Market access and human capital accumulation: the European Union case

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This study evaluates the role that market access plays in determining the spatial distribution of educational attainment levels among EU regions. Evidence is provided showing that in the EU educational attainment levels are higher in those regions with greater market access. This finding proves that remoteness is a penalty for the economic development and convergence of the European Union regions.

I. Introduction

The empirical investigation on the significance of market access for regional development has triggered a plethora of contributions, Clark et al. (1969), Dicken and Lloyd (1977), Keeble et al. (1982), Hanson (2000), Redding and Schott (2003), Redding and Venables (2004).

The idea that market access is important for regional development dates back at least to Harris (1954) who approximates a market potential function, which expresses the potential demand for goods produced in a location as the sum of the purchasing power in all other locations, weighted by transport costs. The analysis assume that market access is important for investment decisions and, therefore, regional growth. Firms in remote locations pay greater transport costs, reducing the value added to remunerate education.

The aim of the study is to add to the empirical investigation on the significance of market potential for regional development. It investigates whether there exists a spatial educational attainment structure in the EU, i.e. whether there is a positive correlation between regional levels of educational attainment and distance from large consumer markets. The authors demonstrate that there is a penalty of remoteness in terms of return to skill, thereby reducing incentives for investment in human capital accumulation. This result can also be linked to the studies on migration behaviour showing that as a result of agglomeration benefits, human capital often migrates from where it is scarce to where it is abundant, rather than vice versa (Lucas, 1988). Hence migration can lead to regional concentration of human capital which may have a divergent rather than converging effect on the development of local economies (see e.g. Myrdal, 1957; Nijkamp and Poot, 1997; Ritsila and Ovaskainen, 2001).

The investigation complements the work carried out by Redding and Schott (2003). It differs from them in geographical focus (European Union regions rather than World countries) and in the method to compute market access (geographic information system (GIS) rather than a gravity equation). The findings also give support to the interpretations of the processes of human capital accumulation made by authors that work on empirical issues of economic growth. Some scholars that research on the relationship between human capital accumulation and economic growth do not take into account the possible reverse impact of growth in human capital, but rather view it as a cause of economic growth. The authors demonstrate that there is a penalty of remoteness in terms of return to skill, thereby reducing incentives for investment in human capital accumulation.
capital accumulation. Cheng and Hsu (1997) in a study for Japan found bidirectional causality between human capital and economic growth. More recently Freire-Serén (2002) for the case of Spain proposed a new interpretation which assumes that the level of income achieved by the economy determines the accumulation of human capital. These interpretations are in line with the findings of the present study which show a positive correlation between market access and human capital accumulation.

The rest of the paper is structured as follows: Section II introduces the market access measure, describes the methodology used to compute market access values and shows the results of the computations in a map. Section III contains the econometric estimations of the model to test the relationship between market access and educational attainment levels. Section IV contains the main concluding remarks.

II. Market Potential: Definition and Calculus

The concept of market potential obeys the following expression:

\[ MP_i = \sum_{j \neq i}^n \frac{M_j}{D_{ij}} \]  

where \( MP_i \) is the market potential of region \( i \), \( M_j \) is a measure of the volume of economic activity of region \( j \), \( D_{ij} \) is a measure of the distance or transport costs between \( i \) and \( j \) and \( n \) is the number of regions considered.

The concept of market potential can be understood as a measure of the demand potential that the whole population exerts over every location in the space.

In the paper we have constructed the market potential for the NUTS 2 regions of the 15 EU countries for the year 2000 using as a variable of economic activity \( (M_j) \) the population of each region. These data have been taken from Eurostat and Gisco.

The results of the computations can be seen in the map (Fig. 1). Figure 1 displays a classification in five levels of market potential values within the EU15.

The market potential values are reflected in the relative shade of the colour used, that is, the darker the shade of the region, the higher its market potential and vice versa.

III. Market Potential and Educational Attainment Levels in the EU

The relationship market potential-Educational attainment levels can be tested by using the following regression equation:

\[ \ln(EA_i) = \alpha_0 + \alpha_1 \ln(MA_i) + \varepsilon_i \]  

where \( \ln(EA_i) \) is the logarithm of educational attainment for region \( i \), \( \ln(MA_i) \) is the logarithm of market access for region \( i \) and \( \varepsilon_i \) is the error term.
Equation 2 allows one to check if there is a spatial educational attainment structure in the EU, i.e. whether there is a positive correlation between medium and high levels of educational attainment and distance from large consumer markets, i.e. if high market access locations have relatively high levels of education.

$EA_t$ stands for levels of educational attainment for the different EU regions and periods of time. In the analysis, the dependent variable in the regression analysis of European regions is the log of educational attainment. The corresponding data were taken from the Eurostat Region databank – first and second intermediate reports on economic and social cohesion (dates of release 30-01-2002 and 30-01-2003) and the third report on economic and social cohesion (date of release 2004). The educational attainment is a three-level measure defined as persons aged 25 to 59 (as a percentage of total) with low, medium or high levels of education. The dependent variable is given for 203 European Union NUTS2 regions. The right-hand side of the equation contains the market access variable, a constant and the random disturbance.

Figure 2 plots medium + high educational attainments against market potential for year 2000. It is clear from this figure that the relationship between regional levels of medium + high educational attainment levels and regional market potentials are in line with the theoretical expectations. The relationship is robust and is not due to the influence of a few individual regions.

Table 1 presents the results of the econometric estimations for 203 EU NUTS2 regions. Log medium + high educational attainment on log market potential is regressed using OLS. The coefficients on market potential are significant and the signs correspond with theoretical expectations.

These results show that almost 20% of the variation in regional levels of secondary and tertiary education is explained by market potential. However, the model given in Table 1 is marked by outlying observations. The outlying regions do not correspond with the spatial educational attainment structure determined by the majority of the observations. Outliers will affect the coefficients estimates, if they are influential leverage points, i.e. outlying observations with regard to the measure of market potential. In order to control for effects of outlying observations, dummy variables for the outliers are introduced. The most significant outliers are the

![Fig. 2. Regional market access vs. human capital EU 15, Year 2000 (medium + high educational attainments)](image)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>$t$-statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_0$</td>
<td>-5.91</td>
<td>1.80</td>
<td>-3.27</td>
<td>0.00</td>
</tr>
<tr>
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<td>0.00</td>
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<tr>
<td>Estimation</td>
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<td>$R$-squared</td>
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<tr>
<td>Number observations</td>
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<td>$F$-statistic</td>
<td>49.16</td>
<td>0.00</td>
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<tr>
<td></td>
<td></td>
<td>Prob($F$-statistic)</td>
<td>0.00</td>
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</tr>
</tbody>
</table>
regions of Brussels and Inner London. Moreover, the regions of Vienna, Andalusia and Denmark are outliers as well. To control for the latter observations, regional dummies were included.

Including dummies for outlying regions does alter the estimates considerably (see Table 2). In particular, the coefficient of the market potential increases in the regression.

According to the results, market potential has a positive effect on the educational attainment levels of the European Union regions. This effect is reinforced when dummy variables are included in the regressions. Moreover, dummy variables improve the fit of the regressions considerably (inclusion of dummies increase the fit of the regression by 50%). The model presented in Table 2 explains around 30% of the spatial variation in the educational attainment levels in the European Union.

The results are in line with those obtained by Redding and Schott (2003) for a world sample of countries. In their estimations market potential itself explained 23% of the variation in educational attainment (105 countries) and excluding from the sample OECD countries, the USA, Japan and Belgium (66 countries) the explanatory power of the regression raised to 26%.

These results shed new light to the pioneering work initiated by Redding and Schott (2003), showing that at the EU level there is a positive correlation between countries’ human capital investments and market potential. Fruitful avenues for future research include the analysis of the relationship between changes in educational attainment and changes in market potential within regions and the exploitation of exogenous changes in market potential associated with changes in policy regimes.

### IV. Conclusions

This study analyses the relationship between market potential and educational attainment levels in the European Union regions for the year 2000. It provides empirical evidence of a spatial educational attainment structure in the EU, i.e. a positive correlation between regional medium and high levels of educational attainment and distance from large consumer markets. The inclusion of dummy variables alter the coefficient of market access considerably, changing from values around but below 1 to values over 1.34. Moreover, the fit of the regression also increases substantially and the augmented model explains around 30% of the spatial variation in the educational attainment levels in the European Union regions.

Taking into account that human capital accumulation is a key factor for regional development and to promote convergence among EU regions the results of this analysis suggests that there is a penalty of remoteness for human capital accumulation.

These results are in line with others obtained from studies on migration behaviour (Ritsila and Ovaskainen, 2001). One obvious policy implication is that the outlying regions in the EU should make bigger efforts to improve the levels of human capital accumulation. An important role in this sense has been played by the European Union Regional Policy since its institutionalization (1989), devoting an important part of its resources to objective 1 regions (most of them in the outskirts of the EU and so facing the penalty of the remoteness) throughout its three programming periods (Delors I and II packages and Agenda 2000). The majority of resources where channelled to improvements in infrastructure, human capital and aids to productive sectors.

### Table 2. OLS regression of medium + high educational attainment on regional market access and dummy variables, Year 2000. Dependent variable: log(medium + high educational attainment)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-statistic</th>
<th>Prob.</th>
</tr>
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<tr>
<td>$\alpha_0$</td>
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<td>2.09</td>
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<td>$\alpha_1$</td>
<td>1.34</td>
<td>0.15</td>
<td>8.38</td>
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<td>DUK11</td>
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<tr>
<td>DDK</td>
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<td>0.78</td>
<td>2.36</td>
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<td>DES61</td>
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<td>0.79</td>
<td>2.11</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Estimation: OLS

R-squared: 0.28

Number of observations: 203

F-statistic: 13.05

Prob(F-statistic): 0.00
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References


