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The Impact of Educational Activities on Regional Development

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ABSTRACT

A region's pattern of growth depends on its power to attract economic activities and the right blend of people to run them. This power depends on economic and social factors that may be combined into a variable which is referred to as the Image of a region and has been presented in some earlier works (Angelis 1980, 1990, 2009, Angelis & Dimopoulou, 1991) The role of a region's location is crucial for its development. Hence it is difficult for remote and isolated regions to attract economic activities involving production and transportation of tangible goods. An alternative way to assist the development of such regions is to locate there activities that would immediately generate jobs and income and in the long run they may contribute to the improvement of those regions attractiveness. Tertiary education is such an activity.

Universities are traditionally are thought to affect both the economic and the social dimension of a region. Their key economic impacts on a given region, as identified by literature, are the increase of local disposable income and employment opportunities. Their key social impacts, on the other hand, include upgrading the human capital stock and raising the cultural level of the local community.

The Image of a region has so far been expressed as a function of two Indicators, Economic and Social; furthermore each one of those is expressed as a function of a number of Multipliers related to economic and social aspects of a region. The goal of this paper is to

use the concept of a region's Image in order to measure the effect of university's operation on the region of its location.

Toward this end we:

- Define the Educational Multiplier of a region which expresses the impact of tertiary education aspects on the region's development.
- Redefine the region's Basic Image function so as to include the Educational Multiplier.
- Estimate a region's Basic Image value twice, with and without the contribution of universities' operation, focus on the difference between the two values and suggest ways for maximizing the positive effect of Educational Multiplier on the region's well being.

The proposed model is applied to selected regions and the results obtained are presented and discussed.

Keywords: Region's Image, Tertiary education

1. Introduction

The development of an area requires the attraction of business units. Business mobility, however, is largely a voluntary process. Business units move into or out of a given area on the basis of their perception of the area's relative attractiveness. Their mobility is a function of multiple factors such as social, economic and environmental. Hence, a region's growth or decline depends on its power to "pull" and "retain" both industries and people to run them; this pulling power depends on what we call the Image of the region. At each time instant the region "sends out" its Image and depending on its impact on employers and employees, the region may be considered Attractive of Repulsive.

A region's location seems to be a crucial factor for its development, especially in cases of isolated regions. Location becomes an obstacle in the process of attracting economic activities whose operations involve the production and transportation of tangible goods.

An alternative way to assist the development of such regions is to locate there activities that would immediately generate jobs and income and in the long run they may contribute to the improvement of those regions attractiveness. Tertiary education is such an activity.

Universities contribute to regional development, both in the terms of economy and society. The presence of a university contributes to the improvement of region's education level, brings new jobs, raises the cultural attractiveness of the region, contributes to an equitable spatial distribution of public services, gives new employment opportunities and limits the outflow of young people toward urban centers.

The purpose of this paper is (a) to defne the Educational Multiplier of a region which expresses the impact of tertiary education aspects on the region's development (b) to redefine the region's Basic Image function so as to include the Educational Multiplier and (c) to estimate a region's Basic Image value twice, with and without the contribution of universities' operation, focus on the difference between the two values and suggest ways for maximizing the positive effect of Educational Multiplier on the region's well being.

The remainder of this paper is organized as follows: Section 2 provides a brief literature review of the role of Universities on regional development, section 3 presents the concept of a Region's Basic and Specific Images, section 4 measures the effects of tertiary educational activities on a region's development while in section 5 applies the theoretical findings in to the thirteen Greek prefectures and presents the application results. Finally, section 7 summarises the conclusions and makes suggestions for further research.

2. The role of Universities in region's development; A brief overview

Universities traditionally are thought to affect both the economic and the social dimension of the region. The key economic impacts, as identified by the literature, are local gross output, local disposable income and local employment. In each case overall local impact is the combination of direct income or employment, indirect income and induced income effects. Direct income and employment is generated at the University itself. Indirect income and employment arises when expenditures at the university generate business for local firms. Induced income and employment is generated as a result of the expenditures by the University and local businesses (Bleaney *et al*, 1992). The key social impacts, on the other hand, upgrading the human capital stock and raising the cultural level of the local community, gives new employment opportunities in that region and limits the outflow of young people to urban centres (Ricci, 1997).

Many and different approaches have been developed in order to determine the effect of the University in regional development, and numerous cases studies have attempted to

quantify the contribution of a particular institution of higher education to a region's well being and development.

Exeter University and the Wolverhampton Polytechnics have been examined by Lewes & Kirkness (1974) and Lewis et al (1988) respectively.

Blake and McDowall (1967) had examined the impact of the University on St.Andrews by using the input output methodology, while many studies have been developed by identifying and calculating a series of local income multipliers. Lewis (Wolverhampton,1988); Leanet et al. (Nottingham, 1992), Sinclair and Suntclife (1978 and 1982), estimated income multipliers before and after University establishment. Brownrigg (1973) examined the impact of Sterling University by adapting the Keynesian open economy macroeconomic multipliers for use at local level.

Amstrong et al, (1997) examined the case of Lancaster University by assuming that the local economic impact of construction expenditures at the University are examined separately from the annual operation expenditures. In their study, they concluded that the key local benefits arising from university are (a) the increase in local GDP, (b) the direct employment of local residents and effects on local economy and (c) social and recreational benefits in local community.

Econometric approaches have also been developed and used. All these studies have tried to estimate the economic impact of an innovation that produced in a University in the local economy. Griliches (1979) used production functions, Jaffe (1989) used log-linear models, Isserman (1987) used t-test to measure the difference of means between the regions with universities and regions with out. Reed and Rogers (2003 used multiple regression model to find the significance of net impact of an innovation to development of region. Goldstein et al. 2004 used a quasi experiment approach (non linear regression model).

Gaps mentioned in existing literature are addressed to input-output models and multipliers which can only capture economic growth that stems from backward linkages induced by the spending of an institution of higher education (Thanki, 1999). Acs *et al* (1994), set off the issue concerning the measurement of innovation that a university produces. The number of patterns seems to be a temporary solution. Finally, Goldstein (2004), claimed that universities apart from economic development contribute to technology development and creation of human capital. These two factors are hardly investigated by the existing literature.

3. The Concept of Basic Image

The growth or decline of a region depends on its power to "pull" and retain both business activities and the right blend of people to run them; this pulling power depends on what we call the Image of the 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 region may be considered attractive or non attractive. In other words, the growth of a region depends on the nature of the net flows of investment and migrants between the region and the rest of the world which are frequently influenced by something as insubstantial as the kind of image the region puts forth (Perloff, H. S. and Wingo, L., 1971).

One may argue that since people "receiving" the image of the region belong to various distinct groups (i.e. employers, unskilled workers, skilled workers etc.) and are sensitive to different factors; the impact of the Image of the region on the members of each particular group will be different. Whilst this is plausible, the evidence presented in section 2 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: the Basic Image and the Specific Image.

Basic Image of a given region measures the degree to which the 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.

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 the region as their best final choice. This Specific Image however, although a function of specific factors appealing mainly to members of that group, is primarily a function of the Basic Image.

The concepts of Basic and Specific Image has been discussed in full details in some earlier papers (Angelis, 1980, 1990, 2009; Angelis & Dimaki, 2010). Summarizing the findings for the Basic Image which is our main interest in this rarer, we can say the following:

The factors affecting the Basic Image that have been presented so far, include land availability for business expansion, access to markets and materials, housing conditions, sanitary and environmental conditions, regional influence etc. Furthermore, they have been divided into two sets according to whether they express the economic or the social function of the region. The factors of the first set (*Accessibility to Centers of Influence, Land Availability, Financial Conditions*) provide a measure of the region's economic development prospects. This measure is referred to as **Economic Indicator (*EI*).** Similarly, the factors of the second set (*Housing Conditions, Environmental Conditions, Social Conditions*) provide a measure of a region's social profile. This measure is referred to as **Social Indicator (*SI*).** Hence,

$$Basic\ \ Image = \varphi\left(Economic\ Indicator,\ Social\ Indicator\right).$$

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, H. S. and Wingo, L., 1971 and Zolotas, X., 1981).

At this point it should be mentioned that the growth 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 regions 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 terms as compared to the corresponding values of the "typical" region.

Furthermore, it has been shown that the process of shaping a region's Basic Image has all the properties characterizing phenomena which may be modeled in terms of Catastrophe Theory (Thom, 1975; Zeeman, 1973, 1977). Hence we may now use Catastrophe Theory to estimate a region's Basic Image. It is reminded that the Basic Image of a region has been defined as a function of two conflicting indicators. Therefore, the appropriate elementary catastrophe is the cusp. Consequently, the value x, of a region's Basic Image, at each point in time, is given as a solution of the equation:

$$x^3 - bx - a = 0 \qquad (1)$$

with,

$$\begin{cases} a = m(\alpha - \alpha_0) + (\beta - \beta_0) \\ b = (\alpha - \alpha_0) - m(\beta - \beta_0) \end{cases} \; if\ m \le 1 \; \left(i.e.\ \theta \le \frac{\pi}{2} \right)$$

and

$$\begin{cases} a = (\alpha - \alpha_0) + (1/m)(\beta - \beta_0) \\ b = (1/m)(\alpha - \alpha_0) - (\beta - \beta_0) \end{cases} \; if\ m > 1 \; \left(i.e.\ \theta > \frac{\pi}{2} \right)$$

since,

$$\begin{pmatrix} \alpha - \alpha_0 \\ \beta - \beta_0 \end{pmatrix} = \cos\theta \begin{pmatrix} \cos\left(\frac{\pi}{2} - \theta\right) & -\sin\left(\frac{\pi}{2} - \theta\right) \\ \sin\left(\frac{\pi}{2} - \theta\right) & \cos\left(\frac{\pi}{2} - \theta\right) \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} \quad if\ \ \theta \le \frac{\pi}{2}$$

and

$$\begin{pmatrix} \alpha - \alpha_0 \\ \beta - \beta_0 \end{pmatrix} = \sin\theta \begin{pmatrix} \cos\left(\frac{\pi}{2} - \theta\right) & -\sin\left(\frac{\pi}{2} - \theta\right) \\ \sin\left(\frac{\pi}{2} - \theta\right) & \cos\left(\frac{\pi}{2} - \theta\right) \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} \quad \text{if}\ \ \theta > \frac{\pi}{2}.$$

Equation (1) is referred to as the **Basic Image Equation** and its graph is qualitatively equivalent to the Cusp Catastrophe Graph (Figure 1).

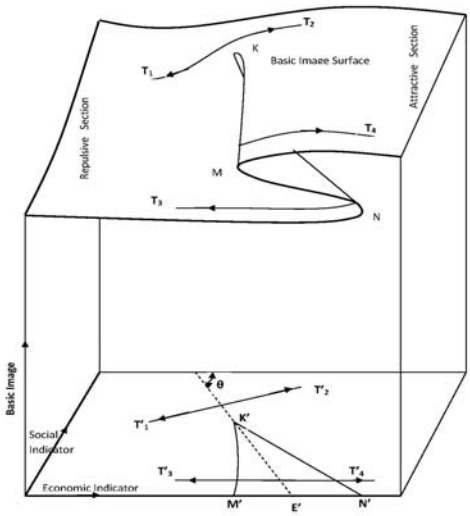

Figure 1. The Cusp Catastrophe graph in the case of Basic Image

The variables α, β express the values of the two Indicators, while α_0, β_0, express the values of those two Indicators for the "typical" region. The point (α_0, β_0) corresponds to the vertex of the cusp, while $m = \tan\theta$ represents the slope of the cusp axis and expresses the relative weights attached to each one of the two indicators in defining the Basic Image.

For the purposes of this work, the values of all Indicators lie in the interval [0,1], whereas the value of its Basic Image lies in the interval [-1,1]. The value of the "typical" region's Basic Image is 0. Hence, positive Basic Image indicates an attractive region that may be considered as a potential final choice by the various groups of prospective movers.

The position of the cusp in Figure 1 is indicative. The trajectory of a region's Basic Image lies on the Basic Image surface. As long as the trajectory remains on the upper section of this surface the area is attractive while if the trajectory moves on the lower part, the region becomes repulsive. T_1T_2 and T_3T_4 are typical trajectories of an area's Basic Image and $T_1^{'}T_2^{'}$, $T_3^{'}T_4^{'}$ are their projections on the two dimensional Control Space C. The line KM is the locus of breaking points for areas undergoing sudden loss of attractiveness while the line KN is the locus of turning points for regions going through a phase of sudden increase of attractiveness. $K^{'}M^{'}, K^{'}N^{'}$ are the projections of KM, KN on the Control Space and $K^{'}E^{'}$ is the projection on C of the cusp axis.

Returning to the present case it is reminded that the factors affecting a region's Basic Image may be divided into two sets according to whether they express the economic or the social aspect of the region. The factors of the first set provide a measure of the region's economic development prospects. This measure is referred to as the **Economic Indicator.** Similarly, the factors of the second set provide a measure of a region's social profile. This measure is referred to as the **Social Indicator.**

Each of those two Indicators is expressed as the geometric mean of several multipliers depending on a number of factors among those affecting the region's Basic Image. The use of this geometric mean is justified by the fact that each one of the Multipliers affecting the respective indicator is considered to be critically important for this indicator's value.

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

and

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

The **Location Multiplier** ($LOCM$) expresses the proximity of a region to influence centers. It is a function of distance/transportation cost between the region and the main influence centres.

The **Land Availability Multiplier** ($LAVM$) expresses the availability of land which may be required to accommodate a region's expansion.

The **Financial Conditions Multiplier** (FCM) expresses the economic conditions prevailing in the region and somehow reflects the standard of living of its inhabitants. It is a function of the region's GDP per capita.

The **Housing Conditions Multiplier** (HCM) expresses the availability and quality of the region's housing stock. It is a function of the ratio of houses over the population as well as of the ratio of new houses in the region's total housing stock.

The **Social Conditions Multiplier** (SCM) expresses the level of health and education services provided in the region. It is a function of the ratios of doctors, hospital beds, teachers and classrooms, respectively, over the population.

The **Environmental Conditions Multiplier** (ECM) expresses the quality of the environment of the region. It is a function of the ratio of energy used for industrial purposes over the total energy used and the ratio of the number of cars over the population

A list of all variables affecting a region's Basic Image and an outline of their conversion into the two indicators, is given in Table 1.

Table 1: Conversion of the variables affecting a region's Basic Image

Indicators	**Multipliers**	**Indices**	**Variables**
Economic Indicator	$LOCM$	Location Index	Size of Influence Centres
			Distance/Cost from Influence Centres
	$LAVM$	Land Availability Index	Area
			Population
	FCM	Financial Conditions Index	Gross Domestic Product,
			Population

Social Indicator	*HCM*	Housing Conditions Index	Total Number of Houses
			Population
			Number of New Houses
			Total number of Houses
	SCM	Social Conditions Index	Number of Doctors
			Number of Hospital Beds
			Population
			Number of Teachers
			Number of Classrooms
			Population
	ECM	Environmental Conditions Index	Industrial Electricity Consumption
			Total Electricity Consumption
			Number of Cars
			Population

4. Measuring the effects of tertiary educational activities on a region' s development

4.1 Direct and indirect effects

The location of a university in a region generates a number of positive direct and indirect effects.

The main direct effects are**:**

- Generation of university related jobs. The majority of those jobs will be taken by newcomers in the region.
- Generation of student places. The majority of those places will be taken by persons outside the region.
- Generation of income generated by the new job holders and the students.

Similarly, the main indirect effects are:

- Generation of jobs not directly related to the university. Those jobs are needed to satisfy the extra demand generated in various service industries by the new job holders and the students.
- Improvement of the region's social profile.

The next step will be to quantify those effects on the image of the region, its attractiveness and its eventual development. For the purposes of this paper we will quantify separately the effects of:

- Income generation
- Jobs generation
- Improvement of the region's social profile

4.2 Income generation

The income generated in a region as the result of a university's operation consists of two components:

- Income from the state to cover the university's operation expenses
- Income from the students' families to cover the student's living expenses

The first component includes academic and non-academic staff salaries, other operational expenses, the cost of books provided free by the state to the students and the cost of students' board and lodging. The data has been drawn from the Ministry of Education data base.

The second component covers the students' cost of living and may be estimated as a product of an estimate of a student's annual average living expenses and the number of students living in the region.

Furthermore, we assume that 40% percent of the first component and 30% percent of the second component will be spent in the region and will increase its GDP accordingly. Obviously, the part of GDP which is due to the university's operation is included in the GDP as given by the official statistical sources and has therefore been used to determine the region's Financial Conditions Multiplier (*FCM*) and hence its Basic Image (BI). If we want to have an indication of the region's image without the university's operation we must subtract this part of GDP and use the reduced GDP for the calculation of the region's Financial Conditions Multiplier and its Basic Image.

4.3 Jobs generation

The number of university related jobs may be easily calculated from the respective organizational chart. The number of all other jobs, not directly related to the university's operation but needed to satisfy the extra demand generated in various service industries by

the new job holders and the students, may be estimated as a function of the demand/income generated in such industries (restaurants, bars, bookstores, computer stores etc.). At this point, however, it should be mentioned that jobs availability and prospects as well as labour availability and quality are factors affecting not the Basic Image of a region, but its Specific Images as perceived by various groups of potential movers. Hence, for the purposes of this paper we will not deal with them.

4.4 Improvement of the region's social profile

The operation of a university in a region will improve its social profile. For the purposes of this paper the effect of a university's operation on the region's social profile, its attractiveness and its eventual development will be expressed through the newly defined **Educational Multiplier** (*EDM*), which together with the Housing Multiplier (*HSM*), Social Conditions Multiplier (*SCM*) and the Environmental Multiplier (*ECM*) will determine the region's new Social Indicator (SI) and hence its new Basic Image. Thus,

$$SI = \sqrt[4]{HCM * SCM * ECM * EDM}$$

For the purposes of this paper and in line with all other multipliers, the *EDM* is a non linear transformation of the **Relative Educational Index** (*REDI*) which gives an indication of the level of tertiary education services in the region. The Relative Educational Index is expressed as a weighted average of five ratios giving respectively the number of university departments operating in the region, the number of students registered, the number of academic staff, the number of non-academic staff and the number of research publications over the respective numbers for the typical region. The weights attached to each of the five ratios indicate their relative significant in defining this Multiplier. For the purposes of this paper, the weights of all ratios are considered equal to 0.2.

An overview of the variables affecting this Educational Multiplier and their conversion into the region's EDM is given in Table 2

Table 2: Conversion of variables affecting a region's Educational Multiplier

Educational Multiplier		
Multiplier	**Index**	**Variables**
EDM	Educational Index	Number of universities' departments
		Number of students
		Number of Academic Staff
		Number of non-Academic Staff
		Number of Publications

5. Application

The methodology presented in the previous section is now applied to the case of the thirteen Greek regions as shown in Figure 2. Before proceeding to the calculations we briefly present the characteristics of those regions.

Figure 2: Map of the Greek Administrative Regions

East Macedonia and Thrace region is located in northeast Greece and covers some 14157 square kilometers. About 561838 people live in this region and its economy is based on all three sectors.

Central Macedonia is located in north central Greece and covers about 19147 square kilometres. About 1871052 people live in this region which is considered as the metropolitan centre of Balkans.

West Macedonia is located in the north-western part of the country, covers 9451 square kilometres and has 293015 inhabitants. It is the most under-populated region in the country. The secondary and tertiary sectors are dominant in this region's economy. Furthermore, most of the country's power generation plants are located there.

Thessaly is located in central-eastern continental Greece and covers 14036 square kilometres. About 753888 people live in this region. The secondary and tertiary sectors are fastly developing, but the primary sector still remains important for the region's economy.

Epirus is a coastal region of north-western Greece, covering 9223 square kilometres, with 353820 inhabitants. It is a predominantly rugged and mountainous region where primary sector, tourism and marble extraction are the main sources of income.

Ionian Islands region is located in the western part of Greece, covers 2318 square kilometres and has 202000 inhabitants. The region is composed of thirty eight islands, and tourism sector is the main source of income.

West Greece stretches from the northwest part of the Peloponnese to the western tip of the Greek mainland, covers an area of 11350 square kilometers and its population rises up to 741282. The region is considered as a communications and transport hub connecting Greece to the rest of Europe.

Central Greece is located in the mainland of Greece, covers about 15549 square kilometres and has a population of about 662802 people. The secondary and tertiary sectors are fastly developing, but the primary sector still remains the basic source of income for the region.

Peloponnese is located in southeast continental Greece and covers some 15490 square kilometres. About 1086935 people live in this region, and their basic income source is the primary sector.

Attica is located in southern Greece, and covers some 3,800 square kilometers. About 3,750,000 people live in this region, with 95% of them occupying the Greater Athens metropolitan area.

North Aegean is located in northeast Greece, covers 3836 square kilometers and has 208151 inhabitants. Primary sector plays a dominant role in the region's economy, as Mytilene is well known for its olive oil and ouzo, Chios for its unique mastic and Samos for its famous wine. Tourism, shipping and trade are also developing sectors in this region.

South Aegean is located in southeast Greece, and covers some 5286 square kilometres. About 301700 people live in this region, most of which are occupied in the tourism sector.

Crete is located in south Greece and covers some 8335 square kilometres. About 562276 people live in this region, most of which are in the business of tourism and farming.

The proposed methodology consists of the following three steps.

1. Estimation of the regions' GDP with and without the contribution of the universities' operation.
2. Calculation of the regions; Educational Multiplier (EDM)
3. Estimation of the regions' Basic Image (BI) with and without the contribution of the universities' operation

Table 3 summarizes GDP data per region.

Table 3: GDP per region (in million Euro), 2007

Regions	GDP	GDP generated by Universities' Operation	GDP without Universities' operation
East Macedonia & Thrace	8218.40	203.25	8015.15
Central Macedonia	30518.60	578.23	29940.37
West Macedonia	4853.20	67.06	4786.14
Thessaly	10957.00	179.18	10777.82
Epirus	5212.90	191.91	5020.99
Ionian islands	3663.90	67.17	3596.73
West Greece	9614.40	237.31	9377.09
Central Greece	10166.50	22.24	10144.26
Peloponnese	9810.30	111.34	9698.96
Attica	113046.00	891.03	112155.00
North Aegean	2915.30	147.87	2767.43
South Aegean	6410.80	3.17	6379.11
Crete	11049.40	247.12	10802.28

Most specifically,

- column 1 presents the regions' GDP, as drawn from the official statistics sources, including the income generated from the universities' operation
- column 2 gives an estimate of the regions' GDP generated by the universities' operation. This estimate has been produced along the lines described above
- column 3 gives the regions' GDP without the contribution of universities' operation as the difference of the respective figures of the previous two columns

Table 4 summarizes, all the data needed for the calculation of the regions' educational multiplier (columns 2-6) as well as the value of this multiplier (column 7).

Tables 5 and 6 present the Economic Indicator, Social Indicator and Basic Image values for all regions, with and without a contribution of the universities' operation respectively. It is reminded that the universities' operation influences the Economic Indicator through the Financial Conditions Multiplier and the Social Indicator through the Educational Multiplier.

Table 4: Regional Data, 2007

Administrative Regions	Number of Universities Departments	Number of students	Number of Academic Staff	Number of non-Academic staff	Number of publications (per year)	Educational Multiplier
East Macedonia & Thrace	18	13033	816	569	257.6	0.902
Central Macedonia	18	41948	2969	1854	1744.8	1.627
West Macedonia	6	2084	169	44	10	0.634
Thessaly	16	6825	774	408	220	0.823
Epirus	17	12526	685	577	714.4	0.951
Ionian islands	17	2686	177	113	51	0.696
West Greece	21	16047	989	663	897.2	1.075
Central Greece	2	291	23	21	10	0.598
Peloponnese	10	2023	330	150	14.4	0.674
Attica	78	92779	4609	3977	3046.6	1.966
North Aegean	14	7248	396	311	596	0.821
South Aegean	3	1553	85	66	128	0.629
Crete	22	11913	981	640	899.6	1.048

Table 5: Values of Basic Images of 13 Greek Regions without Universities' contribution, 2007

Administrative Regions	Economic Indicator	Social Indicator	Basic Image without Universities' contribution
East Macedonia & Thrace	0.46384	0.570	-0.3466
Central Macedonia	0.52157	0.608	0.3676
West Macedonia	0.50446	0.668	0.3951
Thessaly	0.53231	0.555	0.2972
Epirus	0.48941	0.628	0.2905
Ionian islands	0.43629	0.624	-0.1682
West Greece	0.51656	0.613	0.3558
Central Greece	0.55333	0.551	0.4240
Peloponnese	0.51676	0.601	0.2970
Attica	0.64562	0.525	0.5979
North Aegean	0.39771	0.584	-0.3948
South Aegean	0.43282	0.600	-0.2987
Crete	0.42402	0.581	-0.3737

Table 6: Values of Basic Images of 13 Greek Regions with Universities' contribution

Administrative Regions	Economic Indicator	Social Indicator with *EDM*	Basic Image with Universities' contribution
East Macedonia & Thrace	0.46438	0.538	-0.3281
Central Macedonia	0.52167	0.654	0.4573
West Macedonia	0.50405	0.554	0.2482
Thessaly	0.53215	0.515	0.2880
Epirus	0.49111	0.586	0.2793
Ionian islands	0.43633	0.539	-0.3690
West Greece	0.51713	0.619	0.4013
Central Greece	0.55157	0.483	0.3691
Peloponnese	0.51608	0.542	0.2692
Attica	0.64439	0.614	0.6454
North Aegean	0.40007	0.534	-0.4227
South Aegean	0.43169	0.511	-0.4489
Crete	0.42441	0.566	-0.3007

Looking at the Tables 5 and 6 the following conclusions may be drawn:

- There is no change in the sign of a region's Basic Image resulting from the universities' operation
- The Basic Image of regions with large and traditional universities (Attica, Central Macedonia) improves when the contribution of universities' operation is taken into account.
- The Basic Image of regions with small and new universities (Peloponnese, Central Greece) deteriorates when the contribution of universities' operation is taken into account.
- Finally, the Basic Image of regions with medium size universities (East Macedonia & Thrace, Crete) remains almost constant when the contribution of universities' operation is taken into account.

The findings seem to suggest that the foundation/operation of a university alone cannot improve, at least in short-term the Basic Image of the less favorably located regions. What we can do however, is to improve the well-being of its inhabitants by generating new jobs and additional income. As we can see from Table 3, which gives the contribution of universities' operation on the regions' GDP, less favorably located regions with medium size

universities display a higher than average contribution of universities' on their GDP. On the contrary, unfavorably located regions with small universities display a much lower and in most cases lower than average contribution.

6. Conclusions

A region's pattern of growth depends on its power to attract economic activities and the right blend of people to run them. This power depends on economic and social factors that may be combined into a variable which is referred to as the Image of a region and has been presented in some earlier works (Angelis 1980, 1990, 2009) The role of a region's location is crucial for its development. Hence it is difficult for remote and isolated regions to attract economic activities involving production and transportation of tangible goods. An alternative way to achieve the development of such regions is to locate there activities that would immediately generate jobs and income and in the long run they may contribute to the improvement of those regions attractiveness. Tertiary education is such an activity.

Our objective in this paper was to examine the effect of a University's location in a region, on the region's development. The theoretical approach and the application considered shows that the attractiveness of a region, as expressed through its Basic and Specific Images, is not practically affected by the University's operation. However, the values of a set of indicators related to local economy, have improved considerably indicating a positive effect of the University's operation in the area's well being. However, further research is required to support and verify those findings. Areas of further research may include the elaboration on the definition and quantification on the set of indicators used and their impact on the region's image.

References

1. **Acs, Z.J., Audretsch, D.B., Feldman, M.P., (1994).** "R& D spillovers and recipient firm size", *Review of Economics and Statistics*, **76**, pp. 336-340.
2. **Angelis, V., (1980).** "Factors affecting the movement and location of both industrial units and their employees", *Proceedings Volume, J. Karkazis and J.B. Boffey eds., Meeting IV the Euro Working Group on Location Analysis, Chios*, pp. 219-236.
3. **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 of the Euro Working Group on Location Analysis*, Chios.

4. **Angelis, V. (2009)** The Image of a Region: A Tool for its Sustainable Development, *Proceedings, 5th National & International HSSS Conference "From Systemic Thinking to Systems Design and Systems Practice",* 24-27 June, Xanthi, Greece.
5. **Angelis, V., Dimaki, K. (2010).** A Region's Basic Image as a Measure of its Attractiveness *(submitted)*.
6. **Angelis, V., Dimopoulou, M., (1991).** 'A Decision Support System for the Location of Unidustrial Units. Theoretical Framework and Applications", Studies in Location Analysis, 3, pp. 219-236.
7. **Amstrong, H.W., Dorrall, J., Grove-White, R., (1997).** "Maximising the local economic, environmental and social benefits of a university: Lancaster University:, *GeoJournal* **41** (4), pp. 339-350.
8. **Blake and McDowall, (1967).** "Maximising the local economic, environmental and social benefits of a university: Lancaster University:, *GeoJournal* **41** (4), pp. 339-350.
9. **Bleaney, F.M., Binks, R.M., Greenway, D., Reed, V.G., Whynes, K.D., (1992).** "What does a University add to its local economy?" *Applied Economis*, **24**, pp. 305-311.
10. **Brownrigg, M., (1973).** "The Economic Impact of a New University", Scottish Journal of Political Economy, **20**, pp.123-139.
11. **Cullingworth, J.B. (1969),** "Housing and Labour Mobility", OECD, Paris .
12. **Goldstein, A.H., Renault, S. C., (2004).** "Contributions of Universities to Regional Economic development: A Quasi-experimental Approach", *Regional Studies*, **38** (7), pp. 733-746.
13. **Griliches, Z., (1979).** "Issues in assessing the contribution of research and development to productivity growth", *Bell Journal of Economics*, **10**, pp. 92-116.
14. **Hunter, L. and Reid, G. (1968).** Urban Worker Mobility, OECD, Paris.
15. **Jaffe, A., (1989).** "Real effects of academic research, American Economic Review, **79**, pp. 957-970.
16. **Isserman, A. Merrifield, J., (1987).** "Quasi-experimental control group methods for regional analysis: an application to an energy boomtown and growth pole theory", *Economic Geography*, **63,** pp.3-19.
17. **Leanet *et al, (*1992),** "Examined the impact of Sterling, used a quasi experiment approach (non linear regression model), *Urban Studies*, (27), pp. 53-61.

18. **Lewes, F.M.M., Kirkness, A.,(1974).** "Exeter – University and City: A study of Economic and Social Interactions caused by University Growth. University of Exeter.
19. **Lewis, J.A., (1988).** "Assessing the Effect of the Polytechnic, Wolvehampton on the Local Community", *Urban Studies*, (25), pp. 53-61.
20. **Sinclair, M.T., Suntcliffe, C.M.S., (1978).** "The first Round of the Keynesian Regional Income Multiplier", *Scottish Journal of Political Economy*, **25**, pp.177-186.
21. **Sinclair, M.T., Suntcliffe, c.M.S., (1982a).** "Keynesian Income Multipliers and First and Second Round Effects: An application to Tourism Expenditures", *Oxford Bulletin of Economics and Statistics,* **44***,* pp. 321-338.
22. **Perloff, H. S and Wingo, L. (1971).** Planning and Development in Metropolitan Affairs in Leahy. *Urban Economics, Theory, Development and Planning*, The Free Press, New York.
23. **Reed, W.R., Rogers, C., (2003).** "A study of quasi-experimental control group methods for estimating policy impacts", *Regional Science and Urban Economics*, **33**, pp. 3-25.
24. **Ricci, M., (1997)**. "The urban role of a new university: a case study of Chieti-Pescara, Abruzzo, Italy", *GeoJournal* **41** (4), pp. 319-324.
25. **Thanki, R., (1999).** "How do we know the value of higher education to regional development?, *Regional Studies*, **33**, pp. 84-89.
26. **Thom, R. (1975).** *Structural Stability and Morphogenesis: An Outline of a General Theory of Models.* Addison-Wesley, Reading M.A
27. **Zeeman E.C. (1973).** Applications of Catastrophe Theory, *Manifolds*. Tokyo.
28. **Zeeman, E.C. (1977).** *Catastrophe Theory-Selected Papers 1972,* Addison-Wesley, Reading MA.
29. **Zolotas, X. (1981).** *Economic Growth and Declining Social Welfare*, New York, University Press.