The General Feature of JIDEA5

~ Structure and simulation result ~

Yasuhiko Sasai

Kyoei University

Associate Researcher of ITI

Summary

ITI and members of Chuo university has developed JIDEA model since 1993 and it was revised in 2003 as JIDEA version 5. In this paper, the main structure of JIDEA5 and the simulation in the base line from 1998 to 2010 are explained. In addition, the future figure of Japanese industry and employment are analyzed on the base line assumption of JIDEA5. Japanese industry encounters the severe world competition and decrease of population, and these background make it difficult for each industry to adapt to the future economy.

1. Basic structure of the model

The model of JIDEA5 (Japan Interindustry Dynamic Econometric Analysis, version 5) is an INFORUM type model based on the Japanese Input-Output table. The I-O table components such as household consumption, private investment, export, import, wages, profit, depreciation, etc. are changed into functions by each sector and

JIDEA5: General Concept of the Model

I-O table (100×100)

Price deflator, Employment and world trade data
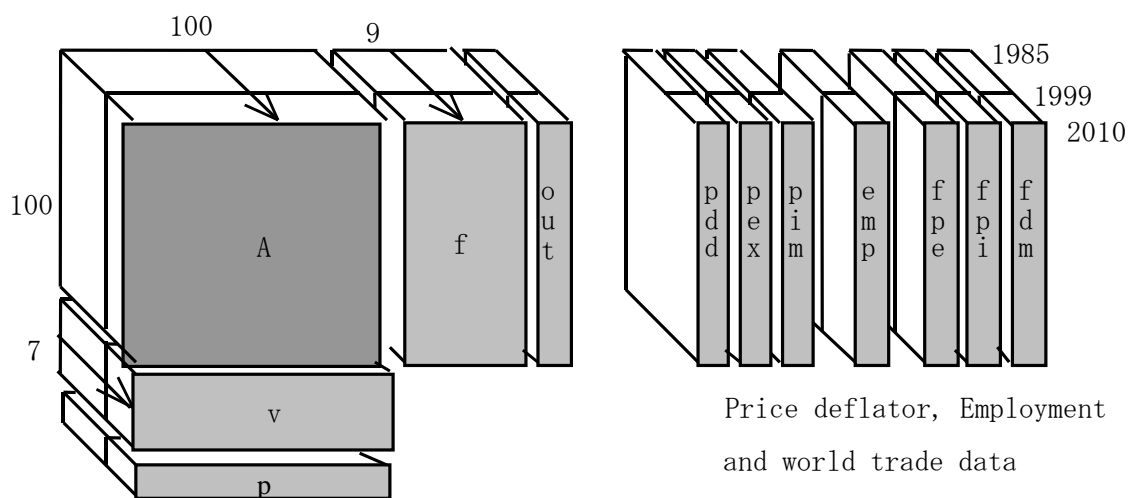
put into the model. The parameters of these functions are estimated by OLS based on the data of Japanese Input-Output table 1985-1999. For the export function, the foreign demand data is supplied by BTM[1](Bilateral Trade Model) and for import share function, the import price data supplied by the same source.

The final demand side components are added to compose demand total which produces output employing intermediate coefficient. Our intermediate coefficient is estimated for future simulation by the past time-series intermediate coefficient. The value added components are same as final demand side but value added total is estimated in nominal and divided by real output so as to produce unit prices.

The model is demand driving type model but supply and demand is balanced by prices of each sectors, accordingly it has the character of general equilibrium model and also it reflects inter-industry induced effect to simulate total industrial activities.

JIDEA5 has 100*100 matrices for 1985 to 1999 and it contains also employment data by sectors for 1985 to 1998. The model also contains macro variables from new SNA data of Japan 1985 to 2000. With the Japanese I-O table, the capital matrix is also published by every 5 years, so the model uses it as a bridge matrix to convert private investment data by selling industry to purchasing industry or vice versa.

The mains concept of model explained by equivalent is as follows;

<u>Final demand side (Real side):</u>

`Q = AQ + F - M(p,..)Q`

- `Q` : Output vector in real term
- `A` : Intermediate coefficient in real term
- `F` : Final demand vector contains also import in real term
- `M(p,..)` : Import share function explained by domestic demand and relative price

<u>Value added side (Nominal side)</u>

`p = p*AD + pₘ*AM + v`
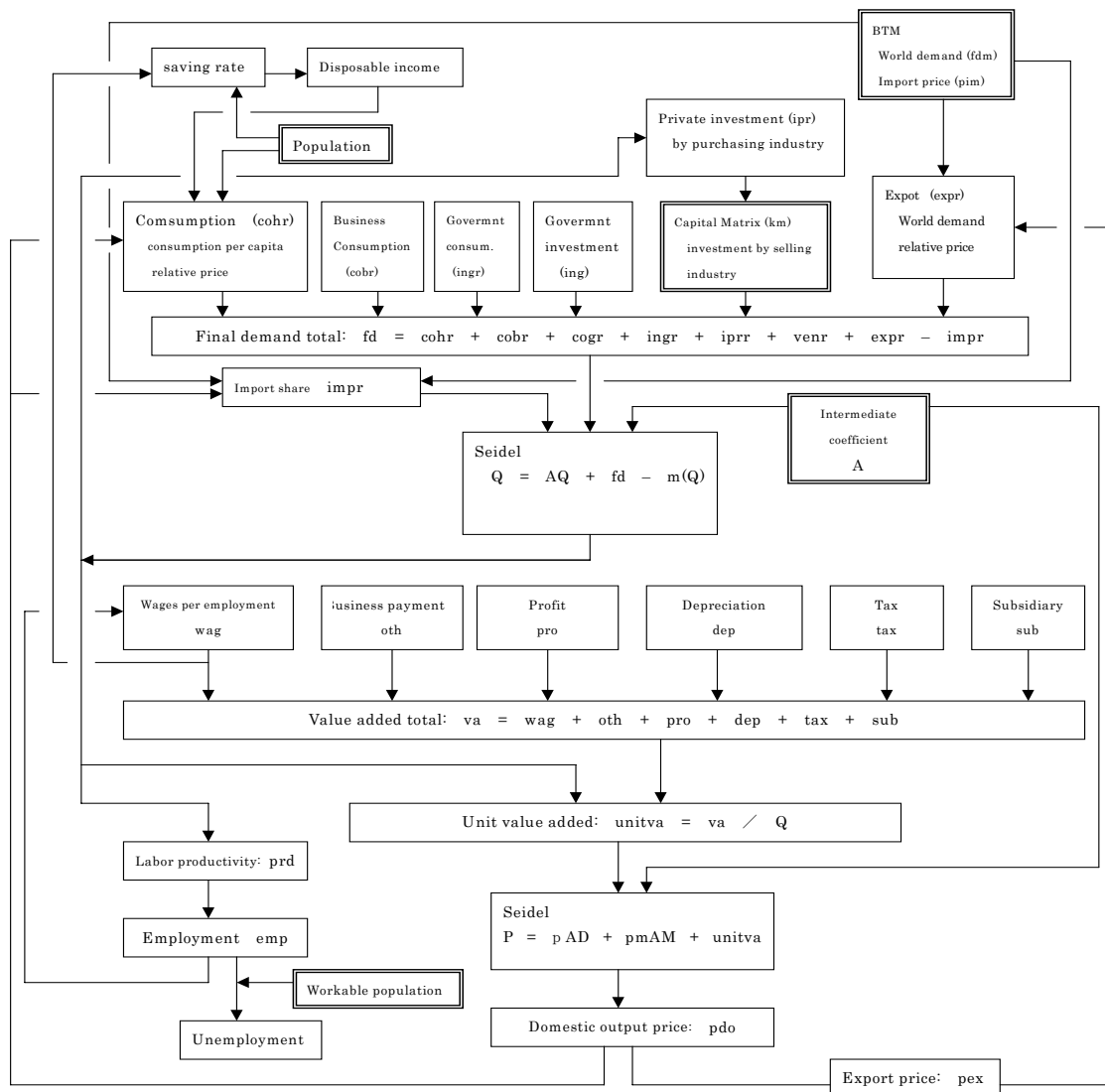
- `p` : Output price vector
- `AD` : `AD = A - AM` (Domestic intermediate coefficient)
- `pₘ` : Import price vector
- `AM` : `AM = A * Imps` (`Imps` is a matrix of which diagonal elements are import shares)

---

[1] Constructed and maintained by INFORUM

The data flow of JIDEA5

saving rate → Disposable income

BTM
World demand (fdm)
Import price (pim)

Population

Private investment (ipr)
by purchasing industry

Comsumption (cohr)
consumption per capita
relative price

Business Consumption (cobr)

Govermnt consum. (ingr)

Govermnt investment (ing)

Capital Matrix (km)
investment by selling industry

Expot (expr)
World demand
relative price

Final demand total: fd = cohr + cobr + cogr + ingr + iprr + venr + expr − impr

Import share   impr

Intermediate coefficient
A

Seidel
Q = AQ + fd − m(Q)

Wages per employment
wag

Business payment
oth

Profit
pro

Depreciation
dep

Tax
tax

Subsidiary
sub

Value added total: va = wag + oth + pro + dep + tax + sub

Unit value added: unitva = va ／ Q

Labor productivity: prd

Employment   emp

Seidel
P = p AD + pmAM + unitva

Workable population

Unemployment

Domestic output price: pdo

Export price: pex

The equation of each component of final demand side and value added side is as follows;

－The household consumption function by sectors is explained by relative price (consumption price by sectors/household consumption total) and disposable income by capita. The share of sectoral household consumption to total consumption will be decided by sectoral consumption function. The budget constraint works on total consumption.

－The private investment function by purchasing industry by sectors is

explained mainly by lagged output or lagged GDP.

－The export function by sectors is explained by foreign demand and relative price(export price/import price by sectors).

－The import share function by sectors is explained by domestic demand added export and relative price(import price/domestic output price by sectors).

－The wage function is explained by productivity and wage index of aggregated tradable sectors.

－The depreciation function is explained by the value of purchasing sectors' investment or time trend.

－The profit function is explained by labor productivity and/or GDP in nominal term.

－The labor productivity function is explained by the difference of output from the past peak of output or time trend. Many sectors of the productivity function do not work well, accordingly, many sectors of productivity were fixed as exogenous.

２．The base line of JIDEA5

　　Japanese economy in the past 15 years is dramatically fracturing. The period between 1975 to 1985 is said to be the low progress economy era. The growth rate has fallen to $3-5\%$ in this period compared to 10% of just previous decade. After the oil shock, pessimistic view spread over the people that Japan would have no more high growth rate and it caused shrinkage of consumption and investment. But thanks to aggressive US economic policy, Japan could find large export market enough to escape from falling in depression. The energy crisis encouraged the investment for energy conservation technology and equipment that made industries much more effective to compete in the world market. But the improvement of effectiveness of Japanese industry caused more severe trade conflict between Japan and US/Europe.

　　After Plaza accord, Yen's high appreciation caused difficulty for Japanese economy. The Japanese government was afraid of depression caused by highly appreciated Yen which would make export shrink, they adapted to the easy money policy. But it finally led to the infamous bubble age in Japan. Many people bought the real estate, houses, luxury cars, membership of golf clubs, luxury furniture as well as acquirement for financial assets. The many manufacturing industries, which found difficult to compete with low labor cost countries, tried to move their factories outside Japan.

At the end of 1980s, the official discount rate pulled up, the stock price touched the ceiling. In 1991, the bubble economy burst out and it left a big deficit in the banking and government sectors as well as in many private sectors. The Japanese depression has continued even in 2003 and it is the longest depression after the World War II.

Following this rough sketch above of Japanese economy, JIDEA model base line assumed the following basic concepts of future Japanese economy;

1. Though Japanese population will reach the ceiling in 2006, the labor population reaches the ceiling in 2000, much earlier than population.
2. The stagnant Japanese economy continues for several years and even after the recovery in 2005, the growth rate of GDP will remain low.
3. The world economy of which data derived from BTM, is some kind favorable for Japanese economy; the foreign demand keeps upward trend and Japanese export enjoy high growth rate.
4. The big financial deficit of Japanese government makes it difficult to take an action to stimulate the economy. Accordingly, the growth rate of government investments assumes as low as 2% from 2003 to 2010.
5. The shortage of labor force compels population to join into the labor market, accordingly, the labor participation rate of work population grows from 63% in 1998 to 68% in 2010. Even in this assumption, the unemployment rate in 2010 will be positive 1.9% though it improves drastically.

The data bank of JIDEA5 contains I-O tables from 1985 to 1998 and as for macro data from 1985 to 2003, accordingly, we set the model to describe the real Japanese economy from 1998 to 2003 following macro data of Japan consistently.

5

	Total Imports	Total Investment
	Millions of 1995 Yen	Millions of 1995 Yen
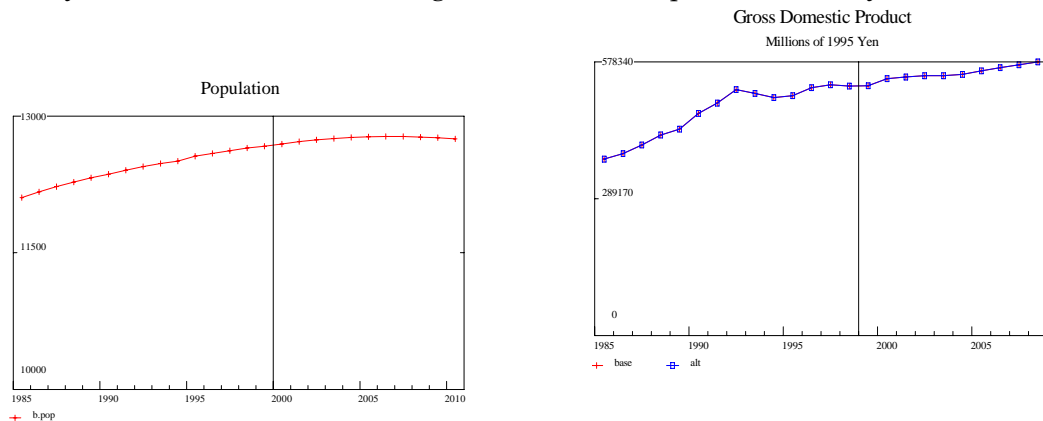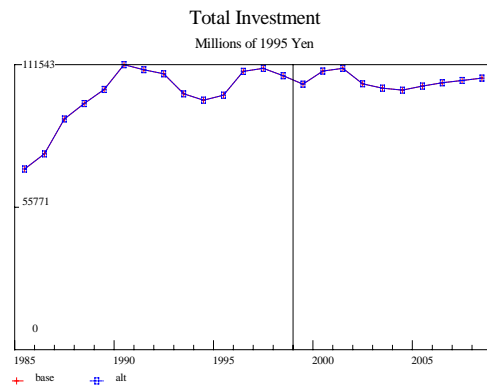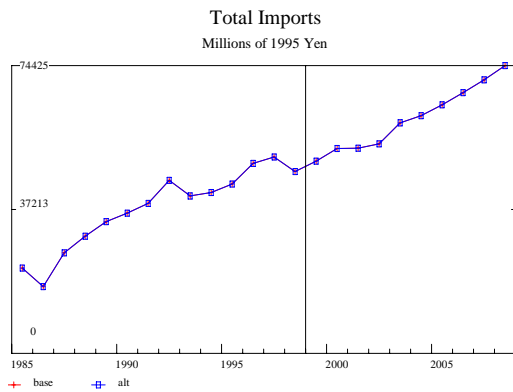
After 2003, the base line of Japanese economy drawn by JIDEA5 is as follows. Looking at GDP components of expenditure category, the household consumption and private investment keep low growth rate. Only the foreign sectors such as export and import grow relatively high.

Table 1. GDP Components by Expenditure Category (Trillions of 1995 Yen, average growth rate %)

	1993	1998	2003	2008	88-93	93-98	98-03	03-08
Gross Domestic Product	511.337	526.895	549.013	578.34	3.8	0.6	0.8	1.0
Total Consumption	360.293	370.304	400.397	426.73	4.3	0.5	1.6	1.3
Consumption of Business	19.86	20.032	20.893	21.693	0.7	0.2	0.8	0.8
Consumption of Households	271.617	283.43	307.733	330.36	4.9	0.9	1.6	1.4
Consumption of Government	68.816	66.842	71.772	74.68	3.3	-0.6	1.4	0.8
Total Investment	146.107	146.476	146.564	155.22	2.6	0.1	0.0	1.1
Business Investment	100.07	107.161	102.271	106.27	0.8	1.4	-0.9	0.8
Government Investment	46.037	39.315	44.292	48.95	7.4	-3.2	2.4	2.0
Inventory Change	-1.431	2.097	-3.216	-3.216	0.0	0.0	0.0	0.0
Exports	46.862	53.803	63.788	74.845	3.6	2.8	3.4	3.2
Imports	40.66	46.965	59.082	73.774	5.9	2.9	4.6	4.4

Accordingly, the ratio of each component against GDP, we find only the household consumption enlarges its share except foreign components.

Table 2. The shares of GDP components by expenditure category (%)

	1993	1998	2003	2008
Gross Domestic Product	100.0	100.0	100.0	100.0
Total Consumption	70.5	70.3	72.9	73.8
Consumption of Business	3.9	3.8	3.8	3.8
Consumption of Households	53.1	53.8	56.1	57.1
Consumption of Government	13.5	12.7	13.1	12.9
Total Investment	28.6	27.8	26.7	26.8
Business Investment	19.6	20.3	18.6	18.4
Government Investment	9.0	7.5	8.1	8.5
Inventory Change	-0.3	0.4	-0.6	-0.6
Exports	9.2	10.2	11.6	12.9
Imports	8.0	8.9	10.8	12.8

Table 3. Current Price GDP by Income Category　　(Trillions of Yen(* billion yen), growth rate %)

	1993	1998	2003	2008	88-93	93-98	98-03	03-08
Gross Domestic Product	478.77	532.253	516.415	538.44	5.1	2.1	-0.6	0.8
Labor Compensation	265.726	282.337	271.664	286.01	6	1.2	-0.8	1
Surplus (Profits, Rent, Interest)	105.628	105.208	102.275	101.49	2.2	-0.1	-0.6	-0.2
Capital Consumption	76.871	86.506	79.377	82.204	6.9	2.4	-1.7	0.7
Indirect Tax	34.411	41.451	47.538	52.163	3.2	3.7	2.7	1.9
Consumption Outside Household	18.814	20.366	19.906	20.807	2.2	1.6	-0.5	0.9
Less: Subsidies	3.866	3.615	4.345	4.223	-2.1	-1.3	3.7	-0.6
Total Value added	489.105	532.253	516.415	538.44	4.7	1.7	-0.6	0.8
Unit Value added*	0.533	0.556	0.515	0.512	1.8	0.8	-1.5	-0.1

The value-added side of JIDEA5 is shown in table 3. From the last peak of 1991, the disposable income continues to decline in nominal terms to reach the bottom at 2003 and it recovers the last peak level at 2006 according to our simulation. It is not certain if Prime minister Koizumi's structural reform will succeed, the base line assumption of JIDEA5 follows rather pessimistic view.

Looking at the share of GDP components by income category in table 3, the share of labor compensation decreases because of recession but it gradually recovers as the economy comes up. But surplus continues to decrease. Only the indirect tax increases its share continuously.

Table 4. The ratio of Current Price GDP by Income Category　　(%)

	1993	1998	2003	2008
Gross Domestic Product	100.0	100.0	100.0	100.0
Labor Compensation	55.5	53.0	52.6	53.1
Surplus (Profits, Rent, Interest)	22.1	19.8	19.8	18.8
Capital Consumption	16.1	16.3	15.4	15.3
Indirect Tax	7.2	7.8	9.2	9.7
Consumption Outside Household	3.9	3.8	3.9	3.9
Less: Subsidies	0.8	0.7	0.8	0.8

Though Japanese population reaches the peak in 2008, labor population reaches the peak in 2000, labor force peak is at 2002. The structure Japanese population is just at turning point now. To arrange base line, labor productivity, hours worked and labor participation rate are the key factors to estimate unemployment rate. It is reasonable that the hours worked will be shortened similar to other developed economies. The labor productivity function for each sector under evaluates its future level too much because Japanese productivity improved rapidly in 1980s. But we did not assume this

tendency continues in same speed as in the past. Accordingly, it needs some *fixes*[2] on its function.

Another fix is needed for labor participation rate. Because labor force is gradually shortened in Japan and the women who used to stay home for old days begin to work in recent years. This tendency becomes strong because under the continuous recession, the salary of husband is not enough to keep the quality of life. So, these three kinds of variables fixed exogenously so that the level of unemployment made reasonable in the model. Sometime in the future, Japan needs the immigrant workers for which most of the Japanese are timid enough to take decision.

Table 5.   Employment and Population   (Millions of persons and average growth rate %)

|	1993	1998	2003	2008	88-93	93-98	98-03	03-08
Total Population	124.764	126.486	127.524	127.690	0.3	0.3	0.2	0
Labor Force	66.150	69.299	73.541	73.405	1.4	0.9	1.2	0
(Total Industry Employment)	66.499	69.133	71.010	73.211	1.3	0.8	0.5	0.6
NIPA Employment	64.500	67.015	68.892	71.093	1.4	0.8	0.6	0.6
Number of Unemployment	1.660	2.284	4.649	2.311	1.4	6.4	14.2	-14
Unemployment rate (%)	2.5	3.3	6.3	3.2	-	-	-	-
Labor Force Participation Rate (%)	63.8	63.3	67.1	68.4	0.4	-0.1	1.2	0.4
Hours Worked per employee	1760	1720	1690	1670	-1.4	-0.5	-0.3	-0.2
Total Hours Worked (millions hours)	117.0	118.7	120.1	122.4	-0.1	0.3	0.2	0.4
Average Productivity(output/hours w)	7.842	8.06	8.338	8.575	3.0	0.5	0.7	0.6
Unit Labor Cost	0.290	0.295	0.271	0.272	3.0	0.4	-1.7	0.1

Japan is now suffered from hard depreciation that is shown in table 6. and graph. In the assumption of JIDEA5, the slight deflation continues until 2008.

Table 6.   Price Indexes   (base year in 1995, average growth rate %)

	1993	1998	2003	2008	88-93	93-98	98-03	03-08
Household Consumption deflator	0.929	0.998	0.920	0.897	-0.1	1.4	-1.6	-0.5
Aggregate Wage Index	0.976	1.025	1.071	1.111	4.7	1.0	0.9	0.7
Tradable sec. Wage Index	1.006	1.077	1.155	1.222	4.9	1.4	1.4	1.1
Non-tradable sec. Wage Index	0.975	0.996	1.039	1.076	4.3	0.4	0.8	0.7
Aggregate Wages per employee	0.976	0.997	0.934	0.954	4.7	0.4	-1.3	0.4
Import Price Index	0.926	1.132	1.129	1.154	-2.4	4.0	-0.1	0.4

Real Disposable Income

Millions of Yen

2
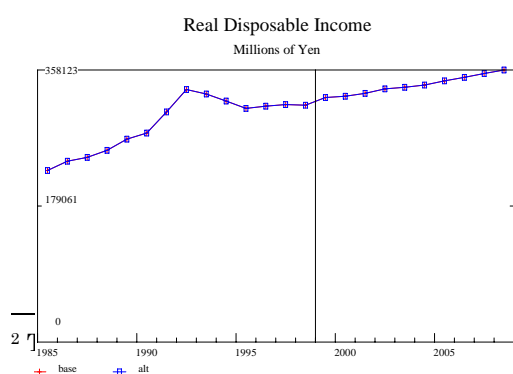
Export Price Index	0.978	1.033	0.969	0.964	−0.1	1.1	−1.3	−0.1
GDP Deflator	0.976	1.054	0.981	0.971	1.3	1.5	−1.4	−0.2
Consumer Price Index	0.995	0.999	0.901	0.873	2.3	0.1	−2.1	−0.6

GDP Deflator (base vs. base)
Index = 1.0 in 1995
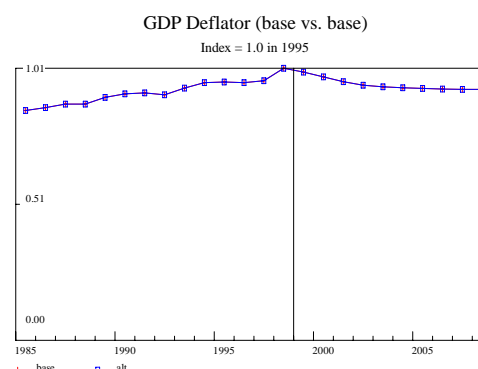
3. The Japanese industry and labor force in future

3-1. Output

To support above-mentioned GDP growth, Japanese industry's output by sectors were estimated as follows in table 8. Total Japanese production continues to increase even with low growth rate but the agriculture, forestry, fisheries sector and mining sector decrease. The construction sector, which is supported by governmental big work to boost Japanese economy, is now in difficulty because huge deficit of the government cannot afford to continue such investment.

Table 7.　Output by sector　　　　　　　　（Trillion of 1995 Yen）

	1985	1990	1995	2000	2005	2010
Total output	690.0	877.1	927.9	996.9	1018.4	1067.1
01 Agriculture, Forestry & Fi	17.4	17.0	15.8	15.1	13.0	11.5
02 Mining	2.0	2.4	1.7	1.6	1.2	0.9
Total Manufacturing	251.8	320.1	312.5	346.7	347.1	353.3
17 Construction	66.0	93.6	88.1	87.4	84.5	87.8
18 Electricity, gas, water	20.0	24.2	26.5	28.6	29.7	31.5
Total service industry	332.8	419.8	483.3	517.4	542.7	582.2

Table 8.　Growth rate of output by sectors　（%）

	85-90	90-95	95-00	00-05	05-10
Total output	4.9	1.1	1.4	0.4	0.9
01 Agriculture, Forestry & Fi	−0.4	−1.5	−1.0	−2.9	−2.6
02 Mining	3.1	−7.0	−0.4	−5.2	−5.9
Total Manufacturing	4.9	−0.5	2.1	0.0	0.4
17 Construction	7.2	−1.2	−0.2	−0.7	0.8
18 Electricity, gas, water	3.9	1.8	1.6	0.8	1.2
Total service industry	4.8	2.9	1.4	1.0	1.4

To understand the structural change of Japanese industry, let's take a look at the output share by sectors shown in table 9 and table 10. It is the result of base line simulation of JIDEA5. In these tables, the 100 sectors of JIDEA5 are aggregated to 28 but to analyze important sectors such as medicine, computer and motor vehicle industry, they are shown separately in the table. The order of sectors are arranged to show descending order in 2010.

As the general tendency, the output share of total manufacturing is decreasing gradually and on the contrary service industry is increasing. In the manufacturing industries, electrical machinery has the biggest share but its size is decreasing slightly after 2005. The computer & communication equipment, which occupies more than half of electrical machinery's share, increases slowly in the first half of 2000s and begins to decrease slightly after 2005. The share of computer & communication equipment industry took over motor vehicle industry, the leading industry of Japan in 1997. The transportation equipment of which motor vehicle occupies almost 90%, continues to grow after recent bottom in 2001. Another continuously increasing sector is medicine, of which importance is small but as a leader of biochemical industry, should grow to be a future big industry. Except petrol & coal products industry, other industries decrease their shares.

Table 9.   Output share of manufacturing industry   (%)

	1985	1990	1995	2000	2005	2010
Total output	100	100	100	100	100	100
Total Manufacturing	36.5	36.5	33.7	34.8	34.1	33.1
13 Electrical machinery	4.3	5.4	5.8	7.4	7.6	7.3
14 Transportation equipment	4.7	5.1	4.5	4.5	4.7	5.0
133 Computer & Communication equip	1.6	2.3	2.9	4.4	4.8	4.7
141 Motor vehicle	3.8	4.4	4.0	4.0	4.2	4.5
06 Chemical products	4.2	4.3	4.2	4.3	4.3	4.3
03 Food & beverage, etc.	5.2	4.4	4.2	4.0	3.9	3.7
12 General machinery	3.2	3.3	2.7	2.7	2.6	2.6
09 Iron & steel	3.0	2.5	2.2	2.2	2.0	1.9
16 Miscellaneous manufacturing	2.2	2.3	2.0	2.1	1.9	1.8
11 Metal Products	1.7	1.9	1.7	1.6	1.6	1.6
05 Wood products & papers	2.3	2.2	1.9	1.8	1.6	1.4
07 Petrol & coal products	1.2	1.0	1.1	1.1	1.2	1.2
01 Agriculture, Forestry & Fishery	2.5	1.9	1.7	1.5	1.3	1.1
061 Medicine	0.4	0.5	0.7	0.8	0.9	1.0
08 Glass & cement, etc.	1.2	1.2	1.0	1.0	0.9	0.8
10 Non-ferrous metal	0.7	0.7	0.7	0.7	0.7	0.7
04 Textile	2.0	1.7	1.2	1.0	0.7	0.4
15 Precision machinery	0.5	0.5	0.4	0.4	0.3	0.3
02 Mining	0.3	0.3	0.2	0.2	0.1	0.1

Table 10.   The service sector and others: the share of output by industries   (%)

	1985	1990	1995	2000	2005	2010
19 Trade	8.9	9.3	11.0	10.3	10.8	11.2
17 Construction	9.6	10.7	9.5	8.8	8.3	8.2
27 Business service	5.6	6.5	6.8	7.0	7.1	7.3
21 House rent	5.2	4.7	5.7	5.4	5.9	6.2
28 Personal service	6.3	6.0	5.8	5.9	5.8	5.7
20 Finance, Real estate	4.5	5.0	5.1	5.0	5.1	5.2
22 Transportation	4.7	4.3	4.4	4.5	4.6	4.6
26 Hospital & health care	3.4	3.3	3.9	4.1	4.1	4.1
25 Education & Research	3.6	3.5	3.6	3.6	3.6	3.7
24 Public administration	3.7	2.9	3.3	3.2	3.2	3.1
18 Electricity, gas, water	2.9	2.8	2.9	2.9	2.9	3.0
23 Communication	1.1	1.2	1.6	2.1	2.4	2.8
29 N.E.C.	1.2	1.0	0.8	0.8	0.7	0.6

Other than manufacturing industries, trading sector takes the biggest share and it continues to grow until 2010. On the contrary, construction occupies the second largest share but it continues to decrease after the last peak in 2000. Except personal service and public administration, the service industries continue to increase the shares of output over the estimated period.

3-2. Employment

To obtain the above estimated production, JIDEA5 model assumes the employment as table 11. In spite of population decrease, total employment continues to increase. In this back ground, we can see that agriculture, mining and manufacturing sector decrease employment but service industries increase in relatively high rate.

Table 11. The index of employment based on 1995 (1995=100)

	1985	1990	1995	2000	2005	2010
Total employment	91.5	96.4	100.0	107.2	107.3	110.8
Agriculture, Forestry & Fi	135.4	115.6	100.0	98.2	80.4	66.9
Mining	153.1	124.7	100.0	187.3	120.0	123.2
Total Manufacturing	98.3	102.5	100.0	103.0	98.7	96.4
Construction	78.1	88.2	100.0	105.8	102.4	107.1
Electricity, gas, water	84.0	93.0	100.0	101.2	99.7	100.3
Total service industry	85.9	93.1	100.0	110.2	115.0	122.6

Table 12. The share of employment by aggregated sectors   (%)

	1985	1990	1995	2000	2005	2010
Total output	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture, Forestry & Fi	10.8	8.8	7.3	6.7	5.5	4.4
Mining	0.2	0.2	0.1	0.2	0.1	0.1

Total Manufacturing	24.2	24.0	22.5	21.7	20.7	19.6
Construction	9.0	9.6	10.5	10.4	10.1	10.2
Electricity, gas, water	0.8	0.8	0.9	0.8	0.8	0.8
Total service industry	55.0	56.6	58.6	60.2	62.8	64.9

3-3. Productivity and employment

In spite of output increase, the Manufacturing industry decreases employment because of productivity increase. As the employment in JIDEA5 is defined as follows, we can distinguish the reason of changes of employment by growth of productivity, output and hours worked.

emp = prdh * outr / hw

where

emp: employment by industry

prdh: productivity defined by total input, labor force, hours worked by
industry

hw　: hours worked per employee by industry

Let's take a look at the changes of main sectors' employment with its factor. The graphs shown below show the growth of employment by line graph and show the growth of output, productivity and hours worked per employee by bar graph. These growth rates mean five years average of 1985-90, 1990-95, 1995-2000, 2000-05 and 2005-10.

For "Manufacturing industry total", the increase of productivity makes employment decrease but increase of output and decrease of hours worked per employee minimize that effect. As Japanese manufacturing industries confronting severe foreign competition, they should not stop the productivity increase. Accordingly, to keep employment, Japan must continue to expand output or divert from stagnant industries

Manufacturing Total
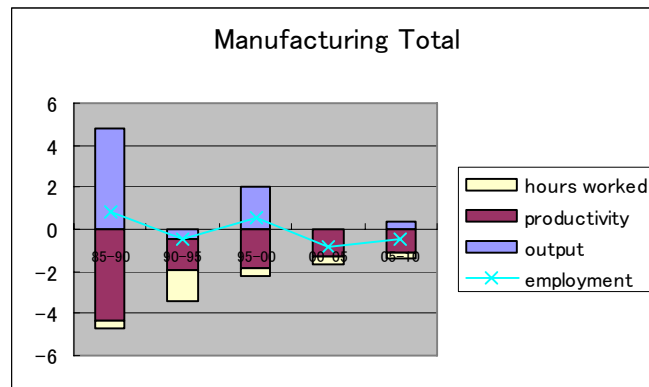
to new industries.

Let's take a look at the several sectors which express some typical patterns of movement in Japanese industries. The patterns of employment growth with the change of productivity, hours worked and output are distinguished by five. The first one is employment decrease with the shrink of output and alight increase of productivity. The second pattern is employment increase with the decrease of output and slight increse of productivity. The third pattern is employment sustained in spite of output and

productivity decrease together. The fourth pattern is increase employment with increase of output as well as increase productivity. The fifth pattern is special for construction sector, which is now in the restructuring process.

Table 13. 5 patterns of employment growth

	1st	2nd	3rd	4th	5th
employment	down	**up**	up	**up**	down
output	down	down	**up**	up	down
productivity	up	up	constant	up	down

1ˢᵗ pattern

The typical first type is textile industry which contains textile industry as well as clothing industry. The employment in the textile industry has been reducing mainly due to decrease in output. The decrease of output is caused mainly by low price import from Asian countries. "Wooden products & furniture", "Plastic", "Household electric", "Computer", "Heavy electric apparatus" and "Precision Machine" show the same
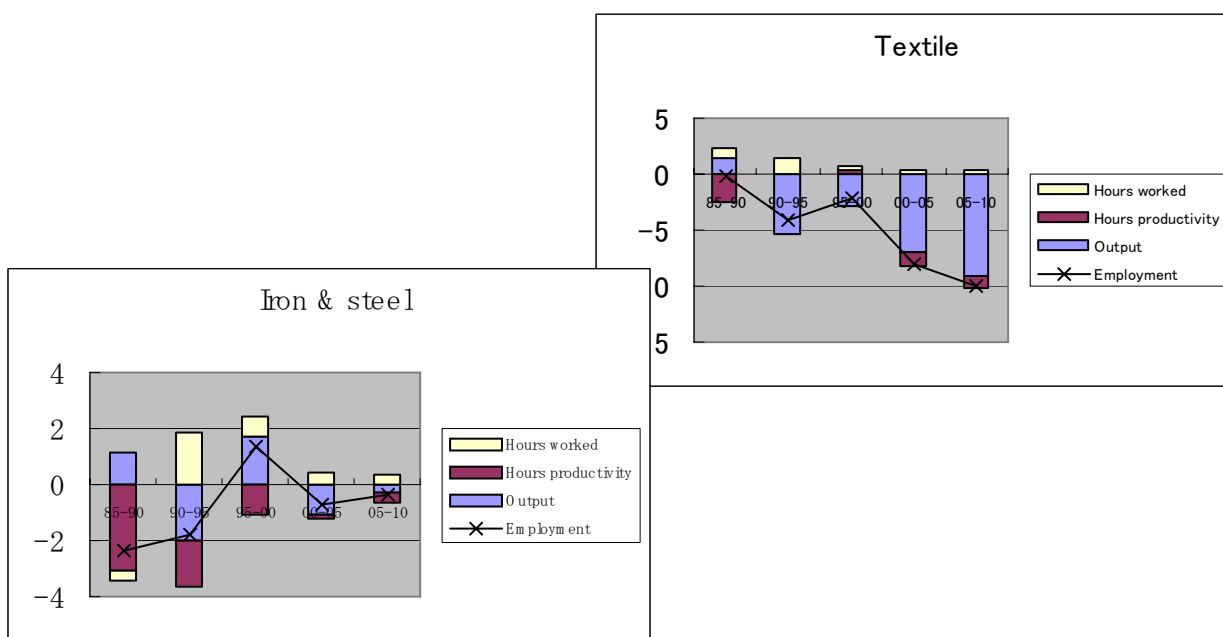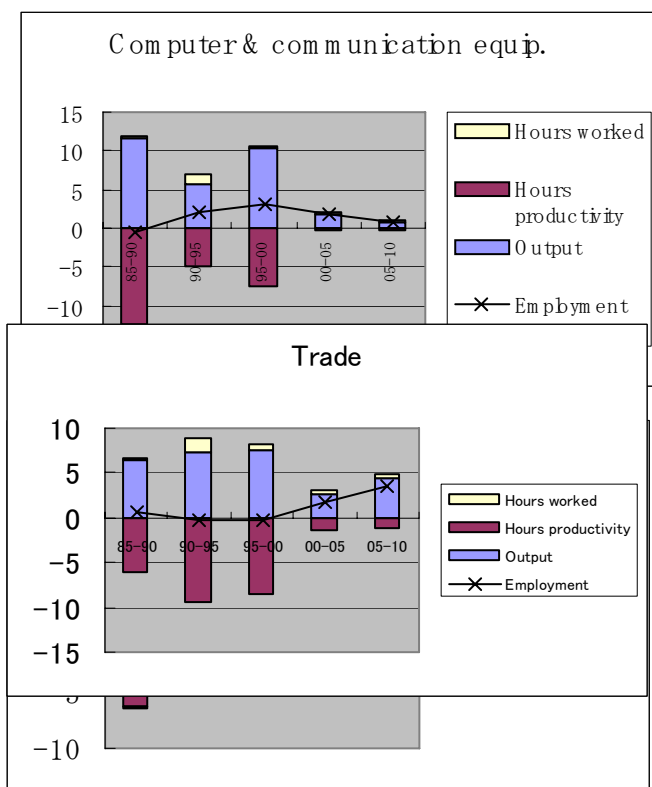

pattern.

2ⁿᵈ pattern

Iron & steel industry belongs second pattern. This industry has been suffered from the low demand comparing to its capacity, so they were forced to make restructuring and now the employment gradually coming back. "Food & beverage", "Rubber", "General machine" and "machine tool" have the same pattern.

3ʳᵈ pattern

The typical third pattern industry is "Electronics", which include computer

industry as well as communication equipment industry. This industry is one of the Japanese leading industries in the past. But in recent year, it was suffered from serious competition with the East Asian countries. "Electronics" sector keeps its employment still rising in spite of slowing down in output. The productivity of this sector assumed constant at very low growth rate.

4<u>th</u> pattern

The fourth pattern is shown in the motor vehicle industry, which is other big industry of Japan. The rapid growth period is over but steady increase continues. The productivity and output continue to increase together. "Medicine" and "Electric power" has the same pattern as motor vehicle industry.

The same fourth pattern but more strong output growth is shown in "Trade" and "Communication" industry. The output growth rate of trade sector kept high in bubble age. Now many big super chains forced restructuring, on the other hand, new type of business models appear in the market. In future output will gradually slow down but it continues to grow. The rapid increase of productivity will be finished.

"Communication" has almost same pattern. Communication industry is one of the first growing industries. The past productivity growth is also high but in future it will be slow down even though it still increase. The employment will grows in future.

5<u>th</u> pattern

After the bubble age, with the shrinkage of government budget, the rapid growth period is over. "Construction" industry is now under reconstruction. In future, low growth rate will continues. "Organic chemical" and "Glass & cement" have more or less in the same pattern.
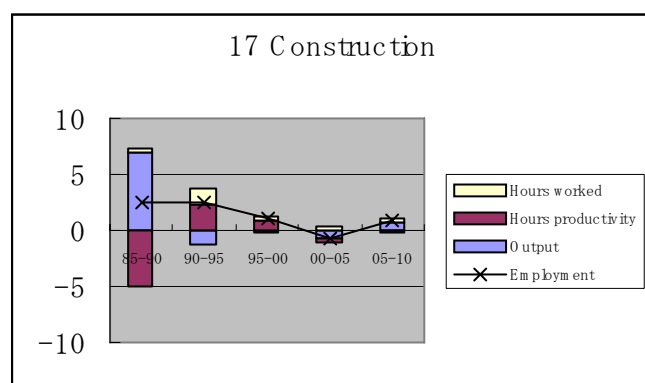
Conclusion

We can find that the INFORUM type model is very efficient to analyze employment problem. But to specify the productivity function, I found some problems to define them. We use the variable "qup" and/or "qdown" variables, the difference of output from its past highest level. But the sign condition of that variable is not fulfilled

in many sectors, accordingly, we should fix them exogenously.

The productivity function is important to determine employment in relation to output. The productivity specification in JIDEA5 need farther elaboration.

References

Almon, Clopper (1999), *The Craft of Economic Modeling*, Fourth edition.

(1995), *Identity-Centered Modeling in the Accountant of SNA-Based Models*, 3rd INFORUM World Conference Absolwent, Lodz, Poland, pp.7-30.

Meade, Douglas (1998), *The Accountant of the JIDEA Model* (INFORUM Paper).

(1997), *The JIDEA Model of Japan: Building Macroeconomic Stabilizers and Developing the Accountant*, in Proceedings of the 3rd INFORUM World Conference, Absolwent, Lodz, Poland, pp.59-

(1993), *The Impact of Equipment Investment on Labor Productivity Growth*, Presented at the Tenth International Conference on Input-Output Techniques, Seville, Spain.

Nyhus, Douglas and Ma, Qing (1996), *Bilateral Trade Model* (INFORUM Paper)

Nyhus, Douglas (1991), *The INFORUM International System*, Economic Systems Research, vol.3, No. 1, pp.55-64.

McCarthy, Margaret Buckler (1991), *LIFT: INFORUM's Model of the U.S. Economy*, Economic Systems Research vol. 3, No. 1.