DESIGN AND APPLICATION OF EMULATION MODEL IN BIG CITY'S ECONOMIC STRUCTURE

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Abstract

Based on the participation in the research and design of the economic structure—emulation model of Urumqi City, this paper was written. Regarding the general problems we met in the research and design and also focusing on the three phrases: Economic theory, System dynamic Method and Application results in practice, this paper discussed the idea and principle. Method and system about the design process of the model was also presented in this paper.

The author thinks that the design of economic structure emulation model should follow six main thoughts and principles. Its model system should includ six main parameter model designs. And the close combination of economic theory and system dynamic method with the application result in practice should be taken as first consideration. The ability of using Dynamic method to solve the economic structure problems can therefore be enhanced.

I

A big city, the centre of various economic activities is a development from commodity economy. Adjustment to a big city's production structure play an important role in the aim of regulating economic structure and getting an economic efficiency.

By regulating economic structure we mean the adjustment of relationships among factors which composed the national economy. As we know, in a synthetical study of national economic structure, we can use different indicators and methods to do classification research. This article focuses on how design system dynamic model in researching big city's economic structure.

II

The key point in applying system dynamic model to economic structure is its model design and model built. Our procedure will be as follows. Section One discusses the design ideas of Modelling.

1. Design Ideas Of Emulate Model In Big City's Economic Structure

As we know, the economic effects of social production and reproduction are responses to the whole national economy's synthetic operation. From the view of systematic theory, economic effects are not only affected by national economic structure but also operating mechanics. The laters are indirect. For
a emulate model design of big city’s economy our emphasis is on its structure affectors. We developed emulated model of big city’s economic structure from following six main design ideas.

A. Planning and Proportional to Operate Social Production.

Marx’s reproduction formula is not only reflects the capitalism’s production character but also contains some basic reproduction theories which, suitable for any societies, especially for the socialist society. Although today’s world economic environment has a lot of difference from that of Marx’s times, proportional production which is the condition of reproduction still work for any society in our times.

Practice in many countries and region has proved and will continue to prove that if we take the Marx’s reproduction low as basement and keep the economic development in proportional we can get economic stable increase in economy. Otherwise there will be economic largeing and degenerating. This is an objective law that no human’s will can change it.

B. Two Design Ideas Combination of EMIBCES and Economic Development Strategy

Economic strategy is a researching of a whole situation operated in national economy. The characters of general system are mainly determined by the system structure. So economic structure is the focus of development strategy researching which is also the guideline and basic of economic structure. Different economic developmental strategy needs keeping with different economic structure. Adjustment to whole strategy will certainly require adjustment of the economic structure. Once the strategy is fixed, the economic structure must be adjusted to fit the demanding of strategy.

C. Big City’s Economic Structure Emulation Model Design Goal -- To maximize Social Economic Efficiency

To some extent, economic construct is to set up an advanced and reasonable national economic structure which will make the social reproduction economic effect continue growing. If economic effect is not good enough to meet national economic aggregation and social common demand, the society’s expanded reproduction will not be possible. And there would be national deficit and deficient of national productive capacity. It must be pointed out the BCESEMD’S focus is on maximasim economic effect which is also the key problem of Chinese economy.

D. The Design of EMIBCES Should Reflects Chinese Big City’s Distinguishable Feature Strip-chunk Economic Pattern

By strip--chunk economic pattern of big city in China we mean that there are three kinds of enterprise in one city. They are central planning enterprise, local planning enterprise and city’s enterprise. In our analysis, we have to take all these enterprises as a whole to consider inside relations of their economic activities, but we can’t unite them in planning because they have different minister sector and different expanded reproduction planning. But we have to consider all of them in order to make our model fit the actual system. So we emphasize Chinese big city’s strip-chunk economic pattern feature, to assure our design model qualified.

E. The Design of EMIBCES Should Had the Model Has as Much Ability as Possible to Solve real Problems.

What abilities does model should have in operating and dealing with variety problems? According to above design idears and principle, first, we should have it has a function of doing economic structure research. That is the model should reflects economic effect relationships among three big trades, insider respective industry, between industry and agriculture, and among agriculture,
light industry and heavy industry at any point time. Second, the model should reflect the main social economic indicators of effects such as GNP, output value per capita, investment effect, labour productive efficiency, funds using effects, and energy using effect etc. Third, according to our development strategy, change some parameter on proposed to emulate the whole system operating and developing state, try to find the unity between target and possibility. Fourth, to supply understandable variety figurative information for researchers.

F. To Set Up a Parameter Model System Is an Important Component of EMIBCES Practice has proved that parameter has the same important role as the model. Many parameters need to set a series of corresponding parameter models which are used partly for calculating and partly for computer super sum. All of them are important component of EMIBCES.

2. Method For Setting Up The Centre City’s Economic Emulate Model

The model-setting method we mean here isn’t the general model setting method in dynamic system, it is the selection and the determination of very specific variables in the model. For the length limit cause we explain this in three aspects.

A. The Determination of Flow Position Variable (FPV) and Flow Rate Variable (FRV)

As we know there are eight kinds of variable equations in dynamic theory. The flow position variable equation and flow rate variable equation are fundamental equations. The first problem we face in the model design is how to determine the flow position variable and FRV which are very important for illustrating the whole system. In our opinion, to solve the problem about the determination of FPV and FRV we must start from Marx’s productive factor theory to select FPV and FRV. Marx believes that productive factor itself is a multilayer complicated structure.

This structure center is the labour and productive means which are also called the subjective factor and objective factor of production. Marx said, no matter what the social production system is, the labour and productive means are always the productive factors. They are essential material and prerequisite condition for producing material things. They include productive means and productive objects such as land, mineral resources, raw material productive equipment, production construction material and transport equipment etc. The productive tools play a main role in the productive means. Therefore, to take fixed assets as FPV in the procedure of setting up EMIBCES is not only necessary but also acceptable. There are four reasons. First, according to Chinese existing accounting system that anything listed as fixed assets should have two conditions. One is over one years lifetime, the other is over quota for each of price. (800 Yun for large enterprise, 500 Yun for medium enterprise, 200 Yun for small enterprise.) Second, As long as the fixed productive factor forms, its effects on the production development remain steady. Third, in accounting system we special set up fixed asset account to reflect fixed asset, an important productivity factor, and increase or decrease situation. The date is also easy to get. Fourth, fixed asset is a very typical accumulating variable. As social simple reproduction and expended reproduction continues going on from one hand, the fixed assets increased yearly, on the other hand, fixed assets decreased by translate its value into products yearly. So, fixed asset is an important FPV. But we can’t make only fixed asset to be the FPV in researching emulating model of big city’s structure. Because both productive materials and labors are heart of productive factors structure.
Naturally, the labor number should be chosen as a FPV. In fact, the number of labor is also a very typical accumulating variant. From one hand, as the simple reproduction and expended reproduction proceeded the number of labor increased yearly. On the other hand, the number of labors will decreased as time goes on and other influence factors such as older people retired, transfer other places, etc. Taking both fixed asset and labors numbers to be FPV of economic structure emulate model is not only the need of production principle but also the design idea of above model. The determination of fixed assets and labor numbers as two FPV provide prerequisite and principle for the determination of FRV. Here we not explain more about design of FRV.

B. Design of the Main Auxiliary Variable Equation.

Generally, once FPV and FRV are determined, the design range of the main auxiliary variable equation has been basically defined. The determination of FPV and FRV makes the skeleton of the main auxiliary variable equation obvious. We know that, the variation of fixed assets (one of FPV) is affected by two variables. The one is an increment of fixed assets in one year, the other is the depreciation quantity of fixed capital a year. We can figure out the later through the depreciation rate. The former we can use delayed function to process, but the delayed function is determined by two variables. That is the determination of investment variable, and is the determination of the time that forms fixed assets, the later is a constant number generally. Actually, in the age of Chinese alternation between new system and old system, this constant number usually change greatly. So careful research need taking. We will state this point later. To the former the processing should be in this way. The investment is determined by two factors, the investment demand and the degree to satisfy the needs. The former we used max-fuction to process, that is to subtract the present fixed assets by the present fixed assets demanding.

This subtracted equation only has three cases. The first case is that its differences bigger than zero, that is investment demand is bigger than the existing fixed assets. The second case is that its differences is smaller than zero, that is investment demand is smaller than existing fixed asset. The third case is that its differences is equals zero, that is the investment demanding equals the existing fixed asset. The later two cases have no meaning of investment demanding.

In design of maximum function, we compared integer 1 with difference. There are only three cases after drawing in integer 1's compare objet. The first case is that the difference is bigger than 1. That means investment demanding is bigger than existing fixed asset. In maximum function take the difference as a invest demanding value. The second case is that the difference bigger than zero but smaller then 1, that means invest demanding is a little bigger than existing fixed asset, we take 1 to be invest demanding value in maximum function. The third case is that the difference is smaller than zero, that means invest demanding is smaller than existing fixed asset. In this case, invest demanding has no mean, maximum function take 1 as invest demanding value. The latter we use min-function to process. If the ratio of investment to investment needs is more than 1. Those means the fund is enough. The supply is more than demand, so take 1 as minifunction. If the ratio of investment to investment needs is less than 1, this means the fund is not enough. Supply is less than demand. It is approriate to take the ratio. This ratio represents the degree of fund meet the demand. If the ratio is 1, that means the fund just meet investment demand. Investment demand is an strong synthetic variable. Its determination is influenced by two aspect's facts. The one is overall situation, long term and special needy
proceed, the country plan regulation and management. The other is that enterprises proceed from market demand, take market as production guidance try their best to meet people's social demand. For the planning management or market demand here, we mean social consumption demanding of a kind product or an enterprise. In transforming social consumption demanding to fixed asset investment demanding we need an transform link which is represented by ratio between output value demand and fixed assets-output value ratio. The problem is that we should how describe output value demand as an variable. In our opinion for this variable, we should proceeding our researching on output demand variable respectively according to Marx's two sectors production, productive means and consume material classify method of social reproduction. For livelihood means which are consumed by general people always have an limit for any kinds product or enterprise to people average consume level. It is reasonable and requisite to forecast and consider the demand of any kind product or enterprise according to this limit. Only for a big city, taking people consume maximum to be a base, we not only conside planed demand but also market demand and not only in big city's inside market but also outside market of import and export. But, for production demand of productive means it is difficult to measure or forecast by using an maximum value. So to this problem, we consider it from two aspects. One aspect is starting from big city's concrete practice to see how well coordinated between enterprise of productive means and livelihood means, and also among inside enterprise of productive means. Namely we often called what is the change trend of long line product and short line product. The other aspect is to see how well the outside market's enterprise of produce productive means influence to the big city's every unite of total production value demand social for productive means in its own territory. Then, according to the social GNP's predictive value at different point-in-time which is iteratated through model system to forecast the develop demand of production means industry. By design these auxiliary variable equation, the dynamic description of fixed asset's FPV and FRV are much more perfect.

For simplification, the design of labor number as an FPV and auxiliary variable equation design are ommited here.

C. Design of Main Parameter Model

The design of parameter model are becoming more important. We suggest that EMIBCES should set up corresponding model systems in six aspects respectively. They are trade staff member increase model; trade fixed asset forming years model; output level of trade net production value model; total population increase rate model; trade fixed asset depreciating value super sum model; trade production value rate of fixed asset regression model.

Here we only show a trade of the city's fixed asset depreciating super sum model.

Industry of whole city's fixed asset depreciation value super sum model is follow where Q' is whole city's fixed assets annual depreciation value.

\[ Q = \sum_{i=1}^{n} \sum_{j=1}^{n} \left( \sum_{k=1}^{n} Y_k + \sum_{l=1}^{n} G_l + \sum_{m=1}^{n} F_m + \sum_{f=1}^{n} Z_f \right) \]

\[ \sum_{k=1}^{n} Y_k \] is sum of industry's machine equipment annual depreciation value. 
\[ k=1 (k=1,2...n) \]

\[ \sum_{l=1}^{n} G_l \] is sum of industry's production tools annual depreciation value. 
\[ l=1 (l=1,2...n) \]
\[ \sum_{m=1}^{n} F_m \] is sum of industry’s construction materials annual depreciation value. 

\[ \sum_{f=1}^{n} Z_f \] is the sum of laboury means the depreciation volume in one enterprise a year. Therefore the annual average fixed asset depreciation rate of a certain industry in the whole city is follow.

III

Based on the design thought and modeling method of emulation model in big city's economic structure mentioned above, we designed and applied the industrial structure simulation model of urumqi city, and preliminary get the expected effect. This mode, starting out from the actual situation of urumqi city and combining with our country's statistic indicator system, divided and defined 31 industries, collected more than 2200 data, arranged more than 200 parameters, established more than 650 equation and organized 36 modules. Operated on the IBM-PC/XT computer, this model was completed carried out. This model's cause and effect illustration and flow diagram.

Using urumqi city's economic structure simulation model we proceeded three simulating programs for the eighth "five-year-plan" period and develop period after the ninth "five-year-plan". The analog result showed that if we plan and arrange it to be realized according to the present ideas (this we take as our first program) investment level will not meet the investment need of more than thirty one trades in urumqi, especially to the every industry where fixed assets increasing slow. If our plan arrangement is according to the investment need of every trad, the social gross output will emerged increasing with a high degree in index form. But here main problems are where the fund come from and how much possibility of meeting the need can be realized. And also it need to further research how much possibility to carry out this program. The third program is directed by the guide idea of development strategy and is combined with whole society's development need and possibility. Its focal point is put on rising up economic effect. This program start from the principle of keeping the whole national economic system continuous, stable, coordinate development to put out an appropriate develop scale under the pre requisite of improved economic syructure and raising up economic effect. And then according to each trade's develop need to arrange each one's fixed asset investment. So as to imitate whole national economic operating trend. The result is ideal.

IV

Conclusions and Summery

To summarize above analysing and application, the EMIBCES we have developed focuses attention first on how combine the method of system dynamics with the applying effect of economic production theory; second on well-considered design idea, principles methods and model systems.

All of these are the key points of using system dynamic model to solve the problems of economic structure.

EMIBCES : Emulation Model In Big City'S Economic Structure.
THE MAIN CAUSE-EFFECT CHART OF URUMQI ECONOMIC STRUCTURE SYSTEM
EPHS: Entrance proportion for high school
SCPP: Social commodity purchasing power
SNS: The shortage number of scientists
TTFCS: Ten-thousand fixed capital scientific density
ASAI: Annual scientific achievement import
ASFP: Annual scientific fruit production
NRPE: The number of research people in expectation
OVFC: Original value of fixed capital
DRFC: Depreciation rate of Fixed capital
DFAI: The Demand for fixed asset investment
PIFC: Practical investment of fixed capital
AIE: Actually investment for the exploration
AIRMC: Annual increasing rate of coal mining capability
OVKFA: Output value rate of fixed asset
UPACL: Urban people’s average consume level
FAIPT: fixed-asset investment for pollution treatment
NCBAW: The number of child-bearing age women
NWBSF: The number of women beween sixteen and Forty nine years old
MNCBA: The move-in number of Child-bearing age women
NWFFO: The number of women in Fiftiety years old
MONCB: The move-out number of Child-bearing age women
NSEP: The number of secondry employment people
NPNEA: The number of people non employment age
NGSFU: The number of graduation students from university and Technical school
EPUTS: Entrance proportion for university and Technical school
NSITS: The number of students in Universitys and Technical schools
NHSGS: The number of high school graduated students
NSHS: The number of student in the high school
NGSFJ: The number of graduate students from junior middle school
NSJMS: The number of students in junior middle school
NPWCP: The number of pupils who completed primary school
NPPS: The number of pupils in primary school
AGSN: The amount of goods satisfying the need

REFERENCES

Jay W. Forrester .1968. -Principles of system.