Ⅳ-217 PRELIMINARY STUDY TOWARDS A LONG-TERM REGIONAL ECONOMETRIC MODEL FOR DESCRIBING SPATIAL AGGLOMERATION IN JAPAN

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INTRODUCTION

The rapid economic growth that Japan has experienced in the past few decades has resulted in monocentric effects of spatial agglomeration. Tokyo which has always had a disproportionate denseness in population since the postwar period is now even more obviously the centre of agglomeration. Two major effects of this are identified as congestion and the rocketing of land values, both indicating socially inefficient allocation; and other environmental effects like air pollution.

In this study we attempt to view the concepts behind the process of spatial aggolmeration in Japan and thereby evaluating strategic policies leading to reduction of those adverse effects, through macro-econometric modelling. Our study area consists of 25 prefectures overlain by a national trunk line joining Hokkaido, Honshu and Kyushu. The period studied is from 1950 to 1985 with a simulation cycle of 5 years, corresponding to years of population census.

Here we present a partial description of the preliminary version of a simulation model which focus on the above mentioned objectives.

DATA RESOURCES

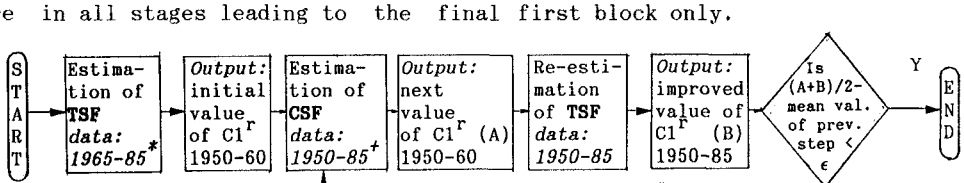
Econometric modelling of this nature evidently requires a strong statistical backing which then depends on the data resources. One of the most important practical constraints that is faced in formulation of a model that spans into history is the deficiency of data. Therefore in all stages leading to the final model we attempt to formulate a possible model using the available data while employing ways to overcome limitations of data by constructive means of data making.

PROCESS OF DATA MAKING

The accuracy of the submodels in the simulation model depend on that of data made available for estimation, thus rely on creative manipulation of existing data mainly through interpolation and extrapolation techniques. Although data making may simply be summarised as a process that estimate the missing part of partially (in time scale) available data by the use of fully available data, the actual working is much more complicated, depending on the type of data, extent of estimation and technique adopted. For example the flowchart in Figure 1 shows the process of computing prefectural public sector consumption $C1^r$ for 1950-60.

SIMULATION

In the process of simulation here, we attempt to study the behaviour of the system using macro variables. The analysis is simplified by trying to formulate the behavioural models enhancing the necessary explanation of the economic activity with a relatively few variables. Simulation from 1950-85 includes atmost 7 cycles. Basically the entire model is divided into three major blocks: *prefectural economic activities block, input-output block,* and *inter-prefectural activities block,* as shown in Figure 2, and here we discuss the first block only.



TSF: Time Series Function $C1^r = f(YR)$
CSF: Cross-Sectional Function: (Real C1: '80 base) $C1^r = g(P^r, \hat{RE}^r, (\hat{V}1^r + \hat{V}2^r), YR)$

* yearly data(to improve deg. of freedom)
\+ pooled data of 46 prefectures(Okinawa excld.)
\# w1 and w2 are chosen so as to achieve convergence

(YR-year:last 2 digits, P-population, $\hat{RE}$-prefectural expenditure, $\hat{V}1$-primary sector value added, $\hat{V}2$-secondary sector value added, r-prefecture, ^ -nominal value)

FIGURE-1 COMPUTATION OF $C1^r$ FROM 1950-60

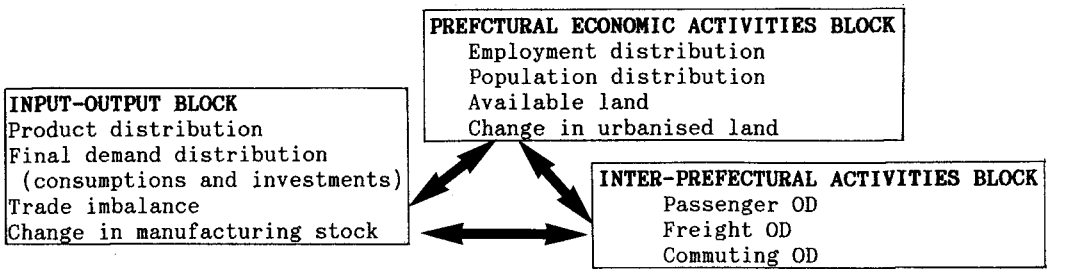


FIGURE 2 SIMULATION MODEL BLOCK CHART

The following explanations on variables are introduced: the industrial sectors for employments and productions, primary, secondary, and tertiary, refer to those at major industry groups as in population census. Employment of a prefecture is the employment at job site there. Finally, inhabitable land L_F refers to that can be used for dwelling, industrial usage and agriculture, while urbanised land L_U is exclusively for urban activities.

PREFECTURAL ECONOMIC ACTIVITIES

In this block we encounter sectorial and prefectural distribution of exogenous national employment E. First, the national employment is distributed to secondary and tertiary sectors by:

$$E2 = f_1[E2_{(-1)}, (E/E_{(-1)}), (Y_{(-1)}/Y_{(-2)})] \quad (1)$$

$$E3 = f_2[E3_{(-1)}, (E/E_{(-1)}), (Y_{(-1)}/Y_{(-2)})] \quad (2)$$

where Y is the per capita income.

While the primary employment is taken as a residual of the total; E1=E-(E2+E3) (3).

These arguments are extended to the distribution of secondary and tertiary employments at prefectural level, and in addition total employment too is distributed with a similar conceptual backing:

$$E^r = f_3[E, E^r_{(-1)}, PP^r_{(-1)}, (Y^r_{(-1)}/Y^r_{(-2)})] \quad (4)$$

$$E2^r = f_4[E2, X2^r_{(-1)}, PP^r_{(-1)}, (Y^r_{(-1)}/Y^r_{(-2)})] \quad (5)$$

$$E3^r = f_5[E3, PP^r_{(-1)}, PE^r, (Y^r_{(-1)}/Y^r_{(-2)})] \quad (6)$$

$$E1^r = E^r - (E2^r + E3^r) \quad (7)$$

Here PP^r and PE^r are population and employment potentials at prefecture r respectively. X2 denotes the secondary sector production.

National population too is considered exogenous. As individual decisions inherent to human settlements tend to follow the choice of employment location, prefectural employments carry a lagged population potential variable. On the other hand the prefectural population depends on the employment of the same period. Incorporating land-use activity as well using available land area L_{AV} of the previous period to attract settlements we distribute the change in national population into prefectures through:

$$\Delta P^r = f_6[\Delta P, PE^r, L^r_{AV(-1)}, N) \quad (8);$$

N - number of prefectures.

Land available for urbanisation is, $L^r_{AV} = L^r_F - L^r_U$ (9); where L^r_F is exogenous. As urbanisation is an irreversible process, change in urbanised land; $\Delta L^r_U \geq 0$. Then the model is given by,

$$\Delta L^r_U = l(L^r_{AV(-1)} + \Delta L^r_F); \; l \varepsilon [0,1] \quad (10)$$

$$\text{here } l = f_7[\Delta P^r, \Delta(E2^r + E3^r)] \quad (11)$$

the factors contributing to the process of urbanisation. Since we consider only positive increases of population and employments in (11): $\Delta P^r \leftarrow \max(\Delta P^r, 0)$ and $\Delta(E2^r + E3^r) \leftarrow \max(\Delta(E2^r + E3^r), 0)$.

CONCLUDING COMMENTS

Here we have outlined partially the preliminary version of a simulation model which aims at describing the dynamic behaviour of cities when transportation improvements are made. Although it is not explicitly shown, the transition of transportation facilities may be reflected through those models with inter-prefectural travel time as a variable which is exogenous. For example in the block explained here, potentials PP^r and PE^r can be regarded as such variables. Reduction in travel times due to transportation facilities results in an increase of potential which may result in agglomerative effects.

Although only the *prefectural economic activities* block has been discussed here, the study requires completion by development of the other two blocks, since all three are inter-related.

Further, the partial results will be shown at the presentation.

REFERENCES

1 Brotchie, J. et.al. *Urban Land-use and Transportation Interaction Models*, Report of ISGLUTI, Gower Publ. Co., 1988.

2 Daluwatte, S. *Historical Review of the Effects on Regional Development due to Transportation Facilities of Japan: Towards a Macro-Econometric Model*, Master Thesis, Kumamoto University, 1989.