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**Conference Paper**

## Supraregional agglomeration economies and regional clubs

38th Congress of the European Regional Science Association: "Europe Quo Vadis? - Regional Questions at the Turn of the Century", 28 August - 1 September 1998, Vienna, Austria

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Mora, Antonio Jose (1998) : Supraregional agglomeration economies and regional clubs, 38th Congress of the European Regional Science Association: "Europe Quo Vadis? - Regional Questions at the Turn of the Century", 28 August - 1 September 1998, Vienna, Austria, European Regional Science Association (ERSA), Louvain-la-Neuve

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**European Regional Science Association**

**38<sup>th</sup> European Congress.**

**Wien, Austria**

**28 August –2 September.**

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### **POVERTY TRAPS: THE SPANISH REGIONAL CASE.**

#### **ABSTRACT:**

Neoclassical models of growth stated the existence of a unique steady state, where all the economies converge. Since the appearance of endogenous growth models, it is admitted the possibility of certain number of steady states, and convergence of all the economies to similar income levels is not guaranteed. All these works start from the idea that the existence of differences in the steady state are caused by the behaviour of the groups on their level of  $k$ . These approaches define the concept of a stable poverty trap as a steady state with low levels of income and stock of capital. It is considered as a trap because economies are not able to exit from this state.

Azariadis and Drazen indicate that there are different paths of growth due to the existence of thresholds effects caused by capital technology, particularly in human capital. The existence of increasing social returns to scale leads to a branching of the steady state that generates growth traps. Another point of view concludes that there are multiple output functions that lead to different states.

The objective of the present work is to find out the existence of a poverty trap in Spain, analysing which are the parameters of their own production function that define this worse located group. We have detected the existence of a poverty trap, and explained which are the possibilities for going out for the regions that perform the trap.

## 1. Introduction.

Neoclassical models of growth stated the existence of a unique steady state, where all the economies converge. The origin was the Solow model and developments from it. Since the appearance of endogenous growth models, it is admitted the possibility of certain number of steady states, and convergence of all the economies to similar income levels is not guaranteed. All these works commented the idea that there could be groups of regions (clubs) with an homogenous behaviour that suppose that each one of them converge to their own steady state. Most of works start from the idea that the existence of differences in the steady state are caused by the behaviour of the groups on their level of  $k$ . It supposes that those regions with the same level of  $k$  tend to develop towards the same steady state. These approaches define the concept of a stable poverty trap as a steady state with low levels of income and stock of capital. It is considered as a trap because economies are not able to exit from this state. The low and the high steady states show stability while an intermediate position between both states is not stable.

However there exist movements within the steady states. The average of capital product ( $f(k)/k$ ) tends to decrease when  $k$  grows. Although, these situation does not happen when the factor increases due to the existence of increasing returns as in models with learning by doing and spillovers. A poverty trap arises when after decreasing returns on factor succeed an interval with increasing. There exist growth rates of capital ( $\gamma_k > 0$ ) when the position is low to  $k_{low}$  (the lowest steady state). When the position is higher to this level of capital there appears negative growth rates on the factor ( $\gamma_k < 0$ ). Literature comments the existence of two groups of regions that corresponds with two stable steady states. In our opinion, those economies with a high level must be considered as a homogenous group while those regions with low levels are considered to be in a growth trap.

Other authors indicate that the existence of clubs of regions with a similar behaviour is due to initial conditions. In this sense, we can see the works of Galor and Ryder (1989), Murphy *et al* (1989) and Durlauf (1993). All these works show that an initially small size of the domestic market determines the future movements of the economies perpetuating this relative situation. Another point of view is the existence of clubs due to a multiplicity of output functions under a unique growth path. Azariadis and Drazen (1990), Bernard and Durlauf (199) and Palivos (1995) defended this idea. Azariadis and Drazen indicate that there are different paths of growth due to the existence of thresholds effects (radical differences in the dynamic behaviour that arise from the local variations at social returns of scale) caused by capital technology, particularly in human capital. The existence

of increasing social returns to scale leads to a branching of the steady state levels, that generates growth traps.

Another point of view concludes that there are multiple output functions that lead to different steady states considering the intermediate equilibrium as the stages of economic growth, in Rostow's terminology. In this sense, we can see the works of Chamley (1993) and Palivos (1995). Chamley expresses the necessary conditions to determine the existence of different steady states following the idea of Lucas that affirms that a multiplication of physical and human capital by the same scale generates new growth paths. The necessary condition for the existence of a unique path is summed up by the inequation:  $\sigma > (\theta - 1 - \eta) / \theta$ , where  $1/\sigma$  is the intertemporal elasticity of substitution,  $\theta$  a measure of externalities in human capital (exists under  $\theta > 1$ ), and  $\eta$  measures the concavity of the learning function.

Although, there would exist shocks or movements of the economies to stable steady positions with a higher speed of convergence towards them caused by structural parameters conditioning the performance of groups. For instance, a group of regions affected by a shock that causes  $\gamma_k > 0$  which could have a negative impact in the level of learning (labour), generating unemployment causing a worse relative situation in the whole of regions. Then, the regions have increased their level of income (output) but they have got a worse general position. These facts will happen under the existence of externalities.

In other way, Palivos affirms that if the rate of return of capital is a function that not decreases monotonically respect to capital stock, then there would exist groups of convergence, that is to say a multiplicity of steady states under a unique growth path. A low situation of capital constitutes a trap, but this time it is demonstrated by a model that follows the evolution of the growth rates of physical capital and the price of investment, studying their local stability. The optimum movements between the steady states depend on their initial position.

For leading to equilibrium positions, it not depends just on the initial conditions of each economy, also in the particularities of the neighbour regions. The existence of externalities causes that an external effect to a region coming from their neighbour leads towards steady states that are no desired. We have commented before that there also exists an intermediate location (middle steady state) that is not stable. Abe (1995) comments that under the presence of instability, it is very

difficult that the model presents convergence. Undoubtedly, the movements within the steady states are caused by the presence of externalities and spillovers.

Then, it seems evident that economies could be grouped into clubs, what allows explaining why differences have been perpetuated. However, what really worms us is the existence of a poverty trap. Thus, we must relate the causes that locate an economy into a poverty trap. A possible classification could be the next one: 1) those ones related to human capital, its low accumulation, financing and development. 2) Lowing levels in the saving rate and demographic factors. 3) Investment level in R&D and the existence of monopolies in the technology. 4) The initial conditions that determine the output function's parameters as well as the market size.

The effects are always via externalities and the interactions can present different forms. For instance: the movement of labour between firms, the transference of technology via trade or the innovation via interaction between complementary activities.

The first of the mentioned causes are those related with the accumulation of human capital. A higher level in the factor allows adapting in an easy way the technology as well as the techniques developed by other regions leading to a catching up. In other sense, this accumulation requires a certain level of quality (skilled labour) and in relation to it, the factor needs financing. As Barham *et al* (1995) or Berthelemy and Varoudakis (1996) shows, it is necessary a financial market capable to hold the growth of the factor and its quality level. The economies differs in their capability of accumulate the factor, as they also differs in their capability in using the financial market. A trap will arise when the agents (economies) are not capable to finance the future education (human capital). It not means that there is no financial sector, just that it is no competitive. Berthelemy and Varoudakis also affirm that it is necessary that the financial sector exceed a threshold to appreciate the effects of it.

In other sense, the spending in human capital also depend on other factors as the expectations on future income or the interest rate. Consume level conditions the education expenditure. De La Croix (1996) affirms that a lack of financing in education for the next generations and/or the presence of low saving rates leads to consume and no increase the human capital. This idea coincide with the marked by Azariadis (1996) who defines it as an impatience trap.

The second cause is related with differences in the saving rate. If we follow for instance, the neo-classical model, differences in this rate causes multiplicity of equilibrium as the output functions will be defined by  $s_i f(k_i)/k_i$  where  $i=1\dots n$ , being  $n$  the number of groups in which we can classify the economies. A low rate does not give the financing enough to hold a high investment in any of the factors of development. Moreover, this fact will imply a negative growth rate in the physical factor generating unemployment worsening this scenario.

In order to the third kind of causes, we can define them as technological type. Undoubtedly, the empirical evidence shows that in Europe any region have got a situation of no growth in this factor, but there have been some regions that shows reduced increases. A poverty trap will arise when the level of  $k$  is very low leading the economy to tend to the worse steady state. Usually, this situation arises when there exists low levels at the rate of substitution between capital and labour ( $\epsilon$ ), which cause more difficulty to abandon this state.

Other aspects are the effects that cause the market structure, factor that allows an economy to get a technological change. But the innovation factor is what really allows increase the future stock of capital. In this sense, the innovations are via externalities and from the international links between followers-leaders as well as the effects that would cause a monopolistic situation. The existence of a technological gap can be solved by the knowledge spillovers due to the international links. These interactions appear via trading and foreign direct investment.

The interdependence generates increases in total productivity. Against it, there exist evidences of specialisation patterns and innovation in high-tech sectors generates multiple external effects that make the South to take advantages in the profitability of externalities. Baldwin and Venables (1994) affirm that we need human capital to take profit of externalities, because without it, it is not possible to adapt foreign technologies. Klundert and Smulders (1996) defines the necessary condition to take profit of these effects:  $\alpha > \epsilon - 1$ , where  $\alpha$  are the effects of the spillovers, being  $\epsilon > 1$ . This relation implies that productivity levels will grow faster in regions that adapt the technology. Against it, if  $\alpha < \epsilon - 1$ , the total productivity will be higher in the North, generating new differences, and then, trapping the economies in low growth levels.

The last cause is performed by the initial conditions, so, the initial structural parameters. It means that we must consider the initial market size, and its ability to assimilate the external factors, because it will limit the effects of the reorganisation of production as the specialisation index. It will

cause that the dynamic externalities will be considered finally as specifically for a concrete economy.

The objective of the present work is to find out the existence of a poverty trap in Spain, analysing which are the parameters of their own production function that define this worse located group. For this purpose, the paper is divided into the next sections. In section 2 we make a reference to the data employed. Section 3 analyses, which have been the evolution of the variables in Spain. In the section 4 we estimate separate production functions to detect which are the regions that could perform this group, and estimate the factors that might have caused this situation. Section 5 describes the possibilities of going out from the poverty trap, and a final conclusion.

## 2. Database.

We have estimated a production function using data for the Spanish regions (NUT II classification) for the period 1964-1991. Data has been obtained from three sources. First, gross value added in constant pesetas ( $y$ ) and the number of employed population ( $l$ ) from the periodical publication *Renta Nacional de España y su distribución provincial*, published by Banco Bilbao-Vizcaya. The net stock of privately held physical capital ( $k$ ) comes from Fundación BBV (1996). It is measured in constant pesetas. Finally, human capital is approached by the fraction of the employed population ( $h$ ), which has at least started secondary schooling. They include, thus, workers that have started higher studies. This information is from Mas *et al* (1995).

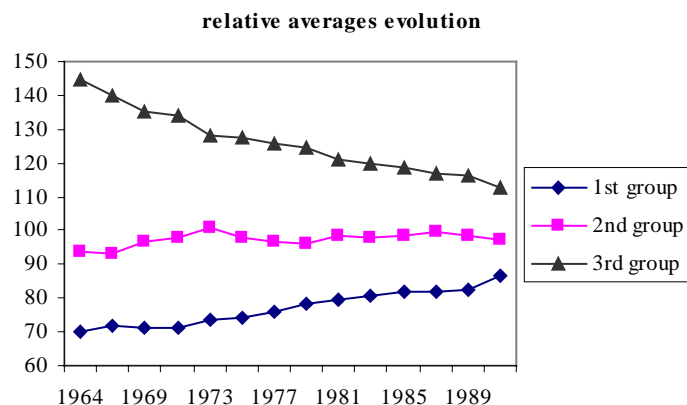
## 3. Regional Spanish evidence.

We have to see which were the initial conditions that showed the Spanish regions at the initial year. For this purpose we can divide the economies into three groups that symbolise the lower, medium and higher level of development. A possible criterion for dividing the economies into homogenous groups is the applied in Mora (1997), where is applied an optimum division of regions maximising homogeneity inside the groups and heterogeneity between groups. If we use this method with the variable  $y$  at the initial year (1964), we can take the number of groups that we desire. The first group defines the regions that probably are trapped into a growth trap. The next table delimits the groups:

Group 1	Group 2	Group 3
Extremadura	La Rioja	Baleares
Galicia	Murcia	País Vasco
Castilla La Mancha	Aragón	Cataluña
Andalucía	Asturias	Madrid
Castilla León	Valencia	
	Canarias	
	Cantabria	
	Navarra	

A simple view of the last table shows us that the groups are not distributed definitively by geographical criteria, so the causes of this grouping are another ones, not neighbouring in space. In this sense, we must detect if the performance of groups presents a high level of stratification; fact that will cause that the regions located in the lower level will be trapped into a poverty trap. For this purpose, we can plot the evolution of the relative averages of each one of the groups.

We can see from the following graph that the relative averages present certain convergence behaviour, but holding initial inequalities between the groups. The first group has approached its level to the intermediate level. However, this plot does not give information about if the performance of the groups have been stable or not. In this sense, we must detect the stratification that shows the groups that we have defined, because mobility can transverse the behaviour of the evolution of the relative averages. This convergence behaviour is mostly due to the evolution of the regions that are considered as the rich ones during the first two decades of the considered period. This fact was demonstrated by López-Bazo *et al* (1997).





For detecting the stratification, we can simply compare the initial groups with the classification that results from the consideration of the last year (1991). The next table defines the final scenario:

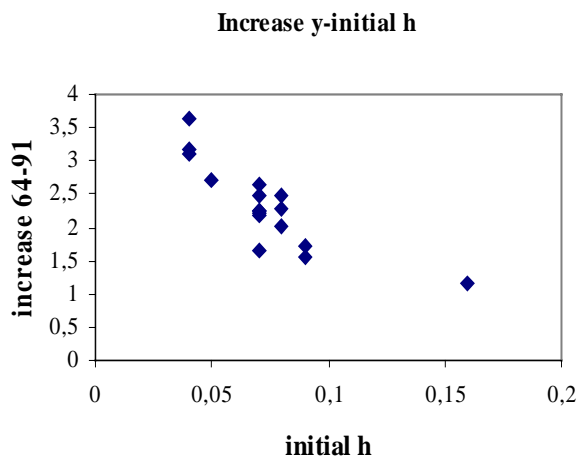
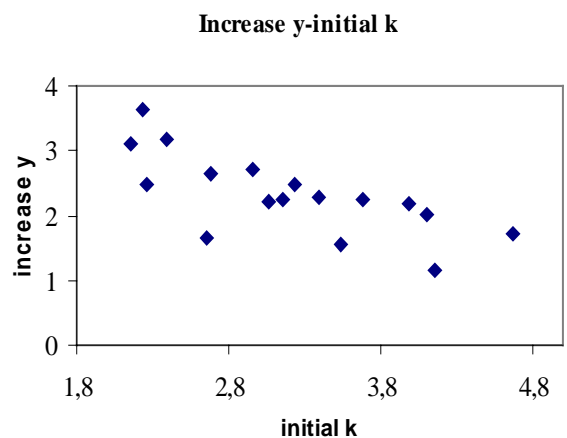
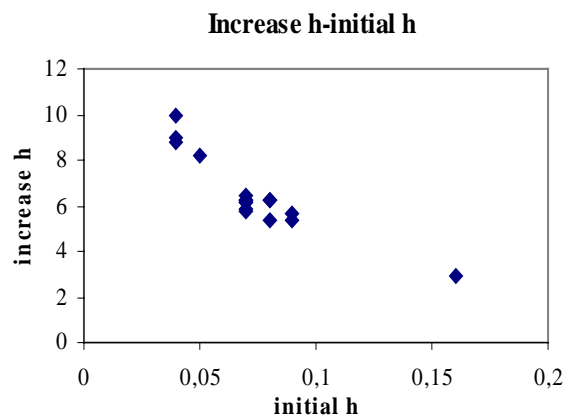
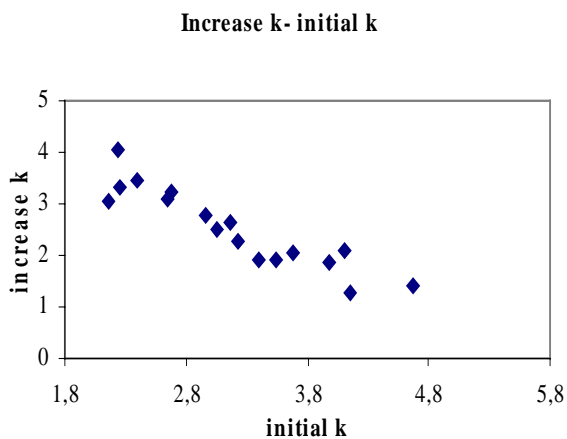
<b>Group 1</b>	<b>Group 2</b>	<b>Group 3</b>
Galicia	Asturias	Navarra
Extremadura	La Rioja	Cataluña
Castilla La Mancha	Valencia	País Vasco
Murcia	Canarias	Madrid
Castilla León	Cantabria	
Andalucía	Baleares	
	Aragón	

Comparing this last table with the previous one, we can observe that Murcia have changed its position towards the first group, therefore arriving the lower steady state. Baleares and Navarra have interchanged their positions between the second and the third groups. So, we can conclude that the first group is composed by economies trapped into a situation of low development, there is a stable intermediate group and three economies that are „trapped“ into the highest group. Therefore, the next purpose will be detecting which are the factors that would have caused this general situation.

Looking for the causes, we can make a relation within the variables that we have mentioned before in database section. Analysing the relation between the variable  $y$  against  $h$  and  $k$  we can see obviously a positive correlation. So, the intention is to make questions about which have been the economies that shows a higher increase in the variable  $y$  taking into consideration which were the initial conditions in the other two variables. The first two graphics shows the evolution of the variables against their initial levels. The other two graphics comments the evolution of the increase in  $y$  against both considered variables.

From the first two graphics we observe that the economies with low levels in both variables have higher increases. So, the accumulation of the factors is higher when the initial level is the low. In the case of the variable  $y$ , the evidence from plots is the same. Those economies with a low level of development have increased their level in the variable more than those ones that was the leaders. In this case, the step in graph of the  $k$  variable is lower than the  $h$  plot. It means that the increases in factor  $k$  are higher in those regions that have higher levels in factor but show less productivity.

This scenario coincides with the idea commented before about the existence of a convergence dynamic behaviour between the relative averages of the groups, probably caused by the increases in both factors. So, it indicate that although these regions have increased their level in  $y$ , it have not been enough to abandon their worse relative positions. Therefore, the next objective is to detect which are the differences in the parameters of the production functions. The interest will be in detecting the level of the returns in each factor.



The possible existence of poverty traps can be analysed in two different cases: low levels in factors  $k$  and  $h$  and lower returns in factors. This is the objective to study in the next section.

#### 4. Estimating separate production functions.

We have estimated a Cobb-Douglas production function expanded to account for h. Specifically, and following Barro and Sala-i-Martin (1991) and Mankiw, Romer and Weil (1992), both physical and human capital are included in the production function:

$$Y/L = f ( A, K/L, H)$$

So,

$$y_{it} = A_{it} k_{it}^{\theta_k} h_{it}^{\theta_h}$$

Being  $k_{it}$  and  $h_{it}$  physical and human capital per worker respectively, and  $\theta_i$  ( $i = k, h$ ) the measure of internal returns to  $k$  &  $h$ .  $A_{it}$  is the exogenous technological level. After log-linearization, we can estimate the next function:

$$y_{it} = \ln A_{it} + \theta_k \ln k_{it} + \theta_h \ln h_{it} + u_{it}$$

We allow for different steady states for each economy by  $\ln A_{it}$ . We have estimated a fixed effects model for considering unobservable region and timing effects. Results of the estimation consider fixed regional and time effects.

The results show returns to physical and human capital. In the case of physical capital the value is 0'47, being highly significant. The return for human capital is 0'19 (highly significant as well).

If we divide the pooled data into three groups (using the last method applied to  $y$ ), we detect which are the structural parameters (returns to factors) for each one of the groups. The composition of the groups is performed depending on which were the initial values in the both variables:  $k$  and  $h$ . Next table shows the composition of these groups depending on the factor.

	<b>Low level</b>	<b>Medium level</b>	<b>High level</b>
<b>Initial h</b>	Castilla La Mancha, Extremadura, Galicia, Andalucía	Aragón, Asturias, Baleares, Canarias, Castilla-León, Murcia, Valencia, Cantabria, La Rioja, Navarra	Cataluña, País Vasco, Madrid
<b>Initial k</b>	Galicia, Extremadura, La Rioja, Castilla La Mancha, Baleares, Castilla-León	Andalucía, Canarias, Valencia, Aragón, Navarra, Cataluña.	Murcia, Asturias, Cantabria, Madrid, País Vasco

Dividing the data by the initial values of k, we observe that the group with high values presents the highest values in returns (0'59). It reaffirms the idea of Palivos that there exist a multiplicity of steady states, because return to capital does not decrease monotonically when k grows. It means that the regions with high initial values in k have taken more profitability from the factor than those ones with low values although they have had a higher increase in the factor. Observing the values of returns to human capital the scenario shows more equality between the extreme groups.

When we consider the other factor (h) at the initial year, the returns to human capital are almost equal for the extreme groups. The scenario for extreme groups is also very similar when we observe the estimated returns to physical capital.

	<b>Low k</b>	<b>Medium k</b>	<b>High k</b>	<b>Low h</b>	<b>Medium h</b>	<b>High h</b>
$\alpha$	0'47 (0'07)	0'49 (0'16)	0'59 (0'18)	0'43 (0'08)	0'37 (0'05)	0'41 (0'21)
$\gamma$	0'25 (0'08)	-0'09 (0'12)	0'22 (0'09)	0'09 (0'12)	0'03 (0'08)	0'11 (0'09)

Another interesting issue is estimating which are the parameters in the production function for the extreme cases, so it means those regions with high initial values in both factors and those ones with low initial values in the two factors. For this purpose, the division of the economies is performed just in two groups (low and high level). This estimation allows detecting the interactions between both factors. In the case of low values in the two variables, we can see the next economies: Galicia, Extremadura, Castilla La Mancha, Baleares, Castilla-León, Andalucía, Canarias and Valencia. With high values we observe the next regions: Navarra, Cataluña, Cantabria, Madrid and País Vasco.

The next table shows the results for both estimated functions:

	<b>Low values</b>	<b>High values</b>
$\alpha$	0'33 (0'07)	0'75 (0'14)
$\gamma$	0'36 (0'09)	0'078 (0'07)

The table leads to consider that those regions that are located in the worse relative position, has experienced a medium low level in returns as well to physical capital as to human capital. They have higher increases in the levels of the factor than the other group but their profitability is lower, considering factor k. In the case of the regions that initiate with higher positions in both factors have not taken profit from the human capital. However, in relation to the physical capital, the returns are very high (0'75). This means that they have concentrated their development in this factor, considering that they showed the higher initial values.

So, if inequality persist, although the higher increases in factors belongs to the worse located regions, we must take conclusions from the returns estimations that present these extreme cases. It indicates that development (growth in income per worker) has been more intensive in capital than in human factor. Therefore, the process has relation with the location of high-tech industries, which are very intensive in physical capital. This is a factor to consider in next section where we explain which are the possibilities of going out from a poverty trap.

## 5. Leaving a poverty trap.

Causes all we have commented before, it will be necessary that the government make intervention for taking profit of knowledge spillovers and externalities. As the factors that cause a poverty trap are different, we must distinguish which is the better way to the government to act. Taking it into consideration, we establish the next classification depending on the existence or not of government intervention: 1) temporary measures, economic policy and direct intervention. 2) Foreign direct investment, future expected scenarios and increasing market size.

The idea of the intervention is just to adapt the spillovers that have been detected. A temporary measure makes to escape an economy from a position in a poverty trap, because there are externalities that are absorbed, as they are dominant in that scenario. A second possibility is to intervene via public expenditure or with measures that facilitate the adoption of the externalities. García-Montalvo (1993) affirms that the public capital plays a higher role than the private capital, because the first one increases the speed of convergence. We must say that we are talking about investment not about transference, because the last one does not allow abandon the trap in the long run. Others authors as Bénabou (1994) affirms that the level of public financing is more effective than the private or local in the long run, in the special case of human capital.

Therefore, the existence of externalities justifies the presence of government intervention, but in a selective way, affecting to specific industrial sectors via improvement in infrastructures or favouring human capital.

In other way, Baland and Francois (1996) says that to abandon a poverty trap, is necessary to exceed a threshold in physical capital. The way to achieve it is changing the industrial structure. In this sense, the public actuation has two effects: a) a displacement effect: government research crowds out private research; b) a discentive effect: the proportion of competitive industries in the economy rises. Then, the effects are contrary. The fact is to observe which is the highest. When public investment is higher enough to reduce the proportion of monopolistic sectors under a critical level, then, the private investment disappears leading the economy to the lowest steady state.

Respect to the other kind of measures the most important is the existence of foreign direct investment. This kind of actuation is not independent of the public policy, because there must to

exist the elimination of ties. The final desired effect is to favour the acceleration of domestic economies. Another possible kind of investment is the foreign help via physical capital and/or educational or technical formation to adapt the new investment. All these kind of measures need the presence of high expectancies of a future scenario to take profit of them. The third possibility is the promotion of the structure and financing market.

One thing to take into consideration is that the measures mentioned before can be superfluous, leading to solutions without a redistribution effect. This is the case of those regions that show a high level of stratification, a scenario that supposes efficiency losses in an aggregated level. A higher stratification leads to a high future inequality.

Considering the Spanish regional case, we must explain which would be the possibilities for this country. The main objective for the regions that belongs to the growth trap is to exceed a certain threshold in  $k$  in specific activities. Their capability of achieving this purpose depends on their level in physical capital in an intensive way. The promotion of the factor needs the public financing, but not with transference. We have commented before that the public financing is better in the long run than the private one, but not causing a displacement effect, diminishing the private activity in the performance of the economies.

Therefore, the idea is to continue promoting the human capital to adapt spillovers, but the higher effort must be in the physical factor. An important issue to consider is that a public intervention might not have effects on the private sector. In this sense, the elimination of domestic monopolies caused by foreign direct investment and the public intervention can provoke disincentives in the private investment.

## 6. Concluding remarks.

In previous sections we have detected the existence of a poverty trap for the Spanish regions. There are a number of regions that had persisted in their worse relative position holding initial low levels of physical and human capital, and product per worker. They have increased their factors intensity more than the other regions, even though they had remained in a separate lower steady state. The reason may be that returns to physical capital seem to have been very low for these regions.

Meanwhile, the richer and better-positioned regions have been the ones that have taken more profitability of physical capital. Then, this factor may have been the cause of persistence in inequalities.

However, equalisation in physical and human capital among the poor regions with the richer ones advises of the possibility that these regions have reached the threshold in inputs and start profiting from higher returns.

An interesting issue is to analyse which are the best possibilities for escaping from this development trap. One possibility could be public intervention that, in a selective way, may support location of high-tech activities that can contribute to take profit of the intensification in physical and, basically human capital.

The promotion of private investment and the existence of certain number of monopolistic sectors with the presence of a high-qualified human capital will allow adapting all spillovers generated by the government intervention in generating new physical capital.

A future line will be the estimation of separate production functions for different time periods in which the levels of physical and human capital were very different. Another development will be estimation of the production function under the method developed by Durlauf and Johnson (1995). The regression tree method allow to detect which have been the factors that influence in a higher way, dividing the regions into different groups classifying with the criteria of the function.

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