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Quantitative vs Qualitative public investment: The case of Portuguese Manufacturing between 1988 and 1992

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Quantitative vs. qualitative public investment: the case of Portuguese manufacturing between 1988 and 1992

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Abstract

It is widely accepted that the injection of capital through state funding with little considerations for particular structures of the industrial mix of a region is not sufficient in itself to induce development. Neoclassic redistribution mechanisms which should lead in the long term to an equitable distribution of wealth through the geographical plane do not work in reality. Also, the failure of the traditional regional policies inspired by the growth pole logic has led to a greater attention being given to the smaller geographical areas and to their particular characteristics.

The coordination of industrial policy guidelines with regional development issues have become of great importance in order to foster development in traditional backward regions. It is the contention of this paper to argue that in the case of Portuguese manufacturing, government measures have since accession to the European Community in 1986 been bias towards the coastal area, increasing disparities rather than the opposite. This argument stands even when considering the proportional differences in distribution of industrial activity throughout continental Portugal.

Simply adding up public funds and comparing regional totals is not enough to perform a realistic analysis. In the present study, data from the total number of projects approved within the Pedip framework is analysed taking into consideration the innovative character of specific Pedip sub-measures. It will be argued that through concentrating most of the qualitative investment (e.g. Operational Programme 5) in the coastal core, the government further undermined the development of new industrial areas in the interior.

1. Introduction

The main contention of the present paper is that Pedip 1, as the main financial instrument within the Government's Industrial Policy framework was spatially extremely biased; the greater the industrial presence in one region, the greater the financial aid towards industrial firms in that region. It could be argued that, since the whole programme was designed by the Portuguese government not as an instrument which should tackle regional imbalances, the spatial distribution of the projects approved within Pedip 1 simply reflected the different weight of industrial sectors as a whole throughout the spatial plane. There are however two clear ways of refuting such an argument. First, Pedip 1 was indeed intended to tackle regional differences within the country, as it was originally designed; second, even taking into consideration the spatial differences in industrial distribution within Portugal as a whole, one can see the Pedip 1 still favoured the richer regions. The second point will be developed in the presence exercise. Also, it will be taken one step forward. It will be argued that measures which could induce greater increases in industrial productivity at the spatial level were focused merely on a very small number of regions.

In the next section, Pedip will be briefly introduced. Next, some important considerations will be made about the spatial distribution of industrial activity in Portugal. Section 4 will discuss the regional discrepancies in the implementation of Operational Programmes 3.1 and OP 5 at the national level, while the next section will do the same but concentrating only in the *Norte* region. The paper will terminate with some brief conclusions and suggestions for future research.

2. Pedip

Pedip 1, which ran from 1988 to 1992, was innovative from the national point of view but also when considering the programme within a wider framework, that of the European Union Regional Policy. Pedip was engineered within the spirit of the 1988 reform, which left behind the idea of concentrating the use of the available financial instruments in particular projects towards the broader use of specific guidelines, which came to practice in a number of Operational Programmes (OPs), which themselves, would provide the guidelines for individual project support. On the other hand, specific OPs would be part of broader policy guidelines, and the practical framework for these would be provided by structured programmes; such was the case of Pedip, a programme

which involved the coordination of several structural instruments, most notably the European Regional Development Fund (ERDF) and the European Social Fund (ESF).

One point which is important to bear in mind, although not being further explored in the present paper is related to the implications of classifying the Portuguese territory as one Objective 1 region. In practice, the implicit consequences are that any EU programme, formulated within the objectives of increasing regional competitiveness through tackling regional disparities, is incorporated into national objectives, without any regional content. Also, the non-existence of decentralised centres of decision-making is an obvious obstacle to the effectiveness of such programmes, in terms of spatial inequalities. So, it is important to clarify the fact that Pedip was intended as a Regional Policy instrument but in practice gave the financial backing to pursue highly centralised policy objectives.

Taking the previous point into account, Pedip will be analysed as a national programme, intended to improve the competitiveness of the Portuguese industry, and without any objectives at the spatial level. From here, the starting preposition is that the proportion of funding going into each region should be coherent with the spatial distribution of industrial firms. Within such a framework, regional disparities would naturally continue to increase, although the state would not be responsible for this movement¹. However, as it will be shown, Pedip was disproportionately bias towards richer regions, helping to accelerate in effect differences between regions with a *richer* industrial mix, in detriment not only of the more rural areas, but also of some old industrial areas.

The main focus of the analysis are two specific Operational Programmes, part of Pedip: OP 3.1 (SINPEDIP) and Operational Programme 5. OP 3.1 was in purely financial terms the most important programme, with 52.7% of all incentives given to the approved projects. SINPEDIP dealt mainly with production line upgrades through the acquisition of new equipment; it can be characterised as a *traditional* and *orthodox* financial instrument created to tackle basic deficiencies at the firm level. On the other hand, OP 5 was the most innovative measure in terms of its focus and the specific

¹ It is assumed as given that, contrary to the old neo-classic arguments that markets would in the end lead to an efficient distribution of resources throughout the spatial plane, regional disparities increase within a free market economy

nature of the programmes approved; it dealt mainly with what became known as *productivity missions*. Its backbone were the *Demonstration Actions* (OP 5A1) and the creation of specialised Consulting Centres, both with the explicit objective of spreading *know-how* throughout competing firms of the same industrial sectors; this would result in relatively localised technological spillovers. In terms of value-added, the impact within any targeted industrial cluster was intended to be significant.

As a result of the characteristic described above, OP3.1 and OP5 were chosen, since they were seen in policy and operational terms as opponents. The former followed a more traditional line of direct incentives to industrial firms, while the latter considered specific aspects which affect industrial firms' productivity. Taking as the starting point the proportional distribution of industrial activity throughout the different regions of the Portuguese territory (at different scales), the distribution of the number of projects approved within the scope of the two OPs chosen should be roughly the same, if Pedip was spatially unbiased. If not, and particularly, if the differences between the spatial distribution of firms and that of OP3.1 projects first and OP5 second is considerably different with the latter being higher than the former, then one should conclude the Pedip 1, as the main financial instrument within the state's industrial policy served as a way of accelerating disparities between Portuguese regions.

3. Spatial Distribution of Industrial Firms

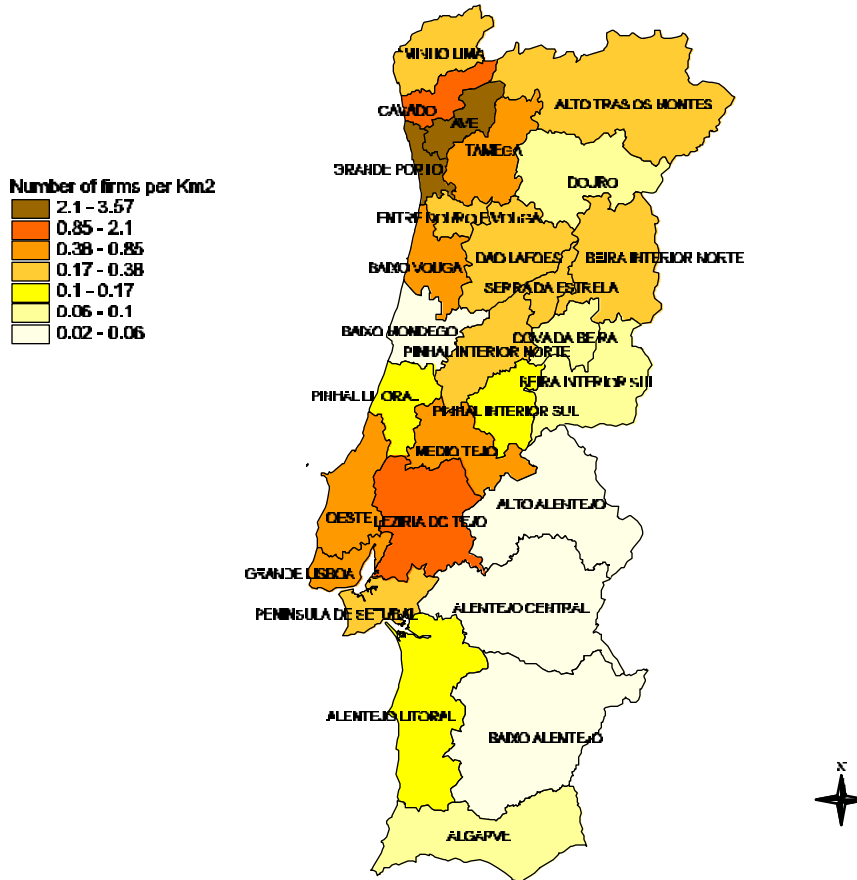
In order to analyse the distribution of industrial activity throughout the national plane, the regional desegregation levels were, first the NUTS 3 level (28 regions) and second the council ("concelhos") level; the latter will serve mainly to show that even within small areas as NUTS3 regions, the spatial distribution of industrial activity can be significantly different²; also, only the *Norte* region will be analysed at the more desegregated level since data for all the other spatial units is not presently available. The main focus will be the number of firms (taken from the SISED database). This value will be weighted by the area in squared kilometres of each region, multiplied by 1000³, giving thus the number of firms per Km². Only industrial firms will be considered

² This fact is natural when considering the heterogeneous nature of the Portuguese spatial plane.

³ The reason for doing this transformation is that the size of each region differs considerably.

(CAE1 15-37). Since Pedip run from 1988 until 1992, the average number of firms per squared kilometre was calculated for this period⁴.

Map 1

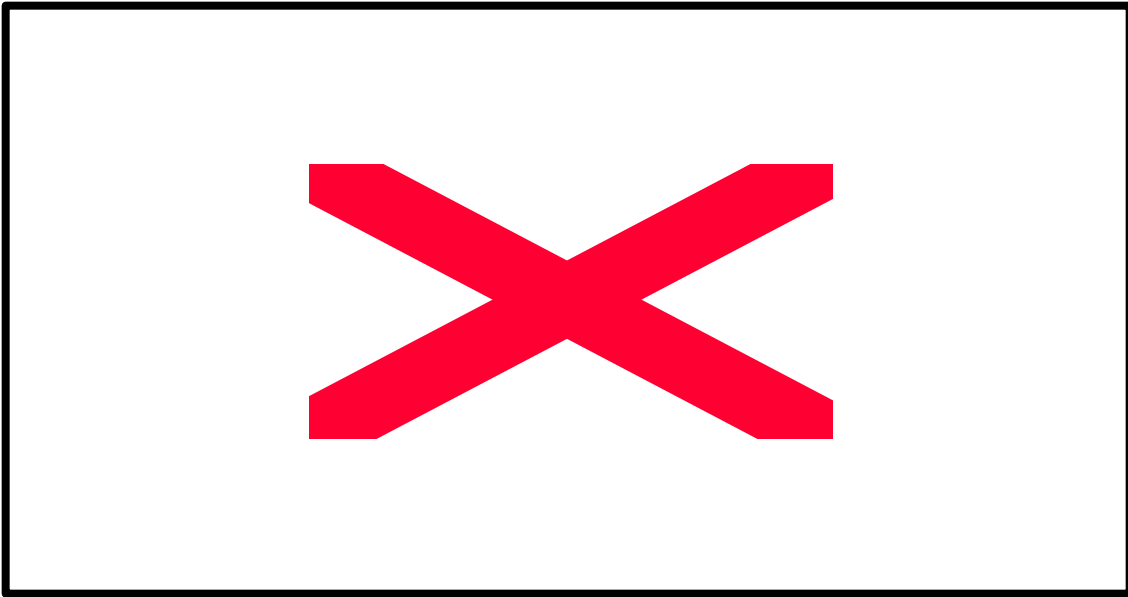


An analysis of map 1 where the number of industrial firms weighted by the area of each region in Km² is represented, shows that first, the main industrial pole is situated in and around *Grande Porto*. Another strong industrial area is in and around *Grande Lisboa*. Also, it is quite obvious that the interior regions, especially those situated in the south, are poorly industrialised. Finally, it is also relevant to notice that industrial activity is not equally distributed along the main motorway, the A1, which links the two largest urban centres, Lisbon and Oporto.

⁴ One alternative approach would be to use the number of firms of a latter period, taking into account the time lags involved since the moment each project is approved until when it actually affects industrial output. However, since in the present analysis what is relevant is the point of view of the decision-maker at the time when each project is approved, such lags were not considered.

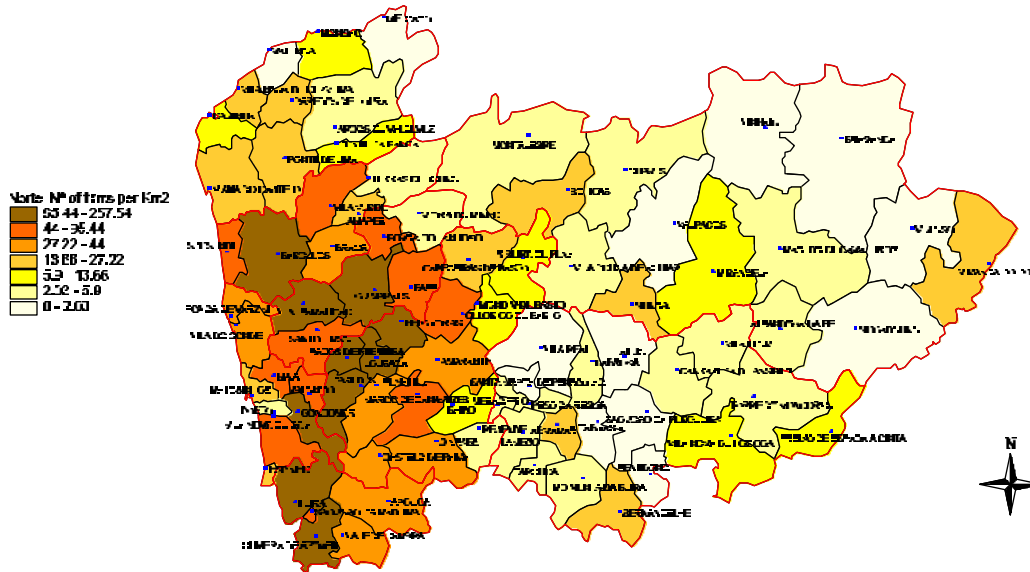
At this point, it is also relevant to analyse the weight of industrial firms in the total population of firms in each region. This analysis will take into account only the *norte* region, and will be done at the next level of spatial desegregation, *concelhos*.

Map 2



Map 2 shows the distributions of *all* firms in the *concelhos* of the north of Portugal (again, weighted by the area). *Grande Porto*, as the largest urban centre in the *norte*, has a much higher score than the rest, since it is where most of the services are located. If we now focus our attention at Map 3, the picture is quite different. Here the proportion of industrial firms in each *concelho* is shown. As we can see, the score of *Grande Porto* is quite low, compared with the neighbouring regions. The coastal area is obviously the most industrialised. Also, it is interesting to note the existence of some industrial nodes in the interior (e.g. *Murça* and *Armamar*). As mentioned in a previous section, this analysis shows how heterogeneous the country is in terms of distribution of economic activity.

Map 3



4. Implementation of OP 3.1 and OP 5

Some considerations should be made about the dataset used, before proceeding. The original dataset, supplied by the Pedip Office, included all the projects approved within the scope of the programme. From one of the fields, *concelho*, it was possible to determine to which NUT3 region each targeted firm belonged to. Some projects were deleted from the list, since the field *concelho* was empty; this does not represent a problem because first, the number of projects was not very significant (449 out of a total of 7326; second, most of the entities involved were public institutions; third, the regional distributions of these 449 projects (in terms of districts) was similar to that of Pedip as a whole.

The first step was to determine whether general relations existed, at the NUT3 level, between the total number of industrial firms (weighted by the size of each region) and the total number OP 3.1 and OP 5 projects. All regions were given a ranking score according to several variables and Spearman's Rank Correlation Coefficients were calculated to evaluate the relation between several pairs of variables. The Spearman Coefficients were calculated using the following formula:

$$r = 1 - \frac{6 \sum (x_n - y_n)^2}{N(N^2 - 1)}$$

Where:

N is the total number of regions.

x and y are the variables rankings.

Table 1 shows the Spearman coefficients obtained for the following relations

Table1

<i>relationships</i>	$r_{spearman}$
<ent> * <op3.1+op5>	0.66
<ent> * <op3.1 >	0.69
<ent> * < op5>	0.56

Several interesting results are obtained. First, the relationship between the number of firms, *ent*, and the total number of projects per NUT3 regions, *op3.1+op5*, is strong, as it would be expected (the spatial distribution of projects and the location of industrial firms are naturally correlated). More importantly are the next two coefficients: the first, which shows the relation between OP3.1 projects and total number of industrial firms, indicate that a stronger correlation exists than with the previous relationship; we can then conclude that the spatial distribution of the more traditional financial instruments, with less coordination between policy objectives, is more coherent with the spatial distribution of firms, and then more regionally unbiased. The third coefficient shows exactly the opposite in relation to the distribution of OP5 projects. We can then conclude that in respect with measures with a more innovative content, and which have a greater potential in benefiting local economies, Pedip's spatial distribution was more incoherent in respect to the real distribution of industrial entities.

The next step is to try to explain the variation between the OP3.1 and OP5 distribution in relation with the total number of industrial firms. A new variable will be created, which will basically represent what the spatial distribution of projects should be, according with the total number of industrial firms. This variable, named *what should*

be variables (wsb) are calculated by comparing the regional proportions in relation to the variable *ent*, and apply those same proportions in respect to the total number of projects approved per region.

The main formula for calculating the *WSBs* is:

$$wsb = \frac{\left(\frac{ent}{\sum ent} \times 100 \right) \times \sum OPtotal}{100}$$

Which can be simplified to give:

$$wsb = \frac{ent}{\sum ent} \times \sum OPtotal$$

Table 2 shows the total and percentage for *ent*, followed by the *WSBs* for OP3.1 and OP5, compared with each of the Operational programmes total. As an example, for *Minho Lima* (codnut 10101), the total number of approved projects (weighted by area) according to the proportion of industrial firms present in the region should have been 52 (2% of 2668,4), while the actual figure was 6,8. The basic rule for analysing the *WSB* scores is that those regions with a *WSB* smaller than the actual number of approved projects were favoured by that particular Operational Programme; the opposite conclusion applies to those regions where the *WSB* score is smaller than the actual number of approved projects.

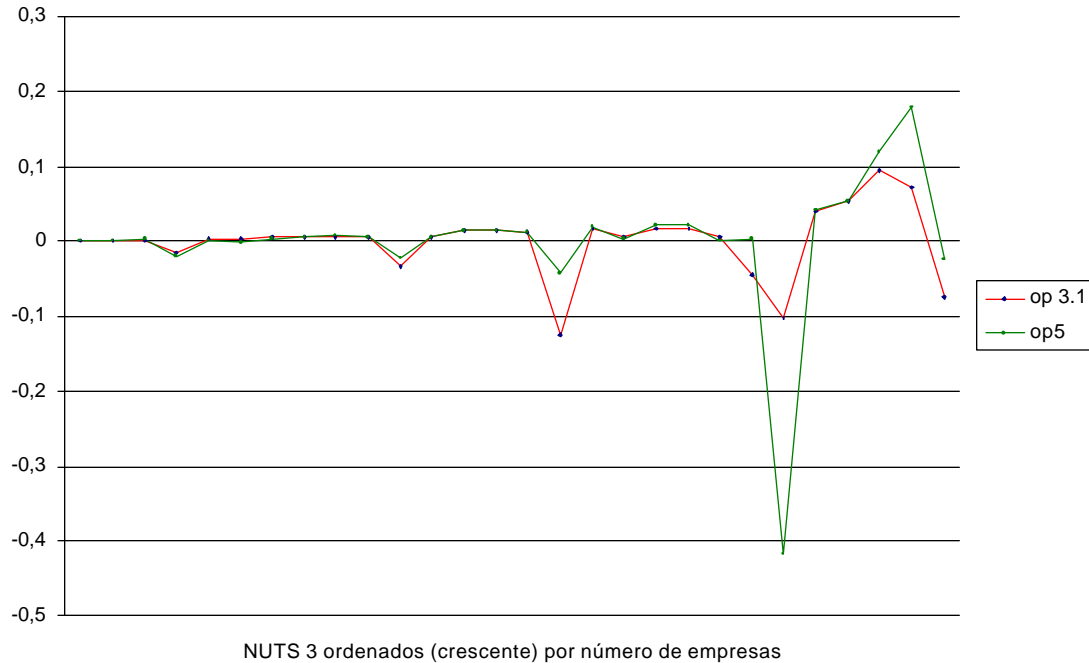
Table 2⁵

codnut	ent		OP 3.1		OP 5	
	n° of firms	%	n° of projects approved	wsb	n° of projects approved	wsb
10101	30	2,0	6,8	52,0	0,5	7,9
10102	23	1,5	1,5	39,9	0,1	6,1
10103	208	13,5	111,1	360,9	6,4	54,7
10104	328	21,3	376,5	569,1	13,7	86,3
10105	357	23,2	819,7	619,4	104,0	93,9
10106	80	5,2	30,8	138,8	4,6	21,0
10107	6	0,4	1,7	10,4	1,0	1,6
10108	28	1,8	385,3	48,6	24,4	7,4
10201	53	3,4	211,4	92,0	12,7	13,9
10202	17	1,1	13,5	29,5	2,3	4,5
10203	23	1,5	1,2	39,9	0,0	6,1
10204	37	2,4	20,7	64,2	1,1	9,7
10205	5	0,3	49,0	8,7	9,2	1,3
10206	23	1,5	9,6	39,9	1,5	6,1
10207	8	0,5	5,8	13,9	2,9	2,1
10208	13	0,8	109,7	22,6	12,1	3,4
10209	10	0,7	1,0	17,3	0,0	2,6
10210	8	0,5	1,1	13,9	0,5	2,1
10301	38	2,5	24,4	65,9	1,6	10,0
10302	85	5,5	6,6	147,5	1,2	22,4
10303	38	2,5	52,5	65,9	10,0	10,0
10304	59	3,8	375,4	102,4	184,8	15,5
10305	33	2,1	44,1	57,3	7,9	8,7
10401	3	0,2	1,9	5,2	0,7	0,8
10402	4	0,3	2,5	6,9	0,1	1,1
10403	10	0,7	1,3	17,3	0,6	2,6
10404	2	0,1	0,5	3,5	0,2	0,5
10501	9	0,6	3,0	15,6	0,4	2,4
Total	1538	100	2668,4	2668,4	404,6	404,6

In order to pinpoint the precise relation between WSBs and actual scores, it is best to represent graphically the results. For this, the total number of firms per region, together with the number of projects approved for each of the two OPs were indexed in relation to each of the columns' total (*ient* for the former, *iOP3.1* and *iOP5* for the latter); both *iOP3.1* and *iOP5* were subtracted from *ient* and the results represented graphically.

⁵ See Appendix A for the list of all the NUTS 3 regions and the corresponding *codnut*

Figure1



From figure 1 it is possible to conclude first that a large number of regions have positive but low values, which show that for most NUT3 areas the number of projects approved was smaller than what should have been, according to the distribution of industrial firms spatially. On the other hand, a number of areas register high negative scores, showing that these were highly benefited from OP 3.1 and 5. Also, as the number of firms increase, so does the difference to the WSB scores. Towards the right hand of the graphic is where the most extreme values occur, showing a cluster of regions with higher values, which mean that these group of regions were far from well represented in OP 3.1 and OP 5. Finally, it is possible to see that differences from 0 are generally greater for OP 5 than for OP 3. Further considerations will be made when analysing the graphical representation of each OP separately.

Figure 2: OP 3.1

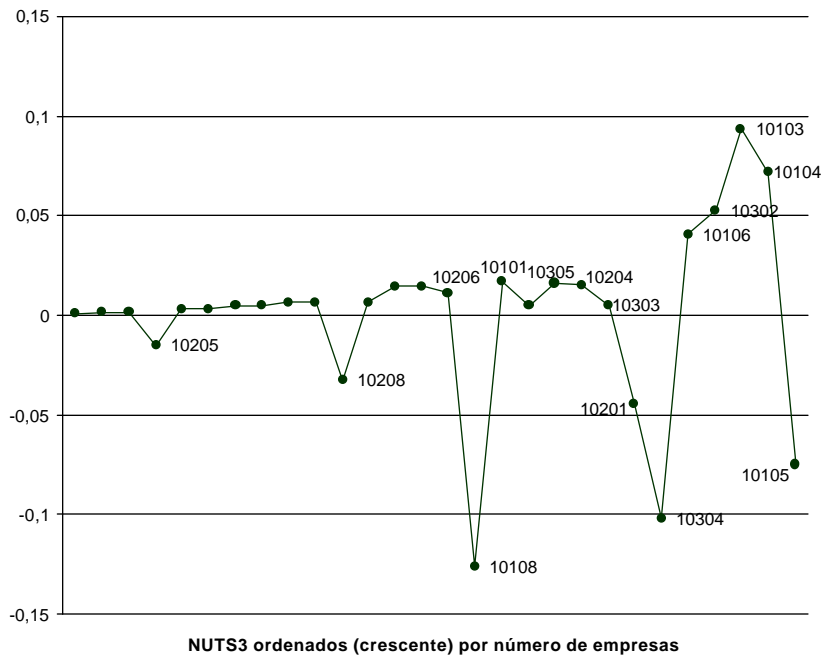
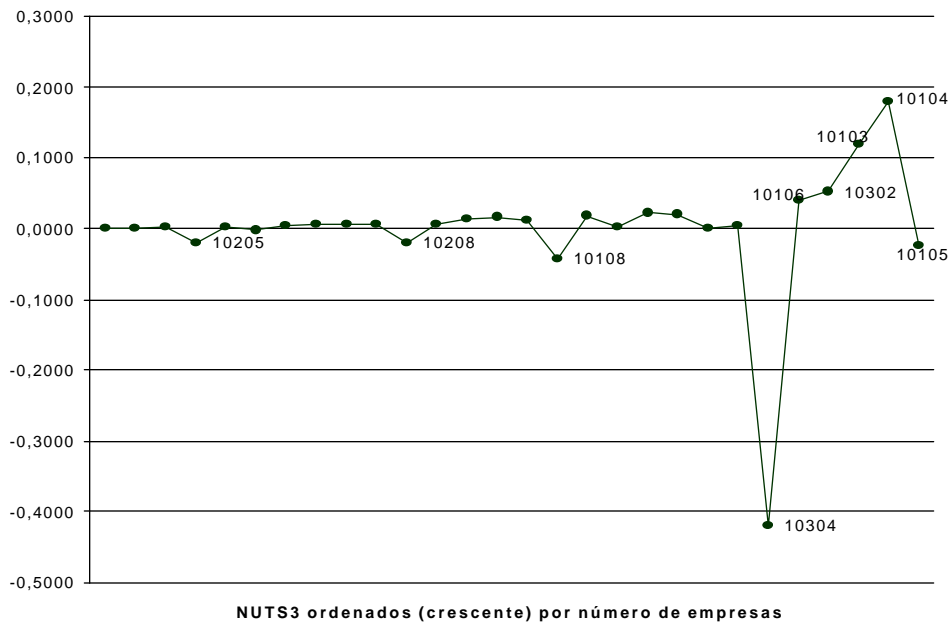


Figure 2 and 3 represent the difference between WSB scores and actual values for OP 3.1 and OP 5 respectively.

Figure 3: OP 5



From here it is possible to see that in relation to OP 3.1, *Pinhal Litoral* (10208), *Entre Douro e Vouga* (10108), *Grande Lisboa* (10304) and *Grande Porto* (10105) were the

most favoured regions, while *Tamega* (10106), *Lezíria do Tejo* (10302), *Cavado* (10103) and *Ave* (10104) are the most under-represented regions.

In relation to OP 5, one region stands out as being extremely over-represented in relation to the proportion of industrial firms; that is *Grande Lisboa* (10304). The group which is mostly worse-off is the same as in OP3.1; it is also important to note that *Grande Porto* (10105) is not as over-represented as it could be expected.

The two figures above, when seen together, should be analysed with care, due to different scale represented. In order to get a clear idea of the difference between both OP's total in relation to the distribution of industrial firms in space, an index of variation (from the WSB scores) can be constructed, simply by using the following formula:

$$iv = \sum |iWSB - iOP|$$

Thus, the index of variation for OP 3.1 is 0.79 while for OP 5 is 1.06. This shows again that SINPEDIP respected more the spatial distribution of industrial activity, when compared with OP 5. So, the general conclusion from this simple, but effective analysis is that generally, in relation to more innovative measures, Pedip favoured a small group of regions in detriment of the rest.

Although it is not the objective of the present exercise to find reasons for the variations found above, it is important nonetheless to show the results found when comparing the values for OP5 with a small number of variables which could help to shed some light in the matter. One first hypothesis was to calculate the Public Leverage ratios (PLr)⁶ for all regions. Again, using the Spearman correlation coefficients, no important relation was found. The same cannot be said however in relation to the total value added for each region. When comparing the regional ranking according to VAB with the OP 5 rankings

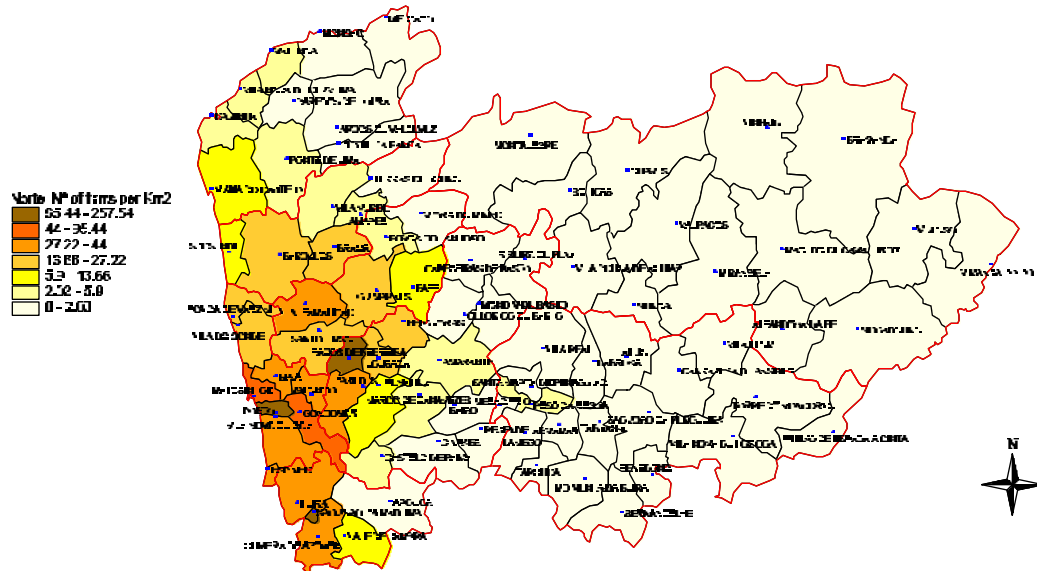
⁶ Public Leverage ratios simply show how much public funds must be given to induce a certain value of private investment, and are calculated by dividing Public incentives by private investment for each project, sum and average for each region.

a coefficient of 0.71 was determined, which show a clear relation between these two figures.

5. OP 3.1 and OP 5 in the Norte

At the more desagregated level, some of the trends identified above should become more clear. First of all, map 4 shows the overall picture of the Northern area or Portugal, according to the distribution of industrial firms (again, weighted by the area in km²).

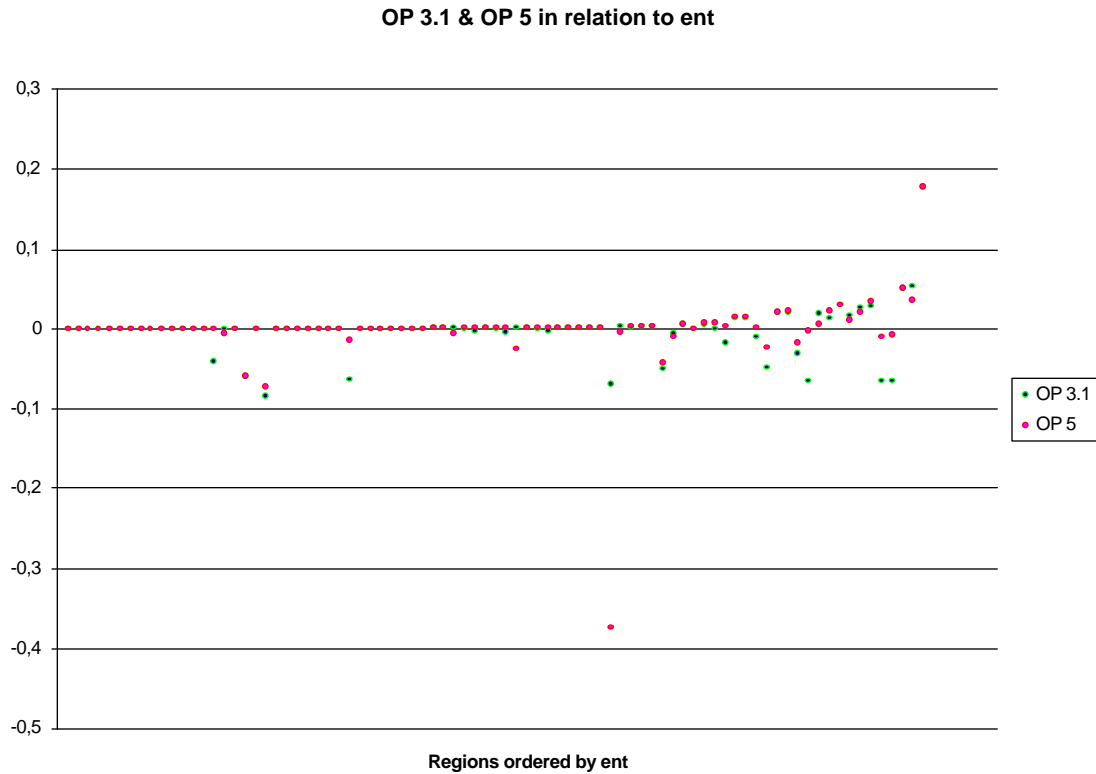
Map 4



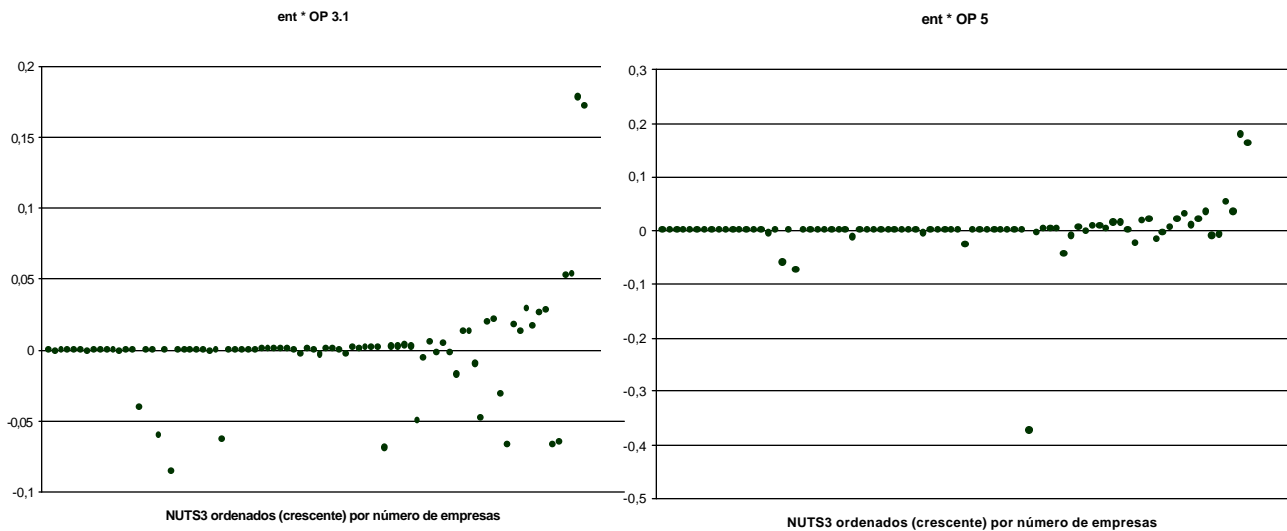
Naturally, there are strong similarities between the distribution of industrial firms and the distribution of all firms shown in map 2, although a careful analysis of the two maps show a more evenly distribution of industrial activity.

In the case of the region *Norte*, it is not possible to compare, using Spearman coefficients, the spatial distribution of the approved projects under OP 3.1 and OP 5 with the distribution of industrial firms, because a significant number of the scores is the same, which invalidates any possible ranking. However, it was possible to calculate, also following the same methodology used above, the *what should be variables* (WSB), and represent graphically the differences between the indexed WSBs for each OP and the actual number of projects (also indexed). Figure 4 shows both the values for OP 3.1 and OP 5 in order to find common patterns.

Figure 4



It is possible to see that, as with the NUTS3 analysis, as we move along the x axis, differences from the wsb scores begin to increase. Also, the number of firms which were favoured by OP 3.1 was greater than those under OP5 (more negative values). On the other hand, the most extreme values were registered in OP5. Again, this results are coherent with the previous analysis, showing that projects approved under OP 5 favoured a smaller number of regions. The following two graphics give a greater weight to the conclusions reached above. Clearly in relation to OP 3.1 the spatial distribution of approved projects show more discrepancies than in relation to OP 5 where it is possible to observe that roughly the regions which are highly industrialised loose out in terms of the number of approved projects. The two extreme values are *Póvoa de Varzim* and *São João da Madeira*. On the other hand, *Porto* was extremely favoured by Operational Programme 5. Still, the most important point to bear in mind is that, while in relation to OP 3.1 there is a considerable number of both positive and negative scores, in relation to OP 5, there is a significant number of high positive values, but only one highly negative; this is precisely the region which was more favoured under Operation Programme 5.



6. Exploring possible relationships

Following the same line of thought introduced in section 4, this section will explore some possible explanations of the spatial distribution of Pedip. With this end in mind, an econometric model was constructed using as the dependent variable the number of approved projects from both OP 3.1 and OP 5; the data used corresponded to the 84 *concelhos* of the *Norte*. Three independent variables were included in the model⁷: <ent1990> (number of firms in 1990 per council); <asf90> (average size of industrial firm in 1990 per council); <topo_vab> (value-added variable)⁸.

The functional relationship tested was the following:

$$op31/5 = f(ent1990, asf90, topo_vab)$$

Where a linear relationship between the dependent and independent variables is assumed to exist.

Below we can see the results of the first model; the first obvious conclusion is that, although the general fit is acceptable, one of the variables, asf90 is not significant and should therefore be excluded from the model. The results of this incorrect equation are

⁷ In the choice of independent variables, a preliminary analysis with simple correlation coefficients was performed, which excluded two variables which the author thought could help explain the spatial distribution of Pedip. These two variables were <risi>, an index of specialisation and the PL ratios for each council.

⁸ See appendix 2 for a detailed description of the value-added variable.

however important since the exclusion of the average size of the firm raises some theoretical considerations. The possibility that particular attention in the policy orientation of Pedip was given to an incubator strategy can be refuted⁹.

```
Number of obs =      84
F( 3,      80) =   69.30
Prob > F      =   0.0000
R-squared     =   0.7221
Adj R-squared =   0.7117
```

op315	Coef.	Std. Err.	t	P> t
ent1990	2.939193	.744372	3.949	0.000
topo_vab	34.2844	4.007155	8.556	0.000
asf90	.1719219	.3132492	0.549	0.585
_cons	-17.09018	6.141521	-2.783	0.007

A second model was then tested, where asf90 was excluded. The results, presented below show an improvement in the overall fit of the model. These results completely support the thesis presented in the present paper. Both the spatial distribution of the firms (ent90) and the value added data are relevant, but the coefficient of the latter is considerably higher than that of the former. This high positive coefficient of the topo_vab variable show that the nature of the industrial mix of each *concelho*, in terms of value added was a factor of great importance in distributing Pedip incentives. Also, value added data helps to explain the variation as shown by the wsb variables.

```
Number of obs =      84
F( 2,      81) =  104.70
Prob > F      =   0.0000
R-squared     =   0.7211
Adj R-squared =   0.7142
```

op315	Coef.	Std. Err.	t	P> t
ent1990	3.090579	.6883917	4.490	0.000
topo_vab	35.20577	3.622813	9.718	0.000
_cons	-15.17203	5.02828	-3.017	0.003

⁹ This takes the simpler version of the incubator hypothesis, according to which the inclusion public intervention should be directed to small and medium size enterprises (SMEs), preferably from dynamic industrial sectors. This public incentives would spillover into further rounds of localised private investment.

As it is mentioned in Appendix II, the topo_vab variable includes the absolute values from 1990 and the variation between 1990 and 1994. In the next model the variable was decomposed into its two components to see whether a greater emphasis was given to the more dynamic sectors (those where the rate of change of the VA in the period analysed was greater). The results are somewhat surprising; the rate of change in the value added data is not significant in itself. The absolute values of VA (vab90) are significant, although the value of the coefficient decrease's greatly. This shows that in fact the formula used for constructing topo_vab was the adequate. Also, this demonstrates that, although the rate of change in VA (vab9094) in itself does not explain the variation in the spatial distribution of OP 3.1 and OP 5, the most correct specification of the value added variable should still include this factor¹⁰.

```
Number of obs =      84
F( 3,      80) =    74.74
Prob > F      =    0.0000
R-squared     =    0.7370
Adj R-squared =    0.7272
```

op315	Coef.	Std. Err.	t	P> t
ent1990	2.803451	.6851975	4.091	0.000
vab90	17.53225	1.769177	9.910	0.000
vab9094	-4.21828	10.05206	-0.420	0.676
_cons	7.538322	11.40699	0.661	0.511

7. Conclusions

The main objective of the present paper was to highlight the centralised nature of decision making in respect to the most important financial instrument available to help restructuring industry in Portugal. It is the contention of the author that Pedip is a clear example of poor coordination between different governmental bodies, each with a different set of policy guidelines and objectives; in this case. Within this theoretical framework, Pedip shows the incoherence between first, the goal of providing the necessary means for the development of national industry, second the long-term objective to achieve regional equality.

¹⁰ A analysis of the graphical distribution of each variable show that the little significance of the vab9094 can be explained the particular form of this variable (polynomium of the third degree).

At the time when the paper was concluded, research on this particular aspect of Pedip 1 was still on an early stage. It is expected by the author that more revealing results will be made available in the near future.

Appendix 1

<i>codnut</i>	<i>nut3</i>
10101	MINHO LIMA
10102	ALTO TRAS OS MONTES
10103	CAVADO
10104	AVE
10105	GRANDE PORTO
10106	TAMEGA
10107	DOURO
10108	ENTRE DOURO E VOUGA
10201	BAIXO VOUGA
10202	DAO LAFOES
10203	BEIRA INTERIOR NORTE
10204	SERRA DA ESTRELA
10205	BAIXO MONDEGO
10206	PINHAL INTERIOR NORTE
10207	COVA DA BEIRA
10208	PINHAL LITORAL
10209	PINHAL INTERIOR SUL
10210	BEIRA INTERIOR SUL
10301	MEDIO TEJO
10302	LEZIRIA DO TEJO
10303	OESTE
10304	GRANDE LISBOA
10305	PENINSULA DE SETUBAL
10401	ALTO ALENTEJO
10402	ALENTEJO CENTRAL
10403	ALENTEJO LITORAL
10404	BAIXO ALENTEJO
10501	ALGARVE

Appendix 2

The starting point for building the manufacturing value-added variable at the NUTS4 level (*concelho*) were the figures provided in the publication *Contas Nacionais*, produced by the Portuguese Statistical Institute (INE). The last year available is 1994 (which suits the present analysis), while the starting year is 1990 (methodological changes make it impossible to include previous years in the analysis).

More specifically, the values used contained the total value added data for each industrial sector, aggregated at the national level. The first step was to divide each of these figures by the total number of firms in each *concelho* for each of the years being considered; this was done in order to get the average value added per firm in each of the industrial sectors.

After having the individual value-added for each industrial sector for each year, each of these figures was multiplied by the number of firms from each *concelho* in each of the corresponding year and sector. The result is a matrix with the VA figure for each sector in each of the 84 regions considered for the period 1990-94.

In order to consider together the absolute VA figures and the yearly variation, two subsets of the data were used; the first which was simply a vector containing the absolute values for 1990; the second represented the rate of change between the base year 1990 and 1994. Next, each element was divided by the average of the correspondent vector, giving the variation from the mean. This was done in order to reduce both subsets to a comparable scale. Finally, each of the sectors' pairs was summed up and divided by two. The resulting vector was used in the present model under the name "topo_vab".

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