Research Situation and Tendency of Input-Output Analysis

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Abstract

Input-output analysis can reflect the national economic departments between input and output of direct contact and indirect contact, thus has been widely used. More than half a century, through the research and application of the economist, the increasingly mature theories and methods, and extended to some new industry. This paper introduces the basic theory and application of the input-output method, and the present research situation and trend analysis in detail.

Keywords

Input-Output Analysis; Dynamic model; Optimization model.

1. Introduction

Input-output Analysis, also known as "input-output technology", "department contact balance method", "industrial connection method", is put forward by the famous American economist Wassily Leontieffor the first time in the 1930s [1].Input-output analysis is an economic quantitative analysis method to study the interdependence relationship between the parts of input and output of the economic system. And it is used in economic analysis, policy simulation, economic forecasting, planning and economic control, etc. It is a combination of economics and mathematics, and it belongs to the interdisciplinary sciences. The “input” in Input-output analysis refers to various inputs (including intermediate input and initial input) in the process of economic activity and its source. Intermediate input (also known as intermediate consumption) refers to the production of raw materials, auxiliary materials, fuel, power, and various services, which are the need for the product. Originally input refers to the input of the added value and so on various elements, including depreciation of fixed assets, tax net and operating surplus laborers remuneration, production. Broadly speaking, input also includes the occupation of fixed assets, current assets, natural resources and labor and so on in the economic activity process. The “Output” in input-output analysis refers to the results of economic activities (such as a certain quantity of a product or service) and the direction of its distribution and using (including intermediate and final), such as used in the production of consumer (middle products), cost of living, net exports and soon (the latter three referred to as the final product).Intermediate use refers to all parts of the economic system, such as the part of products of national economy departments are used for the middle consumption; middle use refers to the products which are used in final consumption, capital formation and net export. Under the condition of market economy, the interdependence relationship of input and output between various parts of the economic system manifest Commodity Exchange relationship, namely the relationship as a commodity buyer, as resources occupy the relationship or users, as sellers, etc.

Input-output analysis can be used in the analysis and measurement in a region, department or the economic activities of the industry, not only the analysis of a company or enterprise's production and operation, but also the analysis of the international economic relations, can use this method to analysis and study [2, 3].Its main application are: 1) the analysis of the relationship between the economic structure, the departments and industry;2) economic forecasts and long term planning;3) research the cost of production and the main price of the product;4) the analysis of the effect of economic policy.

After the practice and development of national scholars more than half a century, input-output analysis theory and method have become increasingly mature, and become a basic tools to study

macro-economic activities, economic analysis and prediction and making economic development plan. Later analysis in recent years is discussed in detail in the present situation of research and trend of output analysis in this paper.

2. The compiling work regularly and institutionalized

Now there are more than 100 countries in the world often prepare a list of the input and output. Some major countries, such as Japan, the Netherlands, and the United States, other OECD countries and developing countries such as China every four to five years prepare a list of the input and output regularly. Input-output table has become an integral part of national economic accounting.

Now prepare a list of the input and output in the world mainly used three methods: survey, non-survey method, HYBRID technology (local survey).Survey method has the advantage of high precision, reliable data compiled by the tables, and the main drawback is that requires a lot of manpower and material resources, tabulating cycle is long. In the past time all input-output table in our country is use survey compiled basically. The advantages and disadvantages of the survey method is exactly opposite of investigation method. HYBIRD technology combines the advantages of the former two methods, and this method has been used in Australia and other countries at present. Therefore, in terms of tabulating method, HYBRID technology is likely to become the mainstream. In addition, the use of computer automatic tabulating is also an important development direction of [4].

3. From the static model to dynamic model

Time factor are not include in static input-output model, therefore, static input-output model can only reflect a period (usually one year) of the reproduction process. Society economy is changing and developing, however, Programming in a given period shouldn't study the period in isolation, but need to contact changes before and after the period and fully consider factors changes over time. Only in this way can we research the organic connection and its motion process between the development and change of social products, labor, labor materials and object of labor. Dynamic input-output model is the development of static model. It analyzes the process of reproduction of several periods, the mutual communications between the reproduction process in different historical periods, to reflect the connection between the various sectors of national economy and its number of dependencies in different periods; so dynamic model is better than static model in reflecting the real economy.

As early as 1948, Huggins et al. were put forward in the form of a system of differential equations to represent dynamic input-output model. On this basis, the Leontief, successively put forward the differential form of continuous dynamic model and the differential equations to express the discrete dynamic model in 1953 and 1965, and he also put forward the famous "the dynamic inversion" method in 1970.This work laid the foundation for further research on the dynamic input-output model. In addition, notable dynamic model also include variable coefficient dynamic input-output model, dynamic input-output model of human capital, etc. dynamic input-output model was discussed in the Eighth international conference on input and output held in Japan in 1986 and the ninth international conference on input and output held in Hungary in 1989 which shows that dynamic input-output analysis is becoming more and more attention in many countries. But because of the complexity of the dynamic model, by and large, the dynamic model is still not mature enough, and still at the stage of research and trial stage. There are also many problems remain to be further study and solve.

4. Revision and forecast of kinds of coefficient

Input-output analysis is an important tool in economic analysis and prediction, input-output tables is the foundation of the application of input-output analysis. But due to the preparation of an input-output table needs a lot of manpower and material resources and time, so that every year compile a table is virtually impossible. and even at the year of compile time, the input-output table of general will lag 2-3 years, so the lack of effectiveness become an important problem of input-output analysis. So, for all kinds of investigation (or survey) technology research which are used to update and

establish new input-output table, which also means revision method research about the direct consumption coefficients in the study domain of input and output will receive widespread attention.

The direct consumption coefficient is the basic factor of input and output model, and the accuracy of coefficient will directly affect the calculation results of the model, determine the quality of model application. The direct consumption coefficient has the vital significance. The key step to Establishment and application of input-output model is to make direct consumption coefficient as close as possible to the actual, and reflect the real forecast period of economic and technology. Given set of variables and parameter values, and establish suitable the linear mode for the economic structure, and when it was used to make predictions, we always assumed that the structure of the economy in the forecast period will have larger changes. However, the reality economic structure is changing, which will inevitably lead to the model results inconsistent with the actual. Therefore, direct consumption coefficient must be correct according to the change of production technology, product structure, the price of production factors and so on timely. For the medium and long term prediction and prepare the extension table; the coefficients are more need to be revised. The accurate and reliable revision method is based on the actual survey data and reestablishes the direct consumption coefficient matrix, but the drawback is that it cost a lot of manpower and material resources and will take a long time to make a table. The effective and feasible method is a survey method. The survey method mainly includes expert evaluation method and the economic mathematics method. Expert evaluation method is based on the experience of experts and opinion to modify the direct consumption coefficients. The advantage is that the use of the experts' judgment information of outlook for production, and the quantitative description of the consumption coefficient changes combined with the history of the past and the future development. But the expert evaluation method has certain subjective capriciousness; its accuracy depends on the expert choice and the choice of evaluation method. The current relatively popular non-survey methods in the international mainly include the RAS method, LAG, TPVA, etc. [5], but the most commonly method used by people is RAS method which is put forward by Richard Stone et al. in the 1960s.Toh applied RAS method in direct revision of the physical Leontief inverse coefficient and obtained a very good revision effect [6].Investment coefficient occupies a very important position in the dynamic input-output model. Its establishment and adjustment is the key to widely use of the dynamic input-output model, but the research work in this area are rare in current international.

Overall, the effectiveness and precision in the application process of input-output analysis depend largely on this coefficient, so revision coefficient method is still a problem that people are very concerned about.

5. The study of Input-output optimization model

Input-output model represented function relation between production and consumption of departments in mathematics, but it can't get the most satisfying plan if only using input-output model. That is to say, the input-output model can only keep balance, coordination, but can't solve the optimization problem. Therefore, the combination of the input and output and optimization method and the build of input-output optimization model is becoming a natural thing, and this is also an important direction of the development of the input-output analysis in the world. In 1958, the American economist Dorfman, Samuelson, Thoreau combined linear programming model and the input-output model to analyze economic activity, and studies the optimal dynamic input-output model, that's the so-called "avenue theorem".

Early input-output optimization models mostly are single objective model, focusing on the performance of the national economy plan and forecasting the development scale and the economic structure. Each component of Model reflects the goal task and the restriction conditions and means to achieve the task respectively. Because of the national economic system is a complex dynamic system, the simple pursuit of the maximum (or minimum) of a goal, regardless of other goals, could lead to the deformation of the social and economic development. In fact, a country or a region's pursuit of social and economic development should be the coordinated development of natural, human, social

and economic. Both to maintain high economic growth rate and to keep the balance of social and economic development coordination, the country or the region should make industrial structure incline to reasonable, constantly improve the quality and efficiency of economic growth, expand employment, reduce the energy consumption and reduce environmental pollution and so on, namely multi-objective coordinated development. Multi-objective dynamic input-output optimization model is aimed at establishing economic planning model for social and economic problems. It is mainly used for economic analysis and forecasting, and make economic development planning tasks. It is a set of multi-objective optimization model with the objective function of social and economic development, constraint conditions of social and economic operation of the environment, Core constraints of dynamic input-output equation. It is a model methods which is more flexibility and practical than single objective model [7].By solving the optimization model can estimate part of the economic indicators during the planning period, in order to select the optimal economic development plan and formulate economic planning.

6. Conclusion

More than half a century, the theory and method of input-output analysis has been increasingly mature, the depth and breadth have very big development. This paper introduces the basic theory and application of the input-output method, and analyzes its present research situation and trend in detail. Development trend of input-output analysis mainly includes: every country in the world make table work of input-output table regularly and institutionalization, the development of input-output model from the static to the dynamic, the revision and prediction of all kinds of input and output coefficient and the research of input-output optimization model.

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