The Determinants of Korea’s Terms of Trade: The Real-Side Approach*

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Previous studies of the determinants of the terms of trade have typically failed to fully reflect the composition of imports and exports and the unique characteristics of trading partners, which have considerable influence on the terms of trade. In particular, most studies of Korea’s terms of trade have focused only on the effects of the exchange rate on the terms of trade, and few studies have considered the supply or demand side, i.e., the real side. This study considers panel data on Korea’s trading partners from 2000 to 2009 (excluding the period of the Korean foreign exchange crisis) to propose a model reflecting both the trading partner’s characteristics as well as the share of manufactured goods in exports and the share of fuel products in imports and provides an analysis of the determinants of Korea’s terms of trade by considering the individual features of each product. The proposed dynamic panel model of the effects of the terms of trade for the previous period on the terms of trade for the current period provides more consistent estimates. By using the system generalized method of moments, the proposed model can estimate the determinants of Korea’s terms of trade from the real-side perspective. The results indicate that an increase in the lagged terms of trade, relative market potential, or relative per capita income improved Korea’s terms of trade, whereas an increase in relative output or the share of fuel products in imports weakened the terms of trade, providing support for common theory. However, an increase in the share of manufactured goods in exports had a negative effect (although not significant) on Korea’s terms of trade, providing no support for the Prebisch-Singer hypothesis.

Keywords: Net Barter Terms of Trade, Prebisch-Singer Hypothesis, System GMM
JEL Classification: F12, F14, O12

* Authors are grateful for helpful comments from the anonymous referees. This work was supported by the National Research Foundation of Korea Grant, funded by the Korean government (NRF-2010-332-B00054). All remaining errors are our own.
교역조건 결정요인에 관한 기존의 많은 연구에서는 교역조건에 절대적으로 영향을 미치는 수출입 상품의 구성과 교역상대국의 특성을 잘 반영하지 못한 단점이 있다. 특히 한국의 교역조건에 대한 기존 연구는 대부분 환율변수가 교역조건에 어떠한 영향을 미치는지에 초점을 맞추고 있으며 수출가격과 수입가격에 영향을 미치게 되는 공급 측면과 수요 측면, 즉 실물 측면에서의 분석은 전무하다. 따라서 본 연구에서는 한국의 교역상황을 대상으로 외환위기 기간을 제외한 2000년부터 2009년까지의 패널 자료를 구축하여 교역상대국의 특성을 반영함과 동시에 제조업 수출비중과 연료 수입비중을 모형에 포함시킴으로써 교역상품의 특성을 고려하여 교역조건의 결정요인을 분석하였다. 특히 본 연구에서는 교역조건 결정요인의 실물부문을 중심으로 추정하기 위해 전기의 교역조건이 현재의 교역조건에 영향을 미치는 동태 패널 모형을 설정하고, 시스템 GMM 방법을 이용하여 한국의 교역조건 결정요인을 실물부문을 중심으로 추정하였다. 분석결과 전기의 교역조건, 상대적인 시장잠재력, 상대적인 1인당 생산량의 증가는 교역조건을 향상시키는 것으로, 상대적인 생산량과 연료 수입비중의 증가는 교역조건을 악화시키는 것으로 분석되어 일반적인 이론과 일치하는 결과를 얻었다. 그러나 제조업 수출비중의 증가는 비록 유의하지는 않았으나 교역조건을 악화시키는 것으로 분석되어 프레비쉬-싱거 가설과 다르게 분석되었다.

핵심용어: 순상품교역조건, 프레비쉬-싱거 가설, 시스템 GMM
JEL 분류: F12, F14, O12
I. Introduction

The “terms of trade” refers to the rate at which the product of one country is exchanged with the product of another country. The terms of trade is the unit of imported products that are attained via one unit of export product, and represents the purchasing power of exports. The terms of trade have generally been classified into the “net barter terms of trade” and the “income terms of trade”. In general, however, the terms of trade refer to the net barter terms of trade and are measured by the ratio of the price of exports to that of imports.\(^1\)\(^2\)

According to the Prebisch-Singer hypothesis, the terms of trade are more likely to decline for a country producing mainly primary products than for that producing mainly manufactured goods. This is because the price elasticity of primary products is lower than that of manufactured goods, which can result in an increase in demand for manufactured goods and a drop in demand for primary products when there is an increase in income. As a result, the export price of manufactured goods increases, whereas that of primary products decreases, resulting in a deterioration of the terms of trade. Thus, according to this hypothesis, a country’s terms of trade are strongly influenced by the type of its exports.

In addition, a country’s terms of trade are influenced by its trading partners. Assuming that goods from the manufacturing industry are exported in both cases, advanced countries are more likely to export value-added products than

1) According to Kim and Kim (2005),

\[
\begin{align*}
\text{net barter terms of trade} & \equiv \frac{\text{export unit value index}}{\text{import unit value index}} \times 100 \\
\text{income terms of trade} & \equiv \frac{\text{export amount index}}{\text{import unit value index}} \times 100 \\
\text{net barter terms of trade} & \times \text{export volume index}
\end{align*}
\]

Here, the export amount is the result of multiplying the export unit value with volume, and as a result the income terms of trade becomes equal to the result of multiplying the net barter terms of trade with the export volume index.

2) Hereupon in this paper, the “terms of trade” shall refer to the “net barter terms of trade.”
developing ones because they are able to develop and sell new products faster. Thus, an advanced country’s terms of trade are likely to exceed that of a developing country. This indicates that a country’s terms of trade are influenced by its trading partners. In sum, a country’s terms of trade can vary according to the composition of its imports and exports and the characteristics of its trading partners.

[Figure 1] shows the trends in Korea’s terms of trade from 1988 to 2010. There were considerable fluctuations in the country’s terms of trade during this period. Until the mid-1990s, the export/import unit value index was relatively stable, with the terms of trade indicating approximately 170. However, since then, Korea’s terms of trade decreased steadily.3) In this regard, this paper examines the factors that influenced these fluctuations in the terms of trade, i.e., the determinants of the terms of trade. A number of factors can influence the terms of trade. However, as discussed earlier, the terms of trade refer to a ratio of the price of exports to that of imports. Therefore, an increase in the relative output of a country can reduce the price of exports, undermining the country’s terms of trade. On the other hand, an increase in the market potential of a country’s trading partner can increase the demand for exports, improving the country’s terms of trade. In this regard, this paper examines the determinants of Korea’s terms of trade by using empirical analysis, focusing on the real side, i.e., the supply and demand sides, among many factors influencing the terms of trade.

3) Such a declining trend can be attributed to the simultaneous influence of the drop in the unit price of exports and rise in the unit price of imports. Up until the early 2000s, the terms of trade dropped drastically due to the fall in the export unit value index. From the mid to later 2000s, the terms of trade continued to fall with the rise in the import unit value index.
Figure 1. Korea’s Import/Export Unit Value Index and Net Barter Terms of Trade from January 1988 to July 2010

A number of studies have examined the determinants of the terms of trade in various contexts, but few have sufficiently reflected the composition of exports and imports and the characteristics of trading partners, which may have considerable influence on the terms of trade. Although Baxter and Kouparitsas (2000) conducted an analysis by considering the good price effect and the country price effect, their study cannot be considered as an analysis of the determinants of the terms of trade. In particular, previous studies in Korea have typically employed time series data and thus failed to reflect the characteristics of exports/imports and trading partners. Most studies of Korea’s terms of trade have focused only on the effects the exchange rate on the terms of trade, ignoring the effects of the real side, i.e., the supply and demand sides, on export and import prices (Kim 1997; Cho, Kim and Kim 2002; Kim and Kim 2005; Kang 2008).4) Thus, the present paper contributes to the literature by

4) As a matter of fact, most of previous studies focus on analyzing the pass-through effect of exchange rate on terms of trade, exploiting time-series analysis (such as structural VAR). However, this paper adopts the panel model, so including won/dollar or won/yen exchange rate will be of no use because it will be regarded as a fixed effect
closing this gap in previous research.

Debaere and Lee (2003) is relevant for this paper. Debaere and Lee (2003) conducted a panel analysis using data from 51 countries for the 1970-1988 period to identify the determinants and found that an increase in the relative output of a country led to a decrease in the price of exports, which weakened the terms of trade, whereas an increase in the market potential of the country led to an increase in demand for exports, which improved the terms of trade.

To take into consideration the characteristics of trading partners and exports/imports, which may have considerable influence on the terms of trade, this paper employs panel data on Korea’s trading partners to control for country’s characteristics and to include the share of manufactured goods in exports and the share of fuel products in imports in the model. In contrast to previous studies, this study introduces a mechanism through which changes in supply- and demand-side conditions influence export and import prices to eventually determine the terms of trade, thereby analyzing the determinants of Korea’s terms of trade based on the real side. The rest of this paper is organized as follows: Section II introduces the analytical model, and Section III provides the calculation of the terms of trade (the ratio of the export price to the import price) and discusses the data. Section IV presents the results, and Section V concludes with some important implications.

II. Analytical Model

As discussed earlier, this paper follows the model of Debaere and Lee

and eliminated in the actual model. Of course, it is natural to remove the part of change, which is resulted from volatile exchange rate, so as to calculate the terms of trade, but this work might be completely different area from that of our purpose. Moreover, the effect of exchange rate is eliminated while calculating the terms of trade even though currency unit is unified as Korean won for terms of trade not to be affected by exchange rate. Therefore, the effects of the exchange rate on the terms of trade are not considered in this paper.
(2003), theoretically explaining the determinants of the terms of trade by considering the real side. As shown in [Figure 2], they suggested that a country’s terms of trade are determined by its relative output and market potential. That is, because its relative output and market potential represent global supply and demand, respectively, the terms of trade are determined by the equilibrium point where the two meet.

This approach to the determination of the terms of trade can be expressed as Equation (1), which implies that the terms of trade can be determined by the country’s relative output and market potential. Here an increase in the country’s relative output, which represents global supply, exacerbates the terms of trade because it shifts the global supply curve to the right, and its coefficient (\( \alpha_1 \)) is negative (-). By contrast, an increase in the country’s relative market potential, which represents global demand, improves the terms of trade because it shifts the global demand curve to the right, and its coefficient (\( \alpha_2 \)) is positive (+).

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5) Equation (1) means the multilateral terms of trade in country \( i \). See Appendix and Debaere and Lee (2003) for details of generating process.
\[ \ln TOT_{it} = \alpha_{0i} + \alpha_1 \ln \frac{X_{it}}{\prod_{j \neq i} X_{jt}^{MS_j}} + \alpha_2 \ln RMP_{it} + \epsilon_{it} \]  \hspace{1cm} (1) \\

where \( TOT \) is the multilateral terms of trade; \( \alpha_{0i} \) is country \( i \)'s fixed effect; \( \frac{X_{it}}{\prod_{j \neq i} X_{jt}^{MS_j}} \) is the relative output; \( X \) is the output; \( MS_j \) indicates the share of country \( j \) out of country \( i \)'s total import; \( RMP \) is the relative market potential; \( i \) is the base country; \( j \) is the trading partner; \( t \) is the year; and \( \epsilon_{it} \) is the independent and identically distributed random variable \( \epsilon_{it} \sim i.i.d. N(0, \sigma^2_\epsilon) \).

The equation (1), however, is the multilateral terms of trade. Since we want to test the determinants of a specific country’s terms of trade, Korea, we have to transfer equation (1) to bilateral terms of trade between Korea and Korea’s trade partners. So that we calculate export and import price of Korea to trade partners. First of all, a country’s export price is identical to each trade partner. Therefore Korea’s export price to trading partner \( n \) (\( P_{knt}^X \)) is equal to the Korea’s export price to world (\( P_{kt}^X \)) (see the equation (A3) in appendix).

\[ P_{knt}^X = P_{kt}^X = \frac{1}{\beta_k} X_{kt}^{\sigma} \left[ \frac{1}{\sigma} \sum_m t_{km}^{1-\sigma} y_{mt}^{\sigma} \right]^{\frac{1}{\sigma}} \]  \hspace{1cm} (2) \\

where \( \sum_m t_{km}^{1-\sigma} y_{mt}^{\sigma} \) is a country \( k \)'s market potential; \( k \) is Korea; \( n \) (excluding \( k \)) and \( m \) (including \( k \)) are trade partners of Korea; \( \beta_k, \sigma, t_{km}, y_{mt} \) and \( P_{mt}^f \) are same as the case of multilateral terms of trade in appendix.

A similar argument of multilateral terms of trade in appendix applies to the Korea’s imports price to world (\( P_{kt}^M \)). If we consider bilateral terms of trade between Korea and Korea’s trading partners, Korea’s import price to all trading
partner \( n \) \( (P_{knt}^M) \) is equal to export price of trading partner \( n \) weighted by import share \( (p_{nt}^{MS_{nt}}) \). In other word, Korea’s import prices are weighted average for exports price of all trading partner \( n \) \( (p_{nt}) \) with respect to import share \( (MS_{nt}) \) as derived the equation (A4) in the appendix. Therefore, we can obtain Korea’s import price as follows.

\[
P_{knt}^M = p_{nt}^{MS_{nt}} = (X_{nt}^{MS_{nt}})^{-\frac{1}{\sigma}} (\beta_n^{MS_{nt}} [\sum_m t_{nm} (1-\sigma) y_{mt}^{MS_{nt}}])^{-\frac{1}{\sigma}}
\]

Consequently, the bilateral terms of trade of Korea is drawn as the Equation (4) by dividing Equation (2) by Equation (3).

\[
\ln \left( \frac{P_{knt}^X}{P_{knt}^M} \right) = \ln (TOT_{knt}) = \frac{1}{\sigma} \ln \left( \frac{\beta_t}{\beta_n^{MS_{nt}}} \right) - \frac{1}{\sigma} \ln \left( \frac{X_{kt}}{X_{nt}^{MS_{nt}}} \right) + \frac{1}{\sigma} \ln \frac{MP_{kt}}{MP_{nt}^{MS_{nt}}}
\]

where \( MP_{kt} = \sum_m t_{km} (1-\sigma) y_{mt} P_{nt}^{1-\sigma} \), \( [\sum_m t_{km} (1-\sigma) y_{mt}^{MS_{nt}}]^{MS_{nt}} \)

The output \( (X) \) can be easily estimated by using GDP. However, a country’s market potential is difficult to measure. Harris (1954) attempted to calculate market potential by examining the selection of FDI sites. Krugman (1992), Redding and Venables (2004), and Head and Mayer (2004) recently refined this methodology. In particular, Head and Mayer (2004) measured the actual market potential. The present study measures market potential by using this methodology, that is, Equation (5) (Krugman market potential).

\[
MP_r = \sum_s \phi_{rs} WE_s
\]
where $MP_r$ is exporting country $r$’s market potential; $\phi_{rs}$ is the degree of market accessibility between exporting country $r$ and importing country $s$; and $WE_s$ is importing country $s$’s competition-weighted expenditure.

In addition, $\phi_{rs}$ and $WE_s$ in Equation (5) are calculated using the coefficients estimated from Equation (6). Thus, market accessibility and competition-weighted expenditure can be calculated from $\phi_{rs} = d_{rs}^\delta \exp[(\beta_s + \lambda L_{rs})B_{rs}]$ and $WE_s = \exp(\chi_s)$, respectively. Through this method, a country’s relative output and market potential are measured, and then Equation (4) is used to analyze the determinants of the country’s terms of trade.

$$\ln EX_{rs} = \chi_r + \chi_s + \delta \ln d_{rs} + \beta_s B_{rs} + \lambda L_{rs} B_{rs} + \epsilon_{rs}$$ (6)

where $EX_{rs}$ is the value of exports from exporting country $r$ to importing country $s$; $\chi_r$ is exporting country $r$’s fixed effect; and $\chi_s$ is importing country $s$’s fixed effect; $d_{rs}$ is the distance between exporting country $r$ and importing country $s$; $L_{rs}$ is the common-language dummy for exporting country $r$ and importing country $s$ (coded as 1 if they use a common language and 0 otherwise); and $B_{rs}$ is a dummy for the border between exporting country $r$ and importing country $s$ (coded as 0 if they share a border and 1 otherwise).

However, as shown in [Figure 1], the terms of trade declined steadily since the mid-1990s. This suggests that the terms of trade for the previous period $(t-1)$ may have considerable influence on the terms of trade for the current period $(t)$. Thus, to estimate the determinants of the terms of trade, the present study considers a dynamic model. In addition, as indicated in Debaere and Lee

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6) Equation (5) is Krugman’s market potential defined through generating aggregate net profit of country $r$. See Head and Mayer (2004) for details generating process.

7) The reason for using interaction term of border and language dummy is that using the same language means the language effect in case of non-border countries.
(2003), relative per capita income may have a significant positive effect on the terms of trade because it is positively related to product quality and variety, and thus, the present study considers this important variable. According to previous research, the terms of trade are influenced by the composition of exports and imports and the characteristics of trading partners. Thus, this paper analyzes the determinants of Korea’s terms of trade by taking into account all these factors.\(^8\)

With all these factors appropriately controlled for, Equation (4) can be expressed as Equation (7), the equation this paper uses to directly estimate the determinants of Korea’s terms of trade.

\[
\ln TOT_{knt} = \alpha_0 + \alpha_1 \ln TOT_{knt-1} + \alpha_2 \ln RO_{knt} + \alpha_3 \ln RMP_{knt} + \alpha_4 \ln PRO_{knt} + \alpha_5 \ln EXR_{knt} + \alpha_6 \ln IMR_{knt} + \epsilon_{knt} \tag{7} \]

where \( TOT \) is the bilateral terms of trade between Korea and individual trading partners; \( RO \) represents relative output; \( RMP \) is the relative market potential; \( PRO \) is the relative per capita income; \( EXR \) is the share of manufactured goods in total exports; \( IMR \) is the share of fuel products in total imports; In addition, \( \epsilon_{knt} = u_n + \lambda_t + \epsilon_{knt} \), where \( u_n \) represents the trading partner’s characteristics that are not observed and do not change over time, \( \lambda_t \) represents time-related characteristics that are not observed and do not change according to the trading partner, and \( \epsilon_{knt} \) is the independent and identically distributed random variable \( \epsilon_{knt} \sim i.i.d. N(0, \sigma^2) \)

We use the basic panel OLS (ordinary least squares) method to estimate Equation (7). Even if the characteristics of the trading partner, \( u_n \), are

\(^8\) Of course other non-observed characteristics regarding the trading partner and time are also considered.

\(^9\) The equation (7) consists of level variables, and when it comes to system GMM estimation, the equation (7) and its first-differenced one combine into one system to establish a model. Both the level equation and first-differenced equation are instrumented each other to consistently estimate the parameters.
eliminated through the use of the fixed effects model, the independent variable must be strictly exogenous with respect to the error term $\epsilon_{kt}$ to achieve consistency. However, Feenstra (1994) pointed out that the price of new products is not included in the terms of trade, whereas the price of non-produced goods is. This can lead to a bias and an endogeneity problem. In addition, previous studies have found that the terms of trade have considerable influence on GDP and oil prices, which can lead to the problem of endogeneity within the model itself. Even if such endogeneity issues are addressed by using revised terms of trade and instrumental variables, as explained in Feenstra (1994), the dynamic panel bias may not disappear through the fixed effects model because the lagged dependent variable is used as an independent variable (Nickell 1981; Bond 2002).

Consequently, the present paper estimates Equation (7) by using the system generalized method of moments (system GMM) (Arellano and Bover 1995; Blundell and Bond 1998). The system GMM combines the Equation (7) as level equation and its first-differenced equation into one system to establish a model. The system GMM is effective in addressing the endogeneity problem for the independent variable and can successfully achieve consistency.\footnote{When using the system GMM method, two assumptions must be established; the error terms must be mutually independent and the instrumental variable must be selected appropriately. The independence of the error terms can be verified through AR examination. If the error terms are independent of one another, the first auto-correlation AR(1) is $E(\Delta \epsilon_{kt}, \Delta \epsilon_{kt-1}) = E(\epsilon_{kt} - \epsilon_{kt-1})E(\epsilon_{kt-1} - \epsilon_{kt-2}) = -E(\epsilon_{kt-1}) = -\sigma^2$, and therefore a negative (-) value, while the second auto-correlation AR(2) is $E(\Delta \epsilon_{kt}, \Delta \epsilon_{kt-2}) = E(\epsilon_{kt} - \epsilon_{kt-1})E(\epsilon_{kt-2} - \epsilon_{kt-3}) = 0$, and therefore the value of 0. Whether or not the instrumental variable has been selected appropriately or not can be verified through the Hansen Test. The Hansen Test is an examination of the validity of the overidentifying restrictions of the instrumental variable, and the null hypothesis, affirming that the appropriate instrumental variable has been selected, must be adopted.}
III. Data and Summary Statistics

Estimating Equation (7) requires the calculation of Korea’s terms of trade with each of its trading partners. For this, we employed the method used by the Bank of Korea (2009) as follows: First, we obtained the value and volume of exports/imports for each of Korea’s trading partners from UN Comtrade by considering the 1992 version the six-digit coding of the Harmonized Commodity Description and Coding System (HS). We excluded ships (89) and weapons (93) and included those items that were greater than or equal to 1/10,000 of the total export and import value for the previous year.11) We then used the inter quartile range (IQR) to exclude items with abnormal prices.12) To calculate the link factor, we employed the resulting data with the Paasche formula (8). According to the Paasche formula, the link factor is connected from the starting point to point \( t \), and the chain index for period \( t \) is calculated as Equation (9).

\[
P^P_{t-1,t} = \frac{\sum_{h=1}^{H} P^h_t Q^h_t}{\sum_{h=1}^{H} P^h_{t-1} Q^h_{t-1}} \times 100
\]

\[
P^{PC}_{0,t} = P^P_{0,1} \times P^P_{1,2} \times \cdots \times P^P_{t-1,t}
\]

where \( P^P_{t-1,t} \) is the export/import unit value link factor of period \( t \), as of the previous period; \( P^{PC}_{0,t} \) is the export/import unit value chain index of period \( t \).

11) What is different from the methodology of the Bank of Korea (2009) is that at least one transaction must exist each month, and only regular export/import transactions which exclude consigned processing transactions and temporary delivery transactions are treated, but as such data do not exist, the above conditions are not applied.

12) According to Bank of Korea (2009), the lowest normal unit value is \( \max(0, Q1 - IQR) \), the highest is \( QB + IQR \). Here, \( IQR = 3/4 \) quartile \(-\) 1/4 quartile.
as of the starting point; $P_t$ and $Q_t$ are the export/import unit value and volume, respectively, for period $t$; and $h$ is the six-digit HS export/import product classification.

To exclude the period of Korea’s foreign exchange crisis from the analysis, we considered the 2000-2009 period. The calculation of chain indices for all periods, as specified by Equation (9), requires link factors for all periods from the starting point to period $t$. However, there were cases in which there was no trade in certain years between Korea and some of its trading partners, and thus, we could not calculate link factors for all periods. As a result, we calculated chain indices by targeting only those periods showing continuous trade before 2009, the most recent year. Thus, [Table 1] shows some discrepancies in the number of trading partners over the sample period. For example, the number of trading partners for which the chain index was calculated for the 2000-2009 period was 127, whereas that for the 2005-2009 period was 152.

Table 1. Number of Analyzed Countries by Year

| Year | No. of Countries | Ratio | Cum. Ratio |
|------|------------------|-------|------------|
| 2000 | 127              | 8.76  | 8.76       |
| 2001 | 135              | 9.32  | 18.08      |
| 2002 | 139              | 9.59  | 27.67      |
| 2003 | 142              | 9.80  | 37.47      |
| 2004 | 146              | 10.08 | 47.55      |
| 2005 | 152              | 10.49 | 58.04      |
| 2006 | 152              | 10.49 | 68.53      |
| 2007 | 152              | 10.49 | 79.02      |
| 2008 | 152              | 10.49 | 89.51      |
| 2009 | 152              | 10.49 | 100.00     |
| Total| 1,449            |       | 100.00     |
[Figure 3] compares the fluctuations in Korea’s export/import unit value indices and terms of trade with those for its major trading partners, including the U.S., Japan, China, Germany, Saudi Arabia, and the UAE. Those countries

Figure 3. Trends in Export/Import Unit Value Indices and Terms of Trade in relation to Major Trading Partners since 2000
to which Korea exported mainly manufactured goods (e.g., the U.S., Japan, China, and Germany) showed relatively stable terms of trade. In particular, Korea’s terms of trade with the U.S. and Japan showed a slightly increasing trend because of rising export prices. By contrast, Korea’s terms of trade with China (Germany) decreased because of rising import prices (falling export prices). Korea’s terms of trade with Saudi Arabia and the UAE, the main sources of Korea’s fuel imports, decreased substantially because of rising fuel prices. These results suggest that the terms of trade can be influenced by the type of product as well as the type of trading partner.

We calculated the data on relative output and per capita income by using Equation (4) and data on GDP and per capita income (based on the constant prices for 2005) from the World Bank WDI (World Development Indicators) Online PPP data. We obtained the data of distance, language, and border dummies for relative market potential by using Equations (4), (5), and (6) and data from CEPII (Research Center for International Economics). Finally, we calculated the share of manufactured goods in Korea’s total exports to each trading partner and the share of fuel products in Korea’s total imports from each trade partner by using data classified by SITC Rev. 3 (manufactured goods under SITC 5, 6 (ex. 68), 7, or 8 and fuel products under SITC 3). In addition, we obtained the export/import data from UN Comtrade database. [Table 2] shows the summary statistics for the data set.13)

13) According to the summary statistics, the average share of manufactured goods in exports is high, while the standard deviation is quite low. This shows that most of Korea’s exports are centered around manufactured goods, and this tendency is more or less consistent in its relations with each of its trading partners. In contrast, the average share of fuel in imports is low, while the standard deviation is rather high, which means that Korea is importing fuel from a handful of certain countries. The analytical data that this paper aims to use can be evaluated as having successfully reflected the characteristics of Korea’s trade relations with a variety of nations.
### Table 2. Summary Statistics of Data used in Analysis

| Variable | Mean | Std. Dev. | Min | Max | Observations |
|----------|------|-----------|-----|-----|--------------|
| lnTOT    | overall | 4.658     | 0.593 | 1.319 | 8.535 | N | 1,461 |
|          | between | 0.311     | 3.045 | 5.569 | n   | 154  |
|          | within  | 0.510     | 2.490 |     | 8.145 | T-bar | 9.487 |
| lnRO     | overall | 27.512    | 0.691 | 21.730 | 27.848 | N | 1,383 |
|          | between | 0.656     | 22.499 | 27.803 | n   | 146  |
|          | within  | 0.173     | 25.665 | 29.032 | T-bar | 9.473 |
| lnRMP    | overall | 13.573    | 0.485 | 10.679 | 14.175 | N | 1,436 |
|          | between | 0.284     | 11.484 | 13.671 | n   | 151  |
|          | within  | 0.388     | 12.348 | 14.439 | T-bar | 9.510 |
| lnPRO    | overall | 9.950     | 0.256 | 7.803 | 10.147 | N | 1,383 |
|          | between | 0.227     | 8.163 | 10.107 | n   | 146  |
|          | within  | 0.113     | 9.196 | 10.491 | T-bar | 9.473 |
| lnEXR    | overall | 4.530     | 0.223 | 0.161 | 4.615 | N | 1,461 |
|          | between | 0.182     | 2.891 | 4.615 | n   | 154  |
|          | within  | 0.153     | 0.978 | 5.432 | T-bar | 9.487 |
| lnIMR    | overall | 1.149     | 1.733 | 0.000 | 4.615 | N | 1,461 |
|          | between | 1.516     | 0.000 | 4.615 | n   | 154  |
|          | within  | 0.807     | -2.893 | 5.301 | T-bar | 9.487 |

### IV. Analysis Results

The interpretation of the results first requires an evaluation of whether the two system GMM assumptions were satisfied, that is, whether the error terms were independent and whether the instrumental variables were selected appropriately. The results indicate that AR(1) was negative and significant at the 1% level for all models, whereas AR(2) was significant for no model, implying that the error terms were independent. Also the Hansen test is not statistically significant for all model, and thus, the null hypothesis that appropriate instrumental variables were selected could not be rejected, which implies that appropriate instrumental variables were selected.
[Table 3] shows the analysis results. Among the models, Models 1 and 2 did not control for the type of product, whereas Models 3 and 4 did. Noteworthy is that the coefficients for Model 1 and Model 2 exceeded those for Models 3 and 4. In addition, the coefficients for the lagged terms of trade, relative output, and relative market potential were higher for Model 1 than for Model 3, whereas the coefficients of all independent variables (including relative per capita income) were higher for Model 2 than for Model 4. These results indicate that the type of product had considerable influence on the terms of trade.

The results of an in-depth analysis of the effects of each independent variable on the terms of trade indicate that the coefficient of $L.\ln TOT$ (lagged terms of trade) was positive (close to 1) and significant at the 1% level for all models. In other words, the terms of trade for the previous year had considerable influence on the current terms of trade. The coefficient of $\ln RO$ (relative output) was negative and significant at various levels according to the model, which provides support for the argument that an increase in relative output (i.e., global supply) can weaken the terms of trade. The coefficient of $\ln RMP$ (relative market potential) was positive and significant at various levels according to the model, which provides support for the argument that an increase in relative market potential (i.e., global demand) can improve the terms of trade.

On the other hand, an increase in relative per capita income ($\ln PRO$) can enhance product quality and variety and thus improve the terms of trade. However, the results indicate that the coefficient of $\ln PRO$ was positive but not significant, suggesting that for Korea, per capita income may not be an important determinant of the terms of trade.

Finally, the Prebisch-Singer hypothesis posits a positive value for the share of manufactured goods in exports ($\ln EXR$) and a negative value for the share of fuel products in imports ($\ln IMR$). However, the results indicate a negative

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14) For more details, refer to Feenstra (1994).
15) This is because, as explained above, as the income elasticity for primary products is
value (although not significant) for the share of manufactured goods in exports. This may be due to the use of a broad definition of manufacturing industry in the classification of industries, that is, the data might not have fully reflected the characteristics of each product. In other words, if manufactured goods are classified into high- and low-technology products, then we may see an increase in the terms of trade for the high-technology product group.16)

Table 3. Analysis Results

|       | (1)         | (2)         | (3)         | (4)         |
|-------|-------------|-------------|-------------|-------------|
| \(L\ln TOT\) | 0.861***    | 0.881***    | 0.819***    | 0.821***    |
|       | (0.063)     | (0.056)     | (0.040)     | (0.052)     |
| \(\ln RO\)  | -1.322**    | -1.785**    | -0.827**    | -1.063*     |
|       | (0.638)     | (0.738)     | (0.415)     | (0.583)     |
| \(\ln RMP\) | 2.986*      | 3.158**     | 1.983**     | 2.018**     |
|       | (1.530)     | (1.262)     | (0.948)     | (0.932)     |
| \(\ln PRO\) | 0.956       |             |             | 0.538       |
|       | (1.123)     |             |             | (1.198)     |
| \(\ln EXR\) |             | -0.021      | -0.041      |             |
|       |             | (0.335)     | (0.329)     |             |
| \(\ln IMR\) |             | -0.031*     | -0.033**    |             |
|       |             | (0.017)     | (0.016)     |             |
| cons  | -0.556      | -0.026      | -0.808      | -0.321      |
|       | (2.873)     | (1.973)     | (3.321)     | (2.632)     |
| Obs.  | 1,353       | 1,353       | 1,353       | 1,353       |
| AR(1) (p-value) | -5.66      | -5.68      | -5.62      | -5.54      |
|       | (0.000)     | (0.000)     | (0.000)     | (0.000)     |
| AR(2) (p-value) | 0.56       | 0.59       | 0.52       | 0.51       |
|       | (0.578)     | (0.556)     | (0.605)     | (0.607)     |
| Hansen (p-value) | 16.60      | 11.48      | 28.21      | 28.82      |
|       | (0.165)     | (0.244)     | (0.169)     | (0.150)     |

Note: 1) *** , ** , and * indicate significance at the 1%, 5%, and 10% levels, respectively.

2) Numbers in brackets are corrected standard errors.

3) Time dummies were included, but the results are not reported.

lower compared to that of manufactured goods, demand for manufactured goods increases with the rise in income, while demand for primary products decreases.

16) As a matter of fact, according to the study by Kim and Kim (2005), the high value-added exporting index improves the terms of trade.
V. Conclusion and Implications

According to the Prebisch-Singer hypothesis and the findings of Baxter and Kouparitsas (2000), the terms of trade are influenced by the characteristics of trading partners and imports/exports. However, most of the previous studies of the determinants of the terms of trade have not fully reflected these characteristics.

In this paper, we employed a panel data set for the 2000-2009 period (excluding the period of Korea’s foreign exchange crisis) to consider the characteristics of trading partners as well as products (the share of manufactured goods in exports and the share of fuel products in imports) for the analysis of the determinants of the terms of trade. In particular, for more consistent estimates, we constructed a dynamic panel model to examine the effects of the terms of trade for the previous period on the current terms of trade and employed the system GMM method to measure the determinants of Korea’s terms of trade, focusing on the real side.

The results indicate that the coefficients of the variables for the lagged terms of trade, relative output, relative market potential, and relative per capita income decreased when product characteristics were controlled for. In addition, the results for most of the independent variables were consistent with the theoretical model. In other words, an increase in the lagged terms of trade, relative market potential, or relative per capita income improved the terms of trade, whereas an increase in relative output or the share of fuel products in imports weakened the terms of trade. These results provide support for the common hypothesis, which explains the terms of trade from the demand and supply sides.

However, an increase in the share of manufactured goods in exports had a negative effect (although not significant) on the terms of trade, providing no support for the Prebisch-Singer hypothesis. This may be due to the use of a broad definition of manufacturing industry in the classification of industries, that is, the data might not have fully reflected the characteristics of each product.
Therefore, to better reflect the characteristics of exports, future research should restrict manufactured goods to high-technology products, as in Kim and Kim (2005).
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Appendix: Theoretical Setup for Terms of Trade

In this appendix, we present a theoretical setup to derive equation (1) for empirical analysis. We begin with a description of a consumer behavior. We assume that preferences are defined by a CES utility function for country $m$ at time $t$.

$$U_{mt} = \left[ \sum_l (\beta_l c_{lmt}) \right]^{\frac{\sigma}{\sigma - 1}}$$

(A1)

where $c_{lmt}$ is country $m$’s consumption of the country $l$’s (aggregate) good at time $t$; $\beta_l$ reflects the taste for or the quality of the goods from $l$; $\sigma$ is the elasticity of substitution between goods.

Consider now that $p_{lmt}$ is the price paid in country $m$ for country $l$’s (export) good. We include iceberg transportation costs $t_{lm}$, so that $p_{lmt} = p_{lt} t_{lm}$ ($t_{lm} > 1$). If consumers in country $m$ maximize utility subject to $\sum_l p_{lmt} c_{lmt} = y_{mt}$, the optimal consumption is derived as equation (A2), which yields country $m$’s demand for country $l$’s products.

$$c_{lmt} = \frac{\beta_l p_{lt}^{1-\sigma} t_{lm} \sigma y_{mt}}{P_{mt}^{\sigma-1}}$$

(A2)

where $P_{mt}^{\sigma} = \left[ \sum_l (\beta_l p_{lt}^{1-\sigma} t_{lm}^{1-\sigma}) \right]^{\frac{1}{1-\sigma}}$ is the overall price index of country $m$.

After multiplying equation (A2) by $t_{lm}$ to account for the goods lost during shipment, we sum a country’s effective demand over all countries $m$ (including $l$). We obtain the world demand for the product of country $l$. In equilibrium,
this world demand is equal to world supply $X_l$, which under the Armington assumption amounts to country $l$’s total production. After some rewriting, we obtain an expression for the price of country $l$’s good, $p_{lt}$, that is at the same time its export price, $P_{lt}^X$.

$$p_{lt} = P_{lt}^X = \beta_l^\sigma X_l - \sigma \left[ \sum_m \frac{t_{lm}^{1-\sigma} y_{mt}}{P_{mt}^{1-\sigma}} \right]^{\frac{1}{\sigma}}$$

(A3)

where $\left[ \sum_m \frac{t_{lm}^{1-\sigma} y_{mt}}{P_{mt}^{1-\sigma}} \right]^{\frac{1}{\sigma}} = MP_l$ is a country $l$’s market potential.

We turn now to the country $l$’s import price ($P_{lt}^M$). To obtain the import price, we define $MS_n$ as the fraction of country $l$’s total imports that is imported from country $n$.(17) Then, we can obtain using the weighted average of all exports price of each country ($p_{nt}$). That is, after multiplying, for all import goods, we can get an expression for the index of the import prices of country $l$ ($P_{lt}^M$) as following.

$$P_{lt}^M = \prod_n p_{nt}^{MS_n} = \prod_n \left( X_{nt}^{MS_n} \right)^{-\frac{1}{\sigma}} \prod_n \left( \frac{\beta_n^{MS_n}}{P_{nt}^{1-\sigma}} \left[ \sum_m \frac{t_{nm}^{1-\sigma} y_{nt}}{P_{nt}^{1-\sigma}} \right]^{MS_n} \right)^{\frac{1}{\sigma}}$$

(A4)

We divide a country’s export price by its import price and take a log transformation, consequentially we obtain the expression for an index of country $l$’s terms of trade, $TOT_{lt}$.

17) Here we use $n$ (and not $m$) to denote all countries (except $l$) from which $l$ imports.
\[ \ln \left( \frac{P_{it}^X}{P_{it}^M} \right) = \ln (TOT_{it}) = \frac{1}{\sigma} \ln \left( \frac{\beta}{\prod_n \beta_{MS_{int}}} \right) - \frac{1}{\sigma} \ln \left( \frac{X_{it}}{\prod_n X_{MS_{int}}} \right) + \frac{1}{\sigma} \ln RMP_{it} \quad (A5) \]

where \( RMP_{it} = \frac{\sum_m \frac{1}{P_{it}} P_{It}^1 \sigma }{\prod_n \sum_m \frac{1}{P_{nt}^{1-\sigma}} P_{It}^{1-\sigma}} = \frac{MP_{it}}{\prod_n (MP_{nt})^{MS_{int}}} \)
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현재 고려대학교 경제학과 조교수로 재직 중이다. 2003년 University of Texas at Austin에서 경제학 박사학위를 취득한 이후 2007년까지 대외경제정책연구원에서 FTA팀장으로 근무하였다. 관심 연구분야는 국제경제학, 외국인직접투자, 응용미시 계량경제학 등이며, 주요 논문으로는 “It Matters Where You Go: Outward Foreign Direct Investment and Multinational Employment Growth at Home”(Journal of Development Economics, 2010), “Trade Structure, FTAs, and Economic Growth: Implications for East Asia?”(Review of Development Economics, 2010), “Regional Production Networks, Service Offshoring, and Productivity in East Asia”(Japan and the World Economy, 2010) 등이 있다.

김혁황(金赫璜)

숭실대학교 경제학과를 졸업하고 동 대학원에서 경제학 석사를 취득하였다. 현재 대외경제정책연구원의 전문연구원으로 재직 중이며, 고려대학교 경제학과 박사과정을 수료하였다. 주요 관심분야는 외국인직접투자, 계량경제학이다. 주요 연구로는 “Foreign Direct Investment, Technology Diffusion, and Host Country Productivity Growth”(ADB Economics Working Paper Series, 2011, 공저), “외국인직접투자의 기업생산성 효과분석: 투자유형을 중심으로”(국제통상연구, 2011, 공저) 등이 있다.