SPACE DYNAMICS AND IMPROVEMENT OF THE TOTAL FACTORS PRODUCTIVITY (TFP)

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Abstract

In this paper, we show that production activity in an area that is influenced by the working localization and the space overflow effects.
Regional economic growth is related to effects which improve the effectiveness of the work factor. In this paper, space regional effects drive or overflow influence the activity of production through the acquisition of new knowledge while benefiting from space effects.
We break up the total factor productivity (TFP) into space factors and we arisen a functional relation which connect the productivity per work and per area growth rate according to a set of space variables.
By using European regional data according to NUTS2 nomenclature, we estimate a simultaneous equations model which shows that the regional development projects and the Community policies cannot achieve the goals of corrections of the latecomer's areas which the transfers aim in first places the development of interdependences relations between production forces.
Achievement of the European structural funds objectives is related to the capacity as of these objectives to improve the labor productivities through integrations of space dimension in construction of the therapeutic policies.

Introduction

The new analyses in economic sciences give a strong attention to the internal and external returns to scales of an industry. These economic theories suppose the existence of a competing sector which produces a homogeneous good, another sector in monopolistic competition which produces differentiated good with increasing return of scale and another sector in imperfect competition profiting from external effects. These assumptions are at the base of the "New Theories of the International Trade" analysis (NTIT). By adding the assumption of freedom movement of the factors of production and spatial analysis into the economic analysis, we can speak then about the New Geographical Economy (NEG).
In this paper, we propose to model the regional interaction by introducing the space variable as factor which directs the effective choices of the economic policy. For that, we propose, in a first section to introduce the geographical character of the labor productivity. We break up, in a second section, the labor productivity spatialized as being the rise of the coordination mode. Empirical approach of space dynamics will be the subject of the last section.

I. Geographical characteristics of economic growth and amelioration of TFP

To seize the geographical character which improves the TFP, consist in breaking up the growth of technical progress by a space elements in interactions. The TFP integrates geographical elements such as the competitiveness indicator of an area.

By analyze the determinants of the total the factors productivity; we try to show how the TFP is explained in its majority by the improvement of the labor productivity. New approaches (Krugman 1991) consider that an industrial sector is competitive if it is able to gain successes in the international trade due to its productivity and maintaining high remunerations of labor. This definition is justified in more in the presence of an economy whose its effect on price is limited. It is the case of the small open countries where the measurement of the labor productivity seems being determining of primary importance of the competitiveness of the nations and sectors.

The productivity is not however the only one determinant of the competitive position of an economy. Small open economies can have certain ability in fixing their prices compared to the world market and thus reflect a possible rise of their production costs. In addition, exchange rate, wages, taxation also comes to form the price component of competitiveness.

After having to point out the interest of TFP in the growth of income of an area, we present some determinants of space natures which take as a starting point the current analyses of technical progress (Romer 1986, and Helpman 1981). It is shown thereafter that the growth of the TFP is largely attached to the improvement of the labor productivity. The latter is in its turn influenced by space sizes which we will expose in an explicit way in the following sections. Moreover, we analyze the variation of the growth rates of TFP and the labor productivity by taking the example of a small country like that of Luxembourg. We show the space character of the labor productivity via decomposition of the TFP.

1. Decomposition of the total factor's productivity (TFP)

The apparent average productivities of each factor, respectively ***Q/L*** and ***Q/K*** are partial because they evaluate in an isolated way the contributions from each one of these two factors contribute to production. However, interdependence of these factors in the growth process encourages measuring a total factors productivity. This implies to bring back the output (production or added value) to an aggregative index (combination) of volume of the factors.

Economic growth is explained partly by the growth of TFP. The latter can be broken up into an element which improves the labor productivity and another which depends on the growth of the capital by workman.

We show that the growth rate of technical progress or the TFP is explained, largely by the growth of the labor productivity.

Calculation method of TFP supposes a constant return to scale. Let us consider the following production function:

$$Q(t) = A(t) \cdot F[K(t), L(t)] \qquad (I,1,1)$$

Q(t), the added value in volume A(t) a parameter of displacement of the production function and F *[...]* a total indicator of inputs.

The total factors productivity Π_F (which coincides with *A(t))* is equal to the relationship between the volume of the output *Q* and the volume of the factors F:

$$\Pi_F = \frac{Qt}{F[K(t), L(t)]} \qquad \text{(I,1,2)}$$

We can express the growth rate of income into the some of three growth rates:

$$\frac{\dot{Q}}{Q} = \frac{\dot{A}}{A} + (1-\alpha).\frac{\dot{K}}{K} + \alpha\frac{\dot{L}}{L} \qquad \text{(I,1,3)}$$

We note by: $1-\alpha = \frac{AF_K K}{Q}$ and $\alpha = \frac{AF_L L}{Q}$, with α is the elasticity of income by report to the labor force quantity employed in sector.

The growth rate of TFP is bellow:

$$\lambda = \frac{\dot{A}}{A} = \frac{\dot{Q}}{Q} - \left[(1-\alpha).\frac{\dot{K}}{K} + \alpha.\frac{\dot{L}}{L}\right] \qquad \text{(I,1,4)}$$

By symbolizing the growth rate of the TFP by λ, the growth rate of labor productivity by *p* and the average productivity of work by *P*, we can write:

$$\lambda = p - (1-\alpha).\frac{\dot{k}}{k} \qquad \text{(I,1,5)}$$

$$\text{With } P = \frac{Q(t)}{L(t)} \text{ and } k = \frac{K(t)}{L(t)}$$

To calculate the total factors productivity (total), it is supposed that the production factors are remunerated by their marginal productivity. This condition is checked for companies "*price-takers"* on the factors markets organized by the pure and perfect competition. Consequently, α and (1- α) are respectively the contribution of labor and capital in the added value.

Growth rate of the A(t) seems as an indicator of the profits TFP. It is a long period growth which is not allotted to the accumulation of the production factors (K and L), but rather with the improvement of the factors productivities, in particular work. These profits as regards as a growth rate of the total added value dissociated from the two factors of production are at the origin of the increase in the product for a given volume of factor of production. It is often of use to allot them to "*technical progress* ". Actually, they represent a fascinating residue of account all the elements not strictly quantitative contributing to the increase in the labor productivity.

In this direction, technical progress does not result only from the improvement of the labor quality or the stock of capital (related to its renovation) but also of progress in the organization and the business management, as well as any forms of externalities related for example in the contiguity, concentration of the specialized labor or to the diffusion of information.

2. Spatial source of TFP: the spatial character of the labor productivity.

A significant teaching of the economic growth model according to Solow (1956) analyses shows that the long run growth of per capita income due only to the quantitative accumulation of production factors under the influence of the decreasing returns to scale. Consequently, TFP evolution is only able to underlie a durable and long run growth path. In traditional models of the exogenous growth, calculation of the TFP evolution makes it possible to obtain

a technical progress indicator. However, this decomposition does not specify the origin of the technical progress which is thus supposed to be exogenous (basket of the sky).
During last years, this analysis was criticized by a certain number of economists (Romer (1986)). The latter developed endogenous growth models. Central idea of this new theory is that the growth does not result solely from one exogenous factor but also from cumulative increase in an endogenous factor which represents the stock of knowledge generated by investment (model of Romer) and human capital (model of Lucas).

The idea that part of technical progress as a source of developments from knowledge is not new (Ibn Khaldoun). Development of knowledge can be seen like the acquisition of an exchangeable good of formation within the sector of R&D or in the form of technological Spillovers according to space modes of coordination trajectory. According to Arrow (1962), the volume of knowledge is positively related to the stock of capital, since the new equipment partly incorporates the results of the last technological innovations. Companies accumulate consequently knowledge while investing, by developing major studies relating to the changes of the markets structures and the volatile vicinity consumer's preferences. New investments and new acquisitions of machines require improvement of the labor productivity, by bias new acquired technologies and which use the labor having a productivity definitely attached to the agglomeration effects and the characteristics of labor markets in the close areas (Fingleton 2001). This effect of training is sometimes described like a process of «learning *by doing*» or " *learning by investing*» which constitutes a technological externality for the whole of the economy. Technical progress becomes thus endogenous with the whole economy and develops the accumulation of capital. In this order of idea, a significant share of the residue of Solow would be then ascribable to the investment rather than with a technical progress which remains unexplained.

We tire to show that the TFP (a measurement of technical progress or growth explained by endogenous factors) is allotted to the profits of labor productivity in spite of an improvement of the growth due to the new investments in the presence of productions functions under increasing returns. If the productivities of the primary education factors of production are cancelled in the long run, labor productivity improves by localization effects. The labor productivity (will be the subject of the following development) is apprehended as being a space variable related on the site and the density of the labor, compared to the space entity. Labor localization is measured by the distance between an area and the central is generally considered as being a leader area. The central area is not defined according to the labor productivity but about various spatialized approaches of the endogenous growth.
Distance from central area that we propose is important according to labor productivity growth. It explains in a large way the TFP growth. Luxembourg is a small country characterized by the importance of its labor density. To endogenous or to spatialize the income growth rate means to find the explanations of the growth of the TFP. In the case of Luxembourg, this task means that it is necessary to seize the variables which explain the trajectory of the labor productivity growth of this country considered very dense as regards to labor distribution. We regard thereafter the area (country) of Luxembourg as being a central area or leader.
Certain A-space analyses classify the areas according to the income per capita. This conceptual nature articulation treats initially, in a comparative economic analysis, the potential of space-time convergence or interregional divergence. This convergence supposes the realization of a stationary state where each economy (area) converges towards a point says "*Steady state "*.

The approach of classification per area approached in this thesis does not coincide with the approaches of regional convergence. Insofar as the income per capita is not the criterion of regionalization. Indeed, the areas are indexed according to its regional memberships of the countries of origin. The regional classification is exogenous. In only one class of areas, the approaches of the endogenous growth remain the sources of the growth and the qualitative changes of the force of work including its trajectories of immigration will intra regional are the variables of the corrections. The endogenous growth regionalized in addition to the qualitative characteristics of the areas integrates the geographical characteristics in order to arise the sources of the growth and the explanations of the per capita regional income inequalities. The endogenous character of the regional growth is thus enriched by the theories by the new geographical economy.

Certain economic analyses of the new economy geographical break up space entireties into several areas of which some between them are regarded as central areas and others are qualified like peripherals. Intra-regional flows of immigration depend on the intensity of the forces of agglomerations and coordination as well as behavior of the factors of production being given their technological delays compared to a standard localization. The theories of the new geographical economy make a theoretical extension of the models of the new theory of the international trade. Indeed, they suppose all the existence of two sectors one in imperfect competition which produces the differentiated well intensive one in know-how and in definitely mobile labor qualified between the areas the other sector in perfect competition which produces a homogeneous good of which the factor work (disqualified in particular) employed and motionless. The analyses of the new geographical economy introduce the space factor which exerts an evection effect on the movement of the factor work. These analyses are based on reasons of a space nature in the explanation of the intensive activities in labor qualified localized in outlying areas. These studies of the NGE suppose that the human capital and initial stocks of knowledge of the workers are the same one in all the areas. In particular, Pierre Mr. Picard and Jacques François Thisse (2004) showed that space is determining exchanges and interactions between areas. They showed initially that: The space of the identical economies react differently to commercial liberalization when their structures of property are differ, in the second place, for the same commercial level of integration, the changes of structure of property can affect the spatial distribution of the companies. This indicates a news and non-commonplace interaction between some non-regional policies, privatization and regional imbalances.

If we introduce differences on the level of the human capital, the analysis of the NGE finds other dimensions and contributes to studies the endogenous growth models (dependent on know-how) characterized by increasing outputs of scale and a perfect mobility of the force of work between the various areas and sectors.

3. Specialization of the technical progress and spatial effect on the labor productivity (the static technical progress)

In following analysis, added value or the production of an area or a country is calculated according to production function of type CES where the economic activity is determined per unit of surface.
Each unit of surface is an area which has particular geographical characteristics. These geographical, demographic or cultural characteristics influence the human behavior responsible for the operation of production or consumption as well as the movements of the

force of work. Each unit of surface or area lodges a labor having specific qualifications which depends on the human capital localization, specific cultures and clean lawful framework. The theoretical approach of the modeling the geography of production takes as a starting point from the theoretical abstraction of Ciccone (1996).

The economic density of any macroeconomic variable is an essential concept in the Ciccone's approach. In particular, the author supposes that the density of work in an area *i* (mail *i)* is a space variable which affects income growth rate of a particular area one country, via the information exchange in the form of a commercial trade.
Per unit of surface labor productivity (by mail i) finds other dimensions in areas where the working density is high (all depends on the elasticity of the value added compared to the density). The transmission channels of working repair in a system *r* influence the labor productivity of an area, economic health and the regional development.
In this case *the technological* spillovers and the TIC play a significant role by the means of various measurements or mode of adoption of new production methods.

Following the Ciccone's (1996) assumptions, we suppose that production function by unit of surface i, is as follows:

$$Y_i = Q_r.\left(E_i.L_i\right)^{\alpha}.K_i^{\beta}\left(y_r / A_r\right)^{\lambda} \qquad \text{(I,3,1)}$$

- ✓ Y_i is the added value of the region i ;
- ✓ E_i is the labor efficiency in the region i;
- ✓ Q_r is a TFP indicator of all regional system ;
- ✓ Y_r and A_r are respectively the added value of the regional system (even a country) and the system area (or country r).

The essential assumption of this model supposes a static technical progress which have'int a regular growth rate in time and for each area.

The term $\frac{y_r}{A_r}$ is named in the NGE by the economic density writen as an average evaluated in by Km^2 added value.
The coefficient λ is a positive elasticity if the economic density affects positively the per unit surface production.
Parameters α and β from (I,3,1) are elasticities. α et β Are the same in all regions. It is noticed that the production function per area i is related to the economic density of the whole system and not to the clean density of r*egions i.*

We try to break up the space and geographical character of the production operation of the regional system *R* by giving to the production function a space characteristic. We call regional system a state member of a perfectly integrated zone. In a regional system, the factors of production (mainly labor of an intensive sector in knowledge) circulate freely and without constraints.
This aggregation is necessary in this development insofar as, we can thank to detect the effect of the spatial variable on the economic operations. This effect which slowly absent or ignored affects the regional growth by the intermediary of the productivities of production's factors, especially the factor work which is strongly mobile.

The per region (i) production function shows particular regional characteristics. Labor productivity is a distinctive characteristic of the units of surfaces. To pass to a production function of more raised scale, country or governorate (all depends on the geographical framework used) is simple. It is enough to multiply the per unit production function by the surface of the local system (country r):

$$Y_r = \sum_i Y_i = \left(A_r Y_i \right) = Q_r . \left(E_r . L_r \right)^{\alpha} K_r^{\beta} A_r^{\gamma} . \left(Y_r \middle/ A_r \right)^{\lambda} \qquad \text{(I,3,2)}$$

This aggregation is done under the assumption bellow:

$L_r = A_r L_i$, $K_r = A_r K_i$ and $\gamma = 1 - \alpha - \beta$

We suppose that the total added value is the production of a whole companies regarded as a rational agent. Consequently, we pass from the micro agent space, rational with another producing agent, by simple aggregation while preserving the basic assumption of the rational behavior of the aggregate producing agent.

If we suppose that the perfect competition exists between the various producing agents on a space macro scale (between the macro-areas r). Consequently, the rule of maximization of profit (the price of the output is standardized with the unit), gives the following results:

- The marginal productivity of labor equal to the marginal cost of this factor which is the wage;

The marginal productivity of the capital equalizes the marginal cost of this factor which is the user cost of the capital noted *C.*

Optimization means that the pure and perfect space competition model supposes areas which have the same sizes. Producers are atomic and do not influences (reduced sizes) price market of a homogeneous good.

In the equilibrium situation (for the producing agent of an area), the last unit of work employed brings back only its cost and the last unit of the capital factor employed brings back only its user cost *C.* Formally, we can write the following equalities which illustrate the theoretical approach of optimization or maximization of the aggregated profit incorporated in the regional system.

$$\frac{\delta \pi_r}{\delta K_r} = 0 \quad \Leftrightarrow K_r = \frac{\beta . Y_r}{C}$$

π_r and C indicate respectively the profit of the aggregate regional agent (of the system or country r and the marginal cost of a unit of the capital. This last is supposed to be constant whatever the country r.

The workforce of the system is in charge of a qualification or of an effectiveness connected to a human capital acquired in the form of academic formation of hours of formation or a space-time interaction. The effectiveness of work E_i is supposed in this model as being proportional to the average S_r and of the years of studies carried out by the labor of the total system r (indicating of the human capital).

We suppose in the following by η is the elasticity of the effectiveness of work (E_r) in the system r compared to the indicator of human capital S_r. This elasticity calculated on the aggregate level is constant in the various regional systems (all countries).

After analytical rearrangements, the aggregate production function is as follows:

$$Y_r = \left(\frac{\beta}{C}\right)^{\beta.\theta} Q_r^{\theta} S_r^{\eta.\alpha.\theta} L_r^{\alpha.\theta} A_r^{1-\alpha.\theta} \qquad \text{(I,3,3)}$$

$$\theta = \frac{1}{1-\beta-\lambda}$$

The development of the equation (I,3,3) gives theoretical relations in the form of equation to be in empirical production estimates according to the systems surfaces and labor. Certain authors built models inspired from the equation (I, 3, 3) by regarding the labor productivity as an endogenous variable whereas the density of labor and the economic density are explanatory variables.

This type of estimate does not constitute a space approach of the labor productivity, insofar as the empirical approach can be a-space. I.e., the sets of data of work density and the economic density are time series of only one system that's its surface remains unchanged in time. By integrating space dimension (i.e. to use data by localizations of the perfectly integrated areas), the empirical approach requires measurements of spatial autocorrelation between variables in the model represented in equation (I,3,4). This step of spatial econometrics implicitly implies modes of coordination and interactions between various operators of a perfectly integrated regional system.

$$\frac{Y_r}{L_r} = \left(Q\beta^{\beta}.C^{-\beta}\right)^{\theta} S_r^{\eta\alpha\theta}\left(\frac{L_r}{A_r}\right)^{\alpha.\theta-1}\left(\frac{Y_r}{A_r}\right)^{\alpha.\theta.\mu} \qquad \text{(I,3,4)}$$

Baptista (2003) supposes that the labor productivity and the economic density per unit of surface (square kilometer) are dependent according to the equation (I, 3, 5). We suppose in this equation that the economic density is constant in various systems *r*. The equation estimated by the author is as follows:

$$\frac{Y_r}{A_r} = \left(Q\beta^{\beta}\, C^{-\beta}\right)^{\theta}\left(\frac{L_r}{A_r}\right)^{\alpha.\theta} \qquad \text{(I,3,5)}$$

The last equation is estimated by the Babtisata (2003) by using American data by states. The author interprets the labor productivity as being a geographical measurement dependent only on one geographical variable which reflects the distribution of the labor in the states.

This attempt to integrate regional dimension hiding place in made an intrinsic causality exerted by the space variable on the human behavior. Although, the areas surfaces do not change in time, the space dimension of the model estimated by Baptista (2003) is accentuated via the movements of labor between the various localizations. In absence of a true space variable, this contributes to growth rates of the areas benefits from productive labor. The work force immigrates and emigrates while benefiting from the interactions in the form of a ball of snow. The workmen of a unit of surface profit from the movements and improve their capacities to produce. Same manner, the workmen profit from their localizations through the interactions ensured by the NTIC while benefiting from the capacities to produce of the close areas.

The effect of the per unit work distribution density in surface ($\frac{L_r}{A_r}$) or the product density ($\frac{Y_r}{A_r}$) on the regionalized productivity of the work factor hide other regional dimensions that the analyses of the NGE expose in an explicit way, through various modes of coordination between the individuals and the human capitals distributed in the space in a purely random

and uniform way. The diffusions or *the technological* spillovers ensure space interaction human behaviors as a producer of a final good, considered here as being an added value by area.

Adoption of a new approach which is articulated on the role played by labor located in a given area is an approach by the space-time interaction between various economic operations. On another side, the analyses of endogenous growth offer a significant number of continuous explanations of the changes in time and space of labor productivity through the formation of a stock of human capital likely to reduce the variation of per capita GDP between the perfectly similar areas. In the same way, the analyses of NGE) enriched by spatial tools and the assumptions of perfect zoning such as regards freedom movement of work) show the existence of a remarkable space effect, on the labor productivity in various integrated areas. The current economic analyses consider that the geography and space are not neutral any more in the formation of richness of areas in interaction.

Space seen like surfaces in the higher model (equation (I,3,1)), does not show sufficiently the importance of geographical dimension in the growth areas. Space must be broken up in order to distinguish spaces according to their distinctive importance. Indeed, in the aforementioned model, surfaces in km^2 made abstraction of the deserts, the mountains or the fertile surfaces.

a. Decomposition of the spatial variable

Given that work is supposed to be distributed in a uniform way in space, the detection of space heterogeneity is impossible. From this idea, space dimension which directs the behavior of work in its formation and its dependence rather requires a modification of the work concentration in particular areas than in some other areas. This resulted in slackening the assumption of constant outputs of scale and the pure and perfect competition in the private final good sector.

Consequently, the term $A_r^{1-\alpha-\beta=\gamma}$ from the equation (I,3,2) will be replaced by the term B_r^{γ} (with $\gamma \neq 1$) who is a measurement the by area work force concentration.

Another vision of the space heterogeneity of production consists in supposing that each area (country) has its intrinsic specificities as regards expenditure in R&D. This heterogeneity creates a difference in labor productivity between areas or countries partner or integrated in the same zone.

Or, l'hypothèse d'hétérogénéité spatiale interrégionale n'apparaît pas significative aux niveaux géographiques. La différence entre régions intégrées et relativement similaires réside essentiellement au niveau de la différence régionale des progrès techniques, considéré comme caractéristique locale agissant ainsi sur le comportement des facteurs de productions, essentiellement le travail.

In an attempt at modeling, we presents a per unit production function of one surface which translates a space connection of labor productivity while supposing an increasing return to scales.

II. Spatial Labor productivity is the rise of coordination mode

We note several studies related to the endogenous growth use a production function which integrates the stock of per unit human capital of surface as being an input. This last

creates growth while improving that of the primary education factors. The human capital of a site is regarded as other intermediate goods, consumed by the productive enterprises of a final good.
We adopt in the first step the P Romer (1986) approach and we consider the per unit surface production function is bellow:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} [A(t)L(t)]^{1-\alpha-\beta} \quad \text{(II,1)}$$

Variables *K* L and *H* represent the inputs per unit of surface. Variable *AL* represents work per unit of efficiency in the site or the localization considered. Parameters α and β respectively represent the elasticity of the output compared to the physical and human capital.

In the model of perfect competition, the factors of production are remunerated by their marginal productivities. The factors *A* and *L* believe according to growth rates "exogenous" *n* and *g*..
Technology is supposed to be uniform for all the areas of the perfectly integrated system.
The growth rate is generally differed between areas.
To recall the evolution of the per unit surface production, of the physical and human capital in economy, we define variables per units of efficiency:

$$y = \frac{Y}{A.L}, k = \frac{K}{A.L}, \text{ and } h = \frac{H}{A.L}$$

If it is supposed that the fractions of income invested in the physical and human capital, s_k and s_h, the economy by area evolves according to following differential equations:

$$\dot{k}(t) = s_k y(t) - (n + g + \delta)k(t) \quad \text{(II,2)}$$

$$\dot{h}(t) = s_h y(t) - (n + g + \delta)h(t) \quad \text{(II,3)}$$

δ is the depreciation rate of the physical and human capital. If the returns to scale are decreasing $(\alpha + \beta \prec 1)$, each area converges towards its steady state.
I.e., if the growth rate of the primary education factors in each area is equal to 0 in the long run. Then, stocks of physical and human capital per unit of efficiency as well as the labor productivity, in a steady state will be as follows:

$$k^* = \left(\frac{s_k^{1-\beta} s_h^{\beta}}{n+g+\delta} \right)^{\frac{1}{1-\alpha-\beta}} \quad \text{(II,4)}$$

$$h^* = \left(\frac{s_k^{\alpha} s_h^{1-\alpha}}{(n+g+\delta)^{\alpha+\beta}} \right)^{\frac{1}{1-\alpha-\beta}} \quad \text{(II,5)}$$

Labor productivity (Y/L) is given by :

$$\left(\frac{Y}{L}\right)^* = A(0) e^{gt} \left(\frac{s_k^{\alpha} s_h^{\beta}}{(n+g+\delta)^{\alpha+\beta}} \right)^{\frac{1}{1-\alpha-\beta}} \quad \text{(II.6)}$$

Labor productivity is the engine of the regional interactions and the corrections between areas, under the principle of *Spillover*

To study the phenomenon of space convergence or geographical correction of labor productivity, we use the equation (II,8) which translates an econometric model. Individuals in this model are the areas. Space dependence in this model is expressed by the phenomenon of space interaction of explanatory variables such as productivities of the areas close (to the area considered) and by spatialization of the error term.

It is supposed that the labor productivity of the interdependent areas are spatially dependent according to various orders on adjacency or interaction. We suppose just as the space bonds between integrated areas contribute to the conditional convergence of the space units towards specific stationary states to each site. The exogenous variables of model can be seen as being observations delayed in space. Orders of space dependences are illustrated through the various weights matrices, specific to each delay.
Given the space nomenclature of a regional system, the endogenous variable which connects the interactions between various labor productivity from various areas, is:

$\ln\left(\frac{y(t)}{y(0)}\right)$.

The delayed spatialized exogenous variables are: $\ln s_k$, $\ln(n+g+\delta)$ et $\ln(y(0))$. This empirical specification reflects the concept of β convergence a-spatial studied an endogenous growth approaches.
The model is bellow:

$$y=\rho_1 W_1 y+\ldots+\rho_s W_s y+\beta X+\varepsilon+\theta_1 W_1 \varepsilon+\ldots+\theta_p W_p \varepsilon \qquad \text{(II,9)}$$

W_i is the matrix of space dependence standardized for the ith contiguity. To pass from an area to another i, we must cross at maximum the borders of i-1 areas.

To standardize the step, we consider only one matrix of space dependence which seized the

1. <u>Increasing return to scale, proximity of contiguity ant steady state</u>

The majority of the space economic surveys consider a production function with partially substitutable factors. This assumption hiding places behind it another significant assumption, checked by the operations of immigrations of the productive forces between areas. This assumption is checked by the space-time character of the production function. Production function of an area is given in time and measures the production per unit of surface, according to the quantities of the factors of the aforementioned unit. Production in an area profits from the capital of whole system. We suppose the absence of externalities effects, related to the physical stock of capital in the close areas, on the production behavior of a particular area.
The per unit surface production function is as follows:

$$Q = A_0 e^{\lambda t} K^{\alpha} L^{\beta} \qquad \text{(II,1,1)}$$

λ is the growth rate of per unit surface (TFP), α and β are parameter of the return to scale and L the employment level. Coefficient α and β are elasticities of the production per unit surface of the corresponding factor. Elasticities are supposed the same ones in the various areas of the perfectly integrated system.
By employing the logarithm on the preceding equation and by applying the total differential on the left and on the right of the equation of labor productivity ($\frac{Q}{L}$),there will be a relation which connects the labor productivity growth rate p at the growth rate of the per capita capital per unit surface k and the per capita growth rate q :

$$p = \frac{\lambda}{\beta} + \frac{\beta - 1}{\beta} q + \frac{\alpha}{\beta} k \qquad \text{(II,1,2)}$$

If we suppose that the capital per capita growth rate is equal to the product per unit surface growth rate, then $q = k$:

$$p = \frac{\lambda}{\beta} + \frac{\alpha + \beta - 1}{\beta} q + \xi \qquad \text{(II,1,3)}$$

Equation (II,1,3) is an empirical relation insofar as is a random term which follows a known distribution law.
If we suppose that : $k = \gamma . q$, equation (II,1,2) check an increasing output of scale implicitly if the term m_1 is equal to :

$$m_1 = \frac{\gamma . \alpha + \beta - 1}{\beta} \succ 0 \text{ and } m_0 = \frac{\lambda}{\beta}.$$

In this case, transformation of the equation (II,1,3) gives the following relation:

$$p = m_0 + m_1 q + \xi \qquad \text{(II,1,4)}$$

p and q are respectively the output and labor productivity or the income growth rate of this area.
m_1 is a coefficient which represents the economy of scale. Indeed, if the value of coefficient m_1 is equal to 0,5, an increase by 1% of output implies an increase in the labor productivity of 0,5 % because of the saving effort of the workmen. It is the case of increase return to scale. Workmen per unit of surface have the capacity to double the production whereas the acquired effort of 0,5% optimal remainder.
Equation (II,1,4) clearly does not show a per unit of surface labor productivity as being an endogenous variable equipped with certain space characteristics such as the distribution of labor, working qualification, clean experiment and the space proximity. Consequently, it will be operational to explain the growth of the TFP by space factors which influence the labor productivity.
With this intention, we develop a model in order to explain the growth of TFP by the effect of the space variables and the effect of vicinity which influence dependence between areas. It is supposed that between the integrated areas where the movements of production factors and the products are free, there is a technology transfer from an area to another which is generally, according to our assumptions, explained by:

- **The effect of vicinity;**
- **Acquisition of new technologies;**
- **Growth of the human capital.**

The endogenous growth stresses the role of TFP in the explanation of the growth. So the term is clarified λ while giving him a space dimension which generates the interactions between differently localized productive forces in a particular regional system.
Coefficient λ determine the labor productivity growth of an area according to the localization of this area in whole regional space.

2. Amelioration of labor productivity by the spatial TFP

Modern growth theory started to make the distinction between the production factors, such as work, capital and total productivity (TFP). Initially it was considered that the total productivity was drawn by an exogenous technological change. However, by preoccupation with coherence these "exogenous" models were to postulate that the technological shocks were absorbed quickly by all the firms. However, actually, gain of productivity is obtained only gradually by a process of training since the new knowledge is diffused slowly.

To understand these mechanisms of the growth process, we must revisit the original trilogy of Schumpeter against innovation and the diffusion:

- The invention refers to a progress of the technical training;
- The innovation is a cumulative process which converts this knowledge into marketable products and methods;
- The diffusion is a sequential process which encourages the use of these new products and these new methods throughout an integrated regional system;

This approach of the innovation phenomenon lays the stress not only on the production of knowing but also on its development, its application and its diffusion. Exogenous growth models, which insisted on a fast adjustment with the technological shocks, were not very convincing in their explanation of the role of the technological change in growth.

To exceed these problems, the theorists of the " new growth and the new geographical economies " tried to make endogenous technological progress, while more binding it to the decisions of investment in adjustment of space and development of competences, through the interactions between the productive forces.
Models of the new growth and the new geographical economies insist on the effects of space drive of the R & D and the technical training. In these models, stock of knowledge by coordination is interpreted like a no competing factor. It is a free good resulting from freedom of movement of the productive forces. The stock of knowledge is a good which generates increasing profits. This model differs from the approach of the neutrality of space because it identifies a "third *factor"* which is not prone to decreasing returns. It reaches that point while being focused on the regional expenditure of technical progress of the integrated areas and the local efforts as regards research and development, which lead to "innovations ".

Initially, the "endogenous" models correspond better so that we note for the innovation process. In particular, the evolution tendency in time and space of the new techniques diffusion shows that the new systems of production, acquired by worker in the form of a positive drive effect are comparable only gradually by the companies. Conclusion of this new growth theory is that the accumulation of knowledge and the phenomena of innovation which result from the regional interactions and research agglomeration effects can increase in a permanent way the economic growth rate of a given area.

Regional policies can, either to seek to increase the stock of knowledge by the means of the therapeutic community investments or to improve the interactions and the exchanges of knowledge by encouraging the technology transfers and the speed of diffusion. Although, community expenditure related to the developments of an area or a whole of areas is significant, they represent only one small part of the innovation process and the most effective

policy of the intervention at the regional level. Efficient regional policies consists to encourage innovation and to improve the diffusion rate of the technology transfers.
Capacity and exchange of information between companies whatever their localizations shows that the productive forces interact in the productive system in form of the networks interactions.
The principal contribution of the networks is to help to exploit the external economies and the other positive externalities by encouraging the vertical and horizontal relations between the independent firms. These bonds of reciprocity and co-operation facilitate the division of the risk and encourage the joint products and the development.

Company's participation in networks increased at the same time as increases the complexity of the systems of production. Regional networks give a little rigidity or stability to the relations inter companies and factors of production and allow the engagement of common investments by independent firms, which would not have occurred differently. Owing to the fact that in the absence of a bond of co-operation, the new highly specialized investments will be too risky. The introduction of the network activity changes considerably the analysis of the innovation process. It is not relevant any more to see the innovations as on the basis of companies isolated with great investments in innovation. On the contrary, we must regard them as a complex process of flow of knowledge which is strongly influenced by the dynamic of the regional networks. Success of the setting in network is strongly based on the idea that the companies learn more from the other companies in various countries of an integrated zone. The training interactive inter undertaken is thus the key element of the innovation and diffusion processes.

Development of local productive systems constitutes another significant shutter of a successful regional strategy. Geographical concentrations of companies, specialized suppliers and service firms in the concerned sectors offer to the firms the advisability of developing their comparative advantages, but also of exploiting the benefit of the co-operation. While gathering, they are able to benefit either from request factors related to their localization or of an offer of qualified labor. On this basis, it is enough easy for a company integrated well to start very small but to grow quickly within a network while drawing left opportunities from subcontracting. These categories of company are strongly mobile in space "without *border* ". It draws advantage while agglomerating with its environment and while benefiting from the movement of the productive forces, the external economies and the technological externalities.

Highlighted by Marshall since 1906, technological externalities find an echo growing in the contemporary economic analyses. They are proposed in the comprehension of the space concentration phenomena (Krugman (1991), Arthur (1986)). They also play a decisive role in the explanation of dynamic growth suggested by endogenous growth theories. With the concept of externality, the idea with a geographical limitation of these effects of overflow is often associated. In the geographical Economy models, local character of the externalities and the intrinsic effects which lead to the space concentration of economic activities, while benefiting from externalities and agglomeration forces. In a more implicit way, endogenous growth theories suppose essentially that the externalities are geographically limited with less inside the national or regional borders for stylized facts. Consequently, attempts at empirical validation such localized phenomena of overflow have made significant great strides for several years. This work seeks using econometric tools nourished by brought up to date statistical approaches of certain author like Clief, Ord (1981) and others to test the local dimension of the externalities resulting from innovating activities. The essence of this work

concerns the American case and reveals a relatively clear tendency to the localization of *the spillovers.* However, we can think that this local dimension is strongly related to the American institutional system. Moreover, these econometric studies encounter difficulties of modeling of the externalities and their geographical dimension. They can be gathered in four great types of approach:

- ✓ **The use of the quotations of patents as markers of *the spillovers***
- ✓ **The study of the innovation concentration, measurement of geographical coincidence;**
- ✓ **The taking into account of the local interactions.**

Only the last approach offers a true modeling of the externalities. In this direction, it can appear preferable. However, it presents the disadvantage of postulating space dimension. Thus, efforts of taking into account of the space aspect are done with the detriment of a precise measurement of *the spillovers* which leads towards the formation of a space effect on the labor productivity. Conversely, work which is based on a modeling of the externalities does not make it possible to show the space dimension of the factor productivity.

In the model which we propose takes a starting point studies as a space dependence of the coordination modes by multiples tools suggested previously in the preceding sections. TFP growth rate represents a space variable related to the worker behaviors in space. Like that we presented previously, the economies of scale are behavioral sources of saving of capacity. Consequently, the improvement of TFP including the factors work is related to the growth rate of productivity of these factors in an area. In short, TFP growth rate of an area seems definitely related positively to the labor productivity growth rate of these areas.

In addition, the phenomenon of space diffusion of behavior and the modes of coordination shows the existence of a space adjacency between productive forces. Heterogeneity of labor productivity in various integrated areas built the effect of vicinity where the productivities of the contiguous areas will be inter-connected.

$$\lambda = \lambda^{*} + \phi.p + \kappa.W.p \qquad \text{(II,2,1)}$$

$$W_{i.j} = \frac{Q_i\, Q_j}{d_{i.0} d_{j.0}} \qquad \text{(II,2,2)}$$

Q_i and Q_j are the income in Euro at constant prices of the respective areas, i and j, at a given date.

W is the weight matrix or of vicinity it is known as matrix of the interregional interaction.

We notice that $Q = PL$.

The term P indicates the average productivity of work per unit of surface.

To normalize the matrix W, it is enough to divide each $w_{i.j}$ by the sum compared to the column of line i : $w_{ij}^{*} = \frac{w_{ij}}{\sum_j w_{ij}}$

Matrix W^{*} is not symmetrical as in the case of the binary matrix seen previously.

We note by $Q = PL$.

λ^{*} is a parameter which summarizes the technical progress growth at the regional level . This parameter is identical to each area. It depends on the initial characteristics of the areas.

These last are generally the particular regional characteristics which determine the activity of innovation extent at the local level. It is about the initial level of technology noted G and the level of the human capital s. As the level of the technology of the area is low, region will be ready to adopt new technologies:

$$\lambda^* = \pi.G + \delta.s \quad \pi \succ 0 \qquad \text{(II,2,3)}$$

$$\text{and} \quad G_i = \frac{p^* - p_i}{p^*} = 1 - ap_i : a \prec 0 : start - of - period$$

p^*_i is the labor productivity of the leader area (better productivity);

p_i is the labor productivity of area i;

G indicates the variation of labor productivity between the leader area and a given area.
The parameter is an indicator of human capital of an area, it is a function of the localization of area i per contribution with the whole regional system.

From this point of view, a technological indicator of proximity between the departments is incorporated in the function (II,2,3). This indicator is adapted by Fingleton (1999).
The vectors of technological position of the departments (areas) are made up using the variable s.
The technological proximity indicator (s) measure then the "resemblance" enters the technological position of a given department and the technological position of its neighbors, according to whether this area can be rural or urban. We indicate this regional characteristic by variable which takes value 1 if the area is urban, 0 if not.

In the same way, it is supposed that the labor qualification or the human capital of an area is a function of the distance which separates an area and the center from the whole regional system *(l)*. This center is regarded as the leader area. We explained in this model the human capital by space variables dependent on the localizations of the areas in the regional system and compared to the economic center of this system.
From where the function:

$$s = \varepsilon + \theta.l + \Gamma.u \quad \theta \prec 0 \quad \Gamma \succ 0 \qquad \text{(II,2,4)}$$

By introducing the equations (II,2,3) in (II,2,4) and the latter in (II,2,1) we will have the following equation:

$$\text{E} : p = \rho.W.p + b_0 + b_1.l + b_2.u + b_3.G + b_4 q + \xi \qquad \text{(II,2,5)}$$

Equation E is a dynamic equation. Indeed, it is an interaction function between areas of space. I.e., E is dynamic because it is related to *W*.

It is noticed that when the areas incomes change, the matrix of adjacency varies. The question essential is when this matrix will be stable?
This stability is interpreted like the realization of a stationary state.
However, the labor productivity in the remote areas from the center will be they similar to those of the area leader? According to what the interaction does accelerate?
To answer all these interrogations we must first of all use econometric tools adequate to consider E all being based on regional data for a determine date. We will estimate thereafter the coefficients of E each time when the incomes change.

III. Empirical approach of the spatial dynamics

The data which we use to evaluate the macro space dynamics of the productive behaviors are diversified. We use the data base published by EUROSTAT REGIO into 2000 and the World Bank data, published in 2000. The regional nomenclature in this work is that NUTS 2, increased by 6 areas for purely statistical ends. We start initially by building regional series of variables of the equation (E).

1. Estimation of the model (S)

The estimated model is represented by system of the following simultaneous equations (S). Estimate of the parameters of system (S) is done for each year going from 1976 to 1998. With each, year we build a space econometric development with regional interaction seen by interregional weights matrices. Interaction matrices rest on the assumption that the economic operations build the weights areas and the interactions. Using of regional incomes in calculations of the elements w_{ij} represent a manner of an endogenous regional interactions.

Regional interaction type rests on optics of gravitational field. Each time, the distance from the areas compared to an economic center (area leader or Luxembourg) increases, the interregional weights decrease.

Spatial character of modeling brought to use the elements of space econometrics. Indeed, spatial literature chows that under endogenous weight matrix, there autocorrelation between residues in a spatial mode and between European regional incomes. By descriptive indicators we can in another Work demonstrate easily that endogenous regional interactions in Europe form clubs of convergence.

In this model, all the equations are over identifiable. Consequently, estimating method is generalized moment of moments (GMM).

The choice of the instruments in the equations model must be robust according to and be proven by a statistical test. The test used is J-statistic which justifies the choice of instruments while referring to the orthogonality between instruments and estimators.

The selection instruments criterion, according to the test of J_statistique requires a high probability to accept the H_0 othogonality assumption.

In the following table, we present the estimating coefficients of the space model (S) in following:

$$(S)\begin{cases} p = \rho.W.p + b_0 + b_1.l + b_2.u + b_3.G + b_4 q + \xi \\ G = b_6 - b_5 p \end{cases}$$

Tableau 1: estimating space model with simultaneous equations

Year	$\hat{\rho}$	b1	b3	b4	b5	b6
1976						
1977(GMM)	46,37888	-3,30E-07	-1,022586	0,012626	1,012146	1,000000
1978(GMM)	40,70351	2,43E-07**	-1,042980**	0,024972	1,012146	1,000000
1979(GMM)	35,74281	6,26E-07**	-1,027069	0,055598**	1,012146	1,000000
1980(GMM)	79,05855	1,21E-06	-1,069197	0,127932	1,012146	1,000000
1981(GMM)	-15,53797	-2,05E-06	0,006080**	0,899075	1,01214	1,0000

1982 (3sls)	13,75253	1,89E-07**	-0,155729	0,774097	1,012146	1,000000
1983(GMM)	177,4543	2,91E-06	-1,195619	0,049071**	1,012146	1,000000
1984(GMM)	41,27069	-2,07E-07**	-1,014822	-0,00866**	1,012146	1,000000
1985(GMM)	31,96620	2,07E-07**	-1,065417	-0,040865	1,012146	1,000000
1986(GMM)	42,75026	-4,30E-07	-1,096812	-0,01874**	1,012146	1,000000
1987(GMM)	63,17814	1,14E-06	-1,097189	0,015051**	1,012146	1,000000
1988(GMM)	39,96286	9,60E-07	-0,993863	0,085487	1,012146	1,000000
1989(3sls)	0,489419	3,08E-06	-0,987985	0,023557**	1,012146	1,000000
1990(GMM)	37,92498	4,21E-07	-1,137982	-0,072566	1,012146	1,000000
1991(MCO)	57,34329	-6,20E-07**	-1,066316	0,163792	1,012146	1,000000
1992 (GMM)	0,521340**	-3,70E-07**	-0,008630	1,079488	1,012146	1,000000
1993(GMM)	142,1787	7,05E-06	-1,353815	0,230477	1,012146	1,000000
1994(GMM)	58,55525	1,16E-06	1,16E-06	0,166491	1,012146	1,000000
1995(GMM)	5,674872	1,23E-06	-0,992875	0,036330**	1,012146	1,000000
1996(GMM)	-35,30919	1,91E-06	-0,948490	0,054471	1,012146	1,000000
1997(GMM)	44,56648	2,69E-07	-1,027437	0,048501	1,012146	1,000000
1998(GMM)	41,30049	-4,27E-07	-1,026380	0,010571**	1,012146	1,000000

NB: values with two stars represent estimators who are not statistically significant for a risk of 5%.

Source: calculus of the author

The majority of the coefficients are statistically significant whatever the year. Determination coefficients of each regression are sufficiently high. Estimate of each year is overall significant while referring to the J-test statistics suggested by Davidson and MacKinnon (1993). Statistics J-test follow Chi two to 7 degrees of freedom, it tests the best alternative of instruments used in each regression. In this model, instruments choice is optimal and gives a high probability except for the years 1978, 1993 and 1998.
Each coefficient of each variable of each year gives theoretical information, concerning the effect of space interactions on the labor productivity in each area.

2. Interpretation of results

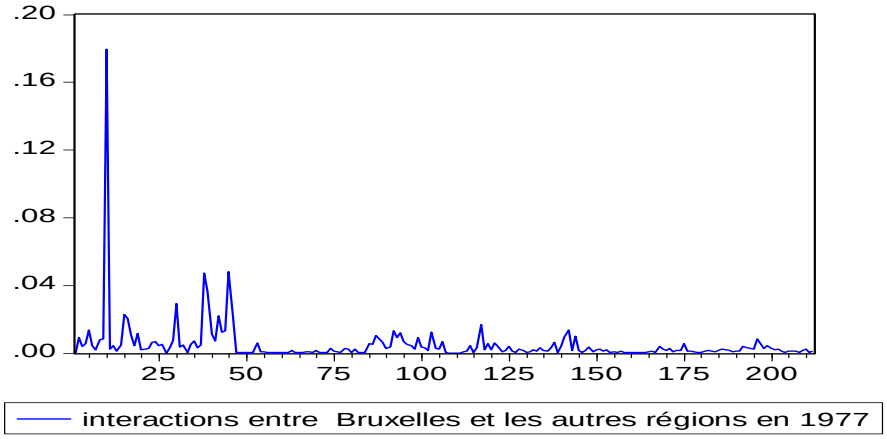
Coefficient which illustrates the space dependence between various areas of the European system is ρ . The estimated values of this coefficient are statistically significant at each year safe in certain years carrying of stars. The tendency ρ represent a remarkable dispersion, whereas the values are in the majority positive.

High and positive values of the coefficient of space interaction ρ are marked by high significativity. Negative Estimators of "intensity of the space interaction" (ρ), are in 1981 and 1996. The estimated value of ρ in 1981 is not statistically significant therefore it does not generate economic implications.

Series of space dependences between labor productivity growth rates in Europe are in fact, series of space averages of interactions modes between the European working forces. Series values do not have a raised variance for each year. This characteristic of the spatial series (ρ W*p)* is deduced to leave employment the matrices from the annual regional

interactions which, depend on the economic masses measured at each year. Matrices which provide the viable space ones are endogenous measurements of the space interaction.

These interactions act positively, in the majority of the years, on labor productivity of European areas.
For example, value of spatial intensity (ρ), in 1977 is ρ =46,37888 and stamps it interaction space used in the empirical estimates integrates the determinants of the European areas in forms of economic interactions. In this case average productivities of areas depend on the averages of the labor productivity in various areas of the European system, plus an effect of distance from the area compared to the European economic center (Luxembourg), plus an effect allotted of development (or productivity) of the area compared to the labor productivity of leader area and finally, plus an effect allotted to the growth of its added value. The labor productivity of Brussels in 1977 is functions of the interregional weights which are decreasing compared to the distance and crescents compared to the incomes areas. The following figure illustrates the evolution of interactions between Brussels and the European areas in 1977:



Interactions between labor productivities vary according to years because size of Europe changes according to time, although we use the same areas during the 22 years of the study.
We cannot consider all the areas as being units of the same system at each year because Europe comprised 9 countries in 1973, 12 countries in 1986, 15 country in 1995 and finally 26 into 2004. This is why, the space effect of the regional influence reached its maximum level in 1983 and 1993. Elasticities values of the labor productivity compared to the neighbors activities in the remarkable years touch 155.

With regard to the distance from center effect on the labor productivities of the areas, we notice that he is sometimes positive or negative but always weak effect. This remark is essential insofar as the distance to interior of Europe does not influence the productivities of the workmen in any area.
Cohesion policies and regional development in Europe do not depend on spaces but on the behaviors of the factors of production in particular work. The objectives of the development funds after its constitution will ensure an improvement of the labor productivities in certain areas abstraction made of distances between the various areas.

With regard to the variable G, we notice that its coefficient (at each year) is positive and statistically significant. This result is logical insofar as, if the variation of

productivity between an area and the leader area increase, the growth rate of labor productivity drops. Values taken by the coefficient b3 are close to the unit for the years 1976 and 1998. The remarkable values (too much weak) of this coefficient were carried out in 1983 and 1993.

Concerning the economies of scale, if the value of the coefficient b4 is positive then we attend a screw and economy of scale. In this model, we notice that at each year there are economies of scale in the European system except for 1976, 1989 and 1990, where increasing returns to scales are decreasing. The maximum value of b4 can reach the vicinity of the unit. Positive value of b4 (for example b4=0,5) means that if the added value growth rate of an area increases by 100%, the growth rate of the labor productivity increases by 50%. The increase in the labor productivity generates a growth more than proportional of the added value growth. This observation filled assumptions of the new theories of international trade (NTIT). While adding to the economies of scale, the free movements of the factors of production, we answer in this case the conditions and the basic assumptions of the new geographical economy (NEG).

Conclusion

Economic policy hose aim to develop areas whose income is lower than the Community average is influenced by the national characteristics. Regional and national contexts have needed to be discussed, analyzed and to be shared.
At the interior of the State, by distinguishing an area from the State, the interesting and relevant problems which touch the regional ones are often ignored simply because the policy is committed at the national level. This idea confirmed by the econometric approach explains well that geographical characters exert effects of ousting on the wills of the economic policy. However, it is necessary to analyze the broad consequences of the national and sub national policies if we want to include "*the hidden cost*" of the national development policy for his areas.
Can we admit an initial intra national deterioration of cohesion is essential if we want to improve international cohesion?

This can be necessary for certain countries by taking account of the considerations and the space characteristics of the areas. However, it is difficult "to *engage"* for an entire country a virtuous circle of growth and convergence in the absence of an initial regional policy. Community policy to the profit of a country, without drawing up exactly the characteristics of all the areas of this country contributes to a deterioration of the Community policy objectives. Actually, going beyond of the space data creates a risk of instability. A territorial focus in the short run could open the diffusion prospects of the benefits from the longer-term growth. However, in the integrated areas there is a real risk that the role of the longer-term government in as well "*as strategic organizer*" is dominated by the requirement of short term and the ignorance of the geographical characteristics. The domination reduces the size of the administration and accentuates the budget deficits. If the role of the public sector compared to the private sector, like that of the national level compared to the UE, evolves in an antagonistic way then cohesion more chance has to degrade itself than to improve.

European policies with the profit of the cohesions countries and the local policies exerted by the developed countries are generally try to return the variations of developments between areas weak and answer the growth targets leveling.
Choices of the economic policies which mobilize transfers can, not to achieve the growth targets by forgetting the concept of social integration ethics. Space and interdependences between the labor productivities then exert positive effects on the productive behaviors on regional growths, as we show the static space model of this paper. But, space effects of coordination modes is dynamic and depend on time in order get benefit from space dynamics in research from a leveling growth.
To take into account the dynamic aspect of the space interactions, economic choices propose target growth of the areas in perfectly integrated system and the reductions of the regional inequalities.

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Appendix

List of regions or European areas according NUTS2

indice de la région	région	indice de la région	région
1	1 BRUXELLES	61	24 Sterea Ellada
2	21 Antwerpen	62	25 Peloponnisos
3	22 Limburg (B)	63	3 ATTIKI
4	23 Oost-Vlaanderen	64	41 Voreio Aigaio
5	24 Vlaams Brabant	65	42 Notio Aigaio
6	25 West-Vlaanderen	66	43 Kriti
7	31 Brabant Wallon	67	11 Galicia
8	32 Hainaut	68	12 Principado de Asturias
9	33 Liège	69	13 Cantabria
10	34 Luxembourg (B)	70	21 Pais Vasco
11	35 Namur	71	22 Comunidad Foral de Navarra
12	01 HOVEDSTADSREGIONEN	72	23 La Rioja
13	02 OST FOR STOREBAELT	73	24 Aragón
14	03 VEST FOR STOREBAELT	74	3 COMUNIDAD DE MADRID
15	11 Stuttgart	75	41 Castilla y León
16	12 Karlsruhe	76	42 Castilla-la Mancha
17	13 Freiburg	77	43 Extremadura
18	14 Tübingen	78	51 Cataluña
19	21 Oberbayern	79	52 Comunidad Valenciana
20	22 Niederbayern	80	53 Baleares
21	23 Oberpfalz	81	61 Andalucia
22	24 Oberfranken	82	62 Murcia
23	25 Mittelfranken	83	63 Ceuta y Melilla
24	26 Unterfranken	84	7 CANARIAS
25	27 Schwaben	85	1 ÎLE DE FRANCE
26	3 BERLIN	86	21 Champagne-Ardenne
27	4 BRANDENBURG	87	22 Picardie
28	5 BREMEN	88	23 Haute-Normandie
29	6 HAMBURG	89	24 Centre
30	71 Darmstadt	90	25 Basse-Normandie
31	72 Gießen	91	26 Bourgogne
32	73 Kassel	92	3 NORD - PAS-DE-CALAIS
33	8 MECKLENBURG-VORPOMMERN	93	41 Lorraine
34	91 Braunschweig	94	42 Alsace
35	92 Hannover	95	43 Franche-Comté
36	93 Lüneburg	96	51 Pays de la Loire
37	94 Weser-Ems	97	52 Bretagne
38	A1 Düsseldorf	98	53 Poitou-Charentes
39	A2 Köln	99	6 SUD-OUEST
40	A3 Münster	100	61 Aquitaine
41	A4 Detmold	101	62 Midi-Pyrénées
42	A5 Arnsberg	102	63 Limousin
43	B1 Koblenz	103	71 Rhône-Alpes
44	B2 Trier	104	72 Auvergne
45	B3 Rheinhessen-Pfalz	105	81 Languedoc-Roussillon
46	C SAARLAND	106	82 Provence-Alpes-Côte d'Azur
47	D1 Chemnitz	107	83 Corse
48	D2 Dresden	108	91 Guadeloupe
49	D3 Leipzig	109	92 Martinique
50	E1 Dessau	110	93 French Guiana
51	E2 Halle	111	94 Reunion
52	E3 Magdeburg	112	01 Border. Midl. and Western
53	F SCHLESWIG-HOLSTEIN	113	02 Southern and Eastern
54	11 Anatoliki Makedonia. Thraki	114	11 Piemonte
55	12 Kentriki Makedonia	115	12 Valle d'Aosta
56	13 Dytiki Makedonia	116	13 Liguria
57	14 Thessalia	117	2 LOMBARDIA
58	21 Ipeiros	118	31 Trentino-Alto Adige
59	22 Ionia Nisia	119	32 Veneto
60	23 Dytiki Ellada	120	33 Friuli-Venezia Giulia
121	4 EMILIA-ROMAGNA	181	D4 Lancashire
122	51 Toscana	182	D5 Merseyside
123	52 Umbria	183	E1 E. Riding/N. Lincs
124	53 Marche	184	E2 N. Yorkshire
125	6 LAZIO	185	E3 S. Yorkshire
126	71 Abruzzo	186	E4 W. Yorkshire
127	72 Molise	187	F1 Derbyshire/Notts.
128	8 CAMPANIA	188	F2 Leices./Rutland/Northants
129	91 Puglia	189	F3 Lincolnshire
130	92 Basilicata	190	G1 Hereford/Worces./Warwick
131	93 Calabria	191	G2 Shrops./Stafford
132	A SICILIA	192	G3 W. Midlands
133	B SARDEGNA	193	H1 East Anglia
134	11 Groningen	194	H2 Beds./Herts.
135	12 Friesland	195	H3 Essex
136	13 Drenthe	196	I1 Inner London
137	21 Overijssel	197	I2 Outer London
138	22 Gelderland	198	J1 Berks./Bucks./Oxford
139	23 Flevoland	199	J2 Surrey/E/W Sussex
140	31 Utrecht	200	J3 Hants./I of Wight

141	32 Noord-Holland	201	J4 Kent
142	33 Zuid-Holland	202	K1 Glouces./Wilts./N. Somerset
143	34 Zeeland	203	K2 Dorset/Somerset
144	41 Noord-Brabant	204	K3 Cornwall/I of Scilly
145	42 Limburg	205	K4 Devon
146	11 Burgenland	206	L1 W.Wales/Valleys
147	12 Niederösterreich	207	L2 East Wales
148	13 Wien	208	M1 N.E. Scotland
149	21 Kärnten	209	M2 E. Scotland
150	22 Steiermark	210	M3 S.W. Scotland
151	31 Oberösterreich	211	M4 Highlands/Isles
152	32 Salzburg	212	N NORTHERN IRELAND
153	33 Tirol		
154	34 Vorarlberg		
155	11 Norte		
156	12 Centro		
157	13 Lisboa e Vale do Tejo		
158	14 Alentejo		
159	15 Algarve		
160	2 AÇORES		
161	3 MADEIRA		
162	13 Itä-Suomi		
163	14 Väli-Suomi		
164	15 Pohjois-Suomi		
165	16 Uusimaa		
166	17 Etelä-Suomi		
167	2 ÅLAND		
168	01 Stockholm		
169	02 Östra Mellansverige		
170	03 Sydsverige		
171	04 Norra Mellansverige		
172	05 Mellersta Norrland		
173	06 Övre Norrland		
174	07 Småland med öarna		
175	08 Västsverige		
176	C1 Tees Valley/Durham		
177	C2 Nmbrlnd./Tyne and Wear		
178	D1 Cumbria		
179	D2 Cheshire		
180	D3 Manchester		