ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Gaki, Eleni; Angelis, Vasilis; Dimaki, Katerina

Conference Paper

Alternative Ways of Overcoming a Region's Spatial Discontinuity

50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Gaki, Eleni; Angelis, Vasilis; Dimaki, Katerina (2010) : Alternative Ways of Overcoming a Region's Spatial Discontinuity, 50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:
https://hdl.handle.net/10419/119103

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

Alternative Ways of Overcoming a Region's Spatial Discontinuity

Eleni Gaki[1], Vasilis Angelis[1], Katerina Dimaki[2]

[1]Quantitative Methods Laboratory
Department of Business Administration
University of the Aegean,
8, Michalon str., 82100 Chios, Greece
e.gaki@aegean.gr, v.angelis@aegean.gr

[2]Department of Statistics
Athens University of Economics and Business
76, Patission str.,10434 Athens, Greece
dimaki@aueb.gr

ABSTRACT

The development of regions and especially those facing spatial discontinuity has been the focus in some previous work (Angelis 1980, 1999) and the region's Image has been defined as a variable expressing its relative attractiveness and its prospects of future development. The findings have been applied to selected Greek regions and the results have been discussed.

Among the factors affecting a region's Image, accessibility to markets, resources and influence centres, seems to be a very crucial one and its improvement will facilitate its development. Although several measures for improving a region's accessibility have been suggested, they seem to have little or no effect for regions with spatial discontinuity. In this case, alternative measures have been introduced and a modification of the initial region's Image concept has been proposed so as to take into account the variables related to those measures (Gaki, Angelis, Dimaki 2009). The use of the modified Image functions for regions with spatial discontinuity seems to be a step in the right direction since, on one hand, they give a better view of their current state of development and future prospects and, on the other hand, they may be used as the basis for the design, but also for the evaluation, of alternative specific measures aiming to assist them in overcoming their problem.

One of the measures suggested for this purpose is the development of local business activities, i.e. activities basically using local resources and selling their products to local markets. For such activities discontinuity is not a handicap since their development doesn't require frequent transportation of physical entities to-and-from other regions. Our objective in this paper is to focus on this solution.

Toward this end we:

- Determine the characteristics that a region should have in order to implement such a solution
- Redefine the Image function so as to include those characteristics
- Apply the theoretical findings to selected Greek regions
- Compare the findings with those obtained when the initial Image function was used and summarize the conclusions.

Keywords: Region's Image, Regional Development, Spatial Discontinuity, Local Business Activities

1. Introduction

A region's development depends on its power to attract business activities. Business mobility, however, is largely a voluntary process. Hence, a region's growth or decline depends on its power to "pull" and "retain" business units 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 economic, social and environmental. Among those factors, proximity to markets, resources and influence centres, seems to be a very crucial one and has been expressed through a variable called Location Multiplier. In some previous papers, the Location Multiplier has been defined and quantified and ways of assisting a region's development by improving its Location Multiplier have been suggested. However, improvement of a region's Location Multiplier is not always an easy task. Indeed in certain cases, such as island or isolated regions, it is extremely difficult and sometimes impossible. In those cases, alternative measures have been introduced and a modification of the initial region's Image concept has been proposed so as to take into account the variables related to those measures (Gaki, Angelis, Dimaki 2009). The use of the modified Image functions for regions with spatial discontinuity seems to be a step in the right direction since, on one hand, they give a better view of their current state of development and future prospects and, on the other hand, they may be used as the basis for the design, but also for the evaluation, of alternative specific measures aiming to assist them in overcoming their problem.

This paper focuses on one of the measures suggested and specifically, the development of local business activities, i.e. activities basically using local resources and selling their products to local markets. For such activities discontinuity is not a handicap since their development doesn't require frequent transportation of physical entities to-and-from other regions.

After this brief introduction, section 2 presents, in more detail, the concept of a region's Image and suggests ways of quantifying it. Section 3 presents a number of general and frequently used methods for improving a region's Image. Section 4 focuses on regions with spatial discontinuity, discusses the relative ineffectiveness of the general methods presented, in those cases and suggests an alternative measure which could assist them to overcome their spatial discontinuity. Section 5 redefines the concept of a region's Image, so as to take into account all the findings of the previous section and section 6 applies the theoretical finding to the case of selected Greek

regions. Finally, section 7 summarizes the main conclusions and makes suggestions for further research.

2. The Concept of a Region's Image

The growth or decline of a region depends on its power to "pull" and "retain" business activities 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 point in time the region «sends out» its Image and depending on its impact on the people (both employers and employees) the area may be considered as Attractive or Repulsive.

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 etc.) 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 following two concepts ***Basic Image and Specific Image*** (Angelis, 1981).

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 a potential final choice.

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 best final choice.

At this point it should be mentioned that the growth or decline of a region may be expressed both in absolute or relative terms. In the latter and most interesting case the development pattern of a given region is compared to that of a hypothetical region, which is referred to as the "typical" region and expresses, as far as possible, an average of the main areas of a similar type to that of the study. In this paper we shall be looking at the relative development patterns of a region. Hence, all the factors affecting its images (Basic and Specific) should be expressed in relative values as compared to the corresponding values of the "typical" region.

2.1. The Concept of Basic Image

The concept of Basic has been discussed in full detail in some earlier papers (Angelis, 1990; Angelis and Dimopoulou, 1991). Summarising the main findings about Basic Image (BI) we could say it may be expressed as a multitude of factors (Cullingworth, 1969; Hunter and Reid, 1968; Rhodes and Khan, 1971; Townroe, 1971, 1979). Furthermore, those factors may be divided into two groups according to which of the two conflicting functions of a region, economic or social, they concern. The factors of the first group (*Accessibility to Centers of Influence, Land Availability, Financial Conditions*) properly quantified and scaled, define three respective multipliers, which in turn provide a measure of the region's economic potential. This measure is referred to as **Economic Indicator** and it is defined as follows:

$$EI = \sqrt[3]{LOCM * LAVM * FCM}$$

where

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

Similarly, the factors of the second group (*Housing Conditions, Environmental Conditions, Social Conditions*) properly quantified and scaled define three respective multipliers which in turn provide a measure of a region's social potential. This measure is referred to as **Social Indicator** and it is defined as follows:

$$SI = \sqrt[3]{HCM * ECM * SCM}$$

where

SI :	Social Indicator
HCM :	Housing Conditions Multiplier
SCM :	Social Conditions Multiplier
ECM :	Environmental Conditions Multiplier

Having defined the two indicators, we can now go on to define the Basic Image as a function of them. Hence,

$$BI = \varphi(EI,\ SI)$$

where

BI :	Basic Image
EI :	Economic Indicator
SI :	Social Indicator

The expression of the Basic Image as a function of those two Indicators is not accidental; on the contrary, it is consistent with the concept of a region as a socio-economic unit. The main advantage of such an expression is that it may be used to underline and eventually describe, the basic conflict that characterises the development of a region (Perloff and Wingo, 1971; Zolotas, 1981).

Furthermore, there seems to be evidence to suggest that the Basic Image function is non-linear and its graph discontinuous. To study this function, Catastrophe Theory has been employed, a general mathematical theory, which is particularly applicable in cases where continuous underlying forces result in discontinuous and divergent phenomena. The theory is derived from topology and classifies the ways in which discontinuities may occur in terms of a few archetypal forms called elementary catastrophes. Although the underlying mathematics are difficult, the elementary catastrophes themselves are relatively easy to understand and can b& used profitably even by non experts on the subject (Thom, 1975; Zeeman, 1973, 1977).

2.2. The Concept of Specific Image

Having defined a region's Basic Image and having suggested ways of measuring it, we may now go on to define the region's Specific Images for the various groups of potential movers. The concepts of Specific Images have been discussed in full detail in some previous papers (Angelis, 1990; Angelis and Dimopoulou, 1991). Summarizing the main findings we could say that the Specific Image, as perceived by a group of potential movers, may be expressed as a function of the region’s Basic Image and certain specific factors relevant to this particular group. The two main groups of potential movers are industries and employees. Furthermore, if needed, industries may be classified into several subgroups i.e. new, mature and declining and the same goes for employees who may be subdivided into professionals, skilled workers and unskilled workers. However, for the purposes of this work, we will limit our analysis to the two basic groups, industries and employees.

2.2.1. Specific Image for Industries

Specific Image for Industries is expressed as a function of four multipliers, corresponding to the region's Basic Image and the three major factors affecting this Specific Image, i.e. Labor Availability, Labor Quality and Financial Incentives for Industries.

On the basis of all the above, the Specific Image of a region, as perceived by Industries, may be expressed as a function of four multipliers as follows:

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

where

BIM :	Basic Image Multiplier
$LBAVM$:	Labor Availability Multiplier
$LBQLM$:	Labor Quality Multiplier
$FINBM$:	Financial Incentives for Industries Multiplier

2.2.2. Specific Image for Employees

Specific Image for Employees is expressed as a function of four multipliers, corresponding to the region's Basic Image and the three major factors affecting this Specific Image, i.e. Job Availability, Job Prospects and Financial Incentives for Employees.

On the basis of all the above, the Specific Image of a region, as perceived by Employees, may be expressed as a function of four multipliers as follows:

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

where

BIM :	Basic Image Multiplier
$JMAVM$:	Job Availability Multiplier
$JBPRM$:	Job Prospects Multiplier
$FINEM$:	Financial Incentives for Employees Multiplier

For the purposes of this work all Specific Image values of the typical region are equal to 1 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 a region with high probability of being considered as the best choice by this group of movers.

3. Improving a Region's Image

As it can be seen from the definition of a region's Specific Images they may be improved either by improving the region's Basic Image, or by improving the specific factors appealing to the members of the various groups of movers.

Improvement of the Basic Image requires mainly infrastructure development. This is expected to generate an inflow of potential investors and eventually lead to an improvement of the specific factors and a self-sustained growth. Infrastructure development refers both to the economic and social aspect of the region. Regarding its social aspect the key points are improving housing stock quality, environmental conditions (air and water quality) and social conditions (health services, education services, social amenities). On the other hand, regarding the region's economic aspect, the key issue is improving its accessibility. This may be achieved by improving transportation infrastructure (roads, ports, airports), transportation means (bigger and faster planes, faster and all-weather vessels) and transportation frequency (more arrivals/departures per day). Obviously, improving a region's Basic Image is a slow and expensive method but, on the other hand, effective and with long-term effects.

Improvement of the specific factors is usually referring to the provision of financial incentives to the various groups of potential movers and particularly to the economic units. Its objective is to "push" investors into the region, hoping that the growth generated will eventually improve the region's Basic Image. Evidence has shown that this solution is rather ineffective with short-term effects unless it is combined with a parallel substantial direct improvement of the region's Basic Image.

Concluding this section we should underline that the key for every region's development is the value of its Basic Image. By keeping the Basic Image of a region attractive, we make sure that, in spite of any possible fluctuations in the effectiveness of various specific factors and of unexpected external adversities, the region may retain its overall pulling power, renew its ageing industries, maintain the right blend of workforce and finally overcome any difficulties. As soon as the Basic Image becomes repulsive, however, the situation changes completely; the region enters a vicious circle of deprivation and decline, the breaking of which is extremely difficult. Piecemeal approaches, aiming at the breaking of this vicious circle, through the

improvement of certain specific factors, may help temporarily but the only lasting solution to this problem is the restoration of the Basic Image.

4. Local Business Activities as a Driving Force for the Development of Regions

All the measures presented so far aim to assist regions in overcoming the development problems they face. Their applicability however, depends on the type of the region and in certain cases, such as islands, is extremely difficult. The key difference in those cases is the geographical discontinuity. There have been many attempts in trying to overcome this problem by "reducing" geographic discontinuity through the improvement of transportation infrastructure and means, but the problem still remains. Since the measures aiming at "reducing" geographic discontinuity don't seem to have the expected results, another set of measures aiming at "bypassing" geographic discontinuity may be introduced.

In some previous papers (Gaki, Angelis, Dimaki, 2009) alternative measures have been introduced and a modification of the initial region's Image concept has been proposed so as to take into account the variables related to those measures. The use of the modified Image functions for regions with spatial discontinuity seems to be a step in the right direction since, on one hand, they give a better view of their current state of development and future prospects and, on the other hand, they may be used as the basis for the design, but also for the evaluation, of alternative specific measures aiming to assist them in overcoming their problem.

One of the measures suggested was the development of local business activities, not requiring extensive transportation of physical entities. It is obvious that local business activities could generate the development of regions, as they could create new jobs, increase employment and improve the inhabitants' income. The only question in this case is if those activities are adequate for the regions to generate development. In the next sections we will redefine Basic Image so as to take into account local business activities and then apply the proposed model to the Greek regions, expecting that the findings will help us give an answer to that question.

5. Redefining a Region's Image

The previous section introduced a measure aiming to improve regions facing spatial discontinuity. In order to quantify the effectiveness of that measure, we have to modify the Basic Image function accordingly, so as to include all the variables that this measure aims at

improving. Those variables are combined into a respective multiplier, which enters the respective indicator's function and hence the basic image function, substituting one of the existing multipliers.

5.1.Redefining a Region's Image

The development of local business, using local resources and selling their products to local markets, implies that the region has a number of characteristics which will facilitate such a development. The first set of characteristics (sources of raw materials, unique products) refers to the region's raw materials availability and is expressed by the Natural Resources Index (NRI). The second set of characteristics (population, GDP per capita) refers to the region's market size and is expressed by the Market Size Index (MSI).

These two multipliers may be combined into the Local Business Multiplier (LBM) which expresses the region's potential for local development and may be defined as follows:

$$LBM = BUI * MSI$$

where,

LBM : Local Business Multiplier

BUI : Business Units Index

MSI : Market Size Index

Going back to the Economic indicator, Location Multiplier will be substituted by Local Business Multiplier which has no meaning in this case, as practically all goods are produced and consumed locally and is defined below. Hence, the redefined Basic Image function will be as follows:

$$BI = \varphi(EI,\ SI)$$

where,

$EI = \sqrt[3]{LBM * LAVM * FCM}$, while SI remains unchanged.

5.2.Business Units

It evaluates a region's entrepreneurship regarding specific business sectors and is expressed as a function of the region's local business units over the number of all business units and the number of employees of the local business units over the total number of employees.

The local business units used refer to specific economic sectors, namely the:

- ✓ Manufacture of food products; beverages and tobacco
- ✓ Manufacture of leather and leather products
- ✓ Manufacture of wood and wood products
- ✓ Manufacture of pulp, paper and paper products; publishing and printing
- ✓ Collection, purification and distribution of water

The choice of those particular economic activities was not accidental. Our aim was to use economic activities that utilize the region's local products thus indicating potential development. For this purpose we used the industrial classification which is used by Eurostat (NACE Nomenclature generale des Activites economiques dans les Communautes europeennes).

5.3.Market Size

It evaluates the general size of the market in the specific region and is expressed as a function of the population and Gross Domestic Product (GDP) per capita.

A clear overview of the variables used and their conversion through a number of indices to the Local Business Multiplier is given in Table 5.1

Table 5.1. Conversion of variables into the Local Business Multiplier

Multiplier	Index	Variable
Local Business Multiplier (LBM)	**Business Units Index**	Number of local business units / Total number of business units
		Number of employees of the local business units /Total number of employees
	Market Size Index	Population
		GDP per capita

The values of every Index are given as an average of the values of the corresponding variables. The value of Local Business Multiplier is given as an average of those two Indices. For the purposes of this work Local Business Multiplier is further standardized so as to take values in the interval [0,2].

6. Application of the Model

The methodology presented in the previous section is now applied for the calculation of the Basic Image values for the 13 Greek regions (Figure 6.1).

Figure 6.1. Regions of Greece

Two different sets of Basic Image values have been produced. The first is based on the initial Basic Image equation using the Location Multiplier. The results are summarized in Table 6.1 showing, for the 13 Greek regions their Location Multiplier, Economic Indicator, Social Indicator and Basic Image values.

Table 6.1. Economic and Social indicator and Basic Image values
(using Location Multiplier**)**

		Location Multiplier	Economic Indicator	Social Indicator	Basic Image
1	**ATTICA**	1,60	0,6456	0,525	0,5979
2	**EAST MACEDONIA & THRACE**	0,91	0,4638	0,570	-0,3466
3	**CENTRAL MACEDONIA**	1,19	0,5216	0,608	0,3676
4	**WEST MACEDONIA**	1,04	0,5045	0,668	0,3951
5	**EPIRUS**	1,30	0,4894	0,628	0,2905
6	**THESSALY**	1,02	0,5323	0,555	0,2972
7	**IONIAN ISLANDS**	0,69	0,4363	0,624	-0,1682
8	**WEST GREECE**	1,28	0,5166	0,613	0,3558
9	**CENTRAL GREECE**	1,28	0,5533	0,551	0,4240
10	**PELOPONNESE**	1,12	0,5168	0,601	0,2970
11	**NORTH AEGEAN**	0,56	0,3977	0,584	-0,3948
12	**SOUTH AEGEAN**	0,57	0,4328	0,600	-0,2987
13	**CRETE**	0,59	0,4240	0,581	-0,3737

The second set of Basic Image values is based on the redefined Basic Image equation, where the Location Multiplier has been substituted by the Local Business Multiplier. The results are summarized in Table 6.2 showing, for the 13 Greek regions their Local Business Multiplier, Economic Multiplier, Social Indicator and Basic Image values. At this point we should note that new multiplier is used only in those regions that have negative Basic Image values, i.e. East Macedonia and Thraki, Ionian Islands, North Aegean, South Aegean and Crete. The reason for doing that is that regions with positive Basic Image values don't need to turn to alternative measures so as to improve their image. Regions with negative Basic Image values, on the other hand, are forced to turn to those alternative measures if they want to have a chance of improving their image.

Table 6.2. Economic and Social indicator and Basic Image values

		Location Multiplier	Local Business Multiplier	Economic Indicator	Social Indicator	Basic Image
1	**ATTICA**	1,60		0,69569	0,525	0,5979
2	**EAST MACEDONIA & THRACE**		0,9559	0,47170	0,570	-0,2451
3	**CENTRAL MACEDONIA**	1,19		0,54833	0,608	0,3676
4	**WEST MACEDONIA**	1,04		0,40847	0,668	0,3951
5	**EPIRUS**	1,30		0,49305	0,628	0,2905
6	**THESSALY**	1,02		0,46210	0,555	0,2972
7	**IONIAN ISLANDS**		0,4611	0,38216	0,624	-0,2410
8	**WEST GREECE**	1,28		0,47388	0,613	0,3558
9	**CENTRAL GREECE**	1,28		0,51237	0,551	0,4240
10	**PELOPONNESE**	1,12		0,50144	0,601	0,2970
11	**NORTH AEGEAN**		0,5982	0,40648	0,584	-0,3289
12	**SOUTH AEGEAN**		0,5075	0,41708	0,600	-0,2404
13	**CRETE**		0,7721	0,46508	0,581	-0,1843

Looking at the Tables 6.1 and 6.2 the following conclusions may be drawn:

- East Macedonian and Thraki is a mainland region which has a negative Basic Image value in Table 6.1 and retains the negative sign in Table 6.2 as well but with a significantly improved value.
- Ionian Islands, North Aegean, South Aegean and Crete, are all island regions, with negative Basic Image values in Table 6.1 which retain the negative sign in Table 6.2 as well but with an improved value.

All the above conclusions seem plausible. Mainland as well as island regions seem to benefit up to an extent from this measure, i.e. the development of local business activities. But this benefit is not that strong so as to change their Basic Image values from negative to positive. This probably means that the those regions can use local business activities along with other activities in order to improve their Basic Image values and not base their development on this measure only. At this point we must note that, although local business activities may not change negative Basic Image Values, they contribute to the region on a social and economic level by creating new jobs, decreasing unemployment, generating income, etc.

7. Conclusions and Suggestions for Further Research

A region's development depends on its power to attract business activities. Business mobility, however, is largely a voluntary process. Hence, a region's growth or decline depends on its power to "pull" and "retain" business units 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 first three sections of this paper introduced the concept of a region's Image (Basic and Specific) as a variable expressing the region's attractiveness and its prospects of future development, suggested ways for its quantification and presented a number of general and frequently used measures for its improvement. Those measures seem to be effective in many cases but have little or no effect in the case of regions facing geographical discontinuity. Hence, the next sections focused on such regions, suggested an alternative measure for improving their Image, redefined the Basic Image so as to take into account the variables related to that measure and applied the theoretical findings to the case of selected Greek regions.

The application of the findings for the case of islands and isolated regions showed that, although the use of local business activities did not change the sign of their Basic Image values from negative to positive, it improved them considerably and also contributed to the regions' overall social and economic level. However, further research is needed towards this direction, i.e. the definition but also better quantification of this contribution.

References

1. **Angelis, V (1981).** Basic Image. A New Approach in Modelling Growth and Decline in Industrial Cities. *Proceedings Volume, Conference on Dynamic Non-Linear Theory and General Urban/Regional Systems*, Organized by the U.S. National Science Foundation and the U.S. Department of Transportation, Washington D.C. USA. *(Invited Paper).*
2. **Angelis V. (1990).** Factors Affecting the Movement and Location of Both Industrial Units and their Employees, Proceedings Volume, J. Karkazis and J. B. Boffey eds., *Meeting IV of the Euro Working Group on Location Analysis,* Chios.
3. **Angelis, V. and Dimopoulou, M. (1991).** A Decision Support System for the Location of Industrial Units. Theoretical Framework and Applications. *Studies in Locational Analysis,* 3.

4. **Berben, C. and Clements, B. (1995).** The European framework for competition in telecommunications, the benefits for peripheral countries, *Telecommunications Policy*, Vol.19, nº4.
5. **Cullingworth, J. B. (1969).** *Housing and Labour Mobility*, OECD, Paris .
6. **De Castro, E. A. and Jensen-Butler, C. (2003).** Demand for Information and Communication Technology-based Services and Regional Economic Development, *Papers in Regional Science,* 82.
7. **Gaki, E., Angelis, V.A., Dimaki, K., (2009).** A Region's Spatial Discontinuity and Ways to Overcome it, *Journal of Management Science and Regional Development* (to appear)
8. **Hunter, L. and Reid, G. (1968).** *Urban Worker Mobility*, OECD, Paris.
9. **Perloff, H. S. and Wingo, L. (1971).** Planning and Development in Metropolitan Affairs in Leahy, W. H. et al (eds) *Urban Economics. Theory, Development and Planning*, The Free Press, New York.
10. **Rhodes, J. and Khan, A. (1971).** *Office Dispersal and Regional Policy*, Cambridge University Press.
11. **Thom, R. (1975).** *Structural Stability and Morphogenesis: An Outline of a General Theory of Models.* Addison-Wesley, Reading, MA.
12. **Townroe, P. M. (1971).** *Industrial Location Decisions. A Study in Management Behavior*, Center for Urban and Regional Studies, The University of Birmingham.
13. **Townroe, P. M. (1979).** *Industrial Movement. Experience in the US and UK*, Westmead, Saxon House, England.
14. **van Geenhuizen M. (2000).** ICTs, E-economy and Regional Development: Is Distance Still Alive?, *40th European Congress of the European Regional Science Association,* Barcelona, 19.08-01.09 2000.
15. **Zeeman, E.C. (1973).** Applications of Catastrophe Theory, *Manifolds,* Tokyo.
16. **Zeeman, E.C. (1977).** *Catastrophe Theory - Selected Papers 1972-1977.* Addison-Wesley, Reading, MA.
17. **Zolotas, X. (1981).** *Economic Growth and Declining Social Welfare*, New York, University Press.