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Economic History and Institutions Dept.
Universidad Carlos III de Madrid
Calle Madrid 126
28903 Getafe (Spain)
Fax (34) 91 624 9574

REGIONAL WAGE CONVERGENCE IN SPAIN 1850-1930*

Joan R. Rosés+

Blanca Sánchez-Alonso++

Abstract

Real wages PPP adjusted are used to analyse labour market integration in Spain. In contrast to earlier research analysing migration and nominal wages rates, our research seems to indicate that a well-integrated labour market had emerged in Spain by 1914 and substantial wage convergence happened from 1850 to 1914 with low rates of internal migration. The shock of World War I and the subsequent globalisation backlash appear to disrupt this integrated market provoking a spectacular increase in wage differentials across regions and provinces. However, real wage convergence across Spanish provinces resumed powerfully over 1920s, this time accompanied by high internal migrations.

Key words: labour market integration; migration; growth regressions.

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+ **Rosés**, Economic History and Institutions Dept. Universidad Carlos III de Madrid.
E-mail: jroses@clio.uc3m.es

++ **Sánchez Alonso**, Department of Economics. Universidad San pablo-CEU.
E-mail: blanca@ceu.es

1. Introduction

Home market integration has been an important factor in the process of economic development of many European and American countries during the 19th century. The subsequent reallocation of production factors across regions induced the process of structural change, increases in efficiency and higher economic growth. In Spain, regions went from a set of relatively separate regional commodity markets to an integrated national market during the course of the 19th century. At roughly the same time the Bank of Spain, joint-stock banks, organized stock exchanges, merchant bankers, and other financial intermediaries were intensifying their tasks in the transfers of capital across regions, contributing to the emergence of a gradually more integrated national capital market.[1]

However, in contrast to the broad agreement regarding the increasing integration of commodities and financial markets over the 19th century, research on the functioning of Spanish labour markets in this period is to some extent against the notion of increasing market integration. Spanish economic historians have commonly identified large migrations as a symptom of good labour market behaviour. The available literature censures the operation of labour markets leaving behind the implicit, or even explicit, impression that in absence of considerable migrations Spaniards lost opportunities for a more efficient labour market behaviour, a higher integration of labour markets, structural change and, therefore, economic growth (Mikelarena 1993, Simpson 1995, Silvestre 2001). However, it should be noted that analyses of the pattern and extent of migration shed little light on the issue of labour market functioning because markets could be perfectly integrated but exhibit little migration or they could exhibit high rates of migration but be poorly integrated (Boyer and Hatton 1997). In other words, labour market integration and efficient performance may or may not be caused by the migration from low wage to high wage regions. A more effective measure of labour market integration is wage rates since as labour markets tend to integrate wage dispersion and wage gaps between regions should decline. For this reason, in this

[1] See the further discussion on these topics in section 3.

paper we use a new dataset on real wages to improve substantially previous research on labour market integration during the second half of the 19th century and the first third of the 20th century in Spain. To our knowledge, no study has been able to include in its calculations differences in housing costs across provinces and regions and to compute cost-of-living deflators following the correct Purchasing Power Parity (PPP) procedure. In consequence, this study has the advantage of to be the first to employ real wages adjusted with a PPP basket in order to consider the issue of labour market integration in Spain. Neither, it has been explored the possibility of labour market integration with low levels of internal migration in Spain. Moreover, it seems that to establish the timing and extent of the economic integration of home labour markets appears to be important for our understanding of the sources of the Spanish backwardness.

Our research points in the direction that substantial wage convergence took place from mid-19th century to 1914. They also seems to indicate that so early as 1860 the integration of Spanish labour markets was in the range of France, United States, Prussia or Sweden levels. This is an unexpected result for the majority of Spanish economic historians. More prominently, labour market integration at national level by 1914 was at least as great as it was in other European countries, including England, and possibly larger than today. Congruently with these results, our different estimations on the speed of convergence â suggest that low wage provinces converged rapidly with high wage provinces although intraregional wage convergence looks more important than interregional wage convergence. In all this process, home migrations give the impression of being only a minor player.

In a sharp contrast, the shock of World War I and the subsequent globalisation backlash interrupted abruptly this process provoking a spectacular increase in wage differentials across regions and provinces in a short period of time. Nonetheless, the results obtained appear to indicate that wage convergence reappeared powerfully in the 1920s, this time accompanied by large internal migrations and a noteworthy reallocation of labour from agriculture to industry and services.

The remaining article is organized as follows. Section 2 reviews the concept of labour market integration in order to define our theoretical framework. The following section provides an analysis of the mechanisms for labour market integration (trade, migrations and capital movements) in Spain during the period considered. Section 4 revises the main mechanisms of labour market disintegration, namely external shocks as World War I. Section 5 discusses the pattern of integration of regional labour markets in Spain employing growth regressions methodology. Basically, we consider the process of wage convergence using the two classical measures of convergence (ó-convergence and â-convergence). Also, we consider the role of migrations as mechanism of wage convergence in Spain. The last section summarizes and presents a research agenda. We also include a final appendix that describes and presents our new data on real wages.

2. Definition of labour market integration

What is intended to be "labour market integration" requires some discussion since the concept remains somewhat vague in the literature. According to Collins (1999) this is due to two main reasons. First, the concept of market integration is inherently relative since full wage equalization is rarely observable. Second, there are several mechanisms that can provoke the integration of labour markets.

There are, at least, two broad reasons why the complete equalization of wages across different locations is difficult to occur even if the labour market is perfectly arbitraged. On the one hand, moving costs from one to other location necessarily drive some differences in wages across locations. On the other, there is a long list of observable and unobservable characteristics that potentially can have an influence on regional wage differentials. The most important is labour heterogeneity. In our research, this problem arises because our real wage data are an average across all adult male wage earners in each occupation and province. Obviously, workers in the different provinces can differ in age, experience, training and education. Other things equal, wages would be presumably higher in provinces where workers enjoyed higher human capital endowments. A

second source of wage differentials is location specific characteristics, in particular, differences in urbanization rates. Economic historians have pointed out urban disamenities provoking higher mortality like inadequate hygienic conditions and overcrowding causing industrial regions to have higher wages than rural regions (Williamson 1990; Brown 1990; Reher 2001b). On the contrary, there are also several urban amenities associated to city size. In particular, greater cities are likely to have greater diversity of goods and services. Furthermore, in terms of labour market conditions, larger cities have more diverse employment opportunities and labour thin markets, which may allow for better matching of workers' skills and employers' requirements (Henderson 1988)[2]. A third source of wage differentials is work conditions. Occupations across Spanish provinces can also differ in daily, weekly or yearly hours of work and in the risk of unemployment (Simpson 2000). Other things equal, in regions where the risk of unemployment is higher and there are less days of work during the year daily wages would be presumably higher. Finally, the last source of wage variation, particularly affecting to industrial workers, is firm characteristics. Recent literature has noted that wages are higher in larger firms and where the ratio of capital per worker is higher (Rosés 1998 Reis 2002). In consequence, even in perfectly integrated labour markets, some wage differences persisted across different locations. In other words, integration is a question of degree and it is necessary to establish the correct criterion of measurement against which wage gaps can be contrasted.

It is important to note that labour market integration may not only be caused by migrations but also by capital and commodity markets integration. Different authors have erroneously identified geographic mobility with labour market integration (e.g. Mikelarena 1993). In their view, the main response to unevenly distributed shocks in integrated markets is labour movements from the low wage to the high wage area. Adjustment mechanisms different from migrations are, then, ignored. However, in a sharp contrast, recent studies find that immigration flows has a small negative impact on native wages (Borjas 1994). In consequence, it is important to stress that,

[2] Some economists have also emphasized the relevance for wage disparities of better climate because most

according to the Heckscher-Ohlin trade theory (Flam and Flanders 1991), trade in goods might substitute or complement for migrations such that the integrated equilibrium can be replicated without, or with relatively scarce, labour movements. In other words, both migrations and trade may induce factor price convergence and, hence, labour market integration (O'Rourke and Williamson 1999).

To motivate this argument, we can employ the standard Heckscher-Ohlin "2x2" model (Flam and Flanders 1991). This model starts from the principle that there are two regions, two commodities and two factors of production. For example, the two regions would be Southern Castile and Catalonia, the commodities wheat and textiles, and the factors of production land and labour. Then, we assume that wheat production is relatively land intensive and textiles production is relatively labour intensive and that Southern Castile has less population density than Catalonia (that is, Castile is land abundant and labour scarce whereas the contrary holds for Catalonia). When regions begin to trade, Castile exports commodities that are intensive in their abundant factor, land, and imports commodities that are intensive in their scarce factor, labour, whereas Catalonia does exactly the contrary. Hence, Castile exports wheat and imports textiles and Catalonia exports textiles and imports wheat. From this basic framework of the HO model we can easily derive the famous Stolper-Samuelson theorem. If the relative price of wheat decreases in Catalonia, then resources shift out of land-intensive agriculture into labour-intensive textile production, the demand for land decreases and that for labour increases, and land rents decreases and wages increases. Equivalently, if the relative price of wheat increases in Castile, then land rents will increase and wages will decrease. The implication of this argument is that commodity markets integration can induce factor price (wage) convergence without requiring movements of production factors (migrations). More specifically, initially high Castilian wages and Catalan land rents will decrease, while initially low Catalan wages and Castilian land rents will increase. In other words, wages and land rents will converge between these regions without the necessity of factor movements.

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probably increase residents' satisfaction of a locality (Ciccone and Hall 1996).

How to measure, then, labour market integration? Starting from the principle that the amount of labour movements are not an efficient measure of market integration, it seems that wage differentials across regions offer the superior perspective on that process. More specifically, as market integration progresses, wage gaps and wage dispersion across regions should decline although absolute wage equalization is rarely observable. In other words, if labour markets are perfectly integrated the only difference observable between real wages in two locations must be due to the cost of moving from one location to another, and the previous list of observable and unobservable characteristics that potentially can influence on regional wage differentials.

3. Mechanisms of labour market integration: trade, migrations, and capital movements

As noted previously, according to Heckscher-Ohlin framework, wage convergence, and hence, growing labour market integration, may be an outcome of trade, migrations, and/or capital movements. Commonly, Spanish economic historians have identified large migrations as a symptom of higher labour market integration. However, labour market integration may or may not be caused by the migration from low wage to high wage regions. In this section, we will review the available evidence on these different labour market integration forces in Spain.

The evidence suggests that migrations in Spain were of little importance up to the early 20th century showing the typical pattern common to Latin countries in Southern Europe (Hatton and Williamson 1994, Sánchez-Alonso 2000b). Spain was a latecomer in the process of mass migration exhibiting comparatively little migrations, neither internal nor external, during the second half of the 19th century.[3] Thus, in a sharp contrast with most of European countries (but not with Italy and

[3] There are two major interpretations of the causes of this low migration rates. On the one hand, some economic historians have blamed the low dynamism of the Spanish agriculture as the main source of the large share of labour in that sector and the absence of migrations from rural to urban centres (Nadal 1975 and Nadal 1984; Tortella 1987 and Tortella 1994; Pérez Moreda 1987). On the other hand, others have insisted that the main reason to the low levels of internal migration was the lack of pull from cities and industry (Sánchez-Albornoz 1968; Prados de la Escosura 1988). On the reasons of the low international emigration rates in the late 19th century, see Sánchez-Alonso (2000a)

Portugal[4]) the falling transport costs, enhanced information flows, and declining institutional barriers to migration did not lead to a sharp increase in labour mobility up to the early decades of the 20th century.[5] Moreover, throughout this 80 years time span, intensity, destination and characteristics of Spanish migrations varied considerably.

Insert TABLE 1

As shown in table 1, two broad periods can be distinguished in the evolution of Spanish migration. An initial period, from 1877 to 1887, in which home migrations seem to have been larger than international migrations although detailed statistics on foreign migrations are not actually available (Arango 1987). Moreover, given that migrants moved mainly from countryside to towns, urbanisation rates increased appreciably and some cities grew significantly (Luna 1988). In the following period, between 1887 and 1910, urbanisation rates and home migration grew very slowly. Instead, international migration peaked in the first decade of the 20th century surpassing slightly internal migrations for first time (Sánchez-Alonso 2000b). It should be noted, however, that the combination of home and international migrations was quantitatively important reaching more than one million population in 1901-1910. During the third period, the 1910s and the 1920s, the situation changed again when migration to foreign countries decreased significantly, as a consequence of the disruption of the international labour markets (O'Rourke and Williamson 1999, Ch. 10; Williamson

[4] In Italy, international migration peaked in the first decade of the 20th century and home migration did in the 1920s after the backlash of international migration (Treves 1976, Sori 1979). Instead, in Portugal, the great movement from countryside to cities, mainly Lisbon, took place in the last decade of the 19th century and the early decades of the 20th (Baganha and Marques 1996) whereas international migration followed a path very similar to Italy's peaking in the first decade of the 20th century (Hatton and Williamson 1994).

[5] In the majority of western European countries, migrations rose to a peak in the 1880s, falling thereafter. See on Germany Hochstadt (1999), on England and Wales Boyer and Hatton (1997) and Baines (1995) and on France Tugault (1973) and Dupâquier (2000). A breakdown by countries of origin of international migration rates per thousand habitants is available in Hatton and Williamson (1998), table 2.1

1995), and internal labour movements increased to unknown levels. Particularly, in 1920s, permanent home migrations reached about one million people.[6]

Emigration rates varied widely across the Spanish provinces although, during the period 1878-1930, there was certain continuity in the distinction between push and pull provinces. The main areas of attraction (the provinces of Barcelona, Madrid and Biscay) were already defined so early as 1877. From the last decade of the 19th century up World War I, Madrid and Barcelona increased their relative importance as major destination for home migrations receiving in average more than the 70 per cent of total immigrants. These figures peaked in the 1920s when these two provinces concentrated about the 80 percent of home immigrants.[7] Demand labour forces have often been invoked as explanation for this extraordinary concentration of home immigrants. Thus, it is commonly argued that the flood of emigrants went from agrarian and backward regions to urbanising and industrialising provinces driven by the job opportunities in industry and urban services (Mikelarena 1993, Silvestre 2001). This reasoning could serve to explain why the three main provinces of attraction (Barcelona, Madrid and Biscay) and other industrialising and urbanising provinces like Huelva, Cádiz, Seville and Valencia received population during one or several decades over the period. However, we also find positive migratory balances in several southern agrarian provinces (Albacete, Ciudad Real, Córdoba and Jaén) that did not experienced remarkable industrialisation or urbanisation processes. All these provinces shared some characteristics as an unequal distribution of land and the predominance of landless workers. The positive migratory balance in these provinces can be explained by an increase in labour demand for

[6] It should be noted that permanent migrations represented a large portion of total migrations but not all migrations since temporary migrations amounted about 25 per cent of total migratory movements between 1877 and 1930 (Silvestre 2002) In effect, several economic historians have noted that part of labour movements were temporary and short-distance given the seasonality of labour demand both in agriculture and in the cities, particularly for unskilled labour (Camps 1995, Florencio and López Martínez 2000, Simpson 2000, Silvestre 2002).

[7] For an analysis of the main areas of attraction see Mikelarena (1993) and Silvestre (2001).

farm labourers that was, in turn, consequence of the increase in farming area and some labour-intensive technological changes in large states (Simpson 2000).

It is also possible to appreciate some regular patterns in the provinces pushing migrants in spite of their large number. Particularly, the Northern provinces of the country, except the Basques provinces of Biscay and Guipúzcoa, concentrated a large proportion of the total amount of emigrants, both to outside destinations and inside the country. More specifically, the 62 percent of Spanish migrants were pushed from the regions of Aragon, Asturias, Balearic Islands, Northern Castile and Galicia. In contrast, the picture is certainly mixed in the South and the East of the country while some provinces experienced notable migration rates others, even sharing similar characteristics and located nearby, experienced little or no migrations.

The mobility of capital has also profound implications for wage convergence since it enables low wage regions to invest and, then, experience wage grow more rapidly than would otherwise have been the case. As it is well known the late 19th century saw international capital flows larger in scale than anything seen before or since (O'Rourke and Williamson 1999). The best evidence of the scope of this international capital markets integration is that both real and nominal interest rates were generally strongly correlated across European countries between 1870 and 1914 (Craig and Fisher 1997).

Although the Spanish data on home capital markets integration have their flaws,[8] all the sparse evidence points to the integration of capital markets throughout the second half of the 19th century.[9] The available evidence seems to indicate that the cost of doing business across regional boundaries decreased substantially. From the 1840s onwards, successive governments conducted important monetary and financial reforms that benefited the integration of the regional capital

[8] Particularly, to our knowledge, no evidence on mortgage interest rates and capital movements across Spanish regions in this period is already available, although there are data on commercial paper rates for some major cities (Castañeda and Tafunell 1993)

[9] The same tests used to establish commodity and labour markets integration can be used to estimate capital markets integration (O'Rourke and Williamson 1999 Ch. 11). Thus, as capital markets integration progresses, interest rates gaps and dispersion between markets should decrease.

markets. Furthermore, an examination of regional convergence in short-term interest rates of commercial paper suggests that the integration of capital markets seems to have been accomplished by the latter half of the 19th century. More specifically, commercial paper shows rapid convergence in prices across regions after 1850 (Castañeda and Tafunell 1993). This decline in interregional short-term interest rate differentials might be attributed to important advances in telegraph network, and profound changes in banking system. The first telegraph lines were established in 1855 and developed rapidly during the following decades connecting all Spanish cities. Simultaneously, banking system experienced notable improvements. At least from the 18th century, the transference of capital across the main financial centres was based on a system of bills-of-exchange and a network of local-based merchant-bankers. For this reason, short-term interest rates varied from one city to another. In 1842, the government authorized the formation of several private banks arranged as limited liability corporations, which were also granted with the right of issuing banknotes. These banknotes were tendered in the same town where they had been issued but not accepted elsewhere. However, the existence of these banks increased notably the movements of capital across Spain. This system of multiple issuing-banks was abolished in 1874 when the Bank of Spain became the unique issuing bank (Tortella 1994). Eleven years later, by 1885, the Bank of Spain established the first nationwide branch network allowing movements of capital across towns at constant and cheap rates and, hence, integrating national capital market (Castañeda 2001).

There are certain dispute on the exact chronology and the causes of the process of commodity market integration but there is an agreement on that this progresses over the century. The traditional interpretation is that home market became integrated during the second half of the 19th century when the dramatic growth of railways and telegraph networks took place (Sánchez-Albornoz 1975, Gómez Mendoza 1982). Alternatively, a new wave of economic historians has argued that the Spanish regions were already integrated into a national market for basic foodstuffs by the 1850s and that market integration did not progress during the second half of the century (Barquín 1997, Martínez Vara 1999). Therefore, in their view, a large part of price convergence

took place before 1850 as a consequence of the liberal reforms and major improvements in road and sea transport and communication systems that occurred in the previous quarter of century[10].

4. The mechanisms of labour market disintegration

External price shocks affecting already integrated labour markets may cause wages to diverge in the short run but wages should come back to their previous relative levels (steady-states) in the medium-long run.[11] This would lead to the impression that markets performed poorly since wage dispersion increases. To provoke this apparent labour market disintegration, the factor price effects of these shocks should be unevenly distributed across Spanish provinces and wages should not be completely rigid.[12] The reasoning is powerful. Following the basic Heckscher-Ohlin framework, more specifically the Stolper-Samuelson theorem, 'any interference that drives up the local import price must unambiguously benefit the productive factor used intensively in producing the import competing good'. Thus, external price shocks affecting particular industries will benefit owners of factors of production used intensively in these industries. Moreover, given that industries are not uniformly distributed across the country because of differences in comparative advantage, external shocks will affect regions (provinces) more than others provoking wage divergence. This effect will be reversed, if markets worked well, when mechanism of integration were again at work. In other words, after a period of large price shocks breaking the previously established wage equilibrium, wages should tend to converge again. The speed of this return to previous levels can, then, serve us to indicate the efficiency of labour markets.

[10] Even more, Reher (2001a) argues that wheat markets were already integrated in the late eighteenth century.

[11] Put more formally, an external price shock may cause ó–divergence in the short-run although, if markets worked well, we should observe â-convergence up to wages returned to previous levels of integration. In this case, the speed of â-convergence is suggesting the efficiency of the markets in response to external shocks.

During the period under study Spanish labour market was affected by a major external shock: the World War I and the subsequent globalisation backlash. There is a wide consensus among Spanish historians (García Delgado 1986) on the importance and the unevenly distribution across industries of the economic disruption created by the War. Spanish neutrality modified its pattern of international specialisation facilitating a sharp and unexpected increase in exports and a decrease in imports. The balance of payments experienced a notable increase in its traditional surpluses and the inflow of foreign capital reached unknown levels (Sudrià 1990). The export boom benefited certain products (such as textiles, machinery and chemical products) that were traditionally sold in the highly protected home markets because Spanish production of those commodities was not internationally competitive. Similarly, the disruption of the maritime transportation by the war accelerated the process of import substitution in the industrial sector benefiting largely the local producers of machinery. Instead, traditional Spanish exports (such as citrics or minerals) decreased sharply because of the war disruption (Roldán, García Delgado and Muñoz 1973). In consequence, some industries benefited from high prices and extraordinary profits but others were in crisis. More prominently, this shock was not translated into higher GDP growth but higher inflation rates; that is, the Spanish supply showed to be partly inelastic to increasing foreign demand. Thus Spanish GDP growth was even slower than during the precedent and subsequent periods (Prados de la Escosura 2002).

To approximate the effects of these external shocks we may analyse the dispersion of prices. If the external shocks are completely unexpected and affect unevenly different industries, we should observe that price dispersion increases substantially at national levels. In other words, if the relative demand for the commodities produced for each industry varies substantially, in presence of not perfectly elastic supply, one should observe that relative prices evolved differently as price dispersion increases.

[12] In the case of rigidities in wages, according to traditional Keynesian models, the consequence is unemployment and large economic fluctuations in output.

Insert FIGURE 1

Figure 1 presents evidence on the increasing dispersion of prices within major sectors as a consequence of the World War I. To be more precise, the dispersion of agrarian prices increased from 1906 to 1910, probably as a consequence of the new 1906's tariffs (Tena 1999); it decreases up to 1913; and it increases again since 1914 remaining at high levels up to 1929. The dispersion of industrial prices was even more sensible to World War I since their initial level was low.

International migration was also affected by the Great War because the Atlantic flow stagnated and emigration re-directed mainly toward European countries, particularly to France. The new migrants had very different regional origins (namely the Mediterranean region and the Ebro Valley) than those in traditional transatlantic migration (Sánchez-Alonso 1995). At the same time the unfriendly atmosphere for transatlantic emigration during the war not only disrupted the traditional flows to Latin America, but also prompted many migrants to come back to Spain.

5. The evidence on labour market integration

There are several available alternatives to estimate the amount of labour market integration. Boyer and Hatton (1994) analyse the correlation coefficient of short-run wage changes in two different locations. In this framework, the higher the correlation coefficient, the more closely integrated the two labour markets are supposed to be. Instead, in our exploration of the regional integration of Spanish labour markets we will use the growth approach, following Collins (1999), given that our research is concerned with the long-run evolution of labour markets as revealed in long-run movements in wages.[13] Specifically, we will consider the process of labour markets integration across Spanish provinces using the two basic measures of convergence proposed by Barro and Sala-i-Martin (1995). The first is "σ-convergence" that refers to a downward time-trend in the cross-section dispersion of wages, which is equivalent to Williamson (1995) measure of market integration, and the second is "β-convergence" that refers to an inclination for initially low-

wage regions (provinces) to experience faster wage growth than high-wage regions (provinces). In this framework, as market integration progresses, σ-convergence and β-convergence takes place simultaneously.

To measure σ-convergence, we will employ the unweighted coefficient of variation. The coefficient of variation in year *t* is the standard deviation of wages of the sample considered divided by the mean values of the sample. If the coefficient of variation decreases over time, we can identify σ-convergence. Table 2 presents calculations for three different occupations and up to seven benchmarks.

Insert Table 2

Table 2 documents real wage dispersion between 1854 and 1930. At the beginning of the period, the wage dispersion was lower in unskilled urban workers than in the other two occupations. By 1914, the differences in wage dispersion between occupations reduced drastically but they increased again during the 1920s with the coefficients of dispersion of agrarian labourers being the largest by far. One may suggests that there is a close parallel between the evolution of these coefficients of variation and the dispersion of prices (see figure 1). Thus, it seems not a mere coincidence that the largest dispersion of prices and salaries corresponded to agriculture while the dispersion of prices and salaries in industry was substantially lower.

One of the most striking results of table 2 is the high labour market integration observed by the mid-19th century. In fact the coefficients of variation are lower in 1854 and 1860 for agrarian and unskilled urban labourers, respectively, than in 1930. This could suggest that institutional changes (Tedde 1994) and improvements in road transport in the first half of the 19th century (Barquín 1997) provoked the integration of the labour market with apparently low levels of internal migration. It seems that the World War One shock was so intense that Spanish labour market was unable to absorb completely this shock during the 1920s.

[13] The absence of yearly series prevent us from employing error correction models or other type of time-series analysis.

The evidence collected in table 2 also indicate the presence of three different regimes for three occupations. In the case of agrarian labourers, the summary statistic falls from 0.25 to 0.18 from 1854 to 1914; from 1914 to 1920, the coefficient of variation grows to 0.36; and from 1920 to 1930 it drops again to 0.31. Similarly, in the case of industry urban workers, the coefficient of variation falls from 0.21 to 0.13 from 1860 to 1914, it increases in the intermediate period, and decreases again in the 1920s.[14] Movements of the coefficient of variation for unskilled urban workers, which departs from the lowest coefficients of variation, evolved differently but also showing the three regimes: up to 1914 showed no convergence,[15] divergence during the intermediate period (1914-1920), and the coefficients show an incomplete slow return to previous World War I levels during the 1920s.

Comparing trends in prices (figure 1) and wages (table 2), one can observe some notable parallelisms that seem to indicate that wage dispersion is likely to be drive by price dispersion as we suggest in section 4. Thus, the increase of price dispersion affecting agriculture, industry and services during the World War I corresponded with a similar increase in wage dispersion on all three occupations. Similarly, the decrease of price dispersion in industry during the post war period encountered its closed parallelism in a decrease in unskilled and skilled industry workers wage dispersions. Following the same argument, one can observe how the absence of decreasing wage dispersion in agrarian wages during the 1920s corresponds quite well with the higher levels of dispersion of agrarian prices.[16]

It might be helpful to analyse this σ-convergence pattern thus far. National trend towards convergence (divergence) is rarely replicated by all regions with the exception of agrarian wages from 1854 to 1914 and the divergence period 1914-1920, which this trend is practically universal

[14] It should be noted that the evidence on the sharp increases in the coefficient of variation during the World War I and thereafter is robust to alternative benchmarks. In other words, divergence through this period is being confirmed by yearly data.

[15] However, only two regions (Andalusia and Northern Castile) drove this divergence whereas the rest of the country experienced σ-convergence.

affecting 17 of 18 observations. During the initial period 1854-1914 the coefficient of variation of wages falls in 14 of 18 observations and in the period 1920-1930 it decreases in 12 of 18 observations. Moreover, it is difficult to appreciate any occupational or geographical distribution in the outliner observations since they appear to be evenly distributed across regions.

Given that market integration is a question of degree, it seems necessary to compare our coefficients of variation in real wages with similar studies for other countries. At the beginning of the period under study (1860), Spanish coefficients ranged from a maximum of 0.25 in agrarian labourers to a minimum of 0.15 in urban unskilled workers. The urban unskilled workers coefficients were comparatively lower (in the range of English coefficients) while the agrarian and industry workers coefficients were in the range or slightly larger than similar coefficients for Prussia, Sweden, France and the United States (Söderberg 1985). Therefore, it appears that the market for unskilled workers was more integrated than the European norm. By 1914, in European terms, Spanish variation coefficients in real wages were even more normal. They ranged from 0.18 in agrarian labourers to 0.14 in industry urban workers while in early 20th century Europe they ranged from a minimum of 0.15 for farm labour in England in Wales to 0.20 for unskilled labour in Sweden (Boyer and Hatton 1994, table 5.4). Instead in India, coefficients of variation in real wages were higher than in Spain ranging from a minimum of about 0.20 to a maximum of about 0.37 (Collins 1999).

Our results on σ-convergence are mixed: there was substantial convergence in several periods but also some strong disruptions in the process along the period 1914-1920. Also, some occupations and regions did not experience the overall pattern of converge. What does this really mean? One can suggest that the forces of convergence may have been weak in the country and that, taking Spain as a whole, labour markets did not cleared given some opportunities for arbitrage no exploited. However, there are, at least, two alternative explanations less astringent with the notion of increasing labour market integration. First it is conceivable that some random variations in labour

[16] Obviously, these are only preliminary observations that merit a more detailed analysis in the future.

heterogeneity, location specific characteristics, work conditions and firm characteristics took place over the entire period. Therefore, the 'true' standard variation of wages after discounting these changes is minor than the actually computed. In other words, if we measure average wage with error, our σ-convergence estimates would be biased against the hypothesis of convergence, leading us to reject market integration when the opposite is the case. It seems important to emphasize that in absence of any occupational or geographical pattern in the outliner observations during the periods of overall convergence (1860-1914 and 1920-1930) this appears to be a very reasonable explanation for the majority of the evenly distributed episodes of divergence during these periods. Second, and more prominently, it is likely for β-convergence to happen without reducing the overall dispersion of income because the market integration forces, which tend to reduce income dispersion, may be counteracted by supply or demand random shocks, which maintain the initial dispersion (Barro and Sala-i-Martin 1995). In other words, shocks affecting particular occupations and regions were disturbing an overall trend towards market integration.[17] Precisely, this seems a reasonable explanation by the divergence period 1914-1920. As shown in figure 1, during the World War I the dispersion of prices within sectors increased substantially.

Given that our evidence on convergence is not yet compelling, more direct evidence is sought below. We now use data on real wages for the Spanish provinces to estimate the speed of β-convergence. That is, we will estimate the rate at which the lower wage regions grew faster than the higher wage regions. There are also two basic types of β convergence: *unconditional* and *conditional*. Following Barro and Sala-i-Martín (1995), convergence is conditional if the growth rate of wages is negatively related to the initial level of real wages after holding fixed some other variables, like the stating levels of human and physical capital. By contrast, the *unconditional*

[17] According to Barro and Sala-i-Martín (1995), the presence of these province or region specific random shocks entails that the steady-state dispersion of wages is greater than zero. In consequence, whether the dispersion of wages expands, reduces or remains stable over time depends on whether the initial dispersion starts below, above, or on par with the steady state value.

convergence does not require holding constant any variable. The basic form of the equation of *unconditional* convergence is:

$$\frac{1}{T}\ln\left(\frac{W_{i,final}}{W_{i,initial}}\right) = a + \Theta \ln\left(W_{i,initial}\right) + e_i, \qquad (1)$$

Where T is the number of years considered, and W is the real wage on the designated year for the province *i*. This equation can be estimated by ordinary least squares (OLS). Following Barro and Sala-i-Martín (1995), it is easy to derive from this estimation the yearly convergence rate β. This can be computed as: $-(1/T)\ln(\Theta T + 1)$, where Θ is the regression coefficient computed on $\ln(W_{i,\ initial})$. In that regression, a negative coefficient on initial levels is taken to indicate convergence[18]. There are two basic measurement problems to be addressed. The first is if our variable of interest, the $\ln(W_{i,\ initial})$, remains statistically significant and of the theoretically predicted sign when we introduce a conditioning set of variables in the regression (Levine and Renelt 1992), that is, when one estimates a *conditional* convergence regression. In other words, we should allow for heterogeneity across provinces and, hence, we drop from our regression the assumption that all provinces have the same parameters. This implies that provinces differed in their steady-state positions and that wages grow faster the further away they are from their own steady-state value (Barro and Sala-i-Martin 1995). To do so, we introduce in our convergence regressions the initial levels of human and physical capital as the basic test for the presence of different steady states. Algebraically, the new equation of *conditional* convergence is:

$$\frac{1}{T}\ln\left(\frac{W_{i,final}}{W_{i,initial}}\right) = a + \Theta \ln\left(W_{i,initial}\right) + \Phi \ln\left(H_{i,initial}\right) + \Lambda \ln\left(K_{i,initial}\right) + e_i, \qquad (2)$$

[18] However, these tests turn out to be affected by measurement problems (Quah 1993; Levine and Renelt 1992).

Where H is the literacy rate as a proxy for human capital and K is the urbanization rate as a proxy for physical capital on the designated year for the province *i*.[19] We will also estimate this equation by OLS. If our coefficient on $\ln(W_{i,\ initial})$ computed by equation 2 differs significantly from coefficient computed with equation 1 this implies that wages are not converging towards a national steady-state value but, instead, we have different steady states according to provincial human and physical capital endowments. The contrary result would indicate the existence of *unconditional* national convergence independent from the provincial initial human and physical capital endowments.

We can also carry out our test on *conditional* β convergence a step further. Thus, we will consider that wages are converging towards different steady states decided by both human and physical capital endowments and the geography. In other words, following Barro and Sala-i-Martin (1995), we estimate the equation 2 (*conditional* convergence) including regional dummies by Seemingly Unrelated Regression (SUR).[20] This procedure allows for region effects that are correlated over time. When the coefficients computed including regional dummies are similar to the previous *unconditional* and *conditional* convergence regressions coefficients one may suggest that the speed at which averages for the six regions are converging is not substantially different from the speed at which averages for the provinces within each of the regions converge towards the national steady state.

A second source of measurement error is the possibility of uneven distribution in the errors across variables. The yearly convergence rate β is computed employing data from two periods. If the earlier wage data was measured with larger error than the later wage data, our Θ estimates are biased. One classical solution to that problem is to compute the reverse regression but Quah (1993) shows that perturbing the initial condition gives no more information on the convergence properties

[19] We define literacy rates as the rate of literacy population per hundred inhabitants and the urbanization rate as the rate of population in cities of 25000 habitants or more per hundred inhabitants. The sources of literacy and urbanization rates are, respectively, Nuñez (1992) and Luna (1988).

[20] The regions are the same of table 2.

over time. Therefore, we should employ errors-in variables (EIV) technique (Judge et alt. 1980). To obtain a consistent estimate of convergence rate β with this technique, we need to identify the ratio of the variances of the true and observed values of $\ln(W_{i,\ initial})$. Commonly, one can approximate this ratio by comparing the variances of the sample considered and the whole population. Unfortunately, this procedure does not seem appropriate in this case given that the variance for Spain as a whole is likely to contain the same measurement error that the full sample of provinces. In consequence, we experiment in our EIV regressions with alternative reliability levels from a minimum of 50 per cent to a maximum of 99 per cent (that is, the measurement error is between 50 and 1 per cent) but without significant changes in our results.[21]

In unreported results, we also tried addressing measurement error with instrumental variables (IV). The instruments comprised lags of the original values of $\ln(W_{i,\ initial})$. Lag values are reasonable candidates as instruments because the correlation of the residuals in the wage growth regressions is never substantial. However, this technique did not prove helpful given that the coefficient estimates are closer to their OLS counterparts while, consistent with weak instruments, standard errors increased. The reason is that, as shown in the previous analysis of σ-convergence, supply and demand conditions varied substantially from one period to the following.

We present in the following tables 3 to 5, respectively, our β convergence estimations for agrarian labourers, unskilled urban labourers and industry urban labourers. Anticipating these tables' findings, we note that our calculations appear to reaffirm our previous conclusion on the existence of three labour market regimes in Spain from mid 19th century to 1930: two periods of convergence (from mid 19th century to 1914, and in the 1920s) and one period of no convergence or even divergence (1914-1920). In all three tables, and in all kind of models of convergence, the estimated coefficients on $\ln(W_{i,\ initial})$ are negative and significant (as the model of convergence predicts) in the periods from mid 19th century to 1914 and from 1920 to 1930 whereas are not significant in the intermediate period (from 1914 to 1920). The joint estimates for the whole period

[21] We report in the tables our estimation based on a reliability of 85 per cent.

indicated that the long-run tendency towards wage convergence was larger than the divergence shock of the period 1914-1920.[22] Moreover, the implied β convergence rate was faster in the 1920s than in the earlier period.

Insert TABLE 3

Table 3 reports the β convergence regressions for agrarian labourers. The first column contains the estimates of unconditional convergence, the second of conditional convergence, the third column of conditional convergence with region dummies, and the latest column of conditional convergence by errors-in-variables methodology. Panel (a) presents the estimates for the initial period (1854-1914), panel (b) for the intermediate period (1914-1920), panel (c) for the latest period (1920-1930) and, finally, panel (d) presents the estimates for the whole period (1854-1930). Interestingly, the statistically significant results of the first and second column differ but both show important convergence rates. In effect, holding human and physical constant, convergence rates increased by 7 per cent in the 1920s[23] and by about 40 percent in the estimation for the entire period (1854-1930). This may suggest that there were several steady states in Spain according to human and physical capital endowments and, hence, that a higher level of human and physical capital in the province may raise the responsiveness of the wage growth rate to reductions in the initial wage level. However, contrary to theoretical predictions, when one holds human and physical capital constant in the initial period from 1854 to 1914, convergence rates decreased by about 16 percent. The empirical relationship between human and physical capital levels and wage convergence might be reversed for a number of reasons. Among others, we would like to emphasize the possibility of capital movements counterbalancing the increasing wage convergence.

[22] Note that R-squared and F-statistics are larger for the two sub-periods than for the joint period. This can be explained by the fact that labour supply-demand conditions varied more strongly in the long run than in the short run.

[23] However, this difference of the 7 per cent is in-between the standard of error of â coefficients, which is not statistically significant.

From our point-of-view, the most relevant results are in the third column because the unreported regional dummies have substantial explanatory power. Thus, when we introduce regional dummies in β convergence regressions, the estimated coefficients on $\ln(W_{i,\ initial})$, then the implied β rate, decrease largely. In the period 1854-1914 the implied β convergence rate decrease more than half (from 4 per cent per year in the unconditional estimation to 1.8 percent per year in the conditional estimation with dummies). In the period from 1920 to 1930 it decreased by more than two-thirds (from 6.7 per cent per year to 2 per cent per year). This finding may suggest that the speed of wage convergence for provinces within regions is faster to that across regions. In other words, convergence was more intense among provinces within the same region than among provinces located in different regions. The joint estimate for the whole period (1854-1930) with regional dummies also seem to point in the direction that convergence was much more important within regions than across regions.

Finally, as mentioned above, in the column fourth we tested the consequence for our estimation of the presence of errors in our $\ln(W_{i,\ initial})$ values. However, the results of this column 4 also seems favourable to the notion of statistically significant β convergence because it shows that if the initial wage value would be measured without error, the coefficients on $\ln(W_{i,\ initial})$ would be even larger than those actually computed. To put an example, in the case of the period 1860-1914, the implied β-convergence rate corrected by assuming a 15 per cent of error in the initial values is a 46 per cent faster than those computed assuming no errors.

Insert Table 4

Table 4 reports the β convergence regressions for urban unskilled labourers. These results appear to be qualitatively the same than in table 3. In consequence, the estimated convergence rates from column 1 and 2 differ little[24] in all periods (holding human and physical capital constant, increases convergence rates by less than 10 per cent), while results in column 4 reaffirm the robustness of our convergence findings. Moreover, as in agrarian labourers wage convergence

[24] That is, this difference is not statistically significant.

regressions, regional dummies seem to have substantial explanatory power but, in this case, implied β rates even decrease strongly. More specifically, in the earlier period (from 1860 to 1914) convergence rates decrease from about 2 per cent per year to a mere 0.4 per cent per year and in the latest period (1920-30) they more than halved from about 8 per cent per year to 3.4 per cent per year. Our results for the first period (but not those for the latest period) point in the direction of absence of convergence across regions. This finding could be caused by many factors, although it is likely that the existence of different Heckscher-Ohlin cones of specialization across regions prevented inter-regional wage convergence.. It is also interesting to note the combination for this occupation of no σ-convergence (table 2) and some β-convergence (table 4) in the early period. This could be explained by the existence of a stable steady-state in urban unskilled wages so that wages grow faster the further away they are from this national steady-state value.

Insert TABLE 5

Table 5 reports the convergence regressions for industry urban workers. The main findings obtained with this exercise appear essentially to be the same than in tables 3 and 4. So, the estimated convergence rates from column 1 and 2 differ little in all periods (restraining human and physical capital to be constant, modifies convergence rates by less than of 10 per cent) and the convergence rate in column 4 is appreciably faster reiterating the goodness of results from the other columns. Moreover, as in the two previous exercises, regional dummies give the impression to have substantial explanatory power halving the speed of convergence in all periods. Moreover, like in the case of urban unskilled workers, it seems that during the early period wage convergence across regions was of very little importance.

It is also important to appreciate the contrasts in β convergence rates among the different occupations, although all occupations experienced the same trend and hence the same three regimes. The fastest rates of convergence during the earlier period corresponded to agrarian labourers, which more than doubled the rates of convergence of urban workers. Instead, during the 1920s, rates of convergence were more similar across different occupations. These two results

together may indicate that after a preliminary period of wage convergence across occupations (the lower agrarian wages experienced faster growth than higher urban wages) labour market across occupations was much more integrated in the 1920s. In any case, these are only preliminary findings that will merit a more detailed analysis in further papers.

Finally, it seems also interesting to compare the rates of convergence with rates for previous studies. In general, our regressions imply that, when took place, real wage convergence looks more stronger among Spanish provinces than among countries and regions in other studies. Thus, in periods of convergence (if we left aside in our discussion the overall estimations and the estimations with regional dummies), the implied β was in the range of a minimum of 1.7 per cent per year to a maximum of 8 per cent per year. Instead, the β estimates made by Barro and Sala-i-Martin (1995) 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 larger than those calculated by these two authors for Japanese prefectures from 1930 to 1990 and for European regions from 1950 to 1900, 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. More prominently, our convergence rates were larger than those obtained by Williamson (1996) for Atlantic economies real wages during the first Globalisation (1.2 per cent per year for the period from 1870 to 1890 and 0.8 per cent per year from 1890 to 1913) and Collins (1999) for Indian real wages from 1874 to 1905 that ranges from 1.2 to 2.4 per cent per year. It is also important to appreciate another certain similitude between our estimates and those of Barro and Sala-i-Martin (1995) that show divergence during the periods of foreign shocks (like the two World Wars) and striking convergence in the subsequent periods of reconstruction after the shocks. A particularity of the Spanish experience, which is not replicated in the several studies collected in Barro and Sala-i-Martin (1995), is the

importance of regional dummies and the different speeds of convergence between regions and between provinces within the same region[25].

Finally, we attempt to compute the effect of migration on â convergence. To deal with this empirical problem, we will estimate convergence regressions including the contemporaneous net migration rate as explanatory variable since the convergence coefficient estimated in wage growth regressions would include this effect from migration (Barro and Sala-i-Martin 1995). If migration is an important source of wage convergence, as many economic historians implicitly assume, the estimated convergence coefficient â should become smaller when migration is held constant.

The following table 6 compares our convergence coefficient â with and without migrations. We report the estimated the speed of convergence, and its standard error, for the whole period and all three occupations.[26]

Insert TABLE 6

Table 6 suggests that the net migration rates were a minor factor determining the rate of wage convergence across Spanish provinces and regions. Holding the net migration rate and the rest of human and physical capital variables constant, the convergence rates â decreased in unskilled and industry urban workers by about the 15 per cent.[27] However, this effect is eliminated when we include in our estimations regional dummy variables. This really may suggest that migrations are only important in wage convergence across provinces located within the same region. It is also interesting to note that net migrations do not seem to affect the convergence rate â in agrarian labourers. Overall, these results appear to provide fragile support for the hypothesis that labour market integration was due exclusively to the effect of migrations on real wages.

[25] Unfortunately, Collins (1999) and Williamson (1996) did not introduce regional dummies in their estimations.

[26] In unreported regressions, we also estimate the speed of convergence including net migration rates for the three sub periods (1860-1914; 1914-1920; 1920-1930) separately without significantly different results from those presented in the table 6.

[27] This difference is not statistically significant given the size of the standard errors.

6. Conclusions and a research agenda

One of the enduring features of Spanish economic backwardness in the long run is the persistently high share of labour force employed in agriculture. Spanish historians have long debated the reasons why labour did not leave agriculture at a faster rate. Since urbanization and internal migrations grew very slowly from 1850 till 1920s, both the lack of demand from industry and services and, above all, the inability of agriculture to free labour have been blame in the literature for this phenomenon. This arguments follow from Spanish historians' implicit assumption that labour markets did not worked well in Spain and that labour market integration did not take place during the 19th century and the early 20th century. Only in the 1920s, the argument follows, the picture started to change. In this article we examine the regional wage integration in Spain from mid-19th century to 1930. The motivation of the exercise is the importance of the question for the interpretation of the Spanish economic history and the debate over the importance of factor price integration in the process of convergence among regions.

Overall, our results point in the direction that labour markets in Spain appear quite well integrated during the period considered. The convergence that others have documented for international labour markets before the World War I is confirmed for internal labour markets in Spain. In addition, real wage convergence within Spain has been faster than wage convergence at international levels. For the Spanish case we have documented three different phases of wage convergence in the long run separated by the World War I. Also, our analysis lead us also to conclude that external shocks played a major role in the Spanish labour markets history, particularly World War I that had an uneven effect on Spanish regions. However, wage convergence seems to have reappeared powerfully over the 1920s.

An unexpected result of our research is that Spanish labour market appears to be as integrated as other European labour markets by mid 19th century. This integration levels remained comparatively high by 1914. Consequently with these two results â convergence rates in Spain were also comparatively faster than the norm. More prominently, our results also point in the direction

that migration were a minor player in this process of wage convergence. We show that the process of regional labour market integration took place without large migration, being then caused by the integration of commodity and capital markets among Spanish regions.

However, we would like to emphasise that this paper is the first step in a larger research project and that our overall conclusions are only tentative. In effect, our results indicate that the issue of labour market integration is very complex, which suggests the need for further investigation on many related issues not considered in this paper. We have completely ignored the issue of the integration between urban and labour markets when this is central in the understanding of the Spanish economy and, obviously, this merits a in-depth analysis. Finally, we have only started to explore the important question of the impact of World War I on labour markets. This seems to be a major episode that would help us to understand how well Spanish markets worked.

Appendix. The New Database on Real Wages

We have been able to construct benchmark series on real average daily wage rates for agrarian labourers, urban unskilled workers, and urban industrial (skilled) workers from about 1850 to 1930 for the Spanish Provinces (48 observations). We delete from our calculations the Canary Islands because they were relatively isolated from the rest of the Spanish provinces.

The dataset only includes male workers. Our benchmarks give a good look to the period when the first great wave of labour movements took place. Specifically, the benchmarks are 1854, 1887, 1910, 1914, 1920, 1925 and 1930 for agrarian labourers; 1860, 1914, 1920, 1925 and 1930 for urban unskilled; and 1860, 1896, 1914, 1920, 1925 and 1930 for industry urban workers.The database is built along the next lines. First, we elaborate nominal wage series from sources. Specifically, sources are: Madrazo (1984) for 1860 data on unskilled urban and industry urban workers wages; Bringas Gutiérrez (2000) for 1854, 1874 and 1910 data on agrarian workers wages; Sanchez-Alonso (1995) for data on 1896 industry urban workers wages; and Ministerio de Trabajo (1931) for the remaining wage data. These refer to average daily wage rates within broadly defined

occupations. We had no other option but to use daily wages and, thus, we cannot control for the duration of the work and some heterogeneity in labour quality and working conditions. However, it has the advantage that we do not restrict our research to a small segment of labour force but, instead, we cover the most widely diffused occupations and a large part of Spanish male wage earners. Sources underlying the nominal wage data for each of the benchmarks had been widely used in other previous studies and, hence, are well known by Spanish economic historians. See, for example, Bringas Gutiérrez (2000) Simpson (1995), and Silvestre (2002).

Second, we elaborate new cost-of-living deflators for each province. Our cost of living figures refer to the whole province, then including urban and rural areas, and are comprehensive, containing detail on food, dwelling rents, fuel, light and clothing. It should be noted that a major advantage over previous series is that, for first time, dwelling rents are considered into provincial cost-of-living indices. To estimate the provincial prices of food, fuel, light and clothing, we rely heavily in the data collected by the Government officials in the different provinces, which had also been widely used by Spanish economic historians. among others, Ballesteros (1997), Reher and Ballesteros (1993), and Sánchez-Albornoz (1975). Instead, we develop our own calculations on dwelling rents. We obtain the data on housing prices from the property provincial bureaus: Ministerio de Gracia y Justicia (several years). We acknowledge Juan Carmona for these data. This dataset includes the prices and quantities of houses sold during the year, the prices and quantities of houses transferred by heritage, and the prices and quantities of houses that were settled in mortgage. Specifically, in the calculations, an average of these three prices during two or three years, according to data availability, has been employed. Average prices per house were transformed in prices by m^2 with data on average size of houses by province from 1874 statistics. Anuario Estadístico (1874). Finally, average prices per m^2 were used to estimate rent levels using interest and depreciation rates. This estimation is derived from the following identity $Rent_H = (Price_H) * (i + \delta)$ where i is the interest rate and δ the depreciation rate. It was assumed a depreciation rate of the 2 percent per year and interest rates were obtained from Tortella (1974) and Martin Aceña (1989).

Third, we convert these provincial nominal wages into national comparable units of measurement deflating by purchasing-power-parity (PPP) price indices for a common market basket. Such common basket are constructed based on information reported in Instituto de Reformas Sociales documents published shortly prior to the World War I (1905-1910), United States Consular Reports and, also, when it was available in other sparse information from different sources (Ballesteros 1997; Dominguez Martín 1997; Fernández de Pinedo 1992; García Sánz 1979-80; Martinez Carrión 1997; Martinez Vara 1997; Pérez Castroviejo 1990 y Pérez Castroviejo 1992; Ponsot 1986 y Serrano 1999). Basically, we follow the Cobb-Douglas PPP indices methodology suggested by Williamson (1995). Specifically, our basket is an unweighted average of all provincial baskets. Also, we tested alternative methods of weighting provincial baskets without obtaining significantly different results. The resulting PPP basket is presented in the following table A.1:

TABLE A.1

Purchasing Power Parity Budget, 1910

Items	**Shares**	
Food	72.1 %	
	Bread	18.6 %
	Oil	4.1 %
	Chick	5.1 %
	Peas	
	Wine	10.4 %
	Beef	13.5 %
	Rice	5.1 %
	Potatoes	5.1 %
	Eggs	1.0 %
	Sugar	0.5 %
	Cod	5.1 %
	Milk	3.6 %
Housing rent	10.2 %	
Clothing	9.6 %	
Others	8.1 %	

Sources and notes: see text.

The following tables A.2 , A.3 and A.4 present the new data base of provincial real wages for different occupations and benchmarks. For the whole period, the provincial real wage observations are standardised by setting the Barcelona wage equal to 100 in 1914.

Table A.2 *Agrarian Wages (Barcelona 1914=100)*

	1854	1874	1910	1914	1920	1925	1930
Alava	77.56	90.60	99.69	99.13	94.64	92.21	96.28
Albacete	79.41	95.95	95.14	92.47	101.20	102.04	98.95
Alicante	78.50	90.00	92.00	90.96	98.24	103.52	102.76
Almeria	80.44	92.60	92.95	91.14	92.34	104.27	104.29
Avila	79.73	86.28	96.20	92.57	80.59	88.24	100.44
Badajoz	77.89	89.31	93.11	91.21	94.34	100.05	104.04
Baleares	82.38	79.72	96.05	94.89	99.43	98.30	102.46
Barcelona	89.44	99.14	100.03	100.00	109.90	109.77	110.58
Burgos	76.35	88.43	98.32	94.81	91.71	96.73	99.63
Cáceres	72.49	85.25	88.07	86.44	90.17	103.61	92.42
Cádiz	84.30	87.51	92.40	90.67	95.03	100.34	104.32
Castellón	77.81	88.22	91.06	89.54	108.18	117.62	113.14
Ciudad Real	88.33	83.21	89.10	87.46	82.48	85.25	100.47
Córdoba	77.87	89.29	93.25	91.30	104.61	88.17	103.63
Coruña (La)	72.97	84.33	95.26	93.59	99.25	105.25	105.67
Cuenca	81.69	81.42	91.93	89.56	94.16	96.63	97.32
Gerona	77.80	93.84	101.53	100.05	104.14	112.11	108.59
Granada	85.35	83.62	89.46	84.24	99.05	98.72	100.06
Guadalajara	79.47	83.89	89.95	87.53	93.66	105.21	94.86
Guipuzcoa	73.85	88.55	90.17	89.63	90.41	95.78	93.64
Huelva	81.70	89.15	95.04	93.04	104.11	93.93	101.88
Huesca	80.04	93.97	99.62	98.40	101.13	102.56	101.59
Jaén	75.86	86.97	91.01	89.55	109.45	94.09	102.94
León	67.04	89.10	95.20	91.41	101.29	95.20	96.64
Lérida	81.35	91.53	99.73	98.13	107.55	106.18	117.77
Logroño	74.30	91.08	93.02	90.06	104.22	99.19	100.32
Lugo	62.95	80.28	95.67	95.38	101.99	101.19	103.57
Madrid	68.64	79.34	85.29	85.66	98.76	97.34	89.38
Málaga	81.63	87.62	91.78	89.86	103.15	98.50	101.16
Murcia	74.63	89.03	91.05	90.10	100.36	101.88	100.96
Navarra	81.55	90.62	98.01	95.64	110.14	108.00	106.25
Orense	73.49	91.86	98.38	96.30	98.33	107.24	105.48
Oviedo	77.66	87.47	99.92	98.47	106.09	113.18	109.32
Palencia	79.61	88.99	92.54	88.75	91.42	98.94	100.05
Pontevedra	66.44	78.78	92.31	92.65	93.38	97.69	96.91
Salamanca	66.19	88.57	94.38	91.64	98.70	79.86	83.85
Santander	72.88	89.21	94.12	93.38	100.33	103.50	101.59
Segovia	77.58	88.13	93.31	89.50	94.16	92.19	76.78
Sevilla	78.73	89.47	95.42	93.75	102.69	104.42	109.94
Soria	72.96	88.40	92.54	88.69	95.11	97.30	101.95
Tarragona	82.28	88.70	94.95	93.55	105.51	111.85	111.03
Teruel	82.13	88.34	94.21	93.20	99.20	100.40	99.48
Toledo	76.97	86.94	91.67	89.36	97.02	92.60	96.20
Valencia	77.48	96.99	85.76	92.65	96.98	104.27	100.23
Valladolid	71.81	85.31	92.29	89.38	94.77	93.36	94.87
Vizcaya	78.94	89.53	94.51	95.44	96.85	107.70	102.46
Zamora	79.39	84.91	94.11	90.43	85.27	88.45	89.34
Zaragoza	86.39	96.97	96.73	95.71	120.50	104.68	106.83

Table A.3 *Unskilled Urban Wages (Barcelona 1914=100)*

	1861	1914	1920	1925	1930
Alava	73.52	74.73	74.12	91.04	85.92
Albacete	52.03	68.73	73.98	83.81	79.05
Alicante	51.73	91.18	110.07	114.74	96.82
Almeria	51.99	68.98	87.48	108.45	74.70
Avila	52.13	69.04	65.17	113.18	77.78
Badajoz	57.09	57.65	64.68	69.28	88.15
Baleares	50.68	90.76	101.02	106.18	88.86
Barcelona	68.09	100.00	116.54	130.59	126.58
Burgos	53.96	71.89	75.21	92.55	90.22
Cáceres	42.82	69.44	64.91	88.50	85.71
Cádiz	59.76	95.62	92.82	110.92	105.43
Castellón	52.50	93.08	85.85	108.53	90.81
Ciudad Real	55.24	72.78	66.41	81.79	76.59
Córdoba	50.88	78.17	78.81	95.44	97.44
Coruña (La)	44.64	95.56	102.00	135.22	117.48
Cuenca	53.18	61.46	59.44	65.00	68.75
Gerona	55.98	92.94	90.68	100.65	124.38
Granada	53.05	78.19	77.62	94.28	90.99
Guadalajara	53.23	72.15	78.50	91.49	70.16
Guipuzcoa	56.73	69.71	69.17	81.89	75.34
Huelva	53.22	93.13	70.49	99.16	101.06
Huesca	61.72	75.28	77.21	98.27	103.45
Jaén	51.20	66.77	58.59	110.50	82.22
León	46.19	71.68	94.56	103.92	106.30
Lérida	60.09	95.13	93.17	111.96	105.75
Logroño	51.28	66.43	81.76	80.19	87.54
Lugo	37.97	71.85	65.28	101.74	95.35
Madrid	31.08	80.37	81.15	113.49	100.69
Málaga	56.52	86.04	77.30	122.71	114.86
Murcia	56.28	78.32	77.41	96.66	81.29
Navarra		74.70	71.30	95.94	95.64
Orense	40.35	99.96	90.98	121.08	114.13
Oviedo	49.53	84.09	113.26	156.03	156.86
Palencia	54.44	87.21	67.38	75.56	93.54
Pontevedra	38.89	63.76	61.87	101.39	91.07
Salamanca	51.25	87.34	87.62	95.10	88.74
Santander	60.54	82.29	92.62	121.28	114.12
Segovia	60.62	53.29	57.96	67.49	78.54
Sevilla	58.09	88.90	84.94	107.03	107.12
Soria	43.76	59.80	57.66	83.30	83.52
Tarragona	57.05	101.15	125.28	124.17	108.58
Teruel	52.49	74.85	104.63	91.40	86.57
Toledo	50.51	68.84	69.41	85.37	79.64
Valencia	56.02	87.55	118.47	125.68	101.31
Valladolid	49.78	55.66	52.39	73.05	89.05
Vizcaya	69.13	70.32	81.69	122.69	113.89
Zamora	52.39	77.87	63.78	82.26	69.83
Zaragoza	56.29	77.72	108.08	105.11	86.64

Table A.4 *Industry Urban Wages (Barcelona 1914=100)*

	1861	1896-97	1914	1920	1925	1930
Alava	74.96	68.33	72.81	69.17	90.06	80.58
Albacete	78.64	55.93	71.48	76.72	93.12	102.10
Alicante	62.13	46.48	94.98	103.40	107.53	106.44
Almeria	75.10	61.88	80.48	68.73	83.78	94.74
Avila	83.99	40.21	79.17	72.75	88.53	83.60
Badajoz	61.48	56.75	67.26	61.00	83.14	95.50
Baleares	67.02	46.19	85.88	94.28	102.75	99.89
Barcelona	76.94	77.97	100.00	111.43	120.54	120.13
Burgos	73.98	48.80	74.55	65.87	78.79	88.69
Cáceres	61.37	46.24	62.96	55.64	74.59	78.85
Cádiz	96.72	71.11	97.50	91.79	112.04	114.80
Castellón	72.92	59.40	78.07	84.71	103.86	100.90
Ciudad Real	70.76	38.46	67.93	62.39	71.08	77.07
Córdoba	59.07	61.13	81.07	77.76	107.58	111.53
Coruña (La)	58.94	52.40	96.52	104.98	138.39	117.48
Cuenca	87.19	60.84	58.79	65.33	81.38	74.35
Gerona	63.56	79.31	101.93	91.25	100.12	111.35
Granada	100.21	61.35	88.81	73.92	105.92	108.94
Guadalajara	85.86	70.60	67.00	68.03	82.63	93.55
Guipuzcoa	52.55	50.09	59.58	61.72	73.49	74.66
Huelva	95.97	77.39	75.26	67.88	96.36	109.48
Huesca	82.29	67.42	84.31	78.79	91.10	96.35
Jaén	80.54	62.19	80.12	62.09	88.61	85.64
León	55.07	61.97	84.55	98.06	107.88	108.94
Lérida	67.53	61.65	89.19	84.70	112.54	108.10
Logroño	77.19	62.44	70.53	74.24	71.87	88.02
Lugo	44.74	47.60	83.82	65.28	97.83	100.24
Madrid	49.57	44.20	76.55	80.42	99.80	84.79
Málaga	92.76	61.87	95.60	76.78	110.61	114.25
Murcia	86.23	55.53	69.62	85.26	94.97	94.55
Navarra		68.38	81.15	74.15	83.15	104.17
Orense	46.03	47.23	93.71	84.66	130.82	122.80
Oviedo	70.96	62.86	92.79	122.41	153.49	142.60
Palencia	84.11	63.86	74.49	75.87	90.87	93.54
Pontevedra	41.49	106.74	73.92	75.46	104.88	106.82
Salamanca	57.79	73.70	84.70	77.57	92.31	82.83
Santander	53.13	76.41	79.80	99.20	130.69	116.66
Segovia	92.37	82.79	65.72	64.40	74.34	85.87
Sevilla	85.75	65.87	87.04	64.86	114.84	124.09
Soria	64.18	50.06	76.11	54.21	83.79	91.77
Tarragona	70.55	72.45	96.33	101.34	115.22	124.09
Teruel	74.44	48.04	77.84	76.00	73.12	79.99
Toledo	56.13	77.20	67.07	71.02	86.42	90.26
Valencia	69.53	56.20	87.55	111.70	120.51	121.11
Valladolid	69.70	60.76	74.21	64.04	83.07	92.12
Vizcaya	61.45	56.53	72.74	88.90	121.21	118.80
Zamora	71.03	75.13	68.60	69.85	86.33	97.34
Zaragoza	81.41	77.42	90.67	93.77	99.83	99.43

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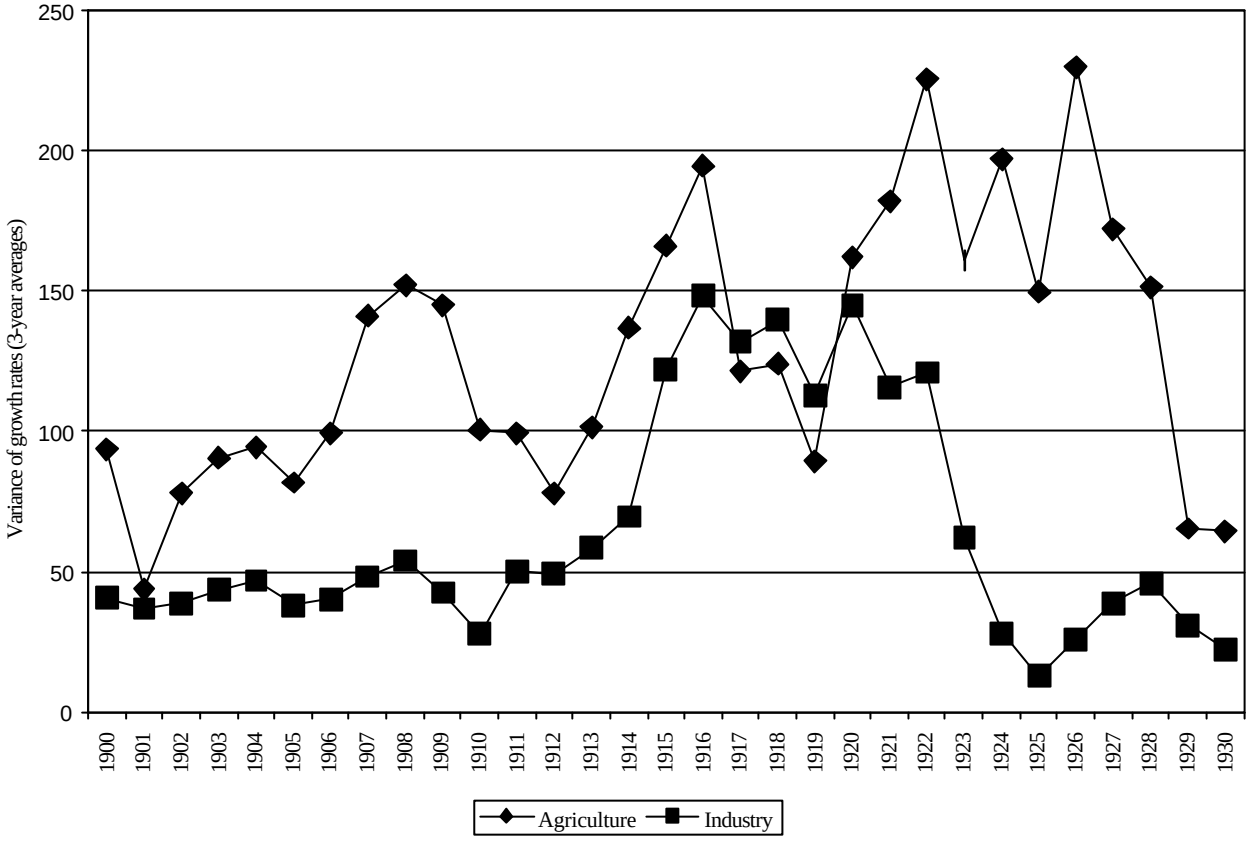
FIGURE 1
The dispersion of prices, 1900-1930



Notes and sources: The dispersion of prices is measured as the variance of price log growth rate (3-year centred averages) of the corresponding group of series (agriculture and industry). The agriculture series are the value added deflators (Implicit GDP deflators) of grains, vegetables, potatoes, oil, wine, raw wool, raw silk, meat, eggs, fertilizers, forestry products and fishing. The industry series are the value added deflators (Implicit GDP deflators) of the following sectors: Food, Beverages, and Tobacco; Textile; Clothing and Shoemaking; Timber, Cork and Furniture; Stone, Clay, Glass and Cement; Metal, basic; Metal, transformation and machinery; Transportation material; other manufacturing; Extractive industries; Utilities; Construction and Public Works. The source of all series is Prados de la Escosura (2002).

TABLE 1

Total Net Migrations in Spain, 1877-1930 (000)

	Home Migration	Share of total population %	Foreign Migration	Share of total population %	Totals	Share of total population %
1877-1887	369,4	2.2	n.a.	n.a.	n.a.	n.a.
1888-1900	428,3	2.0	177,6	0.8	605,9	2.8
1901-1910	565,8	2.9	578,1	3.0	1,143,9	5.9
1911-1920	583,1	2.8	50,1	0.2	633,2	3.0
1921-1930	968,6	4.3	89,9	0.4	1,058,5	4.7

Sources and notes: Home and foreign migration data are drawn, respectively, from Silvestre (2002) and Sánchez-Alonso (1995), appendix. Home migration was computed using census data on residents from other provinces and surviving data. Net migration was calculated employing statistics on departures and returns of migrants and surviving data. Net foreign migration data are less reliable than home migration data because of serious underestimation in the return flow. The percent of total population was calculated using mean population. Numbers are subject to rounding errors.

TABLE 2

σ-Convergence in Real Wages across Spanish Regions

A. Agrarian labourers							
	1854	**1874**	**1910**	**1914**	**1920**	**1925**	**1930**
Spain (48)	0.247	0.209	0.168	0.177	0.365	0.348	0.316
Andalucia (8)	0.147	0.118	0.091	0.124	0.245	0.244	0.149
Ebro Valley (7)	0.173	0.135	0.123	0.142	0.435	0.224	0.378
Mediterranean (8)	0.234	0.268	0.238	0.199	0.224	0.301	0.237
North (8)	0.228	0.202	0.144	0.121	0.223	0.263	0.220
Northern Castile (9)	0.228	0.072	0.095	0.096	0.272	0.245	0.332
Southern Castile (8)	0.277	0.263	0.141	0.110	0.240	0.269	0.212
B.Unskilled urban labourers							
	1860			**1914**	**1920**	**1925**	**1930**
Spain (48)	0.146			0.159	0.220	0.188	0.181
Andalucia (8)	0.062			0.131	0.135	0.089	0.139
Ebro Valley (7)	0.137			0.114	0.171	0.107	0.092
Mediterranean (8)	0.097			0.078	0.167	0.110	0.161
North (8)	0.230			0.164	0.217	0.193	0.220
Northern Castile (9)	0.094			0.178	0.205	0.172	0.122
Southern Castile (8)	0.173			0.101	0.107	0.174	0.128
C. Industry urban workers							
	1860		**1896**	**1914**	**1920**	**1925**	**1930**
Spain (48)	0.213		0.211	0.138	0.200	0.190	0.155
Andalucia (8)	0.161		0.091	0.092	0.129	0.112	0.113
Ebro Valley (7)	0.071		0.139	0.095	0.104	0.163	0.119
Mediterranean (8)	0.109		0.215	0.126	0.110	0.089	0.101
North (8)	0.183		0.326	0.155	0.235	0.215	0.175
Northern Castile (9)	0.173		0.224	0.084	0.172	0.110	0.088
Southern Castile (8)	0.259		0.235	0.078	0.122	0.111	0.114

Notes and sources: We used as measure of σ-convergence the unweighted coefficient of variation. The number of provinces within each region is in parenthesis. We divided Spain in six macro-regions by similarity of characteristics (the so-called homogeneity principle). This kind of division is adequate for analysis based on the Heckscher-Ohlin framework. Kim (1995). Each macro-region comprises a minimum of 7 provinces and a maximum of 9 provinces. Andalucia includes observations for the following provinces: Almeria, Cádiz, Córdoba, Granada, Huelva, Jaén, Malaga and Sevilla. Ebro Valley includes Alava, Huesca, Lérida, Logroño, Navarra, Teruel, and Zaragoza. Mediterranean region comprises the provinces of Alicante, Baleares, Barcelona, Castellón, Gerona, Murcia, Tarragona, and Valencia. North includes Coruña, Guipuzcoa, Lugo, Orense, Oviedo, Pontevedra, Santander and Vizcaya. Northern Castilia comprises the provinces of Avila, Burgos, León, Palencia, Salamanca, Segovia, Soria, Zamora and Valladolid. Finally, Southern Castilia includes Albacete, Badajoz, Cáceres, Ciudad Real, Cuenca, Guadalajara, Madrid and Toledo. See appendix for sources.

TABLE 3

β-Convergence Regressions: Agrarian labourers

Period	Information description	(1) Unconditional OLS	(2) Conditional OLS	(3) Conditional SUR	(4) Conditional EIV
(a) 1854-1914	$Ln(W_{initial})$	-0.0152	-0.0145	-0.0110	-0.0179
	Stand. Error	(0.0016)	(0.0017)	(0.0016)	(0.0017)
	R-squared	0.65	0.65	0.67	0.78
	F-stat.	87.54	30.22	21.49	44.91
	Implied-b	*0.0405*	*0.0340*	*0.0180*	*n.d.*
(b) 1914-1920	$Ln(W_{initial})$	-0.0309	-0.0107	0.0137	-0.0127
	Stand. Error	(0.0442)	(0.0435)	(0.0227)	(0.0517)
	R-squared	-0.01	0.13	0.13	0.13
	F-stat.	0.49	2.27	0.99	2.29
	Implied-b	*0.0342*	*0.0111*	*-0.0132*	*0.0132*
(c) 1920-1930	$Ln(W_{initial})$	-0.0489	-0.0511	-0.0189	-0.0609
	Stand. Error	(0.0123)	(0.0127)	(0.0080)	(0.0146)
	R-squared	0.24	0.25	0.29	0.34
	F-stat.	15.71	6.09	2.06	6.56
	Implied-b	*0.0671*	*0.0715*	*0.0209*	*0.0939*
(d) 1854-1930	$Ln(W_{initial})$	-0.0070	-0.0086	-0.0031	-0.0103
	Stand. Error	(0.0024)	(0.0024)	(0.0018)	(0.0028)
	R-squared	0.14	0.23	0.28	0.32
	F-stat.	8.56	5.67	1.47	6.03
	Implied-b	*0.0100*	*0.0139*	*0.0035*	*0.0201*

Notes and sources: All estimations include 48 observations. OLS: Ordinary Least Squares. SUR: seemingly Unrelated Regressions. EIV: errors in variables regression. Unconditional estimation is computed with the equation 1. Conditional (OLS) estimation is computed with the equation 2 and, then, includes human and physical capital variables. Conditional (SUR) estimation includes previous conditional variables plus regional dummies (regions description in notes to table 2). Conditional (EIV) estimation includes only human and physical capital variables but not regional dummies. We assume a reliability of the $Ln(W_{initial})$ values of the 85 per cent. Standard errors are shown in brackets. Implied-β is the convergence rate computed with the coefficient on $Ln(W_{initial})$ as described in the text. The estimated coefficients for constants, regional dummies and conditional variables are not reported. See text and appendix for sources and the description of the variables.

TABLE 4

β-Convergence Regressions: Urban unskilled labourers

Period	Information description	(1) Unconditional OLS	(2) Conditional OLS	(3) Conditional SUR	(4) Conditional EIV
(a) 1860-1914	$Ln(W_{initial})$	-0.0122	-0.0128	-0.0043	-0.0152
	Stand. Error	(0.0032)	(0.0032)	(0.0022)	(0.0037)
	R-squared	0.22	0.27	0.31	0.36
	F-stat.	14.23	6.75	1.97	7.24
	Implied-b	*0.0179*	*0.0196*	*0.0044*	*0.0287*
(b) 1914-1920	$Ln(W_{initial})$	-0.0098	-0.0046	0.0046	-0.0055
	Stand. Error	(0.0219)	(0.0229)	(0.0120)	(0.0272)
	R-squared	-0.02	-0.05	0.02	0.02
	F-stat.	0.02	0.24	0.59	0.24
	Implied-b	*0.0101*	*0.0047*	*-0.0045*	*0.0056*
(c) 1920-1930	$Ln(W_{initial})$	-0.0530	-0.0547	-0.0290	-0.0651
	Stand. Error	(0.0095)	(0.0098)	(0.0078)	(0.0109)
	R-squared	0.39	0.39	0.43	0.51
	F-stat.	30.95	11.18	5.12	12.95
	Implied-b	*0.0755*	*0.0792*	*0.0342*	*0.1053*
(d) 1860-1930	$Ln(W_{initial})$	-0.0093	-0.0096	-0.0025	-0.0113
	Stand. Error	(0.0028)	(0.0030)	(0.0020)	(0.0034)
	R-squared	0.17	0.14	0.20	0.23
	F-stat.	10.87	3.59	0.56	3.76
	Implied-b	*0.0150*	*0.0159*	*0.0027*	*0.0224*

Notes and sources: See table 3.

TABLE 5

β-Convergence Regressions: Industry urban workers

Period	Information Description	(1) Unconditional OLS	(2) Conditional OLS	(3) Conditional SUR	(4) Conditional EIV
(a)1860-1914	$Ln(W_{initial})$	-0.0121	-0.0125	-0.0072	-0.0148
	Stand. Error	(0.0020)	(0.0021)	(0.0018)	(0.0023)
	R-squared	0.40	0.41	0.45	0.53
	F-stat.	33.61	12.15	5.66	14.24
	Implied-b	*0.0177*	*0.0187*	*0.0082*	*0.0268*
(b) 1914-1920	$Ln(W_{initial})$	-0.0079	-0.0062	0.0019	-0.0073
	Stand. Error	(0.0246)	(0.0246)	(0.0190)	(0.0291)
	R-squared	0.00	0.07	0.07	0.07
	F-stat.	0.10	1.20	0.12	0.31
	Implied-b	*0.0081*	*0.0063*	*-0.0019*	*0.0075*
(c) 1920-1930	$Ln(W_{initial})$	-0.0445	-0.0436	-0.0233	-0.0520
	Stand. Error	(0.0085)	(0.0088)	(0.0073)	(0.0100)
	R-squared	0.35	0.35	0.39	0.45
	F-stat.	27.32	9.47	4.03	10.58
	Implied-b	*0.0589*	*0.0573*	*0.0265*	*0.0734*
(d) 1860-1930	$Ln(W_{initial})$	-0.0084	-0.0086	-0.0049	-0.0102
	Stand. Error	(0.0018)	(0.0018)	(0.0016)	(0.0021)
	R-squared	0.29	0.29	0.33	0.39
	F-stat.	20.86	7.50	3.24	8.23
	Implied-b	*0.0127*	*0.0132*	*0.0060*	*0.0179*

Notes and sources: See table 3.

TABLE 6

Migration and â Convergence rates

	(1) Unconditional OLS		(2) Conditional OLS		(3) Conditional SUR	
Occupation	Migration excluded	Migration Included	Migration excluded	Migration Included	Migration excluded	Migration Included
Agrarian labourers	0.0100	0.0104	0.0139	0.0139	0.0035	0.0035
	(0.0034)	(0.0035)	(0.0039)	(0.0039)	(0.0021)	(0.0021)
Unskilled urban labourers	0.0150	0.0148	0.0159	0.0134	0.0027	0.0034
	(0.0045)	(0.0042)	(0.0050)	(0.0043)	(0.0022)	(0.0022)
Industry urban workers	0.0127	0.0124	0.0132	0.0117	0.0060	0.0062
	(0.0027)	(0.0027)	(0.0028)	(0.0026)	(0.0020)	(0.0020)

Notes and sources: Net migration rates are from Mikelarena (1993). We reported implied-β convergence rate, which is computed with the coefficient on $Ln(W_{initial})$ as described in the text. Regressions period are 1854-1930 for agrarian labourers and 1860-1930 for urban workers. The "migration excluded" â convergence rates are the same than in tables 3, 4 and 5. The "migration included" regressions incorporate as explanatory variable the average yearly migration rate for the period 1878-1930. Standard errors are shown in brackets. The estimated coefficients for constants, regional dummies, net migration rates and conditional variables are not reported. The adjusted R-squared and F-tests (not reported) are practically identical to those obtained in tables 3 to 5. See the appendix for sources and the description of the variables. See table 3 for methods.