INSTITUTE OF DEVELOPING ECONOMIES

IDE Discussion Papers are preliminary materials circulated
to stimulate discussions and critical comments

IDE DISCUSSION PAPER No. 208

Market Access and Intermediate Goods Trade

Kazunobu HAYAKAWA*,

July 2009

Abstract

The role of importer access to the finished goods market in intermediate goods trade is examined by estimating the gravity-like equation derived from the NEG model. Importer access to demand for finished goods is calculated by using the estimates in the gravity equation for finished goods trade, and then intermediate goods trade is regressed on the importer access. Results indicate that imports of intermediate goods are sensitive not only to the magnitude of importer demand for finished goods but also to the demand of neighboring countries. Using results of the regression, the impact of US finished goods market expansion on intermediate goods trade in each country is simulated.

Keywords: Gravity; Intermediate Goods Trade; OECD

JEL classification: F12; F14; R12

* Corresponding author: Kazunobu Hayakawa. Address: Economic Integration Studies Group, Inter-Disciplinary Studies Center, Institute of Developing Economies, 3-2-2 Wakaba, Mihama-ku, Chiba-shi, Chiba 261-8545 Japan. Phone: 81-43-299-9754; Fax: 81-43-299-9763. E-mail: kazunobu_hayakawa@ide.go.jp.

The Institute of Developing Economies (IDE) is a semigovernmental, nonpartisan, nonprofit research institute, founded in 1958. The Institute merged with the Japan External Trade Organization (JETRO) on July 1, 1998. The Institute conducts basic and comprehensive studies on economic and related affairs in all developing countries and regions, including Asia, the Middle East, Africa, Latin America, Oceania, and Eastern Europe.

INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO
3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI
CHIBA 261-8545, JAPAN

Market Access and Intermediate Goods Trade

Kazunobu HAYAKAWA[†][§]

Inter-Disciplinary Studies Center, Institute of Developing Economies, Japan

Abstract: The role of importer access to the finished goods market in intermediate goods trade is examined by estimating the gravity-like equation derived from the NEG model. Importer access to demand for finished goods is calculated by using the estimates in the gravity equation for finished goods trade, and then intermediate goods trade is regressed on the importer access. Results indicate that imports of intermediate goods are sensitive not only to the magnitude of importer demand for finished goods but also to the demand of neighboring countries. Using results of the regression, the impact of US finished goods market expansion on intermediate goods trade in each country is simulated.

***Keywords*:** Gravity; Intermediate Goods Trade; OECD

***JEL Classification*:** F12; F14; R12

[†] Corresponding author: Kazunobu Hayakawa; address: Economic Integration Studies Group, Inter-Disciplinary Studies Center, Institute of Developing Economies, 3-2-2 Wakaba, Mihama-ku, Chiba-shi, Chiba 261-8545, Japan; e-mail: kazunobu_hayakawa@ide.go.jp

[§] I am grateful to Hiroyuki Kasahara and seminar participants at the Institute of Developing Economies and Keio University.

1. Introduction

That a gravity equation is one of the most valuable tools for quantitatively analyzing bilateral trade patterns successfully is well known. A traditional gravity equation has a log of bilateral trade as a dependent variable, and logs of importer and exporter GDP’s as well as a log of distance between trading partners function as independent variables. Derived estimations generally always provide excellent empirical fit. Relying on such properties, a large number of scholars have employed gravity equations in their investigations of bilateral trade. A gravity equation has been used to clarify the causes of growth in world trade after the Second World War (Baier and Bergstrand, 2001). The impact of international agreements on trade such as the Free Trade Agreement (FTA), or those of international organizations like the World Trade Organization have also been evaluated using a gravity equation (Baier and Bergstrand, 2007; Rose, 2004).

Based on the rapid growth of intermediate goods trade, it is becoming even more important to clarify the mechanics of such trade. Worldwide trade in machinery parts and components has grown from $336 billion in 1987 to $1,299 billion in 2003. Commodity trade has increased from $2,127 billion to $6,526 billion, and trade in machinery goods has gone from $837 billion to $2,913 billion (Kimura *et al*, 2007). As a result, the share of machinery parts and components in total commodity trade has increased from 16% to 20%, and machinery goods trade has grown from 40% to 45%. Yi (2003) indicates that trade in intermediate goods seems to follow different mechanics from those of trade in finished goods. Thus, empirical methods for analyzing these two types of goods may also be different. Although there are now a variety of theoretical models supporting gravity formulation (for example Combes *et al*, 2008, p. 127), a traditional gravity equation is not necessarily suited for analysis of intermediate goods trade.

Specifically, a traditional gravity equation fails to capture the distinctive features of intermediate goods trade. It can only clarify the role of importer demand for finished goods in this trade.[1] Domestic producers of finished goods do not necessarily import intermediate goods in order to supply their assembled products only to the domestic market. For example, intermediate goods in Mexico seem to be imported for assembly into finished goods, and these assembled finished goods are then exported to the US.

[1] Some researchers have applied a basically traditional gravity equation only to the intermediate goods trade (for example Athukorala and Yamashita, 2006; Kimura *et al*, 2007). Such research indicates that gravity also works in the intermediate goods trade as follows: High importer and exporter GDP’s encourage active intermediate goods trade, but long distances between them discourages it.

Further, some Eastern European countries may import intermediate goods from Japan in order to export finished goods to Western European countries. As a result, imports of intermediate goods may be sensitive not only to the magnitude of importer demand for finished goods but also to the demand of neighboring countries. Since a traditional gravity equation includes only the demand of the importing country and not the demand of its neighboring countries, it has remained unknown whether or not importer access to such demand for finished goods is important for intermediate goods trade.

Given the above discussion, the role of importer access to demand for finished goods in intermediate goods trade is examined in this paper by estimating gravity equations for trade in upstream and downstream products separately. These equations are derived from the new economic geography (NEG) model which was developed through the pioneering work of Krugman (1991). The fundamental goal of this research is to estimate a gravity equation for trade in upstream products. This includes importer demand for upstream products, which depends not only on importer demand for downstream products but also the demand of neighboring countries adjusted by trade costs with the importer. Such importer demand for downstream products may be obtained by using the Redding and Venables (2004) method. Using regression techniques, a gravity equation for trade in downstream products is developed to obtain estimates of importer-fixed effects and parameters of a trade cost function. Using these estimates, each country's access to the demand for downstream products could be determined and then regressed on bilateral trade in upstream products.

This research contributes not only to literature on gravity but also to empirical studies of the NEG. In the gravity literature, it includes careful exploration of the mechanics of intermediate goods trade. Based on the model developed here, the impact of a rise of total income in a given country on intermediate goods trade, taking input-output relationships and trade costs into account, can be investigated. In empirical investigation of the NEG, on the other hand, this research extends the application range of the Redding and Venables method. Price index is a key variable in the NEG. However, it is hard to obtain its data or to control its effects. Consequently, a two-step approach proposed by Redding and Venables has been adopted in the literature.[2] Estimates obtained initially in a gravity equation are used for constructing market access measures. Their relationships with economic variables can then be examined. Redding and Venables (2004) as well as other researchers (Head and Mayer, 2006; Knaap, 2006; Redding and Schott, 2003) have used such an approach to examine the relationship between wages and market access. Head and Mayer (2004) used such

[2] For other methods of controlling the price index, see Combes *et al* (2008, Section 5.1.4).

an approach in the context of location choice analysis. The present research examines the relationship between intermediate goods trade and market access constructed by using estimates of a gravity equation for finished goods trade.

The paper is organized as follows: A theoretical framework underlying gravity equations used in this research is provided in Section 2. The empirical strategy for estimating the equations is explained in Section 3, and regression results are reported in Section 4. Concluding remarks are given in Section 5.

2. Theoretical Framework

A representative consumer in each region is assumed to have a two tier utility function. The upper tier is a Cobb-Douglas function of the utility derived from consumption of downstream goods (finished goods). Specifically, the following utility function of the consumer in region *r* is applied:

$$U_r = \prod_i \left(C_r^i\right)^{\alpha_i}, \quad \sum_i \alpha_i = 1,$$

where C_r^i is the aggregate consumption of a downstream good *i* in country *r*.

Consider expenditure allocation in a downstream good *i* consisting of multiple varieties differentiated by country (the Armington assumption) with the subscript representing the name of downstream goods omitted for now. A consumer has the following preference specified as a constant elasticity of substitution (CES) function over varieties:

$$C_r = \left(\sum_{s=1}^{R} X_{sr}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}},$$

where R and X_{sr} are respectively the number of countries and the demand of country *r* for the downstream variety produced in country *s*. σ is the elasticity of substitution between downstream varieties and is assumed to be greater than unity. The utility maximization yields:

$$X_{sr} = \alpha \tau_{sr}^{-(\sigma-1)} p_s^{-\sigma} P_r^{\sigma-1} Y_r, \qquad (1)$$

where p_s and P_r denote respectively the price of the downstream variety produced in country *s* and the price index of downstream goods in country *r*. Y_r is total expenditure/income in country *r*. Transactions in downstream goods between countries *r* and *s* may be modeled as facing Samuelsonian iceberg costs, τ_{sr} ($\geq$1). As a result, the total production value of downstream industry in country *i*, which is denoted by E_i, is given by:

$$\begin{aligned} E_i &\equiv p_i X_i \\ &= p_i \sum_r \alpha \tau_{ir}^{-(\sigma-1)} p_i^{-\sigma} P_r^{\sigma-1} Y_r \\ &= \alpha p_i^{-(\sigma-1)} \sum_r \tau_{ir}^{-(\sigma-1)} P_r^{\sigma-1} Y_r \end{aligned}$$

Market structure in the downstream goods sector is assumed to be perfect competition. The downstream goods producer of each country combines a composite index aggregated across varieties of intermediate inputs and primary factors such as skilled and unskilled labor using a Cobb-Douglas model. This index enters the cost function for each producer through a CES aggregator. Specifically, the following cost function emerges:

$$C(X_r) = w_r^{1-\mu} G_r^{\mu} X_r , \quad G_r = \left[\sum_{s=1}^{R} \int_0^{M_s} t_{sr}^{-(\delta-1)} q_s(j)^{-(\delta-1)} dj \right]^{-\frac{1}{\delta-1}} ,$$

where w_r denotes the price index for primary factors employed in country r to produce downstream output X_r (called simply wages). G_r is the price index for upstream products, and μ is a linkage parameter between downstream and upstream goods. Unlike downstream goods, upstream products are differentiated by firm. Their market structure is assumed to be monopolistic competition. Transactions between countries r and s in upstream products are modeled as facing Samuelsonian iceberg costs, t_{sr} (≥1). M_r, $q_r(j)$, and δ are respectively the number (mass) of upstream varieties produced in country r, the price of j-th variety produced in country r, and the elasticity of substitution between upstream varieties. Elasticity is again assumed to be greater than unity.

In this setting, country r's demand for an upstream variety j produced in country s ($z_{sr}(j)$) can be derived. First, applying Shephard's lemma to the above defined cost function yields:

$$H_r = \mu w_r^{1-\mu} G_r^{\mu-1} X_r , \qquad \text{where} \quad H_r = \left(\sum_s \int z_{sr}(j)^{\frac{\delta-1}{\delta}} dj \right)^{\frac{\delta}{\delta-1}} .$$

This is a country r's composite index of consumption of upstream products. Applying the marginal cost-pricing rule to downstream products results in the following:

$$p_r = w_r^{1-\mu} G_r^{\mu} . \tag{2}$$

The composite index can be simplified as:

$$H_r = \mu G_r^{-1} E_r .$$

Second, since each upstream product needs to be chosen to minimize the cost of attaining Q_r, the following minimization problem is solved:

$$\min \sum_s \int t_{sr} q_s(j) z_{sr}(j) dj \qquad \text{subject to} \quad \left(\sum_s \int z_{sr}(j)^{\frac{\delta-1}{\delta}} dj \right)^{\frac{\delta}{\delta-1}} = H_r .$$

With the assumption that all varieties produced in a particular country have the same technology and price, that the following can be derived:

$$z_{sr} = t_{sr}^{-(\delta-1)} q_s^{-\delta} G_r^{\delta-1} H_r .$$

Finally, substituting the simplified composite index yields the following:

$$z_{sr} = \mu t_{sr}^{-(\delta-1)} q_s^{-\delta} G_r^{\delta-2} E_r .$$

Hence, total exports of country s to country r are given by:

$$Z_{sr} \equiv M_s q_s z_{sr} = \mu M_s t_{sr}^{-(\delta-1)} q_s^{-(\delta-1)} G_r^{\delta-2} E_r . \qquad (3)$$

This can be further solved as follows:

$$\begin{aligned} Z_{sr} &= \mu M_s t_{sr}^{-(\delta-1)} q_s^{-(\delta-1)} G_r^{\delta-2} \left(\alpha p_r^{-(\sigma-1)} \sum_i \tau_{ir}^{-(\sigma-1)} P_i^{\sigma-1} Y_i \right) \\ &= \mu \alpha t_{sr}^{-(\delta-1)} \left(M_s q_s^{-(\delta-1)} \right) \left[G_r^{\delta-2} p_r^{-(\sigma-1)} \left(\sum_i \tau_{ir}^{-(\sigma-1)} P_i^{\sigma-1} Y_i \right) \right] . \end{aligned}$$

Taking its log, the gravity-like equation can be expressed as:

$$\begin{aligned} \ln Z_{sr} = &\ln(\mu\alpha) - (\delta-1)\ln t_{sr} + \ln M_s - (\delta-1)\ln q_s - (\sigma-1)\ln p_r \\ &+ (\delta-2)\ln G_r + \ln\left(\sum_i \tau_{ir}^{-(\sigma-1)} P_i^{\sigma-1} Y_i \right) . \end{aligned}$$

It is assumed that upstream producers use only primary factors for production[3]. Hence, downstream product prices are:

$$q_s = [\delta/(\delta-1)] v_s ,$$

where v_s denotes the price index for primary factors employed in a given upstream industry. Substituting these prices into the above gravity-like equation,

$$\begin{aligned} \ln Z_{sr} = &\ln[\mu\alpha\delta/(\delta-1)] - (\delta-1)\ln t_{sr} + \ln M_s - (\delta-1)\ln v_s \\ &- (\sigma-1)(1-\mu)\ln w_r + \{\delta - 2 - (\sigma+1)\mu\}\ln G_r + \ln\left(\sum_i \tau_{ir}^{-(\sigma-1)} P_i^{\sigma-1} Y_i \right) . \end{aligned}$$

For estimation, the number of upstream firms may be replaced with the total production values of upstream products using the relationship that $M_s = Z_s / q_s z$, where z and Z_s are respectively output per firm and total production. As a result, the estimated

[3] The cost function is assumed to be homothetic in factor prices, and the marginal input requirement parameter is set to unity.

equation can be given as:

$$\ln Z_{sr} = \ln[\mu\alpha\delta / z(\delta-1)] - (\delta-1)\ln t_{sr} + \ln Z_s - \delta \ln v_s - (\sigma-1)(1-\mu)\ln w_r$$
$$+ \{\delta - 2 - (\sigma+1)\mu\}\ln G_r + \ln\left(\sum_i \tau_{ir}^{-(\sigma-1)} P_i^{\sigma-1} Y_i\right) \quad . \qquad (4)$$

For the estimation of this equation, we add a stochastic error term.

Using the same notation, a traditional equation for trade in upstream products would be expressed as:

$$\ln Z_{sr} = \ln k + \beta_1 \ln Y_s + \beta_2 \ln Y_r - \beta_3 \ln t_{sr},$$

where k is a constant. Equation (4) differs from this traditional gravity equation in several ways: (i) It incorporates not only exporter upstream production scales (Z_s) for which Y_s is usually a proxy but also wages in the upstream industry (v_s). (ii) In addition to the price index for upstream products (G_r) which is a common variable in the new economic geography model, equation (4) includes importer wages in the downstream industry (w_r). This is due to the fact that countries with lower wages in downstream industries can export more downstream goods and thus import more upstream products for the production of such downstream goods. (iii) The last term of the LHS in (4) includes not only importer Y_r but also Y of other countries. This term is well-known in the NEG model as "market access". Further, even with a log version of equation (3), the estimation of equation (4) has the advantage that it can investigate how the rise of total income in a country affects intermediate goods trade in each country (taking the role of trade costs into account). In short, equation (4) captures the important mechanics of intermediate goods trade.

3. Estimation Strategy

Industries must be carefully chosen to obtain data that allow for differentiation of downstream and upstream sectors. Thus, focus is placed on the motor vehicle industry. Harmonized system (HS) codes are separately available for both downstream and upstream sectors (Ando and Kimura, 2005). Using codes drawn from the UN Comtrade, bilateral trade in automobiles can be classified into both upstream and downstream sectors. The SITC 4-digit code in Revision 3 identifies downstream (3410) and upstream sectors (3420 and 3430) separately. Thus, motor vehicle production and wages in downstream and upstream sectors can be obtained separately from the UNIDO database. In order to acquire all these data in multiple years, the sample used in this research is limited to 19 OECD countries (see Appendix). Sample years were 1997, 1998, and 1999.

Trade costs t_{sr} are formalized as follows:

$$\ln t_{sr} = \rho_0 + \rho_1 \ln \text{Dist}_{sr} + \rho_2 \text{Language}_{sr} + \rho_3 \text{NAFTA}_{sr},$$

where Dist_{sr} is the geographical distance between countries s and r.[4] Language_{sr} is an indicator variable taking unity if a given language is spoken by at least 9% of the population in both countries; otherwise it takes the value of zero. Data for these variables comes from the CEPII website. NAFTA_{sr} is an indicator variable with a value of unity if both countries are NAFTA members.[5]

Obtaining the remaining two terms in RHS is known to be difficult. Feenstra (2002) has proposed that the simplest way to control the term G_r is to introduce fixed effects. Since this term differs by importer by year, importer-year dummy variables are incorporated into the present model. However, in introducing such variables, the last term in the RHS (market access) must be dropped. Since this is of major interest, the Redding and Venables method is instead applied to the trade equation for downstream goods.

Taking the log of (1), the trade equation can be rewritten as:

$$\ln X_{sr} = \ln \alpha - (\sigma - 1)\ln \tau_{sr} - \sigma \ln p_s + (\sigma - 1)\ln P_r + \ln Y_r .$$

Trade costs τ_{sr} are again formalized as follows:

$$\ln \tau_{sr} = \varphi_0 + \varphi_1 \ln \text{Dist}_{sr} + \varphi_2 \text{Language}_{sr} + \varphi_3 \text{NAFTA}_{sr}.$$

Capturing exporter and importer characteristics by exporter (EXP_s) and importer (IMP_r) dummies, the estimated trade equation for downstream goods becomes:

$$\begin{aligned}\ln X_{sr} &= [\ln \alpha - (\sigma - 1)\phi_0] - (\sigma - 1)\phi_1 \ln Dist_{sr} - (\sigma - 1)\phi_2 Language_{sr} \\ &\quad - (\sigma - 1)\phi_3 NAFTA_{sr} + \eta_s EXP_s + \lambda_r IMP_r + u_{sr} \\ &= \psi_0 + \psi_1 \ln Dist_{sr} + \psi_2 Language_{sr} + \psi_3 NAFTA_{sr} + \eta_s EXP_s + \lambda_r IMP_r + u_{sr}\end{aligned} .$$

u_{sr} is stochastic error. Since panel data is used, actual dummies included are those of importer and exporter year. As a result,

$$\begin{aligned}\hat{\eta}_s &= -\sigma \ln p_s = -\sigma(\mu \ln w_s + (1-\mu)\ln G_s) \\ \hat{\lambda}_r &= (\sigma - 1)\ln P_r + \ln Y_r\end{aligned} .$$

Equation (2) may be used in the calculation of η_s. Thus, the price index (G_r) and the market access term (MA_r) may be expressed as:

[4] This is the geographical distance between the most important cities/agglomerations (in terms of population).

[5] An EU member dummy is not introduced because it is highly correlated with distance.

$$\ln G_r = -\left(\frac{\sigma}{\mu}\right)\hat{\eta}_r - \left(\frac{1-\mu}{\mu}\right)\ln w_r$$
$$\ln MA_r = \ln\left(\sum_i \tau_{ir}^{-(\sigma-1)} P_i^{\sigma-1} Y_i\right) = \ln \sum_i \left(Dist_{ir}^{\hat{\psi}_1} \exp(Language_{ir})^{\hat{\psi}_2} \exp(NAFTA_{ir})^{\hat{\psi}_3} \exp\left(\hat{\lambda}_i\right)\right).$$

Unfortunately, it is necessary to obtain parameter values σ and μ for the calculation of G_r. These were obtained externally from Hummels (1999). Hummels provides estimates by industry at the SITC3 2-digit level. However, they are not available separately for the automobile downstream and upstream sectors. Thus, assuming identical elasticity between those sectors, 7.11 is used as an estimate of σ. The estimate of μ (0.25) is calculated directly by using the US Input-Output Table for 1997 compiled by OECD[6]. Using these estimates, the price index G_r could be calculated. MA_r, on the other hand, can be calculated using only estimates obtained in this paper.

Particularly in the trade cost function, trade costs for the case where $i = j$ must be treated in an exceptional manner. First, $Dist_{ii}$ may be set to 0.66*(surface $area_i/\pi)^{1/2}$ as found in the literature of home bias measurement (see for example Head and Mayer, 2000). Second, both $Language_{ii}$ and $NAFTA_{ii}$ may be set to zero. Sensitivity checks of these treatments in the estimates of MA_r are reported in Section 4.3. As a result, MA_r may be decomposed into domestic (DMA_r) and foreign (FMA_r) market access as follows:

$$\ln MA_r = \ln\left(DMA_r + FMA_r\right),$$

where

$$\begin{aligned} DMA_r &= Dist_{rr}^{\hat{\psi}_1} \exp\left(\hat{\lambda}_r\right), \\ FMA_r &= \sum_{i\neq r} \left(Dist_{ir}^{\hat{\psi}_1} \exp(Language_{ir})^{\hat{\psi}_2} \exp(NAFTA_{ir})^{\hat{\psi}_3} \exp\left(\hat{\lambda}_i\right)\right). \end{aligned} \qquad (3)$$

These measures are a baseline and are called "DMA(1)" and "MA(1)".

Two possible econometric issues are worth noting: First, there may be a simultaneity problem between bilateral trade values (Z_{sr}) and total production value (Z_s). If OLS estimation is conducted for equation (4), a correlation emerges between the production value and the error term. In order to address this problem simply, ln Z_s may be moved to the left side, avoiding reliance on instruments. Thus, the dependent variable is replaced with ln (Z_{sr}/Z_s). Second, there is a generated regressor problem, as noted by Pagan (1984), since values for G_r and MA_r in the gravity equation for intermediate goods trade are computed using predicted values for ψ and λ. In this paper, a bootstrap method is employed, and standard errors based on 200 bootstrap

[6] http://www.oecd.org/document/26/0,3343,en_2649_34445_38069722_1_1_1_1,00.html

replications are reported.

4. Empirical Results

This section includes results of regression analysis. After providing the first step results (the regression results of gravity equation for finished goods trade), second step results (the regression results of gravity equation for intermediate goods trade) are reported. Several robustness checks are then provided.

4.1. Gravity for Finished Goods

Results of gravity estimation for finished goods trade are presented in Table 1. In this estimation, there are a number of observations with zero-valued trade. Thus, the value one has been added to all trade before taking logarithms. Column (I) shows results using an ordinary least squares (OLS) method. This provides estimates of coefficients for importer dummy variables and for coefficients in the trade cost function. Dist and Language are estimated to be significant with expected signs. The coefficient for the NAFTA dummy is significantly positive. This indicates that free trade agreements significantly increase finished goods trade among member countries. This model succeeds in explaining 98% of bilateral trade in finished goods. Before moving to the next step, the sensitivity of treatment for zero-valued trade in the results is checked. The gravity equation is estimated using a Tobit estimation technique. This result is reported in column (II) of Table 1 and is both qualitatively and quantitatively unchanged relative to the OLS result in column (I). Thus, OLS estimates are used as the basis for the next step.

=== Table 1 ===

4.2. Gravity for Intermediate Goods

MA_r is calculated using (3) and the OLS result from Section 4.1. Mean values of country r's imports of intermediate goods during 1997-1999 are plotted against the means of calculated MA_r, in Figure 1. Three-letter codes (see Appendix) are used to indicate each country. Excluding two outliers (Canada and Mexico), there is a clear positive relationship between a given country's access to the finished goods market and its imports of intermediate goods. Eliminating the two outliers, an approximated straight line drawn on the sample has a slope of 1.03, and this is close to the theoretical prediction of unity. The extraordinary high market access of outliers is reconsidered in Section 4.3.

=== Figure 1 ===

Substituting predicted values of MA_r into equation (4), the gravity equation for intermediate goods may be estimated. Unlike trade in downstream goods, there are few observations in the sample (only two) with zero-value trade in upstream products. Thus, after adding the value one to all intermediate goods trade before taking logarithms, only OLS results are reported in column (I) in Table 2.

Estimates of coefficients for importer market access to finished goods market and exporter production of intermediate goods are significantly positive. Thus, imports of intermediate goods appear sensitive not only to the magnitude of importer demand for finished goods but also to demand of neighboring countries. The coefficient for exporter production of intermediate goods is near unity; this is also consistent with theoretical prediction. Estimated coefficients in the trade cost function are significant with the expected sign. As usual in studies of gravity, short distance and common language between trading partners increase trade in intermediate goods. NAFTA also contributes to expanding the trade among member countries. As expected, the estimated coefficient for importer wages is significantly negative[7], but the estimation for exporter wages is significantly positive. This unexpected result may be due to the fact that wages also capture worker quality. Since intermediate goods production seems to require workers to be more highly educated than those in finished goods production, the coefficient for exporter wages might be estimated to be positive. Last, the coefficient for price index is significantly negative. Theoretically, this result implies that the elasticity of substitution may be small in intermediate goods or large in finished goods, or that a share of total expenditure on automobiles is large.

=== Table 2 ===

In order to address the above-mentioned simultaneity problem, $\ln Z_s$ may be moved to the left side of the equation. The result is reported in column (II) of Table 2

[7] However, its magnitude is significantly different from that based on the presumption that $\sigma = 7.11$ and $\mu = 0.25$ which were used in the calculation of the price index G. This may be due to the quality of wage data rather than econometric problems. Indeed, the estimated coefficient for wages usually has an unexpected sign. For example, Head and Mayer (2004) obtained the "wrong" sign in their location choice analysis.

and is virtually unchanged relative to (I). These results indicate that the simultaneity problem between trade and production is not so serious. Specifically, the estimated coefficient for MA is significantly positive.

4.3. Modifying DMA

Figure 1 shows that estimates of MAs in Canada and Mexico are extraordinarily large. It seems unnatural that these would be larger than MA in the US. Thus, calculation of MA focusing on these three countries is modified.

The first modification involves balancing DMA and FMA. The mean values of MA(1) and DMA(1) during the sample period are reported in column (I) in Table 3. It is natural that DMA in the US would be larger than that in Canada and Mexico. However, the average DMA is evaluated much lower than FMA. Such a low evaluation could be one source of extraordinarily large MAs in Canada and Mexico. The low evaluation may also be partly attributed to taking the commonality of language into account only in inter-national trade costs despite the fact that the same language is spoken within a nation. Based on this, intra-national trade costs and the method of calculating DMA may be modified as follows:

$$DMA_r(2) = Dist_{rr}^{\hat{\psi}_1} \exp(Language_{rr})^{\hat{\psi}_2} \exp(\hat{\lambda}_r) = Dist_{rr}^{\hat{\psi}_1} \exp(1)^{\hat{\psi}_2} \exp(\hat{\lambda}_r).$$

The modified DMA(2) is reported in column (II) of Table 3. Compared with the DMA(1), the modified version of DMA increases. However, MA(1) is much larger in Canada and Mexico than in the US because DMA(1) in average is still much lower than FMA.

=== Table 3 ===

Further investigation reveals that there are two sources for such low values of DMA(2). One is the evaluation of intra-national distance. Under the definition that $Dist_{rr} = 0.66*(\text{surface area}_i/\pi)^{1/2}$, intra-national distance in the US (around 1,000 km) becomes larger than inter-national distance between the US and Canada (around 500 km). Obviously, it is unnatural that Canadian producers get better access to US demand for finished goods than US producers. Thus, as in Redding and Venables (2004), intra-national distance may be set to 100 km in any country. DMA may then be calculated as follows:

$$DMA_r(3) = Dist_{rr}^{\hat{\psi}_1} \exp(Language_{rr})^{\hat{\psi}_2} \exp(\hat{\lambda}_r) = (100)^{\hat{\psi}_1} \exp(1)^{\hat{\psi}_2} \exp(\hat{\lambda}_r)$$

Column (III) in Table 3 reports results of DMA(3) and shows a large increase in the US. As a result, US MA(3) reaches a similar level to that of Mexico but still much lower than that of Canada.

Another source for lower DMA than FMA is that Canada still gets better access to US markets than the US because of benefits from NAFTA. Thus, the last modification incorporates NAFTA effects into intra-national trade costs. FTAs are one means of moving member countries to an integrated or borderless economy. In this sense, the benefits of intra-national trade should be *at least* as large as the benefits of trade among FTA members. Therefore, the last modification of the calculation of DMA(4) is as follows.

$$\begin{aligned} DMA_r(4) &= Dist_{rr}^{\hat{\psi}_1} \exp(Language_{rr})^{\hat{\psi}_2} \exp(NAFTA_{rr})^{\hat{\psi}_3} \exp\left(\hat{\lambda}_r\right) \\ &= (100)^{\hat{\psi}_1} \exp(1)^{\hat{\psi}_2} \exp(1)^{\hat{\psi}_3} \exp\left(\hat{\lambda}_r\right) \end{aligned}.$$

$NAFTA_{rr}$=1 for any country *r*. The results are provided in column (IV). The relationship between $MA_r(4)$ and intermediate goods imports may also be seen in Figure 2. As a result, US MA(4) exceeds both Mexican MA(4) and Canadian MA(4) due to the remarkable rise of DMA(4).

=== Figure 2 ===

Using these three measures of DMA, equation (4) may again be estimated. Regression results are reported in Table 4 and are almost unchanged from those in Table 2. It is interesting that both R-square and the coefficient of MA rise gradually. Since the theoretically predicted magnitude of the MA coefficient is unity, its rise implies that the measure of MA is quite valid. However, the coefficient for the best measure of MA (MA(4)) is still far from unity (around 0.36). Thus, a more sophisticated measure of MA is needed, especially in the treatment of the intra-national trade cost function.

=== Table 4 ===

4.4. Simulation

Using the model developed earlier, we simulate the impact of finished goods market expansion in a country on intermediate goods trade through input-output relationships between those two types of goods. The simulation scenario includes the rise of US final demand (λ_{US}, in 1999) by 10%. This increases finished goods exports of each country to the US immediately. To produce such finished goods in a given country, it must import intermediate goods from the world. As a result, world trade in intermediate goods experiences an explosive increase. For simulation, the impact of finished goods market expansion in the US on intermediate goods trade is quantified using the case of ln Z_{sr} in column (III) in Table 4. Specifically, differences in predicted values in the original case and the above-mentioned scenario are calculated.

Results are reported in Table 5. First, the rise of λ_{US} directly increases market access in each country. Obviously, such increase becomes more significant in countries that have lower trade costs with the US. Except for the US, Canada experiences the most remarkable increase in MA with Mexico following. Second, though only the US market has expansion, an increase of intermediate goods imports can be observed in all countries. This is a consequence of the model with input-output relationships.[8] In addition, countries with larger increases in MA import more intermediate goods. The larger increase in Canadian imports over US imports is due to the great number of imports of intermediate goods from the US. Third, exports increase in all countries. It is interesting that Japan, Germany, and the U.K. record a relatively large increase in exports due to the volume effect. Since these countries originally have a large amount of exports, changes in the *level* of exports become dramatic.

=== Table 5 ===

4.5. Further Robustness Checks

Further estimations may be made using DMA and FMA as separate terms. Theoretically, this regression is not specified well, but it may be still valuable for examining the validity and significance of importer demand (DMA) and demand of neighboring countries (FMA) separately. Results are reported in column (I) in Table 6. Estimated coefficients for both DMA and FMA are significantly positive, and this indicates a significant role that demand has in neighboring countries of the importer in intermediate goods trade. The magnitude of the estimated coefficient is also a little larger in DMA than in FMA.

=== Table 6 ===

More control variables may also be added. Heretofore, only wages were

[8] This is also based on a property of the CES production function and thus is a different force from the "magnification effect" found in Yi (2003).

introduced as a proxy for primary production factor prices. In order to control the effects of other primary factors, logs of importer and exporter energy production (Ex_Energy, Im_Energy; kilo ton of oil equivalents) and a share of R&D expenditures in GDP (Ex_R&D, Im_R&D) are added. Their data came from the World Development Indicator (World Bank). Results are reported in column (II) of Table 6. The coefficient for Price is insignificant, but the coefficient of MA(4) is still significantly positive though with reduced magnitude. Results in the newly-added variables were disappointing.

Finally, sample countries are extended in the estimation of the gravity equation for finished goods trade. Although the sample in the gravity equation for intermediate goods was restricted to OECD countries due to availability of data, it is important to incorporate demand emanating from non-OECD countries in the calculation of the market access measure. For example, the present measure in Japan does not incorporate access to Chinese demand, and this is one of the most important markets for Japanese finished goods producers. Thus, not only OECD countries but also non-OECD countries are included in the sample for first stage estimation (sample countries increase from 19 to 49).[9]

Results with this extended sample are as follows:[10] Column (V) in Table 3 shows calculated MA, DMA, and FMA. Figure 3 depicts the relationship of MA with imports of intermediate goods. This table and figure shows that US MA again exceeds both Mexican and Canadian MA. But new estimates in the first step-gravity equation with the extended sample yield a lower MA in most countries than before. Gravity results in intermediate goods trade are reported in column (III) of Table 6. While coefficients for importer wages and price index turn out to be positive, estimates of MA are again significantly positive, and magnitudes are larger when compared with those in Table 4. The latter result may indicate the importance of incorporating the demand of as many countries as possible in the calculation of the market access measure.

[9] The following countries were added: Argentina, Bulgaria, Brazil, Switzerland, Chile, China, Colombia, Costa Rica, Cyprus, Estonia, Greece, Guatemala, Hong Kong, Croatia, India, Ireland, Iran, Israel, Kenya, Lebanon, Lithuania, Malta, New Zealand, Poland, Romania, Russian Federation, Singapore, Slovenia, Uruguay, and Vietnam.

[10] As in Table 1, OLS regression in the first stage yielded significant coefficients for Dist (-2.44), Language (1.74), and NAFTA (1.44).

5. Concluding Remarks

The role of importer access to the finished goods market in intermediate goods trade was examined by estimating the gravity-like equation derived from the NEG model. Importer access to demand for finished goods was calculated by using the estimates in the gravity equation for finished goods trade, and then intermediate goods trade was regressed on the importer access. Results indicate that imports of intermediate goods are sensitive not only to the magnitude of importer demand for finished goods but also to the demand of neighboring countries. Using results of the regression, the impact of US finished goods market expansion on intermediate goods trade in each country was simulated. This shows that in spite of expansion of only the US market, an increase in intermediate goods imports can be observed in all countries, particularly in countries that have lower trade costs with the US.

Appendix. Sample Country

3-letter	Country Name
AUS	Australia
AUT	Austria
CAN	Canada
FIN	Finland
FRA	France
DEU	Germany
HUN	Hungary
ITA	Italy
JPN	Japan
KOR	Korea, Republic of
MEX	Mexico
NLD	Netherlands
NOR	Norway
PRT	Portugal
ESP	Spain
SWE	Sweden
TUR	Turkey
GBR	United Kingdom
USA	United States of America

References

Ando, M. and Kimura, F., 2005, The Formation of International Production and Distribution Networks in East Asia, In: Ito, T., and Rose, A. (Eds.). *International Trade* (NBER-East Asia Seminar on Economics, Volume 14), The University of Chicago Press.

Athukorala, P.-C. and Yamashita, N., 2006, Production Fragmentation and Trade Integration: East Asia in a Global Context, *The North American Journal of Economics and Finance*, **17**(3): 233-256.

Baier, S.L. and Bergstrand, J.H., 2001, The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity, *Journal of International Economics*, **53**(1): 1-27.

Baier, S.L. and Bergstrand, J.H., 2007, Do Free Trade Agreements Actually Increase Members' International Trade?, *Journal of International Economics*, **71**(1): 72-95.

Combes, P.-P., Mayer, T., and Thisse, J.-F., 2008, *Economic Geography*, Princeton University Press.

Feenstra, R., 2002, Border Effects and the Gravity Equation: Consistent Methods for Estimation, *Scottish Journal of Political Economy*, **49**(5): 491-506.

Head, K. and Mayer, T., 2000, Non-Europe: The Magnitude and Causes of Market Fragmentation in the EU, *Review of World Economics/Weltwirtschaftliches Archiv*, **136**(2): 284-314.

Head, K. and Mayer, T., 2004, Market Potential and the Location of Japanese Investment in the European Union, *Review of Economics and Statistics*, **86**(4): 959-972.

Head, K. and Mayer, T., 2006, Regional Wage and Employment Responses to Market Potential in the EU, *Regional Science and Urban Economics*, **36**(5): 573-594.

Hummels, D., 1999, Toward a Geography of Trade Costs, GTAP Working Papers **1162**, Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.

Kimura, F., Takahashi, Y., and Hayakawa, K., 2007, Fragmentation and Parts and Components Trade: Comparison between East Asia and Europe, *The North American Journal of Economics and Finance*, **18**(1): 23-40.

Knaap, T., 2006, Trade, Location, and Wages in the United States, *Regional Science and Urban Economics*, **36**(5): 595-612.

Krugman, P., 1991, Increasing Returns and Economic Geography, *Journal of Political Economy*, **99**(3): 483-499.

Pagan, A., 1984, Econometric Issues in the Analysis of Regressions with Generated

Regressors, *International Economic Review*, **25**(1): 221-247.

Redding, S. and Schott, P., 2003, Distance, Skill Deepening and Development: Will Peripheral Countries ever Get Rich?, *Journal of Development Economics*, **72**(2): 515-541.

Redding, S. and Venables, A.J., 2004, Economic Geography and International Inequality, *Journal of International Economics*, **62**(1): 53-82.

Rose, A.K., 2004, Do We Really Know That the WTO Increases Trade?, *American Economic Review*, **94**(1): 98-114.

Yi, K-M., 2003, Can Vertical Specialization Explain the Growth of World Trade?, *Journal of Political Economy*, **111**(1): 52-102.

Table 1. Gravity Estimation for Finished Goods Trade

	OLS	Tobit
Dist	-1.087***	-1.095***
	[0.139]	[0.135]
Language	1.388***	1.408***
	[0.302]	[0.329]
NAFTA	4.385***	4.385***
	[0.678]	[0.733]
Importer*Year	YES	YES
Exporter*Year	YES	YES
Obs.	1,026	1,026
R-sq	0.9818	
Log Likelihood		-2348

Notes: ***, ** and * indicate respectively 1%, 5% and 10% levels of statistical significance. Standard errors are shown in square parentheses. In the sample, 29 observations are left-censored at zero; 997 are uncensored.

Table 2. Gravity Estimation for Intermediate Goods Trade

	(I) $\ln Z_{sr}$	(II) $\ln (Z_{sr}/Z_s)$
Dist	-1.135***	-1.155***
	[0.047]	[0.047]
Language	0.871***	0.826***
	[0.169]	[0.170]
NAFTA	2.364***	2.269***
	[0.390]	[0.392]
Output (Z_s)	0.927***	
	[0.039]	
Wages (w_r)	-0.624***	-0.633***
	[0.181]	[0.181]
Wages (v_s)	0.383***	0.293***
	[0.118]	[0.095]
Price (G_r)	-0.417***	-0.420***
	[0.035]	[0.035]
MA(1)	0.098***	0.103***
	[0.034]	[0.034]
Year	YES	YES
Obs.	1,026	1,026
R-sq	0.6688	0.5314

Notes: MA(1) was calculated by making intra-national trade costs a function only of intra-national distance, defined as 0.66*(surface area$_i$/π)$^{1/2}$. ***, ** and * indicate respectively 1%, 5% and 10% levels of statistical significance. Bootstrapped standard errors are in parentheses (200 replications).

Table 3. Mean Market Access during Sample Period

	OECD Sample									Extended Sample		
		(I)		(II)		(III)		(IV)		(V)		
	ln FMA	ln MA(1)	ln DMA(1)	ln MA(2)	ln DMA(2)	ln MA(3)	ln DMA(3)	ln MA(4)	ln DMA(4)	ln MA(4)	ln DMA(4)	ln FMA
AUS	15.7	16.0	14.6	16.5	15.9	18.6	18.5	22.9	22.9	23.1	23.1	12.2
AUT	18.5	18.7	16.7	19.0	18.0	19.1	18.1	22.5	22.5	20.2	20.1	18.5
CAN	22.7	22.7	13.0	22.7	14.4	22.7	17.1	23.0	21.5	21.5	21.3	19.7
DEU	18.0	18.8	18.2	19.8	19.6	20.5	20.5	24.9	24.9	24.7	24.7	18.7
ESP	17.4	17.7	16.3	18.3	17.7	19.0	18.8	23.2	23.2	22.3	22.3	16.2
FIN	17.2	17.4	15.5	17.7	16.8	18.2	17.7	22.1	22.1	19.5	19.5	16.6
FRA	18.2	18.4	16.7	18.9	18.1	19.5	19.2	23.6	23.6	22.4	22.3	18.9
GBR	18.1	18.6	17.5	19.3	18.9	19.8	19.6	24.0	24.0	24.3	24.3	18.1
HUN	17.7	17.7	14.4	17.8	15.8	17.9	15.9	20.4	20.3	19.2	19.1	17.0
ITA	17.3	18.0	17.3	18.9	18.7	19.6	19.5	23.9	23.9	24.1	24.1	16.4
JPN	15.5	17.6	17.4	18.9	18.8	19.7	19.7	24.1	24.1	23.0	23.0	11.9
KOR	16.7	16.7	12.6	16.8	14.0	16.9	14.2	18.9	18.6	18.7	18.6	14.2
MEX	20.7	20.7	11.5	20.7	12.9	20.7	14.7	20.9	19.1	20.6	20.6	15.3
NLD	18.8	19.1	17.5	19.6	18.9	19.4	18.7	23.1	23.0	22.8	22.7	20.3
NOR	17.5	17.6	15.3	17.9	16.7	18.2	17.5	21.9	21.9	20.0	19.9	17.0
PRT	17.2	17.5	15.9	18.0	17.3	18.0	17.4	21.8	21.8	20.5	20.4	16.0
SWE	17.4	17.6	15.5	17.9	16.9	18.4	17.9	22.3	22.3	22.5	22.5	16.3
TUR	17.0	17.0	14.1	17.2	15.5	17.6	16.8	21.2	21.2	19.6	19.6	15.5
USA	19.7	19.7	16.1	19.8	17.5	20.7	20.2	24.6	24.5	23.8	23.8	17.2

Notes: DMA(1) are calculated by setting intra-national trade costs as a function of only intra-national distance (defined as 0.66*(surface area$_i$/π)$^{1/2}$). DMA(2) are calculated using a function of not only the intra-national distance (as in (I)) but also Language$_{ii}$, (further set to unity). DMA(3) are calculated using a function of intra-national distance (set to 100km in any country), and Language$_{ii}$, (set to unity). In DMA(4), intra-national trade costs are assumed to be a function of intra-national distance (set to be 100km in any country), Language$_{ii}$, and NAFTA$_{ii}$, (both set to unity).

Table 4. Gravity Estimation for Intermediate Goods Modifying DMA

	(I)		(II)		(III)	
	ln Z_{sr}	ln (Z_{sr}/Z_s)	ln Z_{sr}	ln (Z_{sr}/Z_s)	ln Z_{sr}	ln (Z_{sr}/Z_s)
Dist	-1.133***	-1.154***	-1.171***	-1.188***	-1.089***	-1.112***
	[0.046]	[0.047]	[0.047]	[0.047]	[0.045]	[0.046]
Language	0.887***	0.842***	0.828***	0.792***	0.961***	0.911***
	[0.169]	[0.170]	[0.169]	[0.169]	[0.161]	[0.162]
NAFTA	2.382***	2.289***	1.940***	1.861***	2.545***	2.451***
	[0.388]	[0.391]	[0.402]	[0.404]	[0.340]	[0.345]
Output (Z_s)	0.926***		0.942***		0.916***	
	[0.039]		[0.038]		[0.038]	
Wages (w_r)	-0.610***	-0.620***	-0.722***	-0.732***	-1.074***	-1.084***
	[0.179]	[0.179]	[0.170]	[0.169]	[0.163]	[0.164]
Wages (v_s)	0.384***	0.293***	0.359***	0.287***	0.401***	0.299***
	[0.118]	[0.095]	[0.116]	[0.093]	[0.119]	[0.094]
Price (G_r)	-0.407***	-0.409***	-0.382***	-0.383***	-0.375***	-0.378***
	[0.035]	[0.035]	[0.034]	[0.034]	[0.035]	[0.034]
MA(2)	0.105***	0.109***				
	[0.037]	[0.037]				
MA(3)			0.307***	0.313***		
			[0.041]	[0.041]		
MA(4)					0.362***	0.360***
					[0.040]	[0.040]
Year	YES	YES	YES	YES	YES	YES
Obs.	1,026	1,026	1,026	1,026	1,026	1,026
R-sq	0.6688	0.5312	0.6827	0.5516	0.6844	0.5528

Notes: MA(2) are calculated as a function not only of intra-national distance (defined as $0.66^*(\text{surface area}_i/\pi)^{1/2}$), but also Language_{ii} (further set to unity). MA(3) are calculated using a function of intra-national distance (set to be 100km in any country) and Language_{ii}, (set to unity). In MA(4), intra-national trade costs are assumed to be a function of intra-national distance (set to 100km in any country), Language_{ii}, and NAFTA_{ii}, (both set to unity). ***, ** and * indicate respectively 1%, 5% and 10% levels of statistical significance. Bootstrapped standard errors are in parentheses (200 replications).

Table 5. Simulation: Impact of a 10% Rise in the US Market (US $1,000)

	MA(4)	Imports	Exports
AUS	599	6	1,042
AUT	379	43	817
CAN	1,884,473	3,867,829	1,610,208
DEU	432	8	15,731
ESP	1,817	93	7,336
FIN	390	22	196
FRA	448	26	9,125
GBR	1,888	163	14,304
HUN	367	43	173
ITA	374	12	3,373
JPN	228	3	25,868
KOR	895	1,299	3,926
MEX	261,777	177,296	38,871
NLD	446	85	842
NOR	441	22	299
PRT	485	22	338
SWE	411	37	991
TUR	315	10	144
USA	11,990,024	1,700,212	4,013,647
Total	14,146,189	5,747,230	5,747,230

Notes: This table shows the results of the simulation of a 10% rise in the US market (λ_{US}) and uses the result obtained in the case of ln Z_{sr} in column (III) in Table 4. Changes in MA(4), total imports of intermediate goods, and exports are reported.

Table 6. Gravity Estimation for Intermediate Goods Trade: Robustness Checks

	(I)		(II)		(III)	
	$\ln Z_{sr}$	$\ln(Z_{sr}/Z_s)$	$\ln Z_{sr}$	$\ln(Z_{sr}/Z_s)$	$\ln Z_{sr}$	$\ln(Z_{sr}/Z_s)$
Dist	-1.067***	-1.091***	-1.164***	-1.152***	-1.137***	-1.159***
	[0.047]	[0.048]	[0.045]	[0.045]	[0.042]	[0.043]
Language	0.892***	0.839***	0.813***	0.835***	0.847***	0.801***
	[0.167]	[0.167]	[0.162]	[0.161]	[0.154]	[0.154]
NAFTA	2.452***	2.343***	2.237***	2.266***	2.540***	2.450***
	[0.361]	[0.363]	[0.373]	[0.370]	[0.326]	[0.329]
Output (Z_s)	0.915***		1.073***		0.923***	
	[0.039]		[0.039]		[0.038]	
Wages (w_r)	-1.050***	-1.055***	-1.478***	-1.467***	0.513***	0.514***
	[0.168]	[0.169]	[0.175]	[0.175]	[0.099]	[0.098]
Wages (v_s)	0.407***	0.303***	0.479***	0.515***	0.392***	0.297***
	[0.119]	[0.094]	[0.128]	[0.122]	[0.122]	[0.096]
Price (G_r)	-0.397***	-0.401***	-0.444***	-0.439***	0.013	0.015
	[0.036]	[0.035]	[0.034]	[0.034]	[0.016]	[0.016]
MA(4)			0.219***	0.223***	0.444***	0.446***
			[0.045]	[0.045]	[0.027]	[0.027]
DMA(4)	0.259***	0.254***				
	[0.035]	[0.034]				
FMA(4)	0.133***	0.136***				
	[0.029]	[0.029]				
Im_Energy			0.392***	0.388***		
			[0.041]	[0.041]		
Ex_Energy			-0.306***	-0.273***		
			[0.048]	[0.042]		
Im_R&D			-0.123	-0.115		
			[0.124]	[0.125]		
Ex_R&D			0.027	0.053		
			[0.115]	[0.118]		
Year	YES	YES	YES	YES	YES	YES
Obs.	1,026	1,026	1,026	1,026	1,026	1,026
R-sq	0.6615	0.5204	0.7357	0.6260	0.6864	0.5559

Notes: The sample used in the first stage estimation in column (III) includes not only OECD but non-OECD countries as well. ***, ** and * indicate respectively 1%, 5% and 10% levels of statistical significance. Bootstrapped standard errors are in parentheses (200 replications).

Figure 1. Intermediate Goods Imports and MA(1)

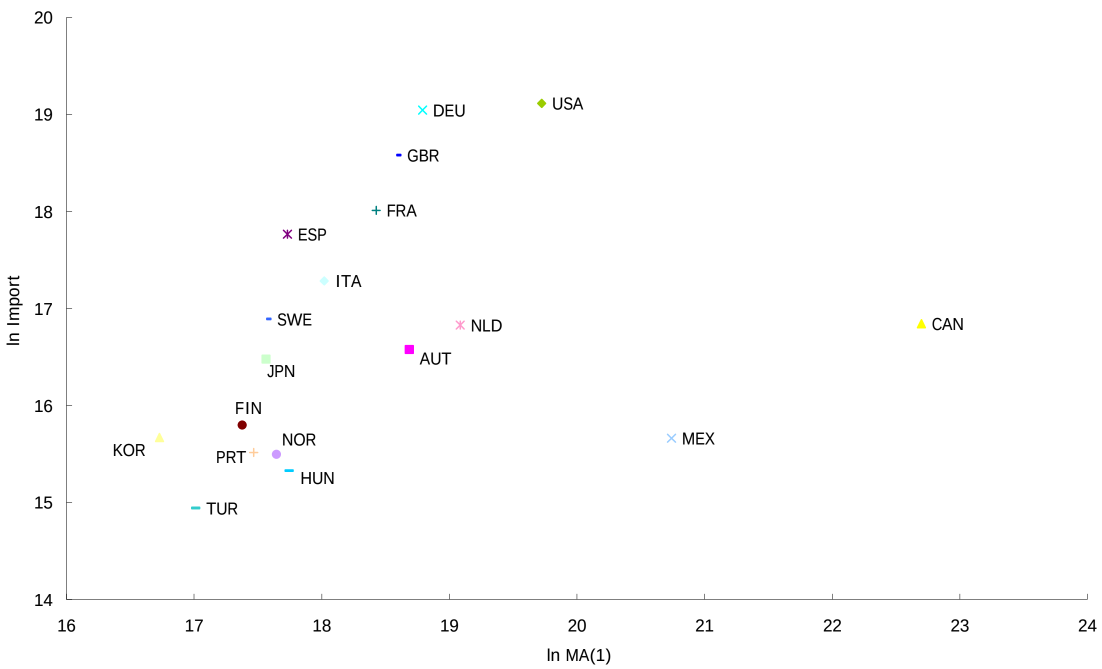


Figure 2. Intermediate Goods Imports and MA(4)

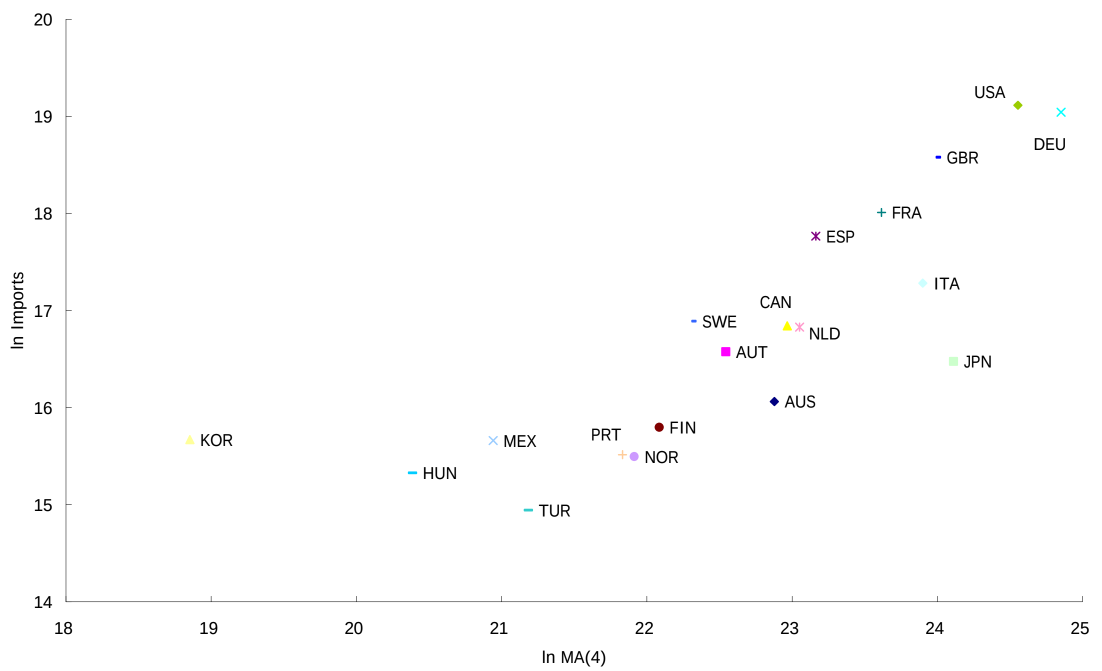
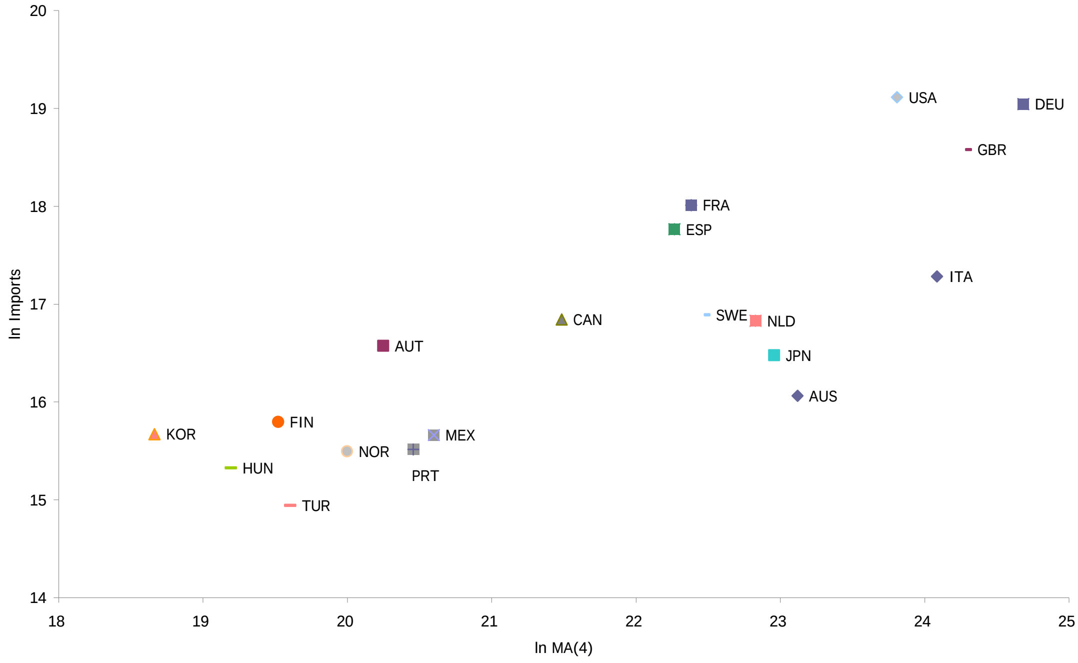


Figure 3. Intermediate Goods Imports and MA(4): Extended Sample



～Previous IDE Discussion Papers ～

No.	Author(s)	Title	
208	Kazunobu HAYAKAWA	Market Access and Intermediate Goods Trade	2009
207	Kazunobu HAYAKAWA, Daisuke HIRATSUKA, Kohei SHIINO, Seiya SUKEGAWA	Who Uses FTAs?	2009
206	Ikuko OKAMOTO	Issues Affecting the Movement of Rural Labour in Myanmar: Rakhine Case Study	2009
205	Takao TSUNEISHI	Border Trade and Economic Zones on the North-South Economic Corridor: Focusing on the Connecting Points between the Four Countries	2009
204	Ando ASAO Bo MENG Chao QU	Trade Coefficients and the Role of Elasticity in a Spatial CGE Model Based on the Armington Assumption	2009
203	Toshihiro KUDO	Location Advantages and Disadvantages in Myanmar:The Case of Garment Industry	2009
202	Yasushi HAZAMA	Economic Voting and Electoral Volatility in Turkish Provinces	2009
201	Tatsuya SHIMIZU	Structural Changes in Asparagus Production and Exports from Peru	2009
200	Takeshi INOUE, Shigeyuki HAMORI	An Empirical Analysis of the Monetary Policy Reaction Function in India	2009
199	Yuko TSUJITA	Deprivation of Education in Urban Areas: A Basic Profile of Slum Children in Delhi, India	2009
198	Kaoru MURAKAMI	Constructing Female Subject: Narratives on Family and Life Security among Urban Poor in Turkey	2009
197	Akiko YANAI	Normative Influences of "Special and Differential Treatment" on North-South RTAs	2009
196	Hisaya ODA	Pakistani Migration to the United States: An Economic Perspective	2009
195	Yukihito SATO	Perfecting the Catching-up: The Case of Taiwan's Motorcycle Industry	2009
194	Natsuko OKA	Ethnicity and Elections under Authoritarianism: The Case of Kazakhstan	2009
193	Futaba ISHIZUKA	Vietnamese Local State-owned Enterprises (SOEs) at the Crossroads: Implications of SOE Restructuring at the Local Level	2009
192	Yasushi HAZAMA	Constitutional Review and Democratic Consolidation: A Literature Review	2009
191	Hisao YOSHINO	Technology Choice in the IT Industry and Changes of the Trade Structure	2009
190	Toshikazu YAMADA	In Memory of Dr. Ali Al-Gritly (1913-1982): His Views on Egypt's Experience with Socialism	2009
189	Kanako YAMAOKA	The Feasibility of Cuban Market Economy: A Comparison with Vietnam	2009
188	Tomohiro MACHIKITA, Yasushi UEKI	Linked versus Non-linked Firms in Innovation: The Effects of Economies of Network in Agglomeration in East Asia	2009
187	Hisao YOSHINO	Financial Policies and Dynamic Game Simulation in Poland and Hungary	2009
186	Kazushi TAKAHASHI	Is South Sulawesi a Center of Growth in Eastern Indonesia?: Japanese ODA Strategy Revisited	2009
185	Bo MENG, Satoshi INOMATA	Production Networks and Spatial Economic Interdependence: An International Input-Output Analysis of the Asia-Pacific Region	2009

No.	Author(s)	Title	
184	Bo MENG, Nobuhiro OKAMOTO, Yoshiharu TSUKAMOTO, Chao QU	Input-Output Based Economic Impact Evaluation System for Small City Development: A Case Study on Saemangeum's Flux City Design	2009
183	Nobuhiko FUWA, Seiro ITO, Kensuke KUBO, Takashi KUROSAKI, and Yasuyuki SAWADA	How Does Credit Access Affect Children's Time Allocation in a Developing Country? A Case Study from Rural India	2009
182	Moriki OHARA Yuri SATO	Asian Industrial Development from the Perspective of the Motorcycle Industry	2008
181	Takeshi KAWANAKA	Political Conditions for Fair Elections	2008
180	Takeshi INOUE	The Causal Relationships in Mean and Variance between Stock Returns and Foreign Institutional Investment in India	2008
179	Naoko AMAKAWA	Reconstruction and Development of Rural Cambodia--From Krom Samakki to Globalization--	2008
178	Kazunobu HAYAKAWA, Toshiyuki MATSUURA	Pitfalls of Location Choice Analysis: The Finished Goods Producer versus the Intermediate Goods Producer	2008
177	Yoko ASUYAMA	The Contribution of Supply and Demand Shifts to Earnings Inequality in Urban China	2008
176	Yoko ASUYAMA	Changes in the Causes of Earnings Inequality in Urban China from 1988 to 2002	2008
175	Ｓatoshi INOMATA	A New Measurement for International Fragmentation of the Production Process: An International Input-Output Approach	2008
174	Mayumi MURAYAMA, Nobuko YOKOTA	Revisiting Labour and Gender Issues in Export Processing Zones: The Cases of South Korea, Bangladesh and India	2008
173	Masahiro KODAMA	The Impact of Unstable Aids on Consumption Volatility in Developing Countires	2008
172	Hiroshi OIKAWA	Empirical Global Value Chain Analysis in Electronics and Automobile Industries: An Application of Asian International Input-Output Tables	2008
171	Eiichi YOSHIDA	Transformation of Woodworking and Furniture Industrial Districts in Kampala, Uganda: Dichotomous Development of SME Cluster and Large Firm Sector	2008
170	Azusa HARASHIMA	The Impact of Tobacco Production Liberalization on Smallholders in Malawi	2008
169	Zaid Bakht, Md. Salimullah, Tatsufumi Yamagata, and Mohammad Yunus	Competitiveness of the Knitwear Industry in Bangladesh: A Study of Industrial Development amid Global Competition	2008
168	Hitoshi OTA	Indian IT Software Engineers in Japan: A Preliminary Analysis	2008
167	Hiroshi Oikawa	TNCs in Perplexity over How to Meet Local Suppliers: The Case of Philippine Export Processing Zone	2008
166	Takeshi INOUE, Shigeyuki HAMORI	An Empirical Analysis of the Money Demand Function in India	2008
165	Mayumi MURAYAMA	Re-Examining 'Difference' and 'Development': A Note on Broadening the Field of Gender and Development in Japan	2008
164	Jose Luis CORDEIRO	Constitutions aroumd the World: A View from Latin America	2008
163	Takahiro FUKUNISHI	Clothing Export from Sub-Saharan Africa: Impact on Poverty and Potential for Growth	2008
162	Koichi USAMI	Re-thinking Argentina's Labour and Social Security Reform in the 1990s: Agreement on Competitive Corporatism	2008
161	Mai FUJITA	Value Chain Dynamics and the Growth of Local Firms: The Case of Motorcycle Industry in Vietnam	2008

No.	Author(s)	Title	
160	Kazunobu HAYAKAWA, Kuo-I CHANG	Border Barriers in Agricultural Trade and the Impact of Their Elimination: Evidence from East Asia	2008
159	Satoru KUMAGAI, Toshitaka GOKAN, Ikumo ISONO, Souknilanh KEOLA	The IDE Geographical Simulation Model: Predicting Long-Term Effects of Infrastructure Development Projectso	2008
158	Satoru KUMAGAI	A Journey through the Secret History of the Flying Geese Model	2008
157	Satoru KUMAGAI	A Mathematical Representation of "Excitement" in Games: A Contribution to the Theory of Game Systems	2008
156	Kazunobu HAYAKAWA, Fukunari KIMURA	The Effect of Exchange Rate Volatility on International Trade: The Implication for Production Networks in East Asia	2008
155	Kazunobu HAYAKAWA	The Choice of Transport Mode: Evidence from Japanese Exports to East Asia	2008
154	Jose Luis CORDEIRO	Monetary Systems in Developing Countries: An Unorthodox View	2008
153	Takao TSUNEISHI	Development of Border Economic Zones in Thailand: Expansion of Border Trade and Formation of Border Economic Zones	2008
152	Nguyen Binh Giang	Improving the Foreign Direct Investment Capacity of the Mountainous Provinces in Viet Nam	2008
151	Syviengxay Oraboune	Infrastructure (Rural Road) Development and Poverty Alleviation in Lao PDR	2008
150	Chap Moly	Infrastructure Development of Railway in Cambodia: A Long Term Strategy	2008
149	Thandar Khine	Foreign Direct Investment Relations between Myanmar and ASEAN	2008
148	Aung Kyaw	Financing Small and Midium Enterprises in Myanmar	2008
147	Toshihiro KUDO	Myanmar Sugar SMEs: History, Technology, Location and Government Policy	2008
146	Momoko KAWAKAMI	Exploiting the Modularity of Value Chains: Inter-firm Dynamics of the Taiwanese Notebook PC Industry	2008
145	Toshikazu YAMADA	Sustainable Development and Poverty Reduction under Mubarak's Program	2008
144	Miki HAMADA	Bank Borrowing and Financing Medium-sized Firms in Indonesia	2008
143	Yoko IWASAKI	Methodological Application of Modern Historical Science to 'Qualitative Research'	2008
142	Masahiro KODAMA	Monetary Policy Effects in Developing Countries with Minimum Wages	2008
141	Yasushi HAZAMA	The Political Economy of Growth: A Review	2008
140	Kumiko MAKINO	The Changing Nature of Employment and the Reform of Labor and Social Security Legislation in Post-Apartheid South Africa	2008
139	Hisao YOSHINO	Technology Choice, Change of Trade Structure, and A Case of Hungarian Economy	2008
138	Shigeki HIGASHI	The Policy Making Process in FTA Negotiations: A Case Study of Japanese Bilateral EPAs	2008
137	Arup MITRA and Mayumi MURAYAMA	Rural to Urban Migration: A District Level Analysis for India	2008
136	Nicolaus Herman SHOMBE	Causality relationship between Total Export and Agricultural GDP and Manufacturing GDP case of Tanzania	2008
135	Ikuko OKAMOTO	The Shrimp Export Boom and Small-Scale Fishermen in Myanmar	2008

No.	Author(s)	Title	
134	Chibwe CHISALA	Unlocking the Potential of Zambian Micro, Small and Medium Enterprises "learning from the international best practices - the Southeast Asian Experience"	2008