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METHODOLOGICAL ASPECTS OF
IMPACT ANALYSIS OF
REGIONAL ECONOMIC POLICY

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Abstract

In this paper some methodological aspects of impact analysis of regional economic policy are discussed. As impact analysis (which focuses on the effects of policy instruments) is part of the comprehensive process of policy evaluation (in which both policy goals and objectives as well as policy instruments are under debate), in the first part of this paper explicit attention is paid to policy evaluation as an introduction to impact analysis.

In the second part of this paper the most common measurement methods are classified into micro and macro studies. The latter class is subdivided into:

- studies without an explicit model;
- single equation models with non-policy variables only;
- single equation models with instruments of policy included;
- simultaneous equation models.

The advantages and weaknesses of each method are described.

It is concluded that the use of the first two macro methods should in general be avoided.

Then an overview of the choice of an appropriate measurement method, given the circumstances under which a specific type of effect of a given kind of instrument has to be measured, is given. The paper concludes with some general remarks on impact assessment.

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1. Introduction

Cuts in public budgets, increased discrepancies among regions and structural changes in many industries have in recent years led to a new interest in regional policy.

Many regional economies are nowadays going through a stage of re-structuring, which -in some cases- may even turn into a depression or a structural recession, but which -in other cases- may open new opportunities for innovative revival. In the latter cases 'creative destruction' (à la Schumpeter) and innovative response may often pave the road toward a stable future, witness the economic success of Silicon Valley, New England or Singapore.

It is however debatable whether regions are self-organizing systems.

Regional economic policy aims at controlling the economic evolution of a state or a region. In many Western countries it primarily consists of the provision of conditions that may act as incubators for new economic initiatives in the region at hand. In this framework the improvement of regional accessibility and of the region's locational profile, the provision of financial aid in various forms and of up-to-date information on new market developments (monitoring via adequate information systems, e.g.; see Nijkamp and Rietveld, 1984), and the effective coordination of private decision-making and public regional development planning (efficient territorial organisation and management, e.g.) are of primary importance.

In this context policy evaluation is of utmost importance in order to rationalise planning and decision strategies implemented by public agencies. Therefore, it is not surprising that in recent years evaluation of regional policy has received increasing attention. Governmental intervention with respect to a wide variety of aspects of the regional system, such as the economic and environmental subsystems, urban development, etc. have extensively been studied (see among others, Glickman 1980 and Pleeter, 1980).

In regional policy evaluation both the policy goals and the instruments are under discussion. When the policy goals are treated as given and attention is only focussed on assessing effects of policy instruments on goal variables we will speak of impact analysis or of measuring effects of policy instruments (see Folmer, 1985 for further details on this subject). It is obvious that impact analysis is an essential part of the more comprehensive process of policy evaluation. Although this paper deals primarily with impact analysis we will in the next section pay attention to policy evaluation in order to provide a frame of reference for impact analysis.

The organization of the remainder of this paper is as follows. In section 3 a conceptual framework for impact analysis is described. In section 4 various classes of regional economic models are reviewed and their advantages and disadvantages for impact analysis are set out. The main purpose of section 5 is to indicate which method (or combination of methods) should be applied to measure the impacts of various kinds of instruments. The paper concludes with a section in which some caveats of impact analysis of regional economic policy are pointed out.

Finally, we want to remark that although this paper deals primarily with regional economic policy, we will also incidentally touch upon regional policy of a non-economic nature. This is inevitable because the economic and non-economic regional subsystems are highly interrelated.

2. Policy Evaluation

As mentioned before, policy evaluation is concerned with both the policy goals and policy objectives on the one hand and the policy instruments on the other.

The debate on policy goals is primarily of an ethical political nature. In most Western economies two main goals of regional economic policy can be distinguished.

First, there is the goal of equity which requires such a spatial distribution of economic activities that the inhabitants of all regions have more or less equal opportunities to reach a desired level of welfare.

Secondly, there is the goal of national efficiency which requires the optimal use of production capacity in order to promote national welfare (see also Richardson, 1979).

From the policy goals the more concrete policy objectives are derived, such as full employment, an efficient spread of the population, environmental quality, etc.

The policy objectives may be achieved by means of a specific set of actions which will be called instruments of regional economic policy.

A major problem in many policy evaluations is caused by the fuzzy nature of effects of instruments and policy objectives. Effects of policy instruments cannot always be measured in an unambiguous manner, as they may be of a quite different nature. The instruments can be subdivided into quantifiable instruments, qualitatively-defined plans and broad legislative measures. Similarly, policy objectives may vary from quantifiable targets (for instance, a four percent increase in employment) to qualitative policy desires (for instance, a rise in social well-being).

One of the consequences of the fuzzy nature of policy measures and policy objectives is that impact analyses are not necessarily based on metric approaches, but may also be qualitative in nature (for instance, in scenario analyses). Due to the frequent lack of a quantitative framework for impact analysis the concept of 'effectiveness' of a policy (i.e. the extent to which a policy measure contributes to the fulfilment of a policy target) is fraught with difficulties.

It is probably partly due to the fuzzy nature of regional economic policy that several serious flaws are inherent in regional economic policy evaluation.

Willbanks and Lee (1984), in a noteworthy paper, point out the following problems: lack of resources (information time, money, audience), insufficient orientation toward the user's needs, dependence on basic research, gaps in knowledge (impacts of exceptional events, e.g.), and lack of integration and learning.

An important benefit of the search for systematic approaches to policy evaluation has been the increasing awareness of the inherent uncertainties, which have often been obscured by mechanically applied standard techniques or by oversimplistic assumptions (for instance, by neglecting inevitable or foreseeable changes in the external environment).

Probability theory or sensitivity analysis can only partly help to take into account future uncertainties.

In this context, robustness theory (analyzing policy flexibility in terms of options left for future decision-making; see Gupta and Rosenhead, 1968) and plausibility theory (dealing with logical decision rules in an uncertain planning environment; see Polya, 1954) may provide new analytical approaches to policy evaluation.

In this connection Janis and Mann (1977), have tried to measure the quality of a policy decision not only by its effectiveness, but (also) by the quality of planning procedures and techniques which were used to arrive at a particular decision. Examples of such pertaining judgement criteria are:

- a complete consideration of all alternative choice options
- a best reliable assessment of consequences of policy actions for all relevant policy targets
- a complete judgement of all costs and benefits of the decision at hand
- an intensive search for new information for a further evaluation of alternatives (including expert views)
- a high flexibility for including new alternative choice possibilities
- a satisfactory provision for implementing the decision(s) to be taken

It is clear that the results from the above mentioned criteria for judging the effectiveness of a decision are co-determined by the kind of decision behaviour of a policy-maker (see, for instance, Keen and Scott Morton, 1978). Important classes of decision modes are:

- rational behaviour ('optimizing' strategies)
- bounded rationality ('satisficing' strategies)
- organizational behaviour ('justifying' strategies)
- political behaviour ('opportunistic' strategies)

It is obvious that despite the variation in decision modes, each policy action aims at realizing some (vaguely or precisely) defined goals.

Because this paper deals primarily with impact analysis we will now pay more extensive attention to the instruments of regional economic policy.

In mixed economies regional economic policy can be typified by means of the degree of control by central regional or local governments. It ranges from moderate attempts at influencing a spatial system to deliberate actions of full control of this system. The latter activity will just be called control here; it presupposes that the set of potential decisions or actions (households, entrepreneurs, e.g.) is substantially restricted by the government. In the first case this set of possible actions is not restricted, but the actual implementation of a specific action which is the object of policy, is demotivated.

In mixed economies instruments of the influencing type are most important in as far as private location decisions are concerned. The management of privately owned companies normally takes essential decisions such as how much or what to produce, why, how and where. Government then tries to influence these essential decisions for reasons of public interest (see also Nijkamp, 1984).

When control instruments are used with respect to privately owned companies they are mostly of the participatory or of the prohibitive type. Commands are practically unknown as far as private decisions of consumers or producers are concerned. Even state-owned companies have usually within certain constraints a high degree of independent decision-making. Control instruments are also used in the area of non-market activities of the government itself.

It should be noted that a given instrument may be both of the influencing and of the control type.

For example, a spatial relocation of governmental activities is of the control type in as far as it is intended to create directly a given amount of employment in the receiving region, while it is at the same time of the influencing type in as far as it is intended to create favourable socio-cultural and economic locational conditions for future private enterprises. Especially conditional policies (infrastructure policies, e.g.) are of the influencing type (see Nijkamp, 1984).

Various instruments of regional economic policy, which have more or less frequently been used in mixed economies, are listed below:

- a. relocation or establishment of governmental activities or state-owned companies;
- b. regionally-based direct financial aid to companies in trouble in the form of subsidies and loans;
- c. participation in privately owned companies, e.g. by regional development companies;
- d. creation of jobs-especially in times of recession-by regionally differentiated employment programmes;
- e. state-financed housing construction
- f. investments in economic and social infrastructure in order to influence the locational profile of a region in the form of, e.g. the construction of industrial sites, harbours, roads, other communication systems, socio-cultural and recreational facilities;
- g. subsidies on capital, e.g. premiums on gross investments, fiscal accelerated depreciations, fiscal investment deduction and subsidies on land use;
- h. subsidies on labour;
- i. mobility stimulating measures, e.g. migration subsidies for migrants and enterprises;
- j. subsidies on transportation and energy use;
- k. government expenditure policy;
- l. allowances of several types.

The instruments g. - j. are of the influencing type, whereas the instruments a. - f. and k. may be both of the control and of the influencing type. Instrument l. is mainly of the control type although it may have unintended deterrent influences. Clearly, not all instruments are equally present in all regional economic impact analysis. This will be illustrated by briefly describing some results of a cross-national review of 50 multiregional (ME) models from 20 different countries (see Nijkamp and Rietveld, 1982).

One of the surprising findings of this study was that in various models it was not quite clear which variables had to be conceived of as goal variables or as instrument variables and for which policy purposes the model had to be used.

A first major question asked to the respective model builders of the abovementioned 50 models was: 'Which policy objectives are endogeneous in the model (at the regional and/or national level)?'. The frequency distribution of these responses is presented in table 1. It is surprising that only from 31 models out of the 50 models a clear identification of policy objectives could be made.

It can be concluded that the most important (socio) economic objectives are present in the table.

There is a clear over-representation of economic growth and labour market variables compared to other socioeconomic objectives. Policy objectives from related fields are only moderately present.

This finding is in conformity with the wide spread impression that regional policy in most Western countries is mainly regional economic policy.

Below it will be shown that a basic requirement adequate impact assessment has to meet is to monitor the complete set of effects on both the objective and non-objective variables. From table 1 it may be concluded that several of the interregional models investigated can only be used to a very limited extent for analysing the effects of policy instruments on energy, environmental or physical planning objectives. Only when these models are linked with other models (e.g. environmental models) comprehensive impact analysis may be feasible.

Table 1. Frequency distribution of objectives in 31 ME models

Socioeconomic objectives

Income production, consumption	25
Employment	21
Unemployment	9
Prices, inflation	7
Balance of payment	2
Income distribution	3

Budgetary objectives

Tax revenues, investment costs, budget deficit	4
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Facilities

Infrastructure, utilities	4
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Energy and environment

Energy consumption	4
Pollution	3

Physical planning objectives

Land use	1
Population distribution	4
Land prices	1
Trip distribution	1

In the above mentioned cross-national inquiry a second major question asked was: "For which policy instruments or policy measures can the effect on the policy objectives be determined (at the regional and/or national level)?" The frequency distribution of these responses is contained in table 2. Clearly, the number of models containing policy handles is fairly low.

Table 2. Frequency distribution of instruments in 29 ME models

<u>Government revenues and expenditures</u>	
Consumption expenditures	11
Employment in government services	3
Public investments	17
Flows between national and regional governments	3
Social security payments	1
Taxes	7
<u>Prices</u>	
Subsidies of private investments	10
Wage subsidies	1
Average or minimum wage	2
Interest rate	2
Public prices	1
Transportation costs	1
Fuel prices	1
<u>Physical planning</u>	
Housing	2
<u>Environment</u>	
Pollution standards	4
<u>Other instruments</u>	
Limits on productive age	1
Agricultural policies	1
National immigration policies	2

These results indicate that the main instruments in these models can be found in the area of government consumption expenditures, public investments, and subsidies of private investments. Other instruments that also receive some attention are taxes and employment in government services. Relatively little attention is paid to price policies (apart from investment subsidies) and to instruments from related policy fields such as physical and environmental planning.

After this brief introduction to policy evaluation we will turn to the main subject of this paper viz. impact assessment, in subsequent sections.

3. Regional Impact Analysis: a Conceptual Framework

An evident problem to be dealt with in a conceptual framework of impact analysis of regional economic policy is the definition of regional economic policy.

However, this problem is all but trivial. In the context of this paper we assume that regional economic policy comprises all those activities of national, regional or local governments, that affect economic characteristics of one or more spatial units in a national system.

Although also the major part of public economic policy (and clearly also a large part of non-economic policy) may have an impact on regional economics, it is assumed here that regional economic policy has an explicit and purposeful orientation toward influencing the economic situation of a set of regions.

The next problem we will pay attention to is the disentanglement of the effects of policy measures from the effects of non-policy variables (exogenous circumstances), which is a prerequisite for adequate impact assessment.

The present problem can be represented by means of the following stimulus-response model (see figure 1).

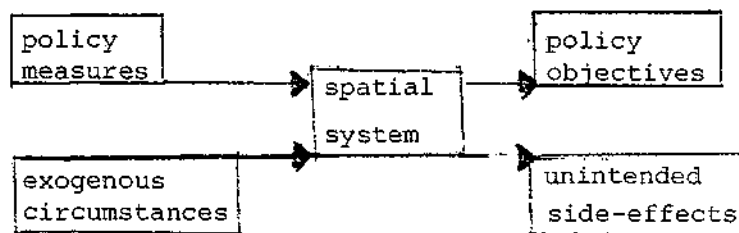


Figure 1. A stimulus-response model for regional impact assessment

Clearly, feedback mechanisms can easily be introduced in Figure 1. (see also Nijkamp and Riétveld, 1982). In order to assess the impact of a policy measure, one

has to gauge the difference between the existing (or expected) situation and the new (or desired) situation that emerges after the policy measures have been active. Consequently, the following three items have to be taken into account:

- a definition (or description) of the initial situation (the 'zero'-situation)
- a description of the possible development of the initial situation without the policy effects at hand (the 'without'-situation). Some methods which can be used in this context are: trend extrapolation, Delphi techniques and scenario analyses.
- a description of the desired situation that has to be reached in a certain period by means of an appropriate choice of policy measures (the 'with'-situation). Methods to be used in this framework are inter alia (multi)regional policy models, expert panels, Delphi methods etc.

It is quite common to make a distinction between ex ante and ex post assessments. In this regard, apart from the pre-dictive and post-dictive nature of the analysis, a major difference is caused by the definition of the 'without'-(or reference)situation. In case of ex ante impact assessment, the reference situation does not include factual information about the impacts of unknown changes in the exogenous circumstances, whereas in the ex post analysis the reference situation may be adjusted for precise and certain information regarding the evolution of exogenous circumstances. Thus it is clear that the simple 'policy-off' and 'policy-on' approach to impact analysis is much more complicated, if one regards impact analysis as a procedural activity comprising ex ante and ex post assessment of policy effects. In addition, the technical assessment itself is a far from easy task.

The relationships and interactions between stimuli, spatial system and responses in figure 1 may be very complicated. Especially the intermediate block made up by the spatial system may exhibit a complex structure. The various kinds of impacts of a policy measure (viewed als stimuli) are presented in figure 2. For the ease of exposition only two sets of spatial systems variables are included, viz. first-order and second-order intermediate variables.

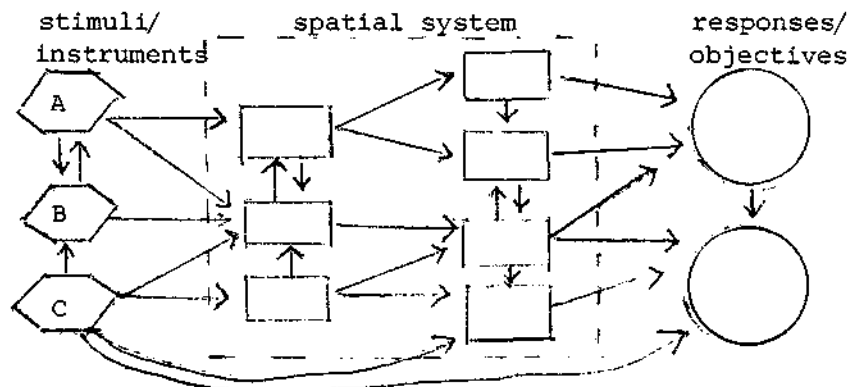


Figure 2. Various kinds of effects in a stimulus-response model of regional economic policy

In order to handle the complexity of the stimulus-response model depicted in figure 2 we will now systematically describe the various kinds of effects inherent to the stimulus-response model. The typology developed will be of great importance for the design of the assessment typology to be presented in section 4.

The notion of effect has to be understood in a causal context. It is often associated with consistency in the direction of impacts and even the order of magnitude in the relationships between two variables across populations, provided that other things are equal in the populations examined (Mosteller and Tukey, 1977).

In order to arrive at consistency, a model should be

specified in such a way that all variables which exert systematic, non-random influences on the system of which the instruments and the goal variables are part, are included in the analysis (see also Basmann, 1963). Usually only relatively few variables are required in order to satisfy this condition (Haavelmo, 1944) In order to select and model these variables an adequate theory (and specification analysis) is of crucial importance. This brings us to the following definition of causality (Feigl, 1953): "The concept of causation is defined in terms of predictability according to a law (or more adequately, according to a set of laws)".

It should be noted that on an abstract level of economic theory it may be argued that the relation between a causal and an affected variable is essentially unidirectional (see, among others, Wold, 1954, Strotz and Wold, 1960). However, in applied economics two-way relations between two variables frequently have to be modelled (see, among others, Bentzel and Hansen, 1955, Fisher, 1969).

Let us now turn to the concept of effects of instruments of regional economic policy. In order to define it, the notion of a regional profile will be introduced first. This should be done because regional economic policy, like most phenomena in the social sciences, is 'multi-effective'. That is, it usually influences several characteristics of the elements of a set of regions, both of an economic or of a non-economic nature (see figure 2). For example, industrialization policy may have consequences for employment and for the physical characteristics of a region in the form of increased pollution. It is obvious, that an adequate measurement of the effects of regional economic policy should also take into account the effects on non-economic characteristics.

The concept of a regional profile is then defined as a vector representation of a set of elements that characterize a region (see Nijkamp, 1979). This approach is also closely connected with the use of multiple criteria evaluation techniques for policy analysis.

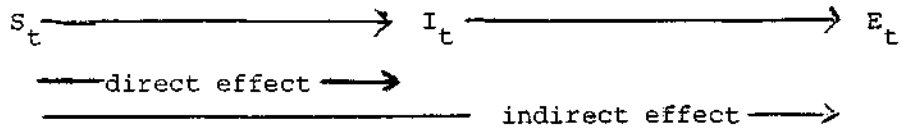
A regional profile can be regarded as a compound representation of components, like economic, social, spatial-physical and environmental subprofiles (see Nijkamp, 1979). Each of these components comprises a set of elements; for instance, the economic subprofile consists of such elements as demand for regional output, investments, employment, etc. Consequently, various policy sectors may be distinguished in the impact scheme of Figure 2.

The concepts of effects of an instrument of regional economic policy in a given spatial unit can then be defined as the extent to which the elements of the regional profile concerned have been influenced by an input of that instrument.

It should of course be noted that some effects of regional economic policy are being realized over a short term and other effects over a long term. For example, some effects of the relocation of government activities are being realized before the activities have actually been relocated, whereas it may take years before investment subsidies lead to an increase of investments and employment. Therefore the notion of effects of a regional policy instrument has to be restricted to a given period.

The notion of a regional profile can also be used to clarify the distinction between direct and indirect effects (see Figure 2). An indirect effect on a given profile element arises via other profile elements. It should be added that the effect on a profile element via a lagged dependent variable will be considered here as indirect. As an illustration consider the following causal chain between a policy instrument "Investment subsidy" (S), "Investment" (I) and a goal variable "Employment" (E) at time t (see Figure 3).

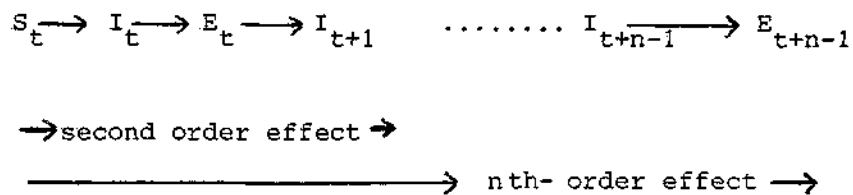
Figure 3. Schematic representation of direct and indirect effects



In this example the relation between S_t and E_t is called indirect, since they are related via I_t . The effect of S_t on I_t is called direct, because there are no intervening variables. Of course whether a relation between two variables should be classified as direct or indirect is dependent on the model or theory at hand (see also Simon, 1954, Blalock, 1964).

From a methodical point of view it is also necessary to distinguish between first-order, second-order, and, in general, n th-order ($n \in \mathbb{N}$) effects (see figure 4).

Figure 4. Schematic representation of second-order and n th-order effects



If the goal variable E appears only once in the causal chain we will speak of a first-order effect. If the goal variable itself is one of the intervening variables, we will speak of a second-order effect in the case of only one intervention, and, in general, of an n th-order effect in case of $n-1$ interventions.

It is clear that the temporal lag structure presented in figure 4 can be extended with spatial lag structures, as is also reflected in the spatial cross-correlation and autoregressive literature.

It should be noted here that in a sense a formal (multi)regional policy model can be regarded as a specific case of the general stimulus-response model in figure 2. In addition, also the recently developed so-called qualitative calculus models (based on signs or directions of impacts) can be considered as special (qualitative) cases of the above mentioned stimulus-response model (see Brouwer and Nijkamp, 1984, and Maybee and Voogd, 1984). The same applies to graph-theoretic models and Boolean representations of complex systems.

In addition, on the basis of figure 2 one may also classify impact assessments into various classes.

- partial versus integral impact analyses (referring to the completeness of the set of effects)
- single versus compound impact analyses (referring to the size of the set of policy measures)

Furthermore, according to figure 2 three phases may be distinguished in any impact assessment:

- tracing the effects by identifying the relevant impacts
- measuring the effects by assessing the intensity (size) of impacts or their probability of occurrence
- interpreting the effects by investigating their relevance for the policy measures (to be) implemented.

In a (multi) regional setting, three aspects deserve more specific attention in designing a regional impact analysis:

- the spatial scale of the effects (including spatial spillover and spinoff effects)
- the time scale of the effects (for instance, short-term versus medium-term effects)
- the level of measurement of the effects (varying from cardinal to non-metric or fuzzy information, see Nijkamp et al, 1984).

We will end this section with a brief overview of some generic requirements an assessment method has to meet in order to comply with scientific standards and policy practice. The requirements can be categorized into methodological, technical and decision-making criteria. Each of these main criteria can be subdivided into derived criteria, which specify more precisely the contents of the main criteria. These subcriteria focus special attention on the way the information has to be used in policy evaluation and impact assessment. Consistency of information on different sectors, completeness of data, cross-regional or intertemporal comparability, integrated or coherent representation of data, and the possibility of testing validity are methodological requirements that are of utmost importance in impact assessment of policy measures. Pluriformity of data, availability of data, feasibility of necessary statistical/econometric/mathematical operations, readability of final results for non-experts, and a transparent and surveyable representation of results are usual technical requirements. And finally, an operational policy relevance of results, a flexibility with respect to problems, a manageability of methods and/or results, an agreement with democratic procedures and an institutional/procedural integration of impact assessments are important decision-making aspects of effect analysis. These criteria are briefly summarized in table 3.

More details can be found in Van Kessel, 1983 and Nijkamp, 1984. Clearly, one may also add specific criteria for the successive decision modes discussed in section 2.

Methodological	Technical	Decision-making
Consistency	Pluriformity	Policy relevance
Completeness	Data availability	Flexibility
Comparability	Feasibility	Manageability
Coherence	Readability	Democratic content
Testability	Transparency	Procedural integration

Table 3. A typology of judgement criteria for impact assessment.

After the discussion of various aspects of impact assessment, the tools for impact analysis have to be dealt with in greater detail. This will be the subject of section 4.

4. Classes of Regional Economic Impact Assessment Methods

The purpose of this section is to evaluate various operational impact assessment methods. Before going into detail we want to remark that various informal assessment approaches are frequently used in the practice of organizations such as ministries, regional or local governments, research agencies, etc.

Examples of such informal approaches are:

- impact assessment on an ad hoc basis (for instance, by employing expert views or by looking only at some global indicators)
- cross-regional or cross-national comparison of experiences with more or less similar regional policies

Although these methods may often give valuable insights at a low cost rate, they do usually not offer the same rate of precision and of controllability that is achievable with the scientifically based methods to be discussed below. Therefore, the informal methods will be left out of consideration here.

In this section, two classes of regional economic assessment methods will be discussed, viz. micro studies and macro studies. In the latter part considerable attention will be given to various categories of models.

4.1. Micro Studies

Two types of data collection exist in micro studies: controlled experimentation, which can seldom be used in the present context and hence will not be discussed here any further, and quasi-experimentation, which consists of surveys among those who have been, or are expected to have been affected by the policy instrument at hand (see also Campbell and Stanley, 1966).

It should be noted that the actors investigated may directly or indirectly have been influenced by the instrument of policy. For example, when investment subsidies have led to the establishment of an important industry in a given region, other actors (i.c., firms) which have chosen later on a location in that region, may have done so because of the attractiveness of the industry at hand (so-called localisation economies).

These firms may be examined later on with regard to the role of the core firm for their locational behaviour.

Micro studies provide information on attitudes of individual actors, so that they may provide an appropriate basis for macro policy studies, especially as far as the detailed impact of instruments and of external variables are concerned.

Two types of surveys can be distinguished: interviews and self-administration of questionnaires. A comparison of both types can be found in Lindzey and Aronson (1968).

Surveys may provide detailed information on all factors influencing decision-making processes and especially on the relative weight of policy instruments. Furthermore, the information becomes available at a level as disaggregate as possible. Therefore, surveys may give the most detailed information on the effects of regional economic policy.

However, the survey approach as a measurement method may suffer from the drawbacks surveys in general appear to suffer from. These can be grouped under the headings: lack of respondent orientation and, in case of interviews, errors on account of communication barriers and perception disturbances of the respondent, and measurement errors due to the interviewer (for detailed information on these drawbacks see, inter alia, Cannel and Kahn, 1968 and Segers, 1977). These drawbacks may result in a gap between the actual effects and the effects as reported by the actors investigated. For example, the respondents might choose their answers so as to influence future policy in a direction desired by them.

Another limitation is that surveys usually cannot provide information on effects on variables in a causal chain beyond the variables associated with the respondents investigated. Consequently, only the effects on variables relevant for the decision-maker in the survey for the time period for which the questions have been formulated can be estimated. In order to estimate subsequent effects new surveys have to be undertaken. A final disadvantage is that surveys usually are very costly and time consuming (see also Folmer, 1981). An example of the use of the present measurement method in The Netherlands can be found in, among others, Poolman and Wever (1978).

4.2. Macro Studies

The data used in macro studies are obtained from micro units in surveys conducted periodically by authorities such as the central offices of statistics. These surveys usually are simple and relate to key issues such as investments, number of persons employed, etc. In contrast to the surveys dealt with in section 4.1., the information asked for in this kind of research does usually not directly relate to regional economic policy. Therefore, there is less danger of answers which have been biased in order to influence it. Because no information on policy inputs is gathered from the micro units, it has to be obtained elsewhere, e.g., at the Ministry of Economic Affairs. As mentioned above, the data for macro studies consist of aggregate observations on micro units. For the purpose of the present study, aggregation with respect to spatial units is important here. However, in addition to grouping in spatial units, the observations on micro units are usually sectorally aggregated as well. This leads of course to various limitations in macro approaches. In the sequel, various types of macro approaches will be discussed successively.

(i) Macro Studies Without an Explicit Model

A basic feature of this kind of approach is that no attempt or (only a weak attempt) is made to correct for the effects of non-policy variables. A first type, which consists of some form of counting, can be used in situations where the effects of policy are not interwoven with effect of non-policy variables, e.g. in the case of land colonisation, the building of new towns (Tuppen, 1979), and the relocation of government offices in as far as only direct effects (on employment, e.g.) are taken into consideration.

A second type is based on a comparison of policy-on and policy-off situations. Different regions (or the same set of regions in different periods) may be compared. An example can be found in Brown (1972), who compared the migration of firms for periods of both intensive and weak regional policy. This method can be used when the difference between the policy-on and the policy-off situations are caused by the policy variables only. In practice such situations seldom occur. Therefore, methods should be used that make it possible to take into consideration non-policy variables as well. This brings us to the other categories of macro studies.

(ii) Single Equation Macro Studies with Non-Policy Variables Only

This method is based on the comparison of the actual policy-on situation with the extrapolated policy-off situation; thus the gap between the two situations is defined as the effect of policy. The simplest variant is the extrapolation on the basis of an univariate time series for the policy-off situation. It rests on the

assumption that the autonomous development of the goal variable in both the policy-on and the policy-off period is the same. This assumption may lead to very distorted outcomes if a development from a short policy-off period is extrapolated over a long policy-on period.

The autonomous development of the goal variable can be accounted for more adequately by analysing a multivariate time series of the goal variable and the determining non-policy variables. In that case only the assumption of a constant relationship between the goal variable and the non-policy variables has to be made.

Examples of the use of the time series measurement can inter alia be found in Moore and Rhodes (1976) and Recker (1977). The cross-section variant has been used in The Netherlands by Vanhove (1962) and Van Duyn (1975). Here the equation of the first-order difference of industrial employment over a relevant policy-on period is estimated by ordinary least squares on the basis of cross-section data for all provinces.

When the latter two methods are applied, the following problems have to be taken into consideration. First, because of the usual lack of regional data the set of explanatory variables may be incomplete. Consequently effects may mistakenly be ascribed to policy impacts. The inclusion of both policy and non-policy variables may of course reduce this problem. Secondly, the omission of policy variables, which both have a direct effect on the dependent variable and are correlated with the independent variables, leads to biased estimators of the regression coefficients and thus of the effects of policy. Thirdly, when the average value of the residuals

in some measurement units are offset by negative ones in other units. This also implies that a quantitative estimate of the effect can not be obtained from the absolute value of the residuals. The degree of success of policy can be derived from a ranking of the residuals by size (see Bartels et al, 1981).

Another way to extrapolate is by means of variants of shift-share analysis. Estimates of functions of the national sectoral growth rates and of the regional sectoral values of the goal variable in a base year in the policy-off period are used to obtain extrapolations of the regional policy-off situation. When this method is applied it is assumed that the function used represents the effects of the regional non-policy variables adequately. This assumption is often questionable, especially in small regions. Furthermore, the national growth rates may also have been influenced by regional economic policy. The most important objection, however, is that the regional component is identified with the effects of policy. Possible effects of regional non-policy variables on the regional component are neglected. (For further criticism of the shift-share analysis approach see Richardson, 1979, and Schofield, 1979). Examples of the use of the shift-share measurement approach can be found in, inter alia, Moore and Rhodes (1973, 1974, 1976) and Ohlsson (1980), while a stochastic variant can be found in Buck and Atkins (1976).

Time series approaches based on recursive regression models (see Dunn, 1982, Harvey, 1981, and Hepple, 1979) or autoregressive error models (see Tervo and Okko, 1983) have also been applied in this frame-work.

We conclude this section by remarking that a drawback of all single equation approaches, in which the instruments of policy are not explicitly incorporated, is that no

comparison between the effects of several instruments on the objectives (sometimes at different spatial levels) can be made. Additional shortcomings, which apply to all single equation methods, will be mentioned at the end of the next subsection.

(iii) Single Equation Macro Studies with Instruments of Policy Included

The next class of impact models includes policy instruments. Two variants belong to this measurement approach. The first is to be used in situations where information on important non-policy variables is missing, and the second in situations where this kind of information is available. In the first case, it is possible to obtain estimators of the effects which are not contaminated with specification errors (see, inter alia, Theil, 1957), under certain conditions. In this case, a univariate time series of the goal variables and the policy variables for the policy-on period must be available. If the policy inputs have had any effect, and if the relationships between the goal variable and the non-policy variables in the second period are the same as in the first period, then the second time series must differ from the first one. The first step in this measurement procedure is then to model the pre-policy series. In this framework, the class of multiplicative seasonal autoregressive integrated moving average models as developed by inter alia Box and Jenkins (1976) may be highly relevant. Given the independence of the policy instruments of the non-policy variables and a linear additive model structure, the goal variable in the second period can then be estimated by standard techniques.

Secondly, if information on both policy and non-policy variables is available, time series, cross-section data and spatio-temporal data may be analyzed by standard techniques. One final remark is in order here. First, the crudest way to incorporate policy inputs into an impact analysis is by distinguishing between policy-on and policy-off situations. These two possibilities are usually represented by dummy variables. Maddalla (1971) has criticized the use of dummy variables by arguing that systematic non-policy variables,

which are not explicitly represented in the model, will also affect the coefficient of the dummy variable. This will lead to biased estimators.

Secondly, with single equation methods only direct policy effects can be estimated. Furthermore, single equation methods do not allow the estimation of the effects of an instrument on several profile elements. For both purposes, either several single equation models are required or simultaneous equation models. The latter class will be discussed in the next subsection.

(iv) Simultaneous Equation Models

In this subsection attention will be paid to two classes of simultaneous equation models, viz. input-output models and general simultaneous equation models. The class of standard input-output models records transactions between economic activities, which are classified into production sectors and several consumption sectors. Both the transactions between the production sectors and the consumption sectors as well as between the production sectors mutually are recorded. Therefore, input-output models can be used to calculate the effects of policy inputs which originate from income or production variables. This means that the present method cannot be used to measure, e.g., the direct effect of investment subsidies on investments, although it may be used to calculate the effects of the latter on changes in production on demand. Depending on the degree of sectoral disaggregation, effects for different sectors can be obtained. Furthermore, if an interregional input-output model is available, interregional effects can be calculated as well. Although input-output analysis is a

very useful method of recording important effects of a number of instruments frequently used, its usefulness is seriously limited by the scarcity of data, especially with respect to interregional linkages. For the same reason, the relations in input-output models are usually not quantified by means of conventional econometric methods. An example of the use of the present method can be found in Oosterhaven (1981).

The second class comprises a large variety of models, which are not restricted to recording transactions between several sectors. Therefore, they will be called 'general simultaneous equation models' here.

In order to estimate the direct effects of an instrument of policy on several profile elements, equations for all the profile elements concerned should be incorporated into the model. Each equation should describe the relevant profile element as a function of the instrument of policy and of the other explanatory variables. In order to estimate indirect effects, equations should be specified for both the ultimate goal variable and for each of the intervening variables in the causal chain between the ultimate goal variable and the instrument of policy (see, inter alia, Folmer, 1980, 1985). Thus, a causal chain is represented by a system of equations where each causal variable is among the explanatory variables of the variables directly affected. In the case of linear models, the direct effect of a policy variable on a profile element equals the coefficient of the policy variable concerned and the indirect effect along a given causal chain equals the product of the coefficients of the variables in that causal chain. Sometimes one may get some insight into possible effects of instruments of regional economic policy even if the latter have not been included into the model. For example, employment could be stimulated either by way of investments

or via demand. By estimating the effects of the latter two variables on employment growth, some insight can be obtained into the effects of stimulating these intervening profile elements on the ultimate goal variable.

We will conclude here with the following remarks. First, within the class of general simultaneous equation models two types of models may be distinguished, namely recursive and non-recursive models. The coefficients in the equations of a recursive model may be estimated by means of ordinary least squares (see, among others, Wold, 1954 and Strotz and Wold, 1960). In case of non-recursive models, methods such as two-stage and three-stage least-squares full information maximum likelihood, etc have to be used (see also Folmer, 1985).

Secondly, despite many bottlenecks, in our view one of the promising measurement approaches is formed by simultaneous equation macro models, although an important limitation to the application of these models is the information needed on many variables and the large number of observations usually required. A possible way out for the latter problem is the use of spatio-temporal data (see Folmer, 1985). An example of the use of the latter measurement method of effects of regional economic policy can be found in, inter alia, Berentsen (1978) and Folmer and Oosterhaven (1983).

5. Instruments of Regional Economic Policy and their Measurement Methods

In this section we will indicate which method (or combination of methods) should be applied to measure the effects of instruments as listed in section 2.

As has been stated above more or less implicitly, the method to be used is dependent on a number of factors, such as the financial and time budgets, the data available, and the goal variables one is interested in.

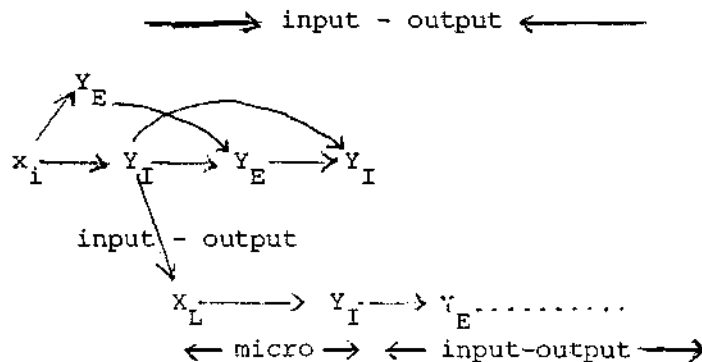
Without loss of generality only one goal variable will be considered here. We start with two remarks in advance. First, from the information required to estimate the effects on that goal variable, the effects on other profile elements can usually also be derived. Secondly, restrictions resulting from the financial and time budgets and from the data available, may be taken into account by analyzing the variations between two extreme cases, viz. one which requires much information and is time consuming and one which has opposite features.

Let us start with a very simple situation, namely the calculation of direct effects of control instruments (instruments a.-e., 1.). It is obvious that these effects can be calculated by some form of counting, e.g., the number of jobs in a certain new employment programme. However, in case of state participation in firms and of financial aid to companies in trouble, the number of jobs concerned gives the maximum effect; both the newly created employment and that saved from disappearing might have occurred regardless of the aid provided.

Indirect primary effects, e.g. via investments in buildings for a relocated government activity, can be calculated by means of input-output analysis. The same method can be used to calculate secondary and higher-order effects that arise via income and/or production variables.

Indirect effects via other intermediate variables, e.g. locational conditions, are more difficult to measure. Some insight might be gained from a survey among firms with respect to the importance for their economic position derived from the presence of the relocated public activities, the establishment of new firms, etc. Higher order effects via other intermediate variables are difficult to estimate by means of micro-studies (see subsection 4.1.). However, when the effects on, e.g. investments have been obtained, input-output analysis may be used to estimate higher-order effects. Figure 5 may help to clarify the discussion so far. The variable x_i denotes the instrument of policy, Y_E employment effects, Y_I investments, and X_L locational conditions. In order to keep this representation simple, intermediate variables, such as consumption, are neglected.

Figure 5. Schematic representation of the measurement of effects of control instruments.



Instead of the combination of micro studies and input-output analysis in the chain $X_L \quad Y_I \quad \dots\dots$ general simultaneous equation models may in principle at least also be used. Another approach is to relinquish the disaggregation of the effects with respect to the variables via which they arise and to measure only the total sum of all indirect (primary, secondary and higher-order) effects by means of time series analysis with missing non-policy variables.

The effects of instrument f. can be assessed in an analogous way because it has both a control and an influencing aspect.

The approach to instruments of the purely influencing type g. - j. is quite different. The most appropriate methods in this case are micro studies and general simultaneous equation models. The former ones can be used to estimate in a detailed way the primary effects on employment. Clearly, general simultaneous equation models may be used to assess all direct and indirect effects. In addition, they may be used as a check on the results of micro studies, given the drawbacks of micro studies mentioned in subsection 4.1.

The use of simultaneous equation models, however, equally requires the availability of data on a large number of variables. When such information is missing, one may be forced to fall back on the use of a single equation approach for a goal variable for which the information on the relevant policy and non-policy situation is available. In case of time series only available for the goal variable and the policy variables, time series analysis with missing non-policy variables may be used.

6. Conclusion

Impact assessment of regional economic policy is a complicated problem, from both a methodological and a technical point of view, as is also indicated in extensive literature reviews (see Bolton, 1980, and ISSAEV ed al., 1982). An appropriate analysis requires a careful definition of goals and instruments, as well as of exogenous variables. The same holds true for the time horizon and the level of measurement of the variables concerned. In addition, a reliable specification of the causal structure and of the external environment of the spatial system at hand is necessary.

An impact analysis should recognize the pluralistic nature of public decision problems and processes, inter alia by employing the notion of regional profiles and by making use of multidimensional spatial data analyses. Various methods of impact analysis are available, ranging from micro to macro and from ad hoc to systematic approaches. Their advantages and disadvantages have extensively been described. From a methodological point of view the use of methods without an explicit model (4.2.i.) and single equation models (4.2.ii.) is not preferable, provided the available data permit alternative approaches. The use of the other types of methods is dependent on various circumstances, in particular the kind of instruments under consideration and the data and resources available. Thus, despite its complicated nature we may conclude that impact analysis of regional economic policy is quite feasible and may provide a useful contribution to regional policy analysis.

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