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July 2009

WP 09-05

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### Abstract

This paper studies the evolution of Spanish regional inequality from 1860 to 1930. The results point to the coexistence of two basic forces behind changes in regional economic inequality: industrial specialization and labor productivity differentials. The initial expansion of industrialization, in a context of growing economic integration of regions, promoted the spatial concentration of manufacturing in certain regions, which also benefited from the greatest advances in terms of labor productivity. Since 1900, the diffusion of manufacturing production to a greater number of locations generated the emulation of production structures and a process of catching-up in labor productivity and wages.

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**JEL Classification:** N93; N94; R11

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Rosés acknowledges financial support from the Spanish Ministry of Science and Innovation projects “Consolidating Economics” within the Consolider-Ingenio 2010 Program and Project SEJ2006-08188/ECON, and from the European Science Foundation for his visit at ICS, Lisbon, where it was written a large part of the paper. Tirado and Martínez-Galarraga thank the financial support from the Network in Economics and Public Policies (XREPP) launched by the Generalitat de Catalunya.

# The Upswing of Regional Income Inequality in Spain (1860-1930)

## 1. Introduction

A source of concern among policy-makers is the possibility that the processes of cross-national integration, like the European Union and the NAFTA, may result in increasing regional inequality.<sup>1</sup> Furthermore, the predictions made by economic theory about the impact of integration on regional economic inequality are at least ambiguous, which calls for empirical analysis.

The Neoclassical trade theory (the Heckscher-Ohlin (HO) model) argues that regional incomes differ because of differences in factor endowments and factor prices. The factor-prize-equalization (FPE) theorem, within this framework, is optimistic about the consequences of market integration: the increase in trade and factor movements lead to factor prices equalization across regions and hence per capita GDP convergence.<sup>2</sup> It should be noted, however, that market integration may also lead to increasing regional specialization because regions differ in factor endowments. In this situation, the HO model predicts a parallel increase in regional income divergence. Conversely, if regional differences in factor endowments tend to decrease, and factor prices converge, one should observe a reduction in regional income disparities.<sup>3</sup>

On the other hand, the recent new developments in trade theory, the New Economic Geography (NEG), are even less optimistic about the regional inequality impact of integration processes.<sup>4</sup> NEG models are constructed around the idea that the existence of product

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<sup>1</sup> In the case of the process of European integration, which lasts more than half century, regional differences within countries have soared, albeit a substantial decrease in cross-national differences in GDP per capita (Puga, 2002). The fact is that large regional inequality appears to be an enduring characteristic of the European economic landscape. Spain is a good example of this situation. According to the last data published by the Spanish statistical office (INE, 2008), per capita GDP in the richest Spanish NUTS II region (the Basque Country) was about two times that of the poorest (Extremadura).

<sup>2</sup> However, to hold, the FPE theorem requires a long list of strict assumptions. See, for example, Samuelson (1949), Deardoff (1986), and Leamer (1995).

<sup>3</sup> Kim (1998).

<sup>4</sup> Baldwin et al. (2003) and Fujita et al. (1999) offer an extensive analysis of this framework.

differentiation, increasing returns to scale and transport costs may generate pecuniary externalities in firms and workers' location choices. In presence of factor mobility or intermediate inputs, these three factors give rise to agglomeration and, hence, uneven regional specialization. As workers tend to concentrate in a given location, the resulting shift in local demand increases the incentive for firms to concentrate production in that location. Also, workers may obtain a wage premium in these places due to the presence of Marshallian externalities, and the subsequent higher labor productivity levels.<sup>5</sup> In sum, NEG argues that market integration could lead to regional divergence.

To complicate more the picture, economic integration is not the only causal factor for regional convergence and divergence. Williamson (1965) pointed out regional inequality could have been growing during the initial phases of modern economic growth and declining from certain levels of development. So, in the long run, in parallel with the processes of economic integration and industrialization, changes in economic inequality may have followed an inverted-U shape. In a similar vein, a several authors have emphasized the importance of structural change in regional inequalities. For example, Caselli and Coleman (2001) related the convergence among regions within the US to the reduction of agricultural employment in the poorest locations. To summarize, a substantial literature has related the upward trend in regional per capita GDP inequality to the unequal distribution of industrial production.

Finally, the growth theory also offers insights about the causes of regional inequality. In the textbook Solow model, in a closed economy context, differences in capital per worker led to slow income convergence across locations (Barro and Sala-i-Martin, 2003). If we add to the model cross-regional movements of capital, convergence rates may increase due to the fact that capital moves from capital-abundant to capital-scarce regions following differences in its relative remuneration (Barro *et al* 1995). The new strand of growth theory, the endogenous growth theory, has also contradictory predictions about the impact of cross-regional integration. In presence of increasing returns, the basic model (Romer, 1986) predicts that the increasing movements of capital lead to regional divergence. Instead, if we consider that technology is not a public good and, hence, subject to decision-making processes of individual agents and their prospect for monopoly rents, an increased scale of the economy will have a lasting positive effect

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<sup>5</sup> An interesting variation of this framework is offered by Epifani (2005), which combines the HO and the NEG models. This author shows that: (1) if regional differences in endowments are relatively small, agglomeration forces induce an over-specialization which results in a reversion of the relation between factor prices and factor abundance; and (2) if trading partners are very dissimilar in terms of endowments, the predictions of the Heckscher –Ohlin framework, including the FPE theorem, hold.

on growth. The reason is that the monopoly rent increases with the number of consumers while the costs for innovation are independent of the size of the economy (Crespo Cuaresma *et al.* 2008).

An obvious historical precedent of these economic unions among nations is the emergence of national markets in many European countries. During the nineteenth century, institutional barriers to trade and factor movements within countries were eliminated, the transport costs decreased dramatically (particularly with the construction of the railways networks), and monetary and financial national markets emerged. As a consequence, domestic movements of people, capital and goods grew exponentially and the prices of commodities and production factors tend to converge across locations. On the other hand, the creation of these national markets was sometimes contemporary to industrialization processes, and the subsequent process of structural change and regional specialization.<sup>6</sup>

In this context, the study of the Spanish experience is particularly appealing. First, Spanish national market emerged over the second half of the nineteenth century as a consequence of the expansion of railways network, the liberalization of markets and the development of a national financial system. However, domestic migrations and structural change were relatively unimportant up to the years following World War I (see further section 2). Second, industrialization developed in certain regions like Catalonia and the Basque Country, while a large part of the country remained agrarian (Nadal, 1974). Third, different studies have confirmed the fact that manufacturing production was increasingly concentrated during the period as is suggested by the NEG models (Rosés, 2003; Tirado, Pons and Paluzie, 2002). Nevertheless, we had sparse and inconclusive evidence about the impact of this industrial concentration on regional income disparities (Rosés, 2004). Finally, in the European context, Spain was a relatively large country with a low population density that specialized in exportation of agricultural goods and minerals. So, one could expect that its experience to be situated in the middle of two extreme historical experiences: the United States, which is characterized by land abundance, the expansion of the land frontier and important transport costs (Kim 1995, 1998, and Kim and Margo, 2004), and the British one, which is marked by high population density, the international specialization in manufacturing exports, and low transport costs (Crafts and Mulatu 2005, 2006).

The rest of the paper will proceed as follows. Section 2 discusses the process of creation of the Spanish national market. In Section 3, we describe the methods and sources for constructing our new per-capita regional GDPs database. In Section 4, we present the main

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<sup>6</sup> The classical account of this process is Pollard (1991).

stylized facts on the evolution of Spanish per capita regional GDP. The following section considers the subsequent regional specialization and the industrialization patterns. Section 6 decomposes the determinants of regional variation in per capita GDP. Section 7 presents the conclusions.

## **2. The formation of the Spanish National Market**

Before the mid-nineteenth century, Spanish regions were relatively independent regional economies. The presence of barriers to interregional trade and the movement of capital and labor were ubiquitous: local tariffs and regulations on domestic commerce were widespread; weights and measures differed across regions; transport costs were very high due to the particular geography of Spain, which avoided an extensive water transport system, and the low public investment in transport infrastructures; economic information moved slowly across regions; banking system was underdeveloped; and many regions had their own currencies (although all currencies were based on a bi-metallic monetary system). As a consequence, Spanish commodity regional markets were scarcely integrated, albeit certain interdependence in commodity prices existed since the eighteenth century,<sup>7</sup> and prices of production factors differed markedly from one region to another.

Both market liberalization and transport improvements, particularly the completion of Spain's railways network, induced the creation of a national market for most important commodities during the second half of the nineteenth century.<sup>8</sup> The successive political reforms of the nineteenth-century gave legal backup to property rights, eliminated tariffs and local restrictions on home commerce and assured the free mobility of people and capital. These actions were implemented along three long waves: the Liberal Revolution (1836-1840), the "Bienio Progresista" (1854-1856) and the "Sexenio Democrático" (1868-1874).<sup>9</sup> Simultaneously, major improvements in transport and communication systems took place. The extension of paved roads increased exponentially from 2,000 kilometers to 19,815 kilometers between 1800 and 1868 (Madrazo, 1984, pp. 163-179). Coastal shipping experienced major advances as a consequence of the improvements in ports and ships although these technical improvements arrived later and had minor impact than in other countries (Frax, 1981). Finally, the Spanish railroads network was completed from 1860 to 1890. With the railways, unit transport costs fell, permitting a widening of the market, growth in urbanization, and an increase in agricultural

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<sup>7</sup> See, for example, Ringrose (1996).

<sup>8</sup> Barquín (1997). Martínez Vara (1999), Peña and Sánchez-Albornoz (1983), and Simpson (1995).

<sup>9</sup> On these liberal reforms see Tedde de Lorca (1994); and Simpson (1995).

specialization (Gómez Mendoza, 1982; Herranz, 2006). However, in spite of those gains, the total direct impact of the Spanish railroads was not superior to other European countries given the low importance of railroad transport within Spanish GDP (Herranz, 2006).

The chronology of the creation of capital and labor markets was markedly different to those of commodity markets. In the case of capital markets, integration could be analyzed by observing the premium paid in commercial paper. In Spain, since the eighteenth century, the movements of capital across the main financial centers were based on a system of inland bills-of-exchange and a network of local-based merchant-bankers (Castañeda and Tafunell, 1997, Maixé and Iglesias, 2009). These bills were not only subject to transaction costs but also paid a market premium related to local capital markets imbalances. However, commercial paper shows rapid decline in interregional short-term interest rate differentials after 1850 (Castañeda and Tafunell, 1997). This convergence in interest rates across regions could be attributed to profound changes in the banking system. The Spanish banking system began its modernization during the early 1840s, when a new legal framework allowed the establishment of private banks organized as limited liability corporations (Tortella, 1973). Several of these banks were also granted with the right of issuing banknotes that had legal tender in the same town where they had been issued but not accepted elsewhere (Sudrià, 1994). This right of local emission did not ease the integration of capital markets since each issuing bank pursued its own monetary policy. As a result, banknotes were exchanged across cities with premium. Furthermore, commercial banks had no branches nationwide until the early twentieth century (Anes, Tortella and Schwartz, 1974). However, a new political reform of the financial system dramatically altered this state of affairs. In 1874, the Banco de España became the sole issuing bank and a national currency –the Peseta– was established (Martorell, 2001). Only eleven years later, by 1885, this issuing bank developed the first nationwide branch network allowing movements of capital across towns at constant and cheap rates and, hence, integrating the national capital market (Castañeda and Tafunell, 1997).

The integration of Spanish labor markets progressed markedly since mid-nineteenth century, albeit the evidence is not conclusive about the existence of a fully-integrated national labor market. More specifically, the PPPs-adjusted wage evidence showed that rural and urban wages converged across different locations prior to World War I, despite low rates of internal migration. This process of wage convergence was interrupted by World War I, which produced a sharp increase in regional wage differentials. These increases proved to be temporary, however; wage convergence re-emerged in the 1920s, this time accompanied by internal migration and substantial re-allocation of labor from agriculture to industry. Despite these patterns, regional

disparities remained important within Spain on the eve of the worldwide Great Depression (Rosés and Sánchez-Alonso, 2004).

### 3. A new database on Spanish Regional per capita GDPs: methods and sources

Our estimation of Spanish per capita regional GDP is mainly based on the methodology developed by Geary y Stark (2002). This departs from the basic principle that the national per capita GDP is equal to the sum of all regions per capita GDP. Algebraically, the total GDP of the Spanish economy is the sum of all regional GDPs:

$$(1) Y_{ESP} = \sum^i Y_i$$

However, given that provincial GDP ( $Y_i$ ) is not already available; this will be proxied according to the following equation:

$$(2) Y_i = \sum^j y_{ij} L_{ij}$$

$y_{ij}$  being the output, or the average added value, per worker in each region  $i$ , in sector  $j$ , and  $L_{ij}$  the number of workers in each region and sector. As we have no data for  $y_{ij}$ , this value is proxied by taking the Spanish sectoral output per worker ( $y_j$ ), assuming that regional labor productivity in each sector is reflected by its wage relative to the Spanish average ( $w_{ij}/w_j$ ). In consequence, we can assume that the regional GDP will be given by:

$$(3) Y_i = \sum^j \left[ y_j \beta_j \left( \frac{w_{ij}}{w_j} \right) \right] L_{ij}$$

where, as suggested by Geary and Stark (2002),  $w_{ij}$  is the wage paid in the region  $i$  in sector  $j$ ,  $w_j$  is the Spanish wage in each sector  $j$ , and  $\beta_j$  is a scalar which preserves the relative region differences but scales the absolute values so that the regional total for each sector adds up to Spanish totals.<sup>10</sup> So, in absence of output figures, Geary and Stark (2002) set a model of indirect estimation based on wage income, which allows for an estimation of GDP by region at factor cost, in current values. The basic data involved in this estimation procedure are national output per worker by sector, and nominal wages and active population, by sector and region. However, in several industries (see below), we had not to resort to indirect estimates given direct estimates of regional output had been computed. It should be noted that this methodology also allows us to compute not only regional GDPs but also figures for the different industries. Geary y Stark (2002)

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<sup>10</sup> Spanish GDP is taken from Prados de la Escosura (2003).



distributed regional GDPs in three different industries (agriculture, manufacturing and services) but, instead, we have considered up to five sectors (agriculture, mining, manufacturing, construction and services) for Spain given the availability of data.<sup>11</sup>

### *Agriculture*

In agriculture, we have been able to compute direct production estimates (nominal gross value added) for 1900, 1910, 1920 and 1930. More specifically, the quantities of production of different agrarian products collected by GEHR (1991) were multiplied by the relative prices and the transforming coefficients provided by Simpson (1994). Then, these real values were converted into nominal values using the disaggregated agrarian prices provided by Prados de la Escosura (2003). Finally, we have scaled the absolute values so that the provincial total for each sector adds up to Spanish totals for agricultural value added from Prados de la Escosura (2003).

For the year 1860, we have employed a modified version of the Geary-Stark's method. A major problem with agricultural estimations is that we know the daily wages but not the amount of working days over the year and the amount of female workforce in agriculture. Moreover, it is likely that these factors had varied widely across regions. For this reason, we have modified the initial estimation based on the original method with a scalar computed by dividing our direct estimation for 1910 by that obtained with the Geary-Stark's method.<sup>12</sup> In consequence, we assume that the amount of days worked and the relative amount of female working population in each province remained constant between 1860 and 1910.

### *Mining*

The provincial mining production has been calculated from information on the production values disaggregated by province, which had been drawn from the Spanish Statistical Yearbook (*Anuario estadístico de España*) for the years 1860, 1910, 1920 and 1930.<sup>13</sup> These figures have allowed us to distribute Spain's mining gross value added at factor cost between the different provinces. However, given the absence of direct production data for 1900, we have resorted to an alternative methodology: the active provincial population engaged in mining in

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<sup>11</sup> However, to simplify our further discussion, we will add up mining, manufacturing and construction to generate industrial sector value added.

<sup>12</sup> The source of wages is Rosés and Sánchez-Alonso (2004) and the source of agricultural population is the Spanish population census.

<sup>13</sup> We have taken the values of 1915 for 1910, and 1931 for 1930.

1900 has been multiplied by a productivity coefficient obtained from 1920 data.<sup>14</sup> In other words, we assume that labor productivity in mining in each province was equal in 1900 than in 1920.

*Industry: Manufacturing and Public Utilities*

To carry out the estimation of regional industrial value added, we begin by assuming the existence of a production function with constant returns to scale, where the output is obtained from the contribution of two production factors, labor and capital.<sup>15</sup> The industrial gross value added (GVAIND) is defined as:

$$(4) \text{GVAIND}_{it} = \alpha_{it} (\omega_{it} * L_{it}) + (1-\alpha_{it}) (r_{it} * K_{it})$$

being,  $\alpha_{it}$  the share of the wage income in industrial gross value added in region  $i$  at time  $t$ ,  $\omega_{it}$  industrial wage in region  $i$  at time  $t$ ,  $L_{it}$  the total industrial active population in region  $i$  at time  $t$ ,  $r_{it}$  the returns to capital in industry in region  $i$  at time  $t$ , and  $K_{it}$  the capital stock in industry in  $i$  at time  $t$ . For the Spanish case, there is information available for each of the components of equation (4) but  $r_{it}$ . For this reason, we had to assume perfect capital mobility. Then,

$$(5) r_{it} = r_t \quad \forall i$$

The wage income included in the equation (4) has been estimated as follow. First, the series concerning industrial employment in each province are compiled from the information provided by the Population Censuses of 1860, 1900, 1910, 1920 and 1930.<sup>16</sup> Then, we have collected the data available on nominal industrial wages from a variety of sources.<sup>17</sup> Finally, under the assumption that the number of yearly working days is identical in all provinces, we have

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<sup>14</sup> This is the year in which mining workforce was more exactly registered at Spanish population census (Foro Hispánico de Cultura, 1957).

<sup>15</sup> In this sector, we have followed the refinement of Crafts (2005) to the original Geary and Stark's (2002) methodology, using tax data to allocate non-wage manufacturing income across regions.

<sup>16</sup> We have also corrected for errors and underreporting of original data according to Foro Hispánico de Cultura (1957).

<sup>17</sup> Madrazo (1984) provided data for 1860, Sánchez-Alonso (1995) for 1900, Ministerio de Trabajo (1927) for 1920, and Silvestre (2003) for 1910 and 1930. However, this kind of data is not available for the Canary Islands; then we had to assume that their wages are equal to the lowest of the Peninsula.

computed the wage income by multiplying wages by the amount of industrial working population.<sup>18</sup>

The data for constructing provincial capital income of equation (4) have been drawn from several fiscal sources. The main source for our calculations is the *Estadística Administrativa de la Contribución Industrial y de Comercio (EACI)* that collects all statistical information on the industrial tax, which was established in 1845. This industrial tax consisted in a fixed rate over the main means of production in use (Nadal and Tafunell, 1992, p. 256). The rate was different by each type of machinery and industrial branch but did not adjusted immediately to changes in machinery productivity. Furthermore, the coverage of this tax was modified substantially by 1907. Joint stock companies, which were the largest Spanish industrial firms, were exempted of its payment but assigned to a new corporate tax based on the net profits (*Impuesto de Sociedades*). More prominently, over the years, many firms transformed themselves into joint stock companies in order to benefit from the lower tax rates of this new corporate income tax (Nadal and Tafunell, 1992, p. 259). Later, in 1921, all different types of partnerships were assigned to this corporate tax and, hence, many firms were exempted from the payment of the old industrial tax. In consequence, from the year 1907 onwards, the information of the EACI is not representative of industrial activities. Fortunately, Betrán (1999: 674-675), in her monumental study on the industrial localization in Spain in the first third of the 20<sup>th</sup> century, reconstructed the industrial taxes paid in each province in 1913 and 1929 employing data on the two types of taxes paid by industrials. In sum, fiscal sources and Betrán (1999) allow us to compute the regional participation in the capital income in 1856, 1893, 1913 and 1929.<sup>19</sup>

Once the provincial distribution of labor and capital income is obtained, we need to calculate the weight of each factor income in total industrial gross value added. In this respect, substantial international evidence shows that the output proportion in labor and capital remains relatively stable for long periods (Gollin, 2002). For this reason, we have opted to compute

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<sup>18</sup> It should be noted that the coverage of wages database is far from perfect, thus, we had to make some assumptions: first, the series of wages, not homogeneous throughout time, are representative of industry; second, as regards the use of nominal wages, to the extent that there are regional variations in price levels then there will be bias (Geary and Stark, 2002, pp. 933-934)

<sup>19</sup> But for 1920, due to the absence of fiscal data, capital shares had been interpolated employing figures for 1910 and 1930. Finally, the addition of the Basque Country and Navarre in the second half of the 19<sup>th</sup> century relies on the data in Parejo (2001) who estimated the contribution of these regions to the Spanish total based on the historical indexes of industrial production. This regional information has been split by provinces according to the share of industrial active population in each date.

different factor-shares for each industry but not for each industrial benchmark. It should be noted, however, that, given that provincial industrial structure varies over time, these shares also varied in the different benchmarks at provincial level. More specifically, to compute these factor-shares we have used the information from the Input-Output Table for Spain in 1958 (TIO1958).<sup>20</sup> From this source, capital and labor shares have been calculated for nine industrial branches<sup>21</sup>. We thus can identify, for this level of aggregation, the factor-shares according to the productive structure of the industrial sector in each province and year. The data on the provincial productive structure by year has been obtained again from the same fiscal sources discussed in the previous paragraph. Finally, with this information, specific factor-shares for each province and for each benchmark have been constructed, except for the Basque Country and Navarre.<sup>22</sup>

### *Construction*

This is composed of two subsectors: residential construction and public works. Data on residential construction is distributed across provinces with data on urbanization rates (the percentage of population living in cities with more than 5,000 habitants) from Reher (1994). In the case of public Works, we have distributed gross national value added across provinces with data on the provincial stock of infrastructures from Herranz (2008).<sup>23</sup>

### *Services*

Many historical studies suffered from the absence of information on wages in the service industries. Geary and Stark (2002: 923), who faced the same problem in their study of the British economy, calculated the service sector wages as a weighted average of agriculture and industry series in each province, where the weights were each sector's share of the labour force. Our

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<sup>20</sup> Using this source to elaborate the factor-shares and then apply them in retrospective implies the assumption that the intensity in the use of factors in 1958 is a good proxy for previous years. However, we have to point out that this assumption has been also employed in previous estimations of the Spanish Industrial Production Indices (Carreras, 1983; Prados de la Escosura, 2003).

<sup>21</sup> The industrial branches are food, textiles, metal, chemicals, paper, wood, ceramic, leather and miscellaneous industries. However, due to data restriction, the industrial branches considered are only seven (food, textiles and footwear, metal, chemicals, paper, wood and cork, and ceramics) in 1913 and 1929.

<sup>22</sup> Since this fiscal information is not available for the Basque Country and Navarre, and it is not possible to know their industrial structure, a similar labor share to the Spanish total is assumed for these regions.

<sup>23</sup> Given that Herranz's (2008) database is only available from 1870 onwards; the data for 1860 has been only based on urban population.

strategy is slightly different. Prados de la Escosura (2003) provides the gross value added of eleven different branches of the Spanish service industry: transports, communications, trade, banking and insurances, housing, public administration, education, health services, hotels and restaurants, domestic services and professions. Taking into account this level of disaggregation, we have compiled the data on active population from the Population Censuses. We have scaled the absolute values so that the provincial total for each sector adds up to Spanish totals for working population engaged in services from Prados de la Escosura (2003). Then, according to skills and productivity levels of workforce, we have employed different wages. More specifically, we have resorted to agrarian wages for domestic service; an unweighted average of industry urban unskilled and skilled wages for commerce, hotels and restaurants; an unweighted average of agrarian and industry urban wages (unskilled and skilled) for transport and communications; and, finally, urban skilled wages for the remaining branches.<sup>24</sup>

#### **4. Stylized Facts of the Spanish Regional Inequality**

Before introducing more sophisticated methodologies, it would be useful to look at the evolution of regional per-capita income trends during the period. Our objective in the next paragraphs is to establish several stylized facts about regional development in Spain. Table 1 ranks all regions according to their 1860, 1900, 1910, 1920 and 1930 per-capita relative income.<sup>25</sup>

#### **[HERE TABLE 1]**

Relevant evidence stands out from this table. First, it is apparent the marked stability of top-ranking positions. Madrid and Catalonia were always among the three first positions of the ranking. The fact is that only Andalusia lost this prominence position in 1900 when it was replaced by the Basque Country, which will stay there during the next thirty years. Second, the lower ranking positions also showed a notable stability. In particular, Galicia and Extremadura were always in the lower segments of the ranking (the last four positions). Finally, one can also observe the progressive emergence of a core-periphery structure of per-capita GDP in Spain,

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<sup>24</sup> Underlining wages have been drawn from Rosés and Sánchez-Alonso (2004).

<sup>25</sup> Spanish per-capita GDP log-growth rates (Prados de la Escosura, 2003) were during the period: 0.92 percent (1860-1900); 0.59 percent (1900-1910); 1.39 percent (1910-1920); 1.85 percent (1920-1930) and 1.07 percent (1860-1930).

which seems completely formed by 1930.<sup>26</sup> The core was located at the area of the triangle with vertices at Madrid, the Basque Country and Catalonia while the poorest regions were situated at the Portuguese frontier. In other words, per-capita income had a decreasing gradient from North-East to South-West of Spain.

### [HERE TABLE 2]

Table 2 collects information on the evolution of two different measures of per-capita GDP inequality (the Gini coefficient, the variance of logarithms, and their bootstrapped standard errors). Inequality increased largely during this period of economic growth, market integration and industrialization. Thus, over the entire period, the value of Gini coefficient and the variance of logarithms increased by about 30 percent. Also, inequality experienced several trends: rising from 1860 to 1900, declining up to 1910, rising again until 1920 (this year marking the maximum of the period), and declining thereafter.

How large were Spanish historical inequality levels when compared with those prevalent today? Spanish Gini coefficient of per-capita regional GDP in 1860 is practically identical to the average values for all OECD countries in 2005 (OECD 2008). Instead the level of inequality prevalent in the peak year (1920) is similar to that observed nowadays in middle income countries like Mexico (which had a Gini coefficient of 0.26). More prominently, this historical peak doubles actual values for Spain (historical 0.224 versus the actual 0.111). Therefore, regional income inequality was higher during the period considered.

### [HERE FIG. 1]

To finish this section, it would be interesting to consider whether these trends in inequality were accompanied (or not) by (unconditional)  $\beta$ -convergence (Barro and Sala-i-Martin, 1991). To tackle this issue, in the most basic way, we regress log growth rates of per-capita GDP from 1860 to 1930 on the initial level of per-capita GDP in logs, without any control variable (see figure 1 above). The results indicate the existence of  $\beta$ -convergence (the  $\beta$ -coefficient of the

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<sup>26</sup> It is important to note that this core-periphery structure is still present in the Spanish economic geography. According to the last information from the INE (2008), the richest Spanish regions are Madrid and regions located at the French frontier (the Basque Country, Navarre, Catalonia and Aragon) while the poorest regions are those located at the Southern and Western part of the country (Canary Islands, Galicia, Murcia, Andalusia, Castile – La Mancha and Extremadura).

regression is -0.0055, with a standard error of 0.0036, and the adjusted  $R^2$  is only 0.07) but at a speed of 0.7 percent per year.<sup>27</sup> In general, our regressions imply that per-capita GDP convergence looks weaker among Spanish NUTSII regions than among countries and regions in other studies. For example, the  $\beta$ -estimates made by Barro and Sala-i-Martin (2003) for personal income among United States range from a minimum of 1 per cent per year in the period from 1880 to 1900 to a maximum of 4 per cent per year from 1940 to 1950. Also, our estimates are commonly slower than those calculated by these two authors for Japanese prefectures from 1930 to 1990 and for European regions from 1950 to 1990, which range from a minimum of 1 per cent per year in the 1980s to a maximum of 2.3 per cent per year in the 1960s. In other words, the evidence supportive of regional convergence in per-capita GDP among Spanish regions is, at best, weak.

### 5. Regional Specialization and Industrialization.

How the economic structure of Spanish regions responded to this process of progressive market integration? To answer to that question, we assemble Krugman indices of regional specialization (Krugman, 1991) that had been computed using seventeen NUTS II regions and one-digit employment levels (agriculture, industry and services). This index (SI) is defined as follows:

$$(6) SI_{ik} = \sum_{j=1}^n \left| \frac{E_{ji}}{E_i} - \frac{E_{jk}}{E_k} \right|$$

where  $E_{ji}$  is the level of employment in sector  $j = 1, \dots, n$  for region  $i$  and  $E_i$  is the total employment for region  $i$  and similarly for region  $k$ . This index ranges between zero and two, where an index value of zero indicates that region  $i$  has the exact industrial structure as the region  $k$ , and a value of two indicates that region's  $i$  industrial structure has nothing in common with that of region  $k$ . Indexes of regional specialization are calculated for each of the 136 bi-regional comparisons (of seventeenth NUTS II regions) and these indexes are averaged, first, to produce a measure of each region's specialization and, then, an overall measure of Spanish regional specialization.

[HERE TABLE 3]

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<sup>27</sup> This yearly convergence rate is estimated as:  $-(1/T) \ln(\theta T + 1)$ , where  $\theta$  is the regression coefficient computed on the initial level of per-capita GDP (Barro and Sala-i-Martin, 1995).

Table 3 shows that, with the reduction of transport costs and the progressive integration of the home market, regional specialization rose substantially in Spain. The overall index was 0.221 in 1860 and rose steadily to the peak of 0.432 in 1920. Then, it decreased slightly to 0.363 in 1930. Note that the movements in the aggregate index cannot be attributed to changes in a small amount of regions. If one looks in detail at table 3, it can be observed how the aggregate pattern is replicated in practically all regions. More prominently, since 1900, it can be observed that the three richer regions (Madrid, Catalonia and the Basque Country) were also the three with the higher specialization indices. Therefore, in terms of the HO model, one should expect a further enlargement of regional inequality following this increasing specialization.

Finally, it is also interesting to study how industry responded to the integration and specialization of Spanish regions. This can be addressed by estimating location quotients (LQ) for industrial sector. More specifically, we estimate the following equations:

$$(7) LQ_{EMP} = \frac{E_{ji}}{E_i} \bigg/ \frac{E_{jSPA}}{E_{SPA}}$$

$$(8) LQ_{GVA} = \frac{GVA_{ji}}{GVA_i} \bigg/ \frac{GVA_{jSPA}}{GVA_{SPA}}$$

where  $E_{ji}$  is the level of employment in industry ( $j$ ) for region  $i$  and  $E_i$  is the total employment for region  $i$  and similarly for Spain and for the Gross Value Added (GVA) in industry. Location quotients above one indicate concentration of industry in that region whereas location quotients below one indicate the contrary.<sup>28</sup>

**[HERE TABLE 4]**

Table 4 shows that the correlation between per-capita GDP and industrialization is far from perfect. The fact is that only in the case of the Basque Country and Catalonia higher income levels could be explained in terms of industrialization. In a sharp contrast, in Madrid higher income is correlated with lower industrialization levels. Even, if one observes in detail the data available for the different benchmarks, one could find several low and middle income regions with industry location quotients above one.

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<sup>28</sup> It should be noted that the first quotient relies only in relative industrial employment whereas the second one also considers the effect of higher industrial labor productivity.



## 6. The determinants of Regional Inequality

As we noted in the introduction, differences in regional income, from the trade theory perspective, rely on differences in relative factor prices and industrial structure of the regions. We investigate this question by utilizing a straightforward modification of the procedure developed by Hanna (1951), and also employed by Kim (1998), to separate income differences into industry-mix and gross value added (GVA)<sup>29</sup> components. The procedure involves constructing two hypothetical regional per worker GDPs and comparing them with actual per worker GDPs. The first assumes that all regions have identical industry mixes and identical industry per worker GVA, with the industry mix and per worker GVA set equal to the overall national average. The second hypothetical per worker GDP assumes that regions have different industry mixes but identical per worker GVA, which is set equal to the national average. The difference between the two hypothetical incomes, the based on industry-mix income and the overall national GVA, furnishes a measure of the GDP per worker disparities caused by the divergence in regional industrial structures (*industry-mix effect*). The difference between the actual GDP and the hypothetical industry-mix income is a measure of the regional GDP per worker variations due to divergence in per worker GVA (*productivity effect*).<sup>30</sup>

### [HERE TABLE 5]

The evidence presented in Table 5 shows that both variations in industry mix and labor productivity at the broad industry level played a central role in explaining GDP per worker differences.<sup>31</sup> More prominently, in most cases, it is observable a direct correlation between

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<sup>29</sup> Per worker GVA in industry and region  $i$  is:  $GVA_i = (w_i L_i + r_i K_i) / L_i$ . However, given the presence of perfect capital markets,  $r_i K_i / L_i$  should be equal across all locations. Consequently,  $w_i$  drives per worker GVA differences across all regions.

<sup>30</sup> The use of one-digit industrial classification in our calculations may conceal greater importance to productivity in explaining regional differences in income per capita than is deserved. The fact is that regional per worker GVA in manufacturing and services activities may be different due to variations in regional industrial structures at a finer industry level.

<sup>31</sup> We have also computed information collected in table 5 for years 1910 and 1920. However, to save space and to simplify the exposition, we do not discuss here these two benchmarks (these calculations are available upon request from the authors).

industry-mix and wage-effect.<sup>32</sup> This result implies that favorable industry-mix is accompanied by higher wages; while, the contrary, also holds.

Let us now summarize several relevant regional stories: Catalonia, the Basque Country, Galicia, Andalusia and Madrid. We consider the first two cases because they are paradigmatic of successful industrialization experiences. Instead, Galicia did not industrialized and remained agrarian over the entire period. So, its experience could be considered as typical of underdeveloped regions. Finally, we have considered Andalusia and Madrid because they are exceptions to the normal behavior of Spanish regions.

Catalonia enjoyed a top-ranking position in per-capita GDP since 1860. At first sight, this ranking position is due to both favorable industry-mix and productivity-effect. However, in detail, one could observe how higher per worker GVA were only observable in industry and services, while in the Catalan agriculture labor productivity was below the Spanish average. For this reason, we conclude that industrialization is behind the Catalan success.

The history of the Basque Country summarizes perfectly well the consequences of rapid industrialization, and subsequent structural change. In 1860, the Basque Country was not in the top-ranking positions of per capita GDP in Spain and its industry was relatively small. So, the Basque Country had a highly negative productivity effect (more than 20 percent below Spanish average). However, only forty years later (in 1900), when Basque industrialization was underway, this situation had changed dramatically: it outperformed Spain in both industry-mix and productivity effects by more than 20 percent in productivity and 34 percent in industry-mix. This Basque lead was still present in 1930, although its advantage due to industry-mix decreased to less than 20 percent given the spread of industrialization to more Spanish regions.

In a sharp contrast, Galicia was in the low-ranking per-capita GDP positions all over the period. Corresponding with this low income level, its industry-mix and productivity-effect were unfavorable (in other words, Galicia specialized in the less productive industries and its labor productivity was below the Spanish average in all of them).

Andalusia, the most populated region in Spain, lost grounds in the per-capita GDP rankings all over the period. In 1860, it was the second richest Spanish region but in 1930 was in the position 12 (of 17), with only a per-capita income of about 75 percent of Spanish average (see table 1 above). The initial pre-eminence of Andalusia was not due to region's industry mix but to favorable wages. In all three one-digit industries considered, Andalusia's wages were well above the Spanish average. Forty years later, in 1900, this advantage had vanished and its wages were

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<sup>32</sup> Specifically, this correlation appears in the 76 percent of occasions in 1860, the 65 percent in 1900 and the 71 percent in 1930.

slightly below the average; instead, its industry-mix was not particularly different from the nation's average. By 1930, the region had neither a favorable industry-mix (e.g. its agricultural employment was ten points over the Spanish average), nor a higher wage level compared with the rest of Spain.

Madrid's successful experience is closely related to the presence of a large services sector in that region, which could be easily related to a certain nation's capital effect. For example in 1900, the per-worker GDP of Madrid exceeded by about 60 percent the Spanish average and about the 98 percent was attributable to its favorable industry-mix. The fact is that about 45 percent of its workforce was employed in services as compared to the about 15 percent of Spanish average. More prominently, only per worker GVA in services was higher than Spanish average. By 1930, the favorable industry-mix was still important but the productivity-effect rose substantially due to the fact that relative wages were higher in services and industry than in the rest of the country (this could be interpreted as evidence on the emergence of Marshallian externalities in Madrid).

The procedure of Hanna (1951) offers information over the causes of regional per capita GDP differences but not in an aggregated way. For this reason, we will approach to the overall causes of labor productivity differences across Spanish regions with the Theil T index (Theil, 1967).<sup>33</sup> This index allows to measure regional inequality in labor productivity using GDP at industry level and employment figures according to the following equation:

$$(9)T = \sum_{j=1}^3 \sum_{l=1}^n \left( \frac{Y_{jl}}{Y} \right) \log \left( \frac{Y_{jl}/Y}{E_{jl}/E} \right) = \sum_{j=1}^3 \sum_{l=1}^n \left( \log(x_{jl}) - \log(\bar{x}) \right) \frac{Y_{jl}}{Y},$$

$$\bar{x} = \frac{Y}{E}$$

where Y is per capita GDP, E is employment, j indexes industries and i regions. The additive decomposability of Theil index makes possible its decomposition into two components: the *within-sector* inequality component ( $T_W$ ) and the *between-sector* inequality component ( $T_B$ ). Specifically, the equation (9) is decomposed in:

$$(10)T = T_W + T_B = \sum_{j=1}^3 \left( \frac{Y_j}{Y} \right) T_j + \sum_{j=1}^3 \left( \frac{Y_j}{Y} \right) \log \left( \frac{Y_j/Y}{E_j/E} \right),$$

where

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<sup>33</sup> More specifically, we follow the approach of Akita and Kataoka (2003).

$$(10a) T_W = \sum_{j=1}^3 \left( \frac{Y_j}{Y} \right) \sum_{i=1}^n (\log(x_{ji}) - \log(\bar{x}_j)) \frac{Y_{ji}}{Y} \text{ for } j = 1, 2 \text{ and } 3,$$

and

$$(10b) T_B = \sum_{j=1}^3 \left( \frac{Y_j}{Y} \right) \log \left( \frac{Y_j/Y}{E_j/E} \right) = \sum_{j=1}^3 (\log(\bar{x}_j) - \log(\bar{x})) \frac{Y_j}{Y}.$$

$T_W$  presents the weighted average of regional inequalities in labor productivity within each sector, while  $T_B$  presents inequality in labor productivity between sectors (agriculture, industry and services). The results of computing these different Theil T indices are displayed in the following table 6.

**[HERE TABLE 6]**

The overall regional inequality in per worker GDP grew dramatically from 1860 to 1900, leveled between 1900 and 1910, and decreased thereafter.<sup>34</sup> Then, in 1930, the levels of regional inequality only exceeded by about ten percent those prevalent in 1860 (0.077 in 1930 versus 0.070 in 1860). The *between sector* effect accounts the lion's share of regional inequality: 70 percent of variation in 1860; more than 90 percent in 1900 and 1910; and more than 78 percent in 1920 and 1930. These two results together give strong support to the hypothesis that relates the upswing of regional inequality to the diffusion of industrialization (Williamson, 1965).

Finally, it would be also interesting to revise the contribution of the different sectors to the *within sector* component. In 1860, surprisingly, the sector with the major regional differences in labor productivity is the primary sector. What could account for these differences? We believed that these were due to two factors: the large differences in relative land endowments across Spanish regions and the way in which we have measured agricultural employment. Due to the paucity of the data, we have excluded agricultural female labor in our calculations (and it is likely that female participation rates varied largely across regions and that, at least marginally,

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<sup>34</sup> At this point readers could be intrigued for the apparent difference between these results and inequality measures of previous table 2. However, previous inequality measures are population-based whereas this measure is employment-based. Consequently, it could be hypothesized that the evolution of differences across regions in participation rates account for the discrepancy.

compensated male wages)<sup>35</sup> and we do not considered temporary labor migrations across regions, which were very important during harvest periods (Silvestre, 2007). The relative importance of different sectors varied after 1910, when industry became the main contributing sector to the *within component*. This result is in line with previous investigations that underline the presence of increasing returns in Spanish manufacturing during the period (Martínez-Galarraga *et al.* 2008).

## 7. Conclusions

This article provides the first empirical analysis of the upswing of regional income inequality in Spain. We do this by constructing a new database in regional per capita GDP for the seventeen Spanish NUTS II regions (by aggregating NUTS III provinces) and the years 1860, 1900, 1910, 1920 and 1930. Our approach follows Geary and Stark's (2002) basic methodology but introduces several refinements. More specifically, we estimate agricultural regional output not indirectly but directly from production figures, consider capital differences in manufacturing (like in Crafts, 2005), and used several different wages as determinants of productivity in different services industries.

The formation of the Spanish national market progressed significantly from 1860 to 1900 due to improvements in transport and institutional changes. At the same time, industrialization and urban expansion were under way. In consequence, the share of industry and services into Spanish GDP grew, in detriment of agricultural participation. These processes were not accompanied by dramatic changes in the position of different regions in terms of per capita GDP. The fact is that only the Basque Country improved its ranking position while Andalusia lost grounds significantly from top to middle positions. Regional incomes practically did not converge, and even diverged from 1860 to 1910. As Trade Theory predicts, in response to market integration, regional specialization increased up to 1920.

What determine the fortunes of the different Spanish regions? In line with the predictions of Jeffrey Williamson, regional inequality increased largely in Spain during the initial phases of economic growth and industrialization. Furthermore, these inequality growth was mainly caused by divergent patterns of regional specialization; that is, for the very unequal distribution of industry and services. The expansion of industry to a limited number of regions during the second half of the nineteenth century increased regional inequality; while the contrary holds for the first third of the twentieth century. In this sense, the Spanish experience closely resembles to that of the United States (Kim, 1998; Caselli and Coleman 2001).

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<sup>35</sup> Following the typical procedure in Spanish literature. See, for example, Prados de la Escosura and Rosés (2009).

Our results have also important implications for judging the validity of alternative theoretical explanations for regional inequality. Broadly speaking, it seems that the proposal of Epifani (2005), which combines HO and NEG models, explains quite well the Spanish historical experience. More prominently, as our decomposition of per capita GDP in productivity and industry-mix effects shows, regions that specialized in the most productive industries also enjoyed of the higher labor productivity levels. In other words, they had favourable endowments and also benefited from NEG forces. However, it seems that HO forces were the main driver behind unequal regional development given that *between-sector* differences account for the lion's share of regional differences in labor productivity. Increasing returns explanation, mainly related to *within industry* differences in industry and services, was only significant in the years 1920 and 1930. In sum, it seems that once industrialization arrived to a considerable number of regions NEG forces gained momentum in detriment of regional differences in factor endowments.

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**Table 1.** Per capita GDP ranking of Spanish NUTS II regions, 1860-1930

1860	1900	1910	1920	1930
Madrid	Basque C.	Catalonia	Catalonia	Madrid
Andalusia	Catalonia	Basque C.	Basque C.	Catalonia
Catalonia	Madrid	Madrid	Madrid	Basque C.
Valencia	Rioja	Balearic I.	Navarre	Balearic I.
Navarre	Valencia	Valencia	Valencia	Valencia
Balearic I.	Cantabria	Andalusia	Aragon	Cantabria
Murcia	Asturias	Aragon	Cantabria	Navarre
Aragon	Aragon	Cantabria	Asturias	Aragon
Castile L.M.	Andalusia	Rioja	Balearic I	Asturias
Basque C.	Castile L.M.	Navarre	Castile Leon	Murcia
Rioja	Navarre	Castile Leon	Andalusia	Rioja
Castile Leon	Baleares	Castile L.M.	Castile L.M.	Andalusia
Cantabria	Castile Leon	Asturias	Canary I.	Castile Leon
Canary I.	Extremadura	Murcia	Rioja	Canary I.
Extremadura	Murcia	Extremadura	Murcia	Castile L.M.
Asturias	Canary I.	Canary I.	Extremadura	Galicia
Galicia	Galicia	Galicia	Galicia	Extremadura

**Sources:** See section 3.

**Table 2.** Regional per-capita GDP Inequality in Spain, 1860-1930

	1860	1900	1910	1920	1930
Gini Coefficient	0.152 (0.031)	0.210 (0.039)	0.185 (0.033)	0.224 (0.034)	0.196 (0.030)
Variance of logs	0.085 (0.033)	0.134 (0.041)	0.102 (0.035)	0.149 (0.042)	0.114 (0.032)

**Notes:** The standard errors have been bootstrapped with 50 replications.

**Sources:** See table 1.

**Table 3.** Krugman's indices of Regional Specialization, 1860-1930

	1860	1900	1910	1920	1930
Andalusia	0.162	0.190	0.223	0.305	0.299
Aragon	0.167	0.185	0.261	0.330	0.269
Asturias	0.321	0.273	0.354	0.366	0.279
Balearic Islands	0.174	0.188	0.239	0.508	0.299
Basque Country	0.170	0.458	0.469	0.616	0.478
Canary Islands	0.177	0.192	0.246	0.344	0.378
Cantabria	0.152	0.184	0.234	0.346	0.303
Castile - La Mancha	0.165	0.211	0.280	0.424	0.391
Castile - Leon	0.147	0.248	0.290	0.369	0.302
Catalonia	0.270	0.427	0.454	0.588	0.512
Extremadura	0.164	0.243	0.284	0.456	0.332
Galicia	0.307	0.349	0.377	0.551	0.421
Madrid	0.692	0.771	0.661	0.888	0.804
Murcia	0.161	0.207	0.363	0.307	0.258
Navarre	0.197	0.188	0.231	0.338	0.338
Rioja, La	0.156	0.209	0.230	0.311	0.255
Valencian Com.	0.183	0.189	0.224	0.306	0.258
<b>Spain</b>	<b>0.221</b>	<b>0.277</b>	<b>0.319</b>	<b>0.432</b>	<b>0.363</b>

**Sources:** See table 1.

**Table 4.** Location Quotients for Spanish industry, 1860-1930

	1860		1900		1910		1920		1930	
	LQ <sub>EMP</sub>	LQ <sub>GVA</sub>	LQ <sub>EMP</sub>	LQ <sub>GVA</sub>	LQ <sub>EMP</sub>	LQ <sub>GVA</sub>	LQ <sub>EMP</sub>	LQ <sub>GVA</sub>	LQ <sub>EMP</sub>	LQ <sub>GVA</sub>
Andalusia	1.18	1.08	1.10	1.00	1.06	0.96	0.92	0.87	0.77	0.85
Aragon	0.64	0.56	0.86	0.66	0.66	0.94	0.74	0.99	0.85	1.03
Asturias	0.67	0.95	0.61	0.80	0.57	1.62	1.05	1.45	1.18	1.14
Balearic I.	0.78	1.04	1.10	0.91	1.23	0.89	1.67	1.02	1.25	0.68
Basque C.	1.15	0.78	1.95	1.84	1.76	1.32	1.66	1.62	1.39	1.46
Canary I.	0.55	0.52	0.79	0.67	1.15	0.70	0.83	0.41	1.19	0.64
Cantabria	0.72	0.92	1.00	1.18	0.77	1.20	1.05	1.18	0.99	1.23
Castile-L.M.	0.91	0.78	0.82	0.61	0.69	0.64	0.64	0.52	0.69	0.67
Castile-Leon	0.83	0.80	0.53	0.60	0.47	0.59	0.56	0.49	0.72	0.67
Catalonia	1.67	1.60	2.04	1.55	1.90	1.50	1.96	1.47	1.81	1.61
Extremadura	0.86	1.04	0.75	0.77	0.72	0.71	0.54	0.53	0.77	0.68
Galicia	0.49	0.76	0.43	0.58	0.46	0.52	0.34	0.42	0.61	0.56
Madrid	1.69	1.01	1.52	0.70	1.26	0.94	1.58	1.02	1.19	0.85
Murcia	1.15	1.31	0.70	0.94	1.83	1.05	0.86	0.78	0.90	0.73
Navarre	0.75	0.48	0.82	0.94	0.75	0.67	1.08	0.80	0.64	0.72
Rioja, La	0.97	1.05	1.11	0.83	1.08	0.80	0.81	0.95	1.00	1.18
Valencian C.	1.23	0.97	1.11	0.80	1.06	0.88	1.03	0.85	1.05	0.77

**Sources:** See table 1.

**Table 5.** Differences in Regional Incomes Attributable to Industry-Mix and Productivity, 1860, 1900 and 1930

1860	AND	ARA	AST	BAC	BAL	CAN	CAT	CNT	CLL	CLM	EST	GAL	MAD	MUR	NAV	RIO	VAL	Spain	
<b>Labour per industry (percent)</b>																			
<i>Agriculture</i>	60.8	67.0	77.1	59.1	67.9	65.2	52.9	64.6	64.6	60.2	66.7	76.5	29.7	62.3	59.3	60.8	64.0	63.0	
<i>Industry</i>	14.7	8.0	8.4	14.3	9.7	6.8	20.8	8.9	10.3	11.3	10.8	6.1	21.1	14.4	9.3	12.1	15.4	12.5	
<i>Services</i>	24.6	24.9	14.5	26.7	22.4	28.0	26.3	26.4	25.1	28.4	22.5	17.3	49.2	23.4	31.4	27.1	20.7	24.5	
<i>Total</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
<b>Per worker GVA (in Ptas.)</b>																			
<i>Agriculture</i>	774	664	257	357	372	389	480	216	544	744	529	242	358	488	764	430	635	528	
<i>Industry</i>	1768	1254	1032	793	1443	986	1571	1436	1176	1305	1335	922	1273	1801	978	1471	1163	1383	
<i>Services</i>	1813	1334	1126	1451	1191	1113	1579	1575	1093	1152	801	702	1893	1726	1199	1461	1522	1381	
<i>Total</i>	1175	878	448	711	659	632	996	684	747	923	677	364	1306	966	921	836	900	843	
<i>Industry-mix</i>	863	809	723	877	802	824	930	830	830	867	812	728	1128	850	876	862	836	843	
<b>Difference attributable to (percent):</b>																			
<i>Industry-mix</i>	2.3	-4.1	-15.4	4.0	-5.1	-2.3	9.8	-1.6	-1.6	2.8	-3.8	-14.7	29.1	0.8	3.8	2.2	-0.9	0.0	
<i>Productivity-effect</i>	30.9	8.2	-47.8	-21.0	-19.5	-26.6	6.8	-19.3	-10.6	6.3	-18.2	-69.4	14.7	12.8	5.0	-3.2	7.4	0.0	
1900	AND	ARA	AST	BAC	BAL	CAN	CAT	CNT	CLL	CLM	EST	GAL	MAD	MUR	NAV	RIO	VAL	Spain	
<b>Labour per industry (percent)</b>																			
<i>Agriculture</i>	69.9	73.2	82.1	50.6	70.5	71.9	52.6	71.0	80.3	77.2	80.0	86.2	34.2	76.8	71.9	67.7	70.3	71.4	
<i>Industry</i>	14.9	11.6	8.2	26.4	14.9	10.6	27.6	13.6	7.2	11.1	10.2	5.9	20.7	9.5	11.1	15.1	15.1	13.6	
<i>Services</i>	15.1	15.2	9.7	23.0	14.6	17.5	19.8	15.4	12.5	11.7	9.8	7.9	45.1	13.7	17.0	17.2	14.7	15.1	
<i>Total</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
<b>Per worker GVA (in Ptas.)</b>																			
<i>Agriculture</i>	512	722	377	481	443	355	537	327	666	754	533	268	576	431	591	855	906	543	
<i>Industry</i>	2523	2164	2730	4803	1660	1552	4005	3100	2670	2107	2003	1652	2428	2897	3002	2483	2384	2896	
<i>Services</i>	3366	3161	4091	3305	2318	2248	4885	3405	2741	3766	2494	2821	3666	2623	2395	3111	3305	3429	
<i>Total</i>	1244	1259	929	2273	899	813	2356	1179	1069	1256	875	551	2352	965	1165	1489	1481	1296	
<i>Industry-mix</i>	1331	1254	1015	1828	1315	1297	1764	1308	1072	1141	1065	909	2330	1161	1294	1394	1321	1296	
<b>Difference attributable to (percent):</b>																			
<i>Industry-mix</i>	2.7	-3.3	-24.4	34.4	1.5	0.1	30.8	0.9	-18.9	-12.7	-19.6	-35.5	58.7	-11.0	-0.1	7.3	1.9	0.0	
<i>Productivity-effect</i>	-6.7	0.5	-8.8	21.8	-38.1	-46.7	28.9	-10.4	-0.3	9.6	-19.7	-50.1	0.9	-18.5	-10.5	6.6	11.5	0.0	
1930	AND	ARA	AST	BAC	BAL	CAN	CAT	CNT	CLL	CLM	EST	GAL	MAD	MUR	NAV	RIO	VAL	Spain	
<b>Labour per industry (percent)</b>																			
<i>Agriculture</i>	57.0	52.6	41.7	26.0	39.7	32.8	26.2	40.6	57.3	63.6	59.8	65.3	9.0	49.1	60.2	47.0	46.4	47.4	
<i>Industry</i>	20.0	22.1	30.7	36.0	32.4	30.9	46.9	25.7	18.6	18.0	20.0	15.8	30.9	23.4	16.5	25.9	27.3	25.9	
<i>Services</i>	23.0	25.3	27.6	38.0	28.0	36.3	26.9	33.8	24.1	18.4	20.3	18.8	60.0	27.5	23.3	27.1	26.3	26.7	
<i>Total</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
<b>Per worker GVA (in Ptas.)</b>																			
<i>Agriculture</i>	1406	1874	1648	1474	4496	2916	1785	1402	2230	1746	1613	1361	1722	3038	2055	1237	3412	1885	
<i>Industry</i>	4418	5686	4827	8169	2892	2157	6136	7361	3622	3326	2606	2546	6237	3678	5437	4959	4168	4878	
<i>Services</i>	6623	6035	6684	7643	5537	4420	8145	6813	4846	5690	4401	4966	8297	4847	7514	5585	7157	6610	
<i>Total</i>	3206	3769	4014	6231	4268	3228	5537	4759	3120	2757	2377	2228	7066	3686	3887	3377	4603	3922	
<i>Industry-mix</i>	3569	3741	4108	4759	4175	4526	4560	4249	3581	3293	3440	3249	5647	3886	3481	3939	3944	3922	
<b>Difference attributable to (percent):</b>																			
<i>Industry-mix</i>	-9.4	-4.7	4.6	19.4	6.2	14.3	15.1	8.0	-9.1	-17.5	-13.1	-18.8	36.5	-0.9	-11.9	0.4	0.6	0.0	
<i>Productivity-effect</i>	-10.7	0.7	-2.3	26.9	2.2	-33.8	19.4	11.3	-13.8	-17.8	-37.0	-37.7	22.4	-5.3	11.0	-15.4	15.4	0.0	

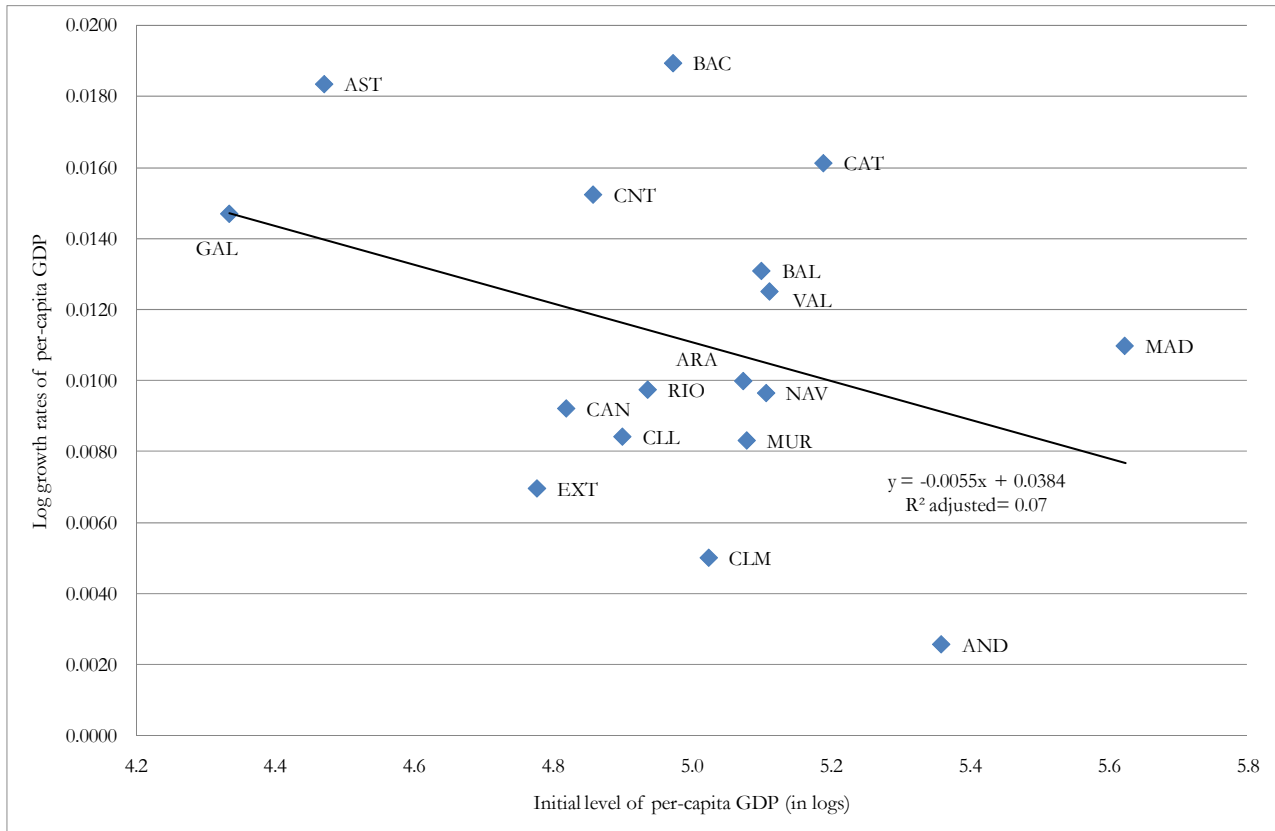
**Notes:** See Figure 1.

**Sources:** See table 1.

**Table 6.** Decomposition of Theil T Index for Labor Productivity, 1860-1930

	1860	1900	1910	1920	1930
<b>Decomposition</b>					
<i>Primary</i>					
<i>Inequality</i>	0.031	0.026	0.012	0.017	0.024
<i>GDP share (%)</i>	39.5	29.9	27.8	31.9	22.8
<i>Secondary</i>					
<i>Inequality</i>	0.010	0.021	0.025	0.022	0.022
<i>GDP share (%)</i>	20.4	30.3	30.7	30.2	32.2
<i>Tertiary</i>					
<i>Inequality</i>	0.016	0.009	0.006	0.016	0.009
<i>GDP share (%)</i>	40.1	39.8	41.4	37.9	45.0
<i>Within-sector inequality</i>	0.021	0.018	0.013	0.018	0.017
<i>Between-sector inequality</i>	0.049	0.161	0.141	0.067	0.060
<i>Overall Inequality</i>	0.070	0.179	0.155	0.085	0.077
<b>Contribution (percent)</b>					
<i>Primary</i>	17.4	4.3	2.2	6.3	7.2
<i>Secondary</i>	2.9	3.5	4.9	7.8	9.3
<i>Tertiary</i>	9.4	2.1	1.6	7.1	5.2
<i>Within-sector component</i>	29.7	9.9	8.6	21.3	21.8
<i>Between-sector component</i>	70.3	90.1	91.4	78.7	78.2

**Sources:** See table 1.



**Figure 1.** The unconditional  $\beta$ -Convergence among Spanish regions, 1860-1930

**Notes:** AND: Andalusia; ARA: Aragon; AST: Asturias; BAC: Basque Country; BAL: Balearic Islands; CAN: Canary Islands; CAT: Catalonia; CNT: Cantabria; CLL: Castile and Leon; CLM: Castile - La Mancha; EST: Extremadura; GAL: Galicia; MAD: Madrid; MUR: Murcia; NAV: Navarre; RIO: La Rioja; and VAL: Valencia.

**Sources:** See table 1.