Outline of ICSEAD's Fukuoka Prefecture Model

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I. Introduction

This paper is intended mainly to give the outline of the "Fukuoka Prefecture Model," a sub-model of the world econometric link model which is being developed by the International Centre for the Study of East Asian Development (ICSEAD) as one of its projects. Before explaining the model, we shall take a brief look at the economy of Fukuoka Prefecture(1). Fukuoka Prefecture has a population of some 4,800,000, a mere 4% of Japan’s total population of 123,300,000. Considering that South Korea and Taiwan have a population of 42,400,000 and 20,000,000, respectively, Fukuoka Prefecture, in terms of population, constitutes a smaller market than South Korea or Taiwan. Nevertheless, Fukuoka’s gross domestic
product (GDP) is $109.7 billion, while Korea's $188 billion and Taiwan's $146 billion. Thus, in terms of income level, the market size of the Fukuoka prefecture is comparable to that of those countries.

Table I-1 GDP of Fukuoka Prefecture

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
</tr>
</tbody>
</table>

Table I-2 Export Partner of Fukuoka

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Next, let us look at the trade partners of Fukuoka Prefecture. As to the exports from Fukuoka Prefecture, the US market plays an important part; it accounts for nearly one quarter of the prefecture's total exports. Asian countries combined also account for nearly one quarter of Fukuoka's total exports; however South Korea and Taiwan each accounting for some 2%.

Table I-3 Import Partner of Fukuoka

![Bar Chart]

The United States is also important to the imports to Fukuoka Prefecture, but its share in the prefecture's total imports is less than 20% which is not as large as in the prefecture's exports. By contrast, Asian countries combined account for more than half of Fukuoka's total imports, South Korea and Taiwan accounting for some 20% and 7%, respectively. In recent years, the share of South Korea in the prefecture's imports is expanding noticeably. This is considered to suggest that the economic integration between Fukuoka Prefecture and South Korea is gaining momentum.

Regional econometric models have a fairly long history to provide a guideline for regional development. The first regional econometric model dates back to the 1960s. Models of this type were for the first time studied extensively by Yukio Kaneko, Fujio Okazaki, and Takao Fukuchi\(^2\). Those models were intended to be used for analyzing how regional development projects, which were formulated in
line with the central government’s policy of giving top priority to economic growth since the 1960, give the effects on the regional economic growth and industrial structure of the regions. Therefore, regional economic models in those days, were developed mainly in collaboration with the central and local administrative agencies. Years later, however, the Japanese economy experienced a radical structural change caused by the oil crises, and the reliability of econometric models was questioned. In the 1980s, when Japan’s economic situation recovered relative stableness, regional econometric models for medium- to long-term economic forecasts began to be developed again. They include the Osaka Model of Nakamura (1986), the Kyushu Model of Yamazaki and Saeki (1988), the Kagoshima Model of Shimokyo (1990), and the Hokkaido Model of Seto (1991).

Our Fukuoka Prefecture Model is an econometric model developed to analyze the prefecture’s economic structure and forecast its economy and it has been built, as a sub-model of the Japan Econometric Model, to work with flows of funds between the central government and the prefecture endogenously. In concrete, the model has, besides the so-called macro economic block, a government finance block where local taxes and other revenues to the local governments are classified in minute detail. In addition, the flows of funds from the central government to the local governments and from the prefectural government to municipal governments are treated as endogenous variables in the model. In our model thereby the central and local finance and macro-economic sectors are interlocked in its structure.

Furthermore, the Japan Econometric Model, the parent model of the Fukuoka Model, is one of the ICSEAD’s world link model. Since overseas variables, which are normally treated as exogenous variables (i.e., given variables in a model) in a particular country model, are treated as endogenous variables in world link models, the international flows of goods and funds can be positively taken into account. Therefore, our Fukuoka Model, when linked to other country models which make up a link model, also permits analyzing the economic effects on Fukuoka Prefecture of overseas economic impacts and policy changes in other parts of Japan or abroad. In the present paper, we shall report the results of a simulation analysis we conducted using the Fukuoka Model experimentally linked to the Japan model and a trade linkage model, which is desired to be used to link the Japan Model and other country models together. In the near future, we intend to create a United States model, South Korea model and Taiwan model to expand the system of the link model.
In Chapter II, the features of the individual blocks of our Fukuoka Model shall be described. In Chapter III, the basic structure of the Japan Economic Model shall be described. In Chapter IV, we shall describe the results of the simulation analysis conducted with the Japan Model and Fukuoka Model linked together.

In the present paper, we shall confine ourselves to the explanation of our Fukuoka Model. With respect to each country model, trade linkage model, and simulations with those models linked together, we shall discuss them in separate papers.

II. Outline of the Fukuoka Model and Features of Its Blocks

In this chapter, we shall describe the basic structure and features of the Fukuoka Model. For a detailed list of model equations and a list of model variables, see Appendix 1 and Appendix 2, respectively. In the following description, an equation number at the end of variable names corresponds to the associated equation number in the Appendix 1.

The Fukuoka Model consists of five blocks as shown in Table II-1.

<table>
<thead>
<tr>
<th>Block</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Real gross prefectural expenditure block</td>
</tr>
<tr>
<td>B.</td>
<td>Nominal gross prefectural expenditure block</td>
</tr>
<tr>
<td>C.</td>
<td>Income and outlay account block</td>
</tr>
<tr>
<td></td>
<td>C-1 Corporations</td>
</tr>
<tr>
<td></td>
<td>C-2 Government</td>
</tr>
<tr>
<td></td>
<td>C-3 Non-profit organizations serving households</td>
</tr>
<tr>
<td></td>
<td>C-4 Households</td>
</tr>
<tr>
<td></td>
<td>C-5 Stock and other variables</td>
</tr>
<tr>
<td>D.</td>
<td>Employment, wage and deflator block</td>
</tr>
<tr>
<td>E.</td>
<td>Government finance block</td>
</tr>
<tr>
<td></td>
<td>E-1 National taxes</td>
</tr>
<tr>
<td></td>
<td>E-2 Finance of prefectural government</td>
</tr>
<tr>
<td></td>
<td>E-3 Finance of municipal governments</td>
</tr>
</tbody>
</table>

Table II-1 Structure of Fukuoka Model
II-1. Gross Prefectural Expenditure Block

This block treats real and nominal values of the demand items in the prefectural expenditure. Table II-2 shows the endogenous variables related to this block.

<table>
<thead>
<tr>
<th>Table II-2 Gross Prefectural Expenditure Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td><strong>Final consumption expenditure</strong></td>
</tr>
<tr>
<td>Households</td>
</tr>
<tr>
<td>Non-profit organizations</td>
</tr>
<tr>
<td>General Government</td>
</tr>
<tr>
<td><strong>Fixed capital formation</strong></td>
</tr>
<tr>
<td>Private residential</td>
</tr>
<tr>
<td>Private non-residential</td>
</tr>
<tr>
<td>Public corporations</td>
</tr>
<tr>
<td>and general government</td>
</tr>
<tr>
<td>Increase in inventories</td>
</tr>
<tr>
<td>private enterprises</td>
</tr>
<tr>
<td>public corporations</td>
</tr>
<tr>
<td>Export and transfer of goods and services</td>
</tr>
<tr>
<td>Import and transfer of goods and services</td>
</tr>
<tr>
<td>Gross domestic product</td>
</tr>
<tr>
<td>Net factor income from outside Prefecture</td>
</tr>
<tr>
<td>Gross Prefectural product</td>
</tr>
</tbody>
</table>

(Not) Variables marked with an asterisk (*) are exogenous variables.

With respect to the government’s final consumption type expenditure, its nominal value [B-04] is determined first as a function of the total of consumption expenditures of the prefectural and municipal governments(3). Then, the nominal value is deflated to obtain the real value. Therefore, through the local government’s expenditure is exogenous at the local government’s finance level, the SNA base government’s final consumption expenditure within Fukuoka Prefecture is not an exogenous variable in our model.

It is considered that private sector’s decision on investment in plants and equipments [A-07] by the private sector in Fukuoka Prefecture is often made at head-
quarters located at Tokyo or Osaka, and that the decision is more or less influenced by the relative procurement costs of production factors in Fukuoka Prefecture and other prefectures. In our model, therefore, we used the share of primary industries in the prefecture's production as a proxy variable of the relative costs of production factors. Namely, we considered that the larger the share of primary industries, the lower would be the procurement costs of labor and land. Furthermore, in view of the capacity of local enterprises, it is also considered that the plant and equipment investment by the private sector and public investment are supplementary to each other. Therefore, such element is also reflected in our model. Table II-3 shows the correlation of functions of the private investment in plants and equipments in Fukuoka Prefecture.

**Table II-3 Private non-residential Investment Function of Fukuoka Prefecture**

When the government expenditure on the whole increases and the government expenditure in Fukuoka keeps unchanged, it directly leads to an increase in private investment in plants and equipments in Fukuoka Prefecture. At the same time, since the total private investment in plant and equipment in Japan increases, it indirectly causes the private investment in plant and equipment in Fukuoka Prefecture to increase further. In order to restrain such a free economic expansion, our model is set to provide an ingenious countermeasure, when we make a multiplier simulation. Namely, when the government expenditure increases, the government
investment in Fukuoka Prefecture is made to be increase accordingly at a certain rate, thereby restraining the private investment in plant and equipment in the prefecture.

With respect to the government's total fixed capital formation too, its nominal value [B-08] is determined first as a function of the total investment type expenditure of the prefectural and municipal governments(4), like in the case of the government's final consumption expenditure described earlier. Therefore, in our model, it is not an exogenous variable, either.

The export and transfer of goods and services [B-11] consists of exports to foreign countries [B-12](5) and transfers to other domestic prefectures [B-13], and the import and transfer of goods and services [B-14] consists of imports from foreign countries [B-15] and transfers from other prefectures [B-16].

Export and transfer of goods and services (FU_EXN) =
Exports to foreign countries (FU_EXCNF)+Transfers to other prefectures (FU_EXDNF)
Import and transfer of goods and services (FU_IMN) =
Imports from foreign countries (FU_IMCNF)+Transfers from other prefectures (FU_IMDNF)

The amount of exports to foreign countries [B-11] is determined by multiplying the total amount of Japan's exports by the share of Fukuoka Prefecture in Japan's total exports. The amount of transfers to other domestic prefectures [B-12] is explained by the income factors of Japan and the relative price factors between Fukuoka Prefecture and Japan. Similarly, the amount of imports from foreign countries [B-14] is determined by multiplying the total amount of Japan's imports by the share of Fukuoka Prefecture in Japan's total imports, and the amount of transfers from other prefectures [B-15] is explained by the income factors of the fukuoka prefecture and the relative price factors between Japan and the prefecture.

II-2. Income and Outlay Account Block

This block handles the distribution of income among institutional sectors. In our model, four institutional sectors: corporations, government, private non-profit organizations serving households, and households are considered. Table II-4 shows a prototype of the income and outlay accounts by the institutional sector used in our model.
<table>
<thead>
<tr>
<th>[Corporations]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct taxes</td>
<td>FU_TDC</td>
</tr>
<tr>
<td>Savings</td>
<td>FU_SC</td>
</tr>
<tr>
<td>Corporate income</td>
<td>FU_YC</td>
</tr>
<tr>
<td>Net transfer</td>
<td>FU_NTRC</td>
</tr>
<tr>
<td>Total outlay</td>
<td>Total income</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[General Government]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Final consumption</td>
<td>FU_CGN</td>
</tr>
<tr>
<td>Property income</td>
<td>FU_YPRGE</td>
</tr>
<tr>
<td>Subsidies</td>
<td>FU_SUB</td>
</tr>
<tr>
<td>Savings</td>
<td>FU_SG</td>
</tr>
<tr>
<td>Direct taxes</td>
<td>FU_TD</td>
</tr>
<tr>
<td>Indirect taxes</td>
<td>FU_TI</td>
</tr>
<tr>
<td>Property income</td>
<td>FU_YPRGR</td>
</tr>
<tr>
<td>Net transfer</td>
<td>FU_NTRG</td>
</tr>
<tr>
<td>Total outlay</td>
<td>Total income</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[Private non-profit organizations serving households]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Final consumption</td>
<td>FU_CNPN</td>
</tr>
<tr>
<td>Property income</td>
<td>FU_YPRNPE</td>
</tr>
<tr>
<td>Savings</td>
<td>FU_SNQ</td>
</tr>
<tr>
<td>Property income</td>
<td>FU_YPRNPR</td>
</tr>
<tr>
<td>Net transfer</td>
<td>FU_NTRNP</td>
</tr>
<tr>
<td>Total outlay</td>
<td>Total income</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[Households]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Final consumption</td>
<td>FU_YPRHIE</td>
</tr>
<tr>
<td>Property income</td>
<td>FU_YPRHIE</td>
</tr>
<tr>
<td>(Consumers' interest)</td>
<td></td>
</tr>
<tr>
<td>Direct taxes</td>
<td>FU_TD</td>
</tr>
<tr>
<td>Savings</td>
<td>FU_SH</td>
</tr>
<tr>
<td>Employee compensation</td>
<td>FU_YW</td>
</tr>
<tr>
<td>Income from proprietorship</td>
<td>FU_YSE</td>
</tr>
<tr>
<td>Property income</td>
<td>FU_YPRHR</td>
</tr>
<tr>
<td>Interest</td>
<td>FU_YPRHIR</td>
</tr>
<tr>
<td>Dividend</td>
<td>FU_YPRHDR</td>
</tr>
<tr>
<td>Rent</td>
<td>FU_YPRHRR</td>
</tr>
<tr>
<td>Net transfer</td>
<td>FU_NTRH</td>
</tr>
<tr>
<td>Total outlay</td>
<td>Total income</td>
</tr>
</tbody>
</table>

The income and outlay account has a role to define disposable income and savings by the institutional sector. Each institutional sector distributes its savings, remainder of the disposable income after the consumption, over tangible assets (residence, land, business equipments) or financial assets (deposits, bonds, stock and etc.). In our model, the household account is important. The disposable income [C-26] is the source of the final consumption expenditure and residential investment, and the balance of savings [C-30], which is called the net worth, also influences the consumption expenditure.
In ordinary country econometric models, the savings of corporations more or less influence their investment in plant and equipment. In our Fukuoka model, however, this is not the case because of the difference of decision making and destination of the investment, as already described in Section II-1.

II-3. Labor, Wage, and Deflator Block

This block determines the numbers of persons employed and unemployed, wages, and deflators for demand items in Fukuoka Prefecture. The number of employees [D-01] is explained as the inverse function of the production function by the combination of production and fixed capital stock. According to the estimated equation, in Fukuoka Prefecture, a 1% increase in production will increase the employment by approximately 0.3%. As to a wage function, in ordinary macroeconomic models, including ICSEAD's Japan Model, it is common practice to assume an reverse correlation of wage and unemployment rate by applying the Phillips' curve. However, in our Fukuoka Prefecture Model, which is a sub-model of the Japan Economic Model, it was assumed that the wage level of Fukuoka Prefecture was based on Japan's average wage level and that it would fluctuate according to the labor market's condition of the prefecture relative to that of whole Japan. Namely, it was assumed that when the unemployment rate of Fukuoka is higher than the national average, the wage level of the prefecture becomes lower than the national wage level, and vice versa.

Table II-5 Correlation of Employment, Wages, and Prices in Fukuoka Model
Table II-5 shows the correlation of employment, wages, and prices in the Fukuoka Model. When Fukuoka Prefecture's gross production increases for some reason, its employment increases and its wage level rises. Since the number of employees multiplied by per capita wage gives the compensation of employees, the main income of households, the final consumption expenditure of households increases, boosting the gross prefectural production further. Indeed the rise of prices of various commodities because of the rise in wages restrains the increase of gross prefectural production to some degree, however since the "rise in wages → decrease in labor demand of enterprises" mechanism which is built in the Japan Model, is not included in our Fukuoka Prefecture Model. Therefore, free economic expansion in our model can hardly be checked.

The key price variable in the model is the wholesale price index, as used in the Japan Model. However, since the wholesale price index of Fukuoka Prefecture was unavailable, that of Fukuoka City was substituted. It was assumed that Fukuoka's wholesale price index would be influenced by the national wholesale prices. The deflators for final demand items are basically explained as functions of Fukuoka's wholesale price index and wage level.

II-4. Finance Block (National Taxes : Portions Collected within Fukuoka Prefecture)

In this block, the portions of national taxes collected within Fukuoka Prefecture are treated as endogenous variables. In Japan, national taxes collected in individual districts are partly re-distributed from the central government to those districts in the form of local grant tax and local transfer tax to the local governments. The re-distribution of those taxes to local governments is extremely important in deciding the scale of local finance, and hence the scale of local economies.

<table>
<thead>
<tr>
<th>Table II-6 National Taxes (Collected within Fukuoka Prefecture)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total national taxes</td>
</tr>
<tr>
<td>Personal income tax</td>
</tr>
<tr>
<td>Corporate income tax</td>
</tr>
<tr>
<td>Liquor tax</td>
</tr>
<tr>
<td>Gasoline tax</td>
</tr>
<tr>
<td>Petroleum gas tax</td>
</tr>
<tr>
<td>Other national taxes</td>
</tr>
</tbody>
</table>
As shown in Table II-6, the national taxes which are treated as endogenous variables are personal income tax [E-02], corporation tax [E-03], liquor tax [E-04], and gasoline tax [E-05]. In formulating tax functions, it is necessary to take into consideration the historical revisions of the tax system. Therefore, a simple regression analysis can hardly be applied. In view of this, for the first three national taxes, their proportions in personal income, corporate income, and final private consumption expenditure, respectively, are given as exogenous variables. The gasoline tax is explained by the product of crude oil price and real private consumption expenditure: a proxy variable representing the oil consumption in Fukuoka Prefecture.

II-5. Finance Block (Prefectural Government)

This block handles the revenue and expenditure of Fukuoka's prefectural government. It is the spirit of our model to describe the flow of funds between the central government and prefectural government as minutely as possible. The items which are considered in the prefectural finance are shown in the form of an account statement in Table II-7.

Table II-7 Finance of Fukuoka Prefectural Government

<table>
<thead>
<tr>
<th>Tax revenues</th>
<th>Assembly expenditure</th>
<th>General affairs expenditure</th>
<th>FU_PE1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal inhabitants tax</td>
<td>FU_TDPHC</td>
<td>Welfare expenditure</td>
<td>FU_PE2</td>
</tr>
<tr>
<td>Corporate inhabitants tax</td>
<td>FU_TDPHH</td>
<td>Sanitation expenditure</td>
<td>FU_PE3</td>
</tr>
<tr>
<td>Enterprize tax</td>
<td>FU_TIPB</td>
<td>Labor expenditure</td>
<td>FU_PE4</td>
</tr>
<tr>
<td>Other taxes</td>
<td>FU_TIPO</td>
<td>Expenditure on agriculture, forestry, and fisheries</td>
<td>FU_PE5</td>
</tr>
<tr>
<td>Local transfer tax</td>
<td>FU_PR2</td>
<td>Expenditure on agriculture, commerce and industry</td>
<td>FU_PE6</td>
</tr>
<tr>
<td>local governments</td>
<td></td>
<td>Expenditure on public work</td>
<td></td>
</tr>
<tr>
<td>Tax allocated to</td>
<td>FU_PR34</td>
<td>Police expenditure</td>
<td>FU_PE7</td>
</tr>
<tr>
<td>local grant tax</td>
<td></td>
<td>Educational expenditure</td>
<td></td>
</tr>
<tr>
<td>National subsidy</td>
<td>FU_PR5</td>
<td>Natural disaster relief expenditure</td>
<td>FU_PE8</td>
</tr>
<tr>
<td>Other revenues</td>
<td>FU_PR6</td>
<td>Bond expenditure</td>
<td></td>
</tr>
<tr>
<td>Income from</td>
<td>FU_PR7</td>
<td>Miscellaneous expenditure</td>
<td></td>
</tr>
<tr>
<td>prefectural bonds</td>
<td></td>
<td>Reserves</td>
<td></td>
</tr>
<tr>
<td>Total revenue</td>
<td>FU_PR0</td>
<td>Total expenditure</td>
<td>FU_PE0</td>
</tr>
</tbody>
</table>
With respect to the revenue items, the local transfer tax [E-12], local grant tax [E-13], national subsidy [E-14], and income from prefectural bonds [E-16], as well as the prefectural tax revenues, are included in the model as endogenous variables. As to the prefectural taxes, the inhabitants tax is divided into two types: personal inhabitants tax [E-08] and corporate inhabitants tax [E-09]. The personal inhabitants tax (for the portion proportional with personal income) is imposed on the preceding year's personal income, and the taxable income is assumed to be the total of the preceding year's employee's compensation, property income receipt, and income from proprietorship, as we assumed for the national income tax. The corporate inhabitants tax, except for the portion imposed at a certain rate, is proportional to the corporate tax, therefore, it is assumed as a function of corporate tax. Though enterprise tax [E-10] is levied on both corporations and proprietor, we assumed that it is explained by the income of only corporate enterprises, because the portion from the corporations accounts for the great majority of the enterprise tax. Other taxes [E-11] include the automobile tax, automobile acquisition tax, light-oil delivery tax, etc. These taxes are assumed to be proportional to the level of the private consumption expenditure.

There are three different types of flows of fund from the central government to local governments. The local transfer tax is a tax which is collected by the central government in place of the local governments and which is then distributed to the local governments. Consisting of certain proportions of gasoline tax, petroleum gas tax, vehicle tonnage tax, etc., it is an earmarked tax (i.e., tax to be used for specific purposes). The local grant tax is a tax which is re-distributed to local governments to correct inter-regional gaps. Consisting of a certain proportion of total revenue of the three main national taxes (income tax, corporate tax, and liquor tax), this tax serves to re-distribute collected taxes (income) from high-income districts to low-income ones. It is a non-earmarked tax. In the case of Fukuoka Prefecture, about 50%\(^{(7)}\) of the three main national taxes collected there are re-distributed to the prefectural and municipal governments. The national subsidy is a kind of central government grants to a local government when the subsidy is considered to benefit not only the recipient district but also surrounding districts. The amount of subsidy is determined through negotiations between the central and local governments. In our model, the total amount of national subsidy is formulated on the assumption that they should be subject to budgetary limitations of the central government. Other revenues [E-15] are assumed to be determined in proportion to the scale of prefec-
tural finance. It is also assumed that prefectural bonds are issued only to fill the shortage of revenue against expenditure.

With respect to the expenditure, all items, except for bond expenditure [E-18], are treated as exogenous variables. The bond expenditure is treated simply as a function of the outstanding prefectural government bonds.

II-6. Finance Block (Municipal Governments)

This block handles the variables in municipal finance. Our model reflects not only the flow of funds between the central and prefectural governments (as described in the preceding section) but also the flow of funds between the central, prefectural, and municipal governments. The variables handled in municipal finance are shown in the form of an account statement in Table II-8.

Table II-8  Finance of Municipal Governments

<table>
<thead>
<tr>
<th>Tax revenues</th>
<th>FU_MR1</th>
<th>Assembly expenditure</th>
<th>FU_ME1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal inhabitants tax</td>
<td>FU_TDMHC</td>
<td>General affairs expenditure</td>
<td>FU_ME2</td>
</tr>
<tr>
<td>Corporate inhabitants tax</td>
<td>FU_TDMHH</td>
<td>Welfare expenditure</td>
<td>FU_ME3</td>
</tr>
<tr>
<td>Enterprise tax</td>
<td>FU.TIMPR</td>
<td>Sanitation expenditure</td>
<td>FU_ME4</td>
</tr>
<tr>
<td>Other taxes</td>
<td>FU_TIMO</td>
<td>Labor expenditure</td>
<td>FU_ME5</td>
</tr>
<tr>
<td>Local transfer tax</td>
<td>FU_MR2</td>
<td>Expenditure on agriculture, forestry, and fisheries</td>
<td>FU_ME6</td>
</tr>
<tr>
<td>Local grant tax</td>
<td>FU_MR3</td>
<td>Public work</td>
<td>FU_ME7</td>
</tr>
<tr>
<td>National subsidy</td>
<td>FU_MR4</td>
<td>Educational expenditure</td>
<td>FU_ME8</td>
</tr>
<tr>
<td>Prefectural subsidy</td>
<td>FU_MR5</td>
<td>Expenditure on commerce and industry</td>
<td>FU_ME9</td>
</tr>
<tr>
<td>Other revenues</td>
<td>FU_MR6</td>
<td>Firefighting expenditure</td>
<td>FU_ME10</td>
</tr>
<tr>
<td>Income from local bonds</td>
<td>FU_MR7</td>
<td>Natural disaster</td>
<td>FU_ME11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>relief expenditure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total revenue</td>
<td>Total expenditure</td>
<td>FU_ME0</td>
</tr>
</tbody>
</table>

The revenue of the municipal governments consists of municipal taxes and transfers from the central and prefectural governments. Of the municipal tax items, inhabitants tax and property tax are included in endogenous variables. The inhabitants tax is divided into personal inhabitants tax [E-23] and corporate inhabitants tax [E-22]. These were formulated in the same way as in prefectural
finance. The conventional method of evaluating fixed assets for the purpose of property tax [E-24] is often thrown up for argument because of significant differences between evaluated and actual values. In our model, the current property tax was explained as the tax revenue of the preceding term multiplied by the rate of increase of the fixed capital formation deflator. The result obtained was almost satisfactory. Like the prefectural government, the municipal governments are granted the local transfer tax [E-26], local grant tax [E-27], and national subsidy [E-28] from the central government. They were formulated in the same way as those for the prefectural government. In addition, the municipal governments have revenue from the prefectural subsidy. This revenue from the prefectural subsidy [E-29] is assumed to be a function of total expenditure of the municipal governments. When the total revenue, including other revenues [E-30], falls short of the total expenditure, our model assumes that a local bond [E-31] is issued to cover the shortage.

With respect to expenditure items, all but bond expenditure are treated as exogenous variables. The bond expenditure [E-33] is assumed simply as a function of the outstanding of local bonds issued.

**III. Basic Structure of Japan Model**

In this chapter, we shall confine ourselves to the basic structure of the Japan Model which was linked to our Fukuoka Model. The Japan Model shall be explained in more detail in a separate paper.

<table>
<thead>
<tr>
<th>Table III-1 Basic Structure of Japan Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Real GDP block</td>
</tr>
<tr>
<td>B. Nominal GDP block</td>
</tr>
<tr>
<td>C. Income and outlay account block</td>
</tr>
<tr>
<td>C-1 Corporations</td>
</tr>
<tr>
<td>C-2 Government</td>
</tr>
<tr>
<td>C-3 Private non-profit organizations serving households</td>
</tr>
<tr>
<td>C-4 Households</td>
</tr>
<tr>
<td>D. Capital finance account block</td>
</tr>
<tr>
<td>D-1 Corporations</td>
</tr>
<tr>
<td>D-2 General government</td>
</tr>
<tr>
<td>D-3 Private non-profit organizations serving households</td>
</tr>
<tr>
<td>D-4 Households</td>
</tr>
<tr>
<td>D-5 Stock and other variables</td>
</tr>
<tr>
<td>E. Production and employment block</td>
</tr>
<tr>
<td>F. Wage and price block</td>
</tr>
<tr>
<td>G. Monetary block</td>
</tr>
<tr>
<td>H. Overseas transaction block</td>
</tr>
</tbody>
</table>
Like our Fukuoka Model, the Japan Model is basically a demand-predetermined model of Keynes type. Even so, the production and employment block of the model provides for a high limit of production capacity to secure a route whereby a rise in activity rate leads to a rise in prices and wages, which in turn leads to a decrease in employment. Thus, the Japan Model is structured in such a way that it reflects not only the demand aspect of goods but also the supply aspect of goods. The Japan Model is an appreciably precise model having the following features.

(1) Since a capital finance account by sector is included in the model, it is possible to obtain savings-investment gap by sector.

(2) The model has a monetary block in which an interest rate is determined with the supply and demand of reserve money taken into consideration.

(3) Not only the trade of goods but also the balances of services and long-term capital are included in overseas transactions.

IV. Simulation Analysis Using Fukuoka Prefecture Model

We, in this report, linked only the Japan Model to the Fukuoka Model to conduct a multiplier analysis of expenditure of Japan’s general government. The analysis covered five years from 1985 to 1989, which was within the period of estimation of the equations.

Table IV-1 shows the result of simulation where the public investment of the general government was assumed to be increased by 1% of Japan’s gross national product. In the period covered, the increase of investment expenditure equivalent of 1% of Japan’s GNP corresponds to some 3.2 trillion yen for 1985 (first year) and some 3.8 trillion yen for 1989 (last year). In the present model, the increase of investment expenditure by the general government in Japan entails an increase of national subsidy to local governments. Namely, in the simulation, the national subsidy to the prefectural government of Fukuoka increase by approximately 16 billion yen to 17 billion yen and those to the municipal governments in Fukuoka prefecture increase by approximately 40 billion yen to 47 billion yen. As described in Section II-1, it was assumed that the investment expenditure by the general government in Fukuoka Prefecture would increase by the same amounts during the simulation.
The rate of increase (multiplier) of Japan's GNP was some 1.1% for the first year and some 1.4% for the last year. On the other hand, the gross prefectural product of Fukuoka, which increased by some 1.5% in the first year, would increase by approximately 3% in the last year. Thus, the multiplier of Fukuoka Prefecture tends to be larger than that of Japan as a whole. The reason for this is that the model is structured in such a way that when the increase of public investment in Fukuoka Prefecture is smaller than the national average, the private investment in Fukuoka Prefecture increases to compensate for the gap. Actually, in 1989, Fukuoka Prefecture accounted for approximately 3% of the government's total investment, but the increase in the government's investment in the prefecture was only about 2% of the total increase of the general government's investment in Japan, when the government's investment in Fukuoka Prefecture was increased by the method mentioned above. Because of that, private investment more increases in Fukuoka Prefecture. Besides, it seems that the expansion of the prefecture's multiplier is ascribable to the fact that, as mentioned in Section II-3, our Fukuoka Model is structured in such a way that free economic expansion in the prefecture can hardly be checked. This point will have to be corrected in the future.

Table IV-1  Effects of Increasing Central Government's Investment Expenditure by 1% of Japan's GNP

<table>
<thead>
<tr>
<th></th>
<th>1985</th>
<th>1987</th>
<th>1989</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan's GNP</td>
<td>1.07</td>
<td>1.35</td>
<td>1.37</td>
</tr>
<tr>
<td>Fukuoka's GNP</td>
<td>1.45</td>
<td>2.30</td>
<td>3.08</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Japan)</td>
<td>0.07</td>
<td>0.23</td>
<td>0.28</td>
</tr>
<tr>
<td>(Fukuoka)</td>
<td>0.07</td>
<td>0.28</td>
<td>0.34</td>
</tr>
<tr>
<td>(United States)</td>
<td>0.15</td>
<td>0.43</td>
<td>0.61</td>
</tr>
<tr>
<td>(South Korea)</td>
<td>0.23</td>
<td>0.78</td>
<td>1.27</td>
</tr>
<tr>
<td>(Taiwan)</td>
<td>0.25</td>
<td>0.49</td>
<td>0.78</td>
</tr>
<tr>
<td>(Other)</td>
<td>0.13</td>
<td>0.36</td>
<td>0.48</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Japan)</td>
<td>1.24</td>
<td>1.84</td>
<td>2.59</td>
</tr>
<tr>
<td>(Fukuoka)</td>
<td>1.26</td>
<td>1.83</td>
<td>2.66</td>
</tr>
</tbody>
</table>

With the increase of Japan's GNP, Japanese total imports (on U.S. dollar basis) increase by a little more than 1.2% in the first year and by approximately 2.6% in the last year. The increase of Japanese imports means export growth to Japan from the United States, South Korea, and Taiwan. South Korea showed the largest
gain (about 1.3% in the last year), followed by Taiwan with some 0.8% and the United States with some 0.6%.

Similarly, with the expansion of Fukuoka’s economy, imports of the prefecture increase. The transfer from other prefectures increased by 0.5% in the first year and by 0.6% in the last year. The prefecture’s imports will increase by some 1.3% in the first year and by approximately 2.6% in the last year.

Notes

(*) The present paper describes personal opinions of the authors on the results of their study to invite opinions from various quarters. It does not represent formal opinions of the ICSEAD.

(1) The population and GDP figures for 1989.

(2) Representative studies include the Kansai District Model (Osaka, Hyogo, etc.) and Japanese regional models developed by Okazaki (1961), Okazaki and Kaneko (1962, 1964, 1965), Kaneko (1966, 1972), Kaneko et al. (1972), and the Japanese regional models developed by Fukuchi (1966a, 1966b), Fukuchi and Nobukuni (1968). A brief survey of those studies by Kaneko et al. (1973) is instructive.

(3) In our model, the government’s consumption expenditure was related to the assembly expenditure, general affairs expenditure, sanitation expenditure, labor expenditure, commercial and industrial expenditure, police expenditure, and educational expenditure of the prefectural government, and to the assembly expenditure, general affairs expenditure, sanitation expenditure, labor expenditure, educational expenditure, commercial and industrial expenditure, and firefighting expenditure of the municipal governments.

(4) In our model, the government’s investment expenditure was related to agriculture, forestry, and fisheries expenditure, public work, and natural disaster relief expenditure of the prefectural and municipal governments.

(5) With respect to exports and imports of Fukuoka Prefecture, reference was made to "Fukuoka Prefecture’s Trade Statistics" (yearbook).

(6) The numbers of employees in Fukuoka Prefecture are not shown in the Statistical Yearbook of Fukuoka Prefecture. Therefore, the number of employees was calculated by dividing the compensation of employees by par capita wage, both of which are shown in the Annual Report of Prefectural Accounts.
(7) The rate of re-distribution to the prefectural government is approximately 20% and that to the municipal governments is approximately 30%.

References


Okazaki, Fujio, "An Econometric Model for Regional Economic Planing," in Japanese, Keizaibunseki, No.6, Economic Planing Agency, Economic Analysis Institute,


APPENDIX

Appendix 1. Equation List of Fukuoka Model
Appendix 2. Variable List of Fukuoka Model
Appendix 3. Detailed Results of a Simulation
APPENDIX 1 EQUATION LIST OF FUKUOKA PREFECTURE MODEL

A. GROSS PREFECTURAL EXPENDITURE BLOC (AT CONSTANT PRICES)

[A-01]: FUKUOKA: Fu CP (IDENTITY) (PRIVATE FINAL CONSUMPTION EXPENDITURE)

\[ \text{Fu}_{CP} = \text{Fu}_{CH} \times \text{Fu}_{CNP} \]

[A-02]: FUKUOKA: Fu CH (FINAL CONSUMPTION EXPENDITURE OF HOUSEHOLDS)

ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989

\[
\log(\text{Fu}_{CH}) = 0.28813 + 0.41010 \times \log(\text{Fu}_{YDH}/\text{Fu}_{PCH}*100) + 0.03551 \times \log(\text{Fu}_{KSH[-1]}/\text{Fu}_{PCH}*100) + 4.02176 \times (4.46703 - 1.69101) - 0.0010 \times \text{STD ERR} + 0.0100 \times \text{LHS MEAN} + 15.6321
\]

\[
\text{SUM SQ} = 0.0010 \quad \text{STD ERR} = 0.0100 \quad \text{LHS MEAN} = 15.6321
\]

\[
\text{R SQ} = 0.9927 \quad \text{R BAR SQ} = 0.9906 \quad F = 3, 10 \quad 455.557
\]

\[
\text{D.W.}(1) = 1.3309 \quad \text{D.W.}(2) = 2.3683 \quad H = 1.5728
\]

[A-03]: FUKUOKA: Fu CNP (FINAL CONSUMPTION EXPENDITURE OF PRIVATE NON-PROFIT INSTITUTIONS SERVING HOUSEHOLDS)

ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989

\[
\log(\text{Fu}_{CNP}) = -1.37565 + 0.20751 \times \text{D76} - 0.25525 \times \text{D89} - 5.02533 \times (4.22751) + 0.0243 \times \text{STD ERR} + 0.0470 \times \text{LHS MEAN} + 11.4238
\]

\[
\text{SUM SQ} = 0.0243 \quad \text{STD ERR} = 0.0470 \quad \text{LHS MEAN} = 11.4238
\]

\[
\text{R SQ} = 0.9788 \quad \text{R BAR SQ} = 0.9730 \quad F = 3, 11 \quad 169.367
\]

\[
\text{D.W.}(1) = 1.4613 \quad \text{D.W.}(2) = 2.2693
\]

[A-04]: FUKUOKA: Fu CG (IDENTITY) (GOVERNMENT FINAL CONSUMPTION EXPENDITURE)

\[ \text{Fu}_{CG} = \text{Fu}_{CGR} \times \text{Fu}_{PCH}*100 \]

[A-05]: FUKUOKA: Fu IF (IDENTITY) (GROSS DOMESTIC FIXED CAPITAL FORMATION)

\[ \text{Fu}_{IF} = \text{Fu}_{IFR} + \text{Fu}_{INF} + \text{Fu}_{IFG} \]

[A-06]: FUKUOKA: Fu IFR (GROSS DOMESTIC FIXED CAPITAL FORMATION (PRIVATE: RESIDENTIAL BUILDINGS))

ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989

\[ \text{Fu}_{IFR} = 0.86613 \times \text{Fu}_{IFR[-1]} + 0.01346 \times \text{Fu}_{YDH}/\text{Fu}_{PCH}*100 - 7687.42 \times (\text{JP}_\text{INRB}-\text{PCH} / (\text{Fu}_{PCH})) + 36705.0 \times \text{D78} \]

\[
(7.02821) \quad (2.84904) \quad (2.16995) \quad (4.63965)
\]

\[
- 114405.1 \times \text{D80} - 35145.7 \times \text{D84} - 7042.3 \times \text{D87} + 21782.5 \times (5.46323) \quad (2.02489) \quad (3.83771) \quad (0.23914)
\]

\[
\text{SUM SQ} = 1.9e+09 \quad \text{STD ERR} = 15589.4 \quad \text{LHS MEAN} = 721102
\]

\[
\text{R SQ} = 0.9967 \quad \text{R BAR SQ} = 0.9945 \quad F = 7, 6 \quad 35.8905
\]

\[
\text{D.W.}(1) = 1.9922 \quad \text{D.W.}(2) = 1.4437 \quad H = 0.6486
\]

[A-07]: FUKUOKA: Fu INF (GROSS DOMESTIC FIXED CAPITAL FORMATION (PRIVATE: PLANT AND EQUIPMENT))

ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989

\[ \text{Fu}_{INF} / \text{JP_Inf} = 0.08455 \times \text{Fu}_{INF} / \text{JP_Inf}[-1] - 0.30543 \times \text{Fu}_{IFG} / \text{JP_Inf} + 13.1494 \times \text{Fu}_{RX1} / \text{JP_Inf} + 2.59533 \times \text{D78} \]

\[
(5.02975) \quad (2.29399) \quad (1.40183) \quad (2.09399)
\]

\[
- 2.75818 \times \text{D79} + 2.70944 \times \text{D83} + 6.62702 \times (2.01285) \quad (2.20636) \quad (1.20559)
\]

\[
\text{SUM SQ} = 8.4515 \quad \text{STD ERR} = 1.0988 \quad \text{LHS MEAN} = 36.9589
\]

\[
\text{R SQ} = 0.99210 \quad \text{R BAR SQ} = 0.8533 \quad F = 6, 7 \quad 13.6018
\]

\[
\text{D.W.}(1) = 1.9559 \quad \text{D.W.}(2) = 2.5060 \quad H = 0.2393
\]

[A-08]: FUKUOKA: Fu IFG (IDENTITY) (GROSS DOMESTIC FIXED CAPITAL FORMATION (PUBLIC))

\[ \text{Fu}_{IFG} = \text{Fu}_{IFG} / \text{Fu}_{PCH}*100 \]

[A-09]: FUKUOKA: Fu JP (INCREASE IN STOCKS (PRIVATE ENTERPRISE))

ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989

\[ \text{Fu}_{JP} = -17463.9 \times (\text{JP}_\text{INRC}-\text{PCH}(\text{Fu}_{PGD})) + 0.11199 \times \text{Fu}_{GDP} - 0.67082 \times \text{Fu}_{KJP[-1]} - 111586 \times \text{D79} \]

\[
(3.96688) \quad (2.91279) \quad (2.44499) \quad (3.03686)
\]

\[
- 102161 \times \text{D84} - 848328 \times (3.00260) \quad (2.80456)
\]

\[
\text{SUM SQ} = 9e+09 \quad \text{STD ERR} = 32604.8 \quad \text{LHS MEAN} = 56194.1
\]

\[
\text{R SQ} = 0.8400 \quad \text{R BAR SQ} = 0.7400 \quad F = 5, 8 \quad 3.9994
\]

\[
\text{D.W.}(1) = 2.2061 \quad \text{D.W.}(2) = 1.9256
\]

[A-10]: FUKUOKA: Fu EX (EXPORTS OF GOODS AND SERVICES)

\[ \text{Fu}_{EX} = \text{Fu}_{EX}/\text{Fu}_{PEX}*100 \]

[A-11]: FUKUOKA: Fu IM (IMPORTS OF GOODS AND SERVICES)

\[ \text{Fu}_{IM} = \text{Fu}_{IM}/\text{Fu}_{PIM}*100 \]

[A-12]: FUKUOKA: Fu GDP (IDENTITY) (GROSS DOMESTIC EXPENDITURE)

\[ \text{Fu}_{GDP} = \text{Fu}_{CP} + \text{Fu}_{CG} + \text{Fu}_{IF} + \text{Fu}_{JP} + \text{Fu}_{GDP} + \text{Fu}_{EX}/\text{Fu}_{IM}/\text{Fu}_{DISC} \]
B. GROSS PREFECTURAL EXPENDITURE BLOCK (AT CURRENT PRICES)

[B-01]: FUKUOKA: FU CPN(IDENTITY)(PRIVATE FINAL CONSUMPTION EXPENDITURE)
FU CPN = FU CHN*FU CPN

[B-02]: FUKUOKA: FU CHN(IDENTITY)(FINAL CONSUMPTION EXPENDITURE OF HOUSEHOLDS)
FU CHN = FU CH*FU PCH/100

[B-03]: FUKUOKA: FU CPN(IDENTITY)(FINAL CONSUMPTION EXPENDITURE OF PRIVATE NON-PROFIT INSTITUTIONS SERVING HOUSEHOLDS)
FU CPN = FU CPN*FU CPN/100

[B-04]: FUKUOKA: FU CGN(GOVERNMENT FINAL CONSUMPTION EXPENDITURE)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU CGN = 0.94077 * (FU PE1+FU PE2+FU PE4+FU PE5+FU PE7+FU PE9+FU PE10+FU ME1+FU ME2+FU ME4+FU ME5+FU ME8+FU ME9+FU ME10) (20.6172)
+ 86745.4
(2.01408)
SUM SQ = 37,778.6
STD ERR = 377.8
LHS MEAN = 95164.5
R SQ = 0.9703
R BAR SQ = 0.9680
F = 1.13
D.W.(1) = 1.7327
D.W.(2) = 1.2584

[B-05]: FUKUOKA: FU IFN(IDENTITY)(GROSS DOMESTIC FIXED CAPITAL FORMATION)
FU IFN = FU IFN+FU IFN+FU IFN

[B-06]: FUKUOKA: FU IFN(IDENTITY)(GROSS DOMESTIC FIXED CAPITAL FORMATION (PRIVATE: RESIDENTIAL BUILDINGS))
FU IFN = FU IFN+FU IFN+FU IFN

[B-07]: FUKUOKA: FU IFNN(IDENTITY)(GROSS DOMESTIC FIXED CAPITAL FORMATION (PRIVATE: PLANT AND EQUIPMENT))
FU IFN = FU IFN+FU IFN+FU IFN

[B-08]: FUKUOKA: FU IFN(IDENTITY)(GROSS DOMESTIC FIXED CAPITAL FORMATION(PUBLIC))
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU IFN = 1.1144 * (FU ME6+FU ME7+FU ME11+FU PE6+FU PE7+FU PE8+FU PE10+FU PE11) - 186536 * D88 - 151010 * D87 + 203913 (3.05177) (2.50316) (2.90172)
(8.09385)
SUM SQ = 55,711.9
STD ERR = 756029
LHS MEAN = 21.9245
R SQ = 0.8567
R BAR SQ = 0.8176
F = 3.11
D.W.(1) = 1.1695
D.W.(2) = 1.8121

[B-09]: FUKUOKA: FU JPN(IDENTITY)(INCREASE IN STOCKS(PRIVATE ENTERPRISE))
FU JPN = FU JPN+FU JPN

[B-10]: FUKUOKA: FU BEXN(IDENTITY)(EXPORTS OF GOODS AND SERVICES)
FU BEXN = FU BEXN+FU BEXN

[B-11]: FUKUOKA: FU EXCNF(IDENTITY)(MERCHANDISE EXPORTS TO FOREIGN COUNTRIES)
FU EXCNF = (TR EXCNF*TR EXMNJ+TR EXCRKNF*TR EXMNK+TR EXCRNT+TR EXMN) * JP RATE/100

[B-12]: FUKUOKA: FU EXCNF(EXPORTS TO OTHER PREFECTURES)
ANNUAL DATA FOR 13 PERIODS FROM 1977 TO 1989
LOG(FU EXCNF/FU PEX*100) = 0.17914 * LOG(JP GNP) - 0.44350 * LOG(FU PEX/JP PDD) - 0.29567 * LOG(FU PEX/JP PDD)[-1] (1.0550) (2.60125)
- 0.14783 * LOG(FU PEX/JP PDD)[-2] + 13.8927 (5.77872)
POLYNOMIAL LAGS:
LOG(FU PEX/JP PDD)
FROM 0 TO 2 DEGREE 1 FAZ
SUM SQ = 0.0122
STD ERR = 0.0350
LHS MEAN = 16.1293
R SQ = 0.8908
R BAR SQ = 0.8689
F = 2.10
D.W.(1) = 0.9642
D.W.(2) = 1.8979

[B-13]: FUKUOKA: FU IMNF(IMPORTS OF GOODS AND SERVICES)
FU IMNF = FU IMNF+FU IMNF

[B-14]: FUKUOKA: FU IMCNF(IDENTITY)(MERCHANDISE IMPORTS FROM FOREIGN COUNTRIES)
FU IMCNF = (TR EXCNF*TR EXMNJ+TR EXCRKNF*TR EXMNK+TR EXCRNT+TR EXMN) * JP RATE/100

22
[B-15]: FUKUOKA: FU_IMNF (IMPORTS FROM OTHER PREFECTURES)

ANNUAL DATA FOR 13 PERIODS FROM 1977 TO 1989

LOG(FU_IMNF/FU_PIM*100) = -0.30829 + LOG(FU_GDP) - 0.60612 * LOG(FU_PIM/FU_GDP) - 0.40408 * LOG(FU_PIM/FU_PGDP)[-1] (2.08909) (5.09981) (5.09981)
-0.20204 * LOG(FU_PIM/FU_PGDP)[-2] + 11.1850 (5.09981)
(4.66706)

POLYNOMIAL LAGS:

LOG(FU_PIM/FU_GDP)
FROM 0 TO 2 DEGREE 1

SUM SQ 0.0120 STD ERR 0.0347 LHS MEAN 16.1807
R SQ 0.9379 R BAR SQ 0.9254 F 2, 10 75.4670
D.W.( 1) 1.2601 D.W.( 2) 2.4140

[B-16]: FUKUOKA: FU_GDPN (IDENTITY) (GROSS DOMESTIC EXPENDITURE)

FU_GDPN = FU_CPN + FU_CGN + FU_IFN + FU_JPN + FU_IGN + FU_EXN + FU_IMN + FU_DISCN

[B-17]: FUKUOKA: FU_EXFN (FACTOR INCOME FROM OTHER PREFECTURES)

ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989

FU_EXFN = -0.37916 * FU_GDPN + 13.5692 * JP_GPNP - 130519 * D75 + 221125 * D89 + 12116.5
(5.08901) (5.55170) (2.29876) (3.71123) (0.10730)
SUM SQ 2E+10 STD ERR 46624.3 LHS MEAN -159970
R SQ 0.9143 R BAR SQ 0.8801 F 4, 10 26.5842
D.W.( 1) 2.4934 D.W.( 2) 2.4871

[B-18]: FUKUOKA: FU_GNPN (IDENTITY) (GROSS PrefECTURAL EXPENDITURE)

FU_GNPN = FU_GDPN + FU_EXFN

C. INCOME AND OUTLAY ACCOUNTS (BLOC BY INSTITUTIONAL SECTORS)

C-1. CORPORATE

[C-01]: FUKUOKA: FU_TDCC (IDENTITY) (DIRECT TAXES)

FU_TDCC = FU_RDTC *(FU_TONC + FU_TOMHC + FU_TDPHC) / 100

[C-02]: FUKUOKA: FU_SC (IDENTITY) (SAVING)

FU_SC = FU_YC + FU_NTRC - FU_TDC

[C-03]: FUKUOKA: FU_Y (CORPORATE INCOME (AFTER RECEIPTS AND PAYMENT OF DIVIDENDS))

ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989

FU_Y = -0.55050 * FU_YW + 0.55291 * (FU_GDPN - FU_DEP - FU_TI + FU_SUB) - 647488
(5.61865) (8.37870) (12.6727)
SUM SQ 2E+10 STD ERR 45487.9 LHS MEAN 864404
R SQ 0.9883 R BAR SQ 0.9864 F 2, 12 508.426
D.W.( 1) 1.1178 D.W.( 2) 1.5450

[C-04]: FUKUOKA: FU_NTRC (NET CURRENT TRANSFERS)

ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989

FU_NTRC = -0.02005 * FU_YC - 2724.23 * D81 - 2412.28 * D82 - 5128.98
(30.0958) (2.70153) (2.39300) (8.02820)
SUM SQ 1E+07 STD ERR 971.197 LHS MEAN -22800
R SQ 0.9881 R BAR SQ 0.9868 F 3, 11 303.834
D.W.( 1) 2.5621 D.W.( 2) 1.3586

C-2. GENERAL GOVERNMENT

[C-05]: FUKUOKA: FU_YPRG (PROPERTY INCOME (DISBURSEMENT))

ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989

FU_YPRG = 0.13022 * (FU_KPD[-1] + FU_KMB[-1]) + 1.24544 * JP_INRB *(FU_KPB[-1]+FU_KMB[-1]) / 100 - 53036.5 * D98
(16.6617) (9.5445) (4.89479)
-88355.0 * D89 - 6958.94
(7.85412) (1.23809)
SUM SQ 7E+08 STD ERR 8491.79 LHS MEAN 329980
R SQ 0.9981 R BAR SQ 0.9974 F 4, 10 1321.25
D.W.( 1) 1.9782 D.W.( 2) 2.3347

23
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU_SUB = 0.00482 * FU_GDPN + 22645.6
(1.86383) (2076391)
SUM SQ 1E+09 STD ERR 10305.9 LHS MEAN 74099.9
R SQ 0.6779 R BAR SQ 0.6193 F 2, 11 11.5760
D.W.( 1) 1.5947 D.W.( 2) 1.7230
AR(1) = 0.5513 * AR(1)
(2.13514)

FU_SUB = FU_YPRGR - FU_YPRG + FU_TID + FU_TID + FU_CGN - FU_SUB

FU_YPRG = 0.85056 * (FU_TILN + FU_TING + FU_TINO + FU_TIMP + FU_TIPR + FU_TIMPR + FU_TIMG) - 30184.8 * D75 + 56807.7 * D89 + 103040
(2.36474) (4.36937) (8.62153)
SUM SQ 1E+09 STD ERR 10969.4 LHS MEAN 611232
R SQ 0.9969 R BAR SQ 0.9661 F 3, 11 1194.27
D.W.( 1) 1.9965 D.W.( 2) 1.6731

FU_TID = (FU_TID + FU_TID + FU_TID) / 100

FU_CGN = 0.55262 * FU_YPRGR[1] + 0.26579 * FU_CGN - 13535.6
(5.77544) (5.08422) (4.44878)
SUM SQ 4E+08 STD ERR 6248.01 LHS MEAN 245778
R SQ 0.9973 R BAR SQ 0.9968 F 2, 11 2053.15
D.W.( 1) 2.2216 D.W.( 2) 2.7298 H -6.8316

FU_TNPG = 0.60574 * FU_TNPR[1] - 0.59674 * FU_CGN + 339013
(2.58190) (1.83440) (1.58957)
SUM SQ 2E+10 STD ERR 46650.1 LHS MEAN -520096
R SQ 0.9771 R BAR SQ 0.9730 F 2, 11 235.15
D.W.( 1) 2.0652 D.W.( 2) 2.5601 H -2.6777

C-3. PRIVATE NON-PROFIT INSTITUTIONS SERVING HOUSEHOLDS

FU_YPRNPE = 0.49265 * FU_YPRNPE[1] + 0.16668 * FU_CNPN + 2156.89
(3.66653) (3.44102) (1.91131)
SUM SQ 2E+07 STD ERR 1185.04 LHS MEAN 33524.5
R SQ 0.9889 R BAR SQ 0.9869 F 2, 11 489.767
D.W.( 1) 1.7965 D.W.( 2) 1.7155 H 0.2299

FU_SNAP = FU_YPRNPR - FU_YPRNPE - FU_TNPR - FU_CNPN

FU_YPRNPR = 0.27739 * FU_CNPN + 5716.45 * D80 + 19184.8
(1.82731) (2.22903) (0.94886)
SUM SQ 1E+08 STD ERR 3244.64 LHS MEAN 44770.1
R SQ 0.9468 R BAR SQ 0.9308 F 3, 10 59.2778
D.W.( 1) 0.9983 D.W.( 2) 1.2065
AR(1) = 0.81731 * AR(1)
(4.75642)
C-4. HOUSEHOLDS

C-16: FUKUOKA: FU YPRHR[PROPERTY INCOME(CONSUMER DEBT INTEREST : DISBURSEMENT)]
COCHRAN-ORCUTT
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU YPRHR
= 0.02522 * FU CHN - 134170
(2.34053) (1.43197)
SUM SQ 1E+08 STD ERR 3579.39 LHS MEAN 34564.6
R SQ 0.9499 R BAR SQ 0.9408 F 2, 11 104.232
D.W.( 1) 2.5057 D.W. ( 2 ) 1.5194
AR_0 = + 0.85363 * AR_1
(11.3985)

C-17: FUKUOKA: FU TOH[IDENTITY](DIRECT TAXES)
FU TOH = FU RTOH * (FUTONY+FTDMHH+FTDPH)/100

C-18: FUKUOKA: FU SH[IDENTITY](SAVING)
FU SH = FU YDR-FU CHN

C-19: FUKUOKA: FU YW[IDENTITY](COMPENSATION OF EMPLOYEES)
FU YW = FU WAGE+FU NW

C-20: FUKUOKA: FU YSE(PRIVATE UNINCORPORATED ENTERPRISE INCOME)
LOG(FU YSE/(FU NIF-FU YSE))
= -0.025265 * TIME + 0.02147 * PCH(FU GDP) + 0.10973 * D9 - 1.01404 * D8 - 1.70167
(5.31848) (1.9527) (2.66214) (2.34970) (21.3429)
SUM SQ 0.0466 STD ERR 0.0135 LHS MEAN -1.9862
R SQ 0.8586 R BAR SQ 0.7860 F 4, 9 12.9351
D.W.( 1) 1.3173 D.W. ( 2 ) 2.7241

C-21: FUKUOKA: FU YPRHR[PROPERTY INCOME(TOTAL)]
FU YPRHR = FU YPRHR+FU YPRHAR+FU YPRHR

C-22: FUKUOKA: FU YPRHR[PROPERTY INCOME(INTEREST RECEIPTS)]
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU YPRHR
= 0.46606 * JP INRB*FU KSH[-1]/100 + 0.02359 * FU KSH[-1] + 231600
(0.55172) (1.15514) (9.8141)
SUM SQ 1E+08 STD ERR 36793.0 LHS MEAN 676088
R SQ 0.9803 R BAR SQ 0.9767 F 2, 11 273.444
D.W.( 1) 1.8928 D.W. ( 2 ) 2.2913

C-23: FUKUOKA: FU YPRHDR[PROPERTY INCOME(DIVIDEND RECEIPTS)]
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU YPRHDR
= 0.12584 * (FU YPRHDR+FU YC) + 5653.19
(14.5870) (0.60425)
SUM SQ 3E+09 STD ERR 14389.9 LHS MEAN 139093
R SQ 0.9424 R BAR SQ 0.9380 F 1, 13 212.782
D.W.( 1) 1.1778 D.W. ( 2 ) 1.1390

C-24: FUKUOKA: FU YPRHRR[PROPERTY INCOME(RENT RECEIPTS)]
ANNUAL DATA FOR 15 PERIODS FROM 1976 TO 1989
FU YPRHRR
= 0.42004 * FU YPRHRR[-1] + 0.04262 * (FU CPI*FU IFR/100) - 8110.13 * D79 - 5352.85 * D80 - 5447.97
(2.93900) (3.23547) (3.20823) (2.27287) (1.32675)
SUM SQ 4E+07 STD ERR 2016.59 LHS MEAN 35690.6
R SQ 0.9589 R BAR SQ 0.9407 F 4, 9 52.5364
D.W.( 1) 1.8678 D.W. ( 2 ) 1.9757
H 0.0705
[C-25]: FUKUOKA: FU NTRH (NET CURRENT TRANSFERS)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU NTRH
= 0.17849 * FU_CPNI - 341546
(36.4290) - (12.0551)
SUM SQ 8E+09 STD ERR 25384.6 LHS MEAN 662561
R SQ 0.9903 R BAR SQ 0.9896 F 1, 13 1327.07
D.W.(1) 1.1379 D.W.(2) 2.0212

[C-26]: FUKUOKA: FU YDH (IDENTITY) (DISPOSABLE INCOME)
FU_YDH = FU_YW + FU_YSE + FU_YPRH + FU_YPRHIE + FU_NTRH + FU_TDH

C.5. STOCK AND OTHERS
[C-27]: FUKUOKA: FU DEP (CONSUMPTION OF FIXED CAPITAL)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU DEP
= 0.03878 * (FU_PIF[-1] + FU_KNF[-1] + 100) + 690000
(33.6056) - (38.9722)
SUM SQ 1E+10 STD ERR 33479.1 LHS MEAN 1221367
R SQ 0.9895 R BAR SQ 0.9886 F 1, 12 1129.34
D.W.(1) 1.1342 D.W.(2) 1.6432

[C-28]: FUKUOKA: FU KNF (IDENTITY) (NET FIXED ASSETS)
FU_KNF = FU_KNF[-1] + FU_IF + FU_DEP +FU_PIF * 100

[C-29]: FUKUOKA: FU JKP (IDENTITY) (STOCKS:PRIVATE)
FU_JKP = FU_JKP[-1] + FU_JP

[C-30]: FUKUOKA: FU KSH (IDENTITY) (OUTSTANDING OF SAVING (HOUSEHOLDS))
FU_KSH = FU_KSH[-1] + FU_SH

[C-31]: FUKUOKA: FU_NIF (IDENTITY) (PREFECTURAL INCOME (AT FACTOR COST))
FU_NIF = FU_YW + FU_YPRH + FU_YPRHIE + FU_YN + FU_YSE

D. EMPLOYMENT, WAGE, AND DEFALATORS BLOC
[D-01]: FUKUOKA: FU_NW (EMPLOYMENT)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
LOG(FU_NW)
= 0.31406 * LOG(FU_GDP) + 0.02203 + LOG(FU_KNF[-1]) + 1.98260
(4.46321) - (1.85898) + (2.05942)
SUM SQ 0.0015 STD ERR 0.0117 LHS MEAN 7.4319
R SQ 0.9674 R BAR SQ 0.9615 F 2, 11 163.462
D.W.(1) 1.0179 D.W.(2) 2.2216

[D-02]: FUKUOKA: FU_U (NUMBER OF APPLICANT FOR UNEMPLOYMENT INSURANCE)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU_U /FU_U + FU_NW)*100
= 0.17073 * PCH(FU_GDP) + 0.02705 * PCH(FU_U + FU_NW) + 0.52797 * D77 + 0.80815 * D78 - 0.53296 * D89 + 2.66863
(6.41650) - (0.71618) + (3.7369) + (4.71614) + (3.52535) + (30.9996)
SUM SQ 0.1500 STD ERR 0.1369 LHS MEAN 2.1561
R SQ 0.9150 R BAR SQ 0.8596 F 5, 8 16.9155
D.W.(1) 2.1475 D.W.(2) 0.9930

[D-03]: FUKUOKA: FU WAGE (WAGES AND SALARIES PER WORKER)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU WAGE
(63.0678) - (5.50978) - (5.17003) - (6.31829)
= 85.0290 * D89 + 466.048
(4.90899) + (10.6068)
SUM SQ 1923.82 STD ERR 14.6205 LHS MEAN 3368.00
R SQ 0.9907 R BAR SQ 0.9995 F 5, 9 5192.38
D.W.(1) 2.2865 D.W.(2) 2.3308

[D-04]: FUKUOKA: FU WPI (WHOLESALE PRICE INDEX)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU WPI
= 0.43618 * FU WPI[-1] + 0.43100 * JP WPI + 6.67398 * D80 + 13.2092
(5.39626) - (4.89750) - (3.85814) - (3.71363)
SUM SQ 14.6520 STD ERR 1.2105 LHS MEAN 93.5689
R SQ 0.9826 R BAR SQ 0.9774 F 3, 10 186.561
D.W.(1) 1.3252 D.W.(2) 1.7071 H 1.0726
[D-05]: FUKUOKA: FU CPI (CONSUMER PRICE INDEX)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU CPI  =  0.82135 * FU CPI[-1] + 0.11515 * FU_WPI + 7.85524
         (30.6906)         (2.68876)         (2.58586)
SUM SQ  9.6294       STD ERR  0.9356       LHS MEAN 91.0277
R SQ    0.9942       R BAR SQ  0.9931       F 2, 11 934.764
D.W.( 1) 1.7564       D.W.( 2) 2.7674       H -0.0463

[D-06]: FUKUOKA: FU PCP (DEF LATOR FOR PRIVATE FINAL CONSUMPTION EXPENDITURE)
FU PCP = FU CPI/FU CP*100

[D-07]: FUKUOKA: FU PCH (DEF LATOR FOR FINAL CONSUMPTION EXPENDITURE OF HOUSEHOLDS)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU PCH  =  0.00141 * FU WAGE + 0.92707 * FU CPI + 2.04385
         (1.81451)         (24.6749)         (2.10577)
SUM SQ  1.8023       STD ERR  0.3875       LHS MEAN 89.4546
R SQ    0.9992       R BAR SQ  0.9991       F 2, 12 7816.15
D.W.( 1) 1.7131       D.W.( 2) 2.6592

[D-08]: FUKUOKA: FU PCNP (DEF LATOR FOR FINAL CONSUMPTION EXPENDITURE OF PRIVATE NONPROFIT INSTITUTIONS SERVING HOUSEHOLDS)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU PCNP =  0.00770 * FU WAGE + 0.64850 * FU CPI + 9.8006
         (2.8359)         (4.93464)         (2.89206)
SUM SQ  21.9710       STD ERR  1.3531       LHS MEAN 93.5467
R SQ    0.9911       R BAR SQ  0.9896       F 2, 12 668.936
D.W.( 1) 1.1387       D.W.( 2) 2.1975

[D-09]: FUKUOKA: FU PGC (DEF LATOR FOR GOVERNMENT FINAL CONSUMPTION EXPENDITURE)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU PGC  =  0.65685 * FU PGC[-1] + 0.00564 * FU WAGE + 14.3908
         (3.17041)         (1.34172)         (2.97152)
SUM SQ  15.8172       STD ERR  1.1991       LHS MEAN 93.2857
R SQ    0.9893       R BAR SQ  0.9874       F 2, 11 510.907
D.W.( 1) 1.7580       D.W.( 2) 2.5163       H 0.1225

[D-10]: FUKUOKA: FU PIF (IDENTITY) (DEF LATOR FOR GROSS DOMESTIC FIXED CAPITAL FORMATION)
FU PIF = FU_IF/FU IF*100

[D-11]: FUKUOKA: FU PIFR (DEF LATOR FOR GROSS DOMESTIC FIXED CAPITAL FORMATION (PRIVATE: RESIDENTIAL BUILDINGS))
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU PIFR  =  0.80056 * FU PIFR[-1] + 0.12994 * FU WPI + 6.04763 * D79 + 5.69134 * D89 + 8.85568
         (9.6289)         (1.08517)         (2.95162)         (2.58548)         (1.39560)
SUM SQ  32.0521       STD ERR  1.8872       LHS MEAN 94.0786
R SQ    0.9764       R BAR SQ  0.9659       F 4, 9 92.9513
D.W.( 1) 2.4013       D.W.( 2) 2.1830       H -0.8207

[D-12]: FUKUOKA: FU PIFMR (DEF LATOR FOR GROSS DOMESTIC FIXED CAPITAL FORMATION (PRIVATE: PLANT AND EQUIPMENT))
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU PIFMR =  0.43124 * FU PIFMR[-1] + 0.31094 * FU WPI + 25.7358
         (6.42737)         (5.61558)         (8.24189)
SUM SQ  6.8004       STD ERR  0.7863       LHS MEAN 95.5357
R SQ    0.9810       R BAR SQ  0.9776       F 2, 11 284.067
D.W.( 1) 1.1167       D.W.( 2) 2.1150       H 1.2604

[D-13]: FUKUOKA: FU PIFG (DEF LATOR FOR GROSS DOMESTIC FIXED CAPITAL FORMATION (PUBLIC))
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU PIFG  =  0.44559 * FU PIFGR + 0.68880 * FU PIFR - 13.4801
         (5.85062)         (16.0997)         (3.23015)
SUM SQ  7.1665       STD ERR  0.7228       LHS MEAN 92.2656
R SQ    0.9957       R BAR SQ  0.9949       F 2, 12 1374.90
D.W.( 1) 1.7928       D.W.( 2) 2.4074
[D-14]: FUKUOKA: FU_PJP (DEFLATOR FOR INCREASE IN STOCKS : PRIVATE ENTERPRISE)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU_PJP = 0.73207 * FU_PJP[-1] + 0.27126 * FU_WPI + 14.2434 * D79 - 6.33785 * D85 - 7.21843 * D86 + 0.72992
       (2.36907)   (1.17498)   (5.94968)   (2.84687)   (3.40810)   (0.10677)
SUM SQ    31.9607   STD ERR  1.9988   LHS MEAN 95.8061
R SQ      0.9632   R BAR SQ  0.9403   F  5, 8  41.9298
D.W.( 1)  1.3348   D.W.( 2)  2.0117   H  0.4192

[D-15]: FUKUOKA: FU_PEX (DEFLATOR FOR EXPORTS OF GOODS AND SERVICES)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU_PEX = 0.87927 * FU_WPI + 2.14983 * D79 - 2.23186 * D88 + 11.4873
         (28.2306)   (1.92910)   (2.02445)   (3.96008)
SUM SQ    12.4138   STD ERR  1.0623   LHS MEAN 92.6267
R SQ      0.9865   R BAR SQ  0.9829   F  3, 11 268.737
D.W.( 1)  0.9737   D.W.( 2)  2.0949

[D-16]: FUKUOKA: FU_PIM (DEFLATOR FOR IMPORT OF GOODS AND SERVICES)
COCHRAN-ORCUTT
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU_PIM = 0.77024 * JP_WPI + 23.4874
         (10.9723)   (3.30465)
SUM SQ    13.7824   STD ERR  1.1193   LHS MEAN 93.2071
R SQ      0.9833   R BAR SQ  0.9803   F  2, 11 324.153
D.W.( 1)  1.8929   D.W.( 2)  2.4717   AR_0 = + 0.68623 * AR_1
       (4.15311)

[D-17]: FUKUOKA: FU_PGD (IDENTITY) (DEFLATOR FOR GROSS DOMESTIC EXPENDITURE)
FU_PGD = FU_GDPN/FU_GDP*100

[D-18]: FUKUOKA: FU_PGN (IDENTITY) (DEFLATOR FOR GROSS PREFECTURAL EXPENDITURE)
FU_PGN = FU_GPN/FU_GNP*100

E. FINANCE BLOC (NATIONAL, PREFECTURES AND MUNICIPALITIES)

E-1. NATIONAL TAXES
[E-01]: FUKUOKA: FU_TN(.IDENTITY) (NATIONAL TAXES (TOTAL))
FU_TN = FU_TDNY+FU_TDNCE+FU_TLIN+FU_TING+FU_TINO

[E-02]: FUKUOKA: FU_TDNY(IDENTITY) (INCOME TAX)
FU_TDNY = FU_TDNCE*(FU_YH+FU_YPR+FU_YSE)/100

[E-03]: FUKUOKA: FU_TDNCE (IDENTITY) (CORPORATE INCOME TAX)
FU_TDNCE = FU_TDNCE*(FU_YC+FU_YC[-1])/200

[E-04]: FUKUOKA: FU_TLIN (IDENTITY) (LIQUOR TAX)
FU_TLIN = FU_TLINE*(FU_CPN/100

[E-05]: FUKUOKA: FU_TING (GASOLINE TAX)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU_TING = 0.00565 * (TR_Poil*JP_RATE*FU_CP/(26.98*238.54)) + 18368.4 * D78 + 17543.0 * D79 + 14178.5 * D86
          (9.5928)   (3.30786)   (1.29666)   (2.55222)
         (2.65996)   (7.04657)
SUM SQ    2E+08   STD ERR  5038.96   LHS MEAN 57065.3
R SQ      0.9346   R BAR SQ  0.8982   F  5, 9  25.7111
D.W.( 1)  2.4049   D.W.( 2)  2.8197

[E-06]: FUKUOKA: FU_TINO (OTHER TAXES)
COCHRAN-ORCUTT
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU_TINO = 0.11347 * FU_CPN - 727495
          (2.46295)   (1.77001)
SUM SQ    2E+09   STD ERR  13326.8   LHS MEAN 71935.7
R SQ      0.9353   R BAR SQ  0.9235   F  2, 11 79.4753
D.W.( 1)  1.5711   D.W.( 2)  1.8700   AR_0 = + 0.85173 * AR_1
       (14.4032)

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E-2. PREFECTURAL FINANCE

[E-07]: FUKUOKA: FU PR1(IDENTITY)(TAX (TOTAL))
FU PR1 = FU_TDPHC + FU_TDPHH + FU_TIPB + FU_TIPO + FU_TPHO

[E-08]: FUKUOKA: FU TDPHH(INDIVIDUAL INHABITANTS TAX)
FU_TDPHH = FU_RTDPHH(INDIVIDUAL INHABITANTS TAX)
FU_TPHO = FU_YPRHR[-1]*FU_YPRHR[-1]/100

[E-09]: FUKUOKA: FU TDPHC(CORPORATE INHABITANTS TAX)
ANNUAL DATA FOR 20 PERIODS FROM 1970 TO 1989
FU_TDPHC
= 0.09288 * FU_TONG - 726.027
(29.1569) (1.07282)
SUM SQ 3E+07 STD ERR 1358.08 LHS MEAN 16907.7
R SQ 0.9772 R BAR SQ 0.9871 F 1, 18 850.126
D.W. (1) 2.3094 D.W. (2) 2.4719

[E-10]: FUKUOKA: FU TIPB(ENTERPRISE TAX)
FU_TIPB = FU_RTIPB*(FU_YC+FU_YC[-1])/200

[E-11]: FUKUOKA: FU TIPO(OTHER TAXES)
FU_TIPO = FU_RTIPO*FU_CMP/100

[E-12]: FUKUOKA: FU PR2(LOCAL GRANT TAX)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU PR2
= 0.01472 + (FU_TING+FU_TINO) + 0.00182 * D89*FU_CMP + 2362.73
(8.38941) (1.7597)
SUM SQ 592832 STD ERR 223.277 LHS MEAN 5160.87
R SQ 0.9970 R BAR SQ 0.9970 F 2, 12 2294.45
D.W. (1) 2.3821 D.W. (2) 2.1942

[E-13]: FUKUOKA: FU PR3A(LOCAL TRANSFER TAX)
FU PR3A = FU_RPR3A*(FU_TDOM+FU_TONG+FU_TINL)/100

[E-14]: FUKUOKA: FU PR5(NATIONAL SUBSIDY)
FU PR5 = FU_KP5*(JP_IFGGM*JP_CGN)

[E-15]: FUKUOKA: FU PR6(OTHER REVENUE)
COCHRAN-ORCUTT
ANNUAL DATA FOR 19 PERIODS FROM 1971 TO 1989
FU PR6
= 0.14961 + (FU_PROP-FU_PR2) - 27281.3
(7.10691) (1.66734)
SUM SQ 9E+08 STD ERR 7502.53 LHS MEAN 69069.3
R SQ 0.9615 R BAR SQ 0.9567 F 2, 16 199.909
D.W. (1) 2.1094 D.W. (2) 2.1380
AR_0 = + 0.64398 * AR_1
(3.1406)

[E-16]: FUKUOKA: FU PR7(PREFECTURAL BOND)
ANNUAL DATA FOR 20 PERIODS FROM 1970 TO 1989
FU PR7
= 1.02600 + (FU_PCO-(FU.PR1+FU.PR2+FU_PR3A+FU_PR5+FU_PR6)) + 6186.14
(56.2592) (5.35817)
SUM SQ 1E+08 STD ERR 2466.38 LHS MEAN 63283.6
R SQ 0.9944 R BAR SQ 0.9940 F 1, 18 3188.93
D.W. (1) 1.7515 D.W. (2) 2.3116

[E-17]: FUKUOKA: FU PRO(REVENUE (TOTAL))
FU PRO = FU PR1+FU PR2+FU PR3A+FU PR5+FU PR6+FU PR7

[E-18]: FUKUOKA: FU PE12(INTEREST PAYMENT)
ANNUAL DATA FOR 19 PERIODS FROM 1971 TO 1989
FU PE12
= 0.09873 + FU_KPB[-1] + 27465.9 + D85 + 14113.3 + D86 - 12154.1 + D89 + 4942.87
(51.5663) (1.01930) (5.12511) (4.03182) (5.18976)
SUM SQ 9E+07 STD ERR 2507.81 LHS MEAN 52294.1
R SQ 0.9968 R BAR SQ 0.9959 F 4, 14 1097.47
D.W. (1) 1.9091 D.W. (2) 1.8869

[E-19]: FUKUOKA: FU PE6(EXPENDITURE (TOTAL))
FU PE6 = FU PE1+FU PE2+FU PE3+FU PE4+FU PE5+FU PE6+FU PE7+FU PE8+FU PE9+FU PE10+FU PE11+FU PE12+FU PE13+FU PE14

[E-20]: FUKUOKA: FU KPB(OUTSTANDING OF PREFECTURAL BONDS)
FU KPB = FU KPB[-1]+FU PR7

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E-3. MUNICIPAL FINANCE

[E-21]: FUKUOKA: FU MR1(IDENTITY)(TAX (TOTAL))
FU_MR1 = FU_TOMHC+FU_TOMHH+FU_TIMPR+FU_TIMO

[E-22]: FUKUOKA: FU TOMHC(IDENTITY)(CORPORATE INHABITANTS TAX)
FU_TOMHC = FU_RTDHH*(FU_YW[-1]+FU_YPNNR[-1]+FU_YSE[-1])/100

[E-23]: FUKUOKA: FU TOMHH(IDENTITY)(INDIVIDUAL INHABITANTS TAX)
FU_TOMHH = FU_RTDHH*(FU_YC+FU_YC[-1])/200

[E-24]: FUKUOKA: FU TIMPR(PROPERTY TAX)
ANNUAL DATA FOR 14 PERIODS FROM 1976 TO 1989
FU_TIMPR
= 1.03495 * (FU_TIMPR[-1] + (FU_PIF/100) - 1) + 4004.98
(44,5328)
SUM SQ 11.11856 STD ERR 3996.57 LHS MEAN 12827.2
R SQ 0.9940 R BAR SQ 0.9935 F 1, 12 1983.17
D.W.(1) 1.0589 D.W.(2) 2.1392

[E-25]: FUKUOKA: FU TIMO(OTHER TAXES)
FU_TIMO = FU_RTIMO*FU_CPN/100

[E-26]: FUKUOKA: FU MR2(LOCAL TRANSFER TAX)
ANNUAL DATA FOR 15 PERIODS FROM 1975 TO 1989
FU_MR2
= 0.0734 + (FU_TING+FU_TIMO) + 0.00148 * D89*FU_CPN - 1743.53 * D75 - 2235.39 * D85 - 1521.72 * D86 + 2906.56
(11,7773)
SUM SQ 3731561 STD ERR 643.908 LHS MEAN 126325.5
R SQ 0.9916 R BAR SQ 0.9896 F 5, 9 2117.52
D.W.(1) 1.9129 D.W.(2) 1.7714

[E-27]: FUKUOKA: FU MR3(LOCAL GRANT TAX)
FU_MR3 = FU_RMR3*(FU_TONY+FU_TDCN+FU_TINLY)/100

[E-28]: FUKUOKA: FU MR4(IDENTITY)(NATIONAL SUBSIDY)
FU_MR4 = FU_RMR4*3P_IFGGN

[E-29]: FUKUOKA: FU MR5(IDENTITY)(PREFECTURAL SUBSIDY)
FU_MR5 = FU_RMR5*(FU_MEOFU_ME1FU_ME2FU_ME9)/100

[E-30]: FUKUOKA: FU MR6(OTHER REVENUE)
ANNUAL DATA FOR 20 PERIODS FROM 1970 TO 1989
FU_MR6
= 0.1808 * FU_MRO + 3598.65
(36,5795)
SUM SQ 2E-09 STD ERR 9774.70 LHS MEAN 180823
R SQ 0.9077 R BAR SQ 0.9060 F 1, 18 1338.06
D.W.(1) 1.0802 D.W.(2) 1.2440

[E-31]: FUKUOKA: FU MR7(MUNICIPAL BOND)
ANNUAL DATA FOR 20 PERIODS FROM 1970 TO 1989
FU_MR7
= 1.14770 * (FU_MEO+FU_MR1FU_MR2FU_MR3FU_MR4FU_MR5FU_MR6) - 14651.9 * D75 + 14069.0 * D87 + 8796.25
(33.8899)
SUM SQ 5E-08 STD ERR 5362.42 LHS MEAN 103756
R SQ 0.9066 R BAR SQ 0.9044 F 3, 16 399.450
D.W.(1) 1.5113 D.W.(2) 1.8461

[E-32]: FUKUOKA: FU MRO(IDENTITY)(REVENUE (TOTAL))
FU_MRO = FU_MR1FU_MR2FU_MR3FU_MR4FU_MR5FU_MR6FU_MR7

[E-33]: FUKUOKA: FU ME12(INTEREST PAYMENT)
ANNUAL DATA FOR 13 PERIODS FROM 1977 TO 1989
FU_ME12
= 0.096965FU_KMD[-1] - 21614.3 * D89 + 17571.9
(31.3837)
SUM SQ 2E-08 STD ERR 4582.52 LHS MEAN 123154
R SQ 0.9910 R BAR SQ 0.9892 F 2, 10 552.253
D.W.(1) 1.2984 D.W.(2) 1.4931

[E-34]: FUKUOKA: FU MEO(IDENTITY)(EXPENDITURE (TOTAL))
FU_MEO = FU_ME1FU_ME2FU_ME3FU_ME4FU_ME5FU_ME6FU_ME7FU_ME8FU_ME9FU_ME10FU_ME11FU_ME12FU_ME13

[E-35]: FUKUOKA: FU KMB(IDENTITY)(OUTSTANDING OF MUNICIPAL BONDS)
FU_KMB = FU_KMB[-1]+FU_MR7

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