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TECHNOLOGICAL CAPACITY AND REGIONAL DISPARITIES IN ECONOMIC GROWTH: AN EXPLANATION BASED ON THE EUROPEAN EXPERIENCE (1980-95).

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1. INTRODUCTION.

The empirical evidence handled in recent works (Cheshire and Carbonaro 1995; Fagerberg and Verspagen 1996; Fagerberg, Verspagen and Caniëls 1996; Dunford 1996; Adams, J. and Pigliaru, F. 1999) have taken to question the thesis of the regional convergence during the last years in Europe and, consequently, its theoretical foundations. On the other hand, the data relative to the period 1980-95 for the European regions provided by the Regio data base (Eurostat) let us to notice the existence of a process of divergence or, in the best case, of maintenance of a high level of disparities. What corresponds now is to explain the reasons or factors that lead that process. We can reasonably suppose that some factors push in the direction of convergence and other factors promote divergence, controlling these last factors to the first ones in the assembly of the period, although there are periods in which that is not true. What corresponds, once arrived until here, is to identify the factors that act in each direction and trying to explain why they predominate on the others.

A brief review of the main recent empirical Literature on growth of the European regions suggests that the technological variable, in anyone of its forms, is revealed like one of the main factors of divergence. This characterization turns it into an important element whose study does not have to happen inadvertent. It is more, its special nature and their strong specificities (cumulative character, located, path dependent...) do very difficult to catch all their dimensions in a simple model. Because of that reason one comes considering an forced exercise for the understanding the economic dynamics to analyse the magnitude of the role played by this variable on the process of economic growth, as well as its guidelines of behavior.

In this sense, this work tries to satisfy this necessity and contribute to the explanation of growth and regional disparities in Europe (annexe 1) during the period 1980-95, taking special attention in the role played by the technological capacity of each territory.

2. SPECIFICATION OF THE MODEL.

On the base of the analysis and discussion suggested by the previous empirical evidence, we set out to advance in the understanding and explanation of the evolution of regional disparities in Europe during the period 1980-95. We will leave from a model bases of the convergence equation, specified through four versions relating to different dimensions of the technological variable, in which we included some initial variables that we considered that explain the interregional differences in growth rates. Later, respecting the statistical limits as well as the fulfillment of the statistical conditions on relations between the variables of an econometric model, some variables are included relating to different countries (country dummies) that will allow us to extend this explanatory capacity. The fundamental difference between the four versions of our basic model is, as it has been indicated previously, the different dimension of the regional technological capacity. In this sense, the first specification (model A) includes like technological variable of level the total innovating effort of the region (ETTOT), measured through the quotient between the volume of the total R&D employment in 1994 and the active population of the region in the same year.

The second version (model B) includes, on the other hand, the innovating effort of the firms of the region (ETEMP), approximated by the quotient between the volume of business R&D employment and the active population of the region (1994). Thirdly (model C) we included the innovating effort of the universities (ETUNI), measured through the relation between the R&D expenditure from the universities in 1994 and the GDP of the region in the same year. Finally, the last version of our basic model (model D) considers like technological variable the relative participation of the companies of the region in the R&D FrameWork Programs (POL). With the inclusion of this last variable, measured through the volume of business participation in the assembly of 2nd, 3th and 4th FrameWork Program (FWP) weighed by the average population of each region in period 1980-95, we try to capture the impact of the communitarian technological policy on the economic growth of the European regions.

From the previous considerations on, the four versions of our basic model are specified of the following way:

MODEL A $Y(80\text{-}95)= \beta_0+\beta_1 Y(80)+ \beta_2 DEM+\beta_3 AGR+\beta_4 UNEMP+\beta_5 \mathbf{ETTOT}+u$

MODEL B $Y(80\text{-}95)= \beta_0+\beta_1 Y(80)+\beta_2 DEM+\beta_3 AGR+\beta_4 UNEMP+\beta_5 \mathbf{ETEMP}+u$

MODEL C $Y(80\text{-}95)=\beta_0+\beta_1 Y(80)+\beta_2 DEM+\beta_3 AGR+\beta_4 UNEMP+\beta_5 \mathbf{ETUNI}+u$

MODEL D $Y(80\text{-}95)=\beta_0+\beta_1 Y(80)+\beta_2 DEM+\beta_3 AGR+\beta_4 UNEMP+\beta_5 \mathbf{POL}+u$

where **Y(80-95)** is the growth rate of the GDP *per capita* among 1980 and 1995 obtained by the following expression: $1/T * \ln (Y_t/Y_{t-T})$, where T is the lengh (years) of the period and $\ln (Y_t/Y_{t-T})$ is the logarithm of the ratio GDPpc(95)/GDPpc(80); β_0 is a fixed parameter that captures the medium characteristics of the regions; **Y(80)** is the logarithm of the GDP *per capita* in 1980; **DEM** is the growth rate of the GDP per capita in the group of the other regions from the country for the same period and, thus it tries to capture the evolution of the demand coming from the country market; **AGR** is an structural variable related to the share of the agricultural employment in the global enmployment of the region in 1981; **UNEMP** is another structural variable which reflects the long-term unemployment rate in 1987; **ETTOT**, **ETEMP**, **ETUNI** and **POL** are the four R&D variables and, finally, **u** is a random term that dissapears when we estimate the model by LSO.

These are the four versions of a same basic model on which we always included the same four variables (Y(80), DEM, AGR, UNEMP) having information for the 95% of the regions, and soon we added respectively the different technological variables (ETTOT, ETEMP, ETUNI, POL). Since the availability of data for each one of these variables is different for each region, the number of observations in the assembly of the estimations varies between 89% and 95% of our sample.

As we have previously indicated, these four specifications of the basic model are extended by the introduction of 7 country dummies; in concrete: Germany (GER), Belgium (BEL), Spain (SPA), France (FRA), Portugal (POR), Italy (ITA) and United Kingdom (UK), allowing us to capture the degree of homogeneity in the behaviour of the regions that compose each country and, consequently, elevating the explanatory

capacity. However, this extension of the basic model with country dummies has forced to us to exclude in this exercise the variable related to the evolution of the demand (DEM), considering that the introduction of the country dummies gathers already of by himself great part of the explanatory capacity attributed to that variable. The inclusion of this last variable in the model would cause with all probability problems of estimation because of that reason.

3. RESULTS.

In tables 1 and 2 the results of the estimation by L.S.O. appear.

TABLE 1: Estimation by L.S.O. without dummies

	Model A	Model B	Model C	Model D
C	0,084 (2,81)	0,074 (2,46)	0,069 (2,25)	0,098 (3,42)
Y(80)	-0,009 (-2,88)	-0,007 (-2,46)	-0,007 (-2,29)	-0,01 (-3,46)
DEM	0,76 (4,5)	0,80 (4,62)	0,78 (4,39)	0,68 (4,23)
AGR	-7,6E-05 (-1,05)	-0,0001 (-1,38)	-9,1E-05 (-1,2)	-8,9E-05 (-1,32)
UNEMP	-0,0002 (-1,45)	-0,0002 (-1,26)	-0,0002 (-1,52)	-0,0002 (-1,76)
ETTOT	0,002 (2,2)			
ETEMP		0,002 (0,9)		
ETUNI			0,005 (1,73)	
POL				3,9E-05 (3,22)
R^2 (R^2 Adjust.)	0,41 (0,38)	0,38 (0,35)	0,40 (0,37)	0,45 (0,42)
N	89	89	89	95
S.E.	0,004	0,004	0,005	0,004
D.W.	1,51	1,48	1,5	1,4

The number between parenthesis underneath the coefficients corresponds to the t-statistics
S.E. = standard error of regression; D.W. = Durbin-Watson statistics
Source: Own processing from REGIO (Eurostat) and DGXII (EC).

TABLE 2: Estimation by L.S.O with dummies

	Model A*	Model B*	Model C*	Model D*
C	0,18 (4,77)	0,17 (4,43)	0,15 (3,9)	0,21 (5,7)
Y(80)	-0,02 (-4,09)	-0,015 (-3,72)	-0,013 (-3,18)	-0,02 (-5,2)
AGR	-0,0002 (-2,36)	-0,0002 (-2,66)	-0,0002 (-2,44)	-0,0002 (-2,28)
UNEMP	-0,0007 (-3,49)	-0,0006 (-3,05)	-0,0006 (-2,95)	-0,0008 (-4,37)
ETTOT	0,003 (2,68)			
ETEMP		0,004 (1,94)		
ETUNI			0,003 (0,78)	
POL				5,9E-05 (4,56)
GER	-0,01 (-3,38)	-0,01 (-3,33)	-0,01 (-3,27)	-0,002 (-0,76)
BEL	-0,009 (-2,33)	-0,009 (-2,34)	-0,01 (-2,52)	-0,003 (-1,13)
SPA	-0,002 (-0,47)	-0,002 (-0,69)	-0,003 (-0,87)	0,005 (2,12)
FRA	-0,01 (-3,1)	-0,01 (-3,76)	-0,01 (-3,6)	-0,003 (-1,74)
POR	-0,009 (-2,5)	-0,009 (-2,27)	-0,009 (-2,32)	-0,007 (-2,27)
ITA	-0,003 (-0,96)	-0,004 (-1,2)	-0,005 (-1,59)	0,004 (1,66)
UK	-0,009 (-2,91)	-0,01 (-3,17)	-0,01 (-3,1)	-0,003 (-1,45)
R^2 (R^2 Adjust.)	0,55 (0,49)	0,53 (0,47)	0,52 (0,45)	0,58 (0,53)
N	89	89	89	95
S.E.	0,004	0,004	0,004	0,004
D.W.	1,81	1,76	1,62	1,73

(*) with dummies.
The number between parenthesis underneath the coefficients corresponds to the t-statistics
S.E. = standard error of regression; D.W. = Durbin-Watson statistics
Source: Own processing from REGIO (Eurostat) and DGXII (EC).

The main conclusions that are derived from the estimation of the different proposed models could establish as it follows: In the first place, the negative sign that presents, in general, the coefficient corresponding to the initial GDP per capita (Y(80)) is coherent with the hypothesis of the beta convergence. However, its level of significance is different from one each other, since while in the models without country

dummies this variable is significant in all the specifications, this level of significance increases when we introduce the country dummies. In the first case (models A, B, C and D), therefore, the rest of variables that conform the model (DEM, AGR, UNEMP and the corresponding technological variable) act catching part of the divergence factors, with which it allows a certain level of significance of the initial GDP per capita.

In the second case (models A*, B*, C* and D*), the introduction of "country dummies" favours clearly the increase of this level of significance, acting therefore like explanatory variables of divergence. In any case, the value of the coefficient is in all the cases reduced and varies depending on the introduction of country dummies. This means that the regions tend to experience a higher growth of their GDP per capita when they leave from a lower level, although the difference is very small (its capacity to generate convergence is reduced).

On the other hand, and in agreement with the Catch-Up theories, we could consider that the variable initial GDP per capita measures the potential of catch-up or the "technological gap" of the region in relation to the leader and, consequently, the possibilities of each region to benefit from the processes of technological diffusion. In this sense, our results (negative sign and significance) leave this possibility open. However, what seems more reasonable at sight of the results obtained in other works is that the technological process of catch-up has been able to take place only in certain "intermediate" regions that count on the sufficient "social capacity" to make it reality.

We must remember that the diffusion and imitation processes are not as automatic as we could think. These processes require the existence of a social capacity that allows to take advantage of the knowledge and the technology of the regions which go in head and, indeed, one of its elements are the R&D activities, along with the human capital, suitable institutions, etc. (Abramovitz, 1989). Therefore, the poor regions need a minimum level of R&D to avoid them falling in an impasse in which the only alternative is to contemplate the richest neighbors moving away to a vertiginous speed.

Secondly, the increase of the demand coming from the rest of the country (DEM), approximated through the growth of the GDP per capita of the rest of the country, is strongly significant and positive in all the cases (this variable is only included in the models without country dummies). This variable behaves, consequently, as a factor with a high explanatory capacity favouring to a great extent the results. This result suggests, indeed, that the growth of a region depends on the evolution of the neighbouring regions

that constitute its main market. There is a permanent influence throughout the different phases from the economic cycle, so that the growth rate tends to follow a similar evolution and with the more synchronous cycles between the regions of each country. This means that the regions of a same country present a high degree of integration and interdependence and, at the same time, confirm the kaldorian hypothesis about the role of the demand and, very specially, of the external demand, for the explanation of the regional growth. Also, it gives a greater importance to the role of the macroeconomic policy from the central government, promoting growth rates varying significantly between the different countries in the European Union. In a more general sense, this variable serves to emphasise the role of the interdependence of the regions in the growth process, as opposed to the implicitly autarkic vision that sublies in the most conventional explanations. In addition, the fact that the demand, external to the region in this case, plays an important role in the explanation of the regional growth constitutes an argument which debilitates the neo-classic explanation of the convergence, centred in the factors endowment and in the decreasing returns that affect to the accumulation of one of them (capital).

With respect to the two variables of structural type (AGR and UNEMP) both work correctly, with the anticipated signs, although the one that presents better results is the long term unemployment (UNEMP). In this sense, the results point out that they are the regions with greater rate of long term unemployment experience a smaller growth, which does not have to be strange to us because of the proportion of the active population that does not participate in the productive process is higher in these regions. In addition, if we analysed the geographic distribution of this variable we can verified that these regions are also regions whose level of global unemployment (short and long term) is already elevated (a considerable number of Spanish and Italian regions, for instance). The fact that a very specific pattern of behaviour by countries in long-term unemployment exists is indeed one of the reasons that explain why this variable becomes significant when the country dummies are introduced. In this sense, we must consider that many of these Spanish and Italian regions (characterised by a high index of long-term unemployment) experienced high growth rates during the considered period, which explains the greater significance of this variable when the "*country dummies*" are included in the model.

The influence of the productive structure on the differences in growth of the GDP per capita has been studied through the influence of the proportion of the primary sector (AGR). In this sense, starting off of the emphasis that a great part of the structural literature on growth and development has put on the importance of the relative weight of the different sectors to explain the capacity of growth of an economy, we have tried to incorporate other structural variables as much relative to the primary sector as to the industry and service sectors. We tried, really, to capture the delaying effect of agriculture, as well as the dynamic effect of the industry; something that has been well established in the Literature. In the case of the service sector the situation becomes a little more complex, although it has been revalued recently to the light of the industrial crisis and the new role that the services are assuming in the new model of growth that characterises to the economy based on the knowledge (OCDE 1996; Vence 1998b). However, the different variables relating to the productive structure are strongly correlated, thus we have chosen to include only the percentage of employment in agriculture in 1981, trying to catch the essential characteristics of the productive structure of each region.

The variable AGR adopts negative sign, although its level of significance is not high enough except in the case of the models with country dummies in which it is significant. The negative sign of this variable indicates us that a weight elevated of agriculture at the beginning of the period has been translated in a smaller growth of the GDP per capita; and, therefore, the poor regions, with little industrial presence, in which the primary activities, of low productivity, occupe an important part of the population, tended to grow less than the average, observing like the gap that separated them from the developed regions was increased throughout the period.

However, we must not to accept that a higher growth needs a reduction of the agrarian employment or, at least, a reduction of its percentage in the total employment. On the contrary; it is not the reduction of the agrarian employment what causes the growth of the GDP per capita but the increase of the employment in the other sectors whose productivity is more elevated (industry or services). In fact, many slow regions that have experienced a fall of the agrarian employment (and also of the percentage) but whose industrial employment also has been reduced and the employment of the sector services has stayed or grown a little in absolute terms (but increasing its weight relative) have not been corresponded with a higher growth of the GDP per capita but all the

opposite. This is explained to a great extent because that reduction of the agrarian employment has not been translated in the transference to other sectors but, mainly, to the inactivity and unemployment. For that reason the variables "variation of the agrarian employment" or "variation of the relative weight of the agrarian sector" have little explanatory capacity of the differences in the growth rates of the European regions and, consequently, they have been eliminated. Finally, we want to emphasise the fact that the introduction of the country dummies allows that this variable (AGR) becomes significant, which obeys, like it happened with variable UNEMP, to that is observed an important state component in the characterisation of the regions in agreement with its level of agrarian employment.

Finally, we have preferred to leave for the end our valuation on the behaviour of the technological variables (ETTOT, ETEMP, ETUNI, POL). As first important note we want to emphasize the fact that all the variables relative to the regional technological capacity adopt the correct, positive sign, and its level of significance is, in general, quite acceptable.

The three technological variables related to the regional technological effort (ETTOT, ETEMP, ETUNI) have behaved of quite unequal form. The better results correspond to ETTOT, being positive and significant as much without the inclusion of the country dummies like with them, increasing slightly its significance in this last case. Considering that this variable tries to catch the sum of the efforts, in this case in human resources, directed by the different agents (firms, universities and governments) from activities of innovation and technological development as synergies derived from the tacit and expressed collaboration, the meaning which can be extracted of these results is that the regions that have grown more have been those in which the sum of individual and collective efforts in R&D has been higher. In other words: the innovating effort of many regions has been compensated in terms of economic growth, which is perfectly coherent with the spirit of the present work. However, considering the results provided by other works related to the regional disparities in technological capacity (European Commission 1997, Rodil 1999), we will agree upon which the total innovating effort has had a very unequal space distribution, honoring a reduced group of regions of high level of development and in which great part of the European capitals is integrated and of the regions that conform the famous "great banana". On the contrary, it is also observed how the less developed regions of the Community "fight" to occupy the last

positions of the ranking in innovating effort. This fact makes us think that variable ETTOT has strongly acted in a differentiating and divergent sense.

On the other hand, the business innovating effort (ETEMP) shows a quite different behavior based on the inclusion of country dummies. The positive sign indicates us that this variable acts in a clearly differentiating and divergent sense, especially if we considered the strong space concentration that characterizes to all the variables related to the regional technological capacity. If we think that the technological capacity of the firms constitutes a factor that determines its capacity to reduce costs, to diversify and to improve the quality of its products, we will agree in the importance of this variable to explain the capacity of the firms and, really, of the regions to compete and, in last instance, to grow. In our opinion, the variable related to the business R&D acts favoring the economic growth of the region because the most innovating firms tend to experience a higher growth and because the R&D-intensive sectors experience a hard expansion in the period 1980-95. The territories that have lodged to those firms and sectors have been those that have tended to grow more quickly. On the other hand, although its level of significance is not high enough, perhaps had been higher but for the great space concentration that characterizes to the R&D in comparison with the productive activity, so that its effect is distributed towards other regions through the plants of production of the great companies and other mechanisms of diffusion. This high degree of concentration to which we finished referring is left sufficiently patent when we consider that 50% of the firms R&D or the patents in the European Union are concentrated in only 5 regions (Ile de France, Baden-Wuertenberg, Baviera, Nordrhein-Westfalia and South East). Luckyly, this highest concentration of the R&D has not been corresponded with an analogous concentration of the growth of the GDP per capita because, among other reasons, some less intensive sectors in technology have been specially dynamic in the EU during this period. On this sense, some intermediate regions have based indeed their strategy of growth on sectors of middle technology, with a relatively moderate effort in R&D, and they are experimenting, however, rates of growth very elevated (Vence, 1998a).

The fact that the level of significance of the business effort is lower than the global effort of the region can be explained, in our opinion, by two possible reasons. Firstly, by the fact that the used data are refered to the year 1994 (in some cases, by defect, years 1993 or 1992). It is necessary to remember that in these years we still live

the effects derived from the economic recession in the nineties that affected to the European regions, and many firms chose to direct most of their efforts to the cleaning of their financial accounts. Consequently, the business effort in R&D during these years has been significantly lower than in the rest of the period and, therefore, less patent its influence on the growth of the regions. Secondly, it is necessary to consider that variable ETTOT not only catches the business effort in R&D but that also the carried out effort by other agents (universities and research centers) and, really, gathers more "ingredients" of the technological capacity of the region, reason why its greater level of significance at the time of explaining its economic growth is explained. On the other hand, the global technological effort tries to also gather the externalities that are generated around the process of technological change as a result of the interaction of the different agents which participate and integrate the regional systems of innovation, reason why is catching something more than the sum of the parts.

Relating to the innovating effort of the universities (ETUNI), the obtained results have been similar to those of the business effort. Although its positive sign must be interpreted in the sense that a higher technological effort of the universities takes to higher growth rates, acting like a clear factor of divergence, the fact that its level of significance falls when we include the country dummies makes us to suppose that its heterogeneneous role is lower to the other two variables related to the innovating effort of the regions. The image that is come off the space distribution of this variable is less polarized than the distribution from the global and business effort, which attenuates in certain way its differentiating character. If we think that the R&D effort of the universities is indirectly measuring the size of the universities and, really, the volume of human capital that forms in the region, the fact that in the estimation without country dummies (model C) this variable acquires its higher level of significance, it indicates the existence to us of a positive relation and (almost) significant between the effort in the formation of human capital and the economic growth of the region.

Independently of the discussion of if that human capital that forms in the region reverts finally in the assembly of its productive activity or if, on the contrary, it goes to increase the volume of unemployment of the region or it even chooses to emigrate to other regions; what we can consider is that it is coherent with the thesis of which the formation of human capital has a positive effect on the creation and assimilation of new knowledge that are promoting in last instance higher growth rates. The fact that this

variable (ETUNI) is not statistically significant does not have to be strange to us whereas what we are considering it is a flow of human capital and it is logical to think that its influence must take a certain period of time in "settling" and showing its real impact on the capacity of growth. In this sense, we must have present that the human capital that is forming can really contribute to the economic growth of the region but, firstly, we have to wait not only for the end of its period of formation but also for the generation of employment in the region (which is not easy in the slowst regions) and for the integration of this human capital in the productive process.

The technological variable that seems to have one more a clearer influence (maintains in all the cases its significance, more elevated than in the rest) it is the variable related to the technological policy (POL), measured through the relation between the business participation in the three FrameWork Programs of R&D (2nd, 3th and 4th FWP). This result aims at the existence of a clear positive impact of the communitarian technological policy on the growth of the mainly benefitted regions.

In other words, the meaning of the obtained results can be explained in the sense that they have been those regions with higher relative business participation (in agreement with its number of inhabitants) in the FWP those that have experienced higher growth rates. Really, this result can be considered like a justification of the important role that the technological policy can carry out in agreement with the objective of the regional economic cohesion.

In this sense, to improve our understanding on the operation of this variable it is enough to us with considering the fact that the more participative regions (in relative terms), as much at global as business level, were in their majority basically regions with a high level of development (practically many of them conform the famous "great banana", in addition to an important presence of the European capitals), with an important concentration of the regional participation in the communitarian programs of R&D. On the contrary, the rest of regions, many of them with a low level of development, reached quite low level of participation (European Commision 1997, Vence 1998[a], Rodil 1999). Considering this unequal distribution of the regional participation in the communitarian policy of R&D, the fact that variable POL appears with negative sign (and significant) is indicating us that the more developed regions and with a higher participation of their firms (in relative terms) in the FWP have been those that have grown more. While, the rest of regions, with a lower level of

development and a lower participation of their firms, have experimented a lower growth, seeing therefore enlarged the differential of economic growth that separates to them of first and making difficult, consequently, the so proclaimed objective of the regional economic cohesion.

On the other hand, it can seem partially contradictory that the business effort has not been as significant as the variable of technological policy (POL) that also made reference to this sector (business participation). In our opinion, this different behavior is justified, among other factors, by the fact that the business participation in the communitarian programs of R&D usually goes accompanied of bonds of collaboration between the participant firms and different agents from other regions, gathering therefore efforts and higher synergies than which can be derived from the individual efforts in R&D.

Finally, the explained part of the differences in the growth of the regions cannot come explained by very marked factors in a singular group of regions or by the specific characteristics of the Regional Systems of Innovation that are difficult to catch through a simple model, overall considering the statistical availabilities. In this sense, everything seems to aim at that the tourism constitutes an important explanatory factor of the growth in some regions. On the other hand, also the externalities and the relations of interindustrial type, the relations bank-industry, the cooperation, the existence of specialized services, the quality of the human resources, the organizational, creative and strategic capacity seem to have been important factors in this process. This last type of factors of qualitative type has acquired a greater weight progressively, of almost parallel form to the gradual reduction of the relative importance of the natural resources, physical infrastructures or the manual labor. All these factors are intimately associated to the emergency of the economy based on the knowledge and to the process of dismaterialization of the productive processes that takes not as much to that the existing differences between the regions that have reached a certain level depend of the conventional factors, but of more complex and "fine" factors, very difficult to capture considering the current statistical limitations.

4. CONCLUSIONS.

The obtained results have been quite satisfactory, confirming the hypothesis that the level of technological effort of each region explains an important part of its

economic dynamics. All the variables related to the regional technological capacity act in differentiating sense and constitute, therefore, clear factors of divergence; especially if we consider the high degree of geographic concentration that characterizes to the technological variable in Europe.

Concretely, in the case of the business technological effort the significance of this variable must be interpreted in the sense that the technological capacity of the firms constitutes a determining factor of the process of reduction of costs and, which is not less important, of its innovating capacity related to the productive diversification and the improvement of the quality of products, which reverts positively on the capacity of the firms to compete. The influence of this variable on the regional economic growth is understood, therefore, because they are the companies and sectors more innovating are those that experience higher growth rates, as well as the few territories where they are concentrated.

In the same sense we must interpret the meaning of the positive relation which we detected between the total technological effort and the regional economic growth. It is more; everything seems to indicate that a certain level of R&D over a minimum threshold constitutes an indispensable requirement for the slowst regions can leave the vicious circle of economic and technological delay in which they are. All this comes to endorse the hypothesis that the potential of catch-up by itself does not guarantee the convergence of the poor regions in relation to richest, allowing only a relative approach to those regions of upper middle level equipped with a certain social capacity that allows them to benefit from potential saying of catch-up. The exception to this rule is in those regions that count on some specially favorable circumstance, like can be, for example, those that benefit from a massive tourism of "beaches and sun".

Another result of great interest that is derived from our econometric study is related to the variable of technological policy, approximated by the relative participation of firms in the communitarian FWP of R&D. This variable has been the one that better has behaved in the different made tests, being always positive and highly significant. Considering the high concentration of the communitarian policy of R&D that reveals several studies (Vence 1998a; European Commission 1997; Rodil 1999), this result allows to maintain us that the common technological policy has acted in a clearly differentiating sense, making possible a higher growth in those more participative regions (in general, the most developed and most of the European capitals) that in the

rest, preventing consequently the objective of the regional economic cohesion. This result gives, therefore, a greater responsibility to the design of the common technological policy at the time of combining efforts towards the attainment of so wished and proclaimed objective.

Really, at sight of the obtained results, we can affirm that all the variables related to the regional technological capacity explain a relatively important part of the disparities in the regional economic growth, although its influence does not seem to follow a model as linear as the one of another type of variables, and it is translated in the loss of significance that takes place, in some cases, when other variables are introduced.

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ANNEXE 1: Regions

Country	Desagregation level	Regions	
Spain	NUTS 2 (17 regions)	es11 GALICIA es12 ASTURIAS es13 CANTABRIA es21 PAIS VASCO es22 NAVARRA es23 RIOJA es24 ARAGON es3 MADRID es41 CAST.-LEON	es42 CAST.-LA MANCHA es43 EXTREMADURA es51 CATALUNA es52 COM.VALENCIANA es53 BALEARES es61 ANDALUCIA es62 MURCIA es7 CANARIAS
France	NUTS 2 (22 regions)	fr1 ILE DE FRANCE fr21 CHAMPAGNE-ARD. fr22 PICARDIE fr23 HAUTE-NORMAND. fr24 CENTRE fr25 BASSE-NORMANDIE fr26 BOURGOGNE fr3 NORD-PASDECALAIS fr41 LORRAINE fr42 ALSACE fr43 FRANCHE-COMTE	fr51 PAYS DE LA LOIRE fr52 BRETAGNE fr53 POITOU-CHARENTE fr61 AQUITAINE fr62 MIDI-PYRENEES fr63 LIMOUSIN fr71 RHONE-ALPES fr72 AUVERGNE fr81 LANGUEDOC-ROUS fr82 PROVENCE-ALPES fr83 CORSE
Italy	NUTS 2 (20 regions)	it11 PIEMONTE it12 VALLE D'AOSTA it13 LIGURIA it2 LOMBARDIA it31 TRENTINO-ALTO A. it32 VENETO it33 FRIULI-VENEZIA G. it4 EMILIA-ROMAGNA it51 TOSCANA it52 UMBRIA	it53 MARCHE it6 LAZIO it71 ABRUZZO it72 MOLISE it8 CAMPANIA it91 PUGLIA it92 BASILICATA it93 CALABRIA ita SICILIA itb SARDEGNA
Portugal	NUTS 2 (5 regions)	pt11 NORTE pt12 CENTRO (P) pt13 LISBOA E VALE DO TEJO pt14 ALENTEJO pt15 ALGARVE	
Germany	NUTS 1 (11 regions)	de1 BADEN-WUERTT. de2 BAYERN de3 BERLIN(W) de5 BREMEN de6 HAMBURG de7 HESSEN	de9 NIEDERSACHSEN dea NORDRHEIN-WEST. deb RHEINLAND-PFALZ dec SAARLAND def SCHLESWIG-HOLST.
Belgium	NUTS 1 (3 regions)	be1 REG.BRUXELLES be2 VLAAMS GEWEST be3 REGION WALLONNE	
Holland	NUTS 1 (4 regions)	nl1 NOORD-NEDERLAND nl2 OOST-NEDERLAND nl3 WEST-NEDERLAND nl4 ZUID-NEDERLAND	
United Kingdom	NUTS 1 (11 regions)	uk1 NORTH uk2 YORKSHIRE & H. uk3 EAST MIDLANDS uk4 EAST ANGLIA uk5 SOUTH EAST (UK) uk6 SOUTH WEST (UK)	uk7 WEST MIDLANDS uk8 NORTH WEST (UK) uk9 WALES uka SCOTLAND ukb NORTHERN IRELAN
Greece	NUTS 1 (4 regiones)	gr1 VOREIA ELLADA	

		gr2 KENTRIKI ELLADA gr3 ATTIKI gr4 NISIA AIGAIOU, KRITI
Dinamarca	NUTS 0 (nivel estatal)	dk DANMARK
Luxemburgo	NUTS 0 (nivel estatal)	lu LUXEMBOURG (GRAND-DUCHE)
Irlanda	NUTS 0 (nivel estatal)	ie IRELAND