terms), which perhaps reflects the fact that in those times women went to school a lot less. The value of the Durbin-Watson statistic has increased up to reasonable figures and the coefficient of determination is above 0.9 in both cases, which proves the statistical relevance of the cross fixed effects. In other words, local factors seem to have been decisive in the literacy process; not only the condition of capital cities and the mining-industrial nature of these localities, but also the other factors too. We have referred to some of them before: the use of vernacular languages different to Castilian Spanish and the intensity of commercial activity.

If we accept, as the theory says, that it's the models with fixed effects which best show the influence of the different variables[12], the role played by the railway in the improvement of the educational levels of Spaniards in cities seems to have been modest or even non-existent. Based on these results we may conclude that the opening of schools, and above all the presence of the Church, were the variables really had an influence on the slow reduction of illiteracy.

An objection to these results resides in that all models use provincial data for the variables «priests» and «teachers» from each one of the localities of these provinces, whilst in the

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[12] Hausman test for the alternative Random Effects Model produce $\chi^2(3) = 151.1$ for men model and $\chi^2(3) = 95.4$ for women. Therefore, Random Effects Model is rejected for men and for women.

endogenous variable and in the «railway» variable, local data has been employed. Although it seems reasonable to suppose that capital cities reflect the situation of their provinces, and even though it is not clear whether a more detailed measurement would be possible or desirable, we wanted to confirm the results with two new estimations. They are practically the same in all respects to the previous ones but using provincial literacy data. To establish the influence of the railway on a provincial level we have defined the variable in the following way: we have computed in each census period the proportion of localities which have access to the railway, so that the new variable ranges between 0 and 1, but now any intermediate value is also possible. Table 6 shows the results.

**Table 6**
**Panel data models, Transversal and Time Fixed Effects**
Provinces

|  | Men | Women |
|---|---|---|
| Constant | 31.29*** | 13.17** |
|  | (1.69) | (2.79) |
| Railway | 1.40* | 2.26* |
|  | (0.77) | (1.25) |
| Priests | 0.20*** | 0.26*** |
|  | (0.039) | (0.054) |
| Teachers | 0.10*** | -0.051 |
|  | (0.039) | (0.076) |
| $R^2$ | 0.98 | 0.93 |
| NxT | 240 | 240 |
| D-W | 1.48 | 0.94 |

With respect to tables 1 and 2 the conclusions are basically the same. Railway is now marginally significant but in sharp contrast to Priests and Teachers for men. Priests are once again the most decisive variable. Its coefficient still doubles that of teachers in the men's model, and it is even greater than that of women, where female teachers do not have any influence.

There are some issues that need to be addressed. First, the above equations can suffer problems of omitted variables. Panel cross fixed effects models only take into account omitted variables that remain unchanged in time. But fiscal capacity, landowner concentration, teacher salaries and work conditions, rates of attendance or data for agricultural and industrial share (rather than a dummy variable for the latter), are all obvious candidates to be considered and any of them are expected to remain constant. In this study they have not been employed mainly because there are not available data of these factors for the whole panel.[13] But really it is not easy to imagine big changes in any of these variables in the period 1860-1910[14].

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[13] We have been able to collect data on teaching spending but only by provinces and for the years 1855, 1870, 1880 and 1885. Hence dates do not cover the entire period and, even in the 19th century, they did not fit the census. On the other hand, this variable is expected to be highly correlated with teachers so its omission should not be an important problem.

[14] For example, with respect a landowner share, Carmona, Roses and Simpson (2012) only find evidence of a drop of landless workers from 1890 to 1930. It seems too late to affect our models. Unfortunately, we have not detailed (provincial) information to test this possible effect.

A second source of concern is causality. Certainly we cannot claim causality for our equations since exogeneity of explanatories is not guaranteed. So what we have found is, strictly speaking, a strong statistical association. However, intuition said that causal direction runs from *Teacher* (*Priests*) to *Literacy* and not the other way around. Something similar can be said for *Capital*. Situation is not so clear for *Train* and *Mining-Industry* but they usually work as explanatories in the literature.

## 5.- Interpretation and conclusions

At beginning of this paper we have proposed two explanations to the slowness of the literacy process in Spain: First, the lack of economic incentives. Second, the weakness of the investment in the educational offer. Now, we can suggest some answers to this puzzle.

In the previous econometric models there are three variables related to the economic incentives: «railways», «capital status» and «Mining-Industry». The results of the models do not allow us to state that the railway had an important effect on the education of Spaniards. In the models of tables 2 and 3, the sign of the coefficient for men is what is expected, and it is significant for men; but not for women (except in the last census). But when we use panel data models with fixed transversal effects, the statistical significance sharply decreased. Our interpretation is that it's not the railway, but the idiosyncratic conditions of each locality, which really explain the improvement in literacy rates. Nevertheless, it's true that the last model, where we use a sample with information of "provincial railway", proves the existence of a weak relationship. Whichever way, it doesn't seem that the railway entailed a huge revolution in the literacy process of Spaniards in the 19th Century. It probably played a positive but modest role; a result which is consistent with others (for Prussia, Cinnirella, Cinnirella and Hornung, 2013: 26 and 63; for urbanization and railways in Spain, Barquín, Pérez and Sanz, 2012).

The other idiosyncratic variables related to the incentives, «capital status» and «mining and industry», seem to have had a notable influence on literacy in men. But in the case of women the influence of mining/industry is practically non-existent, and capital status less so, although still relevant. These two variables would have had an influence by increasing the labour possibilities of literate people. Therefore, it is quite logical that they would have a lesser effect on women than on men, as women did not tend to have jobs that required specific training or they just simply did not work in exchange for a salary. So, the absence of incentives could not explain the low literacy rates of women. From the point of view of a policy maker, the decision of building a railway web did not seem so effective in literacy process than the mere construction of the bureaucratic structures of a Liberal Regime. In short, the Spanish Liberal Governments probably had not "demand tools" to foster literacy process.

The alternative explanation is the weakness of investment in education. In fact, variables «teachers» and «priest» have a positive and strong correlation on the percentage of literacy in the women models; but not always in the men. It is remarkable that the clergy have a prolonged effect on literacy; and, above all, that it was greater than that of the actual teachers in the last models, which are, theoretically, better than first ones. This is an unexpected result. It is

reasonable to think that the Church has been decisive in the educational levels of Spain in the middle of the 19th Century; but it is surprising that this influence should be maintained in the following decades and overtake that of schools. Our interpretation of this result stars from the observation that the explanatory capacity of the Church, although clear, is not outstanding. The idiosyncratic factors seem much more powerful than the non-idiosyncratic ones, which explain the marked improvement of the models which use cross effects. In other words, the problem cannot be limited to explaining the educational capacity of the Church, but the poor role played by schools in the literacy of children, which was non-existent in the case of girls.

So, this is understandable and to be expected in the light of existing bibliography. There is an extremely critical view of the role played by public administrations in the literacy process during a large part of the period contemplated in this study. It is significant that between 1870 and 1900 the number of schools in Spain grew by 0.38% annually (from 28.177 to 31.529), when the mere population growth was 0.46% (Botrel, 1993: 324-331). Núñez (1992: 301-309) observes that if between 1860 and 1880 the annual rate of increase in public spending (in constant pesetas) in primary school education was 1.8%, between 1880 and 1902 it was only 0.6%. This difference becomes even more notable if we calculate the public spending per inhabitant: 1.4% versus 0.09%.

Moreover, not all registered pupils attended school, nor did all those who attended learnt to read and write. It was not uncommon for parents to send their children to school, and especially their daughters, with the sole aim of learning Catholic doctrine and some domestic chores. Therefore, in 1885 the schooling and literacy rates among children from the ages of six to twelve were 52.4% and 23.8%, respectively. These same percentages in 1908 were still 47.3 and 31.6%. The real change takes place from this moment onwards: in 1950 these rates were 83.1 and 68.8%. (Gabriel, 1997a: 235-238; Núñez, 1992: 228-250). All the indicators point to the low literacy efficacy of 19th century schools.

Therefore, the relative success of Church to promote literacy of children should be explained by the relative fail of the Central Administration to do it. Essentially, priests played the role that teachers could not do it. This conclusion get strength the previous one, that is, the cause of the slowness of literacy process in Spain was the weakness of educational investment.

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