Socio-Economic Impact Assessment of Investments: The Case of the Portuguese Northern Region

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1. Introduction

During the last fifteen years, the Portuguese northern region received a significant number of public and private investments that surely contributed to its economic and social development.

Most of those investments conveyed the implementation of public policies settled in many strategic documents that framed and guided regional development processes (Pinho et al., 2011). These investments were aimed at strengthening the economic competitiveness (within an adverse internal and external environment), enhance social cohesion (in a territory with strong coast-inland cleavages) and reduce the impacts of projects (through environment requalification). Other investments took place, namely in industry, building industry, trade, services and tourism as a result of the initiatives of different economic regional agents (or agents attracted by the region) hardly influenced by public development policies (Pinho et al., 2011).

Both public and private investments shaped the regional economic, social and environmental development. Despite this development is comparable to what happened in other national and European regions through a series of statistical indicators, a deep reflection is required in order to understand the particularities and challenges projects raise to regional development.

The analysis reported in this article is relevant because it relates the current situation of the Portuguese northern region and its evolution with the performed public investments, and assesses their impact on population's wellbeing, so it enables the re-settlement of policy and programs´ goals. It further fits the current European debate on the efficiency of cohesion policies, and the national debate on investment policies.

This article starts with the theoretical framework. Then the proposed methodology is shortly described and applied to the case study, followed by the discussion of the attained results. Finally conclusions are presented, and some remarks are made on the impacts and challenges of investments on regional socio-economic balances.

2. Theoretical Framework

Different international studies assess the effects of public investments on product and productivity, and respective inter-relations (Bajo-Rubio and Sosvilla-Rivero, 1994; Bradley, 2006; Bradley et al., 2005; De la Fuente, 2006; Ministério das Finanças, 2003; Mizutani and Tanaka, 2010; Modesto and Neves, 2005; Moreno et al., 2002; Nijkamp and Poot 2004; Forslund and Johansson, 1995; Kataoka, 2005; Yamano and Ohkawara, 2000). They have studied, namely, the influence that different kinds of investments, demographic variables and private investments exert on product and productivity (Crain and Oakley, 1995; Kamada et al., 1998; Kemmerling and Stephan, 2002; Rodriguez-Oreggia and Rodriguez-Pose, 2004).
However, the current scientific literature is not unanimous on the existence of a significant impact of public investments on economic development (Batina, 2001; Gramlich, 1994; Pereira and Andraz, 2002; St. Aubyn, 2005). Public investment can indeed exert either

straight or indirect effects on gross domestic product (GDP): the former refer to the capability of public investments to generate production increases (apart from possible changes in other macroeconomic factors). The later, by their turn, refer to the capability of public investments to engender production changes through the influence they exert on private investments: if they foster private investment their effects are called “crowding in”, if they refrain them, on the contrary, their effects are called se “crowding out”.

All the studies carried on in Portugal lead to the conclusion that public investments exert a positive effect on economic growth; these investments are profitable (in macroeconomic terms), and they further stimulate private investments. However, Batina (2001) notes that public investments exert different effects on economic growth, depending on the kind of investment. Pereira and Andraz (2002; 2004) compare the increase in product with public investments and conclude that they are highly profitable in Portugal. Pina and St. Aubyn (2005a; 2005b) reinforce this conclusion, stressing that the high profitability of public investments result from their leverage effect on private investments.

In order to study the impacts of public investments on the economic development, in general, and on other macroeconomic variables, in particular, researchers often resort to temporal analysis in autoregressive vectors (St. Aubyn, 2005). This methodology enables the assessment of public investments in what concerns: (i) the straight relations between public investments and other variables such as private investments, employment and regional GDP; (ii) the identification of the responses of other variables to changes in public or private investments; (iii) the elasticities of private investments, employment and regional GDP in the view of public investments; and (iv) the computation of the profitability of public, private and total investments (St. Aubyn, 2005). In order to test the existence of causality relations between public investments and other macroeconomic variables, literature further proposes the application of Granger causality tests that relate past changes in public investments with contemporary changes in the variables belonging to autoregressive models (St. Aubyn, 2005).

3. Methodology and Its Application to the Portuguese Northern Region

Most studies on investments´ economic impacts – whether ex-ante, on-going or ex-post – assume a supra-regional level, focus on the consequences of individual projects and investment programs and plans, and usually direct to deadline meeting.

The current methodological assessment of the impact of investments aims at supporting the decisions of regional and local leaders, technicians and financial institutions to outline integrated policies for sustainable development. These policies should include straight and indirect effects of public investments, considering the complementarities between public and private investments on regional development and population’s wellbeing. It further seeks to develop flexible user-friendly tools to assess investments (Bradley et al., 2005; Salminen and Lahdelma, 2001).

So this research pursues an extensive analysis of different statistical and documental economic sources. It resorts to the econometric methodology of auto-regressive vectors in order to evaluate and quantify the relevance of performed investments, their effects on other macroeconomic variables (gross domestic product, private investment, and employment), and their productivity, elasticity, and profitability. This analysis conveys a more supported perception of the social utility of investments. The general adoption of this methodology in international scientific literature and empirical studies (St. Aubyn, 2005) renders the comparison of results easier at national and international grounds, what reinforces the conclusions. It tackles different endogenous variables, considers dynamic relations among

different variables, enables comparisons among public investments, and supports the analysis of alternative models for the same reality.

3.1. Brief Characterization of the Portuguese Northern Region

The northern region of Portugal is a territorial unit that comprises the districts of Viana do Castelo, Braga, Porto, Vila Real and Bragança, and part of the districts of Aveiro, Viseu and Guarda. It borders on Spain at the north (Galicia) and east (Castila and Léon). At south it connects to the Portuguese central region, and at west borders on the Atlantic Sea. Its surface amounts to 21 278 km² (24% of the continental Portugal). Its population is around 3 745 246 people (37% of the whole continental Portugal). It is a planning region that splits into the north coast (districts of Viana do Castelo, Braga and Porto) and the North Inland (districts of Vila Real and Bragança), and is made up of eight sub-regions: Alto Trás-os-Montes, Ave, Cávado, Douro, Entre Douro e Vouga, Grande Porto, Minho-Lima, and Tâmega.

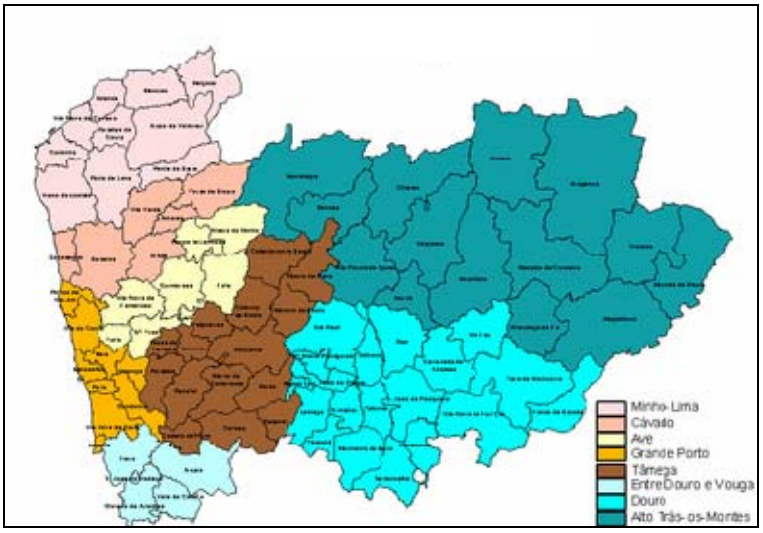

Figure 1. Portuguese Northern Region
(Source: Portuguese Statistics Institute)

Within the scope of all the Portuguese regions, this is the one that experienced the lowest per capita gross added values along the last fifteen years, and it still keeps away from Portuguese average values.

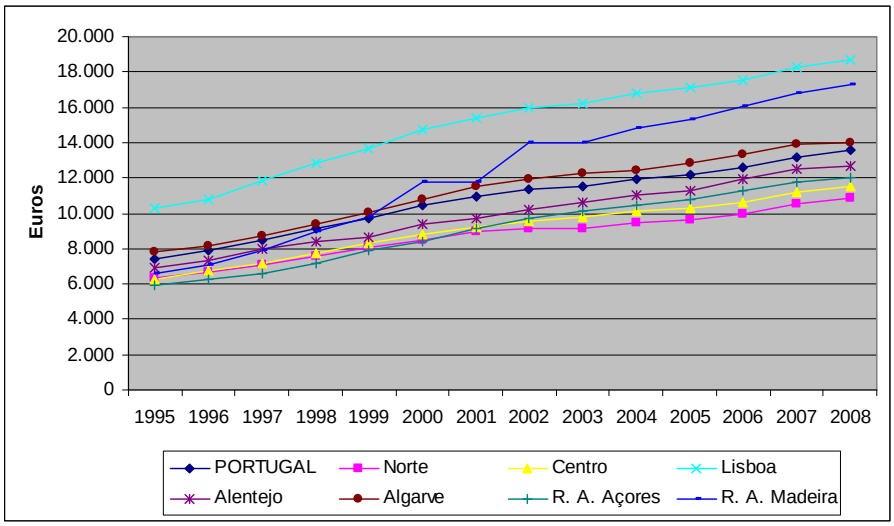

Figure 2. Evolution of the per capita gross added value in Portugal (by regions and average Portuguese values), between 1984 and 2006
(Source: Portuguese Statistics Institute)

As far as investments are concerned (measured by the gross formation of fixed capital, according to the national statistics system), the scenery is not much different. The northern region has indeed received lower amounts of public investments; despite they have been growing gradually along the last fifteen years (with the exception of the ones allocated to the region of Lisbon and Tagus valley).

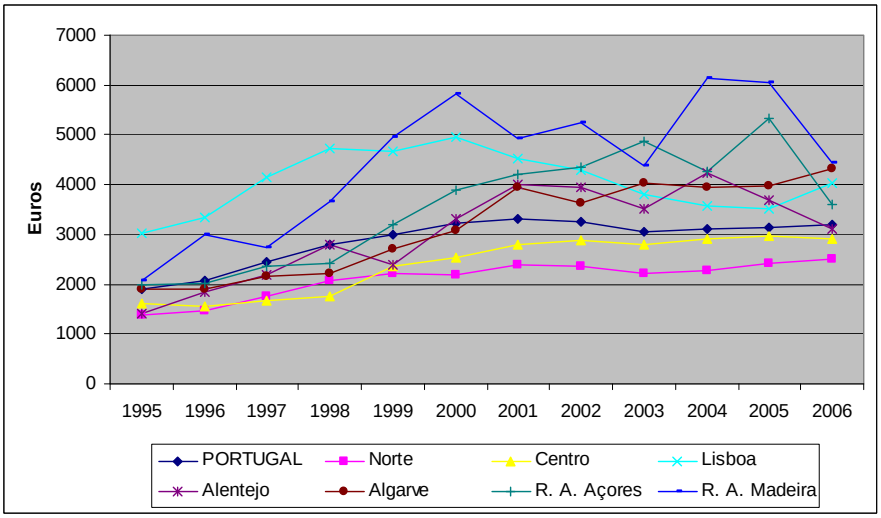

Figure 3. Evolution of the per capita gross capital fixed formation in Portugal (by regions and average Portuguese values), between 1984 and 2006
(Source: Portuguese Statistics Institute)

Transforming industries are the economic activities mainly responsible for the regional gross added value, followed by trade, real estate activities, services lend to firms, and building industries (Rebelo, 2011). Between 1995 and 2008 the northern region registered – within the national scope - the higher gross added values in transforming industries, production and distribution of electricity, gas and water, building industry and education. However, respective

per capita values all place last or second at last in all the activities of the northern region, except transforming and building industries, and power-related activities.
The evolution of the gross added value, and their distribution among the different activities between 1995 and 2008 stresses the percentage reduction in farming, transforming industries and trade, and the strengthening in real estate activities, services lend to firms, public administration, defence and social security, education, health and other collective, social and personal activities (Rebelo, 2011).

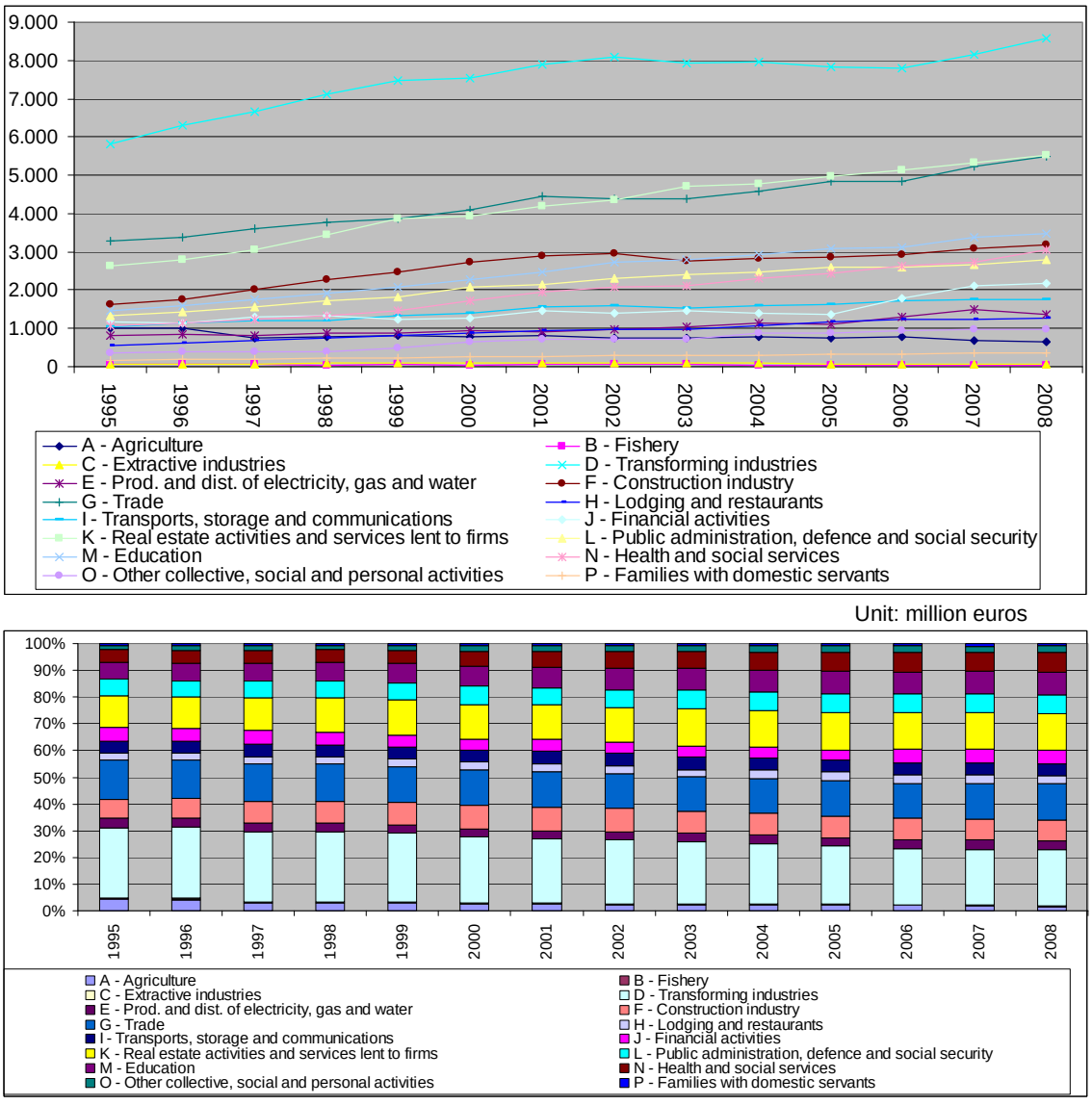

Figure 4. Evolution of Gross Added Values and correspondent percentage distribution by economic activity in the Portuguese Northern Region between 1995 and 2008
(Source: Portuguese Statistics Institute)

The evolution of the economic situation of the northern region along the last fifteen years stresses an important change in the structure of activities, that conveyed a strong reinforcement of real estate activities and services lend to firms, and a considerable decrease in the percentage of transforming industries, primary sector activities, construction industry and trade. It should also be noticed that the increase in services lend to firms

probably means an accrued dimension of firms and their increasing dynamism (that require specific services), what is probably directly related to their added values (Rebelo, 2011).
At the national scope, the northern region leaded gross fixed capital formation in, communication, transports and storing, financial activities, public administration, education, health, social action and other collective, social and personal services. However, the corresponding per capita values are placed at last at the national level, except as far as transforming industries are concerned. It is also important to notice that investments in transforming and building industries decreased substantially during the studied period.
However, despite public investments as a percentage of accrued added value have increased between 1995 and 2007, they decreased to about its half from then on, opposite to the increasing trends of private investments.

Employment in the northern region has been decreasing in transforming industries, and increasing in building industries and tertiary activities (that serve local communities and without doubt improve life quality but, usually, don't represent a straight cash entrance to the region). Employment also decreased in the farming sector. However, most employment in the northern region still remains in the transforming industries, far from other activities´.

3.2. Data Collection and Treatment

The shortcomings of data on investments, and the lack of other kind of statistical aggregations for public investments organized at the level of the northern region lead to the use in this research of values on gross fixed capital formation of public administration, obtained from Portuguese national statistics (activity sector L).

After data collection and the analysis of the evolution of the main macroeconomic indicators along the latter years, autoregressive models were applied in order to assess and compute the relevance of investments, their effects on other macroeconomic variables (GDP, private investment and employment) as well as its productivity, elasticity and profitability.

The methodology was pursued according to the following steps: (i) analysis of the temporal series, in order to identify how they will be introduced in the model; (ii) identification of the order of the autoregressive vector (number of time lags among endogenous variables); (iii) computation of the effects exerted by public and private investments on the regional gross domestic product; (iv) determination of the public investments´ impulse-responses (how the considered variables respond to structural changes in investments), and identification of respective coefficients and, finally (v) analysis and interpretation of the obtained results, and respective comparison with homologous national values.

In order to measure the economic effects that accrue from public investments on the evolution of the regional product, the autoregressive vector model was settled considering the following four endogenous variables (Bernanke , Sims , 1980, 1986; Rebelo, 2011)[1]: public investment, private investment, gross domestic product, and employment. The analysis covered the period 1995 to 2006.

3.3. Relevance of Public Investments for the Regional Gross Domestic Product, Employment and Private Investment

In order to test the relevance of public investments for the regional GDP, employment and private investments Granger causality tests were pursued. Thus autoregressive vector models were fitted where each of these variables (considered, in each case, as the most exogenous one) is expressed as a function of public investments. Then qui-square tests were applied to test the null hypothesis that the coefficients of the lagged values aren't statistically significant in the correspondent equation (Rebelo, 2011).

The following table sums up the statistical values for the irrelevance of public investments for the GDP, private investments and employment in the northern region (for the period that

ranges from 1995 to 2006) and compares them with the values achieved for Portugal in a study developed by St. Aubyn (2005) (for the period that ranges from 1980 to 2004).

	Northern region	Portugal*
Period	1995 - 2006	1980 - 2004
Number of time lags	1	1
Irrelevance of public investments for the GDP	0,038	0,985
Irrelevance of public investments for private investments	0,2549	0,273
Irrelevance of public investments for employment	0,4094	0,244

* Value obtained for the model without public consumption.

Table 1: Statistical irrelevance of public investments performed between 1995 and 2006 for the regional gross domestic product, private investment and employment, and comparison with the values correspondent to Portugal between 1980 and 2004

It can, thus, be concluded that public investments are more relevant both for regional GDP and private investments, and less relevant for employment than for homologous national values.

3.4. Analysis of Investments´ Elasticity, Productivity and Profitability

In stationary autoregressive vectors the impulse-response function tend towards zero in the long term (St. Aubyn, 2005; Rebelo, 2011). This means that, when increasing or decreasing effects that accrue from changes in public investments don't express any longer, what possibly may remain are level effects. So the long-term elasticity of the GDP can be computed, considering the cumulative effects of impulse-response functions. The long-term elasticity of private investments in view of public investments can also be computed from these cumulated values (this elasticity may be positive or negative according to the accrued effects, "crowding in" and "crowding out", respectively).

In the case of an orthogonal impulse in public investments, important cumulative effects are exerted on public and private investments, despite their influence on employment and GDP are less representative.

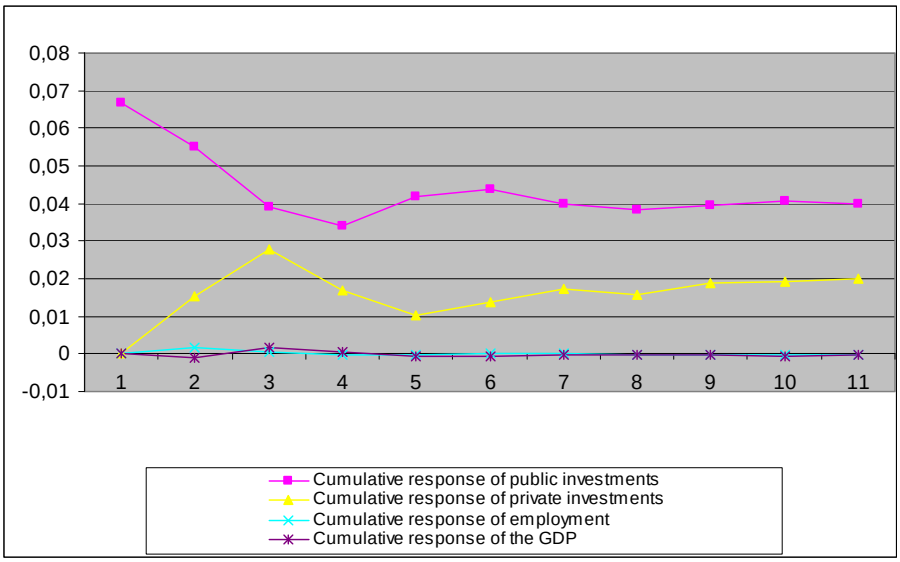

Figure 5. Cumulative response of public investments, private investments, employment and GDP to an orthogonal impulse in public investment
(Source: Author)

The elasticity of the regional GDP in view of public investments was computed from the quotient between the values of the cumulative impulse-response to GDP and public investments (St. Aubyn, 2005). These values explain the impacts exerted by public and private investments on the regional GDP. The elasticity of private investments considering public investments was assessed from cumulated impulse-response functions as well.
The marginal productivities of public (PMG) and private (PMI) investments – product engendered by each additional unit of public and private investments, respectively – were computed by the product between the quotient product/investment and respective elasticity (St. Aubyn, 2005). The marginal productivity of the total investment (PMIT), by its turn, was computed through the expression:

$$PMIT = \frac{1}{\frac{1}{PMG} + \frac{1}{PMI}}$$

Product variations – that enable the computation of their "dynamic or total effects" accrue not only from changes in public investments but also from the changes they induce on private investments ("crowding in"). According to St. Aubyn (2005), the profitability rate of total investments is the rate that equals the gross present value of increases in product to the present value of the additional public investments required to obtain it.

	Northern region (1995-2006)	Portugal (1980-2004) (without public consumption)
Quotient GDP/Public investments	33,78	25,68
Quotient GDP/Private investments	5,29	4,63
Elasticity of the GDP in view of public investments	-0,01	0,090
Elasticity of the GDP in view of private investments	0,10	0,172
Elasticity of private investments in view of public investments	0,50	-
Marginal productivity of public investments (PMG)	-0,35	2,32
Marginal productivity of private investments (PMI)	0,543	0,795
Marginal productivity of total investments (PMIT)	-0,974	0,592
Profitability rate of public investments	-	0,043
Profitability rate of private investments	-0.05	-
Profitability rate of total investments	-	-0,026

Table 2. Computation of the elasticity of the GDP in view of public and private investments, of the marginal productivities and of the profitability of public, private and total investments in the northern region (1995-2006) and in Portugal (1980-2004)

Public investments´ elasticity and marginal productivity are negative in the northern region, what means that an increase in public investments will involve a reduction in the product (however, considering the "crowding in" effects they induce on private investments, productivity and profitability of public investments are not as low as they should be in the absence of these indirect effects). In these circumstances it is not possible to compute the profitability rate neither for public nor for total investments (as they both present negative values). A negative profitability rate means that, in the long term, the return on product is below the sum of investment increases. However, the results concerning public investments were already anticipated, considering that the studied investments are quite recent, and that most used data reflect public investments not directly targeted at increasing the GDP.

The attained values lead to the conclusion that the elasticity of private investments is high in view of public investments in the northern region. It means that, for each unit percentage increase in public investments, private investments increase by 0,5%. The GDP in the northern region has a tendency to decrease in view of an increase in public investments, but it tends to increase as a result of private investments.

The elasticity of the GDP in view of investments performed in Portugal between 1980 and 2004 was positive, opposite to what happened in the northern region for the studied period. The Portuguese GDP also reacted more strongly to private investments then the regional GDP.

The productivity of public investments in Portugal, besides being positive, is also higher than private investments´. On the contrary, it was negative in this region. The national productivity of private investments, by its turn, increased 0,795 euros in the absence of consumption, whereas the regional GDP for the period 1995-2006 increase 0,543 euros on average.

4. Conclusions

The Portuguese northern region socio-economic conditions have generally increased during the last fifteen years, what is reflected in the rise in their citizens´ quality of life. The provision of transports and energy infrastructures was intended to cover transversely the whole region that, as a result, attained a significant level of territorial equity. But the correspondent intra-regional approach and network integration was not followed by convergence approaches in social conditions (such as education and income), and by the settlement of sustainable economic conditions. In fact, this region has becoming increasingly dependent on outside consumer products. Besides, most public investments weren't properly made profitable as they generally involved a decrease in regional gross domestic product. Public investments, however, were able to mobilize internal resources through the "crowding in" effect they exerted on private investments. Within this scope, external economic agents seemed to have taken advantage from public investments as potential income-generators, what subsequently blocked the development of internal endogenous resources. It can also be noticed that most of these public investments weren't able to engender relevant positive externalities on hosting territories.

Thus the recent evolutionary framework clearly reveals unfavourable from the economic standpoint. The cycle of investments in huge infrastructures and public equipments (obvious in the studied years) is becoming to an end, and we currently witness a progressive dematerialization of economic production. Despite this latter tendency is already noticeable in some OECD countries where a new reinvented transforming industry is emerging, its affirmation in the northern region – as a response to the European convergence goals – will require structural adjustments and the surmounting of chronic backwardness (Pinho et al., 2011).

The execution of public investments resorting to cohesion funds and other funds directed to regional development induced a sudden leap in regional development. Despite they conveyed a significant increase in life conditions (more communications, easier access to consumption goods and credit), this nevertheless showed that that local economies weren't able to keep the same swiftness in their development processes. Furthermore, despite European policies fostered the development of tertiary activities, some regions weren't able to reach in this short-timed period a compatible development level due to their structural backwardness (as is the case of the Portuguese northern region). Added to the expectations these policies created to populations, local consolidated economies ended up strongly threatened. The supposed "ideal of free circulation of goods" ended up by troubling the traditional regional activities, without proposing a believable sustainable alternative, funded on endogenous regional strengths. Regional socio-economic characteristics (namely subsistence endeavours that supported low wages in the secondary sector, and so its competitiveness) were called into question. Without technologies and high-qualified workmanship, and considering the general rise in life quality patterns engendered by the entrance of European funds, the northern region quickly went downhill, and its sustainability suffered vicissitudes. Even the investment in employment ended up as insufficient because the region mainly had low-qualified aged workmanship, used to work in the same fields for long periods of time, so the region was lacking young, innovative and entrepreneurial workmanship.

Thus the northern region lost its traditional successful activities due to those investments, and it was launched to a situation where it wasn't able to face new challenges, and became more and more dependent on external goods and services. Probably investments took place in the wrong order. Instead of investing first in infrastructures (and after, probably in other regional value-generating investments), the order should be the opposite: to make a bet first in regional strengths and, then, on its external connections.

It can be concluded that public investments didn't work on the regional GDP and employment as anticipated. However, considering the eminently industrial characteristics of the northern region, the effect of public on private investments was rather interesting as it shows that capital and initiative do exist, but public policies should receive and encourage these initiatives, and provide the conditions for its fulfilment.

Currently the northern region is getting over its backwardness because, in view of a crisis scope, it bets on its strengths through differentiation strategies (instead of low-cost strategies prevailing till recently). That is, it was able to surmount the European competition (that accrued from the free circulation of products), and the competition from emergent countries (that accrued from labour costs considerably lower) though marketing strategies, mainly investing on the quality and design of its products. This response was mainly set off by the lethargy of the region, recently deepened by the economic crisis.

The current research stresses the importance of a strategic vision of development processes, able to guide investments to the development of regional strengths, and to surmount its weaknesses. Thus public investments – when pursuing their mission - should not only respond to specific needs, but also link together with other sectorial projects (taking advantage of synergies and complementarities), and be able to trigger new private investments. Only this way its capability to engender positive externalities will come into force. If public investments don't pursue this vision, projects will end up by not taking the desired effects on economic development and social wellbeing.

Endnotes

[1] In this analysis was used the free software "EasyReg International".

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