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International Competitiveness of the Japanese Industry
- An Analysis Based on JIDEA5 -

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1. Introduction

The purpose of this paper is to present the second version of the analysis on structural changes and international competitiveness of the Japanese industry discussed in the 10th INFORUM World Conference held at the University of Maryland last year[1]. What we did in the previous paper was the analysis based on the historical data for JIDEA5 model which had been just under construction at that time, and we could at least distinguish some of the sectoral differences in the turning point of the international competitiveness of Japanese manufacturing industries induced by the various domestic factors, though we could not point out clearly the factors which had caused structural changes.

Now JIDEA5 model has been finally completed, we can present the analysis based on the results of policy simulation by JIDEA5 model, details of which, as well as the structure of the model itself, are available in Sasai (2003). The results of simulation 5, simulation 6 and simulation 7 are deeply related to the analysis of international competitiveness of manufacturing industries, and will be discussed in this paper. In the next section a short survey of the index of international competitiveness will be presented quoting well prepared review articles[2]. The third section is to propose a new index of international competitiveness, which, in the fourth section, plays effective roles in describing changes in international competitiveness of the Japanese manufacturing sectors under the various assumptions of policy simulation based on JIDEA5. The final section is mainly for the summary of what has been done in this

[1] See Imagawa (2002).
[2] See Vollrath (1991) and Laursen (1998).

paper and pointing out some of the remaining problems that should be challenged in the future study.

2. A short survey of the index of international competitiveness

The index of international competitiveness (here after abbreviated as IIC) employed in the last year's analysis was a simplified but frequently used one, an index of net export divided by total trade. It is most appropriate to review various types of IIC, quoting what has been summarized by Vollrath (1991), in which he describes 10 different kinds of IIC, each of which he names RCA1, RCA2, …and RCA10[3]. He begins with the index of relative export performance (RCA1) by Liesner (1958).

$RCA1 = X_{ij} / X_{ik}$,

where X equals export value and subscript i refers to the export of any specified commodity and subscript j and k points, respectively, to one's own country and any of the other specified country (here after subscript i for a commodity and subscript j for a country unless other notations are specified).

The most well known IIC is revealed comparative advantage (RCA2) by Balassa (1965).

$RCA2 = (X_{ij} / \sum_i X_{ij}) / (\sum_j X_{ij} / \sum_i \sum_j X_{ij})$,

subscript i refers to the export of any manufactured commodity, and subscript j points to selected developed countries. Theoretically, RCA2 is same with the following RCA3.

Export specialization index (RCA3) by Kanamori (1964) is available in one of the UN publications[4].

$RCA3 = (X_{ij} / \sum_i X_{ij}) / (\sum_j X_{ij} / \sum_i \sum_j X_{ij})$,

where subscript i refers to the export of any commodity and subscript j points to any country.

Simple relative export-import measure (RCA4) is also available in Balassa (1965).

$RCA4 = (X_{ij} / \sum_i \sum_j X_{ij}) / (M_{ij} / \sum_i \sum_j M_{ij})$,

where M refers to import[5].

Trade-only index of comparative advantage (RCA5) by UNIDO (1982) is the most frequently employed IIC[6].

$RCA5 = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij})$,

where the numerator is net export and the denominator is total trade.

One of the advantages of this index is its simplest form of calculation in which trade

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[3] RCA is the abbreviation of revealed comparative advantage. Though he denies some of the indices he surveyed to be RCA, he calls them RCA.

[4] Unfortunately present author could not locate the document.

[5] Ultimately, this index was rejected by the author (Vollrath, *ibid*, p.269).

[6] Some of the examples are Webster & Gilroy (1995) and Imagawa (2002).

data of a single country is enough, though some have doubts on the validity of this index as a true measure of comparative advantage in the world market[7].

Trade-only index of comparative advantage (RCA6) by Donges and Riedel (1977) is rather complicated one.

$$RCA6 = (((X_{ij} - M_{ij}) / (X_{ij} + M_{ij})) / ((\sum_j X_{ij} - \sum_j M_{ij}) / ((\sum_j X_{ij} + \sum_j M_{ij})) - 1) * (\text{sign}\ (\sum_j X_{ij} - \sum_j M_{ij})),$$

if $(\sum_j X_{ij} - \sum_j M_{ij})$ comes positive (negative), plus (negative) sign is given to $(\sum_j X_{ij} - \sum_j M_{ij})$.

Alternative measure of revealed comparative advantage by Bowen (1983) is the first one in which output data plays important roles in the index.

$$RCA7 = (X_{ij} - M_{ij}) / (Y_j / \sum_j Y_j) * \sum_j Q_{ij},$$

Y_j stands for country j's gross national products and Q_{ij} for domestic production of commodity i of country j. RCA7 is not trade only index and could be excluded from this analysis[8].

Alternative definition of revealed comparative advantage by Vollrath (1987) is the first one in which trade data of a specified commodity and/or a specified country are separated from the summation of the world total.

$$RCA8 = RXA_{ij} - RMA_{ij}, \text{ where}$$

$$RXA_{ij} = (X_{ij} / \sum_h X_{ij}) / (\sum_k X_{ij} / \sum_h \sum_k X_{ij}) \text{ and}$$

$$RMA_{ij} = (M_{ij} / \sum_h M_{ij}) / (\sum_k M_{ij} / \sum_h \sum_k M_{ij}),$$

subscript h refers to all traded commodities minus commodity i and subscript k refers to the world minus country j. As a variant of RCA8 he presents two more indices in the logarithmic form.

$$RCA9 = \ln(RXA_{ij}) \text{ and}$$

$$RCA10 = \ln(RXA_{ij}) - \ln(RMA_{ij}).$$

The most satisfying measures recommended by Vollrath are RCA3 (RCA2) or RCA9. He prefers the latter because it eliminates double counting.

Other examples of alternative IIC are following three indices.

Revealed symmetric comparative advantage (RSCA) by Laursen (1998) is a revised version of Balassa's RCA2.

$$RSCA = (RCA2 - 1) / (RCA2 + 1),$$

The point of claim in his revision of RCA2 is that when using the RCA2, it should always be adjusted in such a way that its measure ranges from -1 to +1.

Trade specialization index (MI) by Michaely (1962) was at first intended to measure dissimilarity in the composition of the country's exports and imports by summing up the index, though later a number of researchers have applied the index as a measure of

[7] Vollrath, *ibid.*, p. 272.

[8] See choice of IIC in section 3.

sectoral trade specialization[9].

$MI_{ij} = (X_{ij} / \sum_i X_{ij}) - (M_{ij} / \sum_i M_{ij})$,

Normalized export/import ratio (WI) by Wolter (1977) could be said a variation of MI.

$WI_{ij} = (X_{ij} / \sum_i X_{ij}) / (M_{ij} / \sum_i M_{ij})$,

where export share is divided by import share, while in MI the latter subtracting from the former comes to the index.

Variant of RCA4 (VRCA) by Weiss (1983) is not really a variation of RCA4 by Balassa, because country summation is not included.

$VRCA = \ln((X_{ij} / \sum_i X_{ij}) / (M_{ij} / \sum_i M_{ij}))$,

where logarithmic form of WI makes an index.

Vollrath's intention is to present a theoretical evaluation of alternative trade intensity measures and did not try to examine statistical relations among various IIC. Some examples of comparison of various IIC are available in the following articles. One is by Balance *et al* (1987) and the other by Laursen (1998).

Table 1 (p.159) in Balance *et al* (1987) shows correlation coefficients among RCA indices (trade-only Indices of RCA2, RCA5 and RCA6)[10], which are the following;

R (RCA2: RCA5) = 0.57, R (RCA5: RCA6) = 0.32, R (RCA6: RCA2) = 0.18.

Table 4 (p.10) in Laursen (1998) presents correlation coefficient between RSCA and MI, which is the following; R (RSCA: MI) = 0.64 (for 19 OECD countries average)[11]

From these results of comparison of various IIC we may say that RCA5 (UNIDO type) which was employed in our previous analysis is not so bad an index as was criticized by Vollrath[12], though we need more trials of comparison. In the next section a new index of international competitiveness will be presented.

3. Proposing a new index of international competitiveness

The definition of a new index of international competitiveness (here after abbreviated as NIIC) is the following;

$NIIC = (1 + ((X_{ij} - M_{ij}) / (X_{ij} + M_{ij})))$ or $NIIC = 1 + RCA5$,

where

if $M = 0$, $NIIC = 2$,

$X \geqq M > 0$, $NIIC \geqq 1$,

$M > X > 0$, $1 > NIIC > 0$ and

[9] One of the examples is by Kol & Mennes (1986).

[10] The sample calculating these indices are two-year averages (1979-1980) covering 21 sectors of 3-difgit SITC categories for iron & steel, textile, wood products and electronics.

[11] Across 22 manufacturing sectors from 1970 -1993, total number of observation is 528.

[12] See footnote 7.

X = 0, NIIC = 0.

If $NIIC_i > 1$, the sector i could be defined as internationally competitive, and if $1 > NIIC_i > 0$, then the sector i as internationally less competitive. Though the new index is a simple modification of RCA5, some points of its claim are that while it keeps perfect matching with RCA5, that is, correlation coefficient between them is one, the index could be transformed into logarithmic value[13].

Table 1 below summarizes the past performance of NIIC. As the table shows, non-competitive sectors in 1985 were sectors such as 3. food & beverages, 5. wood products, 7. petro & coal products and 10. non-ferrous metal, while in 1998 two more sectors such as 4. textile, 16. miscellaneous manufacturing joined in the less competitive group. Other sectors can be defined as internationally competitive, though most of them have declining trends in their NIIC. In 1985 there were 6 sectors which were more competitive than total manufacturing, while 15. precision machinery turned to be less competitive than total manufacturing in 1998.

Table 1 Past Performance of NIIC

Sector	1985	1990	1995	1998
Total Manufacturing	1.512	1.277	1.165	1.216
03 Food & beverage, etc.	0.325	0.123	0.069	0.086
04 Textile	1.104	0.593	0.338	0.395
05 Wood products & papers	0.566	0.391	0.240	0.299
06 Chemical products	1.220	1.135	1.130	1.164
07 Petro & coal products	0.236	0.248	0.417	0.412
08 Glass & cement, etc.	1.444	1.160	1.210	1.157
09 Iron & steel	1.772	1.472	1.426	1.583
10 Non-ferrous metal	0.586	0.408	0.487	0.661
11 Metal Products	1.765	1.388	1.225	1.225
12 General machinery	1.753	1.648	1.690	1.629
13 Electrical machinery	1.794	1.661	1.461	1.416
14 Transportation equipments	1.897	1.753	1.687	1.709
15 Precision machinery	1.589	1.442	1.200	1.133
16 Miscellaneous manufacturing	1.045	0.507	0.363	0.659

Table 2 below shows typology of various IIC surveyed in the above section and newly presented NIIC in the first paragraph of this section. They are classified into three groups[14].

Table 2 Typology of Various IIC

[13] In the last year's analysis what troubled us most was un-transformability of RCA5 into logarithmic value, even if the log-linear regression equations of IIC is desirable.

[14] RCA7 was excluded from the grouping, since trade only indices are of our interests.

Components	Single Country	Multi-country
Export only		RCA1, RCA2
		RCA3, RCA9,
		RSCA
Export &	RCA5, MI,	RCA$, RCA6
Import	WI, VRCA,	RCA8, RCA10
	NIIC	
Export, Import		RCA7
and Output		

Out of this table, single country indices will be taken to compare with each other. The reason why we chose single country indices should be mentioned here. An analysis based on multi-country indices may be much more informative and realistic for the study of international competitiveness of a specific country in the world market, though not comprehensive like the analysis based on the bilateral trade model (BTM). Since JIDEA5 model is a part of the multi-country model called INFORUM type model which connects the models of member countries by BTM, if one wants to prepare a multi-country index of international competitiveness, it is most desirable and reliable to obtain the world trade data from BTM, though we did not make a request for the full use of BTM data this time. In estimating export equations of JIDEA5, data of the world demand for Japanese exports and of import prices are supplied by BTM. When the trade data of BTM is completely updated, we are expecting to make the most use of them. Apart from the simplicity to calculate the single country index of international competitiveness, this is the main reason why NIIC was chosen for this study.

Five indices of RCA5, MI, WI, VRCA and NIIC are classified as the single country index in Table 2. Since VRCA is a logarithmic form of WI, and RCA5 and NIIC are same in the sense that the correlation coefficient between them is 1, three indices of NIIC, MI, and WI will be taken into comparison.

Table 3 includes correlation coefficients among these three indices of international competitiveness for 14 sectors in the manufacturing industry.

Table 3　Correlation Coefficients among NIIC, MI and WI

Sector	NIIC:MI	NIIC:WI	MI:WI	Sector	NIIC:MI	NIIC:WI	MI:WI
3				10			
Food & beverages	0.3687	0.9061	0.0211	Non-ferrous mtl	0.3923	-0.4823	-0.9707
4				11			
Textile	0.8009	0.8252	0.6010	Metal products	0.9701	-0.8873	-0.7813
5				12			
Wood products	0.1062	0.8621	-0.2459	General machinery	-0.0610	-0.9466	0.3138
6				13			
Chemical products	0.0324	0.5135	0.2065	Electrical machinery	0.6107	-0.9679	-0.6826
7				14			
Petro & coal products	0.8803	-0.6741	-0.7805	Transportation machinery	0.9394	-0.9800	-0.9358
8				15			
Glass & cement	0.3685	0.3850	0.5345	Precision machinery	0.8349	-0.9227	-0.8907
9				16			
Iron & steel	0.8805	-0.9376	-0.7740	Miscellaneous manufacturing	0.4886	0.2033	0.0995

Note: Observation period for the calculation is from 1985 to 1998.

As the table shows, correlation coefficient between NIIC and MI for each of 14 manufacturing sectors is positive, except for 12. general machinery, though in the cases of 5. wood products and 6. chemical products the coefficients are very low. One of the reasons of these un-welcomed phenomena may be caused by the inappropriate aggregation of 100 sectors into 34 sectors though we did not examine the differences in coefficient by 100 sectors. Out of 14 sectors 8 sectors have negative correlations between NIIC and WI and these two indices are not compatible. The same results are shown in the case of correlations between MI and WI and these two indices are also un-compatible. Combined with the suggestion in section 2 above that RCA5 (UNIDO type) could be acceptable for IIC, the above result also encourages us to utilize NIIC for the analysis of international competitiveness of Japanese manufacturing industries which follows in the next section.

4. International competitiveness of the Japanese industry

We have tried a variety of simulation analysis according to alternative policy assumptions, detailed explanation of which is available in elsewhere[15]. Simulation 5, simulation 6 and simulation 7 are directly related to this analysis. First, the assumption for these simulations should be explained briefly.

Assumption for simulation 5 (increased foreign demand effect); 10% of export value in 2002 in real terms (expr) will be added to the value of expr from 2003 to 2007.
Assumption for simulation 6 (increased domestic demand effect); 10% of import value in 2002 in real terms (impr) will be added to the value of impr from 2003 to 2007.
Assumption for simulation 7 (export price effect); level of foreign exchange rate in 2002 (exrat) will be devaluated by 5% and this rate will be kept constant from 2003 to 2007.

[15] See Sasai, *ibid.*

All the results of policy simulations are shown in the form of differences from the result of the base line simulation and are discussed only for 14 manufacturing sectors out of the aggregated 32 sectors though the original results are available in 100 sectors. First, the result of base line projection should be presented, which comes in Table 4. As discussed in the previous section, sectors which belonged to the less competitive group in the observation period, such as 3. food & beverages, 4. textile, 5. wood products, 7. petro & coal products, 10. non-ferrous metal and 16. miscellaneous manufacturing, will stay as non-competitive in the base line projection, while the rest will continue to be internationally competitive, with the exception of 11. metal products and 15. precision machinery which are going to be in the less competitive group. Notice should be given that most of them have declining trends in their NIIC.

Table 4 Base Line Projection of NIIC

Sectors	1998	2002	2003	2004	2005	2006	2007	2008
Total Manufacturing	1.216	1.185	1.147	1.147	1.134	1.119	1.102	1.085
03 Food & beverage, etc.	0.086	0.088	0.080	0.082	0.080	0.078	0.078	0.076
04 Textile	0.395	0.207	0.177	0.161	0.146	0.132	0.117	0.106
05 Wood products & papers	0.299	0.333	0.324	0.337	0.346	0.351	0.349	0.361
06 Chemical products	1.164	1.162	1.136	1.151	1.152	1.150	1.145	1.142
07 Petro & coal products	0.412	0.544	0.531	0.571	0.603	0.651	0.683	0.720
08 Glass & cement, etc.	1.157	1.128	1.082	1.080	1.069	1.058	1.038	1.028
09 Iron & steel	1.583	1.616	1.608	1.622	1.633	1.645	1.655	1.667
10 Non-ferrous metal	0.661	0.679	0.664	0.678	0.682	0.684	0.683	0.681
11 Metal Products	1.225	1.024	0.943	0.909	0.854	0.804	0.753	0.716
12 General machinery	1.629	1.637	1.609	1.608	1.597	1.588	1.578	1.571
13 Electrical machinery	1.416	1.374	1.328	1.313	1.279	1.244	1.207	1.170
14 Transportation equipments	1.709	1.717	1.703	1.707	1.704	1.701	1.697	1.693
15 Precision machinery	1.133	1.058	0.996	0.973	0.945	0.911	0.880	0.851
16 Micelleneous manufacturing	0.659	0.576	0.570	0.584	0.590	0.601	0.609	0.612

Table 5, Table 6 and Table 7 are summaries of the policy simulation results. Export increasing effects on NIIC in Table 5 are naturally positive, though the differences from the base line are diminishing as a whole. Out of 14 manufacturing industries, 11. metal products, 15. precision machinery and 16. miscellaneous manufacturing are receiving higher positive effects than the total manufacturing in 2003, while in 2007 together with above mentioned three sectors, following 2 sectors of 8. glass & cement and 13. electrical machinery are getting higher benefits than the total manufacturing.

Table 5 Export Increasing Effects on Sectoral NIIC

					Sim5-base (Export increase by 10%)			
International Competitiveness	1998	2002	2003	2004	2005	2006	2007	2008
Total Manufacturing	0	0	0.036	0.033	0.032	0.030	0.029	−0.001
03 Food & beverage, etc.	0	0	0.007	0.006	0.006	0.006	0.006	0.000
04 Textile	0	0	0.013	0.012	0.009	0.006	0.008	0.000
05 Wood products & papers	0	0	0.017	0.013	0.010	0.010	0.017	−0.003
06 Chemical products	0	0	0.033	0.030	0.029	0.028	0.027	0.000
07 Petro & coal products	0	0	0.029	0.024	0.023	0.021	0.020	−0.006
08 Glass & cement, etc.	0	0	0.025	0.025	0.033	0.025	0.034	0.000
09 Iron & steel	0	0	0.019	0.016	0.015	0.014	0.012	0.000
10 Non-ferrous metal	0	0	0.020	0.021	0.018	0.015	0.013	−0.002
11 Metal Products	0	0	0.036	0.026	0.028	0.029	0.031	−0.007
12 General machinery	0	0	0.023	0.020	0.019	0.020	0.019	−0.003
13 Electrical machinery	0	0	0.031	0.030	0.030	0.029	0.029	0.001
14 Transportation equipments	0	0	0.016	0.015	0.015	0.014	0.013	0.001
15 Precision machinery	0	0	0.042	0.042	0.034	0.037	0.037	0.003
16 Miscellaneous manufacturing	0	0	0.043	0.037	0.037	0.035	0.032	−0.009
Note: Difference in NIIC from Base line.								

Table 6 below, summarizing import increasing effects on sectoral NIIC, shows that sectors which are receiving higher negative effects than the total manufacturing in 2003 are 6. chemical products, 8. glass & cement, 11. metal products and 13. electrical machinery, while in 2007, afore-mentioned sectors and 15. precision machinery belong to this deteriorating group. It should be mentioned that NIIC of 16. miscellaneous manufacturing is improving exceptionally from 2003 to 2007, though the sector itself is always less competitive.

Table 6 Import Increasing Effects on Sectoral NIIC

					Sim6-base (Import increase by 10%)			
International Competitiveness	1998	2002	2003	2004	2005	2006	2007	2008
Total Manufacturing	0	0	−0.048	−0.047	−0.047	−0.045	−0.043	0.005
03 Food & beverage, etc.	0	0	−0.008	−0.008	−0.008	−0.007	−0.007	0.001
04 Textile	0	0	−0.012	−0.010	−0.008	−0.010	−0.005	0.002
05 Wood products & papers	0	0	−0.027	−0.026	−0.024	−0.023	−0.015	−0.001
06 Chemical products	0	0	−0.053	−0.064	−0.063	−0.061	−0.058	−0.005
07 Petro & coal products	0	0	−0.031	−0.030	−0.023	−0.035	−0.031	0.012
08 Glass & cement, etc.	0	0	−0.062	−0.061	−0.060	−0.067	−0.056	0.000
09 Iron & steel	0	0	−0.040	−0.048	−0.046	−0.041	−0.041	−0.008
10 Non-ferrous metal	0	0	−0.031	−0.027	−0.028	−0.027	−0.026	0.008
11 Metal Products	0	0	−0.061	−0.058	−0.062	−0.057	−0.060	−0.007
12 General machinery	0	0	−0.039	−0.039	−0.038	−0.039	−0.038	0.003
13 Electrical machinery	0	0	−0.048	−0.048	−0.050	−0.048	−0.045	0.004
14 Transportation equipments	0	0	−0.024	−0.027	−0.028	−0.029	−0.030	−0.004
15 Precision machinery	0	0	−0.042	−0.043	−0.046	−0.043	−0.043	−0.003
16 Miscellaneous manufacturing	0	0	−0.030	−0.021	−0.013	−0.007	−0.002	0.038
Note: Difference in NIIC from Base line.								

From Table 7 including exchange rate devaluation effects on sectoral NIIC, we can find that sectors much more benefited than total manufacturing in 2003 are 5. wood products, 8. glass & cement, 11. metal products, 15. precision machinery and 16. miscellaneous manufacturing, and that in 2007, 5. wood products and 16. miscellaneous manufacturing are eliminated from the beneficial group, while 13. electrical machinery is registered as a new comer to the better off group. One caution should be mentioned to the behavior of 10. non-ferrous metal. In this simulation 7 only this sector is the loser. It may well say that one of the main causes of the increase in the import of this sector will be induced by the increase in exports of other sectors.

Table 7　Exchange Rate Devaluation Effects on Sectoral NIIC

				Sim7−base (depreciation of exchange rate by 5%)				
International Competitiveness	1998	2002	2003	2004	2005	2006	2007	2008
Total Manufacturing	0	0	0.018	0.082	0.083	0.074	0.074	0.063
03 Food & beverage, etc.	0	0	0.010	0.017	0.017	0.018	0.014	0.011
04 Textile	0	0	0.014	0.015	0.011	0.009	0.009	0.008
05 Wood products & papers	0	0	0.023	0.066	0.072	0.066	0.069	0.060
06 Chemical products	0	0	0.009	0.090	0.074	0.070	0.070	0.059
07 Petro & coal products	0	0	0.004	0.011	0.021	0.010	0.017	0.018
08 Glass & cement, etc.	0	0	0.027	0.078	0.085	0.082	0.080	0.077
09 Iron & steel	0	0	0.004	0.072	0.055	0.055	0.055	0.042
10 Non−ferrous metal	0	0	0.007	−0.005	−0.007	−0.004	−0.006	−0.004
11 Metal Products	0	0	0.046	0.128	0.158	0.124	0.128	0.112
12 General machinery	0	0	0.010	0.043	0.045	0.040	0.041	0.036
13 Electrical machinery	0	0	0.006	0.108	0.111	0.097	0.097	0.081
14 Transportation equipments	0	0	0.009	0.054	0.058	0.052	0.053	0.048
15 Precision machinery	0	0	0.038	0.117	0.119	0.104	0.095	0.073
16 Miscellaneous manufacturing	0	0	0.071	0.053	0.054	0.055	0.051	0.060
Note: Difference in NIIC from Base line.								

What will be the policy implication drawn from the results of these simulations? The policy to devaluate yen/dollar rate trying to increase exports by cheaper yen could not be accepted if we think of the Japanese responsibility in the world economic system. Trade expansion by increasing both foreign demands and domestic demands will be our choice. Though we did not try a combined policy simulation to stimulate both exports and imports simultaneously, we can get some hints for the effects of trade expansion policy by putting together the results of simulation 5 and simulation 6[16]. Comparing the results in Table 5 and Table 6 and summing up figures in the tables, we can find negative values showing the sectoral international competitiveness slightly weakened except for 16. miscellaneous manufacturing, though the sector is always less competitive.　Our policy recommendation may not be welcomed by the Japanese business world, but we can not keep strong international competitiveness in all the sectors of manufacturing industry. With such an enormous size of the Japanese economy, Japan has to give way to newly industrializing countries so that they can increase their exports to Japan, and to accept having slightly weaker NIIC than the level of base line for some sectors. It is an inevitable course for Japan to make continuous efforts to open her domestic market, if she wants to stay as one of the highly industrialized countries much involved in the network of the world economy. For example, to promote　to establish free trade areas (FTA) with many countries and regions is strongly recommended. Then what sectors should be brought up as strategic and leading industries with strong international competitiveness?　One answer will be found in Hasegawa (2003).

[16] The combined simulation effects will be different from the simple addition of results of simulation 5 and simulation 6.

5. Concluding remarks

In concluding the analysis of international competitiveness based on the JIDEA5, it is most appropriate to summarize what has been done in this study. First, we could present a short survey on the various indices of international competitiveness, 14 of them were collected and included in the survey. Secondly, a new index of international competitiveness (NIIC) was introduced, and together with the existing IIC the relationships among some of these indices and NIIC were examined. The empirical result suggests the validity of this NIIC with some reservation. Using this NIIC with the help of policy simulations based on the JIDEA5, we could analyze international competitiveness of the Japanese industry. Policy suggestions derived from this study are to take a combined policy for trade expansion by increasing both foreign demands and domestic demands and at the same time to try to bring up new strategic and leading industries with strong international competitiveness.

Problems remaining in this analysis are the followings. In this model of JIDEA5 output and import sectors are simultaneously decided, but relations between exports and outputs are not; the mechanism of which is characteristic in this type of input-output models. Changes in output will take effect on the changes in export only through the changes in the relative price. This problem should be discussed more in the separate paper.

The second problem is to examine international competitiveness of the Japanese industry in the framework of multi-country model combined by BTM. We do hope to obtain the updated and detailed world trade data from the database of BTM so that we can calculate a multi-country IIC instead of a single country IIC for the revised version of this study.

The third problem deeply related to the second is to re-examine the meaning of international competitiveness with reference to the expansion of intra-industry trade, an economic phenomenon reflecting the diversity in production and trade patterns, inevitable for the industrialized countries facing the globalization of the world economy, where negative value in net export of a specific industry does not necessarily mean the industry is less competitive[17].

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[17] For the main points of the subject, see pp. 194 – 197 in Appleyard, D. R. & A. J. Field (1998).

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