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## Conference Paper

# The Effect of a Region's Location on It's Development

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## **The Effect of a Region's Location on its Development**

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**Abstract:** The sustainable development of a region depends on its power to attract industrial units. Industrial mobility, however, is largely a voluntary process. Hence, a region's growth or decline depends on its power to "pull" and "retain" industries but also the right blend of people to run them; this pulling power depends on what we call the Image of a region. At each time instant the region "sends out" its Image and depending on its impact on the people (both employers and employees) the region may be considered Attractive or Repulsive.

The image of a region may be defined as a function of a multitude of factors physical, economic and social. One of those factors, on which our emphasis is placed in the present work, is the region's proximity to influence centers (markets, resources and decision centers). This proximity may be expressed through a variable, which is referred to as the region's Location Multiplier. Our objective in this paper is to define a region's Location Multiplier, suggest ways of quantifying it and apply the theoretical findings on data drawn from a number of selected Greek counties, in order to test the effect of a region's location on its development.

**Keywords:** Regional Development, Remote and Island Regions, Region's Image, Location, Accessibility, Proximity, Information and Communication Technologies.

## **1. Introduction**

The sustainable development of a region depends on its power to attract industrial units. Industrial mobility, however, is largely a voluntary process. Hence, a region's growth or decline depends on its power to "pull" and "retain" industries but also the right blend of people to run them; this pulling power depends on what we call the Image of a region. At each time instant the region "sends out" its Image and depending on its impact on the people (both employers and employees) the region may be considered Attractive or Repulsive.

The Image of a region may be defined as a function of a multitude of factors physical, economic, social and environmental. One of those factors, on which our emphasis is placed in the present work, is the region's proximity to influence centers (markets, resources and decision centers). This proximity may be expressed through a variable, which is referred to as the region's Location Multiplier.

After this brief introduction, section 2 presents the concept of a region's Image and suggests ways of measurement. Section 3 defines a region's Location Multiplier and suggests ways for measuring it. Section 4 applies the theoretical findings of the previous two sections on data drawn from a number of selected Greek counties for the period 1971-2001 and summarizes the main conclusions. Finally, section 5 makes suggestions for further research.

## **2. The Concept of a Region's Image: Definition and Quantification**

### ***2.1. Definition***

As it has already been mentioned a region's growth or decline depends on its power to "pull" and "retain" industries but also the right blend of people to run them; this pulling power depends on what we call the Image of a region. However, one may argue that since people "receiving" the Image of a region belong to various distinct groups (i.e. employers, professionals, unskilled workers, skilled workers, e.t.c.) and are sensitive to different factors, the impact of the region's Image on the members of each particular group will be different. Whilst this is plausible, empirical evidence suggests that all groups of potential movers react similarly to a basic set of factors;

more precisely, a set of minimum standards, largely common to all groups, must be satisfied if the region is to be considered as a potential choice by any of them. To reconcile these two views we refine the concept of a region's Image by introducing the concepts of Basic and Specific Image. These two concepts have been discussed in full detail in some earlier works (Angelis (1990), Angelis and Dimopoulou (1991) and Doumi (2005)) and the most important points are summarized below.

The Basic Image of a given region measures the degree to which this region satisfies a set of basic criteria common for all movers. A region satisfying those criteria is considered, by all potential movers, as worth a closer examination and as a potential final choice. On the other hand, the Specific Image of a given region, as perceived by a particular group of potential movers, measures the degree to which movers belonging to that particular group consider this region as their final choice.

The Specific Images for all groups of movers are primarily influenced by the region's Basic Image. Additionally, however, each group of movers is also influenced by several other factors specific to each particular group. In the case of investors the most important of those factors is the provision of financial incentives, while in the case of employees the most important of those factors are job availability and job prospects. However, experience has shown that the effects of the specific factors on the development of a region are weak and temporary, unless they are accompanied by measures aiming at improving the region's Basic Image.

## ***2.2. Quantification***

The Basic Image of a region may be expressed as a function of two conflicting Indicators, Economic (EI) and Social (SI). The values of those two Indicators are given as follows (Angelis (1990), Angelis and Dimopoulou (1991)):

$$EI = \alpha = \sqrt[3]{(LOCM)(LAVM)(FICM)}/2$$

where

EI:	Economic Indicator
LOCM:	Location Multiplier
LAVM:	Land Availability Multiplier
FICM:	Financial Conditions Multiplier

$$SI = \beta = \sqrt[3]{(HSCM)(ENCM)(SOCM)}/2$$

where

SI:	Social Indicator
HSCM:	Housing Conditions Multiplier
ENCM:	Environmental Conditions Multiplier
SOCM:	Social Conditions Multiplier

All the above mentioned multipliers may be expressed in both absolute and relative terms. In the latter and more interesting case the multipliers of a given region  $i$ , are compared to the corresponding multipliers of a hypothetical region which is referred to as the “typical region” and expresses as far as possible an “average” of the main regions of a similar type to that under study. In this paper we shall be looking at this latter case.

The value of a region's Basic Image ( $BI=x$ ) is calculated through its Basic Image Equation (Angelis (1990), Doumi (2005)):

$$x^3 - bx - a = 0$$

with

$$a = m(\alpha - \alpha_0) + (\beta - \beta_0)$$

$$b = (\alpha - \alpha_0) - m(\beta - \beta_0) \quad \text{if } m \leq 1 \text{ (ie. } \theta \leq 45^\circ)$$

and

$$a = (\alpha - \alpha_0) + (1/m)(\beta - \beta_0)$$

$$b = (1/m)(\alpha - \alpha_0) - (\beta - \beta_0) \quad \text{if } m > 1 \text{ (ie. } \theta > 45^\circ)$$

where

- $\alpha$ : the value of the region's Economic Indicator
- $\beta$ : the value of the region's Social Indicator
- $\alpha_0$ : the value of the typical region's Economic Indicator
- $\beta_0$ : the value of the typical region's Social Indicator
- $m$ : a variable expressing the relative weight attached to each of the two Indicators in defining the region's Basic Image

It must be noted that, for the purposes of this work, the values of both the typical region's Indicators are equal to 0.5 and both Indicators' values of any given region lie in the interval [0,1]. Furthermore, the value of the typical region's Basic Image is equal to zero and the Basic Image value of any given area lies in the interval [-1,1]. Positive Basic Image indicates an attractive region that may be considered as a potential final choice by the various groups of prospective movers. Finally,  $m = \tan\theta = \tan 25^\circ = 0.47$ .

The values of a region's Specific Images as perceived by industries (SPIMI) and employees (SPIME) are given as follows:

$$SPIMI = \sqrt[4]{(BIM)(LBAVM)(LBQLM)(FINIM)}$$

where

- SPIMI: Specific Image for Industries
- BIM: Basic Image Multiplier
- LBAVM: Labour Availability Multiplier
- LBQLM: Labour Quality Multiplier
- FINIM: Financial Incentives for Industries Multiplier

$$SPIME = \sqrt[4]{(BIM)(JBAVM)(JBPRM)(FINEM)}$$

where

- SPIME: Specific Image for Employees
- BIM: Basic Image Multiplier

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JBAVM:	Job Availability Multiplier
JBPRM:	Job Prospects Multiplier
FINEM:	Financial Incentives for Employees Multiplier

It must be noted that, for the purpose of this work, all the Specific Image values of the typical region are equal to one and the Specific Image values of any given region lie in the interval [0,2]. Specific Image value, as perceived by a group of prospective movers, greater than 1 indicates an attractive region with a high probability of being considered as the best choice by this group of movers.

### **3. The Concept of a Region's Location Multiplier: Definition and Quantification**

#### **3.1. Definition**

As it has already been mentioned in the previous two sections, the Basic Image of a region may be defined as a function of a multitude of factors, physical, economic and social. In this section the emphasis is placed on one of those factors, namely the region's location which is considered, in many cases, as the key factor for its development (Bighman and Roberts (1952), Blonk (1979), Fromm, (1965), Morlok (1978) and Stubbs, Tyson and Dalvi (1984)).

Every industry in order to operate effectively and efficiently requires access to sources of raw materials, commerce and service centres and clusters of other industries. In other words it requires access to what we may generally call influence centres. A region whose location offers access to those centres has a strong comparative advantage over its competitors in attracting industrial units. Every region  $i$ , is generally surrounded by more than one influence centres. The influence exerted by a centre  $j$  on the given region  $i$  is expressed by what we may call the region's Location Multiplier with respect to centre  $j$  ( $LOCM_{ij}$ ) (Angelis (1994) and Gaki (2005)). The total influence exerted by all the centres on the given region is expressed by what we may call the overall Location Multiplier of the region  $i$  ( $LOCM_i$ ), which is defined as follows:

$$LOCM_i = \sum_{j=1}^n LOCM_{ij}$$

### 3.2. Quantification

Having defined a region's Location Multiplier we will now go on to present alternative ways of measuring it.

A region's Location Multiplier with respect to centre  $j$  may be expressed as a function of two factors:

- the Size Index of centre  $j$ ,  $SI_j$
- the Accessibility Index between region  $i$  and centre  $j$ ,  $AI_{ij}$

In other words, Location Multiplier  $LOCM_{ij}$  is defined as follows:

$$LOCM_{ij} = SI_j * AI_{ij}$$

The Size Index of an influence centre may be seen as a function of the centre's size measured in terms of its GDP. Hence the Size Index,  $SI_j$ , is defined as follows:

$$SI_j = \frac{GDP_j}{GDP_{max}}$$

where

$GDP_j$  : the GDP generated within the centre  $j$

$GDP_{max}$  : the max GDP generated within all centres

The definition of the Accessibility Index ( $AI_{ij}$ ) between region  $i$  and centre  $j$  is more complex. Initially this index may be expressed as a function of a region's distance from centre  $j$  and the corresponding cost of transporting a unit quantity between the region  $i$  and centre  $j$ . In this case the Accessibility Index is simply a Transportation Cost Index ( $TCI_{ij}$ ) and is defined as follows:

$$AI_{ij} = TCI_{ij} = TC_{min} / TC_{ij}$$



where,

- $TC_{\min}$  is the minimum cost of transporting a unit quantity between any region and the centre,
- $TC_{ij}$  is the cost of transporting a unit quantity between region i and centre j

The Transportation Cost  $TC_{ij}$  may be considered as function of distance and is defined as follows:

$$TC_{ij} = a + b * d_{ij}$$

where

$d_{ij}$  : the distance between region i and centre j

a, b : the regression coefficients

Obviously the above function must be properly modified when region i, centre j or both are located on islands. In this case:

$$TC_{ij} = a + b * d_{jp} + c * d_{pi}$$

where

$d_{jp}$  : the distance between the centre j and the most convenient mainland port p

$d_{pi}$  : the distance between port p and region i

a, b, c: the regression coefficients

It appears that this way of calculating the Accessibility Index has a problem as it can't take into account the difficulty in accessing a region, the uncertainty that this difficulty entails and the consequent unwillingness of businesses to locate to the specific region. In order to overcome this problem, another way of calculation is suggested where Accessibility Index is considered as a function of both a region's distance from the main influence centers and the corresponding transportation cost but

also a function of the region's spatial continuity or, in other words, a function of its ability to connect with other regions.

In this case the Accessibility Index  $AI_{ij}$  is defined as follows:

$$AI_{ij} = TCI_{ij} * SCI_i = TC_{min}/TC_{ij} * SCI_i$$

where,

- $SCI_i$  is the Spatial Continuity Index of a region  $i$ .

The Transportation Cost Index  $TCI_{ij}$  is calculated as described above. The Spatial Continuity Index  $SCI_i$ , on the other hand, expresses a region's use of the available alternative transportation modes. Every region may potentially use all four different transportation modes (road, rail, sea and air). A region which actually uses all four modes enjoys full spatial continuity whereas, a region that uses only some of them has a reduced spatial continuity. Using historical data we can get the percentages of use of each transportation mode for the whole country and then use them to calculate the Spatial Continuity Index for each region. Obviously, the Spatial Continuity Index lies in the interval  $[0,1]$  where 1 indicates regions which can use all four transportation modes and 0 indicates regions which can't use any of the transportation modes.

#### 4. Application - Conclusions

In the previous two sections we defined the concepts of a region's Basic Image and Location Multiplier and suggested two alternative ways of measuring them. The difference between those two approaches lies in the different way of calculating Accessibility Index  $AI_{ij}$ , which in turn affects the values of both the region's Location Multiplier and Basic Image. In this section we will apply the theoretical findings of the previous two sections in the case of several selected counties of Greece for the period 1971 – 2001.

Table 4.1 summarises, for the selected regions, the values of their Location Multiplier and Basic Image as obtained when using the first method of calculating the Accessibility Index  $AI_{ij}$ . It is reminded that in this case the Accessibility Index is considered as a function of transportation cost only.

Table 4.2 summarises, for the selected regions, the values of their Location Multiplier and Basic Image as obtained when using the second method of calculating the Accessibility Index  $AI_{ij}$ . It is reminded that in this case the Accessibility Index is considered as a function of both transportation cost and spatial continuity.

**Table 4.1.**

County	Location Multiplier				Basic Image			
	1971	1981	1991	2001	1971	1981	1991	2001
ATTIKH	1,3617	1,3432	1,3232	1,3465	0,4814	0,4717	0,4675	0,4932
BOIOTIA	1,3280	1,3652	1,3137	1,3857	0,5529	0,6778	0,6090	0,7034
ACHAIA	1,2431	1,2408	1,2280	1,2206	0,3213	0,2952	0,3196	0,4062
EVROS	0,6144	0,6216	0,6275	0,6205	-0,5472	-0,4665	-0,4132	-0,4442
XANTHI	0,7656	0,7773	0,7873	0,7733	-0,4607	-0,3239	-0,5387	-0,6533
RODOPI	0,6850	0,6940	0,7018	0,6920	-0,5710	-0,4828	-0,4746	-0,5832
LESVOS	0,4311	0,4219	0,4230	0,4250	-0,4594	-0,4871	-0,4851	-0,5217
SAMOS	0,4555	0,4458	0,4469	0,4491	-0,3774	-0,3876	-0,2805	-0,1614
CHIOS	0,4978	0,4873	0,4882	0,4908	-0,4283	-0,3541	-0,4042	-0,4638

**Table 4.2.**

County	Location Multiplier				Basic Image			
	1971	1981	1991	2001	1971	1981	1991	2001
ATTIKH	1,8073	1,7845	1,7630	1,7906	0,5937	0,5839	0,5794	0,6026
BOIOTIA	1,4764	1,5086	1,4559	1,5326	0,5836	0,6945	0,6415	0,7195
ACHAIA	1,6154	1,6020	1,5782	1,5602	0,4710	0,4699	0,4708	0,5094
EVROS	0,6746	0,6792	0,6870	0,6790	-0,5404	-0,4572	-0,4002	-0,4324
XANTHI	0,8339	0,8426	0,8550	0,8397	-0,4515	-0,3012	-0,5320	-0,6497
RODOPI	0,7519	0,7581	0,7680	0,7571	-0,5649	-0,4743	-0,4652	-0,5783
LESVOS	0,0834	0,0813	0,0817	0,0819	-0,5418	-0,5558	-0,5537	-0,5888
SAMOS	0,0882	0,0859	0,0863	0,0866	-0,4828	-0,4882	-0,4302	-0,3828
CHIOS	0,0963	0,0939	0,0942	0,0946	-0,5195	-0,4655	-0,4977	-0,5476

From the above tables the following conclusions may be drawn:

- In both cases there seems to be a strong positive correlation between the values of a region's Location Multiplier and Basic Image. In other words:
  - Regions with high values ( $> 1$ ) of Location Multiplier exhibit positive values of Basic Image.
  - Regions with low values ( $< 1$ ) of Location Multiplier exhibit negative values of Basic Image.
  
- The results of Table 4.2 underline in a more emphatic way the differences in Location Multiplier and Basic Image values between favourably and unfavourably located regions. In other words, Location Multiplier and Basic Image values of favourably located mainland regions are higher than the corresponding values in Table 4.1. On the contrary, Location Multiplier and Basic Image values of unfavourably located island regions are much lower than the corresponding values in Table 4.1. Finally, Location Multiplier and Basic Image values of unfavourably located mainland regions are almost the same in both Tables.

## **5. Suggestions for Further Research**

The objective of this paper was to define a region's Location Multiplier, suggest ways of quantifying it and finally apply the theoretical findings to a number of selected Greek counties. After a brief introduction, sections 2 and 3 focused on the definition and quantification of a region's Image and Location Multiplier respectively, whereas section 4 presented the application results and a number of conclusions.

Our first conclusion was that there seems to be a strong positive correlation between the values of a region's Location Multiplier and Basic Image. Therefore, Location Multiplier may be used to describe and explain the development pattern of a region. A point of further research would be to use Location Multiplier not only as an explanatory tool but also as an intervention tool. This tool will help us to determine

whether improving a region's Location Multiplier will eventually lead to the subsequent improvement of its Basic Image and then estimate the cost associated with this improvement.

The quantification of a region's Location Multiplier as a function of both transportation cost and spatial continuity emphasizes the difference between mainland and island regions. This is a plausible conclusion but it doesn't take into account the opportunities offered to an island region by the new Information and Communication Technologies (Cohen, Salomon and Nijkamp (2002), Landabaso, (2000) Kaufmann, Lehner and Todtling (2003) and Castells (1989)). A point of further research would be to expand the Accessibility Index so as to include the communication component and define a region's Location Multiplier as a function of transportation cost, spatial continuity and communication continuity.

In this case the Accessibility Index  $AI_{ij}$  could be defined as follows:

$$AI_{ij} = TCI_{ij} * SCI_i * CCI_i = TC_{\min}/TC_{ij} * SCI_i * CCI_i$$

where,

- $CCI_i$  is the Communication Continuity Index of a region  $i$ .

The Transportation Cost Index  $TCI_{ij}$  and the Spatial Continuity Index  $SCI_i$  have already been defined previously. The Communication Continuity Index refers to the region's ability to communicate with other regions, depends on a number of factors and could be defined as a function of the region's access to telecommunication, informatics and internet technologies. It would be quite interesting and useful to identify, further define and quantify those factors.

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