The home market effect in the Spanish industry, 1965–1995

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Abstract This study was intended to identify empirically the existence of the home market effect (HME) in Spanish manufacturing industry, a case which shows some incipient evidence in very early stages of development, and an increasing relevance of this phenomenon over time. Our empirical test is carried out with 17 regions between 1965 and 1995, and lends support to the hypothesis of the existence of the HME in five of the nine industries analysed. These results are obtained using a specification in line with the traditional one but new in the sense that it is defined in proportions instead of levels; this approach has conceptual advantages because it is a relative one, like the definition of HME itself.

JEL Classification R12 · R30

1 Introduction

The works of Fujita, Krugman or Venables, among others, have given rise, since the early 1990s, to a new strain in the literature on localisation known as the new economic geography (NEG). One of the theoretical inferences deduced from this is the so-called home market effect (HME) or effect of increased demand, according to which a change in demand in a country or region provokes more than a proportional change in the output of those industries with increasing returns and transportation costs.

In this article we intend to carry out a rigorous and in some ways, novel test of HME with Spanish data from 1965 to 1995. The analysis can also be seen as a comparison test of trade theories (Head and Ries 2001; Trionfetti 2001): increasing versus constant returns models. In fact, HME was originally introduced within the framework of the New International Trade Theory, later being adopted as an element of the NEG models.

We can defend the value of this exercise with four arguments. First, the specification of the model proposed in this chapter is not only the traditional one. As we will explain in the specification of the empirical model, we have opted to analyse percentage changes in demand and production in a panel of regions. The advantages of this approach are twofold. On one hand, the specification is in much greater agreement with the real concept of HME (an increase of *X* percent in the demand for a good produces an increase greater than *X* percent in its production) and thus both more intuitive and more rigorous. On the other hand, estimations based on the panel of regions, in which some variables are defined with reference to the national average, mean the introduction of an additional geographical element, where the location of demand and production in some regions goes hand-in-hand with their de-location in others.

Second, the Spanish case has been studied by Rosés (2003), but using a historical database from 1797 to 1910 and a corresponding updating is needed if one thinks, as we ourselves believe, that the mechanisms of NEG could have been active during the industrial revolution as well as in modern times. Third, undertaking an empirical test of HME, far from being redundant, will always shed new light on the phenomenon, and so there is no clear consensus in the literature about its validity. In other words, testing of HME is still a useful task.

Finally, the empirical application is carried out with regional rather than international data. Davis andWeinstein (1999) themselves put forward the principal motives for choosing this option. Briefly, their main thesis is that it is easier to detect strong effects of Economic Geography in regional data than in international data due to lower transportation costs in themovement of goods and the greater mobility of factors found at the regional level.

The rest of the paper is set out as follows. In Sect. 2, a conceptual explanation of HME and its theoretical foundations is presented, along with a summary of the most relevant empirical applications. Section 3 concerns the specification of the empirical model for Spanish manufacturing industry. Section 4 describes the database used in the empirical application. Section 5 offers an estimation of the model and the results of the econometric analysis. Section 6, titled Heckscher–Ohlin (HO) versus HME, is a joint analysis of the pattern of production from both the neoclassical and the NEG perspective; and HME dynamics are analysed in Sect. 7. The most significant results indicate evidence of the existence of HME in four of the nine industries analysed, while in other four endowment factors are predominant in any explanation of location. In any case, HO and NEG coexist, in different intensities according to industry, as determinants of the industrial geography of Spain. Finally, the conclusions close the study.

2 HME: theory and evidence

The HME concept is one of the cornerstones of the New International Trade Theory and of the NEG, and with different nuances is generally accepted as one of the typical outcomes of the models which present increasing returns to scale (IRS) and transport costs. However, on the theoretical level, there is a strain of literature which specifies under which circumstances this is produced or not produced, depending on the different initial hypotheses.

The theoretical foundations of HME are found in Krugman (1980) and Weder (1995) which in turn have inspired both theoretical discussion and diverse empirical tests.

2.1 Concept and theoretical discussion

The principal, groundbreaking innovation of Krugman is to show how the introduction of transportation costs alongside the presence of increasing returns imply that an increased demand for a certain product within a country will drive a more-thanproportional increase in production of that product in that country, a phenomenon known as HME. More recently, Weder (1995) introduces different sizes of countries, seeking thus to distinguish between absolute and relative differences in the dimensions of domestic demand of nations. He considers two countries as completely identical except for the absolute and relative size of their domestic demand for each type of differentiated product. Market size does not affect the scale of production, only the number of varieties of the product such that, when international transportation costs are reduced, competition between national and foreign companies increases, which implies that small differences in market sizes can have a great effect on the relative number of varieties produced in the two countries. In a nutshell, one country may be smaller than another and yet be a net exporter when its relative demand is greater. To sum up, the principal contribution of Weder (1995) is the introduction of the idea of a greater *relative* demand and the study of its consequences on production.

Taking the microfoundations referred to above as a basis, the main research on the HME phenomenon has tried to understand the conditions needed for the HME to appear. The first contribution is from Davis (1998), who shows, in a model based on Krugman (1980), that the HME vanishes when both industrial and agricultural goods have the same trade costs. More recently, Behrens et al. (2004) establish that the validity of the HME when it passes from a universe of two geographical units, as in the original propositions, to another with a greater number of regions or countries, is not immediate. Essentially, in defining a setting with multiple non-equidistant countries, they deduce that the appearance of HME should always be produced as long as it is possible to define an index of effective local demand which takes into account, besides local demand, the demands of other countries weighted by distance. The problems arising from dealing with more than two regions were also anticipated in Ottaviano and Thisse (2004).

Hanson and Xiang (2004) note that if the hypothesis present in Davis and Weinstein of intercorrelation between the impact of demand and the impact of supply in the industry is not fulfilled, the results may be inconsistent. Elsewhere, Head and Mayer (2004) reason that the HME result depends crucially on the fulfilment of the hypothesis that the increasing returns industry has a perfectly elastic supply of labour. If this is not the case, a reverse HME effect can even be deduced. The interesting possibility of a non-linear HME, that is, HME being more important for very large and very small countries, is presented in Crozet and Trionfetti (2007). This result is produced when traditional goods are eliminated from the analysis.

Finally, the theoretical literature on the HME has recently produced several works, among which we may cite Melitz (2003), Baldwin and Okubo (2004), Behrens and Thisse (2005), Baldwin and Robert-Nicoud (2005) and Okubo and Rebeyrol (2006); most of them explore the consequences of the introduction of heterogenous companies for the HME.

Definitively, from different perspectives, the literature demonstrates that the existence of the HME depends on the initial suppositions; therefore, it is necessary and indispensable to refer to the data in order to assess the empirical relevance of a phenomenon which, as we have just seen, has been extensively discussed at the theoretical level.

2.2 The evidence

The seminal papers trying to find evidence of HME are the ones by Davis and Weinstein, who have developed an empirical methodology to answer the following question: are idiosyncratic changes in demand associated with more-than-proportional changes in output? If the answer is affirmative the existence of HME is possible.

In their initial contribution, Davis andWeinstein (1996) carried out this analysis for OECDcountries. Its objective is to explore the part played by idiosyncratic elements of demand in the determination of patterns of production via models of Economic Geography and comparative advantage. It is the first empirical test to nest trade models of economic geography with others of the Heckscher–Ohlin–Vanek type. To sum up, they find that factor endowments are a crucial element in understanding the manufacturing structure of the countries in the sample, given that they constitute 90% of explanatory power, whereas economic geography, via the home market effect, constitutes only 10%.

In the construction of variables they follow closely the theoretical model of Krugman (1980). This means that the variablewhich reflects HME(called IDIODEM) initially lacks geographical input, as it supposes that the relative location of countries does not matter, and this implies that links of demand between neighbouring countries are not a priori stronger than links with countries on the other side of theworld,which is not very realistic and which has an effect on the results. Therefore, two strategies were employed to improve these results. The first strategy is used in Davis and Weinstein (1999). The fundamental difference is that IDIODEM is now applied to regions within a single country, in this case, Japan. The IDIODEM coefficient is greater than one in the aggregate level estimates, therefore there is evidence of homemarket effect.1 Davis andWeinstein interpret this result as "clearly in the range of economic geography", in contrast to the result obtained in Davis and Weinstein (1996) with international data, which revealed the nonexistence of the Economic Geography effect. They explain this divergence of results with two reasons: the different trade costs between regions and between countries; and the greater mobility of factors between regions compared to this mobility between countries. Nevertheless, when factor endowments are included there is no evidence of home market effect; but breaking down the data to the level of goods helps the HME emerge in eight of nineteen goods.

In the second strategy, in Davis andWeinstein (2003), the OECD countries are also analysed but IDIODEM is measured differently. The authors conclude that the key to identifying Home Market Effects is to introduce more realism in their models of production and trade. Specifically, the main difference to Davis andWeinstein (1996) is the construction of a new IDIODEM variable which weighs demand against the distance between countries, such that the size of the economy, bilateral distance and the characteristics of a particular industry are brought together in a gravity equation, which determines how demand is dissipated by distance.

However, this is only one of the ways of contrasting the explanatory power of these theoretical models from an empirical perspective. Other articles tackle the problem directly by considering an estimation strategy that uses the spatial variation in earnings to identify the structural parameters of a geography model. Thus, Redding and Venables (2004) and Hanson (2005) estimate a wage equation that relates nominal wages in each zone (cross-country data for Redding and Venables, US cross-country data for Hanson) to its distance from economic centres. In general, they found a spatial correlation of wages and demand. Along the same lines, Crozet (2004) analyses the influence of access to markets (market potential) in the localisation choices of the agents using inter-regional migration data for five European countries. The Spanish case has also been studied using this approach in the works of García Pirés (2006) and Paluzie et al. (2007), where the existence of a spatial wage gradient is detected: a greater access to markets in the core regions ensures higher profits for local firms, and thus higher wages. The articles described above form an established strain in the contemporary literature on the NEG which is complementary to the approach adopted in this work.

The interest for the study of the Spanish case arises from the evidence that, during the industrial development of the 19th century, important regional differences emerged, with Spanish manufacturing becoming concentrated in a few regions due to reduced transport costs and internal trade barriers. The only known research specifically devoted to the analysis of HME in Spain is that of Rosés (2003), who combines the Heckscher–Ohlin and Economic Geography models à la Davis and Weinstein. He concludes that the comparative advantage and the effects of increasing returns were economically very significant and explain practically all the differences in industrialisation levels in Spanish provinces; and, more importantly for our purposes, the deficits of some regions in terms of industrialisation seem to be attributable to their factor endowments, combined with an apparent absence of Home Market Effects (no HME).

Also, the Spanish case could be a good testing ground for analysing this phenomenon, as it has shown an irregular regional distribution of economic activity since the beginning of its industrial development. Among the determinants of localisation, the effects of the reduction in transport costs and internal barriers seem to be eclipsed by a specialisation due fundamentally to factor endowments. However, our hypothesis in this paper is that from the late nineteenth century to today, factor endowments have gradually given way to the forces of economic geography in the production of the Spanish regions and many industries now show clear evidence of the HME phenomenon.

3 Specification of the empirical model of HME for Spanish manufacturing

As mentioned above, this paper attempts to verify the empirical validity of one of the theoretical prescriptions of the NEG, specifically the HME, starting from the methodology proposed by Davis and Weinstein. Adopting the habitual notation of empirical literature, we start with the following relationship:

$$X_g^{nc} = f\left(\mathrm{SHARE}_g^{nc}, \mathrm{IDIODEM}_g^{nc}\right) \qquad (1)$$

Where X_g^{nc} is the output of the activity *g* included in total manufacture *n* and region *c*. SHARE_g^{nc} attempts to capture the tendency, in the absence of idiosyncratic demand, for each region to produce activity *g* in total manufacture *n* in the same proportion as the national average of regions. It is therefore expressed as:

$$\mathrm{SHARE}_g^{nc} = \frac{X_g^{nS}}{X^{nS}} X^{nc} \qquad (2)$$

where *S* represents the totality of Spain and the term X^{nc} is a scalar reflecting the total production of industry in the region, i.e., an indicator of its size. $\mathrm{IDIODEM}_g^{nc}$ collates idiosyncratic demand. Based on this we can detect the existence or otherwise of the Home Market Effect and it is by definition the crucial variable in the test of HME:

$$\mathrm{IDIODEM}_g^{nc} = \left(\frac{D_g^{nc}}{D^{nc}} - \frac{D_g^{nS}}{D^{nS}}\right) X^{nc} \qquad (3)$$

where *D* is internal absorption, proxied in the empirical application by gross value added to factor cost.

The coefficient associated with this variable captures the impact of idiosyncratic demand on production, and so the key point is its interpretation. Three possible scenarios are identified: first, in a context of comparative advantage without transportation costs, the geographical structure of demand should have no effect on production behaviours, and so the coefficient of IDIODEM would be equal to zero. Second, in a world of comparative advantage with transportation costs and without increasing returns, demand deviation affects production location, but in a lesser proportion, so that the coefficient of IDIODEM would be between zero and one. Thus a comparatively high demand for a product in a country will generally lead to net imports of this good. And third, if the typical characteristics of economic geography prevail, the coefficient of IDIODEM will be greater than one, so an increase in demand for good *g* in industry *n* in region *c* leads to a more-than-proportional increase in output X_g^{nc} . Therefore a comparatively high demand for a product in a country will generally lead to net exports of this good. Thus we conclude that the associated home market effect plays some part in production location.

Consequently, the empirical model for estimation would be given by

$$\log X_g^{nc} = \alpha_0 + \alpha_1 \log \mathrm{SHARE}_g^{nc} + \alpha_2 \log \mathrm{IDIODEM}_g^{nc} + \alpha_g^{nc} \qquad (4)$$

where α_0 is the independent term and α_g^{nc} represents random perturbation. For simplicity we omit the time dimension in the notation. Before presenting the results of the estimation we should take into account the following considerations.

The IDIODEM variable may take negative values given that it is a deviation from the national average with the subsequent problem of losing information when logs are taken. To avoid this, IDIODEM is normalised (the most negative value is given a value of almost zero and the rest of the values are rescaled), so it is always positive, and an increase of the variable is unequivocally associated with an increase in the idiosyncratic demand of the region in the subindustry in question. Moreover, the use of logarithms allows us to interpret the estimated coefficients as elasticities.

On the other hand, Eq. (4) measures the volume of production in levels, which is equivalent to the original specification of Davis andWeinstein.We feel an alternative presentation of the model in percentage variations is relevant and useful, given that the same determinants express not only that a region increases production as an effect of increased demand, but also that it includes the element of specialisation or lack of it, because it indicates the position or relative weight of each productive sector in the set of industries. The specification in proportions permits us to analyse if the change in the production of a industry is more or less than proportional to the change in demand, independently of the change in total production level; thus, it allows us to avoid false evidence ofHMEwhere the production of an industry can increase because of increases across all industries and not only because of the existence of HME. In other words, working in proportions allows us to control for the variations in the total production level.

There are also theory-based reasons for working with shares rather than levels. Krugman (1980) original model, which introduces the HME in the literature, is in fact expressed in shares. The HME concept itself and the later contribution of Weder (1995) imply working with relative terms: a change in the location of demand leads to a more than proportional relocation of industry. This is the HME. The best way to test the effectiveness of the change in larger proportions is by defining the variables in shares and not in levels.

Definitively, our proposed specification of proportions which, in our opinion, finds support in recent theory and represents a more intuitive and direct approach to the concept of HME, is:

$$\log\left(\frac{X_g^{nc}}{X^{nc}}\right) = \delta_0 + \delta_1 \log\left(\frac{\text{SHARE}}{X^{nc}}\right) + \delta_2 \log\left(\frac{\text{IDIODEM}}{X^{nc}}\right) + \delta_g^{nc}$$
$$= \delta_0 + \delta_1 \log \frac{X_g^{nS}}{X^{nS}} + \delta_2 \log\left(\frac{D_g^{nc}}{D^{nc}} - \frac{D_g^{nS}}{D^{nS}}\right) + \delta_g^{nc} \qquad (5)$$

We would like to examine further the effects of a formula like (5). The specification given in (4), in levels, derives from the supposition adopted by Davis and Weinstein that demand deviation is transmitted to production proportional to the size of the region through the scale variable *Xnc* which is also imbedded in term $\delta 0$. However, in the model in proportions suggested in (5) this hypothesis of proportionality according to size or scale of the region is completely unnecessary due to the specification itself, already relativised by size and by considering regional-and-time variations can be controlled assuming individual and time effects.2 Also, and this is very important, this relationship between demand deviation and size does not always hold, and in fact it does not hold in our data: we find that it is precisely the smallest regions that have the greatest demand deviation. In this sense estimation in proportions is conceptually superior to estimation in levels, and therefore, having discounted the effect of size there is no need to impose a hypothesis which is not necessarily demonstrable. Because of this also, we consider these results more reliable and also intuitive. Once we control region-and-year total production and the industry composition of production according to the national standards, our model tests if changes in the structural regional deviations from the national standard, which might be called idiosyncratic production, are more than proportional than changes in idiosyncratic demand.

Moreover, the RHS of (5) has a range of variation from $-\infty$ to $+\infty$, while the LHS is limited and takes only negative values, generating possible inconsistencies. In order for both sides of the equation to have the same range of variation, and following Conniffe (1993), a logistical transformation was carried out on the endogenous variable, as is usual if this is a proportion.3

An important aspect which we would like to comment on before passing to empirical application in the next section, is the introduction ofmore geography in the estimation, that is, the consideration of trade costs between regions (transportation costs, which may depend on distance, besides other elements). On one hand, any magnitude which does not change with time is controlled by fixed effects. On the other, the estimation of trade costs can be done in two ways (see Crozet and Trionfetti 2005, p. 19–20), but both need data on bilateral trade flows between regions, which does not exist in the Spanish case.4 Consequently, like Davis and Weinstein (1999), we do not introduce trade costs in the estimation, believing that our results can be understood, perhaps, as a conservative estimation of the existence of HME, given that Davis and Weinstein (2003) appear to confirm that a more explicit consideration of geographic factors such as trade costs tends to increase the probability of detecting HME.

Definitively, the model to estimate is expressed in Eq. (6), where our interest centers on the part played by demand deviation, i.e., the sign and magnitude of $\beta 2$.

$$\log\left(\frac{\frac{X_g^{nc}}{X^{nc}}}{1-\frac{X_g^{nc}}{X^{nc}}}\right) = \delta_0 + \delta_1 \log\left(\frac{\text{SHARE}}{X^{nc}}\right) + \delta_2 \log\left(\frac{\text{IDIODEM}}{X^{nc}}\right) + \delta_g^{nc} \quad (6)$$

4 Database

Regions were taken as the geographical units of reference, as the regional scope is better suited than the international for quantitative testing of HME, as seen in the better results obtained by Davis and Weinstein in a reduced ambit (the regions of Japan as opposed to OECD countries). Also, this could be more convenient in the case of internal trade barriers as the previous test for Spain HME suggests.

The main source of statistics was the publication *Renta Nacional de España y su Distribución Provincial*, Fundación BBVA (1999, 2000). The data provided on Spanish manufacturing industry are the following: production of regions by industries (value of total production and gross value added to factor cost) and total employment in the regions by industries.

The productive capital factor data also came from the Fundación BBVA (2002), specifically their publication *El Stock de Capital en España y su Distribución Territorial* (1964–2000). Data on land productive factors were obtained from the statistical

service of the Ministry of Agriculture and correspond to productive land area. The productive manufacturing industries in the sample are the following: Food, Beverages and Tobacco (1), Transport Equipment (2), Basic Metals (3), Paper, Publishing and Printing (4), Plastics, Rubber, Wood, Cork and Furniture (5), Non-Metallic Mineral products (6), Metal Products and Machinery (7), Chemical Products (8) and Textile, Leather and Footwear (9).

The total sample comprises a panel of 2448 observations, as there is information on 17 autonomous regions, 9 productive manufacturing activities and 16 years (odd years from 1965 to 1995). The description of our data summarised in Fig. 1 suggests to us that an amplified average in output might be found in the industries food, beverages and tobacco (1), transport equipment (2), plastics, rubber, wood, cork and furniture (5), non-metallic mineral products (6) or metal products and machinery (7), on average and for the whole period.

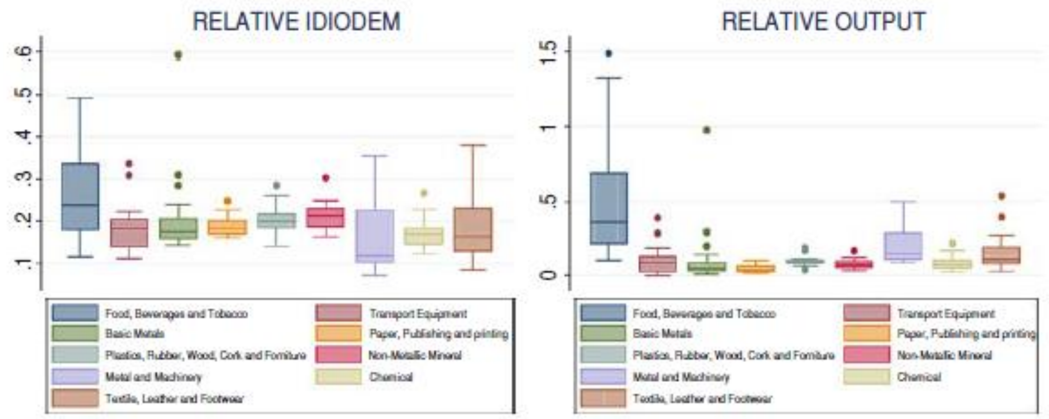

Fig. 1 Data description

5 Empirical estimation and results on the existence of HME

Empirical estimation of (6) presents a problem of simultaneity, which was confirmed by the specification test of Hausman (1976). In this case the set of instruments which allow us to correct endogeneity considers factor endowments: the contemporary K/L (capital-labour) and K/T (capital-land) ratios.5 Also, as we consider data with a geographical component, the possible presence of spatial autocorrelation has been tested. The pertinent contrasts, I by Moran (1950) and C by Geary (1954), at a 5% significance level, unequivocally show the absence of spatial autocorrelation in the variables used in this work.

In the first phase the Eq. (6) was estimated industry by industry, giving an initial approximation of the importance of the HME. However, estimations industry by industry do not take into account the interdependence which can exist between the different equations, given that, although in logarithms and with logistical transformation, the dependent variables are expressed as proportions of one total production. Therefore, it makes sense to consider the joint estimation of the system of equations, combining the panel data technique with instrumental variables and SURE (3SLS-PANEL). This allows us to obtain a more efficient estimation and an additional contrast of the existence of HME. The same instruments have been chosen as in the individual equations. The results, by industry or jointly, are identical and robust, so we present only the latter. Table 1 shows the results with the whole sample (first three numerical columns) and without outliers (last three columns). In both cases, as usual, time specific effects have been taken into account. As can be seen, the HME is present, with and without outliers, in the following industries: transport equipment (2), plastics, rubber, wood, cork and furniture (5), non-metallic mineral products (6) and metal products and machinery (7).

(TABLE 1)

The application of the specified model to Spanish manufacturing takes the period 1965–1995 (odd years only) as reference. The conclusions obtained reflect the changes and impulses which arose starting with the 1960s, with the opening up of the Spanish economy to the outside world, the stabilisation plan of 1959 and greater flexibility in its internal markets. These were the boom years of the 1960s, and later, integration into and catching up with Europe.

In the decade of the 1960s there was a very marked specialisation of Spanish manufacturing industries in traditional activities with internal demand and relatively low technological content, corresponding to industries 1, 3, 4, 6 and 9. This period marked the beginning of certain changes in interindustrial specialisation, reducing the weight of the more labour intensive activities (industries 5 and 9) and producing an increase in capital-intensive industries, i.e., the more advanced or with higher demand and technological content (industries 7 and 8, which include office equipment and other machinery, electric materials and accessories and chemical products). Traditional activities still have greater weight, but less markedly, as the advanced industries have grown at a faster rate.

We have seen that HME exists in industries 2, 5, 6 and 7. Industry 7 has a higher percentage of gross added value than the others; moreover, it has become more important in production due to an increase in productivity levels, as is also the case with 6, despite being a traditional activity. Industry 5 produces intermediate and final products with intensive processes and strong increasing returns, these last being the most important determinants of location of economic activity in Spain between 1979 and 1992, according to Paluzie et al. (2001). Finally, industry 2 features economies of scale, making its size a relevant variable and making Spain one of the world’s leading producers of motor vehicles.

This abundant evidence of HME since the 1960s contrasts with the scanty evidence obtained by Rosés (2003) for the period before 1910. His conclusions attribute the process of industrialisation exclusively to factor endowments (HO) and remark on the minor influence of HME in Spanish industry. Because of this, it appears that over time the mechanisms of agglomeration propounded by the NEG have acquired a certain relative importance. However, factor endowments have not necessarily lost their importance in industry location in Spain, but rather can coexist as determinants along with the importance of the internal market. The explicit analysis of the joint effect of factor endowments and demand elements is examined in the following section.

Finally, we should refer to the limitations of the results obtained so far. Principally, absorption of demand through gross value added to factor cost is approximate, due to the absence of data on intermediate consumption, imports and exports for our sample. Not allowing for intermediate demand, which represents a fundamental mechanism of agglomeration through backward and forward linkages, could be the reason that, for example, in industries such as textiles HME is never found, skewing the results, essentially because this industry is fed by intermediate consumption of other industrial activities.

6 Heckscher–Ohlin (HO) versus home market effect (HME)

The fact that factor endowments are an essential determinant of output assures a potentially relevant role for neoclassical trade theory. Depending on the degree to which regions specialise in the more intensive factor-abundant industries, endowments are important elements when explaining industrial specialisation.

Rosés (2003), investigating the impact of the HO model on production location in Spanish provinces of the 19th century, concludes that endowments account for nearly 85% of the variation in manufacturing output. At the same time, he emphasises that his estimations of the HO model do not necessarily reject an interpretation of differences in regional levels of industrialisation based on forces of Economic Geography. The development of a region does not depend solely on its own factor endowments, but also on the effects of market size, i.e., endowments alone may not be enough to explain the whole story. In this context, our specification is as follows, where the SHARE variable is replaced by regional factor endowments, combining directly the HO theory with the NEG in the determination of location patterns in Spanish manufactures:

$$\log\left(\frac{\frac{X_g^{nc}}{X^{nc}}}{1-\frac{X_g^{nc}}{X^{nc}}}\right) = \beta_0^* + \beta_1^* \log\left(\frac{\text{IDIODEM}}{X^{nc}}\right) + \beta_2^* \log\left(\frac{K}{L}\right)_g^{nc} + \beta_3^* \log\left(\frac{K}{T}\right)_g^{nc} + \beta_g^{*nc} \tag{7}$$

The results of the estimation are very similar to those of Eq. (6) and corroborate the presence of HME in the same industries, and so in order to avoid repetitiveness they are not presented.

Consequently, the emphasis in this section is placed on very different aspects than in the last section. In the previous study we have tried to determine statistically if the mechanism reflected in the IDIODEM variable has a qualitative impact on the pattern of production. Our objective now is to quantify the importance of HME as opposed to factor endowments (see Schumacher and Siliverstovs 2006). To this end, we use the appropriate technique, that of β-coefficients, as proposed by Leamer (1984). For this, we use a statistic which permits investigation of which independent variables aremore important in explaining movements in the dependent variable. In order to calculate this statistic we take *Z* as the matrix of observations for the independent variables and *ZM* the same matrix with the entries of the variable(s) *M* equal to its sample average.[6] βM is defined as follows:

$$\beta^M = \sqrt{\frac{\frac{1}{1-n}(\beta Z - \beta Z^M)'(\beta Z - \beta Z^M)}{\sigma_X^2}} \tag{8}$$

where n is the number of observations and $\sigma 2X$ the variance of the dependent variable.

(TABLE 2)

In other words, βM explains how the standard deviation of the dependent variable can be explained by a movement of the standard deviation in the variable(s) M. The results of this calculation for the nine productive industries appear in Table 2.

The β-coefficientsIDIODEM indicate how a movement in the standard deviation of idiosyncratic demand modifies the standard deviation in production by a certain percentage. The βFACTOR ENDOWMENTS indicate how a movement in the standard deviation of factor endowments (measured by the K/L ratio)modifies the standard deviation in production by a certain percentage.

The results are again coincident. In four of the industries (industries 2, 5, 6 and 7), Economic Geography is more important for these industries at a regional level for two reasons: first, because HME appears in them and second, because it is proven that in these industries βIDIODEM > βFACTOR ENDOWMENTS.

Regarding the weight of factor endowments (K/L ratio), we observe that in industries 3, 4, 8 and 9 this is the element with the most power of explanation, although in the last the differences are minimal. In industry 1, variation in production is more sensitive to internal demand than factor endowments, but not enough (see the section above) to present theHME. Definitively, the internal market mechanism plays a greater part than endowments in industries such as transport equipment (2), plastics, rubber, wood, cork and furniture (5), non-metallic mineral products (6) and metal products and machinery (7),which also present evidence of HME, which is perfectly consistent. In other words, the results obtained in Sects. 5 and 6 can be seen to be systematic.

To conclude this analysis, we can affirm that there is evidence that both mechanisms, HO and HME, coexist and complement each other as explaining factors in production location.

7 HME dynamics

An additional relevant point for a better understanding of the HME phenomenon in Spanish regions is the analysis of its temporal dynamic during the period analysed.

In this paper the existence of HME is contrasted for a relatively long period of 30 years. It indeed would make sense to consider how it has evolved over time. In this section we will attempt to contrast if there is a change in behaviour over time relating to HME. In order to do this we have repeated the analysis for two sub-periods: one at the beginning of the sample and the other at the end, eliminating the intermediate years, characterised by the instability of the periods of the two oil crises (1974–1984). The first sub-period (1965–1973) was a time of rapid increase in the per capita GDP and of convergence with the rest of Europe; years of accelerated industrial growth, an important opening up to external trade and foreign investment, great improvements in productivity and fast growing demand. The second period (1985–1995) is a time of integration in Europe after

Spain joined the EU. Here there is a significant change in the rate of economic growth with a very similar evolution to that of the EU countries: greater capacity for generating employment, although with small improvements in productivity which did not help to correct the imbalances related to inflation and external debt. The intermediate years witnessed political transition, economic crisis, industrial reconversion and divergence from Europe in terms of per capita income. Thus, the analysis has been repeated for each sub-period and the possible existence of a significant change in the coefficient of the IDIODEM variable, indicative of the existence of HME, has been contrasted. The estimation was carried out for the branches which present HME in the total period and as with this case with contemporary and retarded instruments.

Table 3 presents the IDIODEM coefficient for the first and second sub-periods and the *t*-statistics which contrast the significance of their difference, with contemporary instruments and 3SLS estimation with time specific effects.

(TABLE 3)

In our opinion, the conclusions which can be drawn from the above table are extremely interesting. First, eliminating the years of the energy crises makes the HME mechanism much more relevant. In fact, it not only appears in industries 2, 5, 6 and 7, which we already knew; it also appears for the first time in industries 1, 3, and 8, and in the second subperiod of industries 4 and 9. Here one might explore whether the HME is, to some extent, procyclical, given that it has greater importance in the positive phases of economic cycles. In other words, intense crises can make the weight of internal demand tend to diminish in a context of increasing scale returns and transport costs. What is obvious is that the perturbations of the crisis interfere with the HME mechanisms.

Second, the HME shows different intensities in both subperiods. It is stable over time in industries 6 and 7, diminishes in 1 and 2 and increases in the other five industries.This sectorial analysis demonstrates that the relevance of the HME tends to grow over time, although we believe this result needs further empirical evidence to corroborate it.

8 Conclusions

The purpose of the study was to identify empirically the existence of the home market effect (HME) in Spanish manufactures, i.e., we have tried to analyse the presence and importance of these effects in the determination of production location in Spain. For this, we have used as a basis the theoretical models of Krugman (1980) and Weder (1995) and the successive empirical analyses of Davis and Weinstein (1996); Davis and Weinstein (1999, 2003).

The empirical test carried out for 17 regions and 9 industrial sectors from 1965 to 1995 lends support to the hypothesis of the existence of the HomeMarket Effect. This evidence exists in an important number of productive industries; specifically, HME is found in 4 of the 9: transport equipment (2), plastics, rubber, wood, cork and furniture (5), non-metallic mineral products (6), metal products and machinery (7). We want to highlight that these results were obtained with a new specification proposed here, a more intuitive definition of HME as a mechanism of agglomeration of productive activity, which also presents conceptual advantages.

At the same time there is remarkable, wider evidence if the years of economic crisis are left out the analysis, together with the increasing HME over time. The widespread existence of HME in recent Spanish industry contrasts with earlier periods, such as the first industrial revolution, when Heckscher–Ohlin mechanisms predominated over the HME in our manufactures (Rosés 2003).7 This demonstrates that the cumulative factors proposed by the New Economic Geography have now become more relevant. This conclusion has been confirmed in the works of García Pirés (2006) and Paluzie et al. (2007), which also analyse the incidence of the NEG on the Spanish economic landscape.

Furthermore, we have found that factor endowments are still relevant in industrial location in Spain, being especially predominant in basic metals (3), paper, publishing and printing (4), chemical products (8) and textile, leather and footwear (9).

In any case, HO and the NEG coexist, in different intensities according to industry, as determinants of the industrial geography of Spain. This key result confirms all the empirical evidence accumulated to date on the HME. In the words of Head and Mayer (2004, p. 2641) "results are again mixed for the HME".

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FOOTNOTES

1 In the Sect. 3 we explain how HME happens when the coefficient of IDIODEM is greater than one.

2 This region-time variation is controlled statistically by the existence of individual effects in the estimation, contrasted statistically by Hausman's test. We also would like mention that this variation is not very big, with quite stable scale in regions along time which can be caught by the individual effects.

3 There are other reasons, apart from mathematical consistency, to justify the use of the logistical transformation. From a statistical point of view, the random perturbation in (6) has a distribution closer to normal than that of (5) with a truncated variable. From an empirical point of view, we have found that the results in terms of HME are transformation-robust, corroborating the statement by Greene (2003) that the difference is negligible and would be relevant only for very extreme values of IDIODEM.

4 The estimation made by Josep Oliver on bilateral trade flows between Spanish regions only covers the final part of our sample period.

5 Both contemporaneous and one year lagged endowments have been considered, with similar results omitted here for shortness.

6 M is the IDIODEM variable or the factor endowments variables, grouped by the K/L ratio.

7 Rosés (2003) does not deny the presence of economic geography effects in the period corresponding to the first industrial revolution in Spain, although he argues that elements of specialization as described in the H-0 theory had greater explanatory capacity in this phase of Spanish economic development.

Table 1 Existence of HME (3SLS-PANEL)

	PROPORTIONS			PROPORTIONS NO OUTLIERS		
	SHARE	IDIODEM		SHARE	IDIODEM	
1. Food, beverages and tobacco	0.07 (0.85)	0.28* (2.39)	R^2 Adj = 0.91	0.19* (2.58)	0.06 (0.56)	R^2 Adj = 0.99
			Nobs = 272			Nobs = 257
2. Transport equipment	−1.20 (−0.45)	3.75* (11.87)	R^2 Adj = 0.24	0.71 (0.28)	4.23* (13.12)	R^2 Adj = 0.29
			Nobs = 272			Nobs = 272
3. Basic metals	1.31* (19.95)	0.39* (4.01)	R^2 Adj = 0.92	1.13* (17.16)	0.63* (6.60)	R^2 Adj = 0.99
			Nobs = 272			Nobs = 227
4. Paper, publishing and printing	0.87* (12.54)	0.39* (3.18)	R^2 Adj = 0.90	0.94* (17.34)	0.26* (2.64)	R^2 Adj = 0.90
			Nobs = 272			Nobs = 272
5. Plastics, rubber, wood, cork and furniture	0.29 (0.69)	2.22* (35.60)	R^2 Adj = 0.84	−7.52 (−0.67)	8.59* (3.07)	R^2 Adj = 0.14
			Nobs = 272			Nobs = 242
6. Non-metallic mineral products	1.19* (13.02)	2.62* (39.03)	R^2 Adj = 0.91	1.27* (13.43)	2.65* (36.94)	R^2 Adj = 0.91
			Nobs = 272			Nobs = 272
7. Metal products and machinery	−6.47 (−0.73)	1.13* (10.84)	R^2 Adj = 0.33	−5.58 (−0.70)	1.14* (12.01)	R^2 Adj = 0.40
			Nobs = 272			Nobs = 272
8. Chemical products	13.01* (2.58)	0.08* (2.79)	R^2 Adj = 0.05	27.87* (2.54)	0.75* (6.32)	R^2 Adj = 0.57
			Nobs = 272			Nobs = 257
9. Textile, leather and footwear	1.09* (25.22)	−0.52* (−7.63)	R^2 Adj = 0.91	1.09* (24.88)	−0.53* (−7.44)	R^2 Adj = 0.90
			Nobs = 272			Nobs = 272

The t statistics are in parentheses. All estimations include individual and time specific effects and contemporaneous endowments as instruments. The results are robust using lagged instruments

*Significance level of 5%

Table 2 β-Leamer's coefficients

	3SLS-PANEL	
	$\beta^{IDIODEM}$	$\beta^{FACTOR\ ENDOWMENTS}$
1. Food, beverages and tobacco	0.15	0.01
2. Transport equipment	0.08	0.04
3. Basic metals	0.04	0.30
4. Paper, publishing and printing	0.03	0.29
5. Plastics, rubber, wood, cork and furniture	0.91	0.07
6. Non-metallic mineral products	0.86	0.52
7. Metal products and machinery	0.94	0.27
8. Chemical products	0.11	0.60
9. Textile, leather and footwear	0.26	0.27

See footnote of Table 1

Table 3 HME dynamics (3SLS-PANEL)

	Coefficients of IDIODEM (t test)		
	Initial-coeff (1965–1973)	Final-coeff (1985–1995)	Final coeff against initial coeff
1. Food, beverages and tobacco	2.02*	1.51*	11.89
2. Transport equipment	6.11*	3.19**	3.19
3. Basic metals	2.88*	3.61*	−5.25
4. Paper, publishing and printing	−0.004	3.54*	−1.82
5. Plastics, rubber, wood, cork and furniture	2.17*	2.32*	−1.97
6. Non-metallic mineral products	2.68*	2.56*	0.98
7. Metal products and machinery	1.19*	1.16*	0.96
8. Chemical products	2.61*	3.21*	−3.38
9. Textile, leather and footwear	−0.12**	2.42*	−41.76

See footnote of Table 1