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Jidea6 and Accountant
- Is the accountant useful? -

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1. Introduction

Everybody is familiar with the system of national accounts, or the consolidated tables of macro variables of national economy. The latest Japanese document of SNA for 2004 with CD-ROM comes in 578 pages[1]. As is well-known, the table itself is merely presenting the static feature of economic indicators. In other words it simply shows identical relations among various economic variables. On the contrary, accountant attached to I-O model is, based on SNA tables, rearranging the contents of the tables and with additional tables and equations, characterized by its dynamic feature in explaining the relations among various economic indicators in SNA and in I-O model. Accountant is more like a macro economic model including whole variables in SNA, or 'an identity centered model'[2]. More important is that by means of accountant, value of macro economic variables in SNA can be consistent with the value of the sectoral sum of economic indicators in I-O model. At the same time some variables in SNA can be a good controller to adjust the level of some variables in I-O Model. This collaboration of SNA and I-O through the accountant is one of the most important points to be emphasized[3].

As far as the author knows, the first application of accountant to Japanese I-O model is by Meade(1996)[4]. Up until Jidea5, the accountant he had prepared, was playing important roles in Jidea models. Sasai (2000) published in Japanese is a paper

[1] See Department of National Accounts (2006).
[2] Quoted from Almon (1995).
[3] See Meade (1996) for more elaborate explanation of accountant for Jidea model.
[4] This paper was done with Prof. Yasuhiko Sasai, former senior researcher of the Institute of International trade and Investment.

introducing the accountant of Jidea43, and Imagawa, Hasegawa and Sasai (2001) also presented a paper in Japanese describing details of Jidea model and accountant.

One of the big problems related to accountant, though simple in its structure, is that it is really time and energy consuming job to prepare an accountant in addition to building the I-O model. Outcome is that the only few variables in SNA can be put in the position to affect the variables in I-O model. Otherwise the model becomes too complicated and sometimes it may not be converged. In Jidea5 only the personal disposable income is taking the position in this relation from SNA to I-O model. A simple question comes out. What will be a simulation result by the I-O model without accountant? The author of this paper is not denying the usefulness of accountant. Imagawa (1998) in which income tax cut effects on the Japanese economy was discussed, could not have been prepared without accountant in Jidea43. However, profit and loss analysis of accountant in I-O model is also worthwhile to challenge.

The purpose of this paper is to examine what will be the economic picture drawn by Jidea6 without accountant comparing with the picture by the model with accountant. To show the method of testing the feasibility of the simulation with/without accountant is also one of the purposes. In the next section, revision of accountant in Jidea6 is presented, and in section 3 results of historical simulation of Jidea6 with/without accountant are discussed. In the final section some conclusions drawn from this study will be summarized.

2. Revision of accountant in Jidea6

Our project constructing Jidea6 started by scrutinizing the whole parts of Jidea5 including the accountant. Main parts of accountant are certainly not changed, especially the inclusion of equations with coefficient of behavioral proportion[5] which are very convenient and simple method of making the SNA tables dynamic. One of the big changes is in the saving rate equation, in which the variable named motvshare (ratio of expenses for motor-vehicle relative to whole private consumption) has been one of the main explanatory variables. In the new saving rate equation, land price (landpri) and relative share of aged persons to total population (agedrat) as well as motvshare are also effective in explaining the saving behavior.

As a brief sketch of accountant in Jidea6, table-1 shows the number of equations by type of equation in the accountant which consists of fifteen regression files.

[5] See Almon, *ibid*.

Details of households regression file, a part of accountant, is in the right hand side of table-2 and the corresponding items and values in 2004 in households table of SNA are given in the left hand side.

There are three types of equations in the accountant following.

The identity equation is trivial.

f totipr = ipr1 + ipr2 + ipr3 (1)

Here, ipr stands for private investment and identity equation (1) above shows that total ipr (totipr) is equal to the sum of the sectoral ipr.

The example of identity equation with fex is the following.

fex iprdisc = cffpr - totipr (2)

id cffpr = totipr + iprdisc (3)

Here, cffpr and totipr is the private investment in SNA base and the private investment in I-O base, respectively. The variable named as iprdisc obtained by equation (2) is a discrepancy between cffpr and totipr. Supposing iprdisc to be exogenous, cffpr can be defined as the addition of totipr and iprdisc in the identity equation (3), connecting the private investment in SNA base with the private investment in I-O base. The identity equation with fex is characterized as it always comes in pair.

The hypothetical example of identity equation with coefficient of behavioral proportion is the following.

fex ratio1 = cffpr/totipr (4)

f cffpr = ratio1*totipr (5)

Ratio1 of cffpr relative to totipr is defined by identity (4). If this ratio1 is assumed to be constant (exogenous), cffpr is given by the identity equation (5) in which the ratio1 is called as a coefficient of behavioral proportion, or a fixed coefficient. Here again, equations (4) and (5) are always in pair.

A good example of the estimated equations is the saving rate equation. Saving rate (savrat) has to be calculated first as a ratio of personal saving in real terms to real personal disposable income (disincr).

r savrat = dum85, dum90, dum95, agedrat, landpri, motvshare, 1/disincr (6).

In equation (6) savrat is regressed with such variables as ratio of the number of aged person relative to total population (agedrat), land price (landpri) and inverse of disincr with negative coefficient in addition to motvshare to explain the saving behavior of Japan.

Relations from I-O sectors to SNA

In Jidea6, all the GDP components of I-O base except households consumption are determined first, and with discrepancy, GDP components of SNA base are obtained. Value added components of I-O side determining the corresponding items in SNA side are followings. Operating surplus and mixed income (opsmhon) in SNA is determined by the equation with the total corporate profits (totpro) in I-O base as the explanatory variable, compensation of employees, receivable (comhor) is identical with total wages (totwag) in I-O base plus discrepancy (comhdisc) between totwag and comhor, and in the same way such sectors as indirect taxes (tax), depreciation (dep), subsidies (sub) are also determining its counterpart in SNA.

Relations from SNA to I-O sectors

As already mentioned above, personal disposable income in SNA, which is defined through the complicated process in household.reg as shown in the right hand side of table-2, is a core variable in accountant to determine the control total of sectoral households consumption in I-O model.

3. Simulation test of Jidea6 with/without accountant

In order to run simulation test of Jidea6 without accountant, definition of personal disposable income should be changed so that some variables in I-O model can directly determine the level of personal disposable income in SNA. The simplest way to connect the I-O and SNA directly is the following by-pass or a short cut in I-O model.

r disincr = dum85, dum90, dum95, totoutr (7)

Here, disincr stands for personal disposable income in real terms of SNA base and totoutr is real total output of I-O base. Inclusion of this statistical equation is a key difference of the I-O model without accountant from the model with accountant. Needless to say, erasing the definition of personal disposable income in household.reg is crucial to avoid the double definition of the variable.

The main concern of this study is which model will produce better or feasible results in the historical simulation, in the sense that the smaller the difference or error between estimated value and actual value of the main variables, the better is the model. This feasibility test applied to the results of the historical simulation of the model is called final test.

It will certainly be some help to explain a bit what the final test is since the word 'final test' is not available in 'help' of G7 program. To judge the feasibility or the predictability of a newly estimated model, or a set of estimated equations as a whole,

the estimated value of each endogenous variable, or the results of historical simulation should be compared with the actual value of the same variable.

Even if each estimated equation is very good in fitness with high RBSQ and with theoretically correct coefficients, it does not automatically prove that the combined set of the equations as a model produces always good results of estimation. In the final test, actual values of the exogenous variables for the whole observation period, and the actual values of the predetermined endogenous variables in the initial year are taken into the model, as in the case of forecasting simulation. Then the estimated value of every endogenous variable should be compared with the actual value of the same variable not available in the case of forecasting simulation. The average rate of error or differences (per cent)[6] of actual and estimated value of each endogenous variable should be within a permissible range of difference. If the error is too big, the equation behaving badly in the model should be changed with the equation seemed to behave well.

Minor changes of model.cpp for final test procedure were done by Prof.Sasai and Mr.Ono, and all that the author has to do is to rewrite the 'lastdata' and 'dyme.cfg' for the final test or the historical simulation[7]. One caution should be added that the question of 'use all data?' in dyme.cfg of the program should be answered by 'no' for the final test, not 'yes' as in the case of forecasting simulation.

Comparison of two simulation results

Table-3 and table-4 show the results of final test. In table-3 Sim AN stands for a historical simulation of Jidea6 without accountant (Accountant: no), and in table-4 Sim AY implies a historical simulation of Jidea6 with accountant (Accountant: yes). Though observation period of our historical data is from 1985 to 2005, for simplicity, the final test was performed for the latest five years from 2001 to 2005 and 2000 as the initial year. Table-5 shows comparison with actual data of some macro variables and the estimated or interpolated value of the same variables. Since the error or differences between actual and estimated values are negative or positive year by year, as the table shows, simple average of the difference is not correct. Root Mean Square Error (RMSE) should be calculated. In this case five years average of square sum of the error from 2001 to 2005 was calculated, and the square root of this average was computed as shown at the lower part of the table. If this figure of RMSE is less than five percent, it

[6] More precisely, Root Mean Square Error (RMSE) should be calculated as shown in table-5.

[7] The author expresses his sincere thanks to Prof. Sasai and Mr.Ono for their revising the program, which is discussed in Ono (2007).

may well say that the result of the final test is acceptable and the model is performing rather well, while the RMSE comes in double digits, the model should be re-considered.

Comparison of two simulation results in table-5 is amazing. Both Sim AN and Sim AY are performing very well to estimate some selected macro economic variables. Though Sim AY is beating Sim AN in estimating GDPR, difference is very small, and except for estimation of employment (Emp) and rate of unemployment (Unempr), Sim AN is marking better results in private investment in real terms (Invr), private and business consumption in real terms (Cons), growth rate of GDP deflator (infl), exports (Expr) and imports (Impr) in real terms. In estimating employment (Emp), both Sim AY and Sim AN are showing good results. Difference in the figure of RMSE is not quite apart from each other.

One caution should be added to the result of final test for the rate of unemployment. Normally, the variable of stock data shows rather good results in the final test, while the test result of the variable of flow data which is fluctuating more than stock data is sometimes poor. If the number of unemployed instead of rate of unemployment is adopted, the result of the final test will certainly be improved.

4. Concluding Remarks

Section 1 presents a brief sketch of accountant in general and the purpose of this paper to investigate the predictability of I-O model without accountant. In section 2 a short summary of accountant in Jidea6 was introduced, and in section 3, main part of this paper, simulation test of Jidea6 with/without accountant are discussed.

Tentative conclusions drawn from the final test above may be the followings.

(1) As far as the aggregated variables are concerned, I-O model without accountant performs well showing somewhat better results of estimation compared with the model with accountant.
(2) If the main concern of the study is in the sectoral I-O analysis, not particularly interested in the macro variables in SNA base, I-O model without accountant is enough.
(3) If the behavior of macro variables in SNA is also points of analysis, I-O model with accountant has certainly vital importance. As already mentioned in section 1, Imagawa (1998) is a good example.
(4) It is desirable to include some words explaining the final test in 'help' of G7 program, though the historical simulation has similarity with the final test in

handling the model.

(5) Final test itself is not almighty to test the performance of the model as a whole, since it is more applicable to test the behavior of aggregated variables than the behavior of detailed sectoral variables in the model. It is not wise to apply the final test to all the equations in I-O model like Jidea6 of 66 sectors.

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Table-1 Number of Equations in Accountant of Jidea6

item	reg.file name	identity equation	identity equation with fex	equation with coefficient of behavioral proportion	estimated equation
Business disposable income	disincbs	1	1	0	1
Property income	propinc	6	1	10	4
Casualty insurance	nlcnlp	6	0	9	1
Current transfers	cto	1	2	9	1
Households	househol	11	2	19	5
Imputed social contribution	isc	0	1	4	0
Saving	savrat	2	2	0	1
Non_financial corporations	n_finan	15	0	7	7
Financial corporations	financil	9	4	8	8
Private non_profit institutions	n_profit	11	0	4	1
General government	govrmnt	19	6	6	3
NIPA, GDP, GNP	gne	2	5	0	0
Consolidated saving and investment	conssav	4	1	0	0
External balance	external	1	1	0	0
National income and its disposition	consincm	5	0	0	0
total	329	93	26(52)	76(152)	32

Table-2	SNA Households (including Private Unincorprated Enterprises)			HOUSEHOL.REG
2004	Notation of items	payable	receivable	
dinhop	2.4 Disposable income,net		286619.6	
opsmhon	1.3 Operating surplus and mixed income, net		47104.1	<— from PROPINC.REG
inohlhon	(1) Operating surplus (imputed service of owner-occ		27026.5	< — ratio*opsmhon
mixinchon	(2) Mixed income, net		20077.6	< — ratio*opsmhon
comhor	1.4. Compensation of employees, receivable		255376.0	comhor = **totwag + comhdisc + comfor - comfop**
comwshor	(1) Wages and salaries		218506.6	< — ratio*comhor
comeschor	(2) Employers' social contributions		36869.4	< — ratio*comhor
iprhor	1.5 Property income, receivable		21937.6	<— from PROPINC.REG
inthor	(1) Interest		4481.9	As a residual
divhor	(2) Dividends		4896.8	< -- ratio*iprhor, ratio = f(totprorat, timet)
proinchor	(3) Property income attributed to insurance policy h		9542.5	< — f(**totpro**, unempr, timet)
renhor	(4) Rent		3016.4	< — ratio*iprhor ratio =f(realestrat, etc)
taxablehor =	2.5 Balance of primary income, net (=1.3+1.4+1.5-1.1)		310471.4	taxablehor = comhor + opsmhon + iprhor - iprhop
sbhor	2.6 Social benefits other than social transfers in kin		68741.1	< -- sbhorpop = f(unempr, gdppop)
ssbhor	(1) Social security benefits in cash		45616.8	= sbssbcgop < --= ratio*sbgop from
pfsbhor	(2) Pension funded social benefits		5443.4	< — ratio*sbhor **Govrmnt.Reg**
uesbhor	(3) Unfunded employee social benefits (2.2(2))		9904.6	< — ratio*sbhor
sabhor	(4) Social assistance benefits		7776.4	As a residual
ctohor	2.7 Other current transfers, receivable		18766.4	< — from CTO.REG
ctonlichor	(1) Non-life insurance claims		2897.0	< — from NLCNLP.REG
ctomcthor	(2) Miscellaneous current transfers		15869.4	As a residual
homet=	Resources of secondary disposable income account		397978.9	= taxablehor + sbhor + ctohor
iprhop	1.1 Property income, payable	13946.3		<— from PROPINC.REG
(inhop	(1) Interest	13634.6	)	sum
inchop	a. Consumer debt interest	6095.0		< — ratio*iprhop
inohop	b. Other interest	7539.6		As a residual
renhop	(2) Rent	311.7		< — ratio*iprhop
tdihop	2.1 Current taxes on income, wealth, et	24099.1		sum
tditihop	(1) Taxes on income	22195.6		< — ratio*taxablehor
tdiocthop	(2) Other current taxes	1903.4		< — f(gdp)
schop	2.2 Social contributions, payable	65140.8		< — ratio*gdphor gdphor from
aschop	(1) Actual social contributions	55236.2		< — ratio*schop **PROPINC.REG**
(ascahop	a. Employers' actual social contributio	26907.3	)	sum
ascachop	(a) Compulsory employers' actual so	22467.6		< — ratio*aschop -> to Govrmnt.Reg
ascavhop	(b) Voluntary employers' actual soci	4439.8		< — ratio*aschop
(ascbhop	b. Employees' social contributions	28328.9	)	sum
ascbchop	(a) Compulsory employees' social co	26926.8		< — ratio*aschop ->to Govrmnt.Reg
ascbvhop	(b) Voluntary employees' social contr	1402.1		As a residual
ascihop	(2) Imputed social contributions	9904.6		As a residual(= schop - aschop)
ctohop	2.3 Other current transfers, payable	22119.4		< — from CTO.REG
ctonliphop	(1) Net non-life insurance premiums	2973.3		< — from NLCNLP.REG
ctomcthop	(2) Miscellaneous current transfers	19146.1		As a residual
dinhop =	2.5 + 2.6 +2.7 - 2.1 - 2.2 - 2.3		286619.6	
fcehop	4.1Final consumption expenditure	279186.8		
savhop	4.2 Saving, net	7831.2		disinc = fcehop + savhop
dinhop	4.3 Disposable income, net		286619.6	= homet - tdihop - schop - ctohop
chgpen	4.4 Changes in pension reserves , receivable		398.4	
disinc	Resources of Disposable income account	287018.0	287018.0	disinc = dinhop + **chgpen**
Note:	Contents of original table were rearranged to arrive at disinc.			
Source:	*Annual Report on National Accounts*, 2006,pp. 28-31.			

Table-3	Historical Simulation without Accountant (Sim AN)									
Year	GDPR	Inv	Cons	Exp	Imp	Emp	UnER	Infl	GrGDP	GrGDPN
2000	519	93.8	300.2	56.3	54.2	64460	4.73	0.15	0.93	1.08
2001	541.2	89.3	320.4	56.9	58.8	62767	7.04	-0.41	4.27	3.86
2002	544.5	89	331.2	57.4	62.3	62828	6.07	-1.73	0.61	-1.12
2003	525.2	92	325.8	60.7	72.1	64105	3.83	2.61	-3.54	-0.93
2004	524.4	90	326.2	66	73.9	64411	3.02	-1.27	-0.16	-1.43
2005	541.7	90.9	333.9	75.7	79.2	64986	2.28	-0.26	3.31	3.05
Note:	GDPR; GDP in Real Terms, Inv; Busuness Investment, Cons; Private & Business Consumption,									
	Exp; Exportd, Imp; Imports, Emp; Employment, UnER; Rate of Unemployment, Infl; Inflation rate,									
	GrGDP; Growth Rate of GDPR, GrGDPN; Growth Rate of Nominal GDP									

Table-4	Historical Simulation with Accountant (Sim AY)									
Year	GDPR	Inv	Cons	Exp	Imp	Emp	UnER	Infl	GrGDP	GrGDPN
2000	519	93.8	300.2	56.3	54.2	64460	4.73	0.15	0.93	1.08
2001	543.8	89.9	320.1	57.1	59.2	63128	6.51	0.59	4.76	5.35
2002	545.5	89.2	332.7	57.6	63.1	62791	6.13	-2.25	0.31	-1.94
2003	524.7	91.4	322.2	60.6	74	64068	3.89	2.62	-3.8	-1.18
2004	520.6	88.5	325.5	65.7	75.5	64066	3.54	-2.18	-0.79	-2.97
2005	537.2	89.1	338.3	75.3	80.8	64527	2.97	-0.13	3.19	3.06
Note:	Same as Table-3.									

Table-5	Results of Final Test							negative:	underestimated	
	Comparison with Actual Data			(Difference: 100.0*(Sim - Actual)/Actual)				positive:	overestimated	
	Actual	Sim AN	Sim AY	Difference(%)		Actual	Sim AN	Sim AY	Difference(%)	
Year	GDPR	GDPR	GDPR	Sim AN	Sim AY	INVR	INVR	INVR	Sim AN	Sim AY
2000	518.9	519.0	519.0	0.0	0.0	93.8	93.8	93.8	0.0	0.0
2001	519.6	541.2	543.8	4.2	4.7	93.5	89.3	89.9	-4.5	-3.9
2002	509.4	544.5	545.5	6.9	7.1	85.5	89.0	89.2	4.1	4.3
2003	503.4	525.2	524.7	4.3	4.2	91.9	92.0	91.4	0.1	-0.5
2004	511.0	524.4	520.6	2.6	1.9	96.5	90.0	88.5	-6.7	-8.3
2005	522.4	541.7	537.2	3.7	2.8	103.3	90.9	89.1	-12.0	-13.7
SQSum/5				20.8	20.3				45.3	58.3
RMSE(Root Mean Square Error)				4.6	4.5				6.7	7.6
	Actual	Sim AN	Sim AY	Difference(%)		Actual	Sim AN	Sim AY	Difference(%)	
Year	Cons	Cons	Cons	Sim AN	Sim AY	infl	infl	infl	Sim AN	Sim AY
2000	300.2	300.2	300.2	0.0	0.0	0.15	0.15	0.15	0.0	0.0
2001	307.5	320.4	320.1	4.2	4.1	-1.11	-0.41	0.59	-0.6	-1.5
2002	305.7	331.2	332.7	8.3	8.8	-0.19	-1.73	-2.25	8.1	10.8
2003	302.1	325.8	322.2	7.8	6.7	-0.94	2.61	2.62	-3.8	-3.8
2004	303.5	326.2	325.5	7.5	7.2	-0.50	-1.27	-2.18	1.5	3.4
2005	309.2	333.9	338.3	8.0	9.4	-0.27	-0.26	-0.13	0.0	-0.5
SQSum/5				53.7	56.0				16.5	29.2
RMSE(Root Mean Square Error)				7.3	7.5				4.1	5.4
	Actual	Sim AN	Sim AY	Difference(%)		Actual	Sim AN	Sim AY	Difference(%)	
Year	EXPR	EXPR	EXPR	Sim AN	Sim AY	IMPR	IMPR	IMPR	Sim AN	Sim AY
2000	56.3	56.3	56.3	0.0	0.0	54.2	54.2	54.2	0.0	0.0
2001	53.2	56.9	57.1	7.0	7.3	54.8	58.8	59.2	7.3	8.0
2002	56.3	57.4	57.6	2.0	2.3	56.3	62.3	63.1	10.7	12.1
2003	61.7	60.7	60.6	-1.6	-1.8	60.2	72.1	74.0	19.8	22.9
2004	68.6	66.0	65.7	-3.8	-4.2	65.6	73.9	75.5	12.7	15.1
2005	71.7	75.7	75.3	5.6	5.0	68.6	79.2	80.8	15.5	17.8
SQSum/5				20.1	21.1				191.3	256.0
RMSE(Root Mean Square Error)				4.5	4.6				13.8	16.0
	Actual	Sim AN	Sim AY	Difference(%)		Actual	Sim AN	Sim AY	Difference(%)	
Year	Employmnt	Employmnt	Employmnt	Sim AN	Sim AY	Unempr	Unempr	Unempr	Sim AN	Sim AY
2000	64460	64460	64460	0.0	0.0	4.7	4.73	4.73	0.0	0.0
2001	64120	62767	63128	-2.1	-1.5	5.0	7.04	6.51	40.8	30.2
2002	63300	62828	62791	-0.7	-0.8	5.4	6.07	6.13	12.4	13.5
2003	63160	64105	64068	1.5	1.4	5.3	3.83	3.89	-27.7	-26.6
2004	63290	64411	64066	1.8	1.2	4.7	3.02	3.54	-35.7	-24.7
2005	63560	64986	64527	2.2	1.5	4.4	2.28	2.97	-48.2	-32.5
SQSum/5				3.1	1.8				1237.4	693.6