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Use of BTM for Measuring International Competitiveness
- Japanese Manufacturing Exports in the US Market -

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1. Introduction

This is the succession of what I presented in the 11th INFORUM World Conference held at Suzdal, Russia, last year. The purpose of this paper comes in four-hold. First, full use of BTM database in constructing index of international competitiveness will be demonstrated[1] in the form of minimized BTM table. Second is to calculate Balassa's index of international competitiveness or index of revealed comparative advantage based on the data taken from BTM, which is what I promised at the last year's Conference. Third purpose is to construct new index of international competitiveness applicable for the analysis of bilateral trade relations within the framework of the world trade. Fourth is to find out factors determining competitiveness of Japanese manufacturing exports, especially in the US market.

In the next section use of BTM for measuring indices of international competitiveness will be presented, and a new index of international competitiveness will be proposed. The third section describes competitiveness of Japanese manufacturing exports in the US market in the years selected from 1985 to 2000 mainly based on the new index of international competitiveness developed in the second section. In the fourth section, efforts to find out factors determining the competitiveness of Japanese manufacturing exports in the US market, the main part of this analysis, will be extended with the help of various types of data set. The final section is the summary of what has been done in this analysis and to point out some of the remaining problems that should be challenged in the future study.

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[1] Japanese team express thanks to Dr D. Nyhus and Mr Wang, Y. for instructing us how to handle BTM database when they visited Japan in this spring. BTM also consists of main parts of our analysis on Japan-China FTA effects. See Hasegawa, *et al.* (2004).

2. Use of BTM for Measuring Indices of International Competitiveness

In order to calculate multi-country index for international competitiveness and to try time series data analysis on the index, time series data of sectoral trade by country in the world have to be taken from the world trade matrix. It is an inevitable and laborious task that I gave up to attempt last year. Owing to some members of INFORUM, we can now make full use of BTM, of which data processing procedure is available in Sasai (2004). Complicated procedure is to aggregate 120 sectors in BTM to 64 sectors of tradable goods for Jidea5 and to rearrange them to country by country trade data.

Table - 1 shows the image of BTM minimized to 3-region by 3-sector table. Using these hypothetical figures in the table we can explain how to calculate the index relevant to the study of international competitiveness.

Table – 1 Image of BTM Minimized to 3-Region by 3-Sector Table

Region		JAPAN				USA				ROW				Export	
	Sector	1	2	3	Share/T	1	2	3	Share/T	1	2	3	Share/T	GT	Share
JAPAN	1	0	0	0	0	20	0	0	0.118	50	0	0	0.200	70	0.167
	2	0	0	0	0	0	100	0	0.588	0	150	0	0.600	250	0.595
	3	0	0	0	0	0	0	50	0.294	0	0	50	0.200	100	0.238
	T	0	0	0	0	20	100	50	170	50	150	50	250	420	1.000
USA	1	50	0	0	0.135	0	0	0	0	100	0	0	0.182	150	0.163
	2	0	250	0	0.676	0	0	0	0	0	300	0	0.545	550	0.598
	3	0	0	70	0.189	0	0	0	0	0	0	150	0.273	220	0.239
	T	50	250	70	370	0	0	0	0	100	300	150	550	920	1.000
ROW	1	100	0	0	0.154	300	0	0	0.375	250	0	0	0.263	650	0.271
	2	0	300	0	0.462	0	200	0	0.250	0	300	0	0.316	800	0.333
	3	0	0	250	0.385	0	0	300	0.375	0	0	400	0.421	950	0.396
	T	100	300	250	650	300	200	300	800	250	300	400	950	2400	1.000
GT Import		150	550	320	1021	320	300	350	970	400	750	600	1752	3740	1.000
						0.330	0.309	0.361	1.000				1	870	0.233
													2	1600	0.428
													3	1270	0.340
													World GT by Sector		Share

As the index of international competitiveness it is most appropriate to start with Balassa's index[2]. Definition of Balassa's index of international competitiveness (here after abbreviated as BIIC) or index of revealed comparative advantage is given by the following formula[3]:

$$BIIC = (X^i_a/X^c_a)/(X^i_m/X^c_m) = (X^i_a/X^i_m)/(X^c_a/X^c_m),$$

where subscript a refers to any specified (manufactured) commodity, subscript i to any of the countries, subscript m refers to the combined exports of sectoral manufactured goods, and subscript c refers to all the countries studied in the analysis. In other words, BIIC shows a comparison of a country's export structure (numerator) with the world export structure (denominator). BIIC equals 1 when the country's export structure is identical with the world export structure. When BIIC of a certain sector is over 1, the country is regarded as the country specialized in that sector, and vice versa when BIIC is less than 1. There are a lot of variations in measuring the index of

[2] See Balassa (1965).

[3] This simple expression of formula without operator of summation (Σ) is from Bowen (1983) or Vollrath, T. L. (1991).

international competitiveness, of which a short survey is available in Imagawa (2003). One of the examples is RSCA (Revealed Symmetric Comparative Advantage) presented by Laursen (1998). His index is obtained as (BIIC - 1)/(BIIC + 1), of which measure ranges from -1 to +1. Here I prefer to the original BIIC because Laursen's index can not be converted to logarithmic form.

This measure of BIIC for Japan is best illustrated by example using the figures available in the far-right side of the table - 1.

Example of BIIC: Case of Japan

Sector 1 = 0.167/0.233 = 0.717

Sector 2 = 0.595/0.428 = 1.390

Sector 3 = 0.238/0.340 = 0.700

Since BIIC of sector 2 is over 1, the sector can be regarded as internationally competitive, while other 2 sectors are said to be internationally non-competitive.

Table - 2 is the summary table of Balassa's IIC for Japanese 55 manufacturing exports from 1985 to 1998 to demonstrate more clearly competitive and non-competitive industries measured by BIIC for selected years. In the upper part of table - 2 internationally competitive top ten sectors and in the lower part of the table non-competitive ten sectors are listed for years of 1986, 1990, 1995 and 1998. As we can imagine, sectors included in the upper part of the table consist of the high-tech industries such as motor vehicles, IC, computer and precision industry. In the lower part of the table such industries as chemical fertilizer, clothing, leather products and food products, etc are main participants. This tendency was almost unchanging at least for years of 1986, 1990, 1995 and 1998 presented in the table.

Table – 2 Japanese Manufacturing Exports Competitive and Non-competitive in the World Market Measured by Balassa's IIC (Selected Years)

Top 10 Sectors	1986		1990		1995		1998
BIIC52 Communic e	3.3552	BIIC52 Communic	2.6401	BIIC59 Ships	3.6047	BIIC59 Ships	3.3106
BIIC59 Ships	3.3042	BIIC59 Ships	2.5379	BIIC55 Electro pa	2.3941	BIIC45 Machine tc	2.2193
BIIC58 Motor vehi	2.3337	BIIC55 Electro pa	2.5335	BIIC54 IC	2.3940	BIIC58 Motor vehi	2.0736
BIIC56 Heavy el	2.2422	BIIC54 IC	2.5226	BIIC53 El apld&me	2.3431	BIIC44 Machine g	2.0612
BIIC55 Electro pa	2.2099	BIIC53 El apld&me	2.3810	BIIC45 Machine tc	2.1557	BIIC57 Oth light	2.0044
BIIC57 Oth light	2.1468	BIIC58 Motor vehi	2.2600	BIIC44 Machine g	2.0978	BIIC47 Machine ot	1.9815
BIIC54 IC	2.1043	BIIC51 Computer	2.0873	BIIC58 Motor vehi	2.0209	BIIC55 Electro pa	1.9577
BIIC51 Computer	2.0509	BIIC48 Mach offic	2.0625	BIIC47 Machine ot	1.9642	BIIC54 IC	1.9457
BIIC53 El apld&me	2.0226	BIIC57 Oth light	2.0557	BIIC62 Other tran	1.8956	BIIC53 El apld&me	1.9172
BIIC63 Precision	2.0109	BIIC56 Heavy el	1.9799	BIIC63 Precision	1.7849	BIIC63 Precision	1.7845
Lowest 10 Sectors	1986		1990		1995		1998
BIIC38 Steel Cast	0.1880	BIIC19 Chem fert	0.1943	BIIC18 Printing	0.1956	BIIC18 Printing	0.1980
BIIC14 Clothing	0.1790	BIIC21 Chem petr	0.1935	BIIC19 Chem fert	0.1778	BIIC19 Chem fert	0.1610
BIIC19 Chem fert	0.1549	BIIC38 Steel Cast	0.1634	BIIC16 Furniture	0.1772	BIIC41 Metal cons	0.1496
BIIC21 Chem petro	0.1304	BIIC27 Petro prod	0.1081	BIIC61 Air plane	0.1204	BIIC27 Petro prod	0.1402
BIIC31 Leather	0.1161	BIIC14 Clothing	0.0966	BIIC11 Beverages	0.1047	BIIC11 Beverages	0.1167
BIIC10 Food prod	0.1109	BIIC31 Leather	0.0881	BIIC14 Clothing	0.0649	BIIC12 Feeds&ferl	0.1140
BIIC15 Wooden pro	0.0853	BIIC61 Air plane	0.0873	BIIC12 Feeds&ferl	0.0633	BIIC10 Food prod	0.0762
BIIC11 Beverages	0.0771	BIIC10 Food prod	0.0797	BIIC10 Food prod	0.0602	BIIC14 Clothing	0.0609
BIIC61 Air plane	0.0620	BIIC11 Beverages	0.0617	BIIC31 Leather	0.0559	BIIC31 Leather	0.0446
BIIC27 Petro prod	0.0252	BIIC15 Wooden pr	0.0539	BIIC15 Wooden pr	0.0482	BIIC15 Wooden pr	0.0290

One of the tasks related to the study of international competitiveness is to examine the reliability of simplified index of international competitiveness, or UNIDO's

index applied in my last year's report presented in the 11th INFORUM conference[4]. Correlation coefficients between Balassa's multi-country index and UNIDO type of single country index for each of the 55 manufacturing sectors were calculated. The observation periods for the calculation are from 1985 - 1998 and 1986 - 1998. The reason to calculate the coefficient for two different observation period is to see the effects of foreign exchange fluctuation caused by Plaza Accord established in 1985; drastic changes in the international monetary system. Average of correlation coefficients of these 55 sectors is 0.5750 for 1985 - 1998 and 0.6014 for 1986 - 1998. The result is almost identical with what has been examined in Ballance *et al.* (1987)[5].

Our second purpose of this paper is, making full use of BTM, to present new index of international competitiveness in the specific market (here after abbreviated as NLIIC). First, local IIC-A is introduced, that is, adoption of Balassa's IIC in the study of international competitiveness in the specific (local) region, or Japanese manufacturing exports to the US market will be discussed. The same index is already known as Relative Measure of Trade Intensity by Petri or Drysdale[6]. Local IIC-A is the ratio of sector k's export from Japan to the USA relative to Japan's total exports to the USA divided by the ratio of sector k's US import from the world relative to the US total imports, which is given by the following formula:

$$\text{LIIC-A} = (X_{ij}^{k}/\sum_{k} X_{ij}^{k})/(\sum_{i} X_{ij}^{k}/\sum_{k}\sum_{i} X_{ij}^{k}),$$

where subscript k refers to any specified (manufactured) commodity (or sector), subscript i to any of the exporting countries, subscript j refers to any of the importing countries. In the case of Japan-US trade relations, subscript i and subscript j expresses Japan and the USA respectively in the numerator, and in the denominator subscript i refers to any exporting countries to the USA. If LIIC-A is over 1, the sector of the country is competitive in the US market, and non-competitive when LIIC-A is less than 1. We can easily calculate LIIC-A for Japanese manufacturing exports using the figures available in the middle of the table - 1.

Example of LIIC-A: Case of Japan

Sector 1 = 0.118/0.330 = 0.358

Sector 2 = 0.588/0.309 = 1.903

Sector 3 = 0.294/0.361 = 0.814

By the LIIC-A, we can express the relative significance of Japanese export of

[4] See Imagawa (2003) and also Imagawa (2002). For details of UNIDO's index see UNIDO (1982).

[5] See Table - 1 in p.159 of Balance, *et al.* (1987). Correlation coefficient is 0.57 from the sample of two-year average (1979 - 1980) covering 21 3-digit SITC categories(iron and steel, textiles, wood and wood products and electronics).

[6] See p.23 in Petri (1993), and footnote 3, p.195 in Drysdale, *et al.* (1993)

commodity *k* in the US imports, though the relative importance of Japanese export of commodity *k* to the USA in the Japanese export performance in general is not considered[7]. This point is described by the following local IIC-B. Local IIC-B is the ratio of sector k's export from Japan to the USA relative to Japan's total exports to the USA divided by the ratio of sector k's total export from Japan relative to the Japanese total world exports, which will be measured by the following formula:

$$\text{LIIC-B} = (X_{ij}^{k}/\sum_{k} X_{ij}^{k})/(\sum_{j} X_{ij}^{k}/\sum_{k}\sum_{j} X_{ij}^{k}),$$

where subscript *k* refers to any specified (manufactured) commodity (or sector), subscript *i* to any of the exporting countries, subscript *j* refers to any of the importing countries. Attention should be paid that the numerator of the LIIC-B is same with the numerator of the LIIC-A.

In the case of the Japanese export to the world, subscript *i* and subscript *j* expresses Japan and any country other than Japan respectively. If LIIC-B is over 1, the export of the sector of the country in the US market is said to be more competitive than other exporting sectors of the country in the world. We can easily calculate LIIC-B for Japan using the figures available in the middle and the far right side of the table - 1.

Example of LIIC-B: Case of Japan

Sector 1 = 0.118/0.167 = 0.707

Sector 2 = 0.588/0.595 = 0.988

Sector 3 = 0.294/0.238 = 1.235

According to this LIIC-B, Japanese export of sector 3 to the USA is competitive.

New LIIC of the Japanese manufacturing export to the USA is the square root of the product of LIIC-A multiplied by LIIC-B in which both the Japanese export structure (supply side) and the US import situation (demand side) can be integrated. This new LIIC will be named as RNLIIC.

Example of RNLIIC: Case of Japan

Sector 1 = 0.358*0.707 = 0.253 SQRT(0.253) = 0.503 or RNLIIC = 0.503

Sector 2 = 1.903*0.998 = 1.881 SQRT(1.881) = 1.371 or RNLIIC = 1.371

Sector 3 = 0.814*1.225 = 1.006 SQRT(1.006) = 1.003 or RNLIIC = 1.006

As figures above show, Japanese exports of sectors 2 and 3 to the USA are competitive according to RNLIIC, while sector 3 is non-competitive if measured by NLIIC-A.

In the next section, using the RNLIIC explained above, competitiveness of Japanese manufacturing exports in the US market will be discussed.

3. Competitiveness of Japanese Manufacturing Exports in the US Market

In table - 3 below RNLIIC for Japanese 55 manufacturing exports in the US

[7] This point was suggested during the discussion with members of the Japanese team of JIDEA5. Special thanks to Professor Sasai for his helpful comment.

market are presented by descending order for selected years. Out of 55 manufacturing exports 19 sectors are competitive in the US market in 1986, 20 sectors, 17 sectors, 18 sectors and 17 sectors for 1990, 1995, 1998 and 2000 respectively. One caution should be paid to the exceptional high figure of sector 28. coal products, which was the most competitive sector in the US market for years of 1990, 1995, 1998 and 2000, though the sector takes very light weight in the total manufacturing exports of Japan as well as in the total US imports. This sector was also competitive, though not included in table - 2, if competitiveness is measured by BIIC.

Table – 3 New Index of International Competitiveness (SQRT of NLIIC) for Japanese Manufacturing Exports in the US Market (by Descending Order for Selected Years)

SQRT of NewLIIC		1986	SQRT of NewLIIC		1990	SQRT of NewLIIC		1995	SQRT of NewLIIC		1998	SQRT of NewLIIC		2000
RNLIIC52	Communic e	1.9519	RNLIIC28	Coal prod	1.9110	RNLIIC28	Coal prod	2.6609	RNLIIC28	Coal prod	2.1286	RNLIIC28	Coal prod	6.0188
RNLIIC48	Mach offic	1.8066	RNLIIC48	Mach offic	1.9032	RNLIIC58	Motor vehi	1.6998	RNLIIC45	Machine to	1.6098	RNLIIC44	Machine ge	1.9605
RNLIIC51	Computer	1.7311	RNLIIC51	Computer	1.8140	RNLIIC51	Computer	1.6777	RNLIIC44	Machine ge	1.5967	RNLIIC58	Motor vehi	1.8616
RNLIIC58	Motor vehi	1.5803	RNLIIC55	Electro pa	1.6716	RNLIIC55	Electro pa	1.6144	RNLIIC58	Motor vehi	1.5845	RNLIIC63	Precision	1.5380
RNLIIC34	Pottery	1.5352	RNLIIC52	Communic e	1.5793	RNLIIC44	Machine ge	1.5542	RNLIIC51	Computer	1.5066	RNLIIC45	Machine to	1.4360
RNLIIC45	Machine to	1.4468	RNLIIC58	Motor vehi	1.4957	RNLIIC48	Mach offic	1.5508	RNLIIC63	Precision	1.4468	RNLIIC61	Air plane	1.3764
RNLIIC63	Precision	1.3636	RNLIIC63	Precision	1.4206	RNLIIC63	Precision	1.3782	RNLIIC48	Mach offic	1.3354	RNLIIC56	Heavy el	1.2689
RNLIIC55	Electro pa	1.2730	RNLIIC44	Machine ge	1.3652	RNLIIC45	Machine to	1.3112	RNLIIC52	Communic e	1.3335	RNLIIC47	Machine ot	1.2175
RNLIIC62	Other tran	1.1896	RNLIIC57	Oth light	1.3630	RNLIIC52	Communic e	1.2887	RNLIIC55	Electro pa	1.3225	RNLIIC52	Communic e	1.2067
RNLIIC57	Oth light	1.1857	RNLIIC45	Machine to	1.3293	RNLIIC53	El apld&me	1.1958	RNLIIC47	Machine ot	1.3000	RNLIIC25	Medicine	1.1636
RNLIIC44	Machine ge	1.1410	RNLIIC30	Rubber pro	1.3090	RNLIIC30	Rubber pro	1.1831	RNLIIC61	Air plane	1.2405	RNLIIC48	Mach offic	1.1315
RNLIIC42	Heating eq	1.1178	RNLIIC43	Metal othe	1.3011	RNLIIC47	Machine ot	1.1643	RNLIIC22	Chem organ	1.1564	RNLIIC30	Rubber pro	1.1297
RNLIIC46	Machine sp	1.1092	RNLIIC47	Machine ot	1.2393	RNLIIC54	IC	1.1323	RNLIIC57	Oth light	1.1508	RNLIIC22	Chem organ	1.1146
RNLIIC43	Metal othe	1.1012	RNLIIC53	El apld&me	1.2382	RNLIIC57	Oth light	1.1162	RNLIIC46	Machine sp	1.1376	RNLIIC49	Mach servi	1.1078
RNLIIC28	Coal prod	1.0874	RNLIIC56	Heavy el	1.2200	RNLIIC22	Chem organ	1.0768	RNLIIC30	Rubber pro	1.1202	RNLIIC46	Machine sp	1.0906
RNLIIC50	Mach hous	1.0827	RNLIIC54	IC	1.1725	RNLIIC43	Metal othe	1.0766	RNLIIC42	Heating eq	1.1111	RNLIIC57	Oth light	1.0421
RNLIIC56	Heavy el	1.0762	RNLIIC34	Pottery	1.1557	RNLIIC46	Machine sp	1.0067	RNLIIC56	Heavy el	1.1051	RNLIIC20	Chem basic	1.0402
RNLIIC30	Rubber pro	1.0453	RNLIIC42	Heating eq	1.1261	RNLIIC42	Heating eq	0.9700	RNLIIC49	Mach servi	1.0011	RNLIIC24	Chem fiber	0.9431
RNLIIC47	Machine ot	1.0428	RNLIIC22	Chem organ	1.0026	RNLIIC56	Heavy el	0.9476	RNLIIC64	Mfg miscel	0.9862	RNLIIC64	Mfg miscel	0.9430
RNLIIC53	El apld&me	0.9430	RNLIIC37	Steel	1.0005	RNLIIC62	Other tran	0.8455	RNLIIC53	El apld&me	0.9796	RNLIIC51	Computer	0.9401
RNLIIC22	Chem organ	0.9053	RNLIIC46	Machine sp	0.9625	RNLIIC24	Chem fiber	0.8434	RNLIIC43	Metal othe	0.9578	RNLIIC42	Heating eq	0.9114
RNLIIC54	IC	0.8929	RNLIIC49	Mach servi	0.9260	RNLIIC64	Mfg miscel	0.8243	RNLIIC62	Other tran	0.9376	RNLIIC35	Oth cerami	0.8621
RNLIIC49	Mach servi	0.8782	RNLIIC24	Chem fiber	0.8157	RNLIIC49	Mach servi	0.8189	RNLIIC54	IC	0.9276	RNLIIC32	Glass	0.8501
RNLIIC37	Steel	0.8644	RNLIIC29	Plastic pr	0.8031	RNLIIC32	Glass	0.8170	RNLIIC25	Medicine	0.9255	RNLIIC62	Other tran	0.8301
RNLIIC41	Metal cons	0.8209	RNLIIC40	Proce Nonf	0.7999	RNLIIC35	Oth cerami	0.8072	RNLIIC24	Chem fiber	0.9003	RNLIIC43	Metal othe	0.8034
RNLIIC29	Plastic pr	0.8091	RNLIIC64	Mfg miscel	0.7651	RNLIIC61	Air plane	0.7794	RNLIIC35	Oth cerami	0.8684	RNLIIC55	Electro pa	0.6818
RNLIIC40	Proce Nonf	0.7988	RNLIIC50	Mach hous	0.7636	RNLIIC25	Medicine	0.7436	RNLIIC37	Steel	0.8373	RNLIIC23	Chem resin	0.6673
RNLIIC64	Mfg miscel	0.7872	RNLIIC33	Cement	0.7611	RNLIIC20	Chem basic	0.6593	RNLIIC32	Glass	0.8228	RNLIIC29	Plastic pr	0.6512
RNLIIC24	Chem fiber	0.7870	RNLIIC35	Oth cerami	0.7339	RNLIIC37	Steel	0.6442	RNLIIC20	Chem basic	0.8155	RNLIIC40	Proce Nonf	0.6133
RNLIIC35	Oth cerami	0.6918	RNLIIC62	Other tran	0.7252	RNLIIC34	Pottery	0.6167	RNLIIC23	Chem resin	0.6370	RNLIIC37	Steel	0.5808
RNLIIC60	Rail equip	0.6914	RNLIIC32	Glass	0.7206	RNLIIC60	Rail equip	0.6042	RNLIIC29	Plastic pr	0.6201	RNLIIC26	Chem final	0.5467
RNLIIC25	Medicine	0.6581	RNLIIC61	Air plane	0.6891	RNLIIC23	Chem resin	0.5967	RNLIIC60	Rail equip	0.6047	RNLIIC21	Chem petro	0.5163
RNLIIC32	Glass	0.6175	RNLIIC25	Medicine	0.6747	RNLIIC29	Plastic pr	0.5497	RNLIIC40	Proce Nonf	0.5720	RNLIIC53	El apld&me	0.5051
RNLIIC23	Chem resin	0.5568	RNLIIC16	Furniture	0.6636	RNLIIC40	Proce Nonf	0.4630	RNLIIC34	Pottery	0.4734	RNLIIC17	Pulp&paper	0.4866
RNLIIC13	Textiles	0.5204	RNLIIC60	Rail equip	0.6511	RNLIIC16	Furniture	0.4618	RNLIIC26	Chem final	0.4586	RNLIIC54	IC	0.4782
RNLIIC16	Furniture	0.4834	RNLIIC23	Chem resin	0.5772	RNLIIC26	Chem final	0.4325	RNLIIC16	Furniture	0.4514	RNLIIC16	Furniture	0.3827
RNLIIC20	Chem basic	0.4785	RNLIIC20	Chem basic	0.4838	RNLIIC59	Ships	0.3520	RNLIIC17	Pulp&paper	0.4261	RNLIIC60	Rail equip	0.3717
RNLIIC61	Air plane	0.4549	RNLIIC13	Textiles	0.4311	RNLIIC18	Printing	0.3434	RNLIIC13	Textiles	0.3667	RNLIIC18	Printing	0.3710
RNLIIC14	Clothing	0.4299	RNLIIC26	Chem final	0.4193	RNLIIC19	Chem fert	0.3282	RNLIIC50	Mach hous	0.3644	RNLIIC13	Textiles	0.3626
RNLIIC18	Printing	0.4191	RNLIIC18	Printing	0.4040	RNLIIC13	Textiles	0.3133	RNLIIC18	Printing	0.3479	RNLIIC50	Mach hous	0.3516
RNLIIC10	Food prod	0.3473	RNLIIC17	Pulp&paper	0.3970	RNLIIC50	Mach hous	0.3030	RNLIIC10	Food prod	0.2759	RNLIIC19	Chem fert	0.3486
RNLIIC17	Pulp&paper	0.3379	RNLIIC36	Pig iron	0.2945	RNLIIC17	Pulp&paper	0.2972	RNLIIC21	Chem petro	0.2672	RNLIIC34	Pottery	0.3194
RNLIIC26	Chem final	0.3128	RNLIIC41	Metal cons	0.2838	RNLIIC10	Food prod	0.2656	RNLIIC19	Chem fert	0.2552	RNLIIC10	Food prod	0.2815
RNLIIC33	Cement	0.2984	RNLIIC59	Ships	0.2527	RNLIIC21	Chem petro	0.2634	RNLIIC36	Pig iron	0.2465	RNLIIC41	Metal cons	0.1983
RNLIIC15	Wooden pro	0.2913	RNLIIC10	Food prod	0.2477	RNLIIC36	Pig iron	0.1896	RNLIIC12	Feeds&fert	0.2279	RNLIIC59	Ships	0.1959
RNLIIC11	Beverages	0.2739	RNLIIC39	Nonfer met	0.2259	RNLIIC12	Feeds&fert	0.1469	RNLIIC59	Ships	0.2168	RNLIIC11	Beverages	0.1859
RNLIIC36	Pig iron	0.2545	RNLIIC11	Beverages	0.2192	RNLIIC41	Metal cons	0.1467	RNLIIC39	Nonfer met	0.1615	RNLIIC39	Nonfer met	0.1732
RNLIIC39	Nonfer met	0.2256	RNLIIC19	Chem fert	0.2003	RNLIIC39	Nonfer met	0.1308	RNLIIC11	Beverages	0.1365	RNLIIC36	Pig iron	0.1710
RNLIIC59	Ships	0.2085	RNLIIC21	Chem petro	0.1766	RNLIIC15	Wooden pro	0.1280	RNLIIC41	Metal cons	0.1185	RNLIIC12	Feeds&fert	0.1706
RNLIIC21	Chem petro	0.1145	RNLIIC14	Clothing	0.1680	RNLIIC11	Beverages	0.1199	RNLIIC27	Petro prod	0.1066	RNLIIC27	Petro prod	0.1329
RNLIIC38	Steel Cast	0.0858	RNLIIC15	Wooden pro	0.1571	RNLIIC14	Clothing	0.0772	RNLIIC38	Steel Cast	0.0831	RNLIIC15	Wooden pro	0.0660
RNLIIC31	Leather	0.0823	RNLIIC38	Steel Cast	0.0993	RNLIIC38	Steel Cast	0.0639	RNLIIC14	Clothing	0.0777	RNLIIC38	Steel Cast	0.0577
RNLIIC19	Chem fert	0.0669	RNLIIC12	Feeds&fert	0.0684	RNLIIC33	Cement	0.0419	RNLIIC15	Wooden pro	0.0588	RNLIIC14	Clothing	0.0549
RNLIIC12	Feeds&fert	0.0512	RNLIIC31	Leather	0.0391	RNLIIC27	Petro prod	0.0273	RNLIIC33	Cement	0.0459	RNLIIC33	Cement	0.0484
RNLIIC27	Petro prod	0.0314	RNLIIC27	Petro prod	0.0167	RNLIIC31	Leather	0.0209	RNLIIC31	Leather	0.0183	RNLIIC31	Leather	0.0186

This result may be caused if the relative share of a specific sector's export of Japan (numerator) is very small, and the relative share of the specific sector's US import

(denominator) is much smaller. Sectoral reclassification of the input-output table may be the best way to amend this phenomenon.

Table - 4 is a summary table for top ten of competitive sectors and the lowest ten of non-competitive sectors of Japanese manufacturing exports in the US Market in the years of 1986, 1990, 1885, 1998 and 2000.

Table – 4 Top Ten of Japanese Manufacturing Exports Competitive and the Lowest Ten Non–competitive in the US Market Measured by New Index of International Competitiveness (RNLIIC)

Top 10 sectors

SQRT of NewLIIC	1986	SQRT of NewLIIC	1990	SQRT of NewLIIC	1995	SQRT of NewLIIC	1998	SQRT of NewLIIC	2000
RNLIIC52 Communic e	1.9519	RNLIIC28 Coal prod	1.9110	RNLIIC28 Coal prod	2.6609	RNLIIC28 Coal prod	2.1286	RNLIIC28 Coal prod	6.0188
RNLIIC48 Mach offic	1.8066	RNLIIC48 Mach offic	1.9032	RNLIIC58 Motor veh	1.6998	RNLIIC45 Machine to	1.6098	RNLIIC44 Machine g	1.9605
RNLIIC51 Computer	1.7311	RNLIIC51 Computer	1.8140	RNLIIC51 Computer	1.6777	RNLIIC44 Machine g	1.5967	RNLIIC58 Motor veh	1.8616
RNLIIC58 Motor vehi	1.5803	RNLIIC55 Electro pa	1.6716	RNLIIC55 Electro pa	1.6144	RNLIIC58 Motor veh	1.5845	RNLIIC63 Precision	1.5380
RNLIIC34 Pottery	1.5352	RNLIIC52 Communic	1.5793	RNLIIC44 Machine g	1.5542	RNLIIC51 Computer	1.5066	RNLIIC45 Machine to	1.4360
RNLIIC45 Machine to	1.4468	RNLIIC58 Motor veh	1.4957	RNLIIC48 Mach offic	1.5508	RNLIIC63 Precision	1.4468	RNLIIC61 Air plane	1.3764
RNLIIC63 Precision	1.3636	RNLIIC63 Precision	1.4206	RNLIIC63 Precision	1.3782	RNLIIC48 Mach offic	1.3354	RNLIIC56 Heavy el	1.2689
RNLIIC55 Electro pa	1.2730	RNLIIC44 Machine g	1.3652	RNLIIC45 Machine to	1.3112	RNLIIC52 Communic	1.3335	RNLIIC47 Machine o	1.2175
RNLIIC62 Other tran	1.1896	RNLIIC57 Oth light	1.3630	RNLIIC52 Communic	1.2887	RNLIIC55 Electro pa	1.3225	RNLIIC52 Communic	1.2067
RNLIIC57 Oth light	1.1857	RNLIIC45 Machine to	1.3293	RNLIIC53 El apld&me	1.1958	RNLIIC47 Machine o	1.3000	RNLIIC25 Medicine	1.1636

Lowest 10 sectiors

SQRT of NewLIIC	1986	SQRT of NewLIIC	1990	SQRT of NewLIIC	1995	SQRT of NewLIIC	1998	SQRT of NewLIIC	2000
RNLIIC11 Beverages	0.2739	RNLIIC39 Nonfer me	0.2259	RNLIIC12 Feeds&fer	0.1469	RNLIIC59 Ships	0.2168	RNLIIC11 Beverages	0.1859
RNLIIC36 Pig iron	0.2545	RNLIIC11 Beverages	0.2192	RNLIIC41 Metal cons	0.1467	RNLIIC39 Nonfer me	0.1615	RNLIIC39 Nonfer me	0.1732
RNLIIC39 Nonfer met	0.2256	RNLIIC19 Chem fert	0.2003	RNLIIC39 Nonfer me	0.1308	RNLIIC11 Beverages	0.1365	RNLIIC36 Pig iron	0.1710
RNLIIC59 Ships	0.2085	RNLIIC21 Chem petr	0.1766	RNLIIC15 Wooden pr	0.1280	RNLIIC41 Metal cons	0.1185	RNLIIC12 Feeds&fer	0.1706
RNLIIC21 Chem petro	0.1145	RNLIIC14 Clothing	0.1680	RNLIIC11 Beverages	0.1199	RNLIIC27 Petro proc	0.1066	RNLIIC27 Petro proc	0.1329
RNLIIC38 Steel Cast	0.0858	RNLIIC15 Wooden pr	0.1571	RNLIIC14 Clothing	0.0772	RNLIIC38 Steel Cast	0.0831	RNLIIC15 Wooden pr	0.0660
RNLIIC31 Leather	0.0823	RNLIIC38 Steel Cast	0.0993	RNLIIC38 Steel Cast	0.0639	RNLIIC14 Clothing	0.0777	RNLIIC38 Steel Cast	0.0577
RNLIIC19 Chem fert	0.0669	RNLIIC12 Feeds&fer	0.0684	RNLIIC33 Cement	0.0419	RNLIIC15 Wooden pr	0.0588	RNLIIC14 Clothing	0.0549
RNLIIC12 Feeds&fert	0.0512	RNLIIC31 Leather	0.0391	RNLIIC27 Petro proc	0.0273	RNLIIC33 Cement	0.0459	RNLIIC33 Cement	0.0484
RNLIIC27 Petro prod	0.0314	RNLIIC27 Petro prod	0.0167	RNLIIC31 Leather	0.0209	RNLIIC31 Leather	0.0183	RNLIIC31 Leather	0.0186

As the table shows, sectors 52. communication equipment, 48. office machine, 51. computer, 58. motor vehicles, 34. pottery were ranked as top five of competitive sector in 1986. There come sectors 28. coal products, 48. office machine, 51. computer, 55. electronic parts, 52. communication equipment in the competitive top five in 1990, and in 1995 sectors 28. coal products, 58. motor vehicles, 51. computer, 55. electronic parts, 44. general machinery were classified in the competitive group, while in 1998 sectors 28. coal products, 45. machine tool, 44. general machinery, 58. motor vehicles, 51. computer were grouped as the top five sector. The ranking in 2000 was almost same with the picture in 1998, though sector 63. precision industry came in ousting sector 51. computer from the group.

Sectors 38. steel cast, 31. leather products, 19. chemical fertilizer, 12. feeds & fertilizer, 27. petroleum products were included in the least competitive group in 1986. 1990 picture is a bit different from that in 1986. Sector 19. chemical fertilizer could escape from this group and 15. wooden products was dropped in, while other 3 sectors remained in the same group. 1995 picture is again changing. Sectors 14. clothing and 33. cement were new comers, while sectors 27. petroleum products, 31. leather products and 38. steel cast were still in this least competitive group. The most miserable performers in the 1998 US market are sectors 38. steel cast, 14. clothing, 15. wooden products, 33. cement and 31. leather products. The same situation continues in 2000.

If we compare table - 2 and table - 4, though the former is competitiveness in the world market and the latter in the US market, we can find some sectors appear

both in table - 2 and in table - 4. Out of top ten sectors in the competitive group six sectors keep staying in both tables. They are sectors 51. computer, 52. communication equipment, 55. electronic parts, 57. other electric industry, 58. motor vehicles and 63. precision industry in 1986, and sectors 44. general machinery, 45. machine tools, 47. office machine, 55. electronic parts, 58. motor vehicles and 63. precision industry in 1998, while out of lowest ten sectors in the non-competitive group sectors 11. beverages, 19. chemical fertilizer, 21. petro chemicals, 27. petroleum products, 31. leather products, and 38. steel cast are classified into both tables in 1986. In 1998 number of sectors which appear in both tables are decreasing. They are sectors 11. beverages, 14. clothing, 31. leather products and 41. metal construction. One of the big differences is inclusion of sectors 59. ships and 54. IC in the competitive group by Balassa's index in 1998, while by RNLIIC they were no more competitive in the US market. In summary some sectors which are competitive in the US market are also competitive in the world market, while similarity in the trade pattern of the non-competitive group in table - 2 and in table - 4 is changing especially in the recent year.

Turning back to table - 3 we can find out a kind of product cycle in the Japanese manufacturing industries. Some sectors such as 30. pottery, 50. house electric machinery and 62. other transport equipments which were competitive in 1986 were no more competitive and classified into the non-competitive group in 1998 or in 2000. One of the new comers in 1998's competitive group is 61. airplane, and in 2000 sector 25. medicine was classified in the competitive group. A dropout from this category was sector 54. IC which was competitive in 1986, 1990 and 1995.

Following 12 sectors appear in the competitive group in 1986, 1990, 1995 and 1998: sectors 28. coal products, 30. rubber products, 44. general machinery, 45. machine tool, 47. other machinery, 48. machine office, 51. computer, 52. communication equipment, 55. electronic parts, 57. other electric industry, 58. motor vehicles and 63. precision industry, though sectors 51. computer and 55. electronic parts were no more competitive in 2000. As for chronic non-competitive sectors in the US market, following 14 sectors are listed. They are sectors 10. food products, 11. beverages, 12. feeds & fertilizer, 14. clothing, 15. wooden products, 17. pulp & paper products, 18. printing, 19. chemical fertilizer, 27. petroleum products, 31. leather products, 36. pig iron, 38. steel cast, 39. nonferrous metal and 59. ships, though sector 17. pulp & paper products was improving its competitiveness in 2000. Though it is not clear from table - 3, these 12 (14) sectors were always (never) competitive during the observation period of 1985 - 1998[8]. These 26 competitive and non-competitive sectors as well as 55 manufacturing sectors are representing the samples in the cross sectional analysis and the pooled data analysis on the relation between competitiveness and determining economic factors discussed in the next section.

[8] Due to the shorter observation period for Jidea5, 1999 and 2000 data were not included in the sample.

4. Factors Determining Competitiveness of Japanese Manufacturing Exports

Analysis to find out factors determining competitiveness of Japanese manufacturing exports is not new. In 6th INFORUM World Conference held at Shonan Village Center in Japan in 1996, one of our colleagues presented an analysis related to the competitiveness of Japanese manufacturing exports[9].

In the previous section the performance of export sectors competitive and/or non-competitive in the US market measured by RNLIIC, new index of international competitiveness were presented. Our next interest is to investigate and distinguish the factors determining the level of RNLIIC of Japanese manufacturing exports in the US market.

List of variables in the regression equation of RNLIIC are below:

Investment/output ratio (Ainvrat): sectoral investment in real terms (accumulated sum of last two years) divided by sectoral output in real terms.

Labor productivity (Labprd): sectoral output in real terms divided by number of sectoral employee.

R&D ratio (RD): row vector of the input coefficients in real terms for the sector 86. research in I-O table.

Profit rate (Prorat): sectoral corporate profit in nominal terms divided by sectoral out put in nominal terms.

Value added rate (Varat): sectoral value added in nominal terms divided by sectoral output in nominal terms.

Relative price (relpri): sectoral export price divided by sectoral import price.

Two dummy variables (Dum85, Dum90): Dum85 = 1 for 1985, 1986, 1987, 1988, 1989.
Dum90 = 1 for 1990, 1991, 1992, 1993, 1994.

Dum = 1 for sectors with RNLIIC over 1, and 0 for sectors with RNLIIC less than 1

Time trend (timet): timet = 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998.

Form of regression equations for the analysis is the following:

Log linear regression for time series data analysis on each of 55 sectors with the observation period from 1987 to 1998:

$$ln\text{RNLIIC} = f(ln\text{Ainvrat}, ln\text{Labprd}, ln\text{RD}, ln\text{Prorat}, ln\text{Varat}, ln\text{relpri}, \text{Dum85}, \text{Dum90}, \text{timet})$$

Log linear regression for cross sectional data analysis of 55 sectors in 1987, 1990, 1995 and 1998 separately:

$$ln\text{RNLIIC} = f(ln\text{Ainvrat}, ln\text{Labprd}, ln\text{RD}, ln\text{Prorat}, ln\text{Varat}, \text{Dum}).$$

[9] See Hasegawa, *et al.* (1998). The index used in the analysis is UNIDO type.

Log linear regression for pooled data analysis for data combined of 26 sectors in 1990, 1995 and 1998:

$$ln\text{RNLIIC} = f(ln\text{Ainvrat}, ln\text{Labprd}, ln\text{RD}, ln\text{Prorat}, ln\text{Varat}, \text{Dum}).$$

Needless to say, the sign condition for each factor in the equation is positive except for dummy variables and time trend. All the data are taken from Jidea5 database.

One comment should be mentioned whether it is acceptable, as a proxy of R&D rate, to use the row vector of the input coefficients in real terms for the sector 86. research in I-O table. The figure is intermediate demand for sector 86. research of each sector relative to its output. Though the actual figure of R&D by sector is unavailable for the moment, the tendency of sectoral R&D expenses will surely be corresponding to the movement of aforementioned figures.

Table - 5 presents summary results of log linear regression for time series data analysis on each of 55 manufacturing sectors for the observation period of 1987 - 1998.

Table – 5 Reggressiion Analysis by Time Series Data : Factors Determining International Competitiveness of Japanese Manufacturing Exports

ln RNLIIC	36 =f(lnAinvrat, D85, D90, t)	35 =f(lnAinvrat, lnRD, D85,D90, t)	26 =f(lnAinvrat, lnrelpri, D85, D90, t)	b =f(lnLabprd, D85, D90, t)	22 =f(lnLabprd, lnRD, D85, D90, t)	n =f(lnLabprd, lnrelpri, D85, D90, t)	c =f(lnProrat, D85, D90, t)	d =f(lnVarat, D85, D90, t)	10 =f(lnRD, D85, D90,t)	23 =f(lnProrat, lnRD, D85, D90, t)	24 =f(lnVarat, lnRD, D85, D90, t)
RNLIIC10											
RNLIIC11	0.77		0.73	0.78	0.86		0.89	0.93	0.85	0.87	0.91
RNLIIC12	0.85		0.75					0.71	0.77		0.74
RNLIIC14	0.94		0.93				0.97	0.95		0.98	0.94
RNLIIC15				0.84		0.8	0.83	0.82	0.89	0.89	0.88
RNLIIC17	0.52	0.64	0.5								
RNLIIC18	0.71		0.79	0.84	0.84	0.85	0.76	0.77	0.83	0.86	0.81
RNLIIC19				0.54		0.58	0.82	0.63			
RNLIIC27	0.69		0.92			0.9	0.65				
RNLIIC31				0.96	0.95	0.97	0.95		0.95	0.96	0.95
RNLIIC36							0.52				
RNLIIC38										0.59	
RNLIIC39	0.51		0.53			0.55	0.55	0.56	0.74	0.57	0.73
RNLIIC59											
RNLIIC28	0.82		0.8	0.71	0.85	0.66	0.74	0.91			0.9
RNLIIC30				0.61							
RNLIIC44				0.75	0.93		0.71				
RNLIIC45				0.82		0.52	0.65				
RNLIIC47				0.66	0.78	0.74	0.51			0.5	
RNLIIC48	0.78			0.72			0.75				
RNLIIC51	0.75		0.75	0.76	0.72	0.73			0.74		
RNLIIC52	0.70	0.66		0.75		0.89	0.71	0.74			
RNLIIC55				0.6							
RNLIIC57	0.65	0.6	0.59				0.61				
RNLIIC58							0.54				
RNLIIC63				0.97	0.62						

Note 1: Upper collum includes 14 sectors representing internationally non-competitive group
Lower collum includes 12 sectors representing internationally competitive group
Note 2: figures in the table are RBSQ
Note 3: The type of equation is given in the top row of the table.
Note 4: See text for the name of variables.

To select factors determining international competitiveness of Japanese manufacturing exports in the US market, combination of various factors were tried in estimating equations, of which type is given in the top row of the table. Upper column of the table includes results of estimation for 14 sectors representing internationally non competitive group, and in the lower column of the table results for 12 sectors representing internationally competitive group are given. Figures in the table are RBSQ. The table is to select the best fitted RNLIIC equation for each sector. Roughly

speaking for sectors in the internationally competitive group, factors related to labor productivity rather than investment/output ratio gives good results of estimation. If we choose the equation for this group, types of equation of b, 22 and n will be nominated. For sectors in the internationally non-competitive group factors related to investment/output ratio and value added rate rather than labor productivity seem to give good results of estimation. If we choose the equation for this group, types of equation of 36, 26, d and 24 will be chosen. Equation type c which includes profit rate as an explanatory variable gives good fit for both groups. Our first intension was to find out some common factors determining international competitiveness of manufacturing sectors from the results of estimation for sectoral RNLIIC. The attempt was not promising.

Now we turn to alternative methods to obtain the good fitted equation not for each sector but for manufacturing sectors as a whole. Cross sectional analysis covering 55 sectors for 1998 will be the next step to choose best factors determining international competitiveness of Japanese manufacturing exports. Table - 6 gives the results of cross sectional analysis covering whole 55 sector-samples, 18 samples for competitive group and 37 samples for non-competitive group.

Table – 6 Cross Sectional Analysis: Factors Determining International Competitiveness

lnRNLIIC=	Const.	lnAinvrat	lnOutEmp	lnRD	lnProrat	lnVarat	RBSQ	SEE
(1)Whole 55 Sectors	1.5130	0.2621 (0.777)	−0.0192 (−0.128)	0.5476 (4.709)	−0.0996 (−4.80)	−0.1792 (−.370)	0.2739	0.9000
(2)Comnpetit 18 Sectors	−0.9023	0.0649 (0.475)	0.0663 (0.857)	−0.0881 (−1.600)	−0.2498 (−1.972)	0.0613 (0.219)	0.3095	0.1549
(3)Non−comp 37 Sectors	1.2065	0.3175 (0.830)	−0.0325 (−0.194)	0.4792 (3.277)	−0.1784 (−0.818)	0.1512 (0.294)	0.2214	0.8884
(4)Comnpetit 18 Sectors	−0.3270		0.1076 (2.389)				0.2169	0.1649
(5)Non−comp 37 Sectors	1.3173	0.3501 (1.009)		0.4546 (3.334)			0.2728	0.8586

Note1: Figure in parenthesis is t value.
Note 2: See text for the name of variables.

. Again the result is not persuasive to determine main factors for international competitiveness. Though the labor productivity may be one of the determining factors for the competitive group and investment/output ratio together with the technological factor (RD) may be contributing factors for non-competitive group, RBSQ for each equation is unacceptable.

Table - 7 presents cross sectional analysis with dummy variable. If the sample belongs to the competitive group, the dummy variable takes one, if not zero. Whole 55 samples for each year of 1987, 1990, 1995 and 1998 were regressed in finding out factors to determine international competitiveness of Japanese manufacturing exports in the US market. The results are promising. All RBSQ are over 0.5. One of the findings is that the determining factors of competitiveness seem to be

different from year by year or up to and after 1990. Up to 1990 main factors related to the behavior of competitive sectors seem to be RD and value added rate for 1987 and RD and profit rate for 1990, while both for 1995 and 1998 investment/output ratio and RD are crucial as main factors of competitiveness.

Table – 7 Cross Sectional Analysis with Dummy Variable: Factors Determining International Competitiveness

lnRNLIIC=	Const.	lnAinvrat	lnOutEmp	lnRD	lnVarat	lnProrat	Dum	RBSQ	SEE
1987	1.0569			0.2833	0.5122		0.9406	0.5613	0.5898
(1)				(4.246)	(1.821)		(5.279)		
1990	1.7400			0.2151		0.7013	0.9997	0.6020	0.6335
(2)				(2.684)		(3.469)	(5.193)		
1995	0.9513	0.4531		0.3254			1.1564	0.5046	0.7708
(3)		(1.512)		(3.156)			(4.796)		
1998	0.9714	0.4136		0.3476			1.0892	0.5090	0.7401
(4)		(1.560)		(3.383)			(4.712)		

Note 1: Figure in parenthesis is *t* value.
Note 2: Sample size of estimation: 55 whole samples for each year.
Note 3: Dum = 1 for sectors with RNLIIC higher than 1, and 0 for sectors with RNLIIC less than 1.
Note 4: See text for the name of variables.

Final trial is to present a pooled data analysis or a pooling data analysis. 12 sectors always competitive in 1990 (20), 1995 (17) and 1998 (18) are selected and included in the competitive class. Figure in parenthesis above represents number of competitive sectors for the respective year. Out of 20 non-competitive sectors 14 sectors always non-competitive in 1990, 1995 and 1998 were selected and included in the sample. Data of 1990, 1995 and 1998 were combined in estimating the equation. Thus the sample size are: 12 sectors multiplied by 3 years gives 36 samples for competitive group, 14 sectors multiplied by 3 years gives 42 samples for non-competitive group. The sample size of whole sectors is 78.

Table - 8 shows the results of pooled data analysis. To select appropriate factors in estimating the equation first four trials include whole factors supposed to be effective. The result is quite good. Factors determining international competitiveness of Japanese manufacturing exports in the US market are investment/output ratio and profit rate for the sample of 78 with a dummy variable for competitive sectors, while additional factor of RD rate may be contributed for the sample of 78 without dummy variable for competitive sectors, though RBSQ is deteriorating. The RBSQ of former equation is almost 0.8.

Table – 8 Pooled Data Analysis: Factors Determining International Competitiveness

lnRNLIIC=	Const.	lnAinvrat	lnOutEmp	lnRD	lnProrat	lnVarat	Dum	RBSQ	SEE
(1)Whole 78 Samples	8.1435	1.5734	−0.0096	1.1225	1.6068	−1.8711		0.4468	1.9870
		(2.204)	(−0.0373)	(5.995)	(3.116)	(−2.245)			
(2)Competitive 36 samples	0.5562	0.1797	0.1227	−0.0352	0.4976	−0.9714		0.5452	0.2519
		(1.161)	(1.212)	(−0.544)	(2.975)	(−2.650)			
(3)Non−competitive 42 samples	0.4119	2.6358	0.2571	−0.3115	1.8985	−2.1632		0.3334	1.4146
		(3.945)	(1.0372)	(−1.187)	(4.192)	(−3.151)			
(4)Whole 78 Samples with Dummy	−0.3096	1.5697	0.1260	−0.0429	1.3474	−1.7385	4.4254	0.8276	1.1091
		(3.939)	(0.875)	(−0.308)	(4.670)	(−3.736)	(12.653)		
(5)Whole 78 Samples with Dummy	0.1696	1.2985		−0.0009	0.6720		4.4131	0.7928	1.2160
		(3.106)		(−0.0057)	(2.591)		(11.541)		
(6)Whole 78 Samples with Dummy	0.1729	1.2979			0.6720		4.4117	0.7956	1.2078
		(3.227)			(2.612)		(15.610)		
(7)Whole 78 Samples	7.9710	1.2204		1.1724	0.9579			0.4227	2.0298
		(1.749)		(6.203)	(2.223)				
(8)Comnpetitive 36 Sectors	−0.4425		+ 0.3178		+ 0.2011			0.4812	0.2691
			(5.862)		(1.501)				
(9)Non−competitive 42 Sectors	2.2988	+ 2.0249			+ 0.9966			0.2059	1.5439
		(3.171)			(2.642)				

Note 1: Figure in parenthesis is t value.
Note 2: See text for the difference in the sample size for pooled data analysis
Note 3: See text for the name of variables.

If we compare the results in table - 8 with that in table - 7 we can find out big difference in the figure of elasticity of investment/output ratio. Equation (3) and (4) in table - 7 has the elasticity of over 0.4, while in equation (6) and (7) in table - 8 its elasticity is over 1.2. The difference is quite reasonable. In equation (3) and (4) the sample coverage is from sector 10 to sector 64, that is, whole sectors were included in the sample, while in equation (6) and (7) 12 competitive sectors and 14 non-competitive sectors selected from 55 sectors consist of samples for the pooled data analysis.

5. Conclusion

In concluding the analysis of international competitiveness of Japanese manufacturing exports in the US market, it is most appropriate to summarize what has been done in this study. First, we could demonstrate how to utilize BTM database and to achieve, based on the data extracted from BTM to calculate Balassa's index of international competitiveness (BIIC). As an additional experiment we could confirm for ourselves the validity of UNIDO type, or single country index of international competitiveness. Correlation coefficient between BIIC and UNIDO index by sector is 0.57 as an average. Secondly, a new index of international competitiveness (RNLIIC) was developed taking into consideration of the trade structure both of Japan and of the USA. This is a sort of local version of Balassa's index, and a similar index can easily be calculated for the bilateral trade relations between Japan and China or the relations between the USA and Germany. Thirdly, using the new index of RNLIIC, historical picture of competitiveness of Japanese manufacturing exports in the US market were examined, showing that the traditional light industries such as beverages, clothing and leather products were always non-competitive and high-tech industries such as motor vehicles, general machinery and precision industry were staying competitive. Finding out factors determining competitiveness of Japanese industries in the US market comes as the fourth purpose. The empirical result suggests investment/output ratio

and R&D ratio may be the best fitted factors to explain the fluctuation in the RNLIIC. This is the result from cross sectional data analysis based on the whole sample of 55 sectors with a dummy variable for competitive sectors. Pooled data analysis with the sample consisting of 12 competitive and 14 non-competitive sectors selected from whole sample gives a bit different result; the main factors seem to be investment/output ratio and profit rate, Sector by sector analysis based on the data of 12 years of observation naturally gives a different picture, though we could confirm the important roles of investment and R&D in determining international competitiveness of many sectors.

Conclusions mentioned above seem to be rather trivial, but we could at least re-confirm what has already been examined elsewhere[10]. Then, what kind of policy suggestions could we derive from this study? Important roles of investment/output ratio and R&D ratio for internationally competitive industries, and for bringing up new strategic and leading industries with strong international competitiveness can not be emphasized too much. Some of the conventional industries should also be kept strong in the international market by the same strategy

Problems remaining in this analysis are the followings. The first one is to examine the dynamic feature of international competitiveness of Japanese industries within the framework of multi-country model combined by BTM. The analysis in this paper, based on the historical data of BTM and of Jidea5 database, has no relations with dynamic feature of the Jidea5 model or the future trade pattern produced by multi-country model of Japan and the USA combined by BTM[11]. Behavior of US manufacturing sectors competitive with Japanese sectors should also be included in this analysis. We do hope to revise this analysis to obtain more realistic trade relations between Japan and the USA or with other countries.

The second problem still remaining 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 decimal value in index of competitiveness of a specific industry does not necessarily mean the industry is less competitive[12].

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[10] One of the earlier examples is available in Urata (1983).

[11] First attempt to calculate RNLIIC between Japan and China within the framework of our recent analysis on Japan-China FTA effects was given up because of the incompletion of simulation system combining two models.

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

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