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ORIGINAL PAPER

Trade policy and wage gradients: evidence from a protectionist turn

Daniel A. Tirado · Jordi Pons · Elisenda Paluzie · Julio Martínez-Galarraga

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Abstract In the spirit of Hanson (Econ J 107:113–133, 1997), we analyse, first, the existence of a relationship between the wage level and the market potential of Spanish regions; second, we explore the relative importance of domestic and foreign markets in this relationship; and finally, we examine the existence of a regional nominal wage gradient in Spain during the interwar period (1914–1930) centred on the main industrial cluster, Barcelona, and its transformation following the increase in protectionism in the Spanish economy as well as in the international economy. As suggested by NEG literature, our results support the hypothesis of a relationship between wages and regional market access and show the change in the regional wage structure following the gradual closing of the Spanish economy and of Spain's trade partners, as a result of the increasing importance of the domestic market. We find evidence of the existence of a regional wage gradient centred on Barcelona which weakened during these years. Therefore, in Spain, during the interwar period, protectionist policies appear to have favoured the loss of centrality of a border region (Barcelona) and the relative rise of other locations.

Keywords Trade policy · Protectionism · Industrial agglomerations · Wage gradients

D. A. Tirado · J. Martínez-Galarraga
Departament d'Anàlisi Econòmica, Universitat de València, València, Spain

J. Pons
Departament d'Econometria, Estadística i Economia Espanyola and CAEPS, Universitat de Barcelona, Barcelona, Spain

E. Paluzie (✉)
Departament de Teoria Econòmica and CAEPS, Universitat de Barcelona, Av Diagonal 690, 08034 Barcelona, Catalonia, Spain
e-mail: epaluzie@ub.edu

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1 Introduction

At the end of the nineteenth century, there was a change in the Spanish economic policy model. Spain reacted to the agrarian crisis and to the increasing international competition faced by many of its productive sectors, with the protection of the internal market and an increasing public intervention in favour of industrial production. The new economic model was implemented gradually during the first third of the twentieth century and represented the abandonment of a liberal regime and the adoption of a nationalistic model of development.

The increase in protectionism was common in an important group of countries in the late nineteenth century and the first decades of the twentieth century (O'Rourke and Williamson 1999). Nonetheless, as has often been highlighted, the exceptional nature of the Spanish case lies in the depth of the protectionist turn as well as its persistence over time (Palafox 1992). The impact of this change in the economic setting has been analysed from different perspectives: from the evolution of external trade (Serrano Sanz 1997), from the sectoral specialization of the economy (Tirado 1996) or from the long-term economic growth of the Spanish economy (Prados de la Escosura 2003). Our paper can be included among this group of analyses of the variation in the economic model in Spain and its impact on the spatial distribution of economic activity, and in particular on the location of industry across Spanish regions.[1]

With this goal in mind, this study relies on the theoretical models and the empirical analyses conducted within the New Economic Geography (NEG) literature. The NEG has tried to explain which locations attract most firms and what mechanisms make these locations attractive.[2] One of these mechanisms is an externality demand, the market access effect, which predicts the concentration of economic activity in the regions with higher market potential. In this setting, trade liberalization, by changing the relative market potential of the regions, may have an impact on the location of economic activities within countries.

In the New Economic Geography models, such as Krugman's (1991) seminal paper, an important prediction can be derived from the equilibrium condition of profit equalization between regions: that of the existence of regional wage inequalities. In Krugman's model, firms can afford to pay higher wages if they have good access to the larger market. The nominal wage in a region tends to be higher if incomes in other regions with low transport costs from this region are high. Hence, the wage equation in the model exhibits a kind of demand linkage or backward linkage: in the regions with higher proportions of industry, wages are higher; this in turn attracts more workers, and so income and expenditure increase further in these

[1] A'Hearn and Venables (2011) raise a similar point on analysing the geographical distribution of industrial production in Italy.

[2] See Fujita et al. (1999) for a formalization of the different possible agglomeration forces that give rise to industrial centres, and Head and Mayer (2004) and Redding (2011) for a survey of the empirics of economic geography.

regions. In equilibrium, differences in nominal wages persist between the different regions. Higher nominal wages act as a counterbalance to the better market access of central regions. They reflect the existence of agglomeration externalities.

As shown by Hanson (1997), in this context, a trade liberalization process may change the attractiveness of different locations inside a country as the importance of foreign markets to domestic producers rises, thus relating trade policy and the internal geography of countries. Border regions may be favoured while central regions hampered.[3] Nevertheless, as has also been shown by Crozet and Koenig-Soubeyran (2004), Brülhart et al. (2004) and Lafourcade and Paluzie (2011), trade liberalization has two counteracting effects: increased market access (which is favourable to export production) and increased import competition (which is negative for domestic firms that compete with foreign producers). Depending on which of these two effects dominates, border regions will be favoured or hampered by trade liberalization.

Throughout the paper, through the analysis of the Spanish case, we try to verify three basic hypotheses in the context of the intensification of the protectionist policies during the interwar years in Spain. First, we analyse whether, as suggested in NEG models, the size of the regional markets was a key element to explain the location of industry across Spanish regions. In other words, if, as NEG theoretical models predict, wages were higher in those industrial locations where market potential was higher. Second, based on the assumption that the changes in the economic policy could have led to a weakening of the importance of the external market potential in the location decisions of firms, we aim to analyse the evolution of the explanatory power of the regional market potential compared to both the foreign and the internal market potential as a determinant of regional wages and the concentration/specialization of the Spanish industry across regions.

Finally, during the early stages of the industrialization process in Spain, which occurred in parallel with the integration of the domestic market and an increasing integration in the international markets, a notable concentration of industry in a peripheral region like Catalonia was registered. The paper tests whether the change in the economic model represented by the protectionist turn and its intensification in the interwar years led to a loss of centrality of a border region (Catalonia) and to the relative rise of other locations endowed with a better geo-economic position within the Spanish domestic market.

The paper, thus, represents an important contribution to economic history, as it aims to analyse the impact of a change in the political economy model on regional economy, from an alternative perspective. Thus, we analyse whether the intensification of protectionism after the First World War played a significant role in explaining the changes in the geographical distribution of economic activity. Likewise, the paper contributes to the NEG empirical literature, as it develops an empirical test of the existence of a relationship between industrial wages and market potential across regions, through a historical case study. Moreover, this relationship

[3] His well-known study analysed the Mexican case, where the protectionist policies implemented during the years of the ISI strategy favoured the agglomeration of industrial activity around the capital city. Then, the transition to an open economy in the 1980s witnessed a relocation of industrial activities to the north of the country close to US border. See also Krugman and Livas Elizondo (1996).

is analysed in the context of a variation of the economic policy model, a matter where the predictions of the NEG theoretical models are ambiguous and no consensus is reached.

Our results point to: first, the existence of a relationship between regional wage levels and regional market potential. Second, over time, we observe an increasing importance of access to domestic markets in explaining regional wage levels. Third, we confirm the existence of a regional wage gradient centred on Barcelona, the main industrial centre of the country. And, finally, we find evidence of the weakening of the gradient after the intensification of protectionism during the interwar years.

The article is organized as follows. Section 2 presents the theoretical predictions for regional wages emanating from Krugman (1991) and Hanson (2005). Section 3 describes the evidence on the patterns of trade policy, industry location and regional wages in Spain. Section 4 presents our empirical analysis and discusses the results obtained. In the last section, we summarize the main conclusions and suggest some directions for further research.

2 Theoretical predictions

2.1 Industry agglomeration and regional wage gradients

In the New Economic Geography, industrial agglomeration is presented as the result of demand and cost linkages between firms, created by the interaction between transport costs and fixed costs of production. One of these linkages, known as backward or demand linkage, forecasts that firms will be prepared to pay higher salaries in those regions that are closest to the main markets of consumption and production, since these regions enjoy lower transport costs. Hence, this demand linkage predicts the existence of regional wage gradients, with nominal wages decreasing with transport costs from industrial centres, and their possible reversal following changes in trade regimes.

The Krugman wage equation offers the industrial wage that allows firms to cover the costs, given the income and index prices in the regions considered and the transport costs for goods between those regions.

$$w_r^M = \left[\sum_{s=1}^{R} Y_s \left(T_{rs}^M \right)^{1-\sigma} G_s^{\sigma-1} \right]^{1/\sigma} \tag{1}$$

According to this equation, the wage in each region depends positively on the income in the firm's markets, Y_s, negatively on the transport cost levels to those markets, T_{rs}^M, and positively on the Price index in those markets, G_s. σ refers to the elasticity of substitution between varieties. If we assume that there are no differences in the price indexes across regions, then Eq. (1) establishes that the nominal wage in region r would be higher if income in other nearby regions (thus facing low transport costs from r) is high. Hence, it is capturing a kind of backward linkage or externality demand which is comparable to the 'home market effect' in the international trade literature.

In Krugman (1991), the industrial agglomeration is the result of the existence of supply and demand linkages between firms, where such linkages are created by the interaction between transport costs and the existence of fixed costs in production. Under such circumstances, firms accept to pay higher wages when they are located in regions near the main markets of consumption and production, as they incur lower transport costs from these regions. Therefore, the existence of a spatial structure in which nominal wages of a region increase with market potential constitutes evidence in favour of the presence of agglomeration elements associated with market size.

In addition, the Krugman wage equation is very close to the Harris (1954) market potential equation, an ad hoc measure developed by geographers. In fact, the functional form of the Krugman wage equation resembles the Harris market potential equation, the latter being a reduced form of the regional wage equation that can be directly derived from an NEG model.[4] The Harris market potential equation can be defined as:

$$MP_r \equiv \sum_s \frac{M_s}{D_{rs}} \tag{2}$$

where M_s is a measure of the size of location s (usually GDP) and D_{rs} is the distance or bilateral transport costs between r and s. Moreover, this indicator can be computed differentiating two main components: internal and external market potential (see, for instance, Keeble et al. 1982; Crafts 2005). First, the internal market potential includes the locations or 'nodes' selected in the domestic market. Second, foreign markets have to be added to the internal market potential. This way of calculating the market potential, which is not structurally derived from an NEG model but is very close to the Krugman wage equation, allows for an empirical analysis of the importance of these two components in determining the wage structure of a country.[5]

In this setting, changes affecting the domestic and foreign markets may therefore have an impact on the location of economic activities and the dynamics of agglomeration. In particular, a shift in trade policy may generate effects on the spatial distribution of economic activities by changing the market accessibility of locations. To guide our analysis, suppose that in a period of trade liberalization, industry tends to concentrate in a border region, where wages are higher and decreasing with increasing transport costs. However, the implementation of protectionist policies might change the attractiveness of locations as the closing of the economy to trade may negatively affect the border region (with the subsequent weakening of the wage gradient around the industrial centre) and in turn, favour internal locations better placed to satisfy the reserved domestic market for inputs, semimanufactures and manufactures. These predictions of the potential

[4] Departing from the theoretically derived Krugman wage equation, it is possible to obtain the ad hoc market potential indicator developed by Harris (see Combes et al. 2008). To do this, three assumptions have to be made: (a) there is no variation in the price indices from one region to another; (b) the share of each good within total consumption does not vary between regions; and (c) the coefficient associated with distance in gravity equations has to be close to one.

[5] It also yields very acceptable results in the NEG empirical exercises (Head and Mayer 2004).

effect of a variation in trade policy on regional relative wages can be summarized in the following reduced-form equation:

$$\frac{w_i}{w_c} = F(x_i) \tag{3}$$

where w_i is the nominal wage in location i, w_c is the nominal wage in the industry centre (Barcelona), and x_i is unit transport costs from location i to the industry centre. The function F is conditional on location c being the industry centre. It holds that

$$w_c \geq w_i, \quad i \neq c; \quad \text{and} \quad \frac{\partial \frac{w_i}{w_c}}{\partial x_i} < 0 \tag{4}$$

Hence, the hypothesis is that there is a regional wage gradient centred on the border region and that regional relative wages reflect transport costs to the industrial centre. In this context, suppose there is a protectionist turn in trade policy. Trade protection reduces the attraction of the domestic industry centre located at the border, Barcelona. To improve their access to the domestic market, firms may relocate to other central locations. Nominal wages in the border region relative to nominal wages in other regions may be reduced and thus the transition to a closed economy causes a compression of regional wage differentials.

To test the existence of a regional wage gradient centred on the border region and its transformation following a change in trade regime, we specify the following reduced-form log-linear regression equation à la Hanson (1997):

$$\ln\left(\frac{w_{it}}{w_{ct}}\right) = \beta_0 + \beta_1 \cdot \ln(x_{it}) + \mu_{it} \tag{5}$$

where i indexes geographic location, t indexes time, c indexes the open-economy industry centre, and μ_{it} is an error term. Conditional on location c being the industry centre, the predictions are that (1) the regression coefficient β_1 is negative, and (2) in the transition to a closed economy, there is a structural break in this relationship, which reduces the absolute value of this parameter so that $|\beta_{1t} - 1| > |\beta_{1t}|$.

2.2 Other sources of regional wage gradients

Other sources of regional wage differentials such as the exogenous characteristics of regions, localized human capital spillovers or government policy have been analysed extensively.[6] Among the exogenous location-specific characteristics, two stand out: regional differentials in resource endowments and exogenous amenities. Firms may be driven to locate near natural resource concentrations. Regions endowed with minerals such as iron ore will attract industries that make intensive use of this resource. This in turn will attract firms in footloose industries in order to serve the market created by the agglomeration of the first type of industries. In these locations, firms will be able to pay higher wages to their workers. In contrast, exogenous amenities may lead to the opposite results for wages. For instance,

[6] See Hanson (2001) for a good survey of sources of regional wage differentials.

workers may accept lower wages in regions endowed with good climate, beaches, and so on (see Roback 1982). In principle, the effects of the exogenous characteristics of regions can be incorporated into Eq. (5) by including fixed location effects in the estimation.

As for localized human capital spillovers, the prediction is that regions with larger stocks of public knowledge will pay higher wages (see Rauch 1993; Black and Henderson 1999, for empirical tests on this issue).

Finally, government policy may also have an effect on regional wage patterns. If government activities concentrate in a particular region, they contribute to the creation of a consumption mass that will bid up regional wages.

3 Trade policy, industrial location and wages in Spain: the evidence

During the second half of the nineteenth century and the first third of the twentieth century, Spain's economic development, like that of most European countries, was dominated by the increase in the share of industry in production. The particularly hard road to industrialization was accompanied by an increasing domestic integration in markets of goods and factors that favoured the productive specialization of Spanish regions.

Though domestic market integration goes back to the eighteenth century, it was not until the construction of the railway network during the second half of the nineteenth century that the effect of the reduction in internal transport costs led to real progress in market integration. The process was reinforced by the integration of the capital market with the unification of the monetary system (1869) and the expansion of the branches of the Central Bank, the *Banco de España*, after the Restoration of the Monarchy in 1874.[7]

In addition, from 1869 onwards, this context of internal market integration was accompanied by a progressive economic openness towards neighbouring countries (Tena 1999). As Fig. 1 shows, the reduction in tariff protection levels reached its maximum at the end of the 1880s, when Spain signed several trade treaties with its main trading partners. Actually, it was in the early and mid-1880s when Spain signed the most important treaties, with France in 1882, and the modus vivendi with the UK in 1885. The other main treaties with reductions in duties were signed with Sweden-Norway, Switzerland and Germany in 1883 and with Italy in 1884 (Serrano Sanz 1987). Furthermore, during the last decades of the nineteenth century, as O'Rourke and Williamson (1999) highlighted, a considerable reduction in international transport costs due to technological innovations in maritime and land transport led to an increasing integration of national economies in the international markets, favouring international trade in goods and factors.

All this generated an upsurge in international trade. The openness ratio for the Spanish economy in Fig. 2 shows an increasing trend during the second half of the

[7] For the labour market integration, Silvestre (2005). A more detailed description of the process of integration in goods and factors can be found in Rosés et al. (2010).

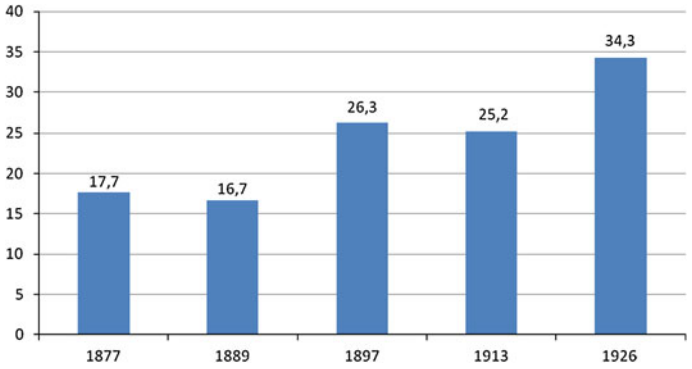

Fig. 1 Nominal protection rates (%). Spain, 1877–1926. *Source*: Tena (1999)

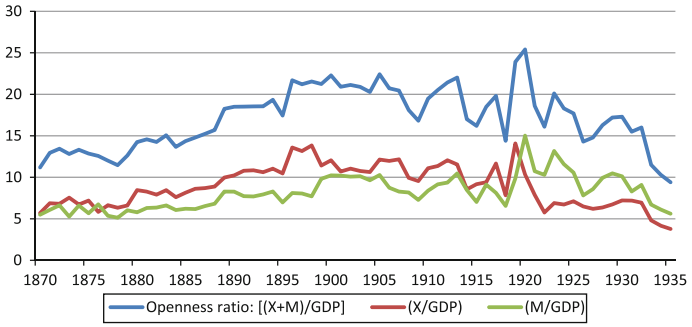

Fig. 2 Openness ratios (%). Spain, 1870–1935. *Source*: 1870–1913, data for exports and imports from Prados de la Escosura (2010); 1914–1935, Tena (2005); GDP figures from Prados de la Escosura (2003)

nineteenth century which only began to be reversed in the last decade of that century.[8]

Indeed, the last decade of the century witnessed an important change in terms of the Spanish economy's integration in the external markets. On the one hand, in 1883, the gold convertibility of the peseta was abandoned, thus debilitating Spain's position in the international capital markets. On the other, from 1892 on, the return to protectionism posed a serious threat to external integration. The return to protectionist policies was generalized across countries in the last decades of the nineteenth century as a reaction to the challenges raised by the First Globalization wave. Both the arrival of raw materials and primary goods like cereals at low prices from the Western Offshoots affected European agriculture and the agrarian sectors claimed for protection (O'Rourke and Williamson 1999). Further, at that time, many countries were adopting protectionist measures as part of the strategy to develop

[8] Prados de la Escosura (2010) recently offered new series of trade for the Spanish economy. The information on imports and exports has been used here to calculate the openness ratio which appears in Fig. 2. With these data, the evolution at the turn of the century is smoothed and the tendency of an increasing openness is reversed with some lag when compared to the original series provided by Tena (2005).

their manufacturing sectors as a way to compete with British goods in the international markets (Allen 2011).

In Spain, the results of this new turn in the tariff regime after 1892 were soon noted. From 1897 or 1900 onwards, depending on the series taken, the openness ratio of the Spanish economy began to fall (Fig. 2). In fact, these were the first signs of what has been called the nationalistic road in Spanish capitalism: a policy that encouraged domestic production through protectionism and increasing public intervention to favour industrial production.

The most important expressions of this new model of development are to be found in the Salvador Tariff of 1906 and in the changes produced in the interwar years. At that time, the response to the crisis of overproduction caused by Spain's neutrality in the First World War was first a further increase in tariffs in order to protect Spanish industry and second the implementation of infrastructure projects through investment which not only reinforced internal market integration but also increased demand for some domestic industrial sectors (Palafox 1992).[9] The return to normality after the end of the conflict led to an economic crisis and a revision of the trade policy. In the context of domestic inflation and a depreciation of foreign currencies, the steps taken aimed to increase protectionism (Serrano Sanz 1986). In Spain, specific tariffs prevailed and therefore they had to be adapted to the evolution of prices to maintain the protection in percentage or *ad valorem* terms. In order to prevent the increase in imports and to restore the pre-war levels of protection which had been eroded by inflation, the Spanish authorities passed the provisional Argüelles Tariff in 1921.[10] Only 1 year later, the Cambó Tariff was approved, consolidating the protectionist policy. Nonetheless, the new tariff was also an instrument for the negotiation of bilateral international trade agreements which, during the 1920s, also became a goal of trade policy. The aim was to obtain advantages for the exportation of traditional Spanish agricultural goods like wine, fruits and olive oil that may help to provide the resources to finance the purchase of imports and to restore the external position of Spain.[11] Figure 2 shows that the trade openness ratio mimics the decreasing imports trend. This trend fits in perfectly with the idea that, as a response to the exceptional flows of imports that followed the end of the First World War, the Argüelles and Cambó bills brought import openness back to pre-war levels.

The policy change made Spain one of the most protectionist countries in the world. According to the League of Nations' (1927) report, Spain's tariff levels were the highest in the world, followed at a short distance by those of the United States.

[9] As has been noted by a referee, mention should also be made to the effect on protection of the surcharges Spain imposed on some foreign currencies.

[10] An additional update of the Salvador Tariff of 1906 to correct the effect of prices was carried out in 1911. In this case, the update left 543 duties unchanged, increased only 24 and reduced up to 130. Sabaté (1992).

[11] The Cambó Tariff was divided into two columns. The first one, aimed at the countries with no trade agreements, was highly protectionist. The second column presented lower values of protection, becoming an incentive for other countries to sign trade agreements that may favour Spanish agricultural exports. The application of the so-called *Ley de Actualizaciones* of 1922 included more flexibility for the second column of the tariff for those countries with bilateral trade agreements.

In addition, the Liepmann report (1938) ranks Spain second in protection in 1913 (after Poland) and third in 1927 and 1931 (after Poland and Bulgaria).

Table 1 reports Spanish protection levels in the period 1913–1931 from an international comparative perspective. Two striking features emerge from these data. First, Spain's tariff levels were higher than those of other Western European countries; second, only Germany showed a higher rate of growth in protection levels. In addition to these extremely high tariffs, the importation of some intermediate goods and raw materials was prohibited. For instance, public consumption of foreign coal was impeded during the period 1907–1930, and private import consumption of coal was prohibited at several times after 1922. Not surprisingly, exports and imports fell drastically during this period and openness ratios diminished considerably as a result (from 25.4 % in 1920 to 15.5 % in 1931).

What happened to the patterns in the location of economic activity after this shift in trade policy? Agglomeration effects may be observed via regional differences in industrial concentration or via differences in nominal wages. Thus, we will first take a look at the regional distribution of industry and then at the regional patterns of wages.

First, the distribution of regional production in Spain underwent a profound transformation. In a descriptive analysis of the evolution of the geographical concentration of industries in Spain in the last 150 years, Paluzie et al. (2004) show that the largest increases in the levels of concentration are to be found during the long period between the middle of the nineteenth century and the Civil War (1936–1939). In this time, the geographical concentration of Spanish industry, as measured by the Gini index, increased substantially both at the aggregate level and in almost all the industrial sectors in which industrial production can be broken down (Table 2).

With regard to the geographical localization of this increasingly concentrated manufacturing production, the phrase used by economic historians that Catalonia became Spain's factory is highly appropriate. In Catalonia, during the second half of the nineteenth century, the rise in industrial production led to a considerable increase in the share of Catalan output in overall Spanish industrial production. Tirado and Martinez-Galarraga (2008) recently provided estimates of the regional industrial output in Spain in the context of the reconstruction of historical regional GDP figures. The estimates are based on the proposal suggested by Geary and Stark

Table 1 Average ad-valorem tariffs (%)

	1913	1925	1931
Spain	37	44	68.5
Germany	14.3	12	37.5
France	18.8	12	29.6
Italy	21.3	17	39.3

Source: Liepmann (1938). The Liepmann report calculates nominal protection levels for 14 European countries on the basis of the tariffs levied on a sample of 144 export commodities. Each one of these products is important in the export structure of at least one of the countries considered

Table 2 Geographical concentration of manufacturing, NUTS3

	1856	1893	1913	1929
Gini	0.44	0.60	0.68	0.78
Hirschman-Herfindhal	0.06	0.13	0.15	0.24
Gini foodstuffs	0.34	0.43	0.55	0.65
Gini ceramics/glass	0.48	0.54	0.66	0.78
Gini metal	0.71	0.79	0.83	0.89
Gini paper	0.76	0.70	0.75	0.85
Gini chemicals	0.61	0.66	0.73	0.87
Gini textiles	0.73	0.87	0.91	0.94
Gini wood	0.86	0.72	0.67	0.65

(In the construction of the table, data on industrial production are obtained from fiscal sources. For 1856 and 1893, the information is compiled from the *Contribución Industrial y de Comercio*, a tax on firms' stock of capital. For 1913 and 1929, data come from Betrán (1999) who added the *Contribución de Utilidades*, a tax on industrial corporations' profits introduced in 1909 to the *Contribución Industrial y de Comercio*). *Source*: Paluzie et al. (2004)

(2002) and Crafts (2005). In line with these studies, the Spanish industrial GVA is allocated across provinces, considering both the wage income and the capital income (using tax data) generated in each province. Particularly, the existence of a production function with constant returns to scale is assumed, where the output is obtained from the contribution of two production factors, labour and capital. Thus,

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

α_{it} being the share of the wage income in industrial GVA in region i at time t, ω_{it} industrial wage in region i at time t, L_{it} the total active industrial 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.[12] Based on this new estimation, the share of Catalonia in total Spanish industrial output increased from 23.18 % in 1860 to 32.01 % by 1896 (see Table 3). If we take, instead, the available industrial production indices for Catalonia and Spain (Carreras 1990), it is possible to establish an even higher increase for the period going from the late 1860s to the late 1890s when Catalonia's contribution to Spanish industrial output rose from 25 to 40 % (see Tirado et al. 2002).

Among Catalan regions, it was in the area around Barcelona, the historical capital, that most of this spectacular growth was found. The coastal province of Barcelona, which had a long history of trade and manufacture, increased its share of Spanish industrial output from 16.96 % in 1860 to 25.42 % in 1896.[13]

Tirado et al. (2002) conclude that Barcelona's rise as the main industrial centre in Spain was linked to the existence of some initial comparative advantages which

[12] A detailed description of the methodology, data and sources used can be consulted in Tirado and Martinez-Galarraga (2008).

[13] Data from Tirado and Martinez-Galarraga (2008). In this case, unlike the regional case of Catalonia (Carreras 1990), we lack an annual series of industrial production indices at a provincial level to measure the share and evolution of Barcelona compared to Spain.

Table 3 Share of manufacturing by regions, NUTS2 (%)

	1860	1896	1914	1930
Andalusia	23.46	16.76	16.99	11.16
Aragon	3.43	2.84	4.46	4.52
Asturias	1.98	2.14	4.33	4.10
Balearic Islands	1.62	1.23	1.43	1.19
Basque Country	1.99	11.97	7.03	9.21
Canary Islands	0.44	0.78	0.86	0.96
Cantabria	1.07	1.49	1.61	2.15
Castile-La Mancha	6.41	3.54	3.48	2.82
Castile-Leon	11.10	5.72	5.20	4.69
Catalonia	23.18	32.01	31.65	34.62
Extremadura	3.50	2.34	2.03	1.54
Galicia	5.02	3.13	3.63	3.48
Madrid	4.93	5.03	6.92	9.31
Murcia	2.00	1.46	1.59	1.28
Navarre	1.03	1.31	0.94	1.01
Rioja, La	1.18	0.92	0.64	0.86
Valencian C	7.67	7.33	7.19	7.10
Spain	100	100	100	100

Source: Tirado and Martinez-Galarraga (2008)

made the Catalan city a privileged location for the industrial processes characteristic of the first technological revolution. These initial advantages, in the presence of economies of scale, favoured the genesis of an industrial agglomeration around Barcelona on a scale much larger than that suggested by pure endowment considerations. All this moreover took place in a context of relative openness.

However, some important changes in the geographical location of industry start to emerge in parallel with the shift in trade policy. Although the geographical concentration of industries continued to rise at the aggregate level,[14] there were changes in the location of the main industrial agglomerations. Catalonia's weight in Spanish industry, aside from some exceptional situations like the First World War or the first years of the Second Republic, stabilized: in 1896, the region's contribution to Spanish industrial production was 32.01 %. It then levelled off prior to the First World War, and by 1930, it was 34.62 %. Its relative growth was remarkable during the period 1860–1896, but now came to an end. In contrast, a new group of territories began to move forward in the Spanish industrial structure: the Basque provinces of Guipuzkoa and Biscay, Saragossa, and Madrid, Spain's capital city and geographical centre (Betrán 1999). By way of example, it is possible to compare the evolution of the share in Spanish GVA in industry in the province of Madrid (as a case of internal location) and Barcelona (a case of a border location).

[14] The aggregate Gini index of geographical concentration of industries increased from a value of 0.68 in 1913 to 0.78 in 1929. This tendency was also verified at a higher level of disaggregation: six out of seven sectors increased their levels of concentration during those years. See Table 2.

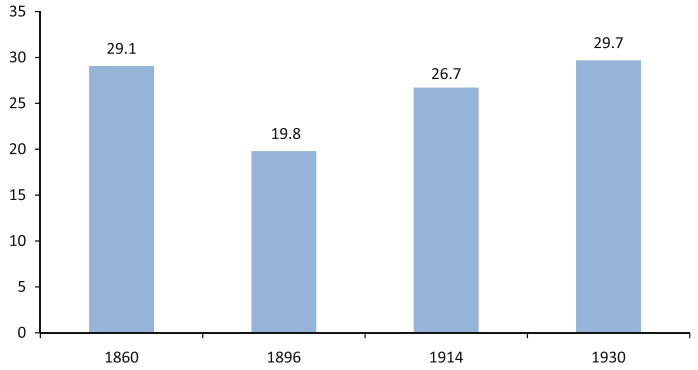

Fig. 3 Madrid's versus Barcelona's industrial output (%). *Source*: own elaboration based on Tirado and Martinez-Galarraga (2008)

Figure 3 shows how in the period of trade liberalization of the Spanish economy the share of the industrial output in Madrid markedly decreased in relation to Barcelona. However, since the last decade of the nineteenth century, in parallel with the protectionist turn in Spain's trade policy, the tendency has reversed. Up to the 1930s, in a period of gradual closing of the Spanish economy to trade, the higher relative growth of Madrid in industrial output led to a recovery of its position compared to the traditional main industrial centre, Barcelona.

As for the regional patterns of wages, we present two maps. Figure 4 plots the geographical distribution of the average nominal wage for manufacturing non-skilled workers in 1914 and 1930.[15] In 1914, we observe an area of high wages centred on Barcelona in the Mediterranean axis (Catalonia, Valencia and Balearic Islands). By 1930, the Mediterranean wage gradient has considerably weakened. We also observe growth in the wages of other areas such as the north (Basque Country and Asturias) and the Ebro Valley (Aragon and Navarre).

Both the pattern of regional wages and the regional shifts in industrial activity point towards a change in the market access forces that might have hampered locations in the geographical periphery of the Peninsula such as Barcelona and favoured domestic centres of consumption in the interior of Spain. In the empirical analysis in the next section, we first study the relationship between market access and wage levels in interwar Spain. Next, we focus on which market potential (internal or external, that is domestic or foreign market) better explains the wage gradient found for the Spanish economy, and its evolution. And, finally, we explore whether a specific wage gradient for regional wages around Barcelona, our border region, existed, and whether it changed during the described shift in trade policy in the interwar years.

[15] We show non-skilled wages due to the greater geographical coverage of the source for these wages. However, it is important to note that the analysis in Sect. 4 will mainly be conducted on the basis of skilled wages. This choice is motivated by the fact that the information regarding skilled wages allows up to 8 sectors of industrial activity to be considered and, therefore, the necessary degrees of freedom to perform the empirical exercise to be increased.

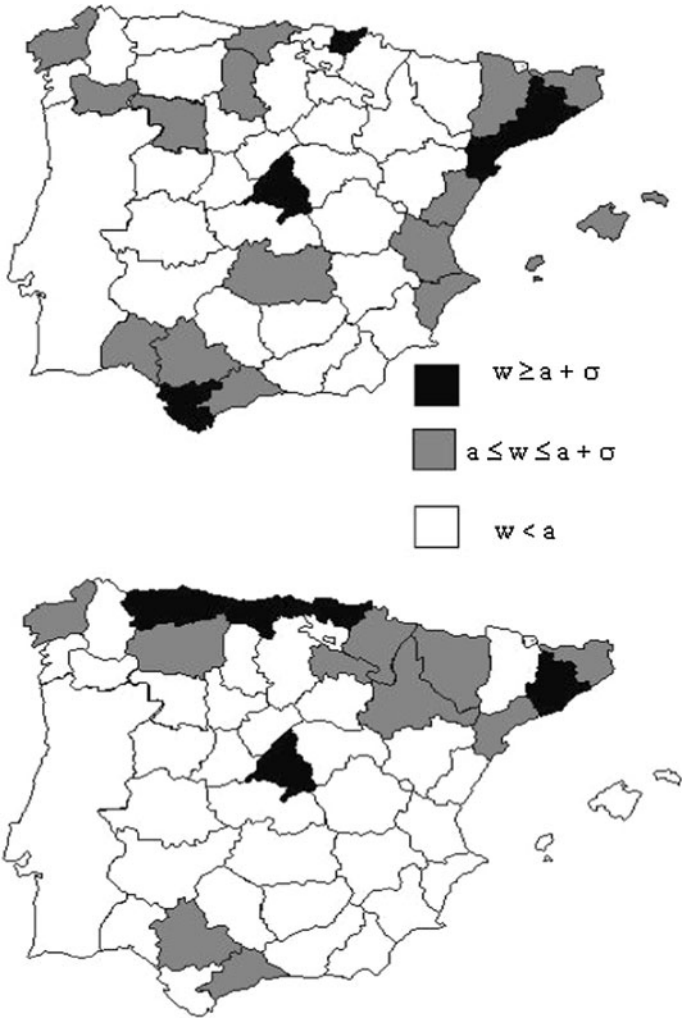

Fig. 4 Nominal wages, non-skilled manufacturing workers, 1914 and 1930. *Source*: Estadística de Salarios y Jornadas de Trabajo, Ministry of Labour and Welfare (1931). *w* is the nominal wage in each province for non-skilled manufacturing workers, a is the Spanish average wage for non-skilled manufacturing workers and σ is the standard deviation

4 Empirical analysis

4.1 The wage equation for the Spanish economy in the interwar years

One of the predictions emanating from NEG models that has been most often tested in the literature is the existence of a spatial structure of wages as suggested in the Krugman equation for wages (for instance, Hanson 2005, for US counties

1970–1990; Brakman et al. 2004, for German urban districts in 1995; Paluzie et al. 2009, for Spanish provinces in 1955–1995, and Garcia-Pires 2006, for Spanish regions in 1981–1995). These studies and others in a similar vein have all confirmed the presence of wage gradients around economic activity centres. As a first stage in the analysis, evidence that such a relationship between wages and distance to markets was at work in 1920 at a provincial level (NUTS3) is provided. Particularly, we verify that, in the interwar years in Spain, wages decreased with distance from the high-income regions (*provinces*) by estimating the following reduced form of the wage equation:

$$\log(W_{rt}) = \beta_0 + \beta_1 \cdot \log\left(\sum_s Y_{st} \cdot e^{-\beta_2 \cdot D_{rs}}\right) + u_{rt} \quad (6)$$

W_{rt} being the nominal wage in industry in province r in period t, Y_{st} the GDP in province s in period t and D_{rs} the distance between provinces r and s. Finally, β_0, β_1 and β_2 are the coefficients to be estimated. Data on provincial GDPs for 1920 come from Rosés et al. (2010) and we take distances by train between the capital city of each province in 1920 as a measure of distances. Provincial nominal wages of non-skilled manufacturing workers come from *Estadística de Salarios y Jornadas de Trabajo* Ministry of Labour and Welfare (1931).[16]

The estimation of Eq. (6) by nonlinear least squares confirms the existence of a wage gradient in the industrial sector in interwar Spain as shown in Table 4. The coefficients β_1 and β_2 are positive and statistically significant. Therefore, a higher market potential is associated with higher wages (β_1) and a larger distance to the main markets would result in lower wages (β_2).

4.2 Access to which markets?

The estimated wage equation shows that firms may accept to pay higher wages in the locations that are near the main production and consumption markets, since they incur lower transport costs. The intuition behind the wage equation is therefore similar to that of the Harris (1954) market potential equation defined in Sect. 2 where accessibility depends on the size of other markets once transport costs are deducted. Thus, income and market potential are directly related and the latter becomes a key variable to explain the spatial agglomeration of economic activities.

Table 4 Structural wage equation NLS estimation results

Variables	Coefficients
β_0	−0.663 (0.038)
β_1	0.088 (0.024)
β_2	0.116 (0.003)
N	47
Adjusted-R^2	0.124

Dependent variable: W_{rt}. In brackets, we indicate the level of significance for which we reject the null hypothesis of a parameter equal to zero

[16] In this source, when an average manufacturing wage per province is needed, the coverage for non-skilled manufacturing wages is higher than for skilled manufacturing wages.

Hence, in a second stage of the analysis, we directly estimate the relationship between wages and a Harris-type equation of market potential. Although the Harris equation is an ad hoc measure, it has a clear advantage for the empirical analysis: it can be decomposed into the internal and foreign components of the market potential and thus it allows the relative role played by these two components and their evolution over time to be assessed. This is of particular interest in our setting, since we are interested in the impact on industrial activity of the shift of trade policy towards a deeper closing of the Spanish economy. The equation we estimate can be written as:

$$w_{rjt} = \beta_0 + \beta_1(\text{market access})_{st} + u_{rt} \quad (7)$$

where now w_{rjt} is the nominal wage in province r, in industry j and in period t; and *market access* is the provincial market potential calculated on the basis of the Harris equation. This specification also captures the notion of a spatial structure of wages and allows us to verify the existence of the backward linkage, that is, the direct relationship between the nominal wage of a region and its market potential. This backward linkage constitutes a key condition for agglomeration dynamics within a country to occur.

In order to test this kind of relationship, the average industrial wage is collected for 47 provinces[17] in 1914 and 1930 from the *Estadística de Salarios y Jornadas de Trabajo* (henceforth, ESJT) published by the Ministry of Labour and Welfare (1931), a source that gives provincial data on hourly wages for different worker categories computed from surveys. We take the wages of skilled workers in eight manufacturing sectors (Metallurgy, Chemistry, Textiles, Electricity, Apparel, Wood, Transport and Furniture). From this information, we estimate the sectoral wage for the provinces for which we do not have direct data using the existing sectoral data and the data on the average provincial wage for skilled manufacturing workers, also given by the source.[18] As for the Harris market potential equation, we use the data from Martínez-Galarraga (2010), who calculates estimates for the Spanish provinces following Crafts (2005). The work by Crafts (2005) for Victorian Britain, which in turn is very close to that of Keeble et al. (1982), has become the reference for the calculation of the Harris market potential equation in historical perspective. In this case, market potential is divided into two main components. First, the internal market potential includes the Spanish provinces considering the size of each province s (usually GDP) and bilateral transport costs (D_{rs}) between province r and s [see Eq. (2)]. In this case, information on distances and average transport rates for commodities are needed. Internal transport is assumed to be by railway and coastal shipping. For railway distances, the sources consulted are Wais (1987) and Ministerio de Obras Públicas (1902). For distances between maritime ports, electronic atlases provide information on the length of sea journeys.

[17] The insular territories (the Balearic Islands and the two provinces within the Canary Islands) are excluded from the analysis throughout.

[18] Hence, differences in sectoral wages are linked to the differences in the average wage of skilled manufacturing workers. The direct data available represent around 35% of the sample of wages for skilled workers.

In addition, for the internal distance of province *r*, one-third of the radius of a circle with an area equal to that of the province is taken.

Second, foreign markets have been added to the internal market potential. In this case, the construction of the external market potential is based on the results of the gravity equation for international trade estimated by Estevadeordal et al. (2003) for the interwar years. In a simple version, gravity equations consider that the intensity in trade flows between two countries is positively related to the size of the economies involved and inversely related to the distance by sea and tariffs. Taking this reduced specification of a gravity equation, the external market potential is calculated as:

$$\varphi_{rs} = \mathrm{GDP}_s(\mathrm{distance})_{rs}^{\delta}(\mathrm{tariffs})_s^{\gamma}$$

where the elasticities obtained by Estevadeordal et al. (2003) for distance (δ) and tariffs (γ) are used to reduce the size of foreign markets (GDP).[19]

With this database, the estimation of Eq. (7) for 1914 and 1930 yields the results presented in Table 5. First, the evidence in columns (a) and (e) confirms the positive relationship between market potential and regional wages. In the previous section, such a relationship was found in 1920 by estimating the Krugman wage equation. In this case, with an alternative, non-structural, but similar estimation, the coefficients show a positive sign as expected, they are statistically significant and show a slight declining trend between the two dates considered. More interestingly, it is possible to analyse the role played by the domestic and foreign markets in the spatial structure of wages. Columns (b) and (f) show the coefficients when the internal market potential is considered alone. The two coefficients being positive and significant, the interesting point to stress is that in a period of a deepening of the closing of the Spanish economy during the interwar years, the magnitude of the coefficient increases, thus supporting the idea that the domestic market became more relevant for wages as the protectionist trade policy was consolidated after the First World War. The opposite can be observed with foreign markets in columns (c) and (g). The impact of foreign markets on wages was low and even decreased through the interwar years as the protectionist policies advanced.[20] A similar pattern is observed when both the domestic and the foreign markets are included in the estimation at the same time (columns d and h).

4.3 A wage gradient centred on Barcelona?

With the spatial structure in wages verified for interwar Spain, we now focus on the analysis of the main industrial centre of the country, Barcelona. Is there evidence of the existence of a wage gradient around Barcelona? Also, in a context of an increasing importance of the domestic market as a result of the intensification of

[19] See Martinez-Galarraga (2010) for more details.

[20] This result is influenced by the general increase in tariffs in the Western economies after the First World War in a period of Globalization backlash (O'Rourke and Williamson 1999). Nevertheless, the effect of an exogenous shock like the First World War is not present in our first date and its impact could be considered as low more than one decade later in 1930 when, in turn, the Great Depression was still at an early stage.

Table 5 Non-structural wage equation OLS estimation: results (The exogenous variable, market potential in province *r*, enters the equation divided by the values for Barcelona (the maximum over the period) in order to make the scales more comparable with the endogenous variable. The magnitude of the coefficients is obviously going to change but it does not affect the significance or the sign of the coefficients or the adjusted R^2s)

Endogenous variable	W_{rjt} 1914	W_{rjt} 1914	W_{rjt} 1914	W_{rjt} 1914	W_{rjt} 1930	W_{rjt} 1930	W_{rjt} 1930	W_{rjt} 1930
Exogenous variable	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Market potential 1914: total	0.18 (0.000)							
Market potential 1914: internal		0.35 (0.000)		0.29 (0.001)				
Market potential 1914: external			0.05 (0.005)	0.04 (0.018)				
Market potential 1930: total					0.16 (0.000)			
Market potential 1930: internal						0.40 (0.000)		0.38 (0.000)
Market potential 1930: external							0.04 (0.003)	0.03 (0.022)
Adjusted R^2	0.31	0.19	0.33	0.37	0.46	0.10	0.24	0.49
N	376	376	376	376	376	376	376	376

All regressions include industry dummies. We do not report their estimated values. In brackets, we indicate the level of significance for which we reject the null hypothesis of a parameter equal to zero. Standard errors are estimated by White's heteroskedasticity consistent method. We have 376 observations because we consider 47 provinces and 8 industrial sectors

protectionist policies in the interwar years, how was that wage gradient affected? Was it weakened or strengthened over time? These are the questions that we are going to address in this section bearing in mind the ambiguous predictions in NEG theoretical models.

In the empirical analysis, Eq. (5), the functional form proposed in Sect. 2, allows us to test our next hypothesis and to establish whether there was a wage gradient centred on Barcelona, and its possible changes following a shift in trade policy. We specify the existence of a log-linear relationship between the structure of nominal wages and transport costs between each location and the main industrial centre, Barcelona. Thus, following Hanson (1997), we have:

$$\log(w_{ijt}/w_{cjt}) = \beta_0 + \beta_{1t}\log(d_i) + \mu_{ijt} \tag{8}$$

where w_{ijt} is the nominal wage in province *i*, for sector *j*, at time *t*, w_{cjt} is the central region (Barcelona) wage for sector *j* at time *t*, d_{i} is unit transport costs from region *i* to Barcelona, and μ_{ijt} is the error term. The theoretical predictions are that $\beta_{1\mathrm{t}} < 0$ and that, over time, Barcelona's centrality being weakened, the absolute value of this parameter will be reduced so that $|\beta_{\mathrm{lt}} - 1| > |\beta_{\mathrm{lt}}|$, an effect that can be captured by including a multiplicative time dummy in the regression.

In relation to the strategy followed in estimating Eq. (8), we have to signal the presence of a problem linked to the existence of idiosyncratic components in the error term. Following Hanson (1997), we assume the error term has the following form:

$$\mu_{ijt} = \varepsilon_i + \omega_j + \phi_t + \eta_{ijt} \tag{9}$$

where ε_i is the fixed effect for region i, related to the specific characteristics of the region, ω_j the fixed effect for industry j, ϕ_t is the fixed effect for year t, and η_{ijt} is an i.i.d. term with mean zero and variance σ. With the available information, we can estimate Eq. (8) with industry and year dummies in the regression, so as to exclude them from the error term. From this functional form, we will test the existence and structural stability of the parameter that defines the wage gradient centred on Barcelona.

Data on wages come from the *ESJT*, the same source as in Sects. 4.1 and 4.2. Now the data used correspond to wages of skilled manufacturing workers for 4 points in time (1914, 1920, 1925 and 1930), for eight manufacturing sectors (Metallurgy, Chemistry, Textiles, Electricity, Apparel, Wood, Transport and Furniture), and 47 provinces. For d_i, we use the distance by railway between the province's capitals in the period analysed.

Table 6 gives estimation results for Eq. (8). We verify the existence of a wage gradient centred on the main industrial centre, Barcelona. The estimated parameter of the variable DistBarcelona is significant and negative. Its quantitative value in column (a) indicates that a 10 % increase in the distance to Barcelona leads to a reduction in the relative nominal wage of 0.26 %. Plus, the coefficient of the interaction of the variable distance with the time dummy in column (b), which is positive and significant at 10 %, can be interpreted as evidence of a weakening of the wage gradient around Barcelona over time. If we subtract the value of the dummy coefficient from the value of the variable on distance from Barcelona, we find that the wage gradient has decreased by 34.6 % (from 0.026 to 0.017).

To check the robustness of the regression results in relation to the regional fixed effects that could be captured by the error term in Eq. (8), we re-estimate Eq. (8), replacing the distance variable with province dummy variables. With this regression, we want to analyse whether the distance to the economic centre is one of the elements to consider among the characteristics of each province that

Table 6 Results for relative nominal wages by sectors

Variables	(a)	(b)
Log(DistBarcelona)	−0.026 (0.000)	−0.035 (0.000)
Log(DistBarcelona) × D2530		0.018 (0.085)
Adjusted-R^2	0.388	0.391
N	1472	1472

Dependent variable: (w_{ijt}/w_{cjt}). All regressions include year and industry dummies. We do not report their estimated values. In parentheses, we indicate the level of significance for which we reject the null hypothesis of a parameter equal to zero. Standard errors estimated by White's heteroskedasticity consistent method

Table 7 Regression results for the estimated province dummies

$w_i^{fe} = \underset{(0.044)}{0.374} - \underset{(0.037)}{0.025}\log(D_{\mathrm{BCN}})$

Adjusted $R^2 = 0.495$

$N = 45$

In parentheses, we indicate the level of significance for which we reject the null hypothesis of a parameter equal to zero

could explain the existence of wage differentials between them. The explanatory power of the model increases considerably (the adjusted R^2 increases to 0.711), indicating the existence of other specific characteristics of the provinces that matter for relative wages.[21]

So, in order to test the importance of distance in explaining these specific characteristics of the regions, we regress the estimated province dummies on the distance vector.

The results are presented in Table 7, where w_i^{fe} is the estimated fixed effect for province i and D_{BCN} is the distance from province i to Barcelona. We verify that the distance variables explain a high percentage (49.5 %) of the variance in fixed province effects, thus suggesting that transport costs, as measured by distance, are an important factor among the characteristics of the provinces that explain the geographical structure of relative nominal wages.

Taken together, the evidence gathered in Sects. 4.2 and 4.3 shows that the weakening of the gradient in industrial wages around Barcelona occurred in parallel with the increasing importance of the domestic market in the interwar years as the Spanish and the international economies intensified their protectionism after the First World War. In the light of these results, it can be argued that the geographical position of the different territories within the Iberian Peninsula combined with the relative internal transport costs affected regional wages more intensely over time and gained relevance in the explanation of the changes in industrial location.

In this context, in relative terms, the trade policy implemented could have favoured some provinces with mineral resource abundance in the North of Spain (Basque Country or Asturias) and also interior provinces like Saragossa and Madrid. The case of the latter province is especially appealing since Madrid, located in the geographical centre of the Iberian Peninsula and being the main hub of the Spanish railway network, experienced an increase in its relative position as an industrial cluster at the turn of the century at the same time as the protectionist turn took place, and this increasing tendency continued up to the Civil War.

Thus, although trade policy was not the only force at work, and our analysis is focused on interwar years due to data scarcity regarding wages for previous decades, it is possible to hypothesize that the nationalistic road of Spanish capitalism favoured the emergence of internal locations as industrial centres in the first decades of the twentieth century to the detriment of the traditional industrial cluster in the border region (Barcelona) which experienced a relative weakening as some NEG models predict (Brülhart et al. 2004; Crozet and Koenig-Soubeyran 2004).

[21] Results available from the authors upon request.

4.4 Other potential explanations for the existence of regional wage gradients

Our empirical analysis supports the hypothesis of the existence of a wage gradient, centred on the province of Barcelona, explained by the existence of agglomeration economies and the presence of transport costs. However, as mentioned in Sect. 2, we cannot neglect other factors that may yield the same prediction for relative regional wages: (1) exogenous natural resource supplies, (2) exogenous levels of amenities, (3) human capital stocks and (4) location bias in government policy. Next, we present some qualitative evidence in direct relationship with these alternative explanations for the existence of a wage gradient centred on Barcelona.

For exogenous natural resource supplies to yield the same main prediction of Eq. (5), that is, the existence of a gradient centred on Barcelona, it must be true that this region concentrates natural resources. Nevertheless, this was not the case; Barcelona lacked natural resources such as water, minerals or coal. For the exogenous levels of amenities to yield the same predictions as Eq. (5), it must be true that they decrease with distance from Barcelona. The evidence suggests the opposite is in fact the case. Moreover, we also believe that amenities were not an important factor in the location decision of firms during the first stages of industrialization. As for human capital stocks, in particular, regional levels of education indicate that Catalonia's position was only average and that this position did not vary during the period considered. (Catalonia's literacy rate was seventh out of 15 NUTS2 regions in Spain in both 1900 and 1930). Finally, for location bias in government policy to lead to the same predictions as Eq. (5), it must be true that government activities were concentrated in Barcelona or that Barcelona benefited from public subsidies. Notwithstanding this, in fact, most government activities were concentrated in the capital city, Madrid, throughout our sample period.

As for the hypothesis of a weakening of the wage gradient, we find significant 1914–1930. Both the Argüelles tariff in 1921 and the Cambó tariff in 1922, and the restriction on imports of cheap coal after this date could explain the reduction in the effect of distance to Barcelona on regional wages. Although the shift in trade policy was gradual and had begun by the end of the nineteenth century, and was reinforced in 1906, the centrality of Barcelona was clearly eroded after these new protectionist measures were imposed.

However, in addition to the trade policy shift, this result could also be explained by a comparative advantage in natural resources in other regions. In fact, these explanations are not mutually exclusive, but rather complementary. On the one hand, the changes in the comparative advantage of the regions in this period are inextricably linked to the change in trade policy. It was the prohibition on the importing of coal and the high tariff protection imposed on steel production that gave a comparative advantage to northern regions such as Asturias and the Basque Country and disadvantaged a region, Catalonia, which lacked natural resources, by increasing the production costs of firms, thus reducing its centrality.

5 Conclusions

In this paper, we analyse whether the consolidation of the protectionist turn in Spain along with the advance of protectionism at an international level after the First World War played a significant role in the changes observed in the geographical distribution of economic activity. First, the paper represents a contribution to the understanding of the spatial distribution of industrial activity within Spain in a historical perspective. In addition, there is also a contribution to the NEG empirical literature. Through the study of a historical case, we offer an empirical analysis of the existence of a relationship between regional industrial wages and market potential at the same time as a change in the economic policy model was being reinforced, a field where no consensus has been reached in the predictions of the theoretical models.

Results prove the existence of a relationship between nominal wages and market potential of regions. Besides, the growing importance of the internal market in the explanation of this regional wage structure has been shown. At the same time, the decrease in the importance of the foreign markets would be linked to the generalized increase in protectionism in the main trading partners of the Spanish economy. The existence of a regional wage gradient centred on Barcelona, the main industrial centre of the country, has also been confirmed; and finally, evidence has been found of the weakening of the gradient after the intensification of protectionism during the interwar years.

In the NEG literature, the impact of trade policy on industrial location has been analysed searching for evidence of changes in wage gradients following trade reforms. So, it can be argued that, in the line of the hypotheses arising from NEG literature, the abandonment of a trade policy characterized by the reduction in tariffs at the end of the nineteenth century and the subsequent intensification of the protectionist turn, especially during the interwar period, may have contributed to weaken Barcelona's role and enhanced the relative growth of other locations. To entirely prove this hypothesis, further research is required. Unfortunately, the scarcity of data does not allow us to analyse this relationship since the late nineteenth century, but nonetheless, we find a structural break in the wage gradient around the main industrial centre for the interwar years, a period when the nationalistic road of Spanish capitalism was configured and protectionism was spreading in foreign markets.

As far as the theoretical debate is concerned, the Spanish case in the first industrialization wave illustrates the effects of the progressive closing of an economy to international trade on the geographical distribution of industrial activity, a case which can be considered to some extent the reverse of the trade policy change recently analysed by the literature. The new scenario did not imply a reduction in the geographical concentration of production, as measured by the Gini indices. However, the most important changes that occurred during this period were in the location of the main industrial agglomerations. Here, we hypothesize that the intensification of the protectionist trade regime may have contributed to weaken the role of the border region, Barcelona, which had concentrated an increasing share of Spanish industrial output during the period of greatest opening to foreign trade; this

would provide support for Crozet and Koenig-Soubeyran's (2004) hypothesis on the effects of trade policy changes on the internal geography of countries. In line with Hanson (1997), we find evidence of a structural break in the relationship between distance and relative wages in the interwar years following the reinforcement of the protectionist turn of the Spanish trade policy and a generic closing of international markets.

References

A'Hearn B, Venables AJ (2011) Internal geography and external trade: regional disparities in Italy, 1861–2011. Quaderni di Storia Economica 12, Bank of Italy

Allen RC (2011) Global economic history: a very short introduction. Oxford University Press, Oxford

Betrán C (1999) Difusión y localización industrial en España durante el primer tercio del siglo XX. Revista de Historia Económica 3:663–696

Black D, Henderson V (1999) A theory of urban growth. J Political Econ 107:252–284

Brakman S, Garretsen H, Schramm M (2004) The spatial distribution of wages: estimating the Helpman-Hanson model for Germany. J Reg Sci 44(3):437–466

Brülhart M, Crozet M, Koenig-Soubeyran P (2004) Enlargement and the EU periphery: the impact of changing market potential. World Econ 27(6):853–875

Carreras A (1990) Industrialización española: estudios de historia cuantitativa. Espasa-Calpe, Madrid

Combes PP, Mayer T, Thisse JF (2008) Economic geography. Princeton University Press, Princeton

Crafts N (2005) Market potential in British regions, 1871–1931. Regional Studies 39(9):1159–1166

Crozet M, Koenig-Soubeyran P (2004) EU enlargement and the internal geography of countries. J Comp Econ 32:265–279

Estevadeordal A, Frantz B, Taylor AM (2003) The rise and fall of world trade, 1870–1939. Quart J Econ 118(2):359–407

Fujita M, Krugman P, Venables AJ (1999) The spatial economy: cities, regions and international trade. The MIT Press, Cambridge

Garcia-Pires A (2006) Estimating Krugman's economic geography model for the Spanish regions. Span Econ Rev 8(2):83–112

Geary F, Stark T (2002) Examining Ireland's post-famine economic growth performance. Econ J 112:919–935

Hanson GH (1997) Increasing returns, trade and the regional structure of wages. Econ J 107:113–133

Hanson GH (2001) Scale economies and the geographic concentration of industry. J Econ Geogr 1:255–276

Hanson GH (2005) Market potential, increasing returns, and geographic concentration. J Int Econ 67:1–24

Harris CD (1954) The market as a factor in the localization of industry in the United States. Ann Assoc Am Geogr 44(4):315–348

Head K, Mayer T (2004) The empirics of agglomeration and trade. In: Henderson V, Thisse JF (eds) Handbook of regional and urban economics, vol 4. Elsevier, NorthHolland, pp 2609–2669

Keeble D, Owens P, Thompson C (1982) Regional accessibility and economic potential in the European community. Reg Stud 16(6):419–432

Krugman P (1991) Increasing returns and economic geography. J Political Econ 99:483–499

Krugman P, Livas Elizondo R (1996) Trade policy and third world metropolis. J Dev Econ 49:137–150

Lafourcade M, Paluzie E (2011) European integration, foreign direct investment (FDI) and the geography of French trade. Reg Stud 45(4):419–439

League of Nations (1927) Tariff level indices. Publications of the League of Nations, Economic and Financial Section, Geneva

Liepmann H (1938) Tariff levels and the economic unity of Europe. George Allen & Unwin, Edinburgh

Martinez-Galarraga J (2010) Market integration and regional inequality in Spain, 1860–1930, PhD dissertation, Universitat de Barcelona

Ministry of Labour and Welfare (1931) Estadística de Salarios y Jornadas de Trabajo, Madrid

O'Rourke KH, Williamson JG (1999) Globalization and history: the evolution of nineteenth-century Atlantic economy. The MIT Press, Cambridge
Palafox J (1992) Atraso económico y democracia. La Segunda República y la economía española (1892–1936), Crítica, Barcelona
Paluzie E, Pons J, Tirado DA (2004) The geographical concentration of industry across Spanish Regions, 1856–1995. Jahrbuch für Regionalwissenschaft (Review of Regional Research) 24(2):143–160
Paluzie E, Pons J, Tirado DA (2009) A test of the market potential equation in Spain. Appl Econ 41(12):1487–1493
Prados de la Escosura L (2003) El progreso económico de España 1850–2000. Fundación BBVA, Bilbao
Prados de la Escosura L (2010) Spain's international position, 1850–1913. Revista de Historia Económica/Journal of Iberian and Latin American Economic History 28(1):173–215
Rauch JE (1993) Productivity gains from geographic concentration of human capital: evidence from the cities. J Urban Econ 34:380–400
Redding SJ (2011) The empirics of new economic geography. J Reg Sci 50(1):297–311
Roback J (1982) Wages, rents, and the quality of life. J Political Econ 90:1257–1278
Rosés JR, Martínez-Galarraga J, Tirado DA (2010) The upswing of regional income inequality in Spain (1860–1930). Explor Econ Hist 47(2):244–257
Sabaté M (1992) La reforma arancelaria de 1906: la protección legitimada, Ph.D dissertation, Universidad de Zaragoza
Serrano Sanz JM (1986) La política arancelaria española al término de la Primera Guerra Mundial: proteccionismo, arancel Cambó y tratados comerciales. In: García Delgado JL (comp) La crisis de la Restauración. España entre la Primera Guerra Mundial y la Segunda República. Siglo XXI, Madrid, pp 199–223
Serrano Sanz JM (1987) El viraje proteccionista en la Restauración. La política comercial española, 1875–1895, Siglo XXI, Madrid
Serrano Sanz JM (1997) Sector exterior y desarrollo en la economía española contemporánea. Papeles de Economía Española 73:308–335
Silvestre J (2005) Internal migrations in Spain, 1877–1930. Eur Rev Econ Hist 9:233–265
Tena A (1999) Un nuevo perfil del proteccionismo español durante la Restauración, 1875–1930. Revista de Historia Económica 3:579–622
Tena A (2005) Sector exterior. In: Carreras A, Tafunell X (eds) Estadísticas históricas de España siglos XIX–XX, vol II. Fundación BBVA, Bilbao, pp 573–644
Tirado DA (1996) Protección arancelaria y evolución de la economía española durante la Restauración: un ensayo interpretativo. Revista de Historia Industrial 14(1):11–49
Tirado DA, Martinez-Galarraga J (2008) Una nova estimació retrospectiva del VAB regional industrial. Espanya (1860–1930), Working Paper E08/192, Facultat d'Economia i Empresa, Universitat de Barcelona
Tirado DA, Paluzie E, Pons J (2002) Economic integration and industrial location: the case of Spain before World War I. J Econ Geogr 2:343–363
Wais F (1987) Historia de los ferrocarriles españoles. Fundación de los Ferrocarriles Españoles, Madrid