SERIE RESEARCH MEMORANDA

25 YEARS OF REGIONAL SCIENCE:

RETROSPECT AND PROSPECT

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Researchmemorandum 1986-3 februari 1986

VRIJE UNIVERSITEIT
FACULTEIT DER ECONOMISCHE WETENSCHAPPEN
A M S T E R D A M

25 YEARS OF REGIONAL SCIENCE: RETROSPECT AND PROSPECT

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Paper presented at the 25th European Conference of the Regional Science Association, Budapest, August 1985.

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This paper will focus attention on the historical evolution of European regional science in the past twenty-five years. Particular emphasis will be placed on various fields of research that have dominated the history of regional science and on the exogenous factors that have been determinative for the choice of specific research issues. In this respect, an attempt is made at identifying 'waves of scientific interest' based on a review of items discussed in the Papers of the Regional Science Association in the past 25 years. It will be demonstrated that - despite the wealth of contributions made in regional science - various important issues have been neglected, from both a methodological viewpoint and an operational policy viewpoint.

In light of the abovementioned strength-weakness analysis, an attempt will be made to outline new research directions which may provide fruitful contributions to further substantial progress in the next twenty-five years.

1. Introduction

The history of the Regional Science Association has demonstrated remarkable features. On the one hand it has developed a package of tools which were closely linked to traditional economic analytical tools, but on the other hand it placed these tools in a spatial setting which made them much more useful than ever before. On the one hand it has included many notions from geography, but on the other hand it has placed these notions in a much more integrative context than before. On the one hand it has used various concepts from planning and policy-making, while on the other hand it has broadened these concepts by linking them to conflict analysis and political science.

This brief sketch of some trends in regional science shows already the rich character of many theories, methods and tools developed during the past decades. Although the regional science movement started from the U.S.A., it has gradually expanded its sphere of influence to many countries in East and West, in North and South. Especially during the seventies it has exerted a substantial impact in Europe, so that at the moment Europe is one of the heartlands of the 'regional science movement'. Several theories and methods developed previously in the U.S. have been fruitfully introduced in many European regional and urban analyses, while Europe has also had an increasingly innovative impact on new ways in regional science. The European conferences of the Regional Science Association held every year in one of the member countries have been a source of new and creative thinking and of dissemination of many new ideas.

In order to show the variety of tools in regional science, a limited but relevant sample will be briefly discussed in this article. In a nutshell the following topics will successively be dealt with:

(1) methodological and conceptual approaches to regional science
(2) location and agglomeration analysis
(3) input-output, spatial interaction and transportation analysis
(4) efficiency, equity and distributional analysis of spatial systems or plans
(5) conflict and multiple objective decision analysis
(6) statistical, econometric, forecasting and data processing techniques
(7) (multi) regional planning issues
(8) local and urban planning issues
(9) environmental, resource and energy problems
(10) spatial changes, technological shifts and labour market developments

2. Ten Issues in Regional Science Analysis

(1) Methodological and Conceptual Approaches to Regional Science

Methodological reflections are of decisive importance for the emergence of a new science or of new scientific approaches. Such - often paradigmatic - approaches have also played a dominant role in the early history of regional science. Questions like 'what is a region?' and 'what is the element of space?' have been a source of intriguing scientific debates in the sixties. Later on the interest has been more directed toward axiomatic and formal approaches to spatial systems (for instance, by using notions from systems theory, fuzzy set theory, topology etc.).

In addition, more emphasis was gradually placed on parallel problems in other disciplines (like biology, psychology, physics), while the introduction of notions from different disciplines also evoked the need for a consistent multi- of interdisciplinary methodological and conceptual framework. New directions have been developed here, for instance, multiple layer projections and satellite models. These new approaches have no doubt increased the operational nature of a multi-faceted discipline like regional science.

(2) Location and Agglomeration Analysis

Location analysis has been the heart of regional science. Starting from the Von Thünen, Weber, Lösch and Christaller framework, regional science has gradually developed an impressive number of tools for locational analysis, not only for entrepreneurs but also for households.

Entrepreneurial locational decisions have been put in an operational framework of industrial complex analysis, growth center analysis, gravity and entropy analysis, and dynamic systems analysis. Public facility locations have been studied from an integrated spatial or network viewpoint, while also residential location problems have been fruitfully analyzed by means of operational utility models, based on a solid utility-theoretic foundation.

Furthermore, recent locational analysis is increasingly being based on disaggregate models of choice (such as logit and probit models). This gives rise to a much more refined analysis, in which various individual locational determinants (including qualitative factors) can be taken into account.

In conclusion, modern location analysis is increasingly oriented towards an operational, behavioural and disaggregate approach, without being hampered by the rigid constraints imposed by the neoclassical macro aproach.

(3) Input-Output, Spatial Interaction and Transportation Analysis

Input-output analysis, developed already many centuries ago by Leontief, Isard and others, provides an operational framework for integrating the sectors of a national economy by means of their mutual interactions. Given a fixed technological structure, input-output analysis allows to calculate the direct and indirect impacts of a change in the final demand (consumption, investments, export etc.) upon the production, value added and employment in all sectors simultaneously. Input-output analysis is still a powerful tool for assessing the consequences of external shifts and it can easily be extendend to describe other spatial linkage patterns. For instance, the diffusion of information flows between different regional agencies can also be dealt with in an input-output context.

Especially in a spatial context, input-output analysis has led to many useful applications. Multiregional input-output tables have played a major role in the analysis of regional economic developments in many countries such as the U.S., Canada, France, the Netherlands and Spain. Also the close links between spatial input-output analysis and spatial interaction analysis have to be mentioned, so that input-output analysis can be dealt in the framework of entropy and information theory.

In the last decades many stringent restrictions of input-output analysis have been relaxed. This has led to new adjustments such as the inclusion of price effects, the inclusion of substitution effects among inputs, the analysis of non-linearities in the production technology, the analysis of product-by-sector-tables (leading to rectangular tables), the development of techniques for updating input-output matrices (for instance, RAS-, entropy and minimum-information principles), and the extension of input-output tables with pollution and energy sectors.

Spatial interactions (for instance, migration and transportation) can also be dealt with in the context of macro-oriented linkage models. There has really been a boom in macro spatial interaction models in the seventies in which gravity and entropy models have played a major role. Very recently, such models have also been used in the context of the analysis of dynamic spatial systems. Also the general Alonso model of movement has to be mentioned in this respect. In recent years, fortunately also much more emphasis

has been placed on the theoretical framework of such models and on their micro-economic foundation.

(4) Efficiency, Equity and Distributional Analysis of Spatial Systems or Plans

Efficiency goals have always played an important role in regional policy analysis, witness also the popularity of cost-benefit analysis. Furthermore, the rapid emergence of operations research in the postwar decades has led to the popularity of programming models for identifying efficient policy decisions. Starting from an efficiency framework for transportation problems, several optimization models have been developed during the sixties and the seventies, among others in the area of land use problems, regional policy problems, urban development policy, allocation problems of scarce human resources, spatial price and location equilibria, and so on.

During the first period of the rise of programming models much emphasis has been placed on the application of linear programming models, especially because of the easily available computer software and the possibilities of interpreting the results of such programming models in a theoretically justifiable way by means of dual prices. These models were also suffering from serious shortcomings, such their linear format, the static nature, the emphasis on efficiency and the neglect of policy conflicts. Consequently, during the seventies several adjustments and extensions have been made, such as: the introduction of qualitative ranking principles, the design of non-linear models (for instance, quadratic and geometric programming models), the development of dynamic structural models (for instance, dynamic programming and optimal control models), the inclusion of additional relevant policy criteria (for instance, spatial equity criteria, distributional conflicts, and spatial externalities), and the development of models for conflict analysis based among others on game-theoric, ideal point or hierarchical principles.

In conclusion, nowadays a large spectrum of optimization methods does exist which can be applied in a systematic and flexible manner to many public choice problems in a regional or urban context.

(5) Conflict and Multiple Objective Decision Analysis

It has already been indicated in the previous subsection that regional optimization models have gradually expanded their scope. One of the most

important developments has been the construction of conflict analysis models. Such models are no longer based on the assumption of one single objective function. Instead, a whole series of welfare indicators is assumed, for instance, maximization of regional employment, minimization of transportation cost, minimization of pollution, and maximization of economic equality. Such a simultaneous optimization of many objective functions requires evidently adjusted methods, based among others on Pareto-optimality analysis. This implies that any good solution of a conflict decision problem should be located on the efficiency frontier reflecting the conflicts and trade-offs among various objectives.

Such models may adopt two different forms. The first one is a straightforward extension of traditional continuous programming models by including multiple target functions in a programming model. In this respect, many methods have recently been developed to find compromise solutions for conflicting objectives (for instance, based on multiple goal programming analysis, game-theoretic pay-off analysis, ideal point analysis etc.).

The second class of models is concerned with discrete decision models, among others for project and plan evaluation including a limited (finite) set of alternative solutions. Such models are usually called multicriteria models. There is also a great variety in multicriteria analyses (for instance, expected value analysis, goals-achievement analysis, concordance analysis, regime analysis, metagame analysis, etc.) These multicriteria models have played a dominant role in many plan and project evaluation problems in several countries (U.S., France and the Netherlands, e.g.).

A final remark is still in order: several multiobjective models aiming at finding compromises among conflicting issues are based on weights for the successive objectives. In order to avoid such weighting schemes it is often more convincing to employ interactive decision strategies based on an interplay between analysts and policy-makers. Such learning procedures once more emphasize the process nature of regional and urban planning. Recently, this has also led to an increased popularity of decision support systems, expert systems and computer-graphic systems in the context of urban and regional planning.

In conclusion, the recently developed multiobjective and multicriteria methods, combined with automated decision aid techniques, offer an innovative and operational contribution to actual regional and urban planning problems.

(6) Statistical, Econometric, Forecasting and Data Processing Techniques

A basic prerequisite for a valid regional and urban analysis is the availability of data anda proper treatment of these data. In the past several methods have been developed for dealing with regional and urban data, such as cluster techniques, principal component analysis, interdependence analysis, multiple regression analysis, canonical correlation analysis, spectral analysis, spatial autocorrelation analysis, etc.

The 'quantitative' revolution has no doubt exerted a significant impact on the methodology of regional science. This has caused much rigour and progress in analytical tools, witness the emergence of a great variety of regional and urban econometric models.

It has to be mentioned, however, that many of these data and modelling techniques are based on the assumption of hard and reliable information, while in practice many data are very weak (for instance, measured on an ordinal or nominal scale). Consequently, recently a whole set of new techniques has been developed focussing of so-called soft data. Examples are: multidimensional scaling techniques, ordinal regression analysis, soft econometric analysis, categorical data analysis, logit and probit analysis, PLS and LISREL models, Generalized Linear Models, etc.
This problem of 'Measuring the Unmeasurable' is once more important, as we are often inclined to 'torture the data' so as to put them on the Procrustes' bed of our rigid models and techniques, instead of flexibly adjusting our old-fashioned models and techniques to the available data. In this regard, also the importance of up-to-date information systems and data-processing techniques has to be stressed. It is surprising that - compared to other sectors of decision-making - the use and quality of urban and regional information systemsis lagging far behind with respect to the potential offered by the modern information technology.

As a whole, one may conclude that modern regional science has provided a lot of interesting and applicable methods which lead to a fruitful treatment of many kinds of data.

(7) (Multi)regional Planning Issues

The problems of lagging (often peripheral) regions are well-known: low growth rates, outdated industrial structures and high unemployment figures. This, of course, has led to sharply controversial issues, such as the debate

on efficiency versus equity.

In this respect, regional science has offered a wide variety of contributions to regional planning problems ranging from empirical case studies, regional planning models to multiobjective multiregional planning models.

In many cases, it turns out to be fairly difficult to include clearly policy instruments and measures in regional planning analyses. This was also a conclusion from an international comparative study carried out at the Institute for Applied Systems Analysis (Vienna). This is evidently a weak point in many analyses, though the current emphasis on more institutional approaches is extremely fruitful. Furthermore, the abovementioned interactive learning strategies in a process planning may be very useful elements in an appropriate regional planning analysis.

It also has to be mentioned that regional planning is not only a matter of a direct use of policy tools, but also of indirect (so-called conditional) measures such as the provision of social overhead capital (or infrastructure). A cross-national study carried out by the EEC has indeed shown the existence of such links between infrastructure and regional development. The empirical estimation of conditional regional economic growth models is however far from easy. As a whole, it appears that in the area of regional planning still a lot of work has to be done.

(8) Local and Urban Planning Issues

During the last decades the main emphasis of regional science has often been on regional analysies: regional growth, regional impacts of agglomeration, spatial equilibrium theory, and so on.

During the seventies, however, there has been an increasing awareness of the negative externalities of urban agglomerations. Many severe problems appeared to emerge in main city centres: segregation, congestion, pollution, criminality, high population density, and lack of local amenities.

In the seventies two striking observations on urban phenomena have been made:

- many urban agglomerations in the industrialized world showed a tendency to a decrease in population (leading to suburbanization and desurbanization).
- the unemployment rate in many urban centres was extremely high, and in many cases much higher than the unemployment rates in lagging peripheral areas.

This has led to a drastic shift in the attention from lagging areas toward urban centres. Beside peripheral regions, many main centres were also regarded as 'problem areas'. Much emphasis has been placed in the seventies on the analysis of agglomeration economies, optimal city size, ghetto formation, diversification of urban structures, spatial mobility and residential choices, and so on. All these studies have contributed substantially to a better understanding of the functioning of cities in a spatial context.

One of the consequences of the attention for urban developments has been the design of urban revitalization (or urban renewal) policies in order to prevent a further urban decay and to stimulate the positive externalities of the urban climate (for instance, by providing better housing, by supplying more satisfactory urban social overhead capital, by implementing more effective migration policies, and by stimulating the labour market).

So, in conclusion, regional science has set the stage for a systematic and operational analysis of urban decay and for a meaningful contribution to urban policies.

(9) Environmental, Resource and Energy Problems

Problems of environmental decay, of resource exhaustion, and of energy shortage have drawn much attention in the seventies. The awareness of the general decline in the quality of life in almost all countries throughout the world has also had a deep-going impact on regional science methods.

A first step has been a thorough study of the concept of externalities in a spatial context. This analysis was very often of a theoretical nature, as it was an attempt to translate concepts from welfare theory to regional-environmental problems. Though its empirical meaning was generally limited, this approach has led to a firm economic basis of studying quality-of-life, resource and energy problems in a spatial context.

Another more operational, development has emerged due to the application of the abovementioned regional science techniques to environmental quality and energy demand analysis. This development has been favoured by including among others pollution and/or energy as special sectors (or sets of sectors) in a (regional or national) input-output table. In respect to this, many regional science methods (such as programming techniques, substitution effects among fuels etc.) provided an extremely useful platform for integrating pollution and energy problems in a broader spatial setting, inter alia by making use of the well-known translog production functions.

Furthermore, many traditional methods for plan and project evaluation had to be adjusted so as to make them more suitable for environmental policy analysis. In addition to and instead of classical cost-benefit analysis, a wide variety of new methods (for instance,multicriteria analysis) has been developed which were more suitable for an operational analysis of environmental quality problems in a policy context.

In conclusion, regional science has developed a lot of new techniques and theories which have led to an extremely fruitful and also operational analysis of environmental and energy problems, leading to much deeper insight into the spatial backgrounds of environmental quality and energy problems as well as into feasible policy strategies.

(10) Spatial Changes, Technological Shifts and Labour Market Developments

The issues of spatial dynamics is increasingly receiving attention. We are more and more becoming aware of the fact that - by focusing attention on structural changes (e.g., in terms of technology and demography)- we are touching some of the key driving forces of spatial dynamics. Much more research however is needed in the field of industrial dynamics (product cycle theory, e.g.) and its relation to urban and regional cycles. Also the emergence and perturbations of agglomeration economies has to be given more satisfactory attention. Especially the incubator hypothesis deserves to be tested in a more rigorous manner. This altogether leads to much more emphasis on micro behavioural research in regional science. In this context, also the structural changes on regional markets (changes in segmentation, or increase in spatial discrepancies, e.g.) has to be mentioned as the labour market is the dual side of technology development. This research area still deserves to be explored in much greater detail.

Altogether it can be concluded that the history of regional science analysis has demonstrated an admirable variety of issues and approaches, which is mainly due to the multi-faceted and multidisciplinary nature of regional science. In the next section, the attention will be paid to the time trajectory of these scientific interest in the past 25 years.

3. Issue Cycles in Regional Science Analysis: A Contents Analysis

The approach in the present section is based on a contents analysis of all 276articles of the Papers of the Regional Science Association from the past 25 European conferences. It is assumed that the contents of these issues

provides a fair representation of the scientific interests and the modes of thinking in European regional science. Clearly, many regional science contributions have also been published in other journals and in book format, but the papers presented at regional science conferences make up the heart of the interest in our discipline.

The regional science movement has been dispersed toward many countries in Europe, witness the geographical distribution of the European RSA conferences in the past 25 years (see Table 1 for a survey). In general, there appears to be a fair balance between East and West, and North and South. Although the Netherlands has the highest record in terms of frequency of RSA conferences in one country, the host city for the twenty-fifth conference, Budapest, has now the highest record in terms of frequency of RSA conferences organized in the same city. In 1986, however, Budapest will have to share this first position with Cracow.

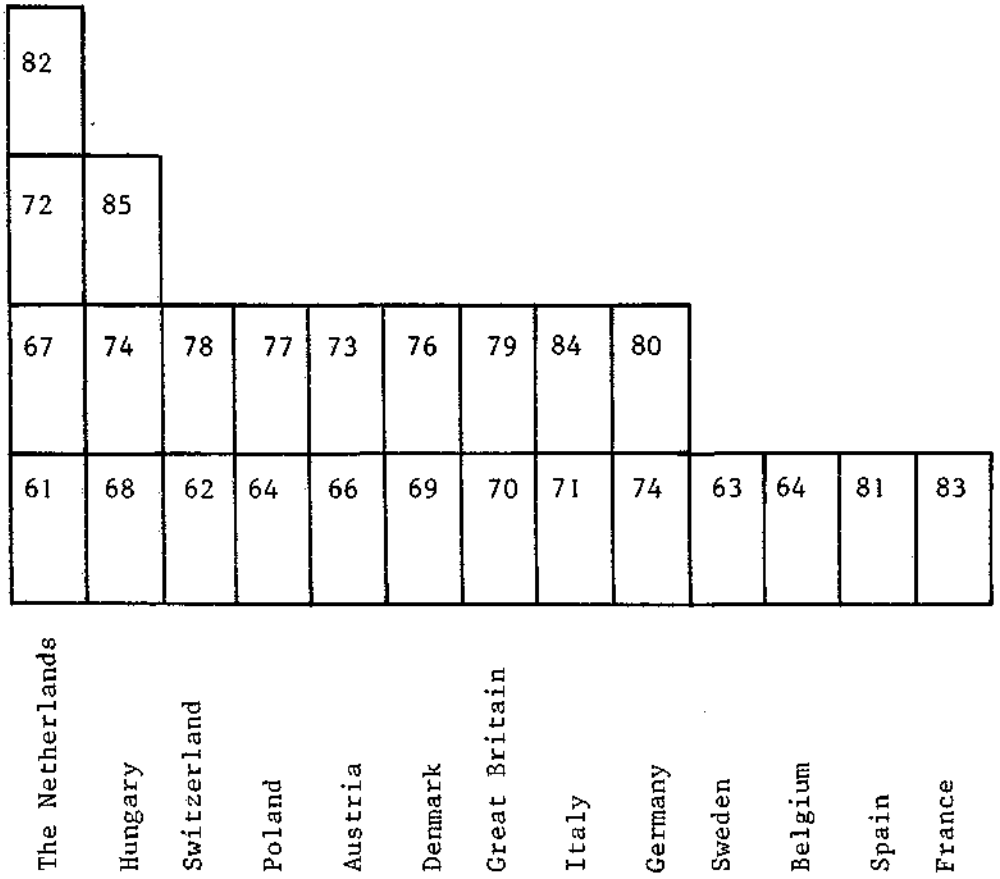

Figure 1. Spatio-temporal distribution of RSA conferences in Europe

Now we will turn back to the 10 issues mentioned above in order to examine whether 'waves' of scientific interest can be identified from a contents analysis of all articles published in the European issues of the Papers of the Regional Science Association.

For the sake of simplicity, each article has been allocated to only one of these 10 issues. This means that the issues mentioned in section 2 have to be described in such a way that altogether they are able to cover the subject matter of all articles. Table 1 gives a description of the contents of all 10 issues.

issues	elements
(1) methodological and conceptual approaches	methodology, theory of regional science, planning theory, conceptual and formal analyses
(2) location and agglomeration analysis	location theory, residential choice theory, agglomeration analysis, industrial complex analysis, allocation models
(3) input-output, spatial interaction and transportation analysis	input-output models, trade models, migration analysis, transport and spatial mobility models
(4) efficiency, equity and distributional analysis	optimization theory and models, cost-benefit analysis, distribution theory and models
(5) conflict and multiple objective decision analysis	conflict theory, game theory, multi-criteria analysis, multi-objective decision-making
(6) statistical, econometric, forecasting and data processing techniques	spatial statistics and econometrics, large-scale modelling, information systems forecasting techniques
(7) (multi) regional planning	regional planning, land use policy, network planning
(8) local and urban planning	facilities planning, metropolitan policy, urban renewal
(9) environmental, resource and energy problems	pollution, energy use, raw materials
(10) spatial changes, technological shifts and labour market developments	spatial dynamics, structural change, innovation, labour market evolution.

Table 1. Description of the contents of 10 issues

Next, all articles from all back issues was characterized by means of only one of the 10 abovementioned issues. Clearly, some articles belonged to multiple issues, but in that case the dominant focus of the article was used as the major classification principle. The relative frequency of each issue in thepast 25 years can be found in Figures 2.a - 2.j. For the sake of simplicity of presentation, the results have been summarized here in 3-year periods. A closer look at these figures leads to some interesting observations.

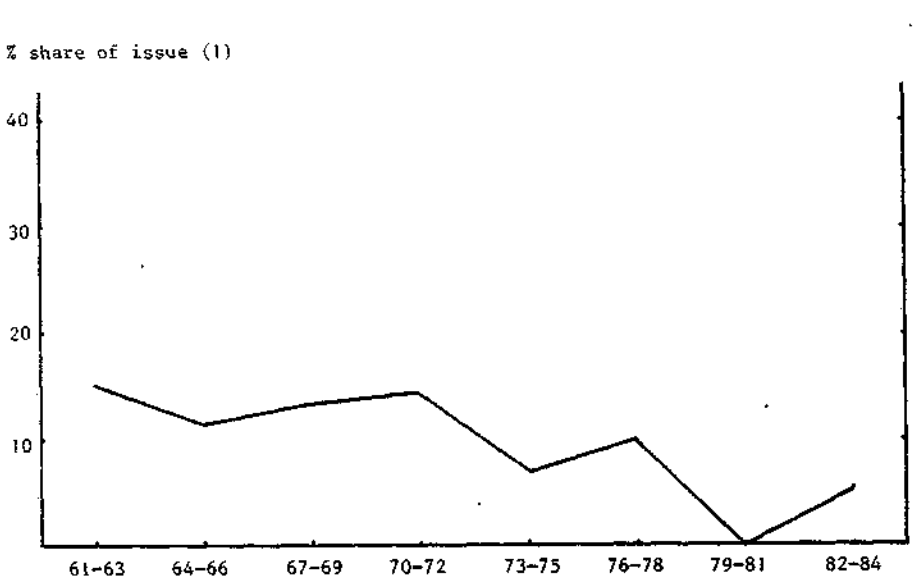

Fig. 2.a. Evolution of the percentage share of issue (1) in European RSA publications

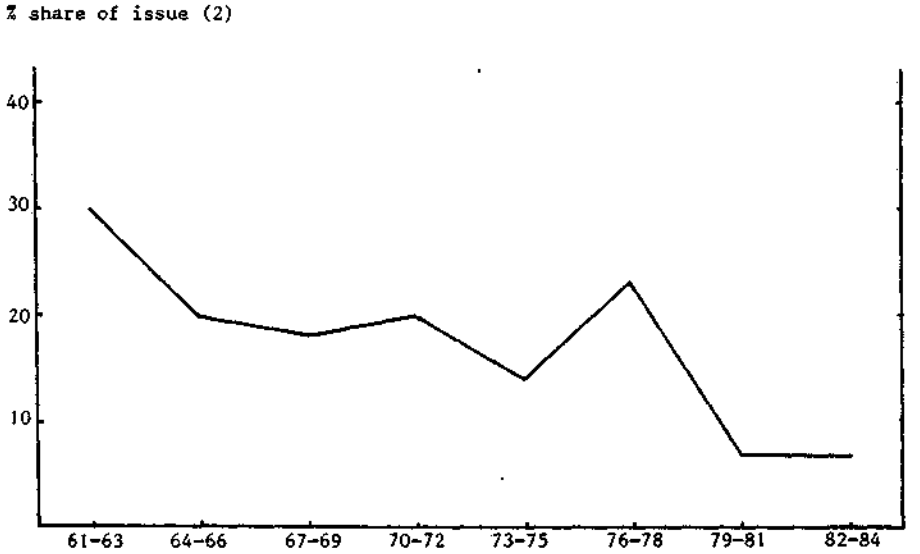

Fig. 2.b. Evolution of the percentage share of issue (2) in European RSA publications

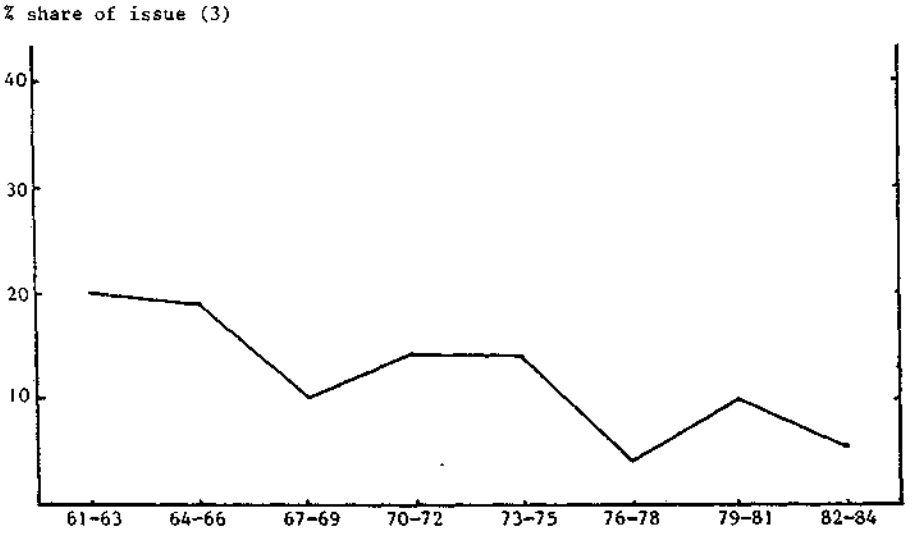

Fig. 2.c. Evolution of the percentage share of issue (3) in European RSA publications

% share of issue (4)

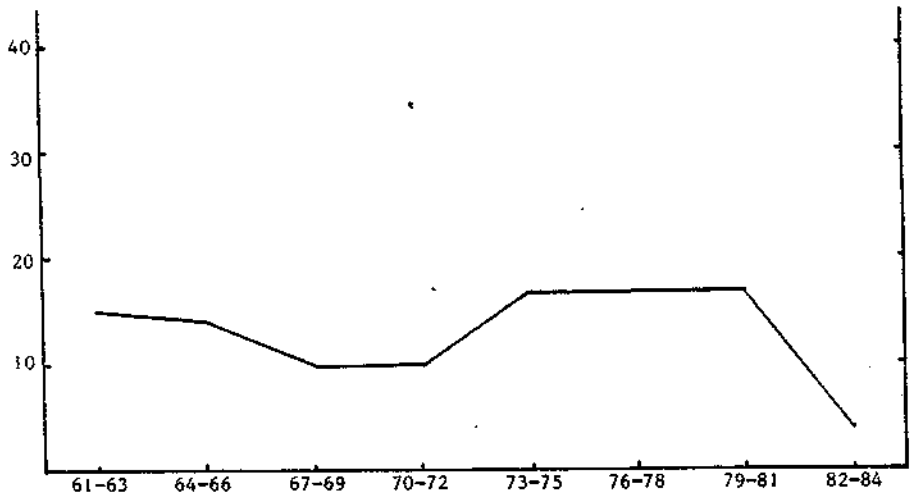

Fig. 2.d. Evolution of the percentage share of issue (4) in European RSA publications

% share of issue (5)

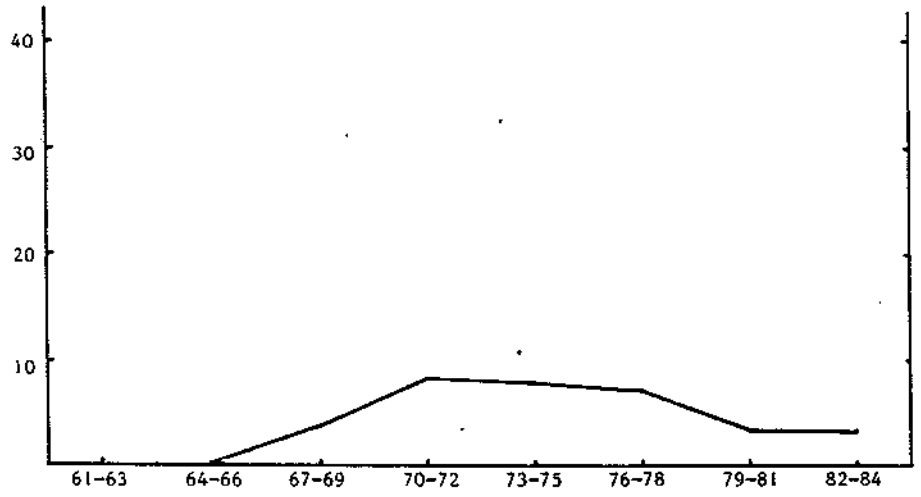

Fig. 2.e. Evolution of the percentage share of issue (5) in European RSA publications

% share of issue (6)

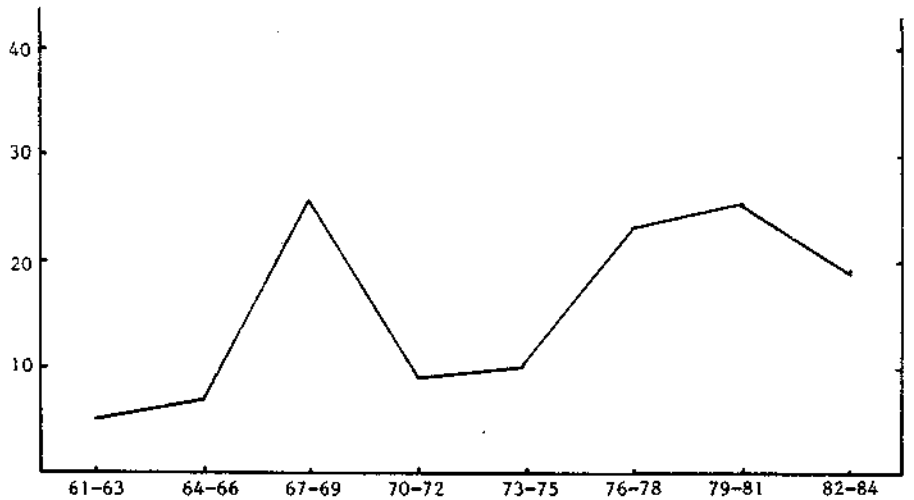

Fig. 2.f. Evolution of the percentage share of issue (6) in European RSA publications

% share of issue (7)

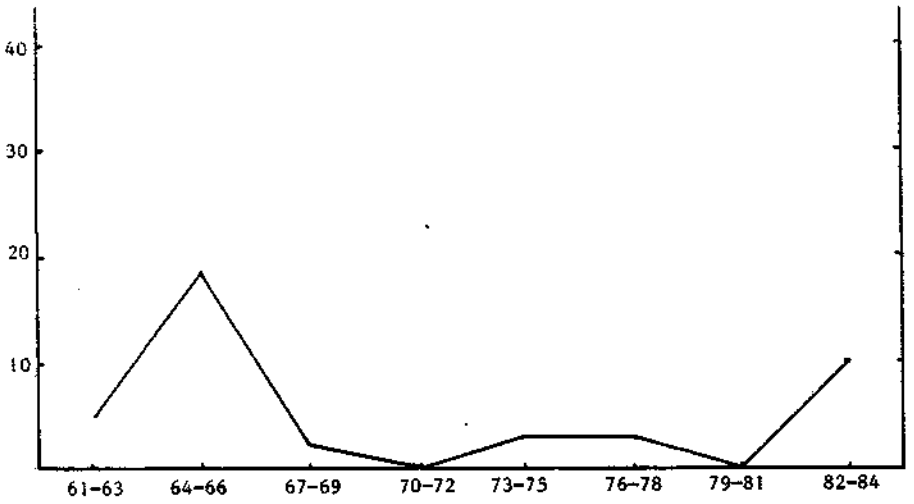

Fig. 2.g. Evolution of the percentage share of issue (7) in European RSA publications

% share of issue (8)

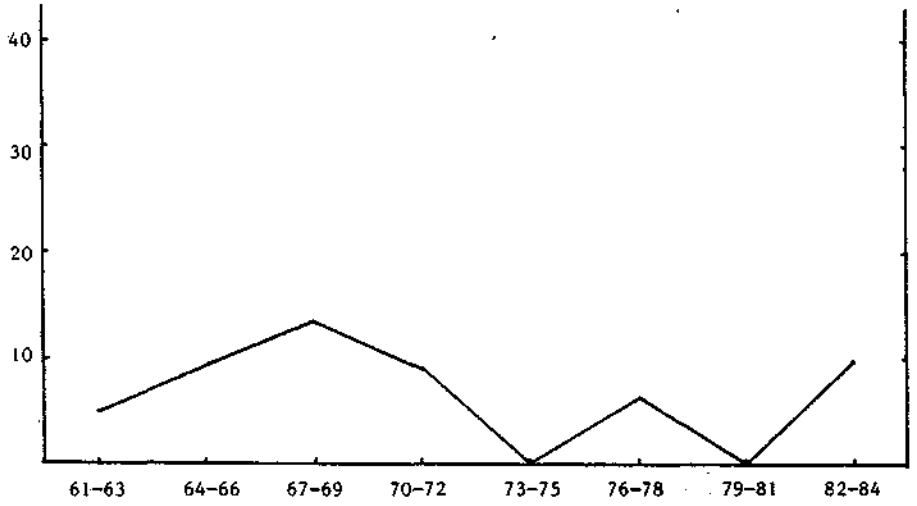

Fig. 2.h. Evolution of the percentage share of issue (8) in European RSA publications

% share of issue (9)

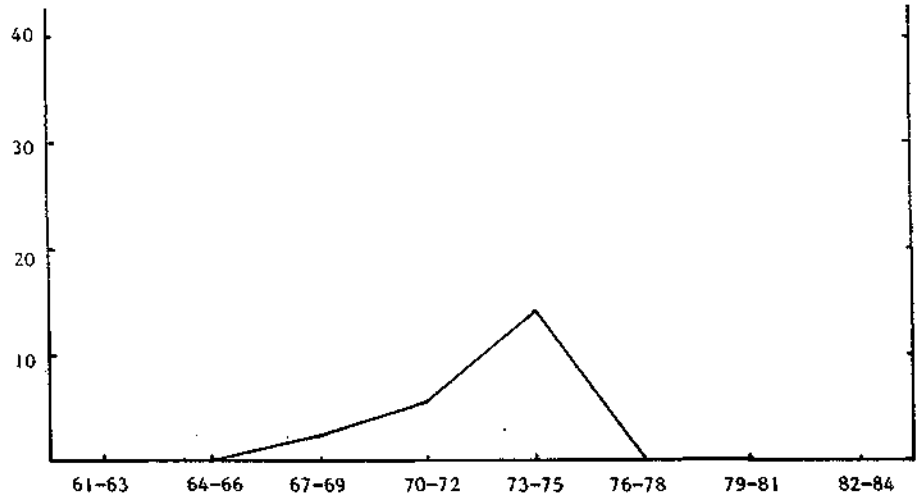

Fig. 2.i. Evolution of the percentage share of issue (9) in European RSA publications

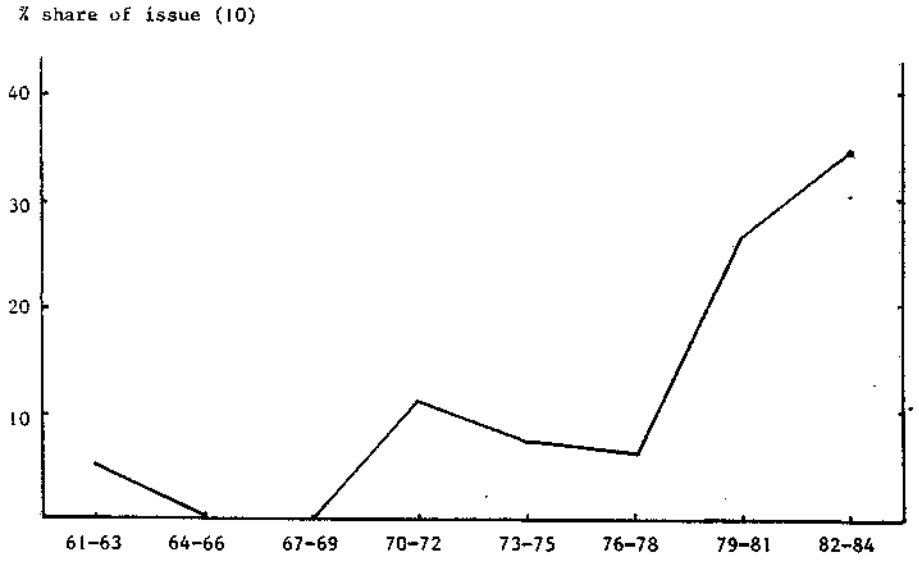

Fig. 2.j. Evolution of the percentage share of issue (10) in European RSA publications

Figure 2.a demonstrates quite clearly that in the early period of the regional science 'movement' in Europe much attention has been devoted to methodological, conceptual and science-theoretic issues. This attention faded away as soon as regional science became an established science.

Location and agglomeration analysis have originally formed the centre of regional science interests. Until the mid seventies this issue could boost a high proportion of publications in the European Papers of the RSA, but since then a paradigmatic shift in interests towards other, new issues has emerged. Figure 2.b indicates the evolution of this paradigmatic shift.

Figure 2.c shows that also spatial linkages (input-output analysis, spatial interaction and transportation) are showing a gradually decreasing degree of interest. Apparently both issue (2) and (3) have reached a certain maturity point in scientific analysis, so that the attention has to be directed toward other issues.

Issue (4) has - apart from the last period - always been a stable source of interest in regional science papers. The pattern of figure 2.d indicates that efficiency and equity aspects have been studied quite intensively in the RSA publications.

Figure 2.e exhibits a typical wave-like pattern: a relatively late interest in conflict and multidimensional policy analysis, leading to an upswing

in the mid-seventies and followed by a downswing in later years. This is an interesting illustration of an issue cycle. It should be added that conflict analysis and multidimensional policy analysis have often been used as analytical tools for the new scarcity, caused by environmental and energy problems. Therefore, it is conceivable that the evolution of interests in issue (5) runs parallel to the time trajectory of environmental and energy issues represented in figure 2.i.

The interest in statistical and econometric modelling techniques shows a double-peaked distribution, with a maximum at the end of sixties (when the potential of mathematical techniques for regional science analysis was first realized) and a second maximum from the middle of the seventies onwards (when the fruits of the 'quantitative revolution' in regional science became increasingly visible). The resulting pattern can be found in figure 2.f.

Figure 2.g suggests only a modest interest in regional planning issues, particularly in the seventies. It should be noted however that implicitly this interest may also be reflected in issue (2) (location and agglomeration analysis), issue (3) (spatial interaction analysis, e.g.), issue (4) (equity and efficiency analysis, e.g.), and issue (5) (multidimensional policy analysis, e.g.). Therefore, this pattern has to be interpreted with caution.

The same holds true for figure 2.h, which reflects the interest in urban planning issues. It is worth noting that this issue cycle started later than the cycle of regional planning (due to the increasing awareness of urban problems at the end of the sixties and the beginning of the seventies), but exhibits a similar pattern.

The pattern of environmental and energy issues has already been discussed in relation to figure 2.e.

Finally, the evolution of the interest in issue (10) is worth mentioning. The interest in structural change in space and time has essentially only started from the beginning of the seventies onward, when the first signs of the economic recession became visible. Especially in recent years there is a remarkable increase in the interest in technological change, innovation and labour market dynamics, witness the upswing phase of the corresponding issue cycle in figure 2.j.

The previous contents analysis shows that for various issues in regional science analysis indeed a fluctuating - and sometimes a wave like pattern - does exist. It may be concluded that such issue cycles are closely related to paradigmatic shifts which are inherent in the historical development of a mature science

Having discussed now the existence of issue cycles, we will turn to a closer investigation of some stronger or weaker points in the regional science approaches in the past 25 years. We will discuss 3 features respectively, viz. the model orientation, the empirical orientation and the policy orientation.

The model orientation concerns the question whether in a certain article a formal (mathematical, statistical or econometric) approach makes up an essential component. Such a formal approach can be used for various purposes (illustration, forecasting, estimation etc.). For each 3-year period again the model orientation of the RSA Papers are examined. The results are presented in figure 3.

The empirical orientation refers to this question whatever the application of a certain theory or method is of crucial importance in the article. This also means then that empirical results have to be included in this article. The evolution of the empirical orientation of RSA publications can also be found in figure 3.

Finally, a policy orientation means that the analysis or solution of a specific policy question stood central in the paper at hand. It can of course not be denied that many articles are (in principle) policy relevant, but the question here is whether the article aimed at tackling an a priori given public policy or decision problem. The resulting time trajectory for all 3-year periods is also reflected in figure 3.

Figure 3 leads to some interesting observations. First, despite some variations the RSA publications have always been marked by a strong model orientation: in almost all periods more than 60 percent of all articles in the European Papers of the RSA were model-oriented, with a slight tendency toward an increase in model orientation over the past 25 years.

Second, despite often heard criticism a considerable proportion of the RSA papers appear to be empirically-oriented. In almost all years, at least 40 percent of all contributions focussed on empirical issues. It is remarkable that the highest share of empirical contributions can be found in the first periods, when the need to justify regional science as a discipline in its own had to be more demonstrated on the basis of empirical relevance, and when the 'quantitative revolution' had not yet taken place.

Thirdly, the policy orientation of RSA articles is no doubt somewhat lower, but also in this respect it has to be stated that policy papers are by no means underrepresented in the RSA papers (30 to 40 percent). It should also be mentioned here that the policy orientation at the beginning was somewhat higher.

A comparison of the trajectory of all 3 curves teaches us that the evolution of empirically-oriented papers and of policy-oriented papers runs very much

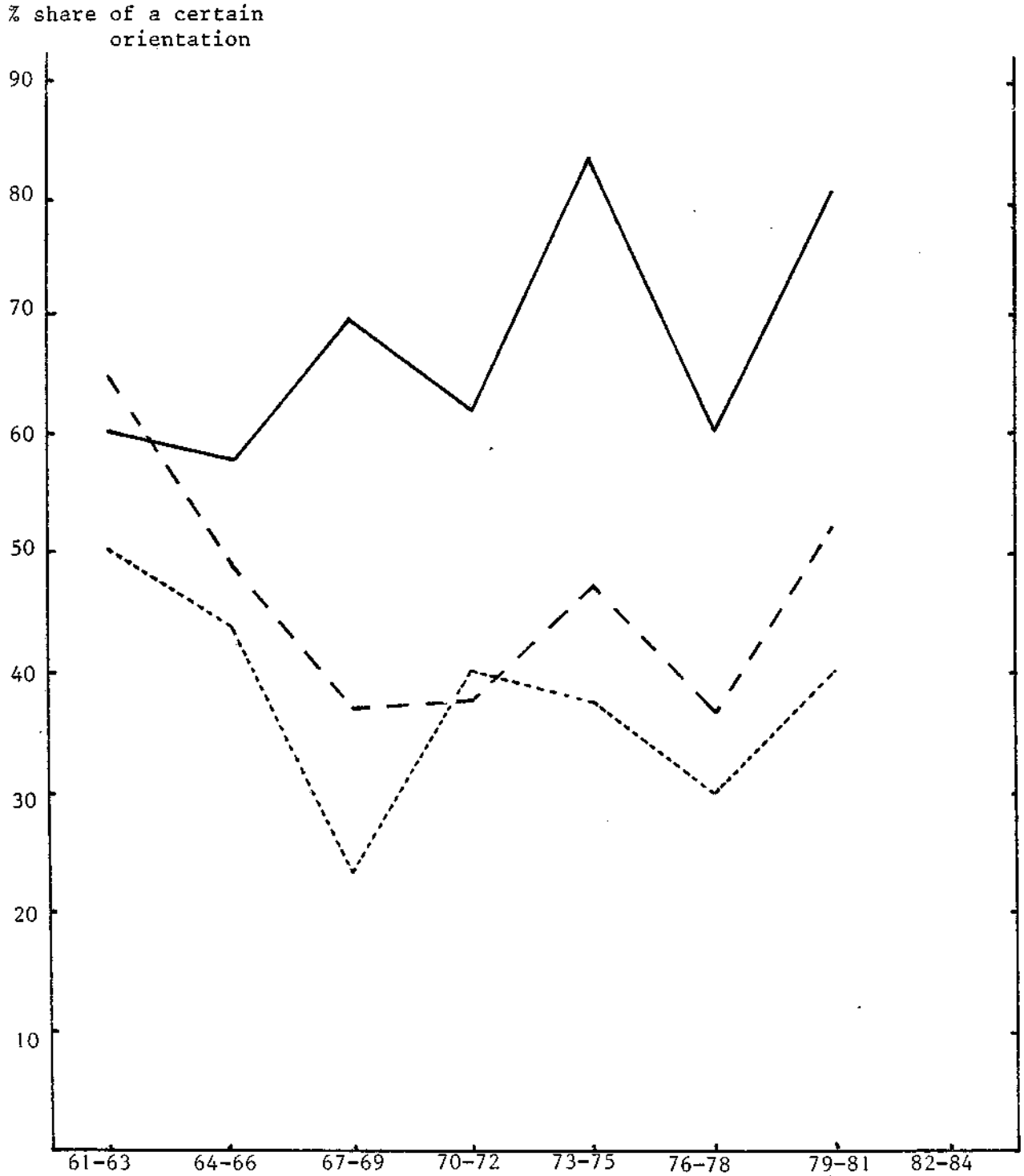

Figure 3. Evolution of model orientation, empirical orientation and policy orientation in European RSA publications.

_____ model orientation

_ _ _ _ _ empirical orientation

---------- policy orientation

parallel. It is also interesting to observe that from the end of the seventies onwards the evolutionary pattern of model orientation, empirical orientation and policy orientation is moving in the same direction. This trend suggests that in a mature stage of regional science modelling efforts have supported the need for a more clear practical and policy focus of regional science analysis. To some extent, one might claim that the interest in modelling, practice and policy was more balanced in the earlier days of the European RSA than it has been in seventies. In this respect, it is an enormous challenge to undertake a serious endeavour to restore the balance.

4. A Prospective View

On the basis of the foregoing sections, a few observations are to be made. First, quantitative approaches have been dominating driving forces in regional science and have no doubt increased its operational character, although in various cases a 'l'art pour l' art' attitude may have worked in the detriment of a further acceptance of regional science. One may expect that a formal orientation will also be a major feature of regional science analyses in the future.

Next, the policy orientation of regional science theories and methods deserves more attention. Regional science policy analysis is still an underdeveloped field and is often only a derivative of nations from planning theory and economic policy theory. Conflict analysis, theories on organizational behaviour (including X-efficiency), and 'satisficer' and 'justificer' principles have to be developed in more rigorous manner and to be tested against empirical facts.

The sometimes underrepresented empirical contents of regional science analyses may to a large extent be due to lack of real-world data. In this respect, two complementary directions can be chosen, viz. (i) the design of operational, up-to-date automated information systems (based on spatial referencing) and decision-aid systems (decision support, artificial intelligence, e.g.), and (ii) the development of new adjusted models and techniques which are able to encapsulate inaccurate, qualitative or soft data (based on recent advances in the area of 'measuring the unmeasurable'). In this context, it is also necessary to draw more attention to the development of operational econometric and statistical tools for the estimation of non-linear dynamic models incorporating qualitative changes (singularities, bifurcations etc.).

In addition, much more attention than in the past should be paid to micro-behavioural analysis, as it is increasingly realized that the real explanation for spatial processes and spatial dynamics can only be found by means of an analysis of individual motives. In this context, a closer orientation toward spatially-

oriented panel and longitudinal studies and dynamic disaggregate choice analysis is a prerequisite. Integrated human activity approaches may then be placed in new operational framework.

The analysis of issue cycles in section 3 has shown that the scientific interest in many issues is the result of exogenous circumstances (for instance, the environmental crisis, the economic recession). In this respect, the question may be raised which issues are likely to play a dominating role in regional science analyses in the next 25 years. The answer to this question requires clearly more rational speculation than hard facts, but perhaps a few directions may be mentioned.

First, the drastic demographic changes in most countries will no doubt exert a profound impact on regional labour markets, housing programmes, the use of amenities and of transportation infrastructure. It is foreseeable that the role which is currently being played by technological change in spatial dynamics is likely to be taken over by demographic change in the next decade.

Second, social changes (such as emancipation, segregation etc.) will continue to exert drastic influences on mobility patterns, labour force participation, housing demand and so forth. A long-term view on such phenomena is necessary for regional science analysis in order to assure a balance between the new emerging trends on the one hand and the set of available methods and theories for studying them on the other hand.

Besides, the impact of new technology on spatial location and interaction patterns is likely to influence the spatial and social organization of our society in a profound way in the nineties. This is evidently a rich research field for regional science.

Next, structural changes and spatial dynamics take place in an interplay between policy dynamics and individual dynamics. Recent contributions in the area of political science indicate that policy cycles (in terms of 'waves' of interest from policy-makers and sometimes of drastic political shifts) are a real phenomenon in a dynamic society, witness the debate on regulation versus deregulation. The same holds true for individual attitudes and behaviour. The links between spatial dynamics on the one hand and policy and individual cycles on the other hand would be a promising field of long-term regional science research.

It may be concluded that in the past 25 years the European RSA has fulfilled to a large extent its high expectations and ambitions. This is no doubt a promise for the next 25 years.