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Chapter 3

Parts and Components Trade and Production Networks in East Asia

-A Panel Gravity Approach-

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Abstract

One of the most striking facts in international trade in the last two decades is that the rapid growth in trade among East Asian countries. A careful investigation identifies that the main source of the expansion of trade in East Asia has been parts and components trade rather than final good trade. This paper studies the structure of parts and components trade in East Asia, and the impact of production network and free trade agreement (FTA) on East Asian parts and components bilateral trade flows. Using panel gravity approach, I show that production network in East Asia and ASEAN FTA (AFTA) actually promote parts and components trade in this region, although the size of effects vary across industries.

Keywords: Parts and components trade, Production network, East Asia, Gravity equation

1. Introduction

The rapid growth of the volume of world trade over the past few decades is regarded as a "mystery," because the declines in tariffs and transportation costs are too modest to explain the expansion of world trade. This mystery has yet to be resolved, and many international economists continue to search for the "true factors" of trade growth. The followings are possible solutions:

1. Growth in incomes – especially in the countries of East Asia – has expanded international trade.
2. As multinational enterprises (MNEs) have grown their international operations, intra-firm trade has increased. MNEs have exploited the relative skill- or capital-intensiveness of home and host countries by breaking the production process into many steps in the production of many goods, saving the final assembly for their affiliates in the host country.
3. Trends in OEM contracts, outsourcing, value-chain management, and others, have reinforced linkages between countries.
4. Technological progress in supply-chain management has reduced the inventory carrying cost of intra-firm trade.
5. The emergence of modular type products in the world market has increased the versatility of parts and components, which in turn has enlarged international transactions.

Another striking fact in the international trade for the last decade is the rapid growth in trade volume in East Asia. While world trade in final goods increased more than 8 times from 1980 to 2005, the trade in final goods within the East Asian region grew more than 20 times for the same period. More surprisingly, while trade in parts and components increased more than 13 times worldwide from 1980 to 2005, the East Asian regional trade in parts and component grew more than 77 times during the same 25 years.

If we look into East Asian trade, we find the following interesting characteristics:

1. Parts and components trade accounts for the lion's share of increase in total trade in East Asia.
2. Within the region, Japan is the largest exporter of parts and components, followed by China, Korea, and Taiwan.
3. China is the largest importer of parts and components, followed by Hong Kong, and Singapore.
4. The data suggest that electrical machinery is the major product category comprising the parts and components trade in the region.
5. The exports of parts and components exceeded the final goods in electrical machinery in the 1980s in Japan and Korea, while parts and components has

exceeded final goods exports from the start in China, Malaysia, Indonesia, and Thailand.

This indicates the importance of MNE-related trade. In other words, MNEs--mainly Japanese MNEs--invested and started to supply parts and components in these countries from the initial stage of the economic development in these East Asian countries.

Therefore, in addition to trade liberalization, transport-cost reduction, and income convergence, the causes of the expansion of parts and components trade in East Asia should include an increase in intra-firm trade as well as arms-length trade, and emergence of free trade agreements.

The purpose of this study is to identify the causes of the expansion of parts and components trade in East Asia using a panel data from 1980 to 2005 over 15 countries. On the other hand, an increase in parts and components trade can be viewed as the result of trade policies, such as tariff policy, foreign investment policy, and free trade agreement. In other words, the investigation of the causes of parts and components trade can be related to the important international trade policy arguments.

The paper is organized as follows. Section 2 overviews a trend of parts and components trade both in East Asia and in the world. Section 3 describes estimation strategy for analyzing parts and components bilateral trade flows in East Asia. Section 4 will then discuss about data and data sources. Section 5 will present the estimated results and discussion. The final section will add some general discussion and conclude. An appendix shows the coverage of the data that are used for this study.

2. Parts and Components Trade in East Asia

As seen in the introduction, parts and components trade has rapidly grown in the world. Figure 1 shows the trend of parts and components trade in the world market since 1980 to 2005. In the figure, final goods and parts and components trade are drawn. Final goods are sum of capital and consumption goods. It shows upward trend of both types of goods for 25 years, however, final goods have been larger than parts and components trade for the observed period.

On the other hand, Figure 2 depicts the trend of parts and components and final goods in East Asia. East Asia includes Japan, China, Korea, Taiwan, Singapore, Philippines, Malaysia, Thailand, Brunei, Indonesia, Viet Nam, and Cambodia. East Asian trade in final goods was 42 billion US$, while 44 billion US$ in parts and components in 2005. Parts and components trade exceeded final goods trade in 2004 in East Asia. It is noteworthy that the rapid growth of parts and components trade in East Asia in the late 1990s is an interesting phenomenon.

When we look at parts and components trade by industries, we will see an interesting trend in electrical machinery. Figure 3 shows the world trade of parts and

components in electrical machinery. Before 1989 world final goods export had been larger than parts and components exports, while after 1989 parts and components exports rapidly grown and surpassed final goods exports. Combined Figure 1 with Figure 3, a notable finding is that parts and components exports in machinery industry explains more than 40% of world total parts and components exports in 2005. It is clear from these Figures that a main factor accounting for the rapid growth of world parts and components trade is electrical machinery. Furthermore, Combining Figure 1 and Figure 2, we will see that East Asian parts and components trade accounts for more than 45% of world parts and components trade.

3. Estimation Strategy

Anderson and van Wincoop (2003) raise the problems when a theoretical gravity model is not estimated. They claim two important problems due to the lack of theoretical foundation of empirical gravity equations. First, estimation results are biased due to omitted variables. Second, comparative statics exercises are not correct. They develop a general equilibrium gravity model that includes 'multilateral resistance term'.

Feenstra (2004, pp.152-163) summarizes the treatments of these problems econometrically as follows: First approach suggests introducing price effect in the gravity equation (Baier and Bergstrand 2001), and second approach addresses to use the estimated multilateral resistance term (Anderson and van Wincoop 2003). The last approach that I use in this paper is to use fixed effect to account for unobserved heterogeneity among countries. Last approach needs panel data, of course.

On the other hand, omitted variable is one of the sources of endogeneity problems. Endogeneity bias has been a problem for estimating cross-country gravity equations. Endogeneity bias occurs when any independent variables are correlated with error term which is usually assumed iid. In this case, ordinary least squares (OLS) yields biased and inconsistent coefficients estimates. As Baier and Bergstrand (2007) in the context of the gravity estimation suggests that the most important source of endogeneity bias is omitted variables and selection biases. Since I include trade policy variable (AFTA) and its related variable (production network), an unobservable heterogeneity in trade flow would be associated with these variables.

Production network:

To see the effects of production network in East Asia, I consider the following simple production network index:

$$\ln\left(Network_{jt}\right)=\ln\left(N_{jt}\right),$$

where N_{jt} is the number of Japanese affiliates in country *j* at time *t*. The number of Japanese affiliates in country *j* is the sum of existing firms and new entrants at time *t*. It is expected that trade volume between country *i* and country *j* increases as the number of Japanese affiliates in East Asian countries increases. It is therefore assumed that as the number Japanese affiliate in East Asian countries increases, intra-firm trade between either affiliates in different countries or between Japan and host countries also increases.

In this study I also calculate network proxy using Japanese firms' employments, that is $\ln(Network_{jt}) = \ln(E_{jt})$, where E_{jt} is the number of employees in Japanese affiliates in country *j* at time *t*. However, these two versions of network variables are highly correlated (correlation coefficient is 0.984) and both have almost same results. Therefore, I don't report the results of employment version of network proxy.

ASEAN Free Trade Agreement (AFTA)

This study also focuses on the impact of trade policy, especially FTA. Among many FTAs, ASEAN free trade agreement (AFTA) has been important for not only ASEAN member countries, but also non-member countries such as Japan and the U.S. Since Japanese and U.S. MNEs have invested in ASEAN countries for more than 40 years, the impacts of tariff reduction among member countries on the strategies of MNEs cannot be ignored. For example, Toyota shifted some automobile productions from the Philippines and Indonesia to Thailand after 2005 so as to exploit the AFTA merits. In general, AFTA provides a large unified market to MNEs, which is important to MNEs who have more than two plants in different ASEAN countries. I include AFTA proxy which is unity if country *i* and country *j* are AFTA members at time *t*.

Hence, a gravity equation I use in this paper is as follows:

$$X_{ijt} = \beta_0 \left(Y_{it} Y_{jt}\right)^{\beta_1} \left(Dist_{ij}\right)^{\beta_2} e^{\beta_3 Adj_{ij}} e^{\beta_4 Lang_{ij}} \left(Network_{jt}\right)^{\beta_5} e^{\beta_6 AFTA_{ijt}}, \qquad (1)$$

where Y_{it} (Y_{jt}) is real GDP of country *i* (*j*) at time *t*, $Dist_{ij}$ is a distance in kilo meters between country *i* and country *j*. Adj_{ij} stands for the adjacent dummy variable that takes unity if country *i* and *j* have common land border, zero otherwise, $Lang_{ij}$ is a binary variable which takes unity if countries *i* and *j* have common official language,

zero otherwise. $AFTA_{ijt}$ is a binary variable which takes unity if country *i* and *j* are members of AFTA at time *t*, zero otherwise, and $Network_{jt}$ is the proxy for production network in this region.

Taking logarithmic formulation of equation (1), and to avoid endogeneity problem (omitted variable and selection bias), I use country-fixed effect model with time dummy.[1] Hence, equation (1) is rewritten as follow;

$$\ln X_{ijt} = \beta_0 + \beta_t + \beta_1 \ln\left(Y_{it}Y_{jt}\right) + \beta_2 \ln Dist_{ij} + \beta_3 Adj_{ij} + \beta_4 Lang_{ij} + \beta_5 \ln Network_{jt} + \beta_6 AFTA_{ijt} + \gamma_1\delta_i + \gamma_2\delta_j + \varepsilon_{ijt} \quad (2)$$

where β_t is time effect. δ_i and δ_j are fixed effects to explain country's heterogeneity. δ_i is indicator variable that takes unity if country *i* is an exporter, zero otherwise, while δ_j is unity if country *j* is importer, zero otherwise. ε_{ijt} is assumed to be log-normally distributed error term.

Since I am interested in the determinants of parts and components trade, I decompose the term $Y_{it}Y_{jt}$ into $\left(Y_{it}+Y_{jt}\right)^2\left(s_{it}s_{jt}\right)$, where $s_{it} = Y_{it}/\left(Y_{it}+Y_{jt}\right)$ and $s_{jt} = Y_{jt}/\left(Y_{it}+Y_{jt}\right)$. It should be noted that the estimated coefficient for $Y_{it}+Y_{jt}$ in the log form, $\ln\left(Y_{it}+Y_{jt}\right)$, is two times larger than the estimated coefficient for $s_{it}s_{jt}$ in the log form, $\ln\left(s_{it}s_{jt}\right)$. It is interesting to note that since $s_{it}+s_{jt}=1$, then $s_{it}s_{jt} = \frac{1}{2}\left(1-s_{it}^2-s_{jt}^2\right)$ which equals Helpman's dispersion index (See Helpman 1987 and Feenstra 2004, p.154). In this study the term $\left(s_{it}s_{jt}\right)$ indicates the income convergence effect, that is, if GDP sizes for two countries are more similar, then trade between these two countries becomes large. The term $\left(Y_{it}+Y_{jt}\right)$ stands for ordinary

income effects in the gravity equation. Using this transformation, I can rewrite equation (2) to the following modified equation:

$$\ln X_{ijt} = \beta_0 + \beta_t + 2\beta_1 \ln\left(Y_{it} + Y_{jt}\right) + \beta_1 \ln s_{ij} s_{ji} + \beta_2 \ln Dist_{ij} + \beta_3 Adj_{ij} + \beta_4 Lang_{ij} + \beta_5 \ln Network_{jt} + \beta_6 AFTA_{ijt} + \gamma_1 \delta_i + \gamma_2 \delta_j + \varepsilon_{ijt} \quad (3)$$

Equation (3) is used for estimation in this study.

4. Data

Trade flow data are available from the Research Institute of Economy, Trade and Industry (RIETI) database (http://rieti.imari.co.jp/). RIETI data cover 50 countries/regions, 13 industries, five production stages, and 26 years (1980-2005). Five production stages include primary goods, processed goods, parts and components, capital goods, and consumption goods.[2] This study uses 15 countries (14 Asia and U.S.A.) and analyzes 13 industries[3] and 2 stages (parts and components, and consumption goods). These nominal trade flow data are deflated by exporters GDP deflator. The number of foreign affiliates and the number of employees in foreign affiliates in East Asia are obtained from Toyo Keizai Inc. (2006). GDP, GDP deflators, and population for each country for each year are from the International Monetary Fund (various issues). Other variables such as distance, contiguous information, and common official language dummies are available from Mayer and Zignago (2006).

5. Results

Tables from 1 to 3 report the results of gravity equation with different dependent variables. Table 1 summarizes the results of the case of total export from country *i* to country *j*. Table shows four different fixed effects cases; without country fixed and time effects in column (1), time effect only in column (2), country fixed effect only in column (3), and both country fixed and time effects in column (4). Columns (1) and (2) show expected sign for all estimated coefficients except for Adjacent dummy although they are not statistically significant. On the other hand, columns (3) and (4) show the correct sign with highly statistical significance for all estimated coefficients except for AFTA dummy in column (4). Comparing columns (3) with (4) for the total export, the size of coefficients for AFTA is larger in column (3) than in column (4). This indicates that in total export case, the large part of the effect of AFTA can be explained by the time trend.

The coefficients for Network show positive and highly statistically significant

in both columns (3) and (4). The size of Network in column (4) is 0.045 which suggests that 1% increase in the number of Japanese affiliates in country *i* (i.e., exporter) raises 0.045% of total export from country *i* to *j* which seems very small. On the other hand, the estimated coefficient for AFTA is 0.055 in column (4) which indicates that the average effect of AFTA increase trade between countries *i* and *j* by 5.65% ($e^{0.055} = 1.0565$).

As for the effects of income ($\ln Y_i + Y_j$) and income convergence ($\ln s_i s_j$), they have correct signs and statistical significances. In the case of column (4), a 1% increase in sum of the GDPs of countries *i* and *j* raises trade flows between countries *i* and *j* by 0.778%.

It is interesting to see how the results differ from Table 1 if estimation is done by 12 industries. Table 2 reports the results.

All estimations in 12 industries in Table 2 use country fixed and time effects. Network has positive impact on bilateral trade flow in 8 industries while AFTA has positive impact on trade in 9 industries. Among 8 industries which have positive effect of Network, estimated coefficient for Network in electrical machinery (column 9) is very high (0.444) compared with other industries. This means that electrical machinery industry has stronger network effect on trade promotion than other industries do.

Next table shows the results of parts and components goods cases. In Table 3, column numbers indicate the industry code same as in Table 2. Some industries, such as (1) foods, (4) chemicals, (5) oil and coal, and (6) stone, clay, glass and concrete products, do not have parts and components goods (stages).

Table 3 reports that in all industries except for (10) transportation equipment and (12) toys and miscellaneous goods industries, network effects show positive and are significantly different from zero. Among them, network effect is very high in electrical machinery (0.755) compared with other industries. In electrical machinery industry, the coefficient for income is just two times larger than that for income convergence, which is predicted from the equation (3). The estimated coefficient for network in electrical machinery indicates that 1% increase in number of Japanese affiliates in host country *j* raises 0.755% of parts and components export from country *j* to other countries including Japan.

As for AFTA, 4 industries have positive and significant impacts of AFTA on bilateral trade. Machinery industries, such as general machinery, electrical machinery, transportation equipment, and precision machinery, are the four industries that have positive and significant impact of AFTA. Electrical machinery has the largest impact among four industries, followed by transportation equipment.

6. Conclusion

In this paper, I estimated the network effects on bilateral parts and components trade in East Asian countries applying a panel gravity approach. Main purpose of the study was to identify how much (Japanese) MNE's network affects parts and components trade in this area. After controlling country size, income convergence, and other exogenous factors, such as distance, common official language, contiguous location, and most importantly endogeneity problem, the results show that the effects of network and FTA vary across industries. Notable findings were that network effect on part and components is the largest in electrical machinery and that the size of impact in electrical machinery is 7-90 time larger than other industries. This results was anticipated because the parts and components trade in electrical machinery in the world has grown more rapidly than final (capital and consumption) goods, which has never happened in other industries.

Although, largest contributor is the sum of incomes of exporting and importing countries which is almost equal unity in electrical machinery industry, impact of network is 0.755 which is also much larger than that of income convergence. This indicates that Japanese MNE's production network has been playing an important role to promote bilateral parts and components in electrical machinery trade in East Asia. Other industries, including general machinery, transportation equipment, and precision machinery industries, have also positive and highly statistically significant coefficients. However, the estimated coefficients are very small compared with electrical machinery industry. These findings shed light on the importance of production network especially in electrical machinery industry in East Asia.

Notes

1. For references of country-fixed effects to removing endogeneity bias, see, for eample, Eaton and Kortum (2002) and Melitz (2007).
2. See appendix for more details about data.
3. While RIETI data decompose electrical machinery industry into electrical machinery and household electric appliances, production network variables are available for only one category, that is, electrical machinery. Therefore, I combined two electrical industries in RIETI data into one electrical machinery industry so as to match two different datasets.

Appendix

Data coverage used in this study is:

Year: 1980-2005 (26 years)

Country: China, Hong Kong, India, Indonesia, Japan, Malaysia, Philippines, Korea, Singapore, Taiwan, Thailand, Brunei, Cambodia, Viet Nam, and USA. (15 countries)

Industry: 1. Foods, 2. Textile, 3. Pulp, paper and wood, 4. Chemicals, 5. Oil and coal, 6. Stone, clay, glass and concrete products, 7. Iron and steel, nonferrous metals, 8. General machinery, 9. Electrical machinery, 10. Transportation equipment, 11. Precision machinery, 12. Toys and miscellaneous goods. (12 industries)

Production stage: parts and components, consumption goods. (2 stages)

AFTA dummy: any pair of countries, including Indonesia, Malaysia, Thailand, Singapore, Brunei, and the Philippines, and after 1993, takes 1, zero otherwise. Pair of countries between Cambodia and any other ASEAN members after 1999 takes 1, zero otherwise. Pair of countries between Viet Nam and any other ASEAN members after 1995 takes 1, zero otherwise.

References

Anderson, James E. and Eric van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle," *American Economic Review*, 93: 170-192.

Baier, Scott L. and Jeffrey H. Bergstrand. 2001. "The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity." *Journal of International Economics*, 53: 1-27.

_____. 2007. "Do Free Trade Agreement Actually Increase Members' International Trade?" *Journal of International Economics*, 71: 72-95.

Eaton, Jonathan, and Samuel Kortum. 2002. "Technology, Geography, and Trade," *Econometrica*, 70: 1741-80.

Feenstra, Robert C. 2004. *Advanced International Trade: Theory and Evidence*. Princeton, NJ.

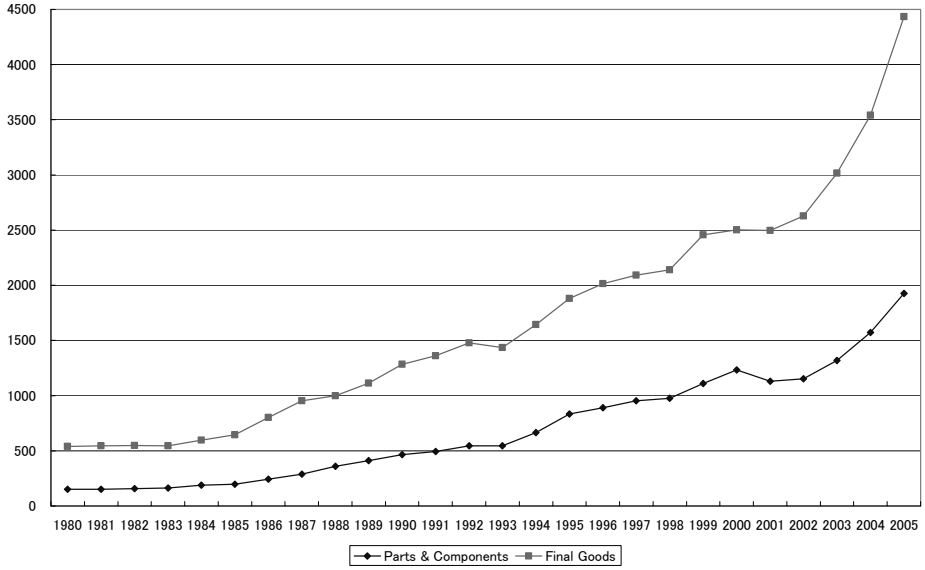
International Monetary Fund (various issues). *International Financial Statistics*.

Mayer, Thierry and Soledad Zignago. 2006. "Notes on CEPII's Distance Measures". http://www.cepii.fr/anglaisgraph/bdd/distances.htm

Melitz, Jacques. forthcoming. "Language and Foreign Trade," *European Economic Review.*

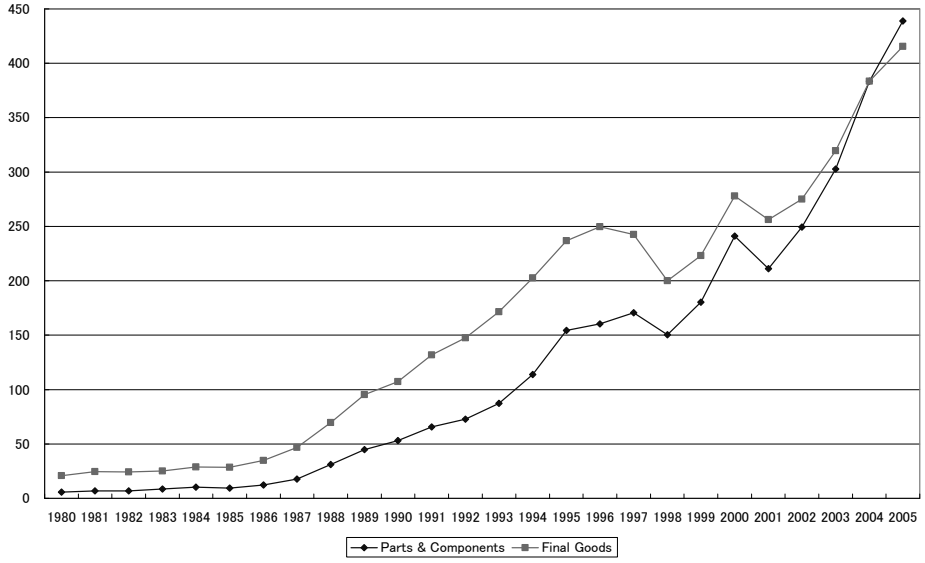
Toyo Keizai Inc. 2006. *Overseas Japanese Company Data*. CD-ROM

Figure 1. Parts and Components Trade in the World



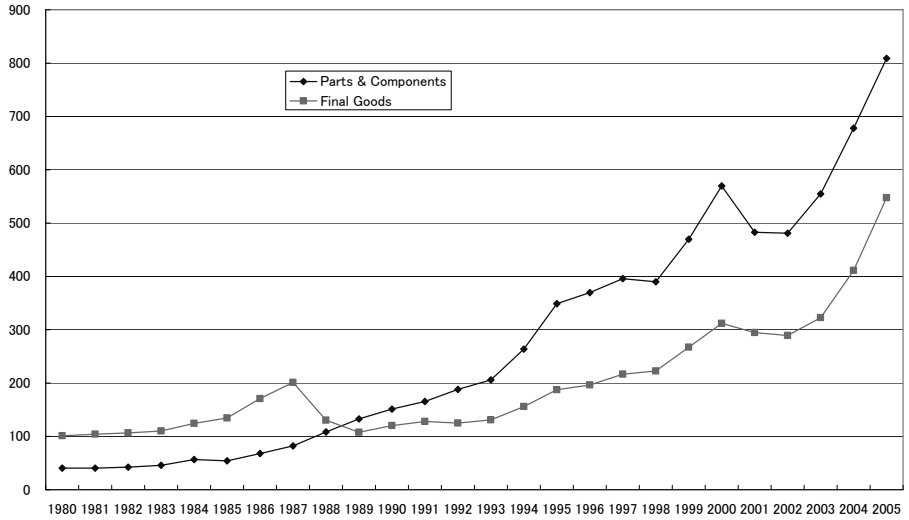
Source: Created from the Research Institute of Economy, Trade and Industry (RIETI) database (http://rieti.imari.co.jp/).

Figure 2. Parts and Components Trade in Asia



Source: Created from the Research Institute of Economy, Trade and Industry (RIETI) database (http://rieti.imari.co.jp/).

Figure 3.
Parts and Components and Final Goods in Electronics Trade in the World



Source: Created from the Research Institute of Economy, Trade and Industry (RIETI) database (http://rieti.imari.co.jp/).

Table 1. Results of Panel Gravity Model (Total Trade Flow)

	(1)	(2)	(3)	(4)
Industry	No country, no time effect	Time effect only	Country effect only	Country and time effects
ln Yi+Yj	1.754	1.757	1.127	0.778
	(0.033)***	(0.034)***	(0.061)***	(0.073)***
ln sisj	0.978	0.978	0.535	0.386
	(0.025)***	(0.025)***	(0.043)***	(0.048)***
Adjacent	-0.001	-0.017	0.214	0.241
	(0.112)	(0.112)	(0.097)**	(0.095)**
ln Distance	-0.784	-0.797	-0.521	-0.530
	(0.049)***	(0.049)***	(0.040)***	(0.039)***
Language	0.970	0.968	0.239	0.238
	(0.063)***	(0.063)***	(0.061)***	(0.059)***
ln Network	0.013	0.020	0.071	0.045
	(0.012)	(0.013)	(0.011)***	(0.011)***
AFTA	0.671	0.658	0.333	0.055
	(0.096)***	(0.099)***	(0.084)***	(0.085)
Observations	4074	4074	4074	4074
R-squared	0.60	0.61	0.81	0.82

Notes:
The dependent variable is the natural log of the real bilateral flow from *i* to *j*.
All estimations use fixed and time effects. However, coefficients on time/fixed effects are not reported. Robust standard errors are in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2. Results of Panel Gravity Model (Total Trade Flow by Industry)

	(1)	(2)	(3)	(4)	(5)	(6)
Industry	Foods	Textile	Pulp,Paper and Wood	Chemicals	Oil and Coal	Stone, clay, glass and concrete products
ln Yi+Yj	0.210	0.197	0.044	0.627	0.800	0.324
	(0.092)**	(0.101)*	(0.095)	(0.067)***	(0.170)***	(0.089)***
ln sisj	0.275	0.112	0.251	0.639	0.736	0.331
	(0.054)***	(0.062)*	(0.056)***	(0.043)***	(0.096)***	(0.055)***
Adjacent	0.412	0.223	0.168	0.368	0.395	0.218
	(0.089)***	(0.102)**	(0.102)	(0.091)***	(0.197)**	(0.101)**
ln Distance	-0.593	-0.622	-0.420	-0.395	-0.695	-0.790
	(0.043)***	(0.046)***	(0.045)***	(0.039)***	(0.081)***	(0.046)***
Language	0.345	0.284	0.239	0.249	-0.193	0.545
	(0.067)***	(0.072)***	(0.064)***	(0.056)***	(0.129)	(0.064)***
ln Network	0.024	0.017	0.059	0.083	0.019	0.057
	(0.012)**	(0.016)	(0.011)***	(0.013)***	(0.022)	(0.013)***
AFTA	0.067	0.648	0.022	0.235	-0.270	0.495
	(0.089)	(0.110)***	(0.087)	(0.076)***	(0.163)*	(0.093)***
Observations	3905	3933	3968	3900	3601	3782
R-squared	0.81	0.79	0.82	0.90	0.61	0.80

	(7)	(8)	(9)	(10)	(11)	(12)
Industry	Iron and steel , Nonferrous metals	General machinery	Electrical machinery	Transportation Equipment	Precision machinery	Toys and Miscellaneous goods
ln Yi+Yj	0.477	0.607	0.370	-0.234	0.798	0.269
	(0.094)***	(0.100)***	(0.085)***	(0.116)**	(0.101)***	(0.090)***
ln sisj	0.511	0.472	0.287	-0.023	0.456	0.356
	(0.055)***	(0.058)***	(0.050)***	(0.068)	(0.060)***	(0.054)***
Adjacent	0.517	0.206	0.244	0.556	-0.040	0.436
	(0.099)***	(0.118)*	(0.089)***	(0.143)***	(0.136)	(0.102)***
ln Distance	-0.526	-0.463	-0.509	-0.523	-0.755	-0.541
	(0.045)***	(0.051)***	(0.040)***	(0.063)***	(0.057)***	(0.045)***
Language	0.075	0.293	0.338	0.323	0.538	0.636
	(0.064)	(0.071)***	(0.059)***	(0.085)***	(0.075)***	(0.065)***
ln Network	0.059	0.108	0.444	0.023	0.065	0.016
	(0.012)***	(0.015)***	(0.009)***	(0.020)	(0.015)***	(0.012)
AFTA	0.336	0.452	0.719	0.726	0.374	0.284
	(0.098)***	(0.105)***	(0.082)***	(0.124)***	(0.110)***	(0.092)***
Observations	3900	3893	7579	3748	3635	3921
R-squared	0.83	0.85	0.82	0.74	0.83	0.86

Notes:

The dependent variable is the natural log of the real bilateral flow from *i* to *j*.

All estimations use fixed and time effects.

However, coefficients on time/fixed effects are not reported. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3. Results of Parts and Components Trade Flows by Industry

	(2)	(3)	(7)	(8)
Industry	Textile	Pulp,Paper and Wood	Iron and steel , Nonferrous metals	General machinery
ln Yi+Yj	1.041	0.381	1.067	0.648
	(0.129)***	(0.111)***	(0.105)***	(0.106)***
ln sisj	0.985	0.346	0.696	0.444
	(0.072)***	(0.068)***	(0.061)***	(0.061)***
Adjacent	-0.014	0.449	0.017	0.164
	(0.156)	(0.130)***	(0.138)	(0.124)
ln Distance	-0.475	-0.486	-0.771	-0.52
	(0.072)***	(0.060)***	(0.060)***	(0.054)***
Language	0.437	0.146	0.588	0.422
	(0.092)***	(0.082)*	(0.078)***	(0.074)***
ln Network	0.06	0.041	0.052	0.112
	(0.019)***	(0.016)**	(0.015)***	(0.016)***
AFTA	0.134	-0.058	0.127	0.465
	(0.133)	(0.105)	(0.112)	(0.119)***
Observations	2760	3490	3422	3817
R-squared	0.67	0.68	0.76	0.83

	(9)	(10)	(11)	(12)
Industry	Electrical machinery	Transportation Equipment	Precision machinery	Toys and Miscellaneous goods
ln Yi+Yj	1.006	-0.031	0.896	-0.381
	(0.119)***	(0.112)	(0.125)***	(0.155)**
ln sisj	0.493	0.089	0.467	0.064
	(0.070)***	(0.067)	(0.069)***	(0.092)
Adjacent	0.141	0.282	0.32	0.185
	(0.114)	(0.132)**	(0.145)**	(0.191)
ln Distance	-0.581	-0.664	-0.979	-0.687
	(0.054)***	(0.061)***	(0.063)***	(0.089)***
Language	0.252	0.561	0.454	0.236
	(0.079)***	(0.084)***	(0.085)***	(0.126)*
ln Network	0.755	0.012	0.047	0.008
	(0.011)***	(0.020)	(0.019)**	(0.025)
AFTA	1.023	0.728	0.525	0.096
	(0.106)***	(0.125)***	(0.132)***	(0.180)
Observations	7095	3678	3211	2532
R-squared	0.72	0.74	0.76	0.51

Notes:
The dependent variable is the natural log of the real bilateral flow from *i* to *j*.
All estimations use fixed and time effects.
Coefficients on time/fixed effects are not reported. Robust standard errors are in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.