INTEGRATED APPROACHES TO REGIONAL DEVELOPMENT MODELS

A survey of some Western European Models

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Abstract

The paper aims at providing a systematic framework for judging regional planning and policy models on the basis of a set of appropriate criteria and characteristics. The nature of these criteria is diverse, so that a multidimensional evaluation of such models may be achieved. This framework will be illustrated in light of a mutual comparison and judgement of (multi-)regional models from three Western European countries (Belgium, France and The Netherlands). The paper will be concluded with a general outlook for the design of regional development planning models.

1. Introduction

In both the industrialized and the less developed world much attention is being focused on the spatial aspects and the spatial distribution of economic development. Regional development policies tend to make up an increasingly larger part of general economic and physical planning efforts. Especially the economic stagnation during the last few years has put more emphasis on the frictions inherent in an economic distribution policy.

Regional economic models are widely accepted as important tools to investigate consequences of regional economic policy. In this way, alternative policy instruments, future policy scenarios and conflictual policy options can be assessed. The current popularity of such models has to be ascribed to both the urgent needs of policy-makers to base their actions on a reliable framework and to the success of several operational regional models.

On the other hand, many regional models have severe limitations. A comparison of many regional models currently in use also demonstrates significant differences in structure and scope of these models. Ideal models do not exist. Each model is limited by its purpose (for example, descriptive versus predictive purposes), its required data base (for example, survey versus non-survey techniques), and the spatial institutional structure (for example, regional autonomy versus a multi-level policy structure).

In light of the variation among current regional models, it may be meaningful to set up a list of evaluation criteria which may serve to judge regional models. In this way, one may achieve a more general view of the structure and conditions for regional models. In section 2 an attempt is made to construct such a list of judgement criteria. In this section also a list of attributes which may characterize regional models is included.

The latter framework of criteria and attributes will be used to examine the structure and contents of three Western European regional models (section 3-5). The last section will be devoted to a general outlook for the design of regional policy models.

2. Judgement Criteria and Characteristics of Regional Models

The great diversity in the structure, scope and contents of regional

models hampers a straightforward mutual comparison and judgement of these models. Yet there is a basic need for more generalization in building and evaluating regional models. In our view, two complementary ways can be chosen to achieve this aim. First, one may specify a set of appropriate criteria (for example, methodological requirements, practical conditions) which may serve as a general evaluation framework for regional models. Secondly, one may also construct a list of attributes which may characterize aspects of regional models without providing an explicit judgement framework for these models (for example, the degree of aggregation, the kind of estimation procedure). Both approaches will be adopted in the present paper.

The analytical framework presented here aims at focusing the attention especially on the regional aspects of model building. General aspects of economic modelling will mainly be left aside. Though this paper aims at seeking for more generality in judging and building regional models, it should be kept in mind that the purposes of different models may vary substantially, the data base of different models may be entirely different, and the spatial subdivision and the regional size may differ among various countries. The framework sketched is especially oriented to the structure and use of operational models currently in use in many countries. As exposed before, the framework is composed of criteria and characteristics.

The judgement criteria are subdivided into two classes, viz. methodological/theoretical criteria and practical/empirical criteria (see for a general discussion of criteria for economic model building Van Lierop and Nijkamp (1979), Nijkamp (1979) and Somermeyer (1967)). In addition, a distinction is made between various uses of models, viz. general analytical/descriptive purposes, predictive (or forecasting) purposes and policy/planning purposes (see Tinbergen (1967)). Table 1 provides this general evaluation framework for regional models. The characteristics or attributes of regional models may relate to both logical/theoretical aspects and practical aspects. These characteristics serve to gain insight into the scope, contents and structure of such models, but do not necessarily imply any value judgement. Table 2 provides a list of such attributes.

Table 1: General evaluation criteria for interregional models

main criterion		sub-criterion	use		
		A	gen.analytical/ descriptive	predictive	policy
methodological/theoretical	1	The model provides an integrated and comprehensive picture of the intraregional economic structure	x		
	2	The interregional interdependences (spatial spillovers, spatial flows) are incorporated in order to obtain a complete picture of the spatial system at hand	x		
	3	The major groups of spatial actors (consumers, entrepreneurs, employees and government) are distinguished	x		
	4	The regional demarcations are in agreement with the specific nature of the problems to be studied.	x		
	5	The regional model consists of regions (and specific regional policies) as the main driving forces in a spatial system exhibiting a bottom-up impact structure toward the national level.	x		
	6	The classification and aggregation of relationships and sectors corresponds to the actual problems the model is addressed to.	x		
	7	Externalities (environmental or social) make up an indispensable component of a regional policy model.			x
	8	National policies with differential regional impacts are incorporated so as to ensure a consistent spatial top-down structure.			x
	9	The behaviour of groups of spatial actors is reflected in testable behavioural relationships.	x		
	10	The use of concepts and elements from non-behavioural science (social physics, e.g.) is at least defended on behavioural analogy interpretations	x		
	11	The regional policy model includes all relevant policy objectives, constraints and instruments			x
	12	Qualitative and fuzzy information is not neglected	x		
	13	Uncertainty and stochastic elements in the models are explicit		x	

Table 1 (continued)

main criterion		sub-criterion	use		
		B	gen.analytical/ descriptive	predictive	policy
practical/empirical	1	The regional model is manageable in size and transferable to similar situations elsewhere.	x		
	2	The model is conceivable and accessible for policy-makers (as well as for experts).			x
	3	The model is able to provide fairly accurate predictions.		x	
	4	The model is able to investigate the practical implications of all kinds of policy measures.			x
	5	The data necessary to operationalize a model are not unmanageable in size.	x		
	6	Unobservable, latent or qualitative information is taken account of in building or using the model.	x		
	7	The outcomes of the model comply with the inner consistency requirement (for example, spatial symmetry of in- and outflows).	x		
	8	The model is estimated with appropriate techniques, given the available data	x		
	9	Dynamic impacts of policy measures (for example, feedback and learning effects) are not neglected			x
	10	The model demonstrates its practical usefulness for regional policy (based on ex post evaluations, e.g.)			x

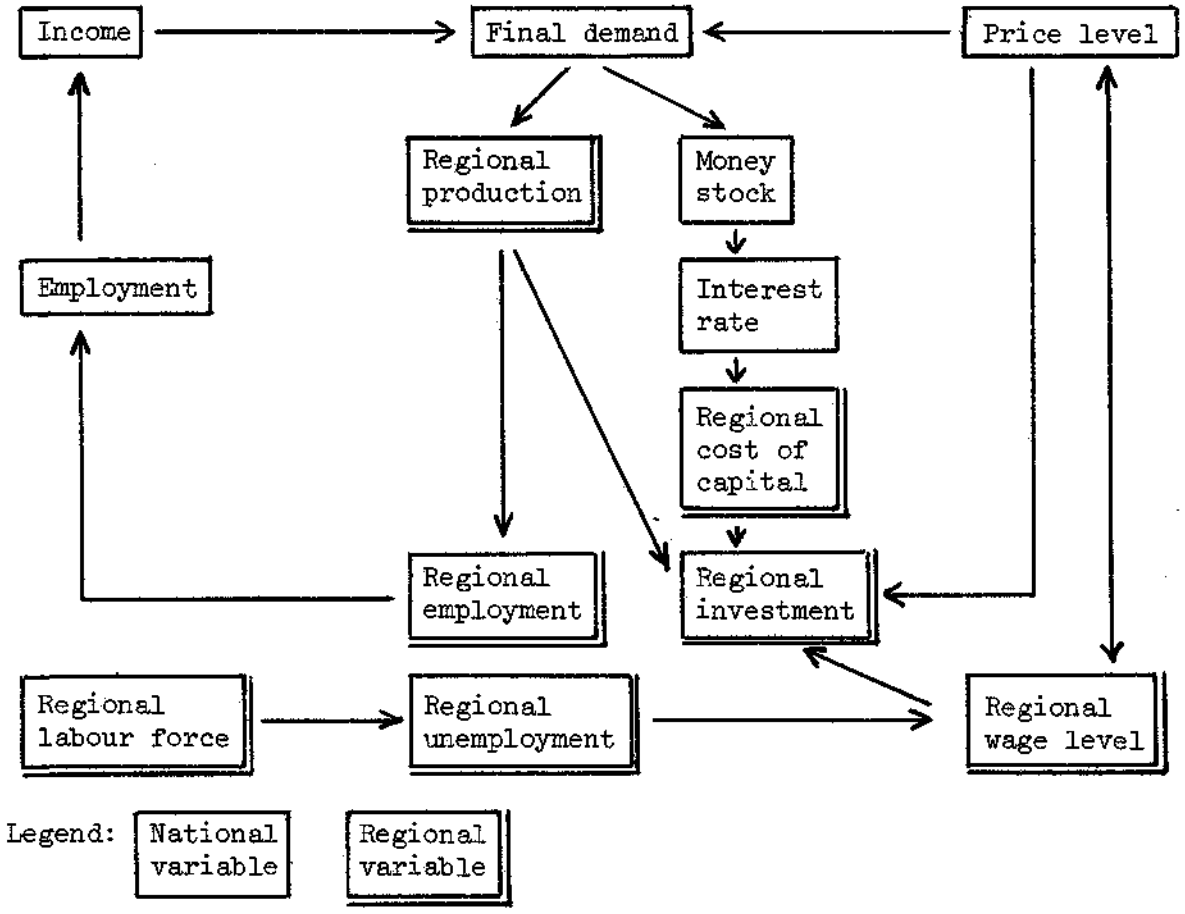
Table 2: List of characteristics of regional models

1. static - comparative static - dynamic structure
2. estimation via cross section - time series combination
3. goodness - of - fit of estimations
4. accuracy of predictions
5. existence of links with national model
6. size and number of regions
7. size and number of sectors
8. size and number of groupes of spatial actors
9. kind of estimation technique used
10. computer time for running the model

3. A Belgian Model: RENA

In various papers and books the RE(gional) NA(tional) Model for Belgium has been described in more or less detail. We mention De Corel et al. (1973), Van Rompuy et al. (1975). Below we present a short description of RENA, based on De Corel et al (1973).

The model has been designed to study several variants of the Belgian 1976-1980 Plan. The regions considered in RENA are Flanders, Wallonia and Brussels. The general structure of the model is presented in Scheme 1 below.



Scheme 1: Flow chart of national-regional relations in RENA

Summarizing, RENA can be described as follows:

Number of regions	3
Data	annual figures (gross, percentage growth or absolute growth)
Period	different periods for different equations
Estimation method	ordinary least squares; generalized least squares when autocorrelation in disturbances appeared
Equations	160, of which: 93 behavioural equations 63 definitions 4 links between national and regional
Exogenous variables	96
National behavioural equations	disposable income, firm income, private expenditures, foreign trade, indirect taxes, prices, money
Regional behavioural equations	invastment, wages, employment, commuting
Interdependence between national and regional parts	from national to regional: GNP, sales prices, interest rate, investment prices from regional to national: wages, employment, investment
Targets of economic and social policy	employment, price stability, balance of trade, growth
Important variables for construction of the Belgian Plan	government investment, subsidies, taxes, social security, exchange rate etc.
Important exogenous variables	worldtrade level, export prices, import price, population, private capital flows, education level
Other characteristics	non-linear, dynamic, non-recursive

The main structure of the links between national and regional variables can be found in Scheme 1. In addition to this scheme the following remarks can be made.There exist share-functions that connect different components of national final demand with regional investment and regional value added.

In the equations explaining the interregional commuting pattern variables measured in all three regions are incorporated. The national commuting level is the sum of the three regional levels. The employment equations have not been linked with national variables nor with national equations. The same applies to the investment functions: regional investment is determined by wage level, capital cost, lagged investment level and value added.

The final part of De Corel et al. (1973) is concerned with the results of a simulation with the model. RENA has been simulated (static and dynamic) for the period 1963-1970. The results are compared with the actual figures in this period, which leads to the general conclusion that the model fits pretty well. For the comparison Theil's U-coefficient has been used.

4. A French model: REGINA

The purpose of REGINA is to analyse, interdependently, regional and national problems. It is a large regional-national model, which analyses the French economic structure at the level of five large regions. The most recent description of REGINA is, to our knowledge, presented in Courbis (1979 a). In this article the interested reader can also find a list of articles and papers in which more detailed information about the contents and the history can be found.
In 1979 another article about REGINA appeared (Courbis, 1979 b). We do not base ourselves on the findings in this paper because it may be rather outdated: the book contains the papers of a conference held in February, 1975.

As indicated above, the model REGINA is concerned with five large regions. These regions are the following:

1. Parisian region; a very developed, urbanized and congested area;
2. Parisian basin, containing the six institutional planning regions surrounding Paris, the natural area of deconcentration for the Parisian region;
3. Northern and eastern France, containing the regions Nord, Lorraine, Alsace and Franche Comté, an old industrial area under redevelopment;
4. The mediterrenean delta, containing Rhône Alpes, Provence, Côte d'Azur, Languedoc and Rousillon, a rapidly growing region;
5. Western and South-western France containing the regions not mentioned above, a more agricultural, rural and less developed region.

Besides this main division, another subdivision is used. The five main regions have been subdivided into three zones, viz.: rural, small urban and large urban zones. As a consequence of this set-up the variables of REGINA are analysed at three levels: national, regional and zonal.

Courbis (1979 a) determines as one of the main characteristics of his model its feasibility to take into account the existence of multi-regional firms. The industries are distinguished in three groups:

a. Industries whose location is strictly determined by geographical factors

b. Industries for which location is determined by demand
c. Industries for which location depends on opportunities to invest in different regions

For different types of industries different ways to determine production levels are used. For the restricted-location industries (types a and b), regional factors determine production. Production in type c industries (called non-restricted-location industries) depends not only on regional factors but also on investment opportunities in the regions. The distinction between the types of industry is called "a basic feature of the REGINA Model" (cf. Courbis (1979 a), p. 124). The determination of regional equilibrium can best be described in Scheme 2, taken from Courbis (1979 a, p. 126).
From the same source we copied Scheme 3, indicating the interdependency between national factors and regional equilibrium.

REGINA distinguishes ten sectors in which production is determined

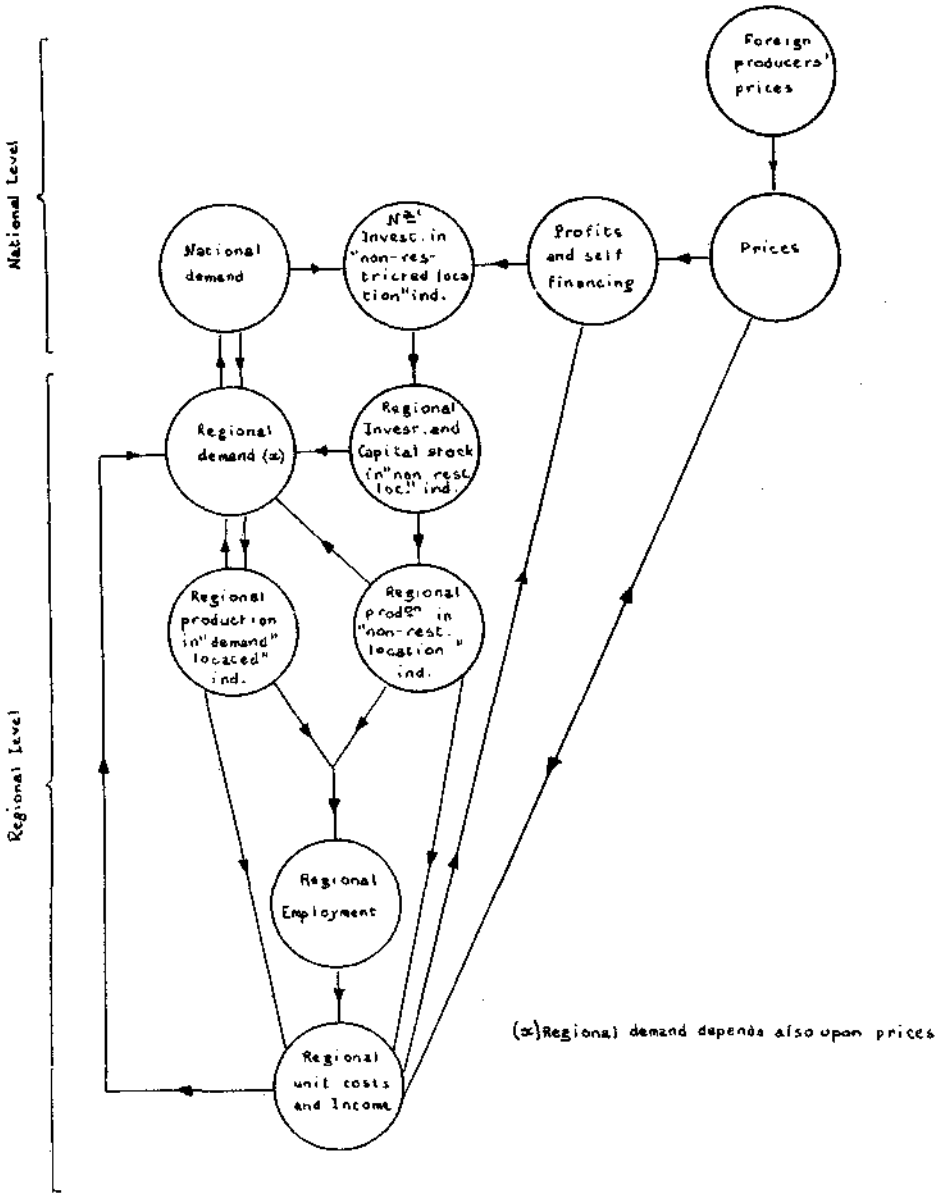
(i) exogenously for agriculture
(ii) by regional demand for building, house rental, services and trade
(iii) as a function of total national production for energy and transportation
(iv) as a function of regional capital stock and investments for "non-restricted-location" industries (manufacturing and food).

Employment in the sectors distinguished is determined by production.
The determination of wage rates is assumed to take place as follows:

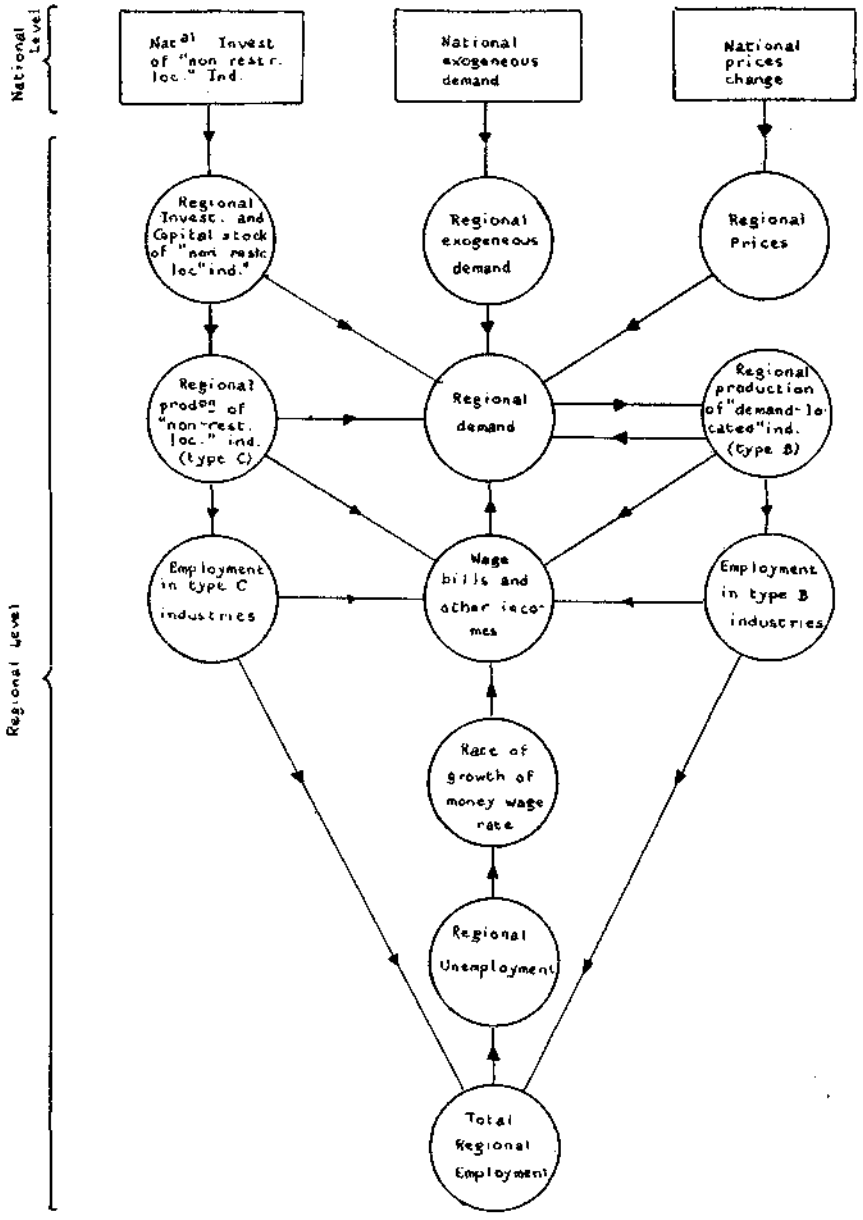
a) for the Parisian region the growth rate of wages is a function of the labour market situation and the rate of growth of consumer prices
b) for the other regions the growth rate of wages is influenced by the Parisian growth rate.

Regional demand is distinguished as follows:

1) intermediate demand; by industry and product
2) productive investment; analysed for each of the industries
3) household consumption; determined in two steps: a) total consumption (as a function of available income) and b) a regional breakdown by product (using a linear expenditure system)
4) residential investment of households.



Scheme 2: Flow chart of national - regional relations in REGINA



Scheme 3: Determination of regional equilibrium.

The integration of spatial factors is made at both the supply and the demand side of the REGINA model.
On the supply side the impact of regional and zonal factors on national development goes via a) working population, b) agricultural employment, c) growth rate of wages, d) input-output coefficients, capital output ratios and transportation costs.
At the demand side the main factors are a) household consumption, b) household residential investment, c) investment of local public authorities.

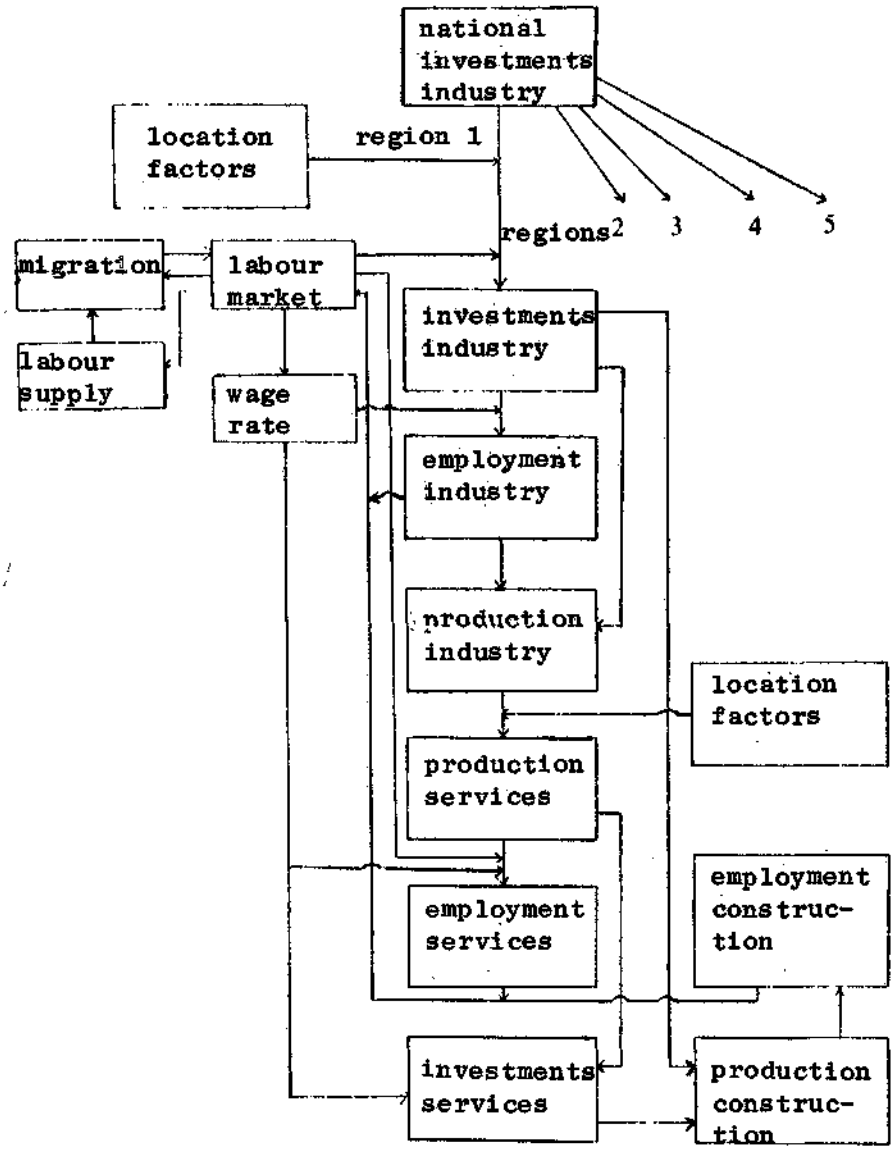
As far as the present authors know, the model REGINA contains more than 8000 equations. This is, maybe, the reason that a complete description, equation by equation, cannot be found in the literature.

5. A Dutch model: REM

The Regional-Economic Model of the Netherlands Central Planning Bureau has been designed to serve the central government as an analytical instrument for regional economic policy. The model is described in Van Hamel et al. (1979) and Van Delft et al. (1977). REM is a multi-regional model in which the national development is considered to be a datum. The model describes the development of the regions in five-year differences. Regional differences between economic sectors are captured in a small number of broad sectors: agriculture, mining, industry, construction, services and government. The model has the opportunity to trace effects of policy instruments as investment-premiums and -taxes and effects of general measures such as dispersion of governmental offices from The Hague to less developed regions.
REM is an allocation model, i.e. a model explaining regional deviations from national totals. The regional development of the different variables is, consequently, considered as consisting of two parts: the national trend and the regional factors.
The model's equations have been estimated on the basis of two cross-sections for the 11 Dutch provinces: 1960-1965 and 1965-1970. The results of the model have been aggregated to five larger regions:

1. North : provinces Groningen, Friesland, Drenthe
2. East : provinces Overijssel, Gelderland
3. West 1 : provinces Noord-Holland, Utrecht
4. West 2 : provinces Zuid-Holland, Zeeland
5. South : provinces Noord-Brabant, Limburg

The estimation method used is ordinary least squares on the two combined cross-sections. REM does not take into consideration interregional effects.
The structure of REM can be found in Scheme 4.
The model distinguishes five sectors: industry; traffic, transport and communication; other services; construction and government.
For each of the sectors equations have been estimated for capital stock, production, employment and investment. Other equations determine supply of labour force, development of population, the ratio of the prices of capital and labour, investment prices corrected for regional subsidies and wage rate of firms.



Scheme 4: Flow chart of national - regional relations in REM

6. Synthesis and Evaluation

This section is devoted to an attempt to use Table 1 as a tool for evaluating the models described in the foregoing sections. For that reason we copy the list of criteria from Table 1 and "score" each model. By scoring we mean that we characterise the models for each criterion by a short qualitative indication. The terms used are:
undetermined: the criterion is outside the scope of the model;
unknown: insufficient information is provided to infer a conclusion;
reasonably fulfilled: the criterion is not totally fulfilled by the model;
scarcely fulfilled: the criterion is almost not fulfilled by the model;
yes: the criterion is totally fulfilled by the model;
no: the criterion is not fulfilled by the model.

criterion		RENA	REGINA	REM
A	1	reasonably fulfilled	reasonably fulfilled	scarcely fulfilled
	2	scarcely fulfilled	scarcely fulfilled	no
	3	yes	yes	yes
	4	yes	yes	no
	5	reasonably fulfilled	unknown	no
	6	yes	yes	yes
	7	no	unknown	no
	8	reasonably fulfilled	unknown	yes
	9	reasonably fulfilled	reasonably fulfilled	reasonably fulfilled
	10	undetermined	undetermined	undetermined
	11	reasonably fulfilled	reasonably fulfilled	scarcely fulfilled
	12	no	no	no
	13	yes	unknown	reasonably fulfilled
B	1	yes	no	yes
	2	yes	no	yes
	3	yes	unknown	unknown
	4	reasonably fulfilled	reasonably fulfilled	reasonably fulfilled
	5	yes	no	yes
	6	no	unknown	no
	7	unknown	unknown	unknown
	8	yes	unknown	no
	9	no	no	no
	10	yes	unknown	no

The results demonstrate a remarkable diversity among the degree to which the judgement criteria are fulfilled. There is only a reasonable positive correspondence among the models for the following criteria: an integrated and comprehensive intraregional picture, a sub-division into major spatial actors, an appropriate classification and aggregation, the presence of verifiable behavioural relationships and the possible inclusion of policy measures. Consequently, only 4 methodological/theoretical criteria and 1 empirical/practical criterion are fulfilled by the three models discussed above.
The models also share some weaker points: inadequate interregional interdependences, absence of externalities, neglect of qualitative or fuzzy information, no inclusion of unobservable or latent variables and absence of dynamic effects of policy instruments.
In general, the RENA model appears to fulfill the majority of both theoretical/methodological and practical/empirical criteria. The REGINA model and the REM model appear to have weaker aspects from both a theoretical/methodological and practical/empirical point of view.

It should be noticed that the above-mentioned models are only a small sample of the total set of (inter-)regional models. The conclusions drawn so far are certainly not valid for other kinds of models. The meaning of this generalized comparative analysis is that it provides foundation stones for designing new (inter-)regional models. These criteria do not intend to give rise to enormous data-intensive and large-scale models, but rather to concentrate on the systematics and coherence of operational models that aim at providing a reasonable and understandable picture of a complicated spatial pattern, especially when accurate data are unavailable (for example, in the field of 'soft econometrics', see Nijkamp (1980)).
The tendency to build all-embracing and ever-increasing large models has been severely criticized by Lee (1973). In his 'requiem for large-scale models' he tried to judge the basic flaws in attempts to build and to use large models. Seven different problems were mentioned by him: the multipurpose nature of comprehensive models, the insufficient level of detail, the excessive data requirements, the discrepancy between model behaviour and its formal specifications, the lack of insight into indirect interactions, the mechanical solution techniques and the high costs of extremely large models.

It has to be admitted that Lee's criticism is to a certain extent correct, although it has to be added (see Nijkamp (1979)) that his objections are especially addressed to the misuse of models, the unjustified expectations, and the false interpretations of outcomes. On the basis of his arguments the construction of interregional policy models cannot be condemned, despite the shortcomings in several (inter-)regional models. It is still true that regional and urban modelling as such is an important vehicle to arrive at quantifiable, testable and reliable statements concerning the complex spatial economic reality. Clearly, such models have to be linked to the limited data base, but on the other hand the future way of collecting data has also to be oriented to the nature of such models.

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