ESTUDIOS DE ECONOMÍA APLICADA VOL. 23 - 2, 2005. PÁGS. 289-298

Sectoral Economy: Do sectors Really Matter?

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ABSTRACT

This paper gives an overview of economic theories and models in the tradition of sectoral analysis and introduces the articles in this special issue. Some actual questions in the debate are highlighted and the attempt is made to give some legitimacy for the sectoral perspective. As one general conclusion one might state that the sectoral perspective or method is valid, if the macroeconomic (=aggregate) outcome of the analysis is considerably different from the outcome of aggregate analysis. The articles in this special issue represent a list of good examples for the validity of the sectoral perspective.

Keywords: Multisectoral Models, Input-Output, Economic Growth

Economía sectorial: ¿Son relevantes los análisis sectoriales?

RESUMEN

En el presente artículo se realiza una revisión de las principales teorías y modelos recogidos en la literatura del análisis sectorial y se realiza una presentación de los distintos originales recogidos en la sección monográfica.

Se han intentado recoger los aspectos más significativos del moderno análisis sectorial tratando de justificar el interés y la relevancia de estos estudios de tipo metzo-económico.

Como principal conclusión estableceríamos que los análisis sectoriales tienen su máximo interés cuando de la agregación de los resultados individuales se pueden obtener conclusiones significativamente diferentes de la que se obtendrían del mero análisis macroeconómico agregado. En este sentido, los artículos recogidos en este monográfico representan un buen ejemplo de la validez de este tipo de análisis desagregados.

Palabras Clave: Modelos multisectoriales, Input-Output, Crecimiento económico.

Clasificación JEL: C67, C68, O41.

Artículo recibido y aprobado en julio de 2005.
Artículo disponible en versión electrónica en la página www.revista-eea.net, ref.: e-23214.

ISSN 1697-5731 (online) – ISSN 1133-3197 (print)

1. INTRODUCTION

The sectoral perspective in economic analysis is directly linked to the issue of structural change. Shifts of resources, output and employment between different sectors accompanying the process of economic growth have been recognized as a possible challenge for adjustment in industrialized economies. Economists interested in this issue clearly advocate the sectoral perspective, but the mainstream hypothesis in economics tends to classify this issue as a short term problem of adjustment. That structural change might not only represent a short run adjustment problem, but a serious challenge for sustained economic growth has been stated by Baumol (1967) in his famous model of 'unbalanced growth'. The concept in this first article has been further developed by Baumol himself and other authors (s. for a recent contribution: Echevarria, 1997) to identify more clearly the conditions for unbalanced growth. Recently Oulton (2001) and Ngai and Pissarides (2004) have made important contributions to this question with more 'optimistic' conclusions for long run growth under certain assumptions. Although this debate is far away from concluded it seems that it had an important influence on mainstream economics to accept the sectoral perspective as a relevant tool of analysis. This is further enforced by recent work of Jorgenson (e.g.: Jorgenson, Ho and Stiroh, 2003) showing that empirical results of growth accounting are completely different when applied at the disaggregated level of industries.

Besides this debate the (rather heterogenous) group of economists who has been advocating the sectoral perspective ever since has made important contributions to economics as shall be reassessed in this paper. That refers especially to input-output analysis with all its extensions and to the different types of multisectoral modelling. Important new issues in economic policy (economic integration, CO_2 emissions reduction, product market liberalization) can only be addressed adequately by disaggregated modelling approaches.

During the history of economic theory and modelling several frameworks of dealing with a sectoral framework have been put forward. Models of different social classes and corresponding sources of income were a typical feature of the theories of 'classical' economists like Ricardo and Marx. The core of the economic analysis was a theory of income distribution for wages, rents and profits linked to a theory of value. In the analysis of Marx that corresponds to a model of production with different sectors (capital and consumption goods). Another similar approach was constructed by the 'outsider' in economics Quesnay in his famous 'tableau economique'. An important study that took up these concepts of the 'classical' school and integrated it into an elaborated model of economic growth and structural change was published by Pasinetti (1981). He uses the concept of 'vertical integration' where each sector only produces final goods and deliveries of intermediate goods between sectors are ignored. The

emphasis of Pasinetti is on the issues of the 'classical' school, like capital accumulation, full employment and the distribution of income.

One of the most important innovations in sectoral analysis undoubtedly has been the contribution by the founder of input-output analysis, Wassily Leontief. In 1941 he published empirical results of his new methodology for the American economy and set the base for the diffusion of input-output analysis in economic research. The potential of this tool based on the full accounting for all links between sectors via intermediate demand turned out to be enormous and the methodology soon was adopted and further developed by Leontief himself and many others. Extensions of the impact analysis of the static model were carried out into the direction of different impact or inter-sectoral linkage methods (forward linkages, backward linkages, extraction methods, chains of production, etc.) and into the direction of extending the accounting framework (Social Accounting Matrix as in Pyatt, Round, 1985 or environmental satellite systems and full environmental analysis as in Leontief, 1970). There are numerous textbooks that give an overview of the state of art in input-output analysis (e.g. Fontela, Pulido, 1993 with applications for Spain and the most recent study: Dietzenbacher, Lahr, 2001). In conclusion input-output analysis can be seen as an established field of economic analysis with bi-annual international conferences (s.: www.iioa.at) and the field journal *Economic System Research*, where contributions to all types of input-output applications can be found.

Another completely different approach to sectoral analysis is chosen by industrial economics. The sector in this type of analysis is described by a number of firms and empirical work is also carried out on firms´ data. That opens up the possibility of new and promising statistical methods (especially panel data econometrics). One central issue in this partial analysis is the market form and the degree of competition in the sectors. The theory of industrial economics has also linked the productivity and cost efficiency in firms to the degree of competition, most prominently in the concept of X-inefficiency. This analysis therefore delivers important insights for sectoral issues like competition or productivity and technical change. This enables the modelling community to describe the single industries in more detail for a sound foundation of macroeconomic sectoral modelling.

The question about the relevance of sectoral analysis is therefore linked to many issues and fields of research. Two main issues shall be singled out here: (i) input-output analysis and multisectoral modelling and (ii) the debate on economic growth and structural change. This paper therefore starts by exposing important issues and recent developments for these two prominent examples of the importance of the sectoral perspective. Then the paper introduces the articles in this special issue as good examples of the relevance of sectoral analysis.

2. MULTISECTORAL MODELS

It is almost impossible to give an overview of the literature on multisectoral modelling. Undoubtedly the most prominent position in this field is taken by the approach of Computable General Equilibrium (CGE) models. The CGE approach is a widespread methodology used by many researchers all over the world and addressing a wide range of economic policy questions. One of the early applications of CGE modelling was the welfare impact of trade liberalization. The main motivation for the sectoral disaggregation was a consumers' model where a certain combination of goods creates a certain level of utility and the Heckscher-Ohlin trade model differentiating between 'export' and 'import' goods (s.: Dinwiddy, Teal, 1988). The macroeconomic perspective in terms of multiplier effects was neglected in this analysis, as these issues were seen as long run issues and the analysis focused on welfare depending on the adjustments in the production (commodity) structure in the economy. It is obvious that a shift in the interest of economic policy away from the traditional macroeconomic questions to issues of economic integration (trade liberalization), competitiveness and other issues where the impact might be concentrated in certain sectors (energy and environmental issues) favoured the use of multisectoral models. That might be seen as one reason why CGE modelling expanded so rapidly in its application during the 1990es. The study by Shoven, Whalley (1992) shows the state of the art of CGE modelling at that time of its surge. Another reason for the success of CGE modelling can be seen in the huge increase in productivity by standardizing model features, software and data bases. There is one dominant modelling approach (GTAP, s.: Hertel, Tsigas, 1997) that can be easily approached and enables researchers to get an applied model without devoting huge resources to data collection and model building.

It must be noted that although CGE modelling has become a dominant approach other lines of multisectoral modelling have been developed and there is a debate between CGE and other modellers on the adequacy of their respective tools. There have been other large and ongoing research projects on multisectoral modelling based on a combination of input-output analysis with econometric techniques. Two traditions in this line are the INFORUM model coordinated by the University of Maryland (Clopper Almon and his collaborators) and the 'Cambridge Growth Project' founded by Sir Richard Stone. The latter is now carried on by Cambridge Econometrics led by Terry Barker and has moved from a purely national perspective for Britain to a European modelling framework (s.: Cambridge Econometrics, 2000 and http://www.camecon.co.uk/e3me/index.htm). Another recent example of a global multisectoral model is GINFORS (Lutz, Meyer, Wolter, 2005) that is currently used for assessing issues of sustainable development. One main difference between CGE modelling and these multisectoral macroeconomic models can be seen in the 'macroeconomic closure'. In the typical open economy CGE model investment might change due to changes in savings, i.e. it is savings driven and the real exchange rate

adjusts to achieve equilibrium. Another assumption is full employment in the labour market (mostly in a competitive labour market). As Robinson (2004) has pointed out recently this 'neoclassical closure' rule represents only one out of four different potential closure mechanisms in a small open economy model. There are two alternative 'Keynesian' closure rules with fixed foreign savings and with fixed investment respectively but without assuming full employment of labour. Applying the 'Keynesian' closure rule with fixed foreign savings leads to a model where the real exchange rate (and therefore prices) adjusts to achieve equilibrium and a positive macroeconomic shock is able to increase employment together with a simultaneous decrease in the real wage. The macroeconomic outcome therefore is similar to a macroeconomic model, where -for example- higher public investment leads to an increase in output, employment and -via the Phillips curve mechanism- to a lower real wage rate.

A special debate on the differences between CGE and macroeconomic modelling concerning the relevant features and the simulation results for identical scenarios has taken place in the field of environmental economics. A comparison of model results from a CGE and a macroeconomic multisectoral model for Europe has been shown by Barker (1999). In a recent European model comparison project the differences between a group of models have been revealed and documented (s.: www.transust.org). The main conclusion of this project was that multisectoral macroeconomic models tended to yield a 'double dividend' (better environment & higher output and employment) in a scenario of taxing CO_2/energy and reducing labour taxation, wheras CGE model results showed a trade off between better environment and higher output.

3. THE MODEL OF (UN-) BALANCED GROWTH

The challenge of combining a model of stable growth along a steady state with structural change between sectors with different productivity paths was formulated by Baumol (1967). In this model the service sector as the 'stagnant' sector with low productivity growth attracts labour and thereby lowers the overall growth rate of the economy. As a side effect this attraction of resources by the 'stagnant' sector leads to a permanent increase in the relative price of this sector and an overall price increase (the 'cost disease' phenomenon). Although this original model might be seen as extremely pessimistic concerning the long run perspectives of highly industrialized countries it has put forward a general problem of combining a certain pattern of structural change ('teriarisation') with stable aggregate economic growth. Although Baumol himself and others have further developed this approach and focused on the conditions for this outcome this general problem has still to be addressed. In Echavarria (1997) and Ngai, Pissarides (2004) wether Baumols 'pessimistic' outcome is reproduced or not depends on the functional forms of the utility function of consumers.

But also in Echevarria (1997) the general problem of combining tertiarisation with stable growth remains, as structural change ceases when the stable growth path is reached.

There is recent research that directly adresses Baumols' question and that puts the emphasis on the interaction between drivers of TFP growth in different sectors, intermediate input demand and tertiarisation. Peneder, Kaniovski and Dachs (2003) discuss the link between tertiarisation and the introduction of IT and new organizational models of the firm. One main result is that intermediate demand for services plays an important role in the process of tertiarisation. This aspect has been fully neglected in the original model of unbalanced growth, where the 'stagnant' service sector produced for consumers and the interaction between structural change and economic growth was determined by price and income elasticities in private consumption and the magnitude of the 'cost disease' effect in a stagnant economy. Oulton (2001) showed that the results change considerably by taking into account intermediate demand for services and that small productivity increases in the services sector are not a threat for an overall stable rate of growth in that case.

Recent empirical research on these issues has been undertaken by Jorgenson (s.: Jorgenson, Ho and Stiroh, 2003) in a growth accounting framework based on detailed sectoral data from input-output analysis and other sources for the US. New methodologies of accounting for capital services (hedonic prices) and for different skill types of labour also play an important role in this analysis. The main result is that the contribution of TFP to overall economic growth can be reduced considerably compared to the results from an aggregate analysis. This can be seen as an important advocacy for sectoral analysis. On the European level there is a large research project carried out in the line of Jorgenson's recent work that should deliver important insights to the main drivers of economic growth in disaggregated framework for Europe (s.: http://www.euklems.net/). So far two general conclusions can be drawn from this debate for the relevance of the sectoral perspective. First of all the large difference in aggregate results compared to the aggregate analysis is a clear indication for the adequacy of sectoral analysis. Second the basic features by which service sectors are described in most models as the 'stagnant' sectors might not be adequate. Partial analysis of productivity dynamics in different sectors, especially taking into account sectoral product market reforms (liberalization, deregulation) and their consequences might help to improve the description of tertiarisation in applied modelling.

4. THIS SPECIAL ISSUE ON "SECTORAL ECONOMY"

The special contribution "The position of Metalworking Industries in theStructure of an Industrializing Economy" in this issue is an unpublished work by Wassily Leontief, the founder of input-output analysis and Anne Carter, one of his intensive collaborators in the early years of this methodology. In this paper the metalworking

complex and its relations with the rest of the economy is described by intensive use of input-output tables. The objective of the analysis was to gain insights in the macroeconomic importance of this industrial complex and deliver a foundation for economic planning, either at the level of industrial policy or at the level of individual investment projects. The paper represents a good example for the practical usefulness of input-output analysis.

The other contributions can be divided into two different fields of 'sectoral economic analysis'. First we find three papers dealing with partial analysis of one sector or market, but with crucial issues in the debates surrounding sectoral analysis, like productivity and unbalanced growth or competitiveness and macroeconomic performance. Two of these single sector papers are dealing with productivity in service sectors and addressing the important empirical questions of efficiency, technical change (diffusion of IT) and productivity in personal services. These aspects have played an important role in the discussion about the model of unbalanced growth (s.: Oulton, 2001). The first of these studies is the one by Seijas Díaz, "Análisis de la eficiencia técnica en la educación secundaria". It evaluates the performance of the secondary education centres of spanish region using different specifications of Data Envelopment Analysis (DEA) and also including sensitivity analysis. DEA can be seen as one major tool for the analysis of efficiency based on the linear programming approach, which is linked to the analysis of technical change in input-output analysis. Seijas Diaz clearly concludes that the technical efficiency of the centres analysed is comparatively high and that the factors, which cannot be controlled by the manager play an important role for the efficiency of the centre.

The second paper in this group is the study on "Causal Relationships between Intangibles and Overall Assessment of the Service Received in a Travel Agency" by Esteban Alberdi, Rubio Andrada and Rodríguez Antón. The leading idea in this article is the correlation between the use of intangible assets and the perception of a differentiation in the service received by consumers for the case of travel agencies. This relationship is described as the outcome of restructuring the sector aimed at finding new competitive strategies. The methodology applied is a covariance structure model that allows the authors to derive an overall index of consumers' satisfaction and its link to intangibles.

Another of the single sector papers in this special issue deals with competitiveness and macroeconomic performance, which is a key issue in the European debate on structural reforms within the 'Lisbon agenda'. The article "Game Theoretic Analysis of the Evolution of Competition in the Spanish Power Sector", by Yepes Rodríguez studies the evolution of competition in the Spanish power market within a game theoretic approach.The model is numerically implemented and among the results it can be highlighted the level of competition and the degree of market power, dynamic investment patterns, the role of entry barriers, the efficiency of the sector as compared

to a perfectly competitive market and total market surplus as well as its distribution between industry and consumers.

The other papers in this special issue all have a multisectoral perspective applying such divergent methodologies as different fields of input-output analysis (linkages, extraction methods, etc.), general equilibrium modelling and statistical cluster analysis.

The paper "Reviewing Structural Analysis from Factoral Analysis: An Application to the European Economies" by Soza Amigo and Ramos Carvajal represents a good example of the huge analytical potential of input-output analysis. First the authors review the methodologies of forward and backward linkages and hypothetic sector-extraction also showing the development in this area of research. Then synthetic indices are derived from the alternative approaches to input-output analysis. In a second stage, applying the multivariate technique of factoral analysis, yields a series of these synthetic indices. These indices are used for a comparison of the economic structures of three European countries revealing the common features of these structures.

Cardenete Flores and Llop Llop ("Multisectoral Applied General Equilibrium Models in Spain: A Review") give an interesting overview of CGE modelling in Spain showing that this widespread methodology also has found a large field of application in Spain. They show the economic policy areas where CGE has been applied in the case of Spain, revealing the special role of fiscal policy. A very interesting aspect of this study is the comparison between models with perfect or imperfect competition. Introducing imperfect competition into CGE modelling can be seen as an important development of relaxing the usually restrictive assumptions of the economic theory underlying CGE models. Cardenete Flores and Llop Llop also include other recent trends in applied CGE modelling in Spain like the extension to regional analysis.

The article of Dietzenbacher, Romero and Bosma represents another example of the high potential of input-output analysis. The authors show in their article "Using Average Propagation Lengths to Identify Production Chains in the Andalusian Economy" why the economic distance between sectors matters and how it can be treated. They start from the well known concepts of production chains and linkages and measure distance as the average propagation length, i.e. the average number of steps it takes an exogenous change in one sector to affect the value of production in another sector. The advantage over the linkage methodology is that this distance does not depend on whether the linkages are forward or backward. The production structure of the Andalusian economy is then described by combining the size of the linkages and the distance between sectors.

The paper "Local productive systems in Castilla y León: recognition and main features" of Juste Carrion and Fernández Arufe attempts to provide an approximation to identify the local productive systems existing in the region. It makes use of a detailed data set of an industrial census at the level of municipalities in Castilla y

León and also uses factoral analysis in order to derive synthetic indices of industrialization. This is further used in a cluster analysis to measure the concentration and industrial specialization of municipalities. Given the very detailed data set a lot of interesting results describing the productive system of Castilla y León can be derived.

«Creating Industry Classifications by Statistical Cluster Analysis» by Peneder analyses the use of cluster analysis to derive sectoral classifications according to certain characteristics. First he compares different measures of distance or dissimilarity between sectors and shows in a sensitivity analysis how results are influenced by the choice of measure. That leads to the proposition of a three stage clustering process which is carried out for the educational and occupational characteristics of the workforce of the different sectors.

Gomez García and Rico Gonzalez show in their paper «La mujer en el medio rural de Castilla y León: Diversificación sectoral y proceso de dinamización económica» how the constant process of emigration from the rural area of Castilla y León negatively affects the economic structure of those areas. The authors analyse a relationship between changes in the population structure towards a highly aged, male rural population and the lack of potential human resources for new economic activities, where women represent a major driving force. The structural change towards a diversification of activities (away from agriculture) therefore is hindered by the female emigration.

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