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## Determinants of the Terms of Trade & Implications

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### 1. Research Background & Purpose

South Korea has an economy that is extensively dependent on trade. The makeup of its exports also differs dramatically from the makeup of its imports. Changes in the terms of trade therefore exert profound effects on the Korean economy. Analyzing how changing terms of trade affect the Korean economy and industries as well as the factors that decide such changes therefore carries much significance in Korea. Although numerous studies have been undertaken, in and outside Korea, to understand the macroeconomic impact of changing terms of trade in general, there are relatively fewer studies exploring the determinants of such changes. The growing volume of intra-industry trade has also raised the importance of the terms of trade at the industrial level. Few studies have ever been attempted that analyze the impact of changing terms of trade on industries.

In acknowledgement of these gaps in the literature, we analyze the trends in changing terms of trade and their determinants at both the macroeconomic and industrial level, with a view to understanding how these changes affect the Korean economy and industries. We also analyze the effects of changing terms of trade on industry competitiveness and explore the implications.

## **2. Concept & Current Status of Terms of Trade**

Terms of trade, also abbreviated as TOT, can be understood as the ratio at which a given country's exports can be exchanged for imports. Common measures include commodity terms of trade (CTT), income terms of trade (ITT), and other such indices. The CTT is an index that expresses the ratio of a country's price of exports to its price of imports, and represents the quantity of imports that can be exchanged for a unit quantity of exports. A rise in CTT indicates a rise in the price of exports relative to the price of imports, i.e., improving terms of trade for the given country. A fall in CTT indicates a rise in the price of imports relative to the price of exports, i.e., deteriorating terms of trade for the country. ITT is obtained by multiplying CTT by the export volume index, and represents the total quantity of commodities that a given country can import with the revenue it has earned from exports. Unlike CTT, ITT simultaneously considers both the price of exports and the export volume and avoids some of the shortcomings of CTT which reflects changes in price only.

South Korea's exports are almost entirely made up of manufactured goods, while primary sector commodities, such as agricul-

tural produce, minerals, and fuel, make up much of the country's imports. Changing trends in the relative prices of manufactured goods and primary sector commodities therefore exert a decisive influence on Korea's terms of trade. The fact that IT devices also make up a significant proportion of Korea's exports indicates that changes in their prices will similarly exert great impact on Korea's terms of trade. From the early 1990s until the outbreak of the Asian Financial Crisis a few years later, Korea's CTT continued to decline in a linear manner. The index, however, has been improving somewhat in recent years. The decline of Korea's CTT in the 1990s reflects the rapid rise of China as the "factory of the world," with Chinese-made manufactured goods flooding markets around the globe, and thereby rapidly decreasing the prices of such goods overall. The concomitant rise in China's demand for raw materials, in the meantime, also quickly raised the prices of oil and raw materials. The revolution of information and communication technology (ICT) around the same time also radically reduced the prices of IT products, further worsening Korea's terms of trade. Since the Asian Financial Crisis, and particularly over the last several years, the major drop in the prices of oil and raw materials due to the worldwide economic recession has served to improve Korea's terms of trade.

Whereas Korea's CTT hit the bottom immediately before the Asian Financial Crisis and has begun to rise in recent years, the country's ITT has been rising steadily over the decades as Korea's export volume continued to grow. The steady increase in this export volume to worldwide destinations has been more than enough to offset the decline in the country's CTT.

The terms of trade for major commodities bear positive correlation to the terms of trade for all commodities in general. In other words, the terms of trade for most specific products follow the trend in overall terms of trade. The extent of overlap, however, varies from commodity to commodity. For example, electronics and primary metal products whose terms of trade have been steadily worsening bear a correlation of 0.7 or higher to the overall terms of trade. In contrast, chemicals, general machinery, and automobiles whose terms of trade have been improving steadily bear a correlation of less than 0.3 to overall terms of trade. While the price of exports and imports move in the same directions for the majority of commodities, the extent of their comovement also differ from industry to industry. The margin of falls in export prices have been relatively significant for electronics and precision machinery, whose terms of trade have been noticeably deteriorating. On the other hand, food and beverages and primary metal products have been experiencing relatively greater leaps in their import prices.

Korea's terms of trade have been declining since 2000, while those of other major economies such as the United States, Taiwan, and Singapore have been improving, albeit marginally, in the aftermath of the global financial crisis. Compared to these economies, Korea's terms of trade also remain more susceptible to fluctuations, suggesting that the Korean economy is more vulnerable to changes in import and export prices than other economies.

### **3. Determinants of Korea's Terms of Trade**

In Chapter 3, we introduce a terms-of-trade function based on

the export-import function and perform an empirical analysis of the factors that affect terms of trade, such as exchange rates, cost of production, and price factors. Before proceeding to the analysis, we explain the overall structure of the analysis model. Using this model, we then analyze in detail the long-term equilibrium between terms of trade and their determinants.

In order to analyze the terms of trade determinants, we apply an autoregressive distributed lag (ADL) model to the monthly trade data from January 2000 to March 2016. With the terms of trade set as the dependent variable, we posit the KRW-USD exchange rate, the KRW-JPY exchange rate, the international oil price, the prices of raw materials, and the world trade volume as independent variables. We also use the export sophistication index (ESI) as a control variable in order to control the rise in export prices over time due to improved quality.

Our analysis reveals that the KRW-USD exchange rate, the ESI, and the world trade volume bear relatively significant long-term equilibrium coefficients in relation to the terms of trade, while the coefficients of the KRW-JPY exchange rate, the prices of raw materials, and the international oil price were relatively small. The estimated coefficients for all these variables were negative except in the case of the ESI. In other words, the rise in exchange rates, international oil and raw material prices, and the like lead a worsening of Korea's terms of trade. This confirms the theoretical expectation as well as the findings of other empirical studies.

Based on this analysis, we also decompose the factors of change in Korea's terms of trade in order to determine how much of these changes each factor can explain. More specifically, we sought to

determine the exact influence of changing exchange rates and international oil and raw material prices on changes in Korea's terms of trade.

We break our analysis duration into three periods, i.e., 2000 to 2005, 2005 to 2010, and 2010 to 2015, and compare the results of each period to the results of the overall duration (2000 to 2015). Korea's terms of trade in 2000 through 2005 worsened by 5.3 percentage points, approximately 20 percent of which could be attributed to changes in exchange rates and the international oil and raw material prices. In other words, the decline in Korea's terms of trade during this period is more reflective of the changes in market conditions or the quality of Korea's products than these macroeconomic factors. Korea's terms of trade further worsened by 6.1 percentage points from 2005 to 2010, with the same three macroeconomic factors explaining over 90 percent of the decline. Korea's terms of trade worsened by 0.6 percentage point from 2010 to 2015, with the same factors explaining approximately 50 percent of the change. From 2000 to 2015, Korea's terms of trade deteriorated by 3.7 percentage points with the exchange rate accounting for 0.1 percentage point, the international prices for raw materials for 1.7 percentage points, and the international price of oil for 0.2 percentage points. These three macroeconomic factors explained 60 percent or so of the overall change in Korea's terms of trade, and their influence has been growing since 2005.

Next, we explore the correlation between Korea's changing terms of trade and trade balance. The general belief is that this correlation is subject to the hierarchical linear modeling (HLM) effect, i.e., that worsening terms of trade affect the trade balance

adversely. Numerous studies have been attempted to verify the HLM effect empirically, but no definitive consensus has arisen yet, and the HLM effect remains a source of wide controversy today.

Mindful of these debates, we adopt an elasticity approach to analyzing, empirically, the correlation between Korea's terms of trade and trade balance, considering terms of trade and the real gross national income as factors affecting Korea's trade balance, and positing the money supply as a control variable. Our approach is distinct from those of earlier studies because we try to single out the influence of the direction of changes in Korea's terms of trade on the country's trade balance, because changes in the former can affect the latter quite differently depending on the direction of such changes.

We thus set up an asymmetric cointegration model and applied the monthly trade data from January 2000 to March 2016. Our analysis reveals that asymmetry exists in the relationship between Korea's terms of trade and trade balance, over both the short and long term. This means that the rise and fall of terms of trade can exert asymmetric impact on Korea's trade balance in both the short and long run. Improving the nation's terms of trade leads to an improvement in the trade balance, or vice versa. More specifically, an improvement in Korea's terms of trade by one percentage point leads to an increase in the country's trade surplus of 0.48 percentage points, while a one-percentage point drop in Korea's terms of trade reduces the trade surplus by 0.27 percentage points. In other words, improving Korea's terms of trade exerts a greater impact on the country's trade balance than a deterioration in the terms of trade.

#### 4. Determinants of Terms of Trade for Industries

In Chapter 4, we analyze the trends and determinants of terms of trade for major industries in Korea, with the goal of identifying policy implications. The industries subject to our analysis are food and beverages, textiles and leather, chemicals, steel, general machinery, electronics, precision machinery, and automobiles. We also consider semiconductors, usually grouped with electronics, separately. The explanatory variables we apply are the KRW-USD and JPY-USD exchange rates, the basic raw material price index, the international oil price, the DRAM price, and time.

While the rule was to use trade data from January 1999 to December 2015, we used data from January 2000 to December 2015 for steel and automobiles. As for the semiconductor industry, we also used data on the DRAM price available as of October 2001 and afterward.

Based on the competitiveness of each industry measured in terms of the revealed comparative advantage (RCA) as well as the trends of changes in terms of trade for each industry, we divided the nine industries into three groups. Group 1 includes industries whose competitiveness has been declining over time along with terms of trade, such as food and beverages and textiles and leather. Group 2 includes industries whose export prices have been steadily dropping, but whose shares of the global market have been on the rise, such as steel, electronics and semiconductors, and precision machinery. Group 3 includes industries whose export prices and shares of the global market remained more or less the same, such as chemicals, automobiles, and general machinery.

The KRW-USD exchange rate, the prices of raw materials, and the estimated coefficient of time exert negative effects on the food and beverage industry, included in Group 1. The prices of raw materials, in particular, show relatively greater elasticity at -0.51. As for the textile and leather industry, the KRW-USD exchange rate and the international price show statistically significant effects at the 10-percent and one-percent significance levels, respectively. The textile and leather industry is also the only industry on which the international oil price exerts a statistically significant negative effect, most likely because the prices of raw materials for synthetic textiles are susceptible to changes in the international oil price.

All four industries included in Group 2 show a strong inverse correlation to time. The terms of trade for the steel industry are particularly susceptible to changes in the KRW-USD exchange rate, but not so to changes in the JPY-USD exchange rate, the prices of raw materials, and the international oil price. The JPY-USD exchange rate, the prices of raw materials (i.e., the DRAM price), and time exert significant effects on electronics. The time coefficient, at -0.76, reflects the rapid decline in the terms of trade for the electronics industry. The fact that semiconductors make up much of Korea's electronics exports is evident in the positive effect that the DRAM price exerts on the industry. However, the KRW-USD exchange rate and the prices of raw materials exert significant negative effects on the semiconductor industry, while the prices of raw materials also show significant negative effects on the precision machinery industry. This suggests that the rising prices of raw materials serve to raise the prices of imports and thereby worsen the terms of trade for these industries.

As for Group 3, the KRW-USD and JPY-USD exchange rates and the international oil price exert statistically significant effects on chemicals. The rise in the international oil price generally raises the price of imports and thereby worsens the terms of trade, resulting in a negative coefficient. In our analysis, however, the coefficient emerged as positive. This is probably because Korea's chemical exports are concentrated in products highly influenced by the international oil price, such as petrochemicals and refined petroleum, while Korea's chemical imports are mostly medical and other such products that are relatively less affected by the international oil price. The JPY-USD exchange rate exerts significant impact on automobiles. Although the Korean automobile industry's dependency on imports from Japan has been dwindling over the years, our analysis concerns years as early as 2000, and therefore shows the JPY-USD exchange rate as still an influencing factor in terms of trade for Korean automobiles. General machinery is unique in that the prices of raw materials exert positive effects on it.

## **5. Conclusion**

Terms of trade, simply put, represent the relative price of exports from a given country to the price of the imports it brings in. It is a measure of the ability of the given country to fund its trade activities. Changes in the terms of trade are therefore bound to affect the country's overall economy. Improving terms of trade serves to enhance overall social welfare by inducing positive changes in production and consumption, while deteriorating terms of trade bring about a decline. In actual economies that include both traded

goods and non-traded goods, the extent to which changing terms of trade affect them necessarily differs according to the significance trade holds in its economy.

In economies like South Korea that are extensively dependent upon external trade, changing terms of trade can considerably impact overall social welfare. South Korea, however, is a small open economy, and most of the changes in its terms of trade are determined by factors out of its control. Policymakers therefore should focus on how to mitigate the adverse impact of worsening terms of trade on national welfare rather than only seeking to improve Korea's terms of trade.

The policy implications of our analysis can be summarized as follows.

First, given the dramatic importance of changing terms of trade on the Korean economy, policymakers should consider them as major variables worthy of their attention when designing and implementing policies.

Second, policy measures are needed to mitigate or capitalize upon the major changes in Korea's terms of trade. The fact that such changes affect different industries in different ways, policy support is especially needed for particularly susceptible sectors or industries when significant changes occur in Korea's terms of trade. This is crucial to policies that strive to control total demand or rates of inflation.

Third, policymakers need to keep in mind the fact that sizable changes in terms of trade can lower the significance of the rate of growth in gross domestic product (GDP), a leading indicator used in economic policymaking. The greater the change in terms of

trade, the greater the disparity between production and income. GDP, which represents the sum of the values of all output from an economy, therefore fails to reflect resulting changes in real income. There are many instances of economic activities in which total income exerts greater impact than total output (think of the business cycle or household consumption). In assessing the business cycle or devising policy measures to stimulate household consumption, policymakers therefore ought to refer not only to GDP, but also to gross domestic income (GDI) which reflects changes in terms of trade. They should also analyze the impact of macroeconomic factors closely related to such changes, such as the international oil price and exchange rates, not only on GDP, but also on GDI.

Fourth, significant changes in terms of trade can also widen the gap between the consumer price index and the GDP deflator. Policymakers need to heed this possibility when making policy decisions based on these indicators. Examples include inflation policies, tax revenue projections, and wage guidelines.

Fifth, changes in terms of trade for different industries also partially reflect the changes in the competitiveness of those industries on the global market. Industrial terms of trade may therefore serve as an indicator of industry competitiveness, particularly with respect to industries with active intra-industry trade.

Sixth and finally, policymakers should think about and find policies that can change the terms of trade. While a small open economy like South Korea can exert only limited effects, it can still exert some impact. An economy with many exports that are dominant on the global market and are therefore in a position to determine prices has a great advantage over deciding terms of trade in more

favorable ways. Considering that Korea's imports are mostly raw materials, Korea can also try to enhance its bargaining power over price or otherwise alter the prices and terms of imports more favorably by developing natural resources and actively participating in merger-and-acquisition deals abroad. The Korean economy should also diversify the sources of its imports and the products being exported to minimize the effect of changes in the prices of imports and exports.