

The Characters and Development Level of the North Korean Economy : Based on a Revealed Comparative Advantages of Trade

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I . Introduction

As all of communist countries have transformed into market economy in 1990s, North Korea is the last one who has autarkic and outdated Stalinist command economy at present. North Korea have pursued communism originally transplanted by the USSR. In practice, the principle of the North Korean strategy for development has stubbornly been guided by *juche sasang*¹⁾ which is thought to be created from the compound of Korea's traditional Confucian culture and western communism. This thought system encompasses the idea of *juche* in ideology, the idea of *chaju* (independence) in political work, the idea of *charip* (self-sustenance) in economic endeavors, and the idea of *chawi* (self-defense) in military affairs. The basic strategy of self-reliance calls for the economy to rely on domestic resources in all sectors. Without building an independent national economy, according to *juche*, it is impossible to establish the material and technological foundations for socialism, and build socialism and communism successfully.

The centerpiece of the North Korean self-reliant strategy is to build self-sufficient agriculture, on the one hand, and to drive industrialization through heavy-industry-first development, on the other. Also, the North Korean policy of self-reliance neglects producing consumer goods and the service sector, which is not willingly developed by communist countries which regard it as "unproductive." So, SOC, facilities, and light industries were set aside in the heavy-industry-first strategy of development. Based on these economic principles, North Korea's economic performance had been outstanding during the early period before 1965. But entering the 1960s, the pace of overall economic progress began to drop

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sharply. Since then, North Korea has not released any information about their economy. The only plausible information may be the trade data of North Korea. As all trade occur between two countries, the trade measures of North Korea can be assembled from the reports of its trading partners. As explained, North Korea has insisted on in practice a self-reliance and closed economic system. Therefore, some argue that trade of North Korea is not pursued on the principle of comparative advantage but on a needs basis. But it is questionable to believe that North Korea, even on a needs basis, imports the commodities of which the country has comparative advantage and exports disadvantage commodities.²⁾ Based on the previous studies, we start with the assumption that trade pattern of North Korea reflects the characters of its domestic economy.

The purpose of this study is not primarily to analyze the trade pattern, but rather to use trade data to find out the characters of domestic economy and development level in North Korea.

II. Model Specification

The trade performance can provide a basis for empirical work where the characteristic of domestic economy, especially resource endowment, cannot be quantified. Assume we know which goods use a particular resource intensively in production. If we measure the trade performance of North Korea for these commodities, we might be able to deduce some facts about the North Korea's resource endowment from the measurements.

In measuring trade performance of North Korea, we are able to make statements about whether North Korea is more successful with respect to a particular commodity in her trade. Following the method of Murrell's study (Murrell, 1990), a particular "revealed comparative advantage(RCA)" summarizes the trade performance of a composite good comprising several 3 digit SITC commodities. If some composite goods might include products whose production needs high technology intensively, then the relevant RCAs measure the effect of high technology on trade performance. The North Korea's RCAs of export and import are expressed :

$$\hat{x}_{id} = \left[\sum_{n \in Ni} X_{nd} / \sum_{n=1}^N X_{nd} \right] / \left[\sum_{n \in Ni} \sum_{t=1}^T X_{nt} / \sum_{n=1}^N \sum_{t=1}^T X_{nt} \right]$$

$$\hat{m}_{id} = \left[\sum_{n \in Ni} M_{nd} / \sum_{n=1}^N M_{nd} \right] / \left[\sum_{n \in Ni} \sum_{t=1}^T M_{nt} / \sum_{n=1}^N \sum_{t=1}^T M_{nt} \right]$$

where is the amount of exports of commodity by North Korea, is the equivalent figure for imports by North Korea. Also T is the number of countries included in the analysis, N is the total number of commodities, and is the set of indices of commodities having a particular property. The measure that is larger than 1 indicate that North Korea has the larger endowment of some composite of the factors used intensively in the production of commodity than that of world average. Can we make conclusion like this without knowing the intensities about use of resource endowment in production? In a multi-commodity and multi-factor world, the answer must be approximate by qualified. Either (1984) points out, in his study, based on restrictions no more severe than those conventionally adopted in a two-good, two-factor economy, that a country tends on average to import those goods which make relatively intensive use of its relatively scarce factors in a quantity sense. Using “tends on average” instead of “must” in the 2×2 economy leads that a functional relationship has been replaced by a probabilistic one. Given that the RCAs give probabilistic, not deterministic, information, we can proceed to organize the information in the manner least likely to give erroneous conclusions. To make correct conclusions more likely, we should ensure that goods have been approximately aggregated when constructing RCAs. Hence measurement from using RCAs for aggregate goods are more reliable than those from using information on individual goods (Balassa & Bauwens; 1988, Lafay; 1992). In order to derive judgement about any specific feature of North Korean economy from its trade data alone, it is necessary to find a composite goods for which trade reliably reflects the level of resource endowment. There are some information about the characters of production and consumption of many goods in the precious studies. These allow us to classify goods according to whether they have a certain property. For example, Hufbauer and Chials (1974) have decided the 3 digit level of SITC codes into three categories corresponding to the three trade theories through the process of economic development. On the other hand, Hufbauer (1970) has classified goods based on economies of scale and Freeman (1982) has aggregated goods by R&D expenditures.

III. Empirical Results

Researchers of North Korean economy are faced with the lack of statistical data and information about this most secretive country. North Korea did not provide any trade data from mid-1960s⁹⁾. But as all foreign trade interaction involve two countries, any given foreign trade transaction is likely to be reported by both, or either country. The trading partner countries of North Korea, also, have provided their trade performance with North Korea.

Hence, the trade measures for North Korea can be assembled from the reports of her trading partner countries. This is the set of so-called mirror statistics.

Since most countries report their own trade data to the United Nations, a individual commodity data for North Korean trade are available only from the United Nations. This study uses trade data of North Korea at 3 digit levels of the UN Standard International Trade Classification(SITC), Revision 1⁴. We, also, use the data of world trade from the *Yearbook of International Trade Statistics* annually issued by United Nations.

The empirical results of North Korea's RCAs are given in Table 2. Viewing the literature on international trade, trade patterns reflect the process of development. For the poorest countries, the natural resources emphasized by Ricardo exert an overwhelming influence in their trade. For the production of "Ricardo goods", a country requires an important factor, usually a natural resource. The empirical results in Table 2 show that North Korea leads to the export of Ricardo goods in early 1970s⁵. This result reflects that North Korea had comparative advantages on the goods with a high natural resource content in early 1970s. This advantages declined in the 1970s, and became less than 1 by the end of 1970s. But, the RCAs show that the comparative advantages on the Ricardo goods increased steadily, again, by the end of 1980s and in the 1990s. On the other hand, the RCAs of imports are lower than 1 until 1976, but the coefficients increased in steady and from 1986 the coefficients are more than 2 at very often. These results indicate that North Korea imported less the goods intensively using natural resources than an average country of the world in the mid-1970s, but exports and especially imports more the Ricardo goods in recent. These results show that North Korea has been suffering from the severe shortage of food and energy in 1990s, and its process of development has been backward in recent.

Based on the trade theories, as the ability of implementing modern industrial technology rises through the process of economic development, trade patterns begin to reflect the proportions of factor used in the production of industrial goods, Hecksher-Ohlin goods. The Hecksher-Ohlin goods are produced with a standard technology based on modern industrial methods. So, technology is well understood and sufficiently disseminated that production can occur at many levels of scale and varying factor proportions. The empirical results in Table 2 show that North Korea has a high share and a comparative advantage in Hecksher-Ohlin goods throughout the whole period. On the other hand, RCAs of the imports in North Korea are less than 1 during the period of the study. These results can be analyzed that North Korea has stepped into the middle stage-development process since the mid-1970s.

When a country becomes one of the most advanced, it develops products and processes that push forward the boundaries of industrial technologies ; trade patterns reflect the

Table 1. Grouping of Commodities for Revealed Comparative Advantages

Name of Group	Name of Group	Commodities Included group	SITC code in Group (Revision 1)
Rcardo goods	Goods using natural resources in production	Food, wood, fibers, minerals, paper non-ferrous metals, oils, ores, raw fuels	011-3, 022-5, 041-8, 051-5, 061, 071-2, 074-5, 121, 242-3, 251, 261-3, 271, 274, 281, 283, 285, 321, 331, 341, 411, 421-2, 431, 667, 681-87, 689
Heckscher-Ohlin Goods	Goods using a standard technology	Beverage, tobacco, cement, petroleum, floor coverings, glass pottery, ferrous metals metal products, domestic appliance, furniture, clothing, books, jewelry, stationery	111-2, 122, 273, 533, 551, 553-4, 611-3, 621, 629, 651-7, 661-2, 664-6, 671-9, 691-8, 724-5, 731-3, 812, 821, 831, 841-2, 851, 892-5, 897
Product-cycle Goods	Goods using advanced Technology	Chemicals, medicine, plastics, dyes, fertilize explosives, machinery, aircraft, instruments, clocks, munitions	512-5, 521, 532, 541, 561, 571, 581, 711-2, 714-5, 717-8, 722-3, 726, 729, 734, 861-2, 864, 951
Economies of Scale	Producing sector is subject to large economies	Perfumery, soaps, paper glassware, electrical-machinery, electrical-appliances, road vehicles aircraft	551-3, 641, 665, 711, 722, 725, 733-4
Diseconomies of Scale	Producing sector is subject to diseconomies	Explosives, leather, textiles, clocks, clothing, nonferrous metals	571, 611, 652-4, 656, 681-9, 841-2, 864
High R&D	Goods produced in sectors that use R&D input intensively	Pharmaceuticals, clothing aircraft, office machines telecommunications equipment	541, 714, 724, 734, 861
Pollution	Production leads to large amount of pollution.	Petroleum refining, chemicals, metals, fertilizers, paper, glass.	332, 512-14, 561, 641-42, 671-79, 681-89
Convenience good	Goods sold in retail outlets with no sales assistance	Meat, dairy products, groceries, alcoholic drinks, tobacco, books, drugs, soaps	011-13, 022-24, 032, 048, 053, 061-62, 111-12, 121-22, 421, 541, 553-54, 892

Source : Murrell (1990)

implementation of advanced technologies -“Product-cycle goods”. Product-cycle goods are produced using technologies that have not spread far from their country, or even company, of origin. For these goods, production is so intimately tied to the development of technology and to the specifics of demand that exports are by countries at the highest stage of development. The empirical results of RCAs for “Product-cycle goods” export of North Korea are extremely low through the whole period of the study. As the spread of new products is often undertaken by multinational corporations, the absence of these corporations means that North Korea lag behind the average of the world in beginning to manufacture Product-cycle goods. However, with the low absolute value of RCAs, the index became slightly increase since 1980s in relative term. The results show clearly that North Korea has comparative disadvantage in the goods using advanced technology. In contrast to exports, the results of RCAs in imports indicate that North Korea, apparently, led to the import of Product-cycle goods up to mid-1970s and early 1980s when North Korea opened its economy to Western industrized nations. But except those period the RCAs of import were lower than 1. So we can conclude that North Korea is far beyond the advanced stage-development process.

The type of economic system affects not only technological advance but also the choice of technique from the set available with a given technology. When decisions are made at the apex and implemented through a hierarchy, some attention must be paid to the cost of organizational complexity. The simplest way to reduce those costs into limit the number of operational units. When a central-planning hierarchy economizes on the number of subordinate units, a country has a comparative advantage in sectors with increasing returns-to-scale and a comparative disadvantage in decreasing returns-to-scale sectors. The empirical results of economies of scale and diseconomies of scale in North Korea are in table 2. The results show that North Korea has low value of the RCAs in export, hence comparative disadvantage in economies of scale sectors. In contrast, North Korea has a comparative advantage in goods with diseconomies of scale. The fact that the RCAs of export for the goods with diseconomies of scale are extremely high indicates North Korea failed to economize on the number of subordinate units, and reduce costs of organizational complexity. This means that North Korea’s the heavy-industry-first strategy of development lost the merits of the “laws of production.”

Technology is a stock, the result of history, much of which has been made by agents acting within the confines of the economic system. Economic system affects technology in many ways. The traditional view focuses on the structure of bureaucracy and the lack of incentives in central-planning economy. Amann and Cooper(1982) review a technology and central-planning economy. They emphasize the followings ; the importance of the gross

Table 2. The RCAs for composite goods in North Korea

Year Trade	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Ricardo	X 1.18	1.09	1.16	0.31	1.45	1.42	1.03	0.80	0.88	0.77	0.94	0.72	0.83	0.70	0.67	0.59	0.62	1.04	1.07	1.00	1.18	1.15	0.76	0.74	0.57	1.02
Goods	M 1.23	0.93	0.75	1.23	0.78	0.47	0.99	1.25	1.28	1.17	1.10	1.20	1.34	1.16	1.13	1.30	1.99	2.20	2.00	1.48	1.63	1.96	2.06	2.14	2.09	1.95
Heckscher	X 1.43	1.36	1.27	1.23	1.08	1.24	1.35	1.68	1.27	1.60	1.55	1.66	1.60	1.58	1.53	1.50	1.31	1.19	1.34	1.61	1.49	1.54	1.58	1.66	1.43	1.25
Ohlin goods	M 0.40	0.38	0.69	0.76	0.96	0.75	0.57	0.73	0.71	0.89	0.85	0.75	0.72	0.88	0.90	0.81	0.62	0.67	0.77	0.83	0.93	0.87	0.91	1.01	0.91	0.90
Product-	X 0.29	0.22	0.39	0.28	0.32	0.24	0.21	0.14	0.26	0.25	0.14	0.20	0.15	0.31	0.42	0.48	0.46	0.42	0.36	0.27	0.25	0.30	0.33	0.41	0.68	0.61
Cycle goods	M 1.86	2.26	2.03	1.32	1.57	2.25	1.98	1.17	0.85	0.87	0.97	1.24	0.11	1.13	1.24	1.20	0.96	0.65	0.64	0.98	0.72	0.65	0.61	0.58	0.54	0.61
Goods with Economies of For scale	X 0.04	0.22	0.28	0.39	0.31	0.14	0.25	0.36	0.24	0.19	0.19	0.60	0.33	0.13	0.13	0.11	0.11	0.14	0.16	0.11	0.11	0.27	0.40	0.25	0.37	0.40
Goods with Diseconomies of scale	M 2.18	2.40	1.65	1.20	1.04	1.61	1.33	0.95	0.56	0.96	1.00	1.36	1.09	0.91	0.97	0.73	0.60	0.35	0.59	0.43	0.36	0.45	0.33	0.33	0.39	0.32
Goods use R&D Inputs	X 2.48	2.75	2.85	3.61	3.28	3.40	3.74	3.38	2.69	3.09	4.04	2.89	3.57	3.35	3.07	3.30	3.43	2.64	3.85	4.54	4.60	3.66	3.25	3.09	2.79	2.99
Goods with Pollution	M 0.24	0.23	0.69	0.45	0.49	0.30	0.30	0.55	0.76	0.77	0.65	0.79	1.31	0.86	0.91	1.10	1.12	1.05	1.06	1.16	1.14	1.61	1.66	1.08	1.96	1.55
Goods with Convenience	X 0.00	0.01	0.03	0.05	0.02	0.03	0.04	0.10	0.17	0.17	0.07	0.19	0.06	0.05	0.14	0.07	0.16	0.11	0.28	0.16	0.44	0.90	1.12	0.48	1.41	1.37
Goods	M 0.51	0.48	0.71	0.55	0.59	0.84	0.96	1.19	0.74	0.72	0.70	0.77	0.46	0.57	0.68	0.53	0.43	0.33	0.44	0.45	0.25	0.25	0.30	0.31	0.32	0.41
Goods with Convenience	X 2.37	2.34	2.65	2.96	2.13	2.55	2.62	1.90	1.52	2.02	2.63	1.88	2.09	1.81	2.07	2.14	1.97	2.04	1.73	1.72	1.72	0.36	1.26	2.81	1.76	0.94
Goods	M 0.31	0.39	0.59	0.91	0.78	0.58	0.55	0.61	1.01	0.87	0.97	0.95	0.64	0.95	0.84	0.82	0.76	1.06	0.88	0.72	0.88	0.96	1.03	1.54	1.07	1.05
Goods	X 0.48	0.49	0.52	0.35	0.32	0.31	0.32	0.34	0.38	0.41	0.43	0.49	0.76	0.85	1.23	0.60	0.26	0.19	0.12	0.18	0.17	0.21	0.14	0.15	0.18	0.18
Goods	M 0.62	0.46	0.32	0.35	0.25	0.18	0.21	0.27	0.48	0.52	0.43	0.17	0.41	0.73	0.68	0.37	0.27	0.27	0.27	0.48	0.60	0.70	0.85	0.85	0.70	0.76

Source : Calculated from the United Nation's trade data, various issues of *the Yearbook of International Trade Statistics*.

output target in the incentives of enterprises distracts attention from cost-cutting innovations, the limited direct contact between producer and consumer stifles the diffusion of technological information, and the unresponsiveness of a centralized price-setting process means that enterprises are often not sufficiently rewarded for the development of new products. So they conclude central-planning economy is technologically backward. Beside these, the lack of entry of new enterprises in central planning economy causes the inability of enterprises to cross sectional lines, and the impossibility of transnational internal organization. From these perspective, one would hypothesize that the pattern of trade exhibited by central-planning economy evidences a lower level of R&D expenditures than in comparable market economies. In Table 2, the RCAs for R&D shows trade performance of North Korea in those commodities that are produced in sectors spending large amounts on R&D inputs. The results in the table are consistent and show an unmistakable pattern. For all comparisons of export-import RCAs for R&D in the table, North Korea has a lower value. The results for North Korea reflect a level of technological development far below from the world average. The North Korean state has consistently affirmed that the development of heavy industry gives the best guarantee for all the other branches of the national economy with modern technology and for effecting a steady technological progress. But this affirmation proved to be a lie.

It is widely believed that environmental polices are viewed as less important in central planning economy than in market economy. If that belief is correct, CPEs will have a comparative advantage in goods that produce large pollution. In order to examine whether environmental policy affects CPEs trade patterns, Murrell constructed RCAs for a group of goods whose cost of production in the United States includes significant payments for pollution abatement. Based on the Murrell's construction, we estimate the RCAs of pollution goods in North Korea. And we find that North Korea's environment policy is less important than the world average as expected. But fortunately, the RCAs of export for pollution goods continue to decrease in 1990s. As influenced from the dramatical economic reform and success of China, North Korea has had several attempts to reform and open her economy. With these attempts, in order to improve the field of consumer goods, the catch phrase of "the great revolution in light industry" was stressed throughout North Korea in 1980s and 90s. As the catch phrase of "light industry revolution" started in 1982, the RCAs of convenience goods export increased relatively during the period 1982 - 1985. But after that period the RCAs dropped again. These results coincide with the visitor's reports that basic needs in food lack variety and most consumer goods and clothes are scarce and expensive in North Korea.

IV. Conclusion

In focusing on the trade performance of North Korea, the purpose of this study is to find the fundamental properties and the development level of North Korean economy. For the purpose, we start with the assumption that trade patterns inevitably reflect the internal character of economies. Those who doubt the reasonableness of this assumption for North Korea should consider whether they would predict that the China exports as many high-level computers as many clothes. So the question is, not whether, how trade depends on the character of the domestic economy.

The empirical results of the RCAs of composite goods in North Korea show the level of development and internal characters of economy in the country. During the 1970–75, North Korea had comparative advantages in the goods using intensively using natural resource-Ricardo goods. But North Korea's comparative advantages in Ricardo goods has declined and North Korea has had advantages in Heckscher-Ohlin goods since early 1970s.

With the advanced technology, the low value of the RCAs in "Product-cycle" goods indicates that North Korea's economic cooperations with multinational corporations and the level of technological development is far below from the world average. In addition, as shown in declining of the RCAs of Product-cycle goods in imports, North Korea seems to abolish any intention to import advanced technology, or to fail any efforts to induce the advanced foreign technology and capital stock and to give up any efforts to develop own technology. This fact is supported by the empirical results that the export-import RCAs of the goods using R&D input has a low value. These results can be analyzed that North Korea has stepped into the middle stage-development process in 1970s. So, North Korea has been establishing domestic industrial substitution from natural resource based to modern standard industry in 1970s. But after 1970s, we can not find any signs that North Korean economy stepped into further process of development. Rather we find North Korea suffering from the shortage of the goods using natural resources such as food and energy, also find the backwardness of economic development.

On the other hand, North Korea has a comparative advantages in sectors with diseconomies of scale and pollution goods. These can be interpreted that North Korea failed to reduce costs of central-planning hierarchy, and failed to take advantages of the heavy-industry-first strategy of development. As all of communist countries have abolished a system of central economic planning, and influencing from the outstanding economic performance of China, North Korea seems to have lost not only the self-confidence to build

up the main theme of long-term economic policy but also the courage to abolish the stubborn - old fashioned - strategies.

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〈NOTES〉

- 1) The concept of *juche* made its first appearance in a speech by Kim Il Sung on December 28, 1955, "On Eliminating Dogmatism and Formalism and Establishing *juche* Ideological Work." Also, "*juche* ideology" was presented as a "the one and only ideological system" at the 15th plenum in the 4th session of the Korean Worker's Party Central Committee in May, 1967.
- 2) Several studies proved that trades of centrally planned economies-Eastern Europe-were based on the principle of comparative advantage. (Holzman;1979, Amann;1982, Hill & McKay;1988)
- 3) North Korea officially published a trade data covering from 1953 to the mid-1960s
- 4) Trade data before 1980 were published by the United Nations as SITC Revision 1, and after 1980 are Revision 2. We convert the data published by Revision 2 into Revision 1 for the consistency of commodity classification
- 5) The previous study about the RCAs of North Korea in export is *A Trade Structure of North Korea in 1980s* by Ju, Sung-Whan and Lee, Sung-Sub(1989). In the study, the RCAs were calculated based on individual commodity, not grouping of commodities, during the period from 1980 to 1984.