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In East Asia, international production/distribution networks have developed and have explosively increased intra-regional trade particularly in intermediate goods. This paper examines whether home bias for intermediate goods gets smaller than that for finished goods in the 1990s. Our findings are summarized as follows. First, differences in location advantages, for which we use differences in per capita GDP as a proxy, are more effectively utilized in intermediate goods transactions. Second, the home bias for intermediate goods has been at the same level as that for finished goods. Particularly in 1995, the home bias in all countries is not smaller for intermediate goods than for finished goods.

Keywords: home bias; fragmentation; agglomeration; East Asia
JEL Classification: D23; F15; R12; R15

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1 Introduction

In East Asia, international production/distribution networks have dramatically developed since the 1990s. The international networks have explosively increased intra-regional trade particularly in intermediate goods. Recently, even developing countries intensively engage in back-and-forth transactions of parts and components. Now, East Asia also comes to play an important role as exporters of intermediate goods in the world.

The development of the international networks must be accompanied by the reduction in policy barriers, e.g., tariff rates, particularly for intermediate goods. Kimura, Takahashi, and Hayakawa (2005) show that, in East Asia, trade-weighted averages of MFN tariff rates on machinery sector have steadily declined since the late 1980s. Furthermore, the tariff rates in intermediate goods become much smaller than those in finished goods. For example[1], in Indonesia in 1998, average applied tariff rates are 21.8% and 86.4% in automotive parts and vehicles, respectively. Also in ASEAN average, they are 26.6% and 47.2%, respectively.

On the other hand, the decrease in non-policy barriers, e.g., coordination costs, also might contribute to develop the international networks. It would be relatively difficult to remove the non-policy barriers, and the non-policy barriers seem to be larger in transactions of intermediate goods than of finished goods. In transactions on intermediate goods, there are potentially huge costs due to the inadequateness of timely delivery and uncertainty regarding the coordination of a series of activities from production to the shipment of end products (Kimura and Takahashi, 2005). However, the development of international networks may mean that even the non-policy barriers in intermediate goods transactions have remarkably decreased.

These policy and non-policy barriers appear in the form of home bias. Home bias, of which Wei (1996) is a pioneer work, is defined as a country's import from itself in excess of its import from other countries after taking into account some elements affecting international transactions. Following Wei (1996), many papers measure the home bias among countries (e.g., Helliwell, 1997; Head and Mayer, 2000; Wolf, 2000; Poncet, 2003). However, to our knowledge there is no study that analyzes home bias among East Asian countries and that carefully distinguish home bias between intermediate and

[1]The numbers in this paragraph are drawn from Abrenica (2000).

finished goods transactions[2].

The purpose of this paper is to examine whether home bias for intermediate goods gets smaller than that for finished goods in East Asia. As argued above, policy barriers are lower in intermediate goods while non-policy barriers seem to be lower in finished goods. However, the dramatic development of the international networks may mean that home bias for intermediate goods in a mass has experienced a more rapid decrease than for finished goods. Indeed, in East Asia, intra-regional trade in intermediate goods has increased much more rapidly than the trade in finished goods in the 1990s (Kimura, Takahashi, and Hayakawa, 2005).

To this end, this paper estimates the equation in which the dependent variable is a ratio of inter-regional to intra-regional import values by goods in order to avoid some cumbersome issues. First, appropriate data on price index in *each good* are definitely unavailable. Second, the necessary data on total expenditure particularly on intermediate goods depend on the underlying theoretical models. Therefore, a mis-specification error is likely to occur. To avoid these problems, we employ the method of "log odds ratios" used in Head and Mayer (2000), whose formulation enables us to cancel out the variables relating to the total expenditure and the price index.

Our findings are summarized as follows. The home bias for intermediate goods has been at the same level as that for finished goods. Particularly in 1995, the bias for intermediate goods in all countries is not smaller than that for finished goods. Rather, we also obtain even the result which shows a more rapid decrease in home bias for finished goods. Consequently, these results are consistent with the theoretical result in Amiti (2005); fragmentation occurs when trade costs[3] in not either but both intermediate and finished goods are sufficiently low level. That is, the decrease of home bias/trade costs in both goods transactions must contribute to develop international production distribution networks in East Asia.

The rest of this paper is organized as follows. In section 2, we specify our estimation equations. Section 3 reports data and econometric issues. The regression results are reported in section 4. Section 5 concludes.

[2]Hayakawa (2005) measures the home bias for intermediate goods among East Asian countries from 1985 to 1995. He finds that the home bias in each East Asian country has remarkably declined since 1985. However, the paper does not distinguish home bias between them and primarily uses Armington specifications that is different from the specifications used in this paper.

[3]It can be said that home bias is trade costs in a broad sense.

2 Empirical specification

This section derives regression equations for transactions of both finished and intermediate goods. In the specification, we should control agglomeration effects. This is because, if the number of firms is much larger in a region than in the other regions, it is natural for the region to input much more home-made goods regardless of trade barriers in the region. To control the effects, this paper draws regression equations from an agglomeration model.

Since Krugman (1991), a number of papers have investigated the mechanics of agglomeration. From those studies, we knew that various kinds of agglomeration sources exist. If we control those sources seriously in each sector, however, a regression equation becomes much more complicated for intermediate goods than for finished goods. Therefore, rather than allowing asymmetry in regression equations between intermediate and finished goods, that is, rather than making use of different dependent/independent variables in the equations, we try to control the sources of agglomeration with keeping identical regressors in both equations by manipulating structural equations in the following model.

We extend a model presented by Amiti (2005), which is in turn a model with vertically linked industries (downstream and upstream industries).

First, the representative consumer in each region is assumed to have a two-tier utility function, which becomes standard in international trade and new economic geography literature. The upper tier is a Cobb-Douglas function of the utility derived from consumption of finished goods in each sector. Specifically, we apply the following utility function:

$$U_r = \prod_{i=1}^{l} \left(C_r^i\right)^{\alpha_i}, \quad \sum_{k=1}^{l} \alpha_k = 1,$$

where C_r^i is the aggregate consumption of finished good i.

We formalize expenditure allocation across finished machinery goods consisting of multiple product varieties and omit the subscript representing the name of finished goods for now. The finished machinery goods are horizontally differentiated by firms. The consumer has the Dixit-Stiglitz preference that is specified as constant elasticity of substitution (CES) function over differentiated varieties:

$$C_r = \left[\sum_{i=1}^{R} \int_0^{n_i} x_{r,i}(j)^{(1-\sigma_F)/\sigma_F} dj\right]^{\sigma_F/(\sigma_F-1)}, \quad \sigma_F > 1 \tag{1}$$

where R, n_i, $x_{r,i}(j)$, and σ_F are the number of countries, the number of varieties produced in country i, the demand of country r for j-th variety produced in country i, and the elasticity of substitution between finished varieties, respectively.

Here, as usual, we assume identical technology across finished goods firms and countries. Then, the import demand in country r for each finished variety produced in country j, $x_{r,j}$, is given by

$$x_{r,j} = \tau_{r,j}^{1-\sigma_F} p_j^{-\sigma_F} P_r^{\sigma_F - 1} E_r^F, \tag{2}$$

where p_j and P_r denote the price of each variety produced in country j and the price index in country r, respectively. E_r^F is total expenditure on finished goods in country r. Transactions in finished goods between country r and s is modeled as facing Samuelsonian iceberg costs, $\tau_{r,s}$.

Second, the market structure in finished goods sector is assumed to be Chamberlinian monopolistic competition; producing differentiated goods with increasing returns technology. The producer of each finished variety combines a composite index aggregated across varieties of intermediate inputs and primary productive factors, e.g., labor, with Cobb-Douglas manner. The composite enters the production function for each firm through a CES aggregator. Specifically, we have the following production function:

$$\begin{aligned} f_F + c_F x_r &= \left(L_r^F\right)^{1-\mu} \left(D_r^I\right)^{\mu}, \\ D_r^I &= \left[\sum_{i=1}^{R} \int_0^{m_i} z_{r,i}(j)^{(1-\sigma_I)/\sigma_I} dj\right]^{\sigma_I/(\sigma_I - 1)}, \quad \sigma_I > 1, \end{aligned}$$

where f_F, c_F, and μ are a fixed cost of setting up a plant, a variable cost, and the vertical linkage parameter between finished and intermediate goods, respectively. L_r^F and D_r^I are a Cobb-Douglas aggregator of primary factors employed by each firm of finished goods to produce output, x_r, and a quantity index aggregated across varieties of intermediate goods. m_i, $z_{r,i}(j)$, and σ_I are the number of varieties produced in country i, the demand of country r for j-th variety produced in country i, and the elasticity of substitution between intermediate goods, respectively.

We assume identical technology across firms of intermediate varieties and countries. Then, import demand in country r for each intermediate variety produced in country j, $z_{r,j}$, is given by

$$z_{r,j} = t_{r,j}^{1-\sigma_I} q_j^{-\sigma_I} \Pi_r^{\sigma_I - 1} E_r^I, \tag{3}$$

where q_j and Π_r denote the price of each variety produced in country j, and the price index in country r, respectively. E_r^I is total expenditure on intermediate inputs in country r. Transactions on intermediate goods between country r and s is modeled as facing Samuelsonian iceberg costs, $t_{r,s}$.

Last, as well as in finished goods sector, the market structure in intermediate goods sector is assumed to be Chamberlinian monopolistic competition. The producer of each intermediate variety may input not only primary productive factors but a bundle of intermediate varieties. Specifically, we suppose the following production function:

$$\begin{aligned} f_I + c_I z_r &= L_r^I \quad \text{if the producers input only primary factors,} \\ f_I + c_I z_r &= \left(L_r^I\right)^{1-\nu} \left(D_r^I\right)^{\nu} \quad \text{otherwise,} \end{aligned}$$

where f_I, c_I, ν, and L_r^I are a fixed cost of setting up a plant, a variable cost, the horizontal linkages among intermediate varieties, and a Cobb-Douglas aggregator of primary factors employed by each firm of intermediate varieties to produce output, z_r, respectively. Here it is assumed that the elasticity of substitution among the varieties is the same for finished goods producers as it for intermediate goods producers. Then, denoting the total value of production of finished and intermediate goods in country r as $\bar{n}_r$ and $\bar{m}_r$, respectively,

$$\begin{aligned} E_r^I &= \mu \bar{n}_r \quad \text{if the producers input only primary factors,} \\ E_r^I &= \mu \bar{n}_r + \nu \bar{m}_j \quad \text{otherwise.} \end{aligned}$$

That is, if the horizontal linkages among intermediate varieties exist, E_r^I is equal to the expenditure both from finished goods producers and from intermediate goods producers themselves. Therefore, the component of E_I heavily depends on the underlying theories.[4]

It is worth noting two agglomeration forces and a dispersion force in this model. As usual, forward and backward linkage effects work. Finished goods firms prefer to locate in a country with many consumers to save transportation costs of the goods, τ, while intermediate goods firms prefer to locate in a country with many finished goods firms to save transportation costs of inputs, t. On the other hand, there is a dispersion force, which must work strongly in East Asia. Suppose that skilled and unskilled labor is required as

[4]As you notice, the producer price of each intermediate variety, q_j, also depends on the underlying theories. This point is examined in Section 4.2.

primary production factors in both sectors and that there is huge variation in factor endowments among countries. Thus, the difference in factor intensities between finished and intermediate goods pulls intermediate goods firms to the country with relatively abundant skilled labors and finished goods firms to the country with relatively abundant unskilled labors. By using the model like this (without the horizontal linkages), Amiti (2005) shows that international fragmentation, that is, international division of labor by production stages, occurs in sufficiently low level of trade costs in both goods since the location of finished and intermediate goods firms becomes more sensitive to comparative advantage.

We here need to sidestep two difficult data issues. First, appropriate data on price index in *each sector* are definitely unavailable. In the recent two decades, data availability of price indices always annoyed empirical analysts. In this paper, to make things worse, we need to obtain price index data for intermediate and finished goods sector separately. Second, as argued above, the necesarry data of total expenditure particularly on intermediate goods depend on the underlying theoretical models. If all firms in the intermediate sector use each other's output as intermediate input, the regression equation for intermediate goods sector becomes a non-(log-)linear equation as in Hillberry and Hummels (2002), which is quite different from the equation for finished goods sector.

To avoid these difficulties, we employ the method of "log odds ratios" used in Head and Mayer (2000). They estimate an equation in which the dependent variable is a log ratio of inter-national to intra-national input values, and this formulation enables us to cancel out the variables relating to the total expenditure and the price index.

From equations (2) and (3), we obtain a ratio of total input values in country r for the goods produced in country j to the values for the goods produced domestically as

$$X_{r,j} \equiv \frac{p_j n_j x_{r,j}}{p_r n_r x_{r,r}} = \left(\frac{n_j}{n_r}\right)\left(\frac{\tau_{r,j}}{\tau_{r,r}}\right)^{1-\sigma_F}\left(\frac{p_j}{p_r}\right)^{1-\sigma_F}, \tag{4}$$

$$Z_{r,j} \equiv \frac{q_j m_j z_{r,j}}{q_r m_r z_{r,r}} = \left(\frac{m_j}{m_r}\right)\left(\frac{t_{r,j}}{t_{r,r}}\right)^{1-\sigma_I}\left(\frac{q_j}{q_r}\right)^{1-\sigma_I}. \tag{5}$$

This formulation relates the decisions of consumers and finished variety producers in country r on how to allocate expenditure between home-made and foreign-made finished goods and between home-made and foreign-made intermediate goods, respectively.

We again encounter the issue of data availability. As well as price index above, the data on the number of firms in *each good* are unavailable. As in Head and Mayer (2000), therefore, rather than using other variables as a proxy for the number, we eliminate the number of firms from the regression equations by using the following relationship.

Remember that we assume identical technology across firms and countries. Denoting the quantity produced by each firm in finished and intermediate goods sector as $\bar{x}$ and $\bar{z}$, respectively, we obtain $\bar{n}_r = \bar{x} p_r n_r$ and $\bar{m}_r = \bar{z} q_r m_r$. Substituting these relationships into equations (4) and (5), the equations are re-written as

$$X_{r,j} = \left(\frac{\bar{n}_j}{\bar{n}_r}\right)\left(\frac{\tau_{r,j}}{\tau_{r,r}}\right)^{1-\sigma_F}\left(\frac{p_j}{p_r}\right)^{-\sigma_F}, \tag{6}$$

$$Z_{r,j} = \left(\frac{\bar{m}_j}{\bar{m}_r}\right)\left(\frac{t_{r,j}}{t_{r,r}}\right)^{1-\sigma_I}\left(\frac{q_j}{q_r}\right)^{-\sigma_I}. \tag{7}$$

Furthermore, in order to avoid simultaneity problem between $x_{r,j}$ and $\bar{n}_j$ and between $z_{r,j}$ and $\bar{m}_j$, as in Head and Mayer (2000), we move $\bar{n}_j$ and $\bar{m}_j$ to the LHS of each equation.

$$\left(\frac{X_{r,j}}{N_{r,j}}\right) = \left(\frac{\tau_{r,j}}{\tau_{r,r}}\right)^{1-\sigma_F}\left(\frac{p_j}{p_r}\right)^{-\sigma_F}, \tag{8}$$

$$\left(\frac{Z_{r,j}}{M_{r,j}}\right) = \left(\frac{t_{r,j}}{t_{r,r}}\right)^{1-\sigma_I}\left(\frac{q_j}{q_r}\right)^{-\sigma_I}, \tag{9}$$

where $N_{r,j} \equiv \bar{n}_j/\bar{n}_r$ and $M_{r,j} \equiv \bar{m}_j/\bar{m}_r$.

We assume that trade costs mainly consist of transport costs incurred by geographical distance and of home bias. In this paper, the home bias, of which Wei (1996) is a pioneer work, is defined as a country's import from itself in excess of its import from other countries after taking into account some elements affecting international transactions. We specify relative trade costs as

$$\ln\left(\frac{\tau_{r,j}}{\tau_{r,r}}\right) = \text{home bias}_r^F + \varphi^F \ln \text{Distance}_{r,j}, \tag{10}$$

$$\ln\left(\frac{t_{r,j}}{t_{r,r}}\right) = \text{home bias}_r^I + \varphi^I \ln \text{Distance}_{r,j}, \tag{11}$$

where $\ln \text{Distance}_{r,j} \equiv \ln d_{r,j} - \ln d_{r,r}$. $d_{r,j}$ is geographical distance between country r and j and is measured by greater circle between their respective capital cities. $d_{r,r}$ is intra-regional distance, of which the most appropriate definition remains unsettled in the literature, and is calculated as a radius of surface area[5] in country r. Specifically, $d_{r,r} \equiv \sqrt{surface\ area_r/\pi}$.

We capture home bias in each country by examining coefficients for importer dummy variables. Final regression equations are given by

$$\ln\left(\frac{X_{r,j}}{N_{r,j}}\right) = \varsigma_0 + \left(\sum_{i=1}^{R-1} \varsigma_{1i} D_i\right) + \varsigma_2 \ln \text{Distance}_{r,j} + \varsigma_3 \ln\left(\frac{p_j}{p_r}\right) + \varepsilon_{r,j}, \quad (12)$$

$$\ln\left(\frac{Z_{r,j}}{M_{r,j}}\right) = \iota_0 + \left(\sum_{i=1}^{R-1} \iota_{1i} D_i\right) + \iota_2 \ln \text{Distance}_{r,j} + \iota_3 \ln\left(\frac{q_j}{q_r}\right) + \epsilon_{r,j} \quad (13)$$

where ϵ and ε denote a normally distributed random error in each equation. D_i, for which the coefficient represents home bias in country i, is a dummy variable taking the value 1 if $i = r$ and 0 otherwise.

3 Data and econometric issues

This section argues on data and econometric issues. We focus on transactions in finished and intermediate goods among East Asian countries in machinery sector since machinery goods have played the most important role in the development of international fragmentation (see Kimura and Ando, 2005). Those data are obtained from Asian International Input-Output Table published by the Institute of Developing Economies[6].

The data of total production values in each good are also available in the table. Our sample consists of nine East Asian counties (China, Indonesia, Japan, Malaysia, Republic of Korea, the Philippines, Singapore, Taiwan, and Thailand) and the U.S. in 1990 and 1995.

In equations (12) and (13), differences in the prices of finished and intermediate varieties, p_j/p_r and q_j/q_r, embody differences in comparative advantage between country r and j due to differences in factor endowments.

[5]The data on surface area are drawn from World Fackbook (Central Intelligence Agency).

[6]Since the import values for some pairs, e.g., import values of Taiwan and Korea from China, are not reported, we exclude those pairs from our sample.

This term represents one of the most important factors in fragmentation, "a difference in location advantages".

In this paper, we simply use the difference in per capita GDP between trading partners as a proxy for the difference in the price of each variety, that is, for the difference in factor prices. Later, we will also use another variable as a proxy for the difference.

Furthermore, two points are to be noted here. First, it is necessary to exclude one country in importer dummy variables in order to avoid dummy trap. The home bias consists mainly of policy and non-policy barriers to foreign-made goods. We exclude Singapore dummy since only few policy barriers exist there. The remaining barriers seem to be universal non-policy barriers, e.g., modular-technique, which are captured by a constant term in the regression equations. In Singapore, for example, tariff rates in machinery sector has been close to zero; 0.017% in 1990 and 0.004% in 1995[7].

Assuming that the remaining Singapore-specific barriers and the elasticity of substitution in each good are almost constant during the period, we investigate the changes in home bias/*country specific barriers* by examining changes in coefficients for importer dummy variables.

Second, in general, separate estimation of two regressions may be accompanied with correlated estimation errors. That is, the error term in the intermediate goods equation could possibly be non-orthogonal to that in the finished goods equation. This correlation is plausible because the unobservable elements, such as nontariff barriers between trading partners, would simultaneously affect both transactions. However, we here use the method of not generalized but ordinary least squares (OLS) by equation, because the same regressors show up in each equation and thus the OLS estimates become equivalent to the generalized least squares estimates. Estimating these equations by OLS, we investigate differences and changes in home bias in each country for finished and intermediate goods by examining the coefficients for importer dummy variables. To test the differences statistically, we conduct the Wald test with the null hypothesis that respective those coefficients are identical in both equations.[8]

[7] These rates are calculated by using data on import duties and foreign input values, which are obtained from Asian International Input-Output Table.

[8] We perform generalized least squares estimation in order only to obtain the covariances between the estimates from different equations, which are needed to perform the Wald test.

4 Empirical results

This section reports the regression results of equations (12) and (13). First, we present baseline estimation results, and next we try to obtain more consistent estimators of home bias.

4.1 Baseline results

The estimation results are shown in Table 1. Three important facts are found in the table.

First, the coefficient for the difference in per capita GDP between trading partners has experienced a steady decrease in both goods and, more importantly, has been significantly larger in intermediate goods than in finished goods. The decrease can be explained as in Kimura, Takahashi, and Hayakawa (2005) and Hayakawa (2005); transactions between developing countries with relatively small income disparity, such as between the Philippines and China, increased rapidly. The difference in the coefficients between the equations implies that transactions on intermediate goods are more affected by the difference in location advantages. In other words, differences in location advantages are more effectively utilized in the international production/distribution networks.

Second, the home bias for intermediate goods has been at about the same level as that for finished goods. Particularly in 1995, in all countries, the bias for intermediate goods is not smaller than that for finished goods. As argued in section 1, in East Asia, policy barriers such as average applied tariff rates are much lower in intermediate goods than in finished goods. Therefore, we can say that most of the home bias for intermediate goods consists of non-policy impediments. In particular, coordination costs must be quite large. Similarly, it can be said that barriers in finished goods mainly consist of policy barriers, e.g., tariff rates.

Third, in association with the second, we cannot see that home bias for intermediate goods have experienced a more rapid decrease than that for finished goods despite the fact that intra-regional trade in intermediate goods has increased much more rapidly than the trade in finished goods. Although the departure from import substitution policy should contribute to reduce policy barriers in finished goods to some extent, the reduction is not drastic, and, even in the latter half of the 1990s, the policy barriers in finished goods are much larger than those in intermediate goods as argued in

Table 1: Baseline results

	1990 Intermediate		1990 Finished	1995 Intermediate		1995 Finished
Const	3.62**		3.04**	2.02**		1.03
	(0.77)		(0.75)	(0.53)		(0.65)
Distance	-0.93**	<	-0.87**	-0.64**	<	-0.63**
	(0.12)		(0.12)	(0.09)		(0.11)
Per GDP	0.65**	>	0.21**	0.38**	>	0.07
	(0.11)	**	(0.08)	(0.07)	**	(0.08)
Indonesia	-9.16**	<	-9.12**	-6.77**	<	-5.20**
	(0.78)		(0.68)	(0.51)	**	(0.62)
Malaysia	-5.33**	<	-5.19**	-2.60**	<	-2.27**
	(0.71)		(0.67)	(0.48)		(0.56)
Philippines	-8.80**	<	-8.00**	-6.09**	<	-5.42**
	(1.16)		(0.64)	(0.67)		(0.56)
Thailand	-5.77**	>	-6.48**	-3.90**	<	-3.22**
	(0.71)		(0.69)	(0.59)		(0.54)
China	-10.67**	>	-11.62**	-6.65**	>	-7.87**
	(0.93)		(0.90)	(0.63)		(0.94)
Taiwan	-3.46**	>	-3.67**	-2.32**	<	-2.28**
	(0.57)		(0.44)	(0.44)		(0.61)
Korea	-4.40**	>	-6.01**	-3.29**	>	-4.01**
	(0.60)	**	(0.55)	(0.42)		(0.40)
Japan	-2.89**	>	-3.82**	-2.22**	<	-1.60**
	(0.56)		(0.55)	(0.41)		(0.56)
U.S.	-2.53**	<	-1.21*	-1.83**	<	-0.52
	(0.66)	*	(0.55)	(0.47)	**	(0.50)
R2	0.6774		0.8707	0.7055		0.7786
Obs.	87		87	89		89

Notes: A dependent variable is a log ratio of "total production values weighted-" international to intra-national import values. Regional names represent importer dummy variables. ** shows 1 % and * shows 5 % significant. The inside of a parenthesis is a White consistent standard error. The column between 1990 and 1995 reports the result of the Wald test with the null hypothesis that each coefficient is identical in intermediate and finished goods equations.

Table 2: Wald tests

	1990 int - fin (7,9)	1995 int - fin (7,9)	1990 int - fin (9,7)	1995 int - fin (9,7)
Indonesia	$<$ **	$<$ **	$>$ **	$>$
Malaysia	$<$ **	$<$ *	$>$ *	$>$
Philippines	$<$ **	$<$ **	$>$	$>$
Thailand	$<$	$<$ **	$>$ **	$>$
China	$<$ **	$<$	$>$ **	$>$ **
Taiwan	$<$	$<$	$>$ **	$>$
Korea	$>$	$<$	$>$ **	$>$ **
Japan	$<$	$<$ **	$>$ **	$<$
U.S.	$<$ **	$<$ **	$<$	$<$ *

Notes: This table reports the result of the Wald test with the null hypothesis that each coefficient divided by the elasticity of substitution is identical in both equations. "int" and "fin" mean intermediate and finished goods equation, respectively. (i, j) indicates that we choose i and j to the elasticity among intermediate goods and among finished goods, respectively. ** shows 1 % and * shows 5 % significant.

section 1. Therefore, it should be relatively difficult to reduce the non-policy barriers in international transactions on intermediate goods.

Remember that the coefficient for importer dummy variables contains the elasticity of substitution. Therefore, the difference in the elasticity of substitution between intermediate and finished goods also contributes to the difference in estimates of the home bias (see equations (8) and (9)). In order to take the difference in the elasticity into account, we evaluate the estimates of the home bias in the elasticity.

Several papers have measured the elasticity of substitution among goods, e.g., Head and Ries (2001) and Hanson (2005). Anderson and van Wincoop (2004) state that "overall the literature leads us to conclude that σ is likely to be in the range of 5 to 10". However, it remains unknown which the elasticity is larger among intermediate or finished goods. Saito (2004) obtained the larger estimates in the elasticity among intermediate goods than among finished goods, while Hummels (1999) obtained the opposite relationship.

Of course, if the elasticity is larger among finished goods, the previous results are unchanged; the home bias for intermediate goods is not smaller and does not decrease more rapidly than that for finished goods. The second and third columns in Table 2 are the result of the Wald test using 7 and 9 for the elasticity among intermediate goods and among finished goods, respectively.

However, if the elasticity is smaller among finished goods, the results may be changed. The forth and fifth columns in Table 2 report the result of the Wald test using 9 and 7 for the elasticity among intermediate goods and among finished goods, respectively. The results show that, in almost all East Asian countries in 1990, the home bias is significantly smaller for intermediate goods than for finished goods. On the other hand, in 1995, the home bias for intermediate goods becomes at the same level as that for finished goods in almost all countries. This result indicates that the home bias for finished goods decreased much more rapidly than that for intermediate goods. Of course, these results are quite sensitive to the choice of the elasticity. But, at least, we can conclude that the home bias for intermediate goods does not decrease more remarkably than for finished goods.

4.2 Another proxy variable for prices

In the baseline estimation, we used per capita GDP as a proxy for primary factor prices. However, the price of finished varieties consists of not only the factor prices but prices of intermediate goods. Moreover, with the setting of horizontal linkages among intermediate varieties, the price of intermediate varieties also contains the prices of intermediate goods themselves. Thus, one may suspect that omitting variable relating to the price index makes OLS inconsistent.

To obtain consistent estimates, we employ the following strategy. As argued before, an appropriate proxy variable for the price index is unavailable. Therefore, we approximate a difference in the prices between country j and r as

$$\frac{p_j}{p_r} = \prod_{i \in G_F} \left(\frac{p_j^i}{p_r^i} \right), \quad \frac{q_j}{q_r} = \prod_{i \in G_I} \left(\frac{q_j^i}{q_r^i} \right)$$

where G_F and G_I denote a bundle of finished machinery goods and machinery intermediate goods at the 5-digit level in SITC revision 2, respectively. p_r^i and q_r^i are the unit price of commodity i that country r exports to the world. SITC revision 2 is the only classification that we can classify commodities into finished and intermediate goods *and* that Chinese data in 1990 are available[9].

For calculation, we used export data, which are on the f.o.b. basis, of each commodity in order to exclude transportation costs. Unit values of exports are obtained at the SITC 5-digit level by export values divided by the corresponding quantities. These data are drawn from UN Comtrade. We exclude Taiwan from our sample due to the data unavailability. Commodities reported by different units between countries are also dropped from G_F and G_I.

The estimation results are reported in Table 3. We immediately see that the results of the Wald test in home bias of each country are similar to the ones using 9 and 7 for the elasticity among intermediate goods and among finished goods, respectively, in Table 2. That is, the home bias for finished goods decreased more rapidly than for intermediate goods in the former half of the 1990s, and consequently the home bias for intermediate goods become statistically at the same level as that for finished goods in 1995.

As a result, our results are consistent with two theoretical results since home bias is trade costs in a broad sense. First, the result may imply the existence of magnification effect proposed by Yi (2003). This is because trade costs in intermediate goods have declined as much as those in finished goods

[9]As for the methodology for the classification and the commodity codes classified into each good, see Kimura, Takahashi, and Hayakawa. (2005).

Table 3: Estimation results in the case of unit price

	1990 Intermediate		1990 Finished	1995 Intermediate		1995 Finished
Const	0.94		2.60**	1.18*		1.32*
	(0.94)		(0.67)	(0.54)		(0.60)
Distance	-0.62**	>	-0.80**	-0.52**	>	-0.68**
	(0.16)		(0.12)	(0.10)		(0.11)
Unit price	0.01	>	0.00*	0.01**	>	0.00
	(0.01)		(0.00)	(0.00)	**	(0.00)
Indonesia	-5.98**	>	-8.80**	-5.93**	<	-5.56**
	(0.76)	**	(0.58)	(0.49)		(0.59)
Malaysia	-3.15**	>	-4.78**	-2.10**	>	-2.41**
	(0.79)	**	(0.63)	(0.48)		(0.51)
Philippines	-5.92**	>	-7.36**	-4.55**	>	-5.49**
	(1.24)		(0.51)	(0.65)		(0.44)
Thailand	-3.39**	>	-5.94**	-3.18**	>	-3.39**
	(0.83)	**	(0.64)	(0.49)		(0.48)
China	-6.52**	>	-10.64**	-5.72**	>	-7.87**
	(0.97)	**	(0.74)	(0.68)	**	(0.83)
Korea	-2.80**	>	-6.19**	-3.09**	>	-4.38**
	(0.70)	**	(0.61)	(0.41)	*	(0.47)
Japan	-2.19**	>	-4.30**	-2.04**	<	-1.97**
	(0.71)	**	(0.57)	(0.44)		(0.57)
USA	-1.87*	<	-1.06	-1.68**	<	-0.66
	(0.89)		(0.57)	(0.50)	*	(0.51)
Obs	70		70	71		71
R-sq	0.5066		0.8735	0.7095		0.8310

Note: See notes in Table 1.

despite the fact that intra-regional trade in intermediate goods has increased much more rapidly than the trade in finished goods. That is, the increase in the number of intermediate stages may augment the transactions on intermediate goods more than proportionally. Second, as is consistent with the outcomes by Amiti (2005), in East Asia, trade costs have experienced a remarkable decrease in both intermediate and finished goods.

5 Concluding remarks

This paper examines whether the home bias for intermediate goods gets smaller than for finished goods in East Asia in the 1990s. We find that, in East Asia, though the home bias for intermediate goods have decreased remarkably, the magnitude in intermediate goods has been at the same level as that in finished goods.

Recently, spatial economy comes to focus on the work of vertical linkages between intermediate and finished goods. In the literature, absolute and relative levels of transportation costs in intermediate and finished goods play an important role in determining industrial location in an economy. The estimates obtained in this paper will present illustrative parameter values of the transportation costs for intermediate and finished goods.

References

[1] Abrenica, J., 2000, Liberalizing the ASEAN Automotive Market: Impact Assessment., Pacific Economic Cooperation Council project on the ASEAN auto industry.

[2] Amiti, M., 2005, Location of Vertically Linked Industries: Agglomeration versus Comparative Advantage, European Economic Review, 49: 809-832.

[3] Anderson, J. E. and van Wincoop, E., 2004, Trade Costs, Journal of Economic Literature 42: 691-751.

[4] Ando, M. and Kimura, F., 2005, The Formation of International Production and Distribution Networks in East Asia, In Takatoshi Ito and Andrew Rose, eds., International Trade in East Asia, University of Chicago Press.

[5] Hanson, G., 2005, Market Potential, Increasing Returns, and Geographic Concentration, Journal of International Economics, 67(1): 1-24.

[6] Hayakawa, K., 2005, Measuring Barriers to International Division of Labor in East Asia, The earlier version was presented at the ARSC Conference held at Meikai University, Chiba, Japan on December 10-11, 2005. See http://leo.meikai.ac.jp/ arsc05/index.htm.

[7] Head, K. and Mayer, T., 2000, Non-Europe: The Magnitude and Causes of Market Fragmentation in Europe, Weltwirschaftliches Archiv, 136: 285-314.

[8] Head, K. and Ries, J., 2001, Increasing returns versus national product differentiation as an explanation for the pattern of US-Canada trade, American Economic Review, 91: 858-76.

[9] Helliwell, J., 1997, National Borders, Trade and Migration, Pacific Economic Review 2(3): 165-85.

[10] Hillberry, R. and Hummels, E., 2002, Explaining Home Bias in Consumption: The Role of Intermediate Input Trade, National Bureau of Economic Research, Working Paper #9020.

[11] Hummels, D., 1999, Towards a Geography of Trade Costs, GTAP Working Paper No. 17, Center for Global Trade Analysis, Purdue University, West Lafayette, Indiana.

[12] Kimura, F. and Takahashi, Y., 2005, International Trade and FDI with Fragmentation: the Gravity Model Approach, mimeo, Keio University.

[13] Kimura, F., Takahashi, Y. and Hayakawa, K., 2005, Fragmentation and Parts and Components Trade: Comparison between East Asia and Europe, The most recent version was presented at the APEA Conference held at Hitotsubashi University, Tokyo, Japan on July 30-31, 2005. See http://www.apeaweb.org/confer/hito05/hito05-papers.htm.

[14] Krugman, P.R., 1991, Increasing returns and economic geography, Journal of Political Economy 99, 483-499.

[15] Poncet, S., 2003, Measuring Chinese Domestic and International Integration, China Economic Review, 14: 1-21.

[16] Saito, M., 2004, Armington elasticities in intermediate inputs trade: a problem in using multilateral trade data, Canadian Journal of Economics 37, 1097-1117.

[17] Wei, S-J., 1996, Intra-National Versus International Trade: How Stubborn Are Nations in Global Integration?, National Bureau of Economic Research, Working Paper #5531.

[18] Wolf, H.C., 2000, Intranational Home Bias in Trade, The Review of Economics and Statistics, 82(4):555-563.

[19] Yi, Kei-Mu., 2003, Can Vertical Specialization Explain the Growth of World Trade?, Journal of Political Economy 111, 52-102.