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METHODS OF REGIONAL IMPACT ASSESSMENT:

A New Approach to the Evaluation of the Performance of the European Regional Development Fund

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1 European Regional Policy: Introduction

The completion of the internal market in Europe serves to improve the competitive position of European countries on internal markets. At the same time it is increasingly recognized that socio-economic discrepancies between EC nations - and in particular between regions in the EC - do not show any sign of convergence. If it is true that Europe becomes the 'home of regions' rather than the 'home of nations', then the regional problem deserves to be treated with priority (Nijkamp, 1990). This also explains the renewed policy interest for regional development from a European perspective, reflected inter alia in drastic increases of EC budgets for regional development policy in all member states. However, the financial expenditures for achieving equity objectives are looked at with much scrutiny by the European Commission.

It is conceivable that recently the need for a critical judgement of all public expenditures by national and supranational governments has arisen. One of the prominent areas with a significant financial support from governmental bodies (regional, national and European) is infrastructure, with particular emphasis on enhancing regional development. When critically reviewing regional policy, one needs to make an assessment of the effects generated solely by a particular regional policy. Clearly, by using public investments in infrastructure as a policy instrument for regional development, we are automatically talking about an active strategy: a strategy where infrastructure is generating private investments (Rietveld, 1989).

The ERDF (European Regional Development Fund) is the major source of EC initiatives for regional restructuring. It commits the main part of its available funds to infrastructure projects (see Table 1). This table shows that, for both the amounts committed and the number of programmes, projects and studies undertaken, more than 75 % falls under the heading of infrastructure. Given the high amounts of money involved, the European Commission has expressed the need for a critical evaluation of the past performance of regional development policy by the EC.

In this paper we will outline a new method which has been developed to assess ex post the impact of ERDF Commitments over a longer period (i.e., the past fifteen years). This approach may also function as a basic framework and an operational tool for monitoring and assessing the meso-economic effects of the ERDF in the future.

2. Impact Assessment Methods: A Concise Overview

Impact assessment methods deal with the estimation of expected consequences of development. Such methods may focus on all impacts which are relevant for (groups in) a region, or on goals to be achieved by implementing a specific policy (e.g., by means of cost-effectiveness analysis). Whether impacts are to be judged from a particular policy angle or from a broader regional perspective, it is clear that in all cases a reliable estimation of expected policy consequences has to be given. This holds for both ex ante and ex post impact assessment; ex ante impacts refer then to foreseeable relevant consequences for regions prior to the implementation of a given policy (or development), whereas ex post impacts refer to realized consequences after implementation.

In the practice of regional policy evaluation a wide variety of impact assessment techniques has been developed, which might broadly be subdivided into ad hoc impact assessment methods and structured impacts assessment methods (Folmer, 1985). Both classes will concisely be discussed here, with a particular view on their relevance for regional and infrastructure planning.

2.1 Ad hoc impact assessment

Ad hoc impact analyses refer to a measurement problem for which no possibility exists to develop a formal operational model, due to time constraints, non-repetitive situations, or lack of data (for example, the impact of a new football stadion on the regional economy). Two approaches may then be adopted:

(a) An informal analysis by using expert views (e.g., Delphi techniques) or by taking a global expert look at some available data (for instance, the effects of sports facilities in other regions).

(b) A comparative analysis based on cross-regional or cross-national experiences with more or less similar regional policy problems and policy measures (for instance, the regional effects of the implementation of new sports policies in different countries).

Despite low costs and easy use of ad hoc impact analyses, they usually do not offer the same rate of precision, controllability and transferability as structured impact analyses do. In practice however, such ad hoc methods may be helpful, as they are able to generate within a limited as taxpayers, residents, tourists and visitors etc. In various cases this is a meaningful way of gathering necessary insights into the impacts of a conservation policy.

2.2.2 Macro studies

The class of macro approaches is not entirely separated from micro analyses, as macro studies are often based on aggregated results of surveys held by bureaus of statistics. These aggregate surveys however, do usually not explicitly refer to policy issues and related impacts and therefore do not involve the risk of biased information like in the case of the micro studies mentioned above. Moreover, macro studies are sometimes less costly and less time consuming than micro approaches.

Macro studies can be subdivided into studies without an explicit formal model and those incorporating a mathematical model. Examples of the first class are:

(a) a qualitative impact systems model (as developed e.g. by Nijkamp and Van Pelt (1990) for strategic development of a city in India)

(b) with/without impact methods, refined in the form of shift - share methods for the regional growth (see e.g. Moore and Rhodes, 1973).

(c) contingency table analysis and log-linear analysis (as developed e.g. by Brouwer, 1988, for recreational behaviour).

Thus there are various non-formal modelling approaches which might be helpful - in particular as complementary methods - in regional policy analysis.

Examples of the second class (impact approaches <u>with</u> a formal model) are:

(a) single equation models (mainly appropriate for a partial impact assessment, but easier to pursue)

(b) multi-equation models (in particular suitable for getting a coherent picture of all relevant interwoven impacts, but more difficult to estimate in a statistically proper way).

In general, the use of a formal model would be preferable in a regional impact analysis, but data requirements are often prohibitive. Nevertheless, in various cases a simple input-output model may be helpful in identifying all direct and indirect economic impacts (via an impact chain) of regional policies. As a compromise, the use of simulation models has gained a great deal of popularity in recent years. Such models may be used in a structured causal impact chain, eventhough some (or all) coefficients may not

As we can see, the above frequency table includes four quadrants when we consider two different variables. The meaning of these quadrants is as follows:

- quadrant I shows the number of regions which have for both variables A and B values above the regional average in a given year
- quadrant II shows the number of regions which have for variable A values above the regional average and for variable B values below the regional average in a given year
- quadrant III shows the number of regions which have for variable A values below the regional average and for variable B values above the regional average in a given year
- quadrant IV shows the number of regions which have for both variables A and B values below the regional average in a given year.

These tables can now be used to explore the hypothesis that there exists a positive correlation between the variables A and B. The direction of causality can however, not directly be derived from these tables. Notice also that no conclusions can be drawn concerning the strength of the correlation between these variables.

The variable that is supposed to be the dependent variable is represented in the vertical column (i.e., the variable A). We are now most interested in the figures in the quadrants I and IV. When the sum of the number of regions in these two quadrants is above fifty per cent of the total number of regions, there is clearly a positive correlation between the two variables. This conclusion is of course more strongly valid if the number of regions in quadrant I and IV is significantly higher compared to the figures in quadrants II and III.

This impact method is easy to handle and presents a directly interpretable picture of a possible influence of one or more explanatory (or control) variables on a (dependent) regional welfare variable. Clearly, such a hypothesis can be tested more rigorously by means of chi-square statistics or in more extensive case by means of contingency table analysis (e.g., by using log-linear models). The data base in the context of our study on European regions does not allow however, such statistically more appropriate tests. In any case, in order to attach sufficient validity to the results of a frequency analysis, it is in general required to have at least a total number of 10 to 15 regions, dependent on the availability of data at a specific regional level (for example, Eurostat sta-

Commitments amount on average to approx. 2 % of the total public investments). In Section 4 we will discuss the results of this method for empirical studies for Italy and the Netherlands. First however, we will present - as a second step - a simple explanatory model which has been developed to further explain the relationship between private investments and ERDF Commitments.

3.2 A simple explanatory model

In this section we will present a simple explanatory model for assessing ex post the impact of the ERDF expenditures. The basic idea is that ERDF Commitments together with public expenditures will attract new entrepreneurial activities wich will first manifest themselves as new private investments. Such new investments might next lead to additional employment. Furthermore, for the explanation of entrepreneurial behaviour a simple hypothesis based on rational expectations is used, which means that (realized or foreseen) increases in value added will also lead to a rise in private investments.

For the assessment of the impacts of the ERDF Commitments on a region's economic development, we use therefore the following causal model as a starting point:

$$I_{pr} = \alpha_0 + \alpha_1 . I_{cr} + \alpha_2 . I_{(o-c)r} + \alpha_3 . \Delta GVA_r \qquad (1)$$

where for region r:

ΔGVA_r = change in gross value added in region r
I_{cr} = ERDF Commitments for region r
$I_{(o-c)r}$ = public investments -/- ERDF Commitments in region r
I_{pr} = private investments in region r
α_0 = intercept
α_i = reaction coefficient (i = 1, 2, 3)

This single equation is derived as a reduced form from a more comprehensive model. The conceptual framework of this model is outlined in Figure 1. In this model the change in the economic performance of a region is measured as the change in per capita gross value added of the region, which has an immediate impact on the private sector. The various relationships speak for themselves. The validity of this equation and of the underlying equations of the model was tested by applying a regression analysis on a data set for the relevant variables and equations. It turned out that the above mentioned equation (1) emerged as the one with the strongest statistical validity. Therefore, it was decided to examine this equation more intensively by developing

Commitments.

The third equation:

$$I_{pr} = \delta_0 + \delta_1.I_{cr} + \delta_2.I_{(o-c)r} + \delta_3.\Delta GVA_r^{(-\sigma)} \qquad (4)$$

is based on a passive response model, i.e. the private investments undertaken by the entrepeneurs depend among others on the economic situation in the past few years. This is represented by the change in gross value added with a negative time lag σ.

Besides these three investment equations a further analysis of regional employment impacts has also been made by investigating the labour-investment ratio:

$$L_r = \mu_0 + \mu_1.I_{pr}^{(-\sigma)} \qquad (5)$$

in order to explore indirectly a possible relationship between the ERDF subsidies and total employment in a region. Clearly, one should carefully interpret the results of this equation because of the intransparant nature of forces active on regional labour markets.

The explanatory model is rather flexible in that it can be based on moving averages of the specific data and/or can be used with different time lags. Again this is dependent on the availability of long time series of data. This model can be applied both for regions which have and which have not (yet) received any ERDF support and allows a cross-regional comparison of impacts of the explanatory variables.

In Section 4 the empirical results for both the frequency tables and the regression analyses applied to the above mentioned four equations will be presented and discussed.

4 Empirical Results

The most plausible data source to use for the PARADISE-Model is Eurostat (the Statistical Office of the European Communities) because of the consistency in definition of all variables needed for our method for all regions in the European Community. In our empirical analysis data sets from two countries were used, viz. Italy and The Netherlands. The Italian data set served - due to a lower reliability - mainly as an experiment, while the Dutch data set may be regarded as a full test.

Year		Ic> *Ic	Ic< *Ic	ΔGVA> *ΔGVA	ΔGVA< *ΔGVA
1975	Ip>*Ip	2	5	2	5
	Ip<*Ip	6	7	0	13
1976	Ip>*Ip	2	7	7	2
	Ip<*Ip	4	7	3	8
1977	Ip>*Ip	2	6	5	3
	Ip<*Ip	7	5	4	8
1978	Ip>*Ip	1	8	6	3
	Ip<*Ip	7	4	3	8
1979	Ip>*Ip	1	8	9	0
	Ip<*Ip	8	3	1	10
1980	Ip>*Ip	1	9	10	0
	Ip<*Ip	8	2	2	8
Total	Ip>*Ip	9	43	39	13
	Ip<*Ip	40	28	13	55

Table 3. Frequency tables for twenty Italian regions based on absolute data standardized for population (time lag = 0 ; years 1975,...,1980).

Clearly, in most frequency tables the largest share of regions is present in quadrant IV. This implies that the situation in which both private investments and ERDF expenditures - or the change in gross valued added - are below the regional average occurs in most cases. When we also add the number of regions given in the first and fourth quadrant of the frequency tables, we can easily derive Table 4 from Table 3.

These results support only to some extent the assumed relationship between private investments as dependent variable and ERDF Commitments - and change in gross value added - as explanatory variables.

When we first take a look at the <u>private investments</u> and <u>gross value added</u> (see the right-hand side of Table 3, and the figures in the right-hand column in Table 4), we may conclude that there is in general a positive correlation between these two variables. The number of regions in the fourth quadrant is 45.8 % of the total number of regions for all years. The share of the number of regions in the first quadrant compared to the total number of regions is somewhat less, but - together with the number in the fourth quadrant - on average around 80 % per cent of the total number of regions are contained in quadrant I and IV.

averages. Such an approach might possibly lead to better result. (see also Subsection 4.2).

The regression analyses applied to the three different investment equations and the employment equation (see Subsection 3.2) have been undertaken for five regions in Italy (viz., Abruzzi, Campania, Marche, Puglia and Sardegna) and for Italy as a whole. The regression analyses have been applied to each equation based on a <u>time lag</u> ranging from zero to five years (if the calculations are based on absolute data) and on a time lag ranging from zero to two, (if the calculations are based on moving averages) (all variables at current prices). In Table 5 the results are presented. The maximum range of the time lags (five and two years, respectively) is a result of the data availability over a limited time period.

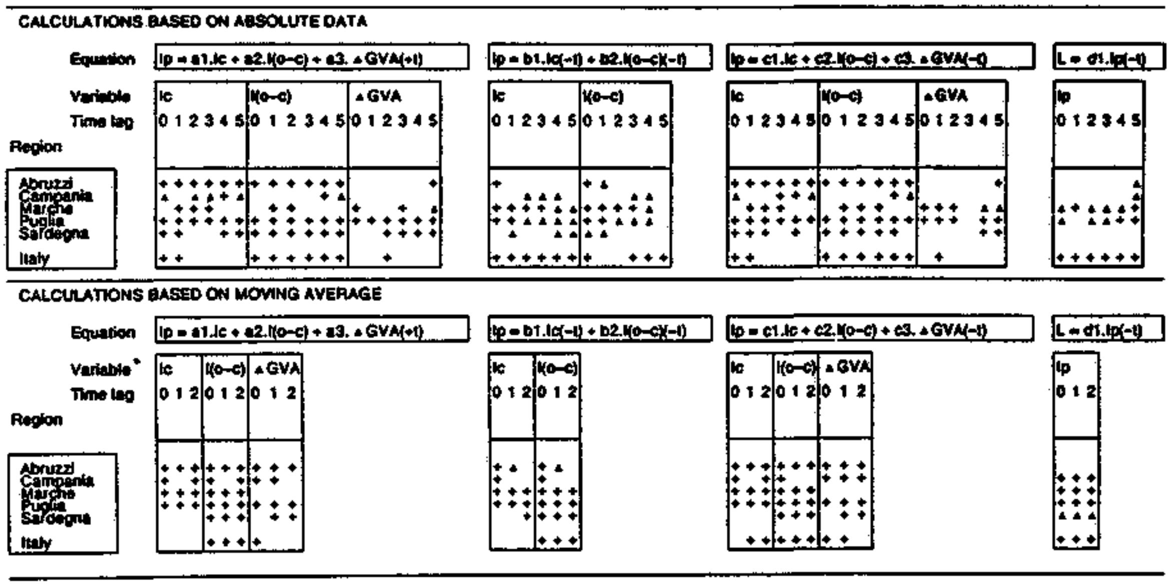

Table 5. Results of regression analyses for Italy; only statistically significant coefficients are indi cated (confidence level > 75 %)

+ = 0.5 < R-squared adjusted < 1

▲ = R-squared adjusted < 0.5

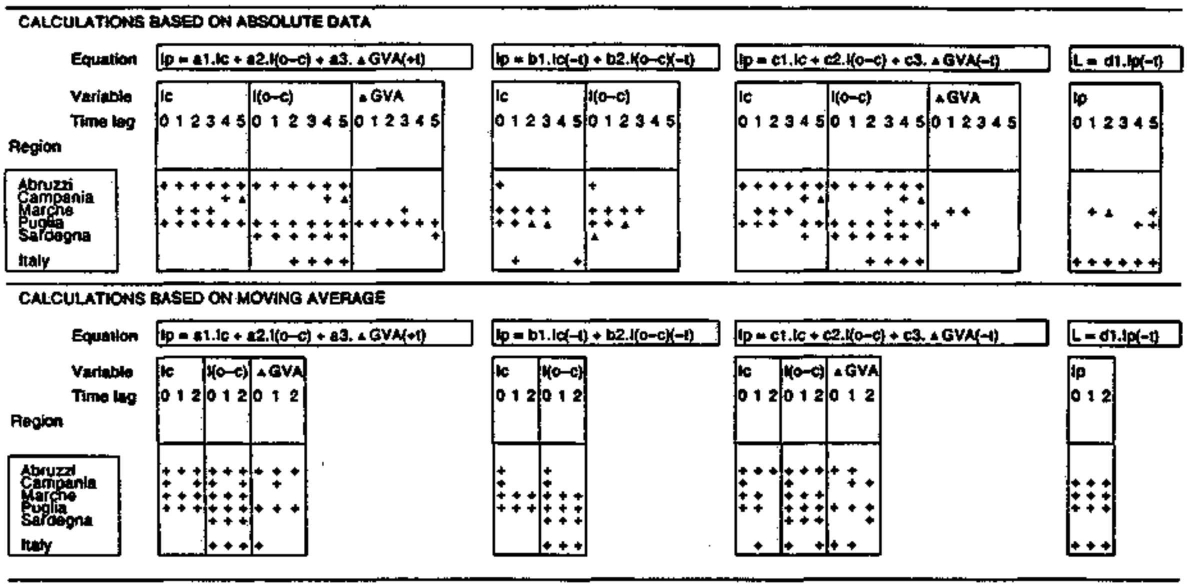

Table 6. Results of regression analyses for Italy; only statistically significant coefficients are indicated (confidence level > 95 %)

+ = 0.5 < R-squared adjusted < 1

▲ = R-squared adjusted < 0.5

The conclusions drawn from the results presented in Table 5 appear to be also valid for the results presented in Table 6. Of course, in the letter case the number of statistically significant relationships is lower because of a higher confidence level.

4.2 The Netherlands.

Since the data set for Italy, derived from Eurostat, was incomplete, we decided to apply the same methods to a more complete data set, in order to obtain more reliable and complete results when testing the method. Therefore an additional empirical study was undertaken for the Netherlands. We used also information from the statistical bureau of The Netherlands that made it possible to build an almost complete data set for all variables. Only for the last three years some estimates had to be made.

value added in 1976. In 1981 the private investments are compared to the relevant variables in 1977 etc. It appears that regions with below average ERDF Commitments are predominantly regions with below average private investments in The Netherlands.

The results are to some extent different compared to the Italian empirical study. Taking a look at the <u>private investments</u> (supposed to be the dependent variable) and the public investments and change in gross value added, respectively, as explanatory variables (the central column and the right-hand column of Table 76), it appears that there is also in this case a strong positive correlation between the two pairs of variables. In each year around 60 % of the total number of regions are contained in quadrant I and IV.

Table 8 summarizes the results of Table 7. Concerning the left hand column (Ip compared with Ic), the total number of regions in the first and the fourth quadrant is quite large in the years 1980 to 1984, but is somewhat decreasing in the subsequent three years, although in the last years presented the percentage of regions does not fall below 45 %. The relation between ERDF Commitments and the private investments is performing much better compared to the Italian case. In the Italian case it seemed that the ERDF Commitments were not sufficient to induce private investments to such an extent that these reached an above average value. However, for a precise analysis of the influence of ERDF Commitments on private investments one should make use of statistical techniques described in the latter part of this section.

Year	Quadrant I + IV	Quadrant I + IV	Quadrant I + IV
1980	55 %	45 %	55 %
1981	73 %	64 %	82 %
1982	64 %	45 %	55 %
1983	64 %	55 %	64 %
1984	45 %	73 %	64 %
1985	55 %	73 %	64 %
1986	45 %	73 %	73 %
1987	45 %	64 %	27 %
Total	56 %	61 %	58 %

Table 8. Number of regions in Quadrant I + IV as percentage of total number of regions (Table derived from Table 7)

The frequency analysis based on moving averages thus leads to better results compared to the analysis based on absolute data.

After the frequency analysis, the regression methods have been used. Regression analyses have been applied for four regions in The Netherlands (viz., Noord Nederland, Oost Nederland, West Nederland, Zuid Nederland) and for The Netherlands as a whole (all variables at current prices[1]). The results are presented in Table 11. This table can be read in the same way as Table 5 and 6 (the empirical study of Italy). We only present here the results for a confidence level > 95 %. Furthermore, the only difference compared to Tables 5 and 6 is that for some regions in The Netherlands the ERDF Commitments are not considered in the regression analyses because these regions did not receive any or hardly any payments of the ERDF in the past fifteen years (West Nederland and Oost Nederland, respectively).

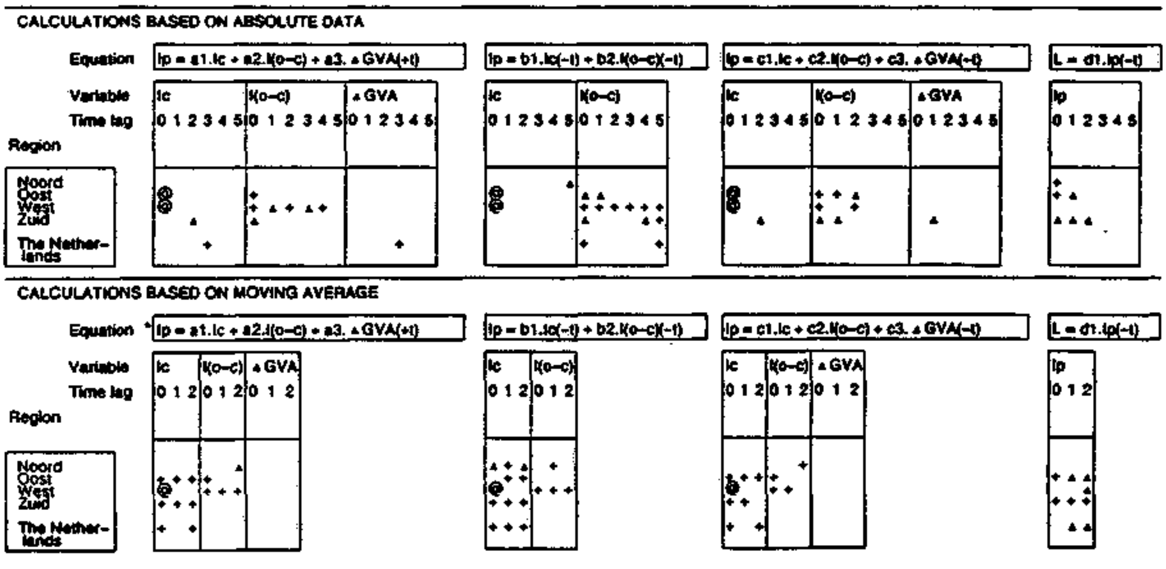

Table 11. Results of regression analyses for The Netherlands (statistically significant coefficients; confidence level > 95 %)
+ = 0.5 < R-squared adjusted < 1
▲ = R-squared adjusted < 0.5
@ = variable Ic is not considered because of absence in specific region

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1 In the Dutch case study we have also undertaken a regression analysis for the simple explanatory model in terms of variables expressed in constant prices. The results were not significantly better compared to the analyses based on variables at current prices. However, this is probably due to the unavailibility of proper index figures for all variables used in the model.

simple explanatory model in combination with regression analysis is really far more powerful, both as a hypothesis testing device and as a mechanism for yielding estimates of the consequences of ERDF expenditures. Both steps of the PARADISE Model proved to be simple and operational when it was tested for Italy and The Netherlands.

A key issue was that the method should be able to assess relevant regional economic effects resulting from the ERDF. Our preliminary conclusion regarding the PARADISE Model (both the frequency table analysis and the simple explanatory model) is that it has the ability to provide a quantitative assessment of effects due to ERDF expenditures. In the empirical studies for Italy and The Netherlands, it was clear that the ERDF expenditures in the past have influenced the private investments in the regions considered. According to the simple explanatory model there is some evidence that the effects differ slightly between the regions supported by the ERDF. By comparing the regions in terms of the number of positive (ERDF Commitments) reaction coefficients (considering the different investment equations and time lags used), it appeared that investments in some regions are more influenced by ERDF Commitments than in other regions. Based on the aggregate ERDF figures used, it is not entirely clear whether these differences between regions are due to the different kinds of projects supported by the ERDF in specific regions or to other omitted factors.

The frequency table analysis revealed changes over time in the correlation between private investments and ERDF Commitments. This is possibly due to the influence of other factors on this correlation which fluctuate over time. For example, when the public investments in certain regions are extremely low in a given time period it is almost impossible that the (relatively small) size of the ERDF Commitments has a sufficiently large critical mass to induce private investments to such an extent that these adopt values above the regional average in the specific regions. This affects the strength of the correlation between ERDF Commitments and private investments.

The influence of the national and the EC-wide economic development on private investments in a given region does not seem to be very evident from the results of our model. In the Dutch case study we have added this factor to the other explanatory variables in the simple model. However, applying a regression analysis to the extended investment equations did not lead to significantly better results. Probably fluctuations in the national and the EC-wide economy are reflected in the Regional Gross Value Added that was already included in the model.

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