Geographic Concentration and Increasing Returns: a Survey of Evidence*

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Abstract

Economic activities are highly clustered. Why is geographic concentration becoming a predominant feature of modern economies? On the basis of the empirical models developed by the 'new' theories of international trade, our answer is that increasing returns are the driving force of economic geography in the US as well as in Europe. In so doing, we review econometric methods proposed in the literature to separate and to test alternative theoretical paradigms.

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1 Introduction

The geographic concentration of activities is a relevant feature of the economic landscape. Scale agglomerations are observed to emerge at different spatial level ranging from technological and financial districts, such as the Silicon Valley, the Route 128 and the City in London, to industrial clusters that cut across states and country boundaries, such as the US 'manufacturing belt' (included in the parallelogram Green Bay - Saint Louis - Baltimore - Portland) and the European manufacturing core (represented by the area between South East England, Ruhr Valley, South East France, Southern Germany and Northern Italy).

The locational Gini index, which measures the share of local manufacturing employment onto the total labour force in the spatial unit of analysis, has been employed as a rough measure of agglomeration on both US and European data. Kim (1995) analyses the US regional specialization pattern over a long time series, 1860-1987, showing that industries have been highly concentrated when the US was becoming an integrated country before the First World War, although since the interwar years locational clustering has been falling. Amiti (1997 and 1998) and Brulhart and Torstensson (1996) mirror these results by computing several descriptive statistics for the Europepean Union (EU). The evidence for most manufacturing sectors in most countries shows an increase in manufacturing specialization between 70s and 80s, with particular relevance in the second half of the sample.

Such an evidence does not provide of course a rigorous test for the existence of economic geography effects but it can be viewed as a prelude for the empirical evidence reviewed here. Indeed, industries appear to be more highly concentrated than the neoclassical theory of comparative advantages

predicts and therefore a better understanding of the determinants of geographic concentration is strongly needed. To this end, we discuss some recent contributions to the empirics of economic geography in order to establish the relative ability of standard versus 'new' theories to rationalize the observed clustering of industries at both international and interregional level. By discussing three different econometric approaches to spatial economics, we point torwards increasing returns as the dominant driving force of geographic concentration, in line with the predictions of the 'new' theories. We take such an evidence as a promising deal for future research to be devoted to developing richer and more realistic empirical models of 'new' economic geography.

By providing a review of economic geography models our purpose lines up with those of previous surveys, although with several important departures. Ottaviano and Puga (1998), and Schmutzler (1999) discuss the heuristics behind the theory of the 'new' economic geography while Fujita, Krugman and Venables (2000) provide a more formal and encompassing treatment of the different branches of the spatial economics. On the empirical side, Amiti (1998) shows interesting descriptive statistics for the EU whereas the stimulating and informal analysis in Brulhart (1998) is mainly focused on location trends (i.e. on evidence of industrial specialization from the analysis of intra- and inter- industry trade). In contrast, this paper not only gives a predominant role to increasing returns in explaning industrial clustering but also presents several formal alternatives to test for it. In so doing, we assess the empirical importance of increasing returns both in the US and in the EU in a general formulation that can be easily extend elsewhere.

The paper is organized as follows. Section 2 provides a brief overview of the main predictions of Neo-classical, 'New' trade and 'New' economic

geography theories while the rest of the review is devoted to the description of rigorous tests. In particular, based on Krugman (1980), which provides a characterization of New trade models, we discuss in section 3 the empirical importance of domestic demand, the so-called home-market effect, to trigger off agglomeration. Section 4 brings the Krugman model (1991) of new economic geography to data, thereby establishing the relevance of market access to create sufficiently strong incentives for firms to locate close to consumers. In section 5, we investigate the empirical link between small and large scale agglomerations by sheding lights on how evidence of the former can be tracked to detect presence of the latter. We conclude with a summary of the state of the art aiming at pointing out directions for further research.

2 Economic geography at glance

Before discussing the empirical relevance of competing theories in international trade on geographic concentration, we consider worthwhile to give some structure to the intellectual backgrounds behind the different contributions. Any synthetic overview of this wide literature is destined to be incomplete, to lack a rigorous treatment and therefore to be an over-simplification of the evolutions in the literature. Nevertheless, in this section we bring side by side the predictions as well as the assumptions of the neo-classical and the 'new' theories of international trade in order to outline a layout for our survey of evidence.

Perfect competition, homogenous products and constant returns to scale characterise the Heckscher-Ohlin world, which represents the building block of the *Neo-Classical Theory* (NCT). The distribution of firms is exogenously determined and it is strictly dependent on the initial spatial distribution of technologies and natural endowments across regions. The pattern of loca-

tion evolves according to the pattern of comparative advantages: in a 2 region-2 goods-2 factors world, economic activities are organised where the opportunity cost of producing one good in terms of the other is lower and considerations regarding the spatial distribution of the demand do not enter the models. The volume of trade is exclusively determined by inter-industrial specialisation while the direction of trade is driven by the prediction that countries export the goods whose production is relatively intensive in the relatively abundant local factor. Hence, the lack of differences in technologies and factor endowments between any pair of countries implies that economic activities are evenly distributed and only few trade occurs across them.

These predictions turn out to be at odds with the evidence that even regions originally 'similar' in terms of technologies and relative factor endowments are capable to develop different patterns of industrial location. Moreover, in such a framework, there is no room for intra-industry trade, which largely determine the flow of exchanges between 'similar' countries, the so-called 'north-north' trade.

The *New Trade Theory* (NTT) models seek to overcome the counterfactual predictions of the NCT by explicitely modeling scale economies in the manufacturing sector. The market structure is the monopolistic competition à la Dixit and Stiglitz (1977) with increasing returns, product differentiation and love-of-variety consumers introduced to trigger off a process of circular and cumulative causation (see Myrdal, 1957). On the one hand economic activities concentrate in one single place to realise economies of scale, on the other hand they locate where a large consumer market exists to minimise transportation costs and have a good access to product markets. In this scenario each country will export the goods for which it has a relatively large domestic demand. This is referred as home-market effect.

The equilibrium numbers of local firms (and therefore of local varieties) is completely determined by the models in the usual Chamberlinian fashion while the home-market size (characterised by the number of workers, typically the immobile factor) remains the only element kept exogenous. Whenever trade barriers are substantial, economic activities spread out and intra-industry trade takes place as well as inter-industry one. However, as long as trade costs fall, the production of differentiated goods (the ones exhibiting increasing returns) concentrate wherever the consumer market is large (i.e. in the core) to enjoy the pecuniary externalities of that location and eventually intra-industry trade vanishes.

The *New Economic Geography* (NEG) approach embodies all the technical progress of the NTT but it moves one step ahead assuming labour mobility. Now, even the equilibrium market sizes are determined within the models and the distribution of economic activities becomes fully endogenous. This framework is built upon a featureless two or three-dimensional space with factors and goods at early stages evenly spread in space. Relative endowments and technologies are assumed to be identical across locations in order to avoid comparative advantages and the geographic concentration is driven by the interaction of transportation costs and scale economies, which creates demand and cost linkages. Demand linkages represent the incentive for producers of both final and intermediate goods to locate close to buyers, whereas cost linkages refer to the incentive for consumers of both final and intermediate goods to locate close to suppliers[1]. Opposing agglomeration are congestion costs, which arise from the limited local supplies of nontradable factors and goods like houses.

The system of goods market clearing conditions in the increasing returns

[1] The dichotomy demand - cost linkages is due to Hirschman (1958).

sector characterises the solution and since it is non-linear in wages, numerical computations are needed. The models are characterized by multiple equilibria, as which regions host the industrial cluster is indeterminant. However, depending on the value of the scale economies parameter, an unambigous result emerges: the relationship between level of trade costs and agglomeration is non-monotonic as the world experiences a polarised core-periphery structure when countries are integrated and dispersion when transportation costs are high.

The different approaches to trade theory are summarised in Table 1.

Insert Table 1 about here

3 The home-market effect

The analysis of domestic demand is crucial to distinguish between a model based on comparative advantages and one based on IRS. In the former case, unusually strong home-demand for a good, *ceteris paribus*, will make that good an import because of diminishing returns to scale at plants level, whereas in the latter one, the opposite is true since an unusually strong domestic demand encourages location in that site to realise scale economies and makes that country an exporter of that good.

Krugman (1980) formalises these considerations in a Dixit-Stiglitz framework (1977) and assumes the existence of two types of consumers each of which demanding only one of the two classes of differentiated varieties produced in the world. The equilibrium quantity of local output for each brand, μ, is derived, for the range of incomplete specialisation, as a function of the tastes of the majority of local consumers, $\mu = \left(\frac{\lambda-\nu}{1-\lambda\nu}\right)$, where $\lambda > 1$ represents the majority-type local consumers in relative proportion and ν stands

for the ratio between the consumption of an imported to a locally produced variety. Notice that ν is smaller than 1 because of trade costs. Whenever idiosyncratic component to demand exists, that is $\lambda > 1$, a country concentrate the production in the variety preferred by the most of local population, and thus $\mu > 1$. However, in order to have a domestic increase in production large enough to make that country an exporter of the local preferred good, one has to check out if the derivatives of μ with respect to λ is bigger than 1, that is, whether the home-market size makes the idiosyncratic high local demand effect 'magnified'. Notice that this derivative is crucial in comparing standard and 'new' theories since in the former, it can be at most equal to one.

Davis and Weinstein (1999 and 2001) borrow the analytical apparatus in Krugman (1980) to nest the idiosyncratic component of demand into a factor endowment model to evaluate their relative ability in explaining local production.

The total number of goods is assumed to equal the number of primary factors, that is, $\sum_{n=1}^{N} G_n = F$, where N stands for the total number of industries, G_n amounts to the number of goods in industry n and F represents the factors of production. Assume that all regions are diversified in production and let technology be a Leontief one with constant returns to scale. Denote g the vector of goods in industry n for country r as:

$$X_g^{nr} = \quad {}_g^n V^r \tag{1}$$

where $g^n \in G_n$ for any $n = 1, .., N$ and such that V^r is a vector of factor endowments. The technology, ${}_g^n$, shared by all locations, is described by an HxH matrix for goods g's in industry n, with $H < F$. The last assumption about H implies that not all primary factors are included in the empiri-

cal model and therefore, all the explanatory power of the missing ones is captured by the error term in this simple Hecksher-Ohlin world.

Home-market size effects are introduced à la Krugman (1980) with the idiosyncratic demand in country r for a good g in an industry n defined as:

$$IDIODEM_g^{nr} = \left[\left(\frac{D_g^{nr}}{D^{nr}}\right) - \left(\frac{D_g^{nW}}{D^{nW}}\right)\right] X^{nr} \tag{2}$$

X^{nr} is equal to $\sum_{g=1}^{G_n} X_g^{nr}$ whereas the two terms in squared parenthesis represent respectively the domestic and the world absorption of the good g as a fraction of the total domestic and world absorption. As pointed out in Davis and Weinstein (2001), the term D_g^{nr}, should not measure only the internal demand (i.e. the one made by residents) but also the one coming from neighbouring countries where the importance of neighbouring demands decrease with distance (i.e. attaching to them a gravity weighting).

The other relevant variable is the relative share of good g in industry n:

$$SHARE_g^{nr} = \left[\frac{\left(X_g^{nW} - X_g^{nr}\right)}{\left(X^{nW} - X^{nr}\right)}\right] X^{nr} \tag{3}$$

which makes the analysis conditioned to the absolute country-sizes. The variables superscripted by W are the world counterpart of those superscripted by r.

The following equation, coming from the ad-hoc model sketched above, is the one to be estimated in order to weight the contribution of the variables (2) and (3) in explaining the deviations of output from that predicted by (1):

$$X_g^{nr} = \alpha_g^n + \beta_1 SHARE_g^{nr} + \beta_2 IDIODEM_g^{nr} + \ {}_g^n V^r + \varepsilon_g^{nr} \tag{4}$$

Notice that the coefficient β_2 is the key one for our analysis and that it is nothing else that $\frac{\partial \mu}{\partial \lambda}$ according to the previous notation. In a comparative

advantage setting with no trade costs, the choice of location is completely independent from the spatial distribution of demand and thus, β_2 would equal zero. When one considers also trade costs, an high local demand tend to cluster the production of that goods to minimise transport services and the relationship between idiosyncratic demand and production structure will be positive but at most one-to-one, that is $\beta_2 \in (0, 1]$. Finally, as discussed above, the interaction between scale economies and trade costs implies that $\beta_2 > 1$. The set of equations described in (4) can be estimated individually or using SURE method.

Davis and Weinstein (2001) nest comparative advantages and increasing returns assuming that while only factor endowments determine the structure of production at 3-digit level, economic geography considerations might help to determine 4-digit production. The most disaggregated data set available in 1985 is employed to capture a broad range of monopolistically competitive varieties. Labour, capital, educational level, fuel and land are used as factors of production. The authors estimate the empirical model in (4) across 54 industries at the 4-digit level for 13 OECD countries, 6 of which belong to the EU (namely, Belgium, France, Germany, Italy, Netherlands and UK) and across 26 sectors at the 3-digit level for 22 OECD countries, of which 10 are Union's member (namely, the previous six plus Greece, Ireland, Portugal and Spain). The findings, at this stage, are a bit puzzling. While, the former case displays β_2's that are bigger than one for half of the industries of interest (with increasing returns sectors accounting on average for 64 per cent of total output variation), the latter seems to corroborate the comparative advantage approach since output is highly correlated with factor endowments for 18 sectors out of 26. However, home-market effects matter in some industries such as textiles, iron and steel, transportation

equipment, precision instrument, pottery and china, plastic products and tobacco products which together explain one half of the total output variation. The results for the latter case are shown in Table 3 (only sectors with β_2 larger than one are reported).

Insert Table 2 about here

Davis and Weinstein (1999) repeat the exercise at regional level to explore whether this setting is the relevant geographical one at which increasing returns matter. The estimates across 19 industries in 47 Japanese prefectures in 1985 support the presence of significant home-market effects in the case of the 8 sectors displayed in Table 4. Moreover, on average a one-standard deviation increase in idiosyncratic demand move production by a half standard deviation.

Insert Table 3 about here

Looking at such an evidence, one can conclude that economic geography is more important for the regional structure of production than for the international one. In particular, comparative advantage based theories explain trade across countries reasonably well, while 'new' theories do a good job across regions. However, as argued by Brulhart (1998), even if this might be potentially true for the NTT, home-market effect might not be the adequate test for NEG models since in the latter, the domestic market size is an endogenous variable and so far no much analytical concern has been given to it. Heuristically, one might expect that agglomeration would cause idiosyncratic demand to impact on local output more than proportionally (i.e. $\beta_2 > 1$) but the point is that this has not been formally proved yet.

4 The demand linkages

Scale economies and transportation costs give each firm an incentive to organize production in a single plant and to locate that plant where a large consumer market exists. The better the market access in one place the stonger the demand linkages are in that place, which becomes a good candidate to host an industrial cluster. It follows that by assessing the importance of increasing returns in the global economy one can establish the relevance of market access in making production geographically concentrated. A simple way to do this is to estimate the spatial labor demand function as embodied in most of the new economic geography models since it is proximity to customers that determinates nominal wages in a given location.

The Krugman model (1991), which originates such a literaure, provides a very simple and suited setting for this kind of analysis[2]. In a 2-region 2 sector world, manufacturing firms have some monopoly power à la Dixit and Stiglitz (1977) producing under increasing returns only one variety of a tradable good. The other sector represents housing services, which are supplied inelastically in perfectly-competitive markets. Workers in the industrial sector are perfectly mobile between regions and consumers are love-of-variety. Transportation costs enter the models as iceberg cost à la Samuelson (1954) such that for each unit shipped from location j to location k it arrives only the fraction:

$$v_{jk} = e^{-\tau d_{jk}} \tag{5}$$

since a part of the good melts away on the road, just like an iceberg. The transportation cost are denoted by τ and d_{jk} is the distance between any

[2] Indeed, following Hanson (2000), I refer to Thomas' (1997) variation of the Krugman model, which, although keeping the same richness of the original model, is empirically more tractable.

pair of locations.

The equilibrium for the model is described by five sets of conditions, including the real wages equalization across regions, the market clearing on both sectors, the labor-demand function and the free entry condition in the manufacturing sector. Depending on the parameter values, the geographic equilibrium is characterized by a small number of industrial clusters coming from the 'arm-wrestling' of two forces. On the one hand, increasing returns at plants level make concentration sustainable since a balkanisation of the production structure turns out to be more costly than a concentrated one. On the other hand, trade barriers and congestion costs make dispersion profitable. The fomer come from the fact that serving dispersed markets from one single location does not allow any transportation costs saving. The latter depend on more competition from local firms and higher labor costs needed to compensate for higher local housing costs in the centre. What location will be eventually prevailing depends on market-access considerations on the ground that being close to a large consumer market minimises transportation costs.

The structural parameters in Krugman (1991) can be estimated through the local labor demand equation that comes from the equilibrium conditions of the model for any location j:

$$\log w_j = \gamma + \sigma^{-1} \log \left(\sum_k^J Y_k^{\frac{\sigma(\mu-1)+1}{\mu}} H_k^{\frac{(1-\mu)(\sigma-1)}{\mu}} w_k^{\frac{(\sigma-1)}{\mu}} v_{jk}^{(\sigma-1)} \right) + u_j \qquad (6)$$

J stands for the total number of regions, γ is a convolution of fixed parameters, w_j represents the nominal wages in region j whereas Y_k and H_k are total income and housing stock in location k respectively. u_j is an idiosyncratic shock whose first difference is assumed, for reasons that will became clear later, to be uncorrelated across regions.

Equation (6) resembles a spatial labor demand function as the demand for labor is higher in regions that are close to areas with high consumer demand. Accordingly, the key parameters to be estimated are σ, the elasticity of substitution between manufactured goods and μ, the expenditure share on manufactures. In particular, the lower was the value of σ, the lower in absolute value was the own-price elasticity of demand for any variety of the good and therefore the more imperfect would result the market competition. Moreover, it can be shown that the ratio of price to marginal cost for manufactures equals $\left(\frac{\sigma}{\sigma-1}\right)$, which turns out to be relevant to measure the intensity of scale economies. Lastly, as shown in Krugman (1991) the model has unambiguous predictions on the industrial pattern of location whenever $\sigma(\mu-1)$ is greater than one since over this value scale economies and/or manufacturing shares become sufficiently high to make economic activities geographically concentrated for any value of the transportation costs.

Hanson (2000) brings the Krugman model to US data by estimating (6) with nonlinear least squares for 3,075 counties. The time dimension of the data set consists of three observations, namely 1970, 1980 and 1990. The dependent variable uses counties as units of analysis although, for computational tractability, the regressors are taken at state level. The latter choice of specification is also made to control for county-specific shocks, which are likely not to affect the entire state economy. Moreover, to avoid any form of endogeneity own-county values are subtracted from the relative state independent variables. Lastly, to control for correlation between regressors and error terms, potentially due to an unobserved fixed effect, a time-differenced specification of (6) is estimated. Table 4 reports the results.

Insert Table 4 about here

The first column shows the estimates for 1970-1980 whereas the second one for 1980-1990 and therefore they together describe the evolution of industrial concentration over time. The structural parameters, σ and μ are positive as predicted by the model. The empirical evidence suggests not only that increasing returns exist since the price-cost ratio is greater than one in both observations but also that the market has become more imperfectly competitive moving from the 70s to the 80s as the value of σ has been decreasing over time. The share of expenditure on traded goods, μ, turns out also to be consistent with the theory, although it is a bit larger than suggested by the value of 0.2 for the average expenditure share on housing. Furthermore, the convolution $\sigma(\mu - 1)$ appears to decline over time from the value of 0.76 in 1980 to 0.5 in 1990, thereby corroborating the view that production in the US will cluster in a few number of locations.

These estimates are fully consistent with the Krugman model and robust to alternative specifications of the sample, the dependent variable and the measure of distance. In an excellent simulation exercise, Hanson (2000) pushes this argument even further by showing that the effects of an income local shock on wages in surrounding counties line up with the predictions of the theory. In particular, demand linkages between counties appear to be rising over time since the impact of a negative shock turns out to be more harmful to neighbouring regions in 1990 than it was in 1980. These effects are strong and decrease rapidly moving away from the centre suggesting that although concentrations are becoming a common feature of the US economy they are limited in their geographic extent.

5 From small to large-scale agglomerations

Large-scale agglomerations are associated with externalities that depend on market interactions whereas small-scale effects are driven by physical proximity. So far at empirical level, the two issues have been handled as separated phenomena and the literature seems to neglect the relationship between the two. In this section we discuss the empirical model in Ciccone (2001) to address this point.

The author estimates a reduced form relationship between employment-density and local productivity in order to detect and measure the spatial externalities that the concentration of economic activities might bring about. The empirical model has a particularly nice feature (as shown in Ciccone and Hall, 1996): it can be derived either from a model based on small-scale agglomerations and spatial externalities or from one based on large-scale economies, factor immobility and IRS.

The production function on an acre of land in a region s belonging to a country c is given by:

$$q = \quad_{sc} \left[(nh)^{\beta} k^{1-\beta} \right]^{\alpha} \left(\frac{Q_{sc}}{A_{sc}} \right)^{\frac{\lambda-1}{\lambda}} \tag{7}$$

where q is the level of output, n is the number of workers, h corresponds to the average level of human capital of workers and k refers to the amount of physical capital. Total production and total acreage in a region s of the country c are denoted by Q_{sc} and A_{sc} such that their ratio, the local density of production, captures spatial externalities. The total factor productivity in that region is measured by $\quad_{sc}$. The parameters α and $\beta \in [0,1]$ indicate respectively returns to factors on the acre and a distribution index of factors. The key-parameter in the model is λ as positive spatial externalities exist if and only if it is greater than 1. Moreover, by considering the density

of production as an argument in equation (7), we are focusing on spatial externalities (i.e. externalities associated to physical proximity) rather than on large-scale effects, the latter being associated to the volume of output. Henceforth, the elasticity of output with respect to the regional density of production, $\left(\frac{\lambda-1}{\lambda}\right)$, is assumed to be constant. Lastly, all small letters denote variables measured per unit of land whereas capital letters equal the former times A_{sc}.

Multiplying both sides of (7) by A_{sc} we can solve the model for the average labour productivity, $\left(\frac{Q_{sc}}{N_{sc}}\right)$, as a function of the local employment-density, $\left(\frac{N_{sc}}{A_{sc}}\right)$ and the density of production in the neighbouring regions, $\left(\frac{Q_{scn}}{A_{scn}}\right)$. We yield, once logs are taken, the equation to be estimated:

$$\log\left(\frac{Q_{sc}}{N_{sc}}\right) = du\,\mathrm{mm}\,ies + \delta\log\left(\frac{Q_{scn}}{A_{scn}}\right) + \theta\log\left(\frac{N_{sc}}{A_{sc}}\right) + E_{sc} + \varepsilon \qquad (8)$$

where ε is some disturbance term capturing the differences in exogenous total factor productivity across locations and E_{sc} is some indicator of the level of education in region s belonging to country c. The coefficient δ represents the spillover effects across surronding regions whereas θ is the object of our analysis. It represents small-scale agglomeration effects since it is a convolution of the structural parameters in the model, α and β, and most importantly the parameter λ that captures spatial externalities. Region-specific dummies can be introduced to control for spatial differences in exogenous total factor productivity and basically to make the error term uncorrelated with the regressors. Since both the density of production in the neighbour regions and the employment-density may be endogenous, equation (8) is estimated via IV method[3].

Using data on some European countries at Nuts 3-level and dummies

[3] See Ciccone (2001) for a discussion of the choice of the instruments.

at Nuts 2-level[4], θ equals 4.4 with a standard error of 1 and δ amounts to 3.3 with a standard error of 1.3. These results are quite robust as changing the level of disaggregation for the dummies does neither affect the point estimates nor the level of significance. Two main conclusions can be drawn from such evidence. Firstly, small-scale agglomeration effects are relevant in France, Germany, Italy, Spain and UK being only slightly smaller than the values that Ciccone and Hall (1996) found among US counties. Moreover, local production at the most disaggregated level (i.e. Nuts-3) has a significant external effect on the productivity of neighbouring regions. The last point might call for some kind of large-scale agglomeration effects and for this reason it deserves some clarifications.

At Nuts-3 level, the unit of analysis is an area approximately 1511 km^2 large that, indeed, appears to be too small to talk about large scales. However, the analysis in Ciccone (2001) suggests that there exist some external economies that spill over regions and cut across states and country boundaries. The consequent exercise would be to implement the estimation in (8) at Nuts-2 and Nuts-1 levels since those seem to be the relevant level of disaggregation at which large agglomerations might occur. The analysis in Ciccone (2001) can be interestingly replicated taking, for instance, the regions at Nuts-1 level as unit of study. The point estimates would return the values for the θ's and δ's across locations (i.e. the parameters referring to the agglomeration and to the neighbouring spillover-effects), and in turn, the ones for the λ's (i.e. the impact of the local density of production on the level

[4] The data source is Eurostat, which divides each EU country into Nuts 1-regions, each Nuts 1-region into Nuts 2-regions and each Nuts 2-region into Nuts 3-regions. Nuts 1-region stands for some group of administrative regions. Nuts 2-region corresponds to one single administrative region. Nuts 3-region represents administrative counties like, for instance, Départments in France, Kreise in Germany, Provincie in Italy, Provincias in Spain and Counties in UK.

of regional output). These findings would allow drawing an agglomeration-map for the EU in terms of the intensity of spatial externalities. Such an evidence would detect whether there exists some core in the Continent characterised by strong agglomeration-effects per sé and surrounded by other regions that exhibit high but smaller values of the parameter λ (i.e. weaker but still relevant spatial externalities). If such a scenario turned out to be the relevant one, the Continent would be characterized by small-scale effects that become larger the smaller is the distance from the centre, thereby suggesting a track from small to large-scale agglomeration effects.

6 Summary and concluding remarks

This paper reviews the empirical literature on large-scale agglomerations by discussing and evaluating the predictions of the neo-classical versus the 'new' theories of international trade. Since industrial clustering appears to be a relevant feature of the geographic landscape, an explanation of why agglomeration occurs is needed among the alternatives provided in the literature. Neo-classical theories argues that concentration may be triggered off by the relative abundance of natural endowments, New trade theory predicts agglomeration effects wherever a large market access exists while New economic geography shows that demand and cost linkages may rationalize a core-periphery structure of production. This survey points towards increasing returns as the dominant driving force of economic geography, thereby lining up with the predictions of the 'new' theories. However, the effects predicted by the 'new' theories seem to be less relevant for the international structure of production than for the regional one.

The natural question at this stage is what indications and insights the empirical results obtained so far can give for the development of world trade

agreements and in particular for the geographic evolution of the production structure in a union like the EU. If the estimated coefficients on idiosyncratic demand really capture fundamental demand and cost linkages, then one can reasonably expect that these effects will characterise the respective increasing returns industries in the Continent following a deeper integration. On the line of the empirical works done by Davis and Weinstein, home-market effects may be interestingly estimated within the EU using the most disaggregated data at Nuts-1 and 2 level. The analysis would allow checking out whether some economic geography effects are present in Europe even at a broader regional level than in Japan.

Considering the structural rigidities in the European labour markets at international level but the good flexibility at regional level (Eichengreen, 1993), future empirical studies might focus on a kind of agglomeration à la Hanson (1996). According to this, the firms of a specific sector would cluster together in a core, whereas their linked economic activities and relative employees would locate in the frontier regions of the countries surrounding this core. Such a movement would allow many producers and workers to live in their native countries, keeping the benefits of the linguistic and cultural community, and, in the meanwhile, to have good access to the large markets beyond the borders. A wage gradient analysis could check out this scenario. The idea is to test whether a particular country/region exhibits a gravity wage structure with wages that increase monotonically as one moves towards the centre, as predicted by the 'new' theories (see Hanson, 1997). Moreover, if a stability test like the one described in Andrews (1993) found statistically significant structural breaks in wage gradients time-series (each one corresponding to a different stage of trade liberalisation), it would be supportive of the presence of some agglomeration effects due to economic

integration.

Hanson's study (2000) points out another line of research. His findings are strongly supportive of the results in Krugman (1991): basically, demand linkages due to larger markets decline fastly with the distance between regions. Future empirical analysis could estimate the parameters of Krugman's model for Europe as it has been done for the US, thereby providing an important evidence about how the agglomeration process is taking place on the Continent.

Finally, there exists at European level, a lack of references for the production data of a large number of industries collected per country (particularly, for the cohesion economies). The question could be by-passed by focusing on local and sectoral analyses which, by using specific data, would provide information about industrial clustering at national level. It would be worthwhile understanding whether the lack of factor mobility across countries may bring about a new wave towards the periphery (see Puga, 1999) or whether the lack of factor mobility across sectors might represent a deterrent to the development of cost linkages in smaller cohesion economies (see Muscatelli and Trecroci, 1999). Moreover, although the benefits of lower wage costs are supposed to encourage producers to move back toward the periphery, the difficulties for local firms in those countries to act as large-scale suppliers could offset the above-mentioned advantages. This would discourage foreign activities from locating back in the periphery hampering the decongestion of the core.

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Table 1 - **From the Neoclassical Theory to the New Economic Geography: the evolution of modelling***

	Neo-classical Theory	*New Trade Theory*	*New Economic Geography*
-Market Structure	Perfect competition	Monopolistic Competition	Monopolistic Competition
-Product Differentiation	No	Yes	Yes
-Technology	Constant Returns to Scale	Increasing Returns to Scale	Increasing Returns to Scale
-Factor mobility	No	No	Yes
-Determinants of Trade	Comparative Advantages	Scale Economies and Trade Costs	Scale Economies and Trade Costs
-Trade Structure	Inter-Industrial Trade	Intra- and Inter-Industrial Trade	Intra- and Inter-Industrial Trade
-Determinants of the Pattern of Industrial Location	i) differences in technology ii)differences in factor endowment iii) differences in factor intensity	i) intensity of scale economies ii) elasticity of substitution of differentiated goods iii) size of home-market (which is exogenously determined)	i) intensity of scale economies ii) elasticity of substitution of differentiated goods iii) trade costs iv) demand and cost linkages v) congestion costs (e.g. supplies of housing)
-Distribution of Economic Activities	Exogenuos (determined by initial factor endowments)	Endogenuos (once the home-market size is given)	Endogenous (determined by factor mobility, especially labour one)
-Main Contributions	Ohlin (1933); Heckscher (1919)	Krugman (1980); Helpman and Krugman (1985); Krugman and Venables (1990)	Marshall (1920); Krugman (1991); Krugman and Venables (1995); Venables (1996)

* This table relies on Brulhart (1998).

Table 2: Home-Market Effects in OECD Countries (1985)

Industries	*Coefficients on IDIODEM (betas)*	*Adjusted* R^2
Textiles	62,64*	0,83
Iron and Steel	3,42**	0,81
Transportation Equipment	1,42	0,91
Precision Instruments	2,95	0,8
Pottery and China	3,05**	0,64
Plastic Products	1,32*	0,91
Tobacco Products	0,81*	0,69

Source: Davis and Weinstein (2001) based on 22 OECD members; country data.
*Coefficients significant at the 5% level
**Coefficients significant at the 10% level

Table 3: Home-Market Effects in Japanese Prefectures (1985)

Industries	*Coefficients on IDIODEM (betas)*	*Analysis of Standard Deviation* #
Textiles	3,95*	0,82
Iron and Steel	3,93*	0,4
Paper and Pulp	1,99*	0,51
Transportational Equipment	6,71*	0,74
Non-Ferrous Metals	1,59*	0,42
Eletrical Machinery	6,27*	0,37
Precision Instruments	4,32*	0,42
Chemicals	6,68*	0,53

Source: Davis and Weinstein (1999) based on 47 Japanese Prefectures; regional data.
*Coefficients significant at the 5% level
The last column indicates the response of the dependent variable (in standard deviations) to a one standard deviation movement in the explanatory variables IDIODEM.

Table 4: Estimation of the Krugman Model

Time period	*1970-1980*	*1980-1990*
Implied values		
elasticity of substitution between pairs of traded goods [σ]	7,597*	6,562*
expenditure share on traded goods [μ]	0,916*	0,956*
price - marginal cost ratio [σ/(σ-1)]	1,152*	1,18*
[σ/(1–μ)]	0,639*	0,226*
Adjusted R^2	0,256	0,347

Source: Hanson (2000) based on 3075 US counties.
*Coefficients significant at the 5% level
Note: parameters are estimated by nonlinear least squares. The estimated specification is the time differenciated counterpart of equation (6) where the dependent variable is the log change in earnings of wage and salary workers.