

Study of Intra-industry Trade in Sino-Japan Service Industry: Measurement and Influencing Factors

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Abstract: By the calculation of G-L Index and MIIT Index between China and Japan from 2001 to 2011, this thesis concludes that industry trade in service is primarily featured by intra-industry trade. On this basis, using the analysis by gradually quoting and illustrating the variable data figures out that market opening, different demand and economics of scale are the critical factors for influencing intra-industry trade in Sino-Japan service industry. Relevant policy conclusions are also suggested at the end of this thesis.

Keywords: Intra-industry Trade Index, Economics of Scale, Per Capita GDP, National Policy

1. Introduction

As deepening of global interest conflicts, all concerned countries began to pay much attention to the development of other trade model except that of intra-industry trade which emerged as a new trade model in 1950s. At the same time, in order to highlight the resource utilization and economic efficiency, industrial structure of various countries has realized huge adjustment, in which the first industry and second industry presented by agriculture and manufacture trends to develop stably while the third industry presented by service grows powerfully. Servitization of social and economic activities is the inevitable developing trend of productivity development. Measuring and explaining the development of intra-industry trade in Sino-Japan service industry from perspective of that between China and Japan will provide support for further improvement and optimization.

Internationally, intra-industry trade could illustrate clearly about international trade reality under the environment of monopoly and competition. Since now, study achievement of intra-industry trade in-and-out sea abroad consists of three aspects introduced as following:

Firstly, theory studies of intra-industry trade. Linder (1961) had explained the phenomenon of intra-industry trade from demand angle on *An essay on trade and transformation*; Grubel & Lloyd (1975) partly showed the reason of intra-industry trade of homogeneous product by amending

H-O model in *Intra-industry Trade: the Theory and Measurement of International Trade in Differentiated Products*; Krugman thought it was imperfect competition and economies of scale, especially the internal economies of scale caused appearance of the intra-industry phenomenon; while Liu Bei had studied the intra-industry trade theory in Sino-Japan service industry from aspect of New trade theory, factor endowments theory and neo-Chamnerlin models in his book named *Research on the Theory of Intra-industry Trade in Service Industry*.

Secondly, empirical study of intra-industry trade. Wang Tao and Jiang Wei explained that projects concerned access fee and franchise fee of computer -information service as well as proprietary have gradually showed the significant characteristics of industries by G-L index and MIIT index based on calculation and analysis of intra-industry trade in service industry from 2000 to 2007 between China and Japan in book named *Empirical Study of Intra-industry Trade in Sino-Japan Service Industry*; Wang Lu analyzed the G-L index of agricultural products among China, Japan and Korea from 1996 to 2007 in books names *Empirical Study of Intra-industry Trade in Service Industry on Agricultural Products based on G-L Index among China, Japan and Korea*; Li Ji and Zhao Fang similar engineering products like SITC7 was priority in intra-industry trade between China and Japan illustrated by data analyzed by index from 1988 to 2009 in book named *Empirical Study including Direct Investment by Japan to China and Vertical Intra-industry Trade in Service Industry*.

Thirdly, study of factors affected the intra-industry trade development. Xu Peiyuan in his book named *Study of Sino-Japan Intra-industry Trade and Its Influencing Factors* showed that there was the positive correction concerned factors of Sino-Japan per capita income gap, expanding of Chinese enterprises' scale and intra-industry trade level between China and Japan; There was the synergic influence between intra-industry trade in service and service industry development by Gong Jing in *Synergic Study of Intra-industry Trade in service of China and Service Industry Development – Dynamic Effort Analysis Based on VAR Model*.

In terms of data collection, adopting the service industry category method in subjected to *Empirical Study of Intra-industry Trade in Sino-Japan Service Industry* written by Wang Tao and Jiang Wei; dividing service industry into 11 items based on EBPOS which is much more systematic compared with HS encoding classification raised by Li Ji and Zhao Fang; taking preference-similarity theory of Linder and market structure theory of Krugman as basis, this thesis locks the four factors that influences the intra-industry trade in service between China and Japan listed as economics of scale, demand structure, FDI and market opening extent of trade policy, which is different with index mentioned by Xu Peiyuan. Currently, Chinese scholars mostly concentrated on the overall-level study or study on manufactured goods industry. There is much more empirical research and quantitative analysis of intra-industry trade on manufactured goods, agricultural products and other industries in subjected to trade research achievement between China and Japan. However, when taking it as breakthrough point, research methods are clearly insufficient only combining the empirical research and quantitative analysis. While the study of this paper could make up the defects mentioned above.

2. Volume and Index Estimation of Intra-industry Trade in Sino-Japan-Service Industry

Fast increasing of trade volume in the past decade has achieved between China, as the largest developing country in Asia, and Japan, as the country with highest economic development in Asia. Only little decreasing of export and import trade volume happened in 2010 and 2013, other years total volume was increased by 11.8% averagely while trade quantity showed the stable increasing trend. Reversely taking statistic data of domestic service industry (the third industry) development as reference, from 2004 to 2012 the inspirited percentage index for increasing of gross domestic production were respectively 4.03, 4.89, 5.73, 6.56, 4.34, 4.02, 4.11, 4.07, 3.5, which were far higher than those of the first industry but lower 5.41% averagely per year compared those of the second industry. Visibly, it could not be underestimated the driving energy by domestic service industry development to economic

development since entering 21century. Due to the close geography, similar history and culture, gradually increased crowd flow and huge potential domestic market, there will be bright and broad trade future between two countries which makes the study of intra-industry trade in service necessary.

2.1. Estimation of Intra-industry Trade

To make it easily understand, this paper adopts theory of intra-industry concept raised by Zhang Zheng and Ma Yeqing (2009), at the same time divides service industry into 11 classification such as transportation, tourism, communications service and so on based on EBPOS (Extended Balance of Payments Services). At present, recognized estimated method mainly is index analysis, such as G - L index, MIIT index and its correction, etc while this paper will only adopt typical G-L index and B index considering time factor.

2.2. G-L Index Estimation and Analysis

G-L index, Grubel-Lloyd Index, belongs to static estimation index of intra-industry trade, the specific calculation formula is as following:

$$B_{ij} = 1 - \frac{|X_{ij} - M_{ij}|}{|X_{ij} + M_{ij}|} \quad (1)$$

B_{ij} represents non-weighted intra-industry trade index in service of J (explain to one service industry) in I (explain to one country), while X_{ij} represents gross export value of J (explain to one service industry) in I (explain to one country); M_{ij} represents gross import value of J (explain to one service industry) in I (explain to one country); taking number of B_{ij} between 0 and 1, which means that the more the index value close to 1, the higher the intra-industry trade level of product is; Reversely, the more the index value close to 0, the lower the intra-industry trade level of product is. Normally 0.5 of G-L index value is considered as the line to recognize the intra-industry trade level, that means if the index value is larger 0.5, intra-industry trade is a priority in this department; otherwise, inter-industry trade will gives the priority.

In order to figure out the intra-industry trade level in Sino-Japan service industry, this paper collects the statistical data of export and import in service industry from 2001 to 2011 between China and Japan and classifications of C-L are as following:

From the data in table 1, it is clear that since 21st century transportation, communication and other commercial service have the highest intra-industry trade level with yearly average G-L index above 0.8 between China and Japan while the trade in tourism, construction, insurance and finance was mainly intra-industry trade model. However, trade in subjected to access fee and franchise fee of computer - information service as well as proprietary, special, cultural, creative and government service mostly was inter-industry trade. Access fee and franchise fee of proprietary kept lowest trade level while held a monopoly in inter-industry trade.

Table 1. G-L Index Table of Sino-China Service Industry Trade.

| | Trans-port-ation | Tourism | Communic-ations | Constructi-on | Insurance | Finance | Compute-Information |
|--------------------------|-------------------------|----------------|------------------------|----------------------|------------------|----------------|----------------------------|
| 2001 | 0.9781 | 0.3342 | 0.6636 | 0.6483 | 0.3689 | 0.5814 | 0.1370 |
| 2002 | 0.9181 | 0.3239 | 0.7568 | 0.4576 | 0.4871 | 0.8098 | 0.2076 |
| 2003 | 0.7178 | 0.5449 | 0.7759 | 0.6244 | 0.7755 | 0.6326 | 0.2982 |
| 2004 | 0.7628 | 0.6091 | 0.7352 | 0.7197 | 0.9741 | 0.7103 | 0.2888 |
| 2005 | 0.9052 | 0.4485 | 0.8775 | 0.8245 | 0.6309 | 0.5167 | 0.2557 |
| 2006 | 0.9464 | 0.9846 | 0.7765 | 0.6589 | 0.6329 | 0.6399 | 0.2134 |
| 2007 | 0.8869 | 0.9614 | 0.8281 | 0.6687 | 0.5991 | 0.3053 | 0.1896 |
| 2008 | 0.7966 | 0.9980 | 0.9511 | 0.8035 | 0.5733 | 0.5793 | 0.1150 |
| 2009 | 0.7172 | 0.8126 | 0.9099 | 0.8580 | 0.7173 | 0.9092 | 0.1075 |
| 2010 | 0.6457 | 0.9485 | 0.9989 | 0.9719 | 0.6040 | 0.8770 | 0.1147 |
| 2011 | 0.7135 | 0.9851 | 0.8895 | 0.5862 | 0.5479 | 0.9179 | 0.0844 |
| Yearly Average G-L Index | 0.8171 | 0.7228 | 0.8330 | 0.7111 | 0.6283 | 0.6799 | 0.1829 |

Table 1. Continue.

| | Others Commerci-al Service | Access and Franchise Fee of Computer-Informati--on service & Proprieta-ry | Special, Cultural, Creative Service | Governme-nt Service |
|--------------------------|-----------------------------------|--|--|----------------------------|
| 2001 | 0.5194 | 0.1089 | 0.2265 | 0.6734 |
| 2002 | 0.6477 | 0.1037 | 0.5367 | 0.5256 |
| 2003 | 0.7795 | 0.0570 | 0.0770 | 0.4254 |
| 2004 | 0.8560 | 0.0443 | 0.7909 | 0.2996 |
| 2005 | 0.8034 | 0.0335 | 0.0628 | 0.2100 |
| 2006 | 0.6848 | 0.0464 | 0.1489 | 0.2734 |
| 2007 | 1.0000 | 0.0206 | 0.2850 | 0.2397 |
| 2008 | 1.0000 | 0.0206 | 0.4160 | 0.2177 |
| 2009 | 1.0000 | 0.0063 | 0.4537 | 0.3588 |
| 2010 | 1.0000 | 0.0266 | 0.3123 | 0.4715 |
| 2011 | 0.6343 | 0.0320 | 0.8031 | 0.5060 |
| Yearly Average G-L Index | 0.8114 | 0.0454 | 0.3739 | 0.3819 |

Remark: 1. Data above is from UN SERVICE DATABASE 2. They are rounded data.

Table 2. MIIT Index Table of Sino-China Service Industry Trade.

| | Transportation | Tourism | Communications | Construction | Insurance | Finance |
|-------------------------|-----------------------|----------------|-----------------------|---------------------|------------------|----------------|
| 2001-2002 | 0.2902 | 0.2697 | 0.4993 | 0.0000 | 0.0000 | 0.0000 |
| 2002-2003 | 0.0856 | 0.9460 | 0.6957 | 0.8730 | 0.1761 | 0.5073 |
| 2003-2004 | 0.8890 | 0.7474 | 0.4605 | 0.9294 | 0.0000 | 0.9563 |
| 2004-2005 | 0.7162 | 0.0000 | 0.0000 | 0.3959 | 0.2682 | 0.0000 |
| 2005-2006 | 0.8266 | 0.0000 | 0.0000 | 0.9582 | 0.6499 | 0.0000 |
| 2006-2007 | 0.5524 | 0.7178 | 0.9188 | 0.6354 | 0.3420 | 0.1072 |
| 2007-2008 | 0.0000 | 0.6967 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2008-2009 | 0.9614 | 0.0000 | 0.5052 | 0.6555 | 0.2942 | 0.0000 |
| 2009-2010 | 0.3534 | 0.0291 | 0.0000 | 0.3815 | 0.4420 | 0.0865 |
| 2010-2011 | 0.3355 | 0.0000 | 0.1532 | 0.0000 | 0.3859 | 0.7479 |
| Year Average MIIT Index | 0.5010 | 0.3407 | 0.3233 | 0.4829 | 0.2558 | 0.2405 |

Table 2. Continue.

| | Compute Information | Others Commercial Service | Access and Franchise Fee of Computer-Information service & Proprietary | Special, Cultural, Creative Service | Government Service |
|--------------|---------------------|---------------------------|--|-------------------------------------|--------------------|
| 2001-2002 | 0.7917 | 0.9019 | 0.0739 | 0.0000 | 0.0000 |
| 2002-2003 | 0.0000 | 0.0000 | 0.0000 | 0.7681 | 0.1443 |
| 2003-2004 | 0.2689 | 0.3230 | 0.0127 | 0.0000 | 0.0000 |
| 2004-2005 | 0.2080 | 0.5853 | 0.0012 | 0.0000 | 0.0000 |
| 2005-2006 | 0.1034 | 0.0000 | 0.0998 | 0.0000 | 0.0000 |
| 2006-2007 | 0.1459 | 0.0000 | 0.0000 | 0.5066 | 0.3835 |
| 2007-2008 | 0.0000 | 0.0000 | 0.0207 | 0.0000 | 0.1481 |
| 2008-2009 | 0.0000 | 0.7757 | 0.0000 | 0.3565 | 0.0000 |
| 2009-2010 | 0.2261 | 0.1153 | 0.1389 | 0.0000 | 0.1981 |
| 2010-2011 | 0.0000 | 0.4193 | 0.0835 | 0.0000 | 0.7895 |
| Year Average | 0.1744 | 0.3121 | 0.0431 | 0.1631 | 0.1664 |
| MIIT Index | | | | | |

Remark: 1. Data above is from UN SERVICE DATABASE 2.They are rounded data.

2.3. Measure and Analysis of MIIT Index

MIIT index, meaning marginal intra-industry index trade, belongs to a dynamic measure index of intra-industry trade considering the time factor, and the formula is as following:

$$MIIT_i = 1 - |\Delta X_i - \Delta M_i| / |\Delta X_i| + |\Delta M_i| \quad (2)$$

MIIT_i represents the marginal intra-industry trade index of classification I in certain period time, ΔX_i and ΔM_i represent the variations of export and import trade of product in classification I in separately periods; Taking number of MIIT from 0 to 1, which means that the smaller the MIIT value is, the larger share of intra-industry trade in increasing volume, otherwise the phenomenon is reverse. To make is easy for statistical analysis, hereinafter the time interval is a year.

Taking the data on table 1 as basis to measure the margin intra-industry trade index with one-year time interval and the measure result is showed in Table 2.

Statistic results in Table 1 and Table 2 are identical each other and index difference become smaller with lower MIIT index value compared with G-L index value, which shows that G - L index may overestimate the level of intra-industry trade from dynamic perspective after considering the time factor.

3. Econometric Analysis of Intra-industry Trade in Sino-Japan Service Influence Factors

3.1. Selection and Quantization of Influence Factors

This thesis hereinafter will analyze influence factor of intra-industry trade in Sino-Japan service industry by establishing the measurement model since the analysis from static and dynamic perspective have been made in first-half article. According to the past literature, the factors such as FDI, economics of scale, domestic demand, national policy geographic distance and trade concentration between two countries have influenced the development level of intra-industry trade. In view of data availability, in this thesis four variables influencing the market opening extent are

selected as the interpretation of variables in model: direct foreign investment, economics of scale, domestic demand and trade policy.

Direct Foreign Investment (adopt the actual investment from Japan to China). Investment motion of investors are various as the FDI constantly changes its performance way due to deepening international division of labor. The reason to choose the direct foreign investment as one of the factor influencing the intra-industry trade level in Sino-Japan service industry is not only because of actual fact that Japan improves investment value to China but also on account that FDI pursuing the product differentiation and economics of scale is positive for national intra-industry trade development.

Economics of Scale (adopt the GDP arithmetic mean value between China and Japan). According to market structure theory of Krugman: economics of scale and product differentiation are the critical factor to form intra-industry trade, economics has no space to create all classified products in order to reach scale economy on certain product due to limited market capacity in one country and then the intra-industry changes correspondingly. Model shows that the development level of intra-industry trade in service and economics of scale present positive correlation.

Demand Structure Differentiation (adopt Sini-Japan per capita GDP differentiation) between China and Japan). Preference-similarity demand theory of Linder explains the appearance basis of intra-industry trade: he thought that trade is resulted from domestic need. The more similar of two countries' demand structure, the more appearance possibility of intra-industry trade. However, the index of measuring the demand structure is per capita income so hereof in the thesis applies the differentiation of per capita GDP between two countries while prior theory thought it represents inverse correlation between intra-industry trade level and differentiation of AGDP.

Opening Extent Influence of Trade Policy (adopt proportion that Chinese service industry of foreign trade occupied in GDP). National trade policy normally always influents the trade structure and volume. Combining national condition of China, national policy has critical even decisive efficiency to industry market opening extent. The higher market opening extent, the lower threshold that service flows in country.

Model Prior thought that it is positive correlation between the intra-industry trade level and national opening up extent.

3.2. Model Establishment

Refer the formula (1) as Established multiple linear regression model and apply the software Eviews7.0 for inspection and regression.

$$LnIIT = C + \beta_1 LnFDI + \beta_2 LnAGDP + \beta_3 LnDAGDP + \beta_4 LnPOLI \quad (3)$$

IIT, measured by G-L index, represents to the intra-industry trade level in service; FDI represents the investment value by Japan to China; AGDP represents arithmetic mean value of GDP in China and Japan; DAGP represents differentiation of AGDP in two countries; POLI represents the percentage of total import an export value of Chinese service trade on GDP. Data of IIT measured by D-L index is calculated based on source of *Un service database*; Data source of FDI, AGDP, DAGDP and POLI is from *China Statistical Yearbook*, World Bank and WTO database while some related data is calculated correspondingly.

It is necessary to remove the influence caused by multicollinearity of explanatory variable on regression result due to the notable linear dependence of DAGDP and AGDP. Now after introducing explanatory variable to remove multicollinearity and inspect serial correlation by DW, now the regression result of IIT is as following:

$$LOG(IIT) = -3.2137 + 0.1398 LOG(FDI) \quad (4)$$

(-1.0021) (0.9687)

$$R^2 = 0.0858, F = 0.9385, DW = 0.5156$$

$$LOG(IIT) = -4.9455 + 0.167 LOG(AGDP) \quad (5)$$

(-1.5953) (1.5608)

$$R^2 = 0.1959, F = 2.4360, DW = 0.4448$$

$$LOG(IIT) = -1.0696 + 0.0922 LOG(DAGDP) \quad (6)$$

(-0.2588) (0.2328)

$$R^2 = 0.0054, F = 0.0542, DW = 0.3492$$

$$LOG(IIT) = 1.9765 + 0.7503 LOG(POLI) \quad (7)$$

(4.3534) (4.5938)

$$R^2 = 0.6785, F = 21.1028, DW = 0.6838$$

It is notable that fitting result is not idea if using single explanatory variable on intra-industry trade between two countries; However, the strengthen influence relatively could be ranked from large to small: POLI, AGDP, FDI, DAGDP. Now take the regression equation (7) as a basis, introduce AGDP, FDI, DAGDP into equation, and then monitor whether change of goodness of fit is obviously. Firstly, the regression result got by introducing AGDP show that: increasing of goodness-of-fit from 0.6785 to 0.7815, little improvement of R^2 after adjustment and pass of F inspection less than 5%,

above which illustrates AGDP could be applied into model. Secondly, the regression result got by introducing FDI show that: goodness-of-fit little increasing of equation, but decreasing of goodness-of-fit after adjustment as well as variable FDI coefficient failing to pass t inspection, above which illustrates FDI shall not be applied. Thirdly, the regression result got by introducing DAGDP show that: increasing of equation to 0.8448, oblivious t value with POLI, AGDP and DAGDP coefficient inspected less than 10% above which DAGDP could be applied into regression model based on Akaike Information Criterion and Schwarz Information Criterion.

Table 1. Influence factor Regression Result of Sino-Japan Intra-industry trade in Service.

| Variable | Coefficient | Std. Error | t-Statistics | Prob. |
|--------------------|-------------|------------|-----------------------|-----------|
| C | -0.056280 | 1.869648 | -0.030102 | 0.9767 |
| LOG(POL) | 0.649644 | 0.132037 | 4.920176 | 0.0012 |
| LOG(AGDP) | 0.244936 | 0.086158 | 2.842875 | 0.0217 |
| LOG(DAGDP) | -0.511569 | 0.283319 | -1.805630 | 0.1086 |
| R-squared | 0.844762 | | Prob. (F-statistic) | 0.001337 |
| Adjusted R-squared | 0.786548 | | Schwarz criterion | -2.658569 |
| F-statistic | 14.51127 | | Akaike info criterion | -2.820205 |
| Log likelihood | 20.92123 | | Durbin-Watson stat | 1.120533 |

3.3. Regression Analysis

Base on Figure 1 the best regression equation is as following:

$$LOG(IIT) = -0.0563 + 0.6496 LOG(POLI) + 0.2449 LOG(AGDP) - 0.5116 LOG(DAGDP) \quad (8)$$

It is notable from final result: POLI, AGDP, DAGDP and intra-industry trade level are identical with expectation. POLI, AGDP and DAGDP are main factors influencing intra-industry trade level in service, which meets preference-similarity theory, market structure theory basis and related experience analysis. Reaction of intra-industry trade level in Sino-Japan service industry is sensitive to service-industry opening extent and demand structure Differentiation while there is less elastic to market scale. Therefor the best effect methods for developing Sino-Japan intra-industry trade development are to enlarge market opening extend in service industry, reduce threshold for relative service industry abroad entering as well as give full play to the role of market competition mechanism. On long-term-development perspective, it is helpful for further improvement of intra-industry trade by driving GDP especially enhancing per capita GDP.

4. Conclusion

There are two main conclusion analyzed through measuring intra-industry trade level in Sino-Japan service industry and influence factors to two countries'

intra-industry trade in service.

4.1. Development Level

From view of dynamic and static perspective, as the common service departments of intra-industry trade in Sino-Japan service industry transportation, communications, insurance and finance have much higher development level, which mainly are intra-industry trade model. However, intra-industry trade model does not occupy too much in departments requiring for much more technology and creation such as computer-information service as well as proprietary, special, cultural, creative service. The phenomenon above illustrate that even though intra-industry trade in Sino-Japan service industry develops rapidly, the trade structure with lower science, technology and creation capacity shall be optimized.

4.2. Influence Factors

It is concluded that the main factors influencing intra-industry trade in Sino-Japan service industry are market opening extent, demand structure Differentiation (Per capita income differentiation) and market scale. In terms of various factors, service market opening extent and per capita income differentiation and market scale have significant affection to intra-industry trade development. Due to China's huge population base, even if the economy is bigger, the per capita income level still has the very big disparity compared with Japan, which seriously hindered the services for the development of intra-industry trade between the two countries. In subjected to gradual opening situation in service market and economy development trend between two countries , intra-industry trade still has greater development and improvement space.

Therefore, enhancing Opening Extent of Domestic Market in Service Industry, improving Science-Technology and Creative Capacity in Department of Service Industry and promoting Domestic Economy Growth Based on Environment of Stable Quality may be effective ways to get faster development in intra-industry trade.

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