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THE SUSTAINABILITY OF KOREA'S TRADE BALANCES WITH CHINA AND JAPAN: PERSPECTIVE FROM THE ASYMMETRY IN INCOME ELASTICITIES

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This analysis of the trade balance has been inspired by the Houthakker and Magee finding, namely that the income elasticity of export (import) exceeds that of import (export). However, it is known that estimates of the income elasticity of demand are substantially biased due to the omission of supply capacity terms such as trade variety or FDI. Many previous studies have used a proxy for the varieties of goods in import demand in order to correct the bias that arises from ignoring product proliferation. This paper uses an import demand equation that incorporates the direct measures of trade variety that are consistent with an underlying constant-elasticity of substitution aggregator function in order to estimate unbiased income elasticities for Korea's trade flows with China and Japan. This paper shows that the income elasticities for export and imports are quite high from the standard import demand equation, and the inclusion of terms such as trade variety and FDI reduce the magnitude of the income elasticity. However, the asymmetry in the income elasticities of export and import in the Houthakker and Magee finding persists for Korea's trade flows with China and Japan. Given that the new elasticities predict "better", the trade surplus in Korea's trade with China is to be small, and deficit with Japan is to be large.

JEL Classification: F1, F10
Keywords: Income Elasticity, Trade Variety, Houthakker-Magee finding

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I. INTRODUCTION

There have been many papers relating trade flows to the importer's income. This was first examined by Houthakker and Magee (1969), in which income elasticities differ substantially across countries. Particularly, estimates of the income elasticity of demand for the United States are higher than those in other countries. The implication of this asymmetry is that the United States would be expected to have an ever-growing trade deficit with balanced world growth. To put it in other words, in order to keep a balanced trade surplus, the United States grows more slowly. This dissatisfaction with the implication has led many of studies to argue that there is an upward bias in income elasticity estimates due to the omission of important factors.

According to Krugman's (1989) "45-degree rule", fast-growing countries will not experience a deterioration of their trade balance. There is negative correlation between countries' income elasticities of income and their income growth rate. He argued that product differentiation and scale economies imply that countries grow by producing new goods that can be exported without adverse terms of trade. In other words, the fastest-growing economies grow because they expand the range of goods they export as they grow.[1] The standard trade equations are mis-specified because they omit a supply term, such as product variety, in import demand. The studies have presented their findings under the assumption that each country produces one type or a group of similar goods, which is referred to as the Armington assumption (1969).

Helkie and Hooper (1988) used import demand equations that augmented the price and income terms with the ratio of home to foreign productive capital stock to reflect the effect of product variation. The new variable significantly reduces income elasticities for US imports from about 2.5 to 2.2. Bayoumi (1999) includes exporter's GDP in panel estimation for trade flows between 21 industrial countries and shows that the supply effect is significant. Marquez (2002) uses immigration as a proxy for US consumers' tastes for varieties from abroad, which reduces

[1] Empirically, Hummels and Klenow (2005) show that high-income countries export and import more varieties with high unit price.

US income elasticities. Feenstra and Shiells (1997) use expenditure share derived from a constant elasticity of substitution (CES) aggregator function. The entry of countries into new products is to expect that the expenditure on sampled products may be falling. They found that the income elasticity for US imports was reduced from 2.5 to 2.2, and that the aggregate import price index is upwardly biased by between 1% and 2% annually. Gagnon (2003a) analyzed US import demand from different source countries and found strong evidence of a supply effect (defined as potential output growth or relative GDP of the exporting country) of roughly half the magnitude (0.75) of the income elasticity (1.5), Kang (2007a) derives an import demand equation that incorporates product variety, and analyzes the foreign income elasticities for Korea's exports to its destination countries while taking into account product variety terms. The inclusion of the export varieties lowers the income elasticity of import demand from about 0.6 to 0.39. Many empirical studies show that the exclusion of the product variety effect leads to over-estimation of the income elasticity. However, the asymmetry in income elasticities is quite durable.

Thus, this paper extends an import demand equation that incorporates product variety in Kang (2007a). Instead of using alternative measures of growth in product varieties, as in previous papers, this paper adopts the direct measures of export variety, which are consistent with an underlying CES aggregator function.[2] The suggested model is based on the monopolistic competition model in which consumers demand many varieties of the differentiated good, the so-called love of variety. The model by Krugman (1989) shows how the economies of scale and a taste for variety leads to a role for supply capacity in determining import demand.[3] As countries grow, they produce more varieties with increasing returns to scale. On the import side, consumers love varieties, given income, and the demand curve shifts out because the demand is directly tied to the varieties.

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[2] Kang (2006) constructs measures of export variety to compare export varieties from a country to its many destination countries. He shows how exports to different destination markets show a distinct pattern with greatest variety to the wealthier and larger markets.

[3] Gagnon (2003 a, b) augments the import demand equation with a term for the production capacity of the exporting country to test for the importance of the supply effect.

Another omitted variable is FDI. An increase in either inward or outward FDI raises or lowers trade. It is possible to allow for FDI as a determinant of import propensities, and the demand curve shifts out. Theoretically, Markusen (1984) focused on horizontal investment in which a firm sets up abroad to produce the same product that it produces at home for the improvement of market access or future market growth. FDI will have a substitute relationship with trade. Helpman (1984) focused on vertical investments in which the production process is decomposed by stages according to factor intensities in different countries. FDI may have mainly a complementary relationship with trade. A range of empirical studies find a substitute relationship between the two (Bayoumi and Lipworth 1997; Graham 1999; Helpman et al. 2003). In contrast, the other studies find evidence of complementary relationship (Brainard 1997; Clausing 2000). Other contributions find evidence for the presence of both substitute and complementary relationships (Goldberg and Kein 1999; Blonigen 2001; Head and Ries 2001; Swenson 2004). In spite of the increasing interest in the impact of FDI on trade, there have been rather scarce specifications including FDI in the import equation. Recently, Barrell and Dees (2005) showed that the income elasticity of demand is reduced, well below the estimated elasticities when inward and outward FDI are not included. Chinn (2006) examines import and export demand functions with supply capacity, particularly vertical specialization in which rising importance of vertical specialization yields more plausible estimates of income elasticties. However, the asymmetry is quite durable. Therefore, this paper augments the demand function including trade varieties with FDI in order to control for a greater effect of the rise of foreign investment.

The objective of this paper is to find estimates from the import demand equation with supply shift variables to affect the import propensities, which are not included in the standard import demand equation. The possible variables may be trade variety and FDI. This paper is organized as follows. In Section 2, a monopolistic competition model is derived for empirical estimation. A discussion of the data follows in Section 3, along with the estimates of the trade elasticities for Korean trade flows with China and Japan. Finally, in Section 4, the paper is concluded with a

summary.

II. THE MODEL

Following the ideas of Kang (2004a,b) and Kang (2007a), this paper develops a monopolistic competition model with CES preference and price index in time version. The preferences in country c are given by a CES function for each period t,

$$U_t^c = \left[\sum_{i \in I_t^{kc}} (q_{i,t}^{kc})^{\frac{\sigma-1}{\sigma}} + \sum_{i \in \tilde{I}_t^c} (q_{i,t}^c)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $q_{i,t}^{kc}$ is the consumption of country k exported variety and $q_{i,t}^c$ is the consumption of country c domestically produced, or all other imported variety. The goods are substitutes, and elasticity of substitution between any two goods is $\sigma > 1$. I_t^{kc} represents the set of importing goods from an exporting country, k. $\tilde{I}_t^c$ represents the available set of domestically produced goods and all other imported goods, $I^c{}_t (= I_t^{kc} \cup \tilde{I}_t^c)$ denotes the available set of goods for country c, and I_t $(= I_t^{kc} \cap \tilde{I}_t^c)$ denotes the set of exported goods that are common in both the set of country k and the set of domestically produced goods and all other imported goods. Y_t^c is the aggregate expenditure or income in country c.

The aggregate CES prices for all goods and for imported goods from country k in country c are

$$\Pi_t^c = \left[\sum_{i \in I_t^c} (p_{i,t}^{*c})^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \quad \text{and} \quad \Pi_t^{kc} = \left[\sum_{i \in I_t^{kc}} (p_{i,t}^{kc})^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \tag{2}$$

The aggregate CES prices for all goods and for imported goods from country k in the set, I_t, are

$$P_t^c = \left[\sum_{i \in I_t} (p_{i,t}^{*c})^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \quad \text{and} \quad P_t^{kc} = \left[\sum_{i \in I_t} (p_{i,t}^{kc})^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{3}$$

The aggregate CES function of quantities of country k's exported goods is described as

$$Q_t^{kc}\left(I_t^{kc}\right) = \left[\sum_{i \in I_t^{kc}} \left(q_{i,t}^{kc}\right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

The ratio of the CES functions over two sets of goods in country c equals the product of the Sato-Vartia index of goods that are common, $I_t = \left(\tilde{I}_t^{\,c} \cap I_t^{kc}\right) \neq \acute{\text{O}}$, multiplied by the terms reflecting the expenditure share of unique goods:[4]

$$\frac{\Pi_t^{kc}}{\Pi_t^c} = \prod_{i \in I_t} \left(\frac{p_{i,t}^{kc}}{p_{i,t}^c} \right)^{W_i(I_t)} \left(\frac{\lambda_t^{kc}(I_t)}{\lambda_t^c(I_t)} \right)^{\frac{1}{\sigma-1}}, \quad k, c = 1, \ldots C, \tag{4}$$

where the weights, $W_i(I_t)$, are constructed from the expenditure shares in two sets.[5]

$$W_i(I_t) = \left(\frac{s_{i,t}^{kc}(I_t) - s_{i,t}^c(I_t)}{\ln s_{i,t}^{kc}(I_t) - \ln s_{i,t}^c(I_t)} \right) / \sum_{i \in I_t} \left(\frac{s_{i,t}^{kc}(I_t) - s_{i,t}^c(I_t)}{\ln s_{i,t}^{kc}(I_t) - \ln s_{i,t}^c(I_t)} \right)$$

$$s_{i,t}^f(I_t) = p_{i,t}^f q_{i,t}^f / \sum_{i \in I} p_{i,t}^f q_{i,t}^f, \quad \text{for} \quad f = kc, c$$

$$\lambda_t^f(I_t) = \frac{\sum_{i \in I_t} p_{i,t}^f q_{i,t}^f}{\sum_{i \in I_t^f} p_{i,t}^f q_{i,t}^f} = 1 - \frac{\sum_{i \in I_t^f, i \notin I_t} p_{i,t}^f q_{i,t}^f}{\sum_{i \in I_t^f} p_{i,t}^f q_{i,t}^f}, \text{ for } \quad f = kc, c \tag{5}$$

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[4] Sato (1976) and Vartia (1976) show that the ratio of cost function can be evaluated using data on prices and quantities in two periods or two countries. Feenstra (1994) derives the exact price index from the CES unit cost function, allowing for new product varieties and taste or quality change.

[5] The numerator is the logarithmic mean of two shares of the two countries, and lies between these shares. The denominator is introduced so that the weight, $w_{i,t}$, sums to unity.

Comparing the aggregate prices of imported goods from country k relative to all available goods in country c requires an additional adjustment for the size of each set of goods, in addition to a weighted average of the price ratios in both sets of goods.

The solution for the demand for aggregate products, Q_t^{kc}, imported from country k from the preference maximization is

$$Q_t^{kc}\left(I_t^{kc}\right)=\frac{Y_t^c}{\Pi_t^c}\left[\frac{\Pi_t^{kc}}{\Pi_t^c}\right]^{-\sigma}. \tag{6}$$

To be consistent with the case of price index, in which this paper uses the conventional price index without the export variety term and the exact price index with the term, This paper adopts the export quantity, $\widetilde{Q}_t^{kc}\left(I_t\right)$, obtained by deflating nominal exports by $P_t^{kc}(I_t)$, rather than deflating by $\Pi_t^{kc}\left(I_t^{kc}\right)$. The quantity obtained with the artificially restricted range of variety $\left(I_t\right)$ is defined as

$$\widetilde{Q}_t^{kc}\equiv\frac{\sum_{i\in I_t^{kc}} p_{i,t}^{kc}q_{i,t}^{kc}}{P_t^{kc}}=\frac{V_t^{kc}}{P_t^{kc}}. \tag{7}$$

Deflating the nominal export by an exact export price aggregate gives the exact quantity:

$$\begin{aligned}\frac{V_t^{kc}}{\Pi_t^{kc}}&=Q_t^{kc}\left(I_t^{kc}\right)\\ V_t^{kc}&=\Pi_t^{kc}Q_t^{kc}\end{aligned} \tag{8}$$

Inserting (8) into (7) yields

$$\widetilde{Q}_t^{kc}\equiv\frac{\Pi_t^{kc}Q_t^{kc}}{P_t^{kc}}. \tag{9}$$

The exact export quantity obtained with the full range of varieties is

equal to the export quantity obtained with the artificially restricted range of varieties, times the adjustment.

$$Q_t^{kc}(I_t^{kc}) = \widetilde{Q}_t^{kc}(I_t)\left(\frac{P_t^{kc}}{\Pi_t^{kc}}\right) \tag{10}$$

Inserting equation (10) into equation (6) yields

$$\widetilde{Q}_t^{kc}\left(I_t\right) = \frac{Y_t^c}{P_t^{kc}}\left[\frac{\Pi_t^{kc}}{\Pi_t^c}\right]^{1-\sigma}. \tag{11}$$

I can define $\prod_{i\in I_t^{kc}}\left(\frac{p_{i,t}^{kc}}{p_{i,t}^{c}}\right)^{W_i(I_t^{kc})}$ as $\frac{P_t^{kc}(I_t^{kc})}{P_t^{c}(I_t^{kc})}$.

$$\frac{\Pi_t^{kc}}{\Pi_t^c} = \frac{P_t^{kc}}{P_t^c}\left(\frac{\lambda_t^{kc}(I_t)}{\lambda_t^c(I_t)}\right)^{\frac{1}{\sigma-1}} \tag{12}$$

Inserting equation (12) into (11) yields the import demand equation:

$$\widetilde{Q}_t^{kc}\left(I_t\right) = \frac{Y_t^c}{P_t^{kc}}\left[\frac{P_t^{kc}}{P_t^c}\left(\frac{\lambda_t^{kc}}{\lambda_t^c}\right)^{\frac{1}{\sigma-1}}\right]^{1-\sigma} \tag{13}$$

Let $\widetilde{I}_t^{\,c} = U_{k=1}^{K} I_t^{kc}$ be the complete set of varieties exported by country $k(k=1,....,K)$. The common set is $I_t^{kc} \cap \widetilde{I}_t^{\,c} = I_t^{kc}$, the set of goods exported by country k to country c. Therefore, from (5) I find that $\lambda_t^{kc}(I_t^{kc}) = 1$, and

$$V_t^{kc} \equiv P_t^{kc}\widetilde{Q}_t^{kc} = Y_t^c\left(P_t^{kc}\right)^{1-\sigma}\left(P_t^c\right)^{\sigma-1}\lambda_t^c \tag{14}$$

and

$$\lambda_t^c\left(I_t^{kc}\right)=\frac{\sum_{i\in I_t^{kc}} p_{i,t}^{k*}q_{i,t}^{k*}}{\sum_{i\in I_t^{k*}} p_{i,t}^{k*}q_{i,t}^{k*}}=1-\frac{\sum_{i\in I_t^{*},i\notin I_t^{kc}} p_{i,t}^{k*}q_{i,t}^{k*}}{\sum_{i\in I_t^{k*}} p_{i,t}^{k*}q_{i,t}^{k*}}.$$

The export variety from country k to country c is the total exports of country k that occur in the set in which country k exports to country c relative to the total export to all destinations. The term will be less than 1 if there are goods that are not exported to country c.[6]

Because of simultaneous bias from export quantities to export prices, this paper presents the reduced form, combining export supply and import demand. This paper follows Goldberg and Knetter (1997) and Gagnon (2003a, 2003b). The model incorporates the concept of pricing to market, so that export price $\left(P_t^{kc}\right)$ is weighted with the average costs of the exporting country $\left(P_t^k / e_t^{kc}\right)$ and the competitors' prices in the importing country $\left(P_t^c\right)$. P_t^k is the aggregate CES price index in exporting country k, and e_t^{kc} is the exchange rate, which is nominated as the amount of exporter currency per unit of importer currency. Parameter γ denotes the extent of pass-through in which $\gamma=1$ implies full pass-through (no pricing to market), and $\gamma=0$ implies no pass-through (complete pricing to market):

$$P_t^{kc}=\varphi\left(\frac{P_t^k}{e_t^{kc}}\right)^{\gamma}\left(P_t^c\right)^{1-\gamma} \tag{15}$$

The model of export supply (15) is substituted into the import demand (14) to obtain a reduced form. re_t^{kc} denotes the real exchange rate $\left(P_t^k / e_t^{kc}P_t^c\right)$:

$$P_t^{kc}=\varphi\left(\frac{P_t^k}{e_t^{kc}P_t^c}\right)^{\gamma}P_t^c=\varphi\left(re_t^{kc}\right)^{\gamma}P_t^c \tag{16}$$

[6] See Kang (2006) for detail.

The reduced form for estimation is

$$V_t^{kc} \equiv P_t^{kc}\widetilde{Q}_t^{kc} = \varphi^{1-\sigma} Y_t^c \left(re_t^{kc}\right)^{\gamma(1-\sigma)} \lambda_t^c . \tag{17}$$

With reasonable values of $\sigma > 1$ and $0 < \gamma < 1$, the coefficient on the real exchange rate is negative. It depends on the elasticity of substitution (σ) and the extent of pass-through (γ).

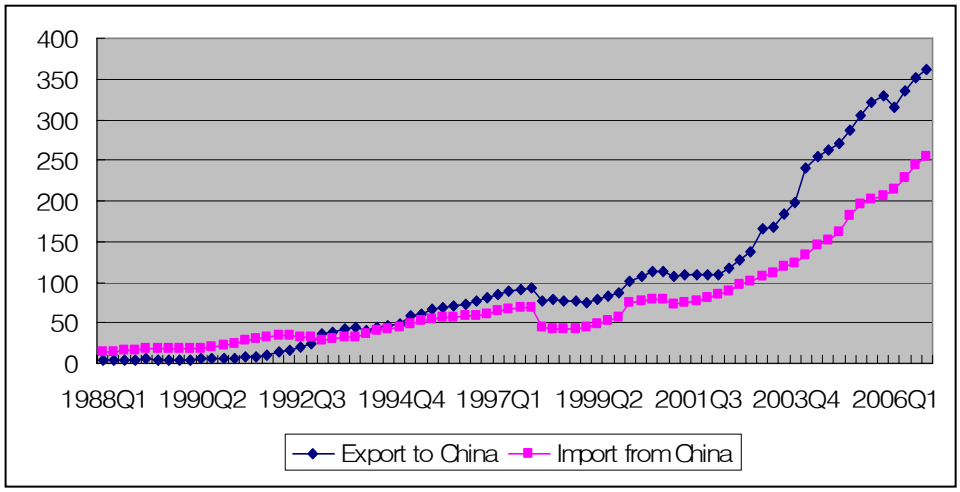
In the standard import demand equation, the variety terms $\left(\lambda_t^c\right)$ is omitted. The omission of the variety terms in the import equation makes the estimators biased. Furthermore, other studies have tried to implement the supply-cum-variety measure using several variables. This paper uses an import demand equation with the direct measures of trade variety that are consistent with an underlying CES aggregator function. In addition, to control for increasing effects of FDI on trade, the model is augmented with FDI in the next empirical section.

III. ESTIMATING RESULTS

3.1 Data

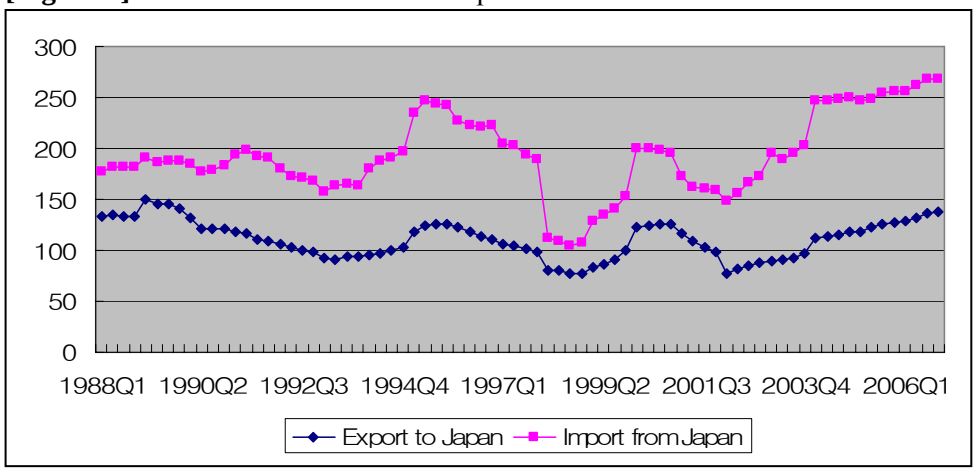
Data on trade are from the Korea International Trade Association, and data on income, consumer price index, and nominal exchange rate are obtained from International Financial Statistics (IFS). Data on Korea's outward FDI are from the Export-Import Bank of Korea, and inward FDI are from Ministry of Commerce, Industry and Energy. Estimation for Korean trade flows with China is implemented on data spanning two periods because of data availability. Data on China's nominal GDP are obtained from CEIC database (1992-2006). The quarterly data on Chinese real GDP are not available from International Financial Statistics or official institutions, but available in Rajaguru and Abeysinghe (2004), which ranges from 1987 to 2002. The calculation of trade variety is based on Korean export and import data by the Korea Customs Research Institute. Export and import products are classified according to the ten-digit Harmonized System (HS).

[Figure 1] Korea's Trade Flows with China



Note: One hundred million US dollars.

[Figure 2] Korea's Trade Flows with Japan



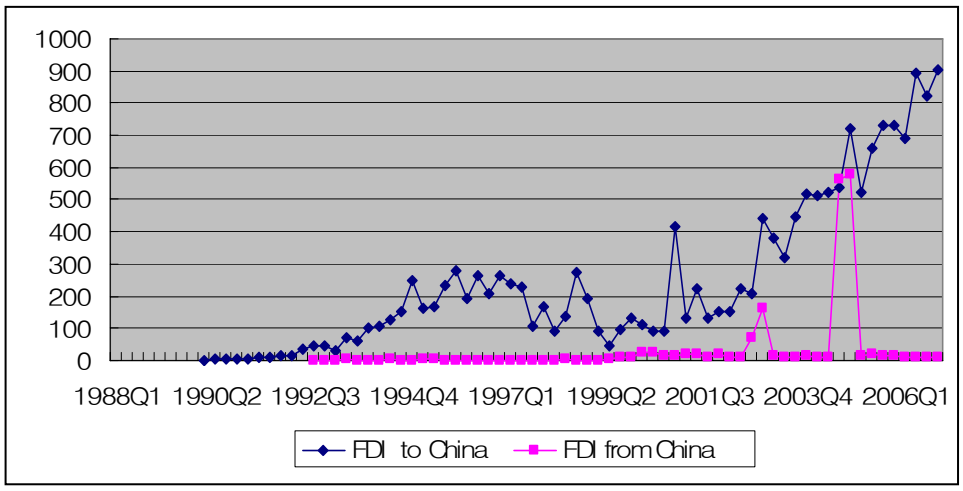
Note: One hundred million US dollars.

Export and import data are measured in current dollars and deflated by CPI. Figure 1 presents Korea's trade flows with China, which are seasonally adjusted. The export and import have increased, and experienced the largest increase in the 2000s. The net trade has been in the surplus and has been more than $10 billion recently. For Korea's trade with Japan, the net trade has been in deficit over recent years as shown in Figure 2. This section investigates that the widening of trade surplus in Korea's trade with China, and the continuity of deficit in that with Japan

is related to the Houthakker-Magee asymmetry in income elasticities.

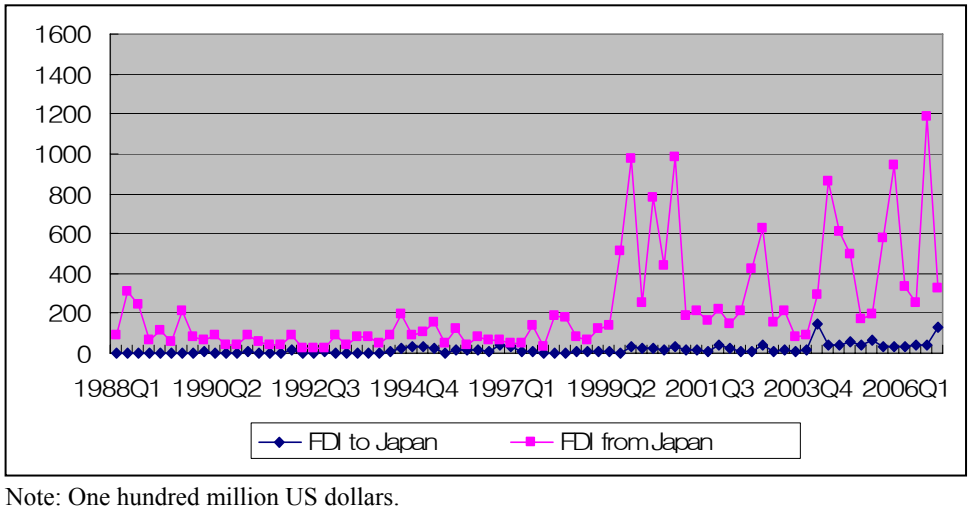
Figure 3 shows the trend of outward FDI to China and inward FDI from China. The increase in outward FDI has been particularly large. However, inward FDI from China has remained low. For Japan, inward FDI has increased sporadically in the 2000s, while outward FDI tends to be at a low level. It is important to examine the sign of the relationship linking trade and FDI.

[Figure 3] FDI to/from China



Note: One hundred million US dollars.

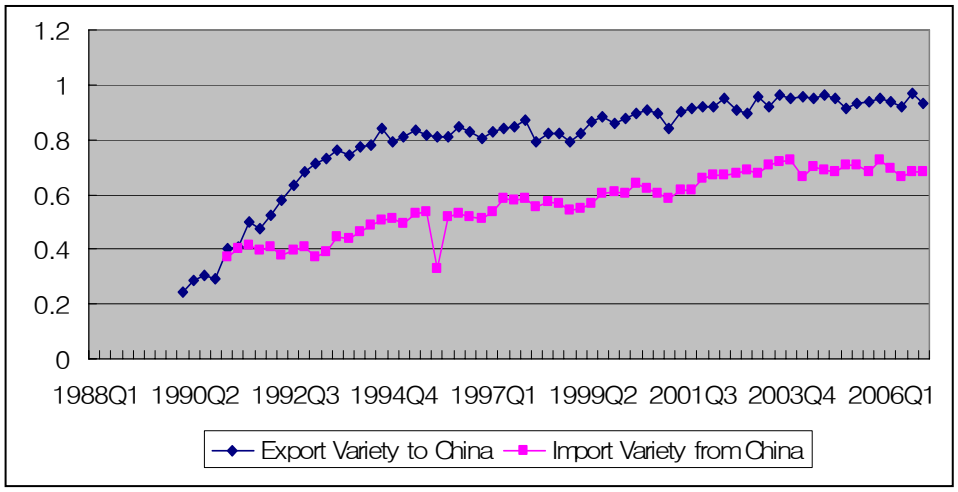
[Figure 4] FDI to/from Japan



Note: One hundred million US dollars.

Figure 5 shows the trend of the varieties in Korea's trade flows with China. The export and import varieties have increased over the past years, and the level of export variety is higher than that of import variety. Figure 6 shows the trend of the export and import varieties in Korea's trade flows with Japan. The export and import varieties have remained relatively high with a noticeably high level of export variety. We expect that the puzzling differences in estimated income elasticities of export and import that has been mentioned since Houthakker and Magee (1969) would be affected by the use of this variety measure.

[Figure 5] Export/Import Variety to/from China



[Figure 6] Export/Import Variety to/from China

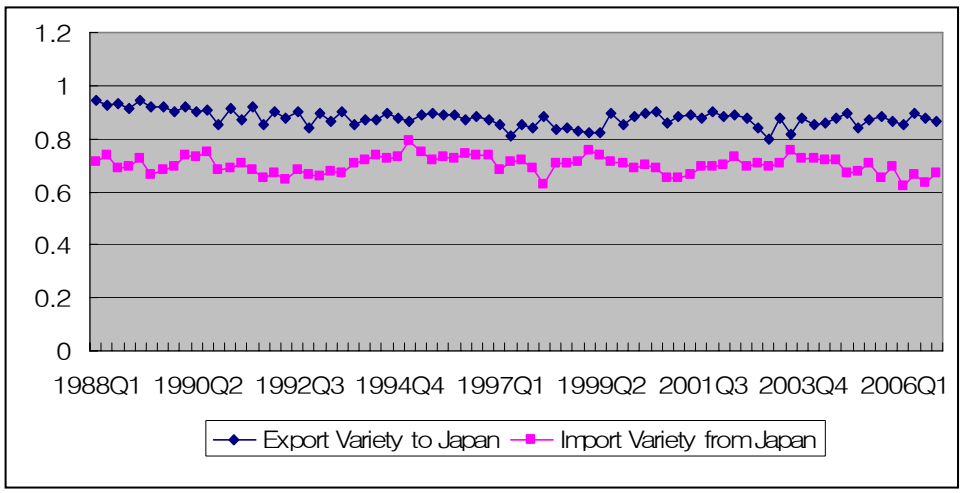
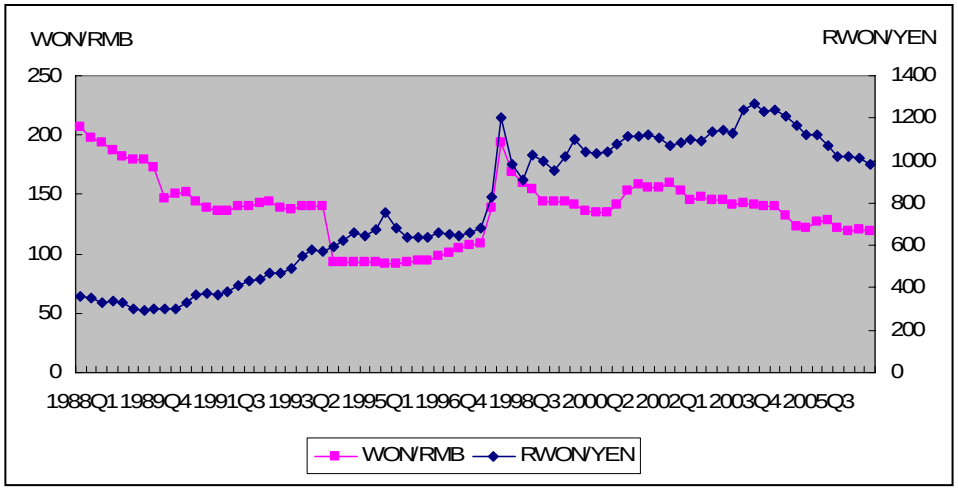


Figure 7 represents the nominal exchange rate between won and renminbi, and the real exchange rate between won and yen. WON/YEN real exchange rates are calculated as Korea and Japan CPI. An increase in this variable represents a depreciation of the won, which increases export and decreases import.

[Figure 7] WON/RMB and WON/YEN Exchange Rate



Note: WON/RMB: Nominal Exchange Rate between WON and Renminbi; RWON/YEN: Real Exchange Rate between WON and YEN.

3.2 OLS Estimation Results

This paper first presents the OLS estimation results. The equations are re-expressed by augmenting the equation (17) with the investment variable for export and import. Many variables are non-stationary in levels, but nearly all variables are stationary by the procedure of the first difference.[7] All variables are measured in natural logs and first-differenced.

$$ex_t = \alpha_0 + \alpha_1 y_t^c + \alpha_2 re_t + \alpha_3 \lambda_t^k + \alpha_4 inv_t^k + \varepsilon_{ex,t} \quad (18)$$

$$im_t = \beta_0 + \beta_1 y_t^k + \beta_2 re_t + \beta_3 \lambda_t^c + \beta_4 inv_t^c + \varepsilon_{im,t} \quad (19)$$

[7] According to the augmented Dicky-Fuller test, the first differences of all variables except real Chinese GDP are stationary.

where ex_t represents export in period t, y_t^c represents import country c's income, re_t represents the bilateral real exchange rate, λ_t^k represents exporting country k's export variety, and inv_t^k represents country k's investment to country c.

[Table 1] OLS Estimates for Korea's Trade Flows with China

Dependent Variables		Independent Variables				R-Squared
		Income	Exchange Rate	Variety	Investment	
EXPORT	China Nominal GDP (1992-2006)	1.68* (0.07)	0.21 (0.24)			0.90
		1.58* (0.13)	0.18 (0.24)	0.64 (0.68)		0.90
		1.48* (0.18)	0.05 (0.30)	0.52 (0.70)	0.09 (0.11)	0.90
	China Real GDP (1987-2002)	3.31* (0.10)	1.35* (0.19)			0.94
		2.45* (0.19)	0.63* (0.23)	1.05* (022)		0.94
		2.29* (0.22)	0.40 (0.29)	0.69** (0.34)	0.14 (0.10)	0.95
IMPORT	Korea Nominal GDP (1992-2006)	2.79* (0.10)	0.02 (0.28)			0.82
		2.83* (0.39)	-0.55*** (0.33)	1.41*** (0.78)		0.80
		2.27* (0.41)	-0.94* (0.32)	1.58* (0.71)	0.02 (0.05)	0.80
	Korea Real GDP (1987-2002)	4.40* (0.15)	-0.06 (0.22)			0.85
		4.82* (0.44)	-0.34 (0.26)	1.35* (0.53)		0.85
		4.04* (0.47)	-0.51* (0.27)	1.10** (0.51)	-0.01 (0.04)	0.88

Note: * significant at 1%, ** significant at 5%, *** significant at 10%.

Table 1 presents results from the OLS estimation for Korea's trade flows with China. Turning first to Korea's export to China, the results are favorable. The Chinese income elasticity, measured by using China's nominal GDP (1992-2006), was reduced from 1.68 to 1.48 with the addition of variety and investment variables, which is highly significant.

The elasticity estimates of exchange rate are of the expected sign, but are statistically insignificant. The coefficients for export variety and Korea's investment to China are insignificant. The Chinese income elasticity, measured by using China's real GDP (1987-2002), was reduced from 3.31 to 2.27 with the addition of the variables, which is highly significant. The coefficients for exchange rate and export variety are significant. Turning next to Korea's import from China, the coefficient for income was decreased from 2.79 to 2.27 with the inclusion of variety and investment. The coefficients for variety are significant, which implies that the increase in Korea's import from China is highly attributed to the increase in import variety. The income elasticity of Korean demand for Chinese goods has been 2 times as large as that of Chinese demand for Korean goods.

[Table 2] OLS Estimate for Korea's Trade Flows with Japan

Dependent Variables	Independent Variables				R-Squared
	Income	Exchange Rate	Variety	Investment	
EXPORT	0.84* (0.24)	1.09* (0.01)			0.99
	0.73* (0.24)	1.09* (0.01)	0.78* (0.20)		0.99
	0.70* (0.24)	1.09* (0.01)	0.85* (0.20)	0.01** (0.00)	0.99
IMPORT	1.91* (0.21)	-0.89* (0.03)			0.96
	1.93* (0.21)	-0.90* (0.03)	0.18** (0.07)		0.97
	1.86* (0.24)	-0.91* (0.03)	0.16** (0.08)	-0.01 (0.02)	0.97

Note: * significant at 1%, ** significant at 5%, *** significant at 10%.

Table 2 presents results from the OLS estimation for Korea's trade flows with Japan. The income elasticity for Korea's export to Japan was reduced from 0.84 to 0.70 with the inclusion of variety and investment terms. The elasticity estimates of exchange rate are of the expected sign and statistically significant. For import from Japan, the income elasticity of the Korean demand for Japanese goods was reduced from 1.91 to 1.86.

Most of the coefficients are significant, and an interesting finding is that the coefficient for investment is negative, which implies that Japanese export and investment to Korea is in the substitute relationship. The income elasticity of Korean demand for Japanese goods has been two to three times as large as that of Japanese demand for Korean goods.

3.3 The Stock-Watson Dynamic OLS Results

The parameter estimates in the OLS approach can be biased in small samples as well as in the presence of dynamic effect. Stock and Watson (1993) suggests an alternative approach.[8] The Stock and Watson dynamic OLS method is a robust single-equation approach that corrects for endogeneity by the inclusion of leads and lags of first differences of the regressors, and for serially correlated error by a GLS procedure. The following equations are re-expressed by augmenting equations (18) and (19) with leads and lags of the differences of the regressors. The estimating equations have the following form:

$$ex_t = \alpha_0 + \alpha_1 y_t^c + \alpha_2 re_t + \alpha_3 \lambda_t^k + \alpha_4 inv_t^k + \sum_{n=-4}^{2} \delta_n \Delta y_{t+n}^c + \sum_{n=-4}^{2} \varphi_n \Delta re_{t+n} + \sum_{n=-4}^{2} \phi_n \Delta \lambda_{t+n}^k + \sum_{n=-4}^{2} \varsigma_n inv_{t+n}^k + \varepsilon_{ex,t} \quad (20)$$

$$im_t = \beta_0 + \beta_1 y_t^k + \beta_2 re_t + \beta_3 \lambda_t^c + \beta_4 inv_t^c + \sum_{n=-4}^{2} \gamma_n \Delta y_{t+n}^k + \sum_{n=-4}^{2} \eta_n \Delta re_{t+n} + \sum_{n=-4}^{2} \mu_n \Delta \lambda_{t+n}^c + \sum_{n=-4}^{2} \tau_n \Delta inv_{t+n}^c + \varepsilon_{im,t} \quad (21)$$

Table 3 presents results from the dynamic OLS estimation. The Chinese income elasticity, measured by using China's nominal GDP (1992-2006), was reduced from 1.68 to 1.21 with the addition of supply shift variables, which is highly significant. The coefficient for investment

[8] The stock and Watson (1993) approach has advantages over the maximum likelihood procedures, because the Johansen method is exposed to the problem that estimates in one equation are affected by any misspecification in other equations.

is significant and positive, which implies that Korea's export and investment to China is a complementary relationship. The elasticity estimates of exchange rate are of the expected sign, but are statistically insignificant. The Chinese income elasticity, measured by using China's real GDP (1987-2002), has been reduced from 3.26 to 1.99 with the addition of variety and investment terms. The coefficients for exchange rate are insignificant. The coefficients for variety are significant, which implies that the increase in Korea's export from China is highly attributed to the increase in export variety. For Korean import from China, the coefficients are similar in the inclusion of variety and investment variables.

[Table 3] Stock-Watson DOLS Estimate for Korea's Trade Flows with China

Dependent Variables		Independent Variables				R-Squared
		Income	Exchange Rate	Variety	Investment	
EXPORT	China Nominal GDP (1992-2006)	1.68* (0.07)	0.70 (0.50)			0.96
		1.51* (0.19)	0.76 (0.66)			0.96
		1.21* (0.11)	0.41 (0.84)	0.84 (2.00)	0.11*** (0.55)	0.97
	China Real GDP (1987-2002)	3.26* (0.07)	0.24 (0.46)			0.98
		1.28* (0.38)	0.10 (0.29)	2.43* (0.55)		0.99
		1.99* (0.68)	0.19 (0.37)	1.38*** (0.79)	0.04 (0.11)	0.99
IMPORT	Korea Nominal GDP (1992-2006)	2.72* (0.09)	-0.65 (0.59)			0.96
		2.50* (0.26)	-0.47 (0.58)	0.37 (0.52)		0.98
		2.73* (0.33)	-0.79 (0.69)	1.14** (0.53)	0.01 (0.04)	0.99
	Korea Real GDP (1987-2002)	4.15* (0.08)	-0.24 (0.44)			0.97
		4.04* (0.38)	-0.52 (0.52)			0.98
		4.08* (0.45)	-0.64 (0.58)	0.20 (0.52)	-0.00 (0.04)	0.99

Note: * significant at 1%, ** significant at 5%, *** significant at 10%.

Table 4 presents results from dynamic the OLS estimation for Korea's trade flows with Japan. The estimating results are similar with the OLS results in Table 2. The income elasticity of Japanese demand is reduced from 0.92 0.59, and the income elasticity of Korean demand for Japanese goods is reduced from 2.71 to 1.75. The income elasticity of Korean demand for Japanese goods has been three to four times as large as that of Japanese demand for Korean goods was. The elasticity of the exchange rate in Korean export is 0.84, and -1.30 in Korean import.

[Table 4] Stock-Watson DOLS Estimate for Korea's Trade Flows with Japan

Dependent Variables	Independent Variables				R-Squared
	Income	Exchange Rate	Variety	Investment	
EXPORT	0.92* (0.33)	0.86* (0.08)			0.99
	0.84* (0.38)	0.85* (0.10)	0.80** (0.37)		0.99
	0.59** (0.28)	0.84* (0.09)	0.89** (0.41)	0.05* (0.01)	0.99
IMPORT	2.71* (0.41)	-1.15* (0.18)			0.97
	2.54* (0.43)	-1.33* (0.18)	0.58* (0.13)		0.98
	1.75* (0.45)	-1.30* (0.17)	0.39* (0.13)	-0.14* (0.03)	0.99

Note: * significant at 1%, ** significant at 5%, *** significant at 10%.

There are several interesting findings from the above estimating results. The first important finding is that the exclusion of variety and investment terms leads to overestimation of the income elasticity. The previous import demand has been mis-specified by the exclusion of the terms. The second important finding is that the asymmetry, the Houthakker and Magee finding, persists for Korea's trade flows with China and Japan, even with the inclusion of the direct measure of the trade variety terms. The Korean income elasticity for Chinese and Japanese goods is larger than the Chinese and Japanese income elasticity for Korean goods.

The third finding is that the variety in Korea's trade flows with China

and Japan has played a key role in the increase in trade value.[9] The fourth finding is that the exchange rate effects are different in trade flow with China and Japan. Because of the Chinese fixed exchange rate, the coefficients of exchange rate are not significant. The import from Japan is more susceptible to the movement of exchange rate than export to Japan. Finally, the coefficients for Korean investment to China are positive and significant in the case of using the recent data period (1992-2006). Korean export and investment to China are complementary. For Japan, outward FDI is positively related to export, while the inward FDI is negatively related to import. To put it in other words, the increase in outward FDI raises export while the increase in inward FDI lowers import.

IV. CONCLUSIONS AND THE DIRECTION FOR FURTHER RESEARCH

Empirical modeling of the determinants of trade flows using the elasticities approach has a very long history in international economics, and is used both to explain the past and project the future. The big benefit from obtaining an unbiased estimator is that better prediction might be possible and debates on international policies are due to the different beliefs in the value of trade elasticities.

This paper finds estimates from the import demand equation with supply shift variables to affect the import propensities, which are not included in the standard import demand equation. The omission of those variables overestimates income elasticity, because trade can be affected by the enhancement of the supply capacity. The possible variables may be trade variety and FDI. Because of the two possible variables, the demand curve shifts out.

The standard import demand equations based on the Armington assumption (1969), in which each country produces a single good, have been criticized because of the mis-specification due to the omission of variety terms. The increased capacity in supply allows the country to produce more varieties. In terms of demand, consumers love varieties.

[9] Kang (2006) shows that export from Korea to the world has shown the increasing extensive margin (export variety), using the World Trade Flows data with 4-digit categories compiled by Feenstra et al. (2000).

Krugman (1989) argues that economic growth leads to product proliferation with increasing returns to scale, and consumers demand many varieties of the differentiated good, which is the so-called "love of variety". The demand curve shifts out because the demand for a country's export is directly tied to the number of varieties it produces.

Many previous papers have used a proxy for the varieties of goods in import demand in order to correct the bias that arises from ignoring product proliferation. This paper uses an import demand equation that incorporates the direct measures of export variety for obtaining unbiased income elasticities for Korea's trade flows with China and Japan. Due to the rise of the role of FDI in trade, this paper augments the import demand equation with investment terms. Hence, it is possible to allow for FDI as a determinant of import propensities. The demand curve shifts out because the demand is directly tied to FDI . Particularly in the vertical FDI, the demand curve shifts out because the complementary relationship is dominant.[10]

This paper shows that the income elasticities for export and imports are quite high from the regressions only with GDP and exchange rate, and the inclusion of terms such as product variety and FDI reduces the magnitude of the income elasticity. However, the asymmetry in the Houthakker and Magee finding persists for Korea's trade flows with China and Japan. The new elasticities yield insights into the evolution of the trade surplus in Korea's trade with China, and its deficit in that with Japan, given that the Houthakker-Magee asymmetry persists. The trade surplus in Korea's trade with China is to be small, and its deficit with Japan is to be large.

Various papers show that trade patterns significantly depend on commodity composition and trading partners. In future research, one needs to prepare estimates for the elasticity of trade flow using disaggregating data sorted by groups such as normal or luxury goods, capital or consumer goods in end-use classification, and homogeneous or differentiated goods in Rauch (1999) classification. The next research

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[10] The author would like to thank the referee for this. He (or she) mentioned the possibility that FDI between China, Korea, and Japan is typically characterized as vertical FDIs, which result in the fragmentation of industries with the sharp increase in intra-firm trade in intermediate goods. The sharp increase in intra-firm trade in intermediate goods reduces the income elasticity of import in North East Asian trade.

must to review the estimates for the other countries, particularly the US, because the analysis or the asymmetry puzzle is inspired by the widening of the trade deficit of the US.

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