

Economic Sanctions against North Korea

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Abstract

North Korea is either in violation of, or the target of, more than 13 U.S. laws. Three of these laws have a direct bearing on U.S. economic sanctions against North Korea, which began on June 28, 1950, when the United States invoked a total embargo on exports to North Korea on the basis of the U.S. Export Control Act of 1949. The most favored nation tariffs were banned on North Korea's exports to the United States based on the Trade Agreement Extension Act of 1951, while the Export Administration Act of 1979 allowed North Korea to be branded as a terrorist state when its agents blew up KAL 858 on November 19, 1987. Until the collapse of the Soviet Union in 1991, North Korea's policies had crossed the paths of many U.S. laws that automatically invoked economic sanctions. Since 1991, however, North Korea's policy appears to have been more calculated based on the belief that freezing long-range missile and nuclear programs may be too high a price to pay for North Korea to accept the largely symbolic easing of economic sanctions, although North Korea's trade data indicate a tightening impact of existing and new economic sanctions against North Korea.

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Economic Sanctions against North Korea

This paper has two-fold objectives: One is to review the history of all major economic sanctions invoked against North Korea, and the other is to review North Korea's trade data to see how the latest sanctions against North Korea may influence the North Korean economy and the thought process of North Korean leaders. The underlying hypothesis of this paper is that existing and new economic sanctions against North Korea, in conjunction with the country's inability to restructure its economy for the rapidly changing global economy, will make North Korea's mounting trade deficit difficult to sustain without prompting a significant negative impact on the North Korean economy. This hypothesis, if true, would have an important policy implication in view of the observation that with the collapse of the Soviet Union in 1991 and steadily progressing nuclear programs in the 1990s, North Korea's pre-1991 violent crossings of many U.S. laws that had automatically invoked economic sanctions against the country were transformed into post-1991 calculated policies of developing a full-blown nuclear program.

Put differently, the growth of the North Korean economy may be assumed to depend on the following Keynesian variables:

$$g = f(c, v, t, x, i)$$

in which g = growth of the North Korean economy; c = consumption expenditures, v = investment, t = government expenditures, x = net exports in foreign trade, and i = institutional arrangement. Of the five independent variables, only v and x are directly affected by economic sanctions (s):

$$g^s = f(v, x)$$
$$dg^s = (g/v)dv + (g/x)dx$$

The impact of sanctions on the growth of the North Korean economy can be traced:

$$dg^s/ds = (g/v)dv/ds + (g/x)dx/ds; dv/ds < 0 \text{ and } dx/ds < 0$$

This paper reviews the history of all major economic sanctions invoked against North Korea that have had an impact on North Korean investment (dv/ds) as well as on North Korea's trade (dx/ds). The review is followed by an analysis of the impact of economic sanctions on North Korea's trade deficit ($dx/ds < 0$) to explore its sustainability and policy implications.

Pre-1991 U.S. Economic Sanctions against North Korea

On June 28, 1950, only three days after the outbreak of the Korean War, the United States invoked a total embargo on exports to North Korea on the basis of the Export Control Act of 1949 (Chang, Fall 2006). This embargo was the beginning of a long journey of U.S. economic sanctions against North Korea. The total embargo was

followed by President Truman's Presidential Proclamation 2914 on December 16, 1950, which effectively invoked additional economic sanctions against North Korea under then-existing laws. The presidential proclamation was allowed under the Trading with the Enemy Act of 1917. A few days later, the U.S. Treasury Department issued Foreign Assets Control Regulations (FACR) to forbid any financial transactions involving, or on behalf of, North Korea (Rennack, 2003, p. CRS-12).

In 1951, the United States passed the Trade Agreement Extension Act that required the suspension of Most Favored Nation (MFN) trade status for all communist countries except Yugoslavia. North Korea was denied MFN trade status on September 1, 1951. The denial continues to this date. "The United States grants MFN status or better to countries that account for more than 99 percent of global exports, and thus denial of MFN would clearly be abnormal. Indeed, in 1998, the term 'most-favored-nation,' or MFN, was officially changed to the more appropriate 'normal-trade-relations' or NTR" (Preeg 1999, p. 4). This denial of NTR has effectively banned imports of North Korean products to the U.S. market. On August 26, 1955, the U.S. State Department issued its first International Traffic in Arms Regulations (ITAR), which denied exports and imports of defense articles and defense services, destined for or originating in certain countries: "North Korea has been listed as a restricted country from the ITAR's inception" (Rennack, 2003, p. 11).

On September 4, 1961, the Foreign Assistance Act was passed, authorizing U.S. government foreign aid programs that encompassed a wide range of development assistance, such as economic support funding, numerous multilateral programs, housing and other credit guaranty programs, the Overseas Private Investment Corporation, international organizations, debt-for-nature exchanges, international disaster assistance, and more. The Foreign Assistance Act, however, denied most non-humanitarian foreign assistance to communist countries, which included North Korea.

On October 22, 1968, the United States approved the Arms Export Control Act, another path that North Korea found itself traversing. The Act authorized the U.S. government military sales, loans, leases, and financing, and licensing of commercial arms sales to other countries. The Act, however, stated that these sales were not allowed to countries that the Secretary of State determined had repeatedly provided support for acts of international terrorism. The countries in this category, again, included North Korea.

On November 29, 1987, Korean Air Lines 858, which was flying from Baghdad (Iraq) and was 45 minutes away from Bangkok (Thailand), exploded mid-flight due to a bomb allegedly planted by two North Korean agents. The explosion killed 115 passengers and crew members. On January 20, 1988, North Korea was placed on the list of countries that support international terrorism according to the Export Administration Act of 1979. Placement on the list made it impossible for North Korea to borrow development funds from international financial institutions including the World Bank and the International Monetary Fund. The placement continues to this date.

In 1989, through satellite photos, the U.S. learned of new construction at a nuclear complex near the North Korea town of Yongbyon. U.S. intelligence analysts suspected that North Korea, which had signed the Nuclear Nonproliferation Treaty (NPT) in 1985 but had not yet allowed inspections of its nuclear facilities, was in the early stages of making an atomic bomb. This was the beginning of what appears to be a never-ending negotiation of linking North Korea's NPT compliance to the normalization of relations between North Korea and the United States. In 1991, the Soviet Union was dissolved and the cold war ended. This marked the end of the Soviet's economic support of North Korea. The end of the Soviet Union may have also marked a transformation in North Korea's policies from a bewildered animal crossing paths with U.S. laws to a calculated dictatorship.

On September 18, 1991, the United Nations accepted both South Korea and North Korea as members. On December 31, 1991, the two Koreas signed the meaningless South-North Joint Declaration on the Denuclearization of the Korean Peninsula. Under the Declaration, both countries agreed not to "test, manufacture, produce, receive, possess, store, deploy or use nuclear weapons" or to "possess nuclear reprocessing and uranium enrichment facilities."

Economic sanctions are not limited to North Korea as a nation. Economic sanctions have also been placed on North Korean firms, and on companies of other countries for assisting North Korea. In 1990, the United States fined the reputable German chemical firm Degussa for illegally supplying U.S.-originated reactor material to North Korea. On March 6, 1992, the United States imposed company-specific sanctions against North Korea's Lyongaksan Machineries and Equipment Export Corporation and Changgwang Sinyong Corporation for missile proliferation activities.

Post-1991 U.S. Economic Sanctions against North Korea

On October 21, 1994, both the United States and North Korea trusted each other enough to conclude four months of negotiations by adopting the "Agreed Framework" which was intended to resolve U.S. concerns about Pyongyang's plutonium-producing reactors and the Yongbyon reprocessing facility. The Framework led to the creation of the multinational Korean Peninsula Energy Development Organization (KEDO), to assist North Korea in developing energy-related projects within the scope of international nuclear nonproliferation efforts. In December 1994, rather than protesting its alleged intrusion across the negotiating table, North Korea returned to its old habit by shooting down a U.S. helicopter near the DMZ, killing the pilot (Chang, Fall 2006).

As a follow-up of the Agreed Framework, the U.S. Treasury Department issued, in 1995, Foreign Assets Control Regulations that authorized travel-related transactions, greater telecommunications, news bureaus, banking, and the importation of magnesite from North Korea. In 1996, after flooding and famine events in North Korea, the Treasury Department issued Foreign Assets Control Regulations that authorized donations targeting basic human needs.

On May 24, 1996, the United States imposed sanctions against North Korea and Iran for transfers related to missile technology. The sanctions prohibited any imports or exports to sanctioned firms and to those sectors of the North Korean economy that were considered to be missile related. However, the pre-existing general ban on trade with both countries made the sanctions symbolic, with no real impact. On April 17, 1998, the United States imposed sanctions against North Korea and Pakistan in response to Pyongyang's transfer of missile technology and components to Pakistan's Khan Research Laboratory.

The main U.S. concern was North Korea's development of long range missiles that could reach the U.S. mainland. On May 25–28, 1999, former U.S. Defense Secretary William Perry visited North Korea and delivered a U.S. proposal. On September 13, 1999, North Korea responded positively by pledging to freeze long-range missile tests. On September 17, 1999, in response to North Korea's willingness to cease long-range missile testing, President Clinton agreed to the first easing of economic sanctions against North Korea since the end of the Korean War in 1953, by announcing the lifting of most export restrictions applied to North Korea. The U.S. Congress, however, passed the North Korea Threat Reduction Act on November 29, 1999, and the Congressional Oversight of Nuclear Transfers to North Korea Act on April 11, 2000, to make sure that North Korea was in compliance with international agreements before U.S. exports to North Korea of nuclear material or technology could be allowed. On April 6, 2000, the United States again imposed sanctions against North Korea's Changgwang Sinyong Corporation for exporting missile systems to Iran.

Details of eased U.S. economic sanctions against North Korea were announced on June 19, 2000, through amendments to the Foreign Assets Control Regulations. Key provisions of the June 19 amendments included the following: the ban on exports to North Korea was ended; U.S. passports were valid for travel to North Korea and individuals no longer needed U.S. government permission to travel to North Korea; and U.S. travel service providers were authorized to organize group travels to North Korea.

On January 2, 2001, and on June 26, 2001, the United States imposed sanctions against North Korea's Changgwang Sinyong Corporation for violation of the Iran Nonproliferation Act that the United States passed on October 6, 2000. On August 16, 2002, the United States again imposed sanctions against the Changgwang Sinyong Corporation and against the North Korean government itself for transferring missile technology to Yemen. Although these sanctions are largely symbolic, the very acts that led to them were hardly conducive to continuing bilateral negotiations between the United States and North Korea.

In retrospect, the period of 1999 to 2000 represents the first of the two wasted opportunities for improved relations between North Korea and the United States. President Clinton was progressive enough to negotiate the test freeze of long range missiles in exchange for symbolic ease of sanctions. President Clinton, however, was not progressive enough to negotiate the next step of lifting the denial of the NTR status and of removing North Korea from the list of countries supporting international terrorism, in

exchange for a verifiable cease of North Korea's nuclear weapons program as well as its long range missile program. To leaders of North Korea, the symbolic ease of sanctions by the U.S. may have been too little for them to give up their prized technology.

On September 11, 2001, there were attacks on the World Trade Center and the Pentagon. On January 29, 2002, President Bush labeled North Korea, Iran, and Iraq as an axis of evil in his State of the Union address. This public characterization of North Korea may have been all North Korean leaders needed to convince themselves of the hopeless journey toward improving relations with the United States. The relation between the two countries became a slippery, downhill slope.

On October 16, 2002, the U.S. publicly revealed the discovery of North Korea's nuclear program. Later in October, North Korea revealed it was renewing its nuclear weapons program, breaking the terms of the 1994 Agreed Framework. In response, the U.S., Japan, and South Korea halted oil supplies to North Korea promised under the 1994 deal. Japan also suspended rice shipments. The Bush administration proposed the U.N. Security Council to take up the crisis and called for multilateral economic sanctions, but to no avail. On February 12, 2003, the International Atomic Energy Agency declared North Korea in breach of atomic safeguards and referred the case to the U.N. Security Council. On March 24, 2003, the United States again imposed sanctions against the Changgwang Sinyong Corporation for a missile-related transfer.

On July 31, 2003 North Korea announced that it was willing to attend six-party meetings with the United States, Japan, South Korea, China, and Russia to discuss North Korea's nuclear program. On August 27 to 29, 2003, and again on February 25-28, 2004, representatives from the U.S., China, Russia, Japan, South Korea and North Korea met in Beijing to negotiate disputes over North Korea's nuclear weapons program without making any significant progress. The period of 2001 to 2003 represents second of the wasted opportunities. The hostile environment created by the axis of evil speech by President Bush and the lack of a substantive offer early during the talk from the U.S. on such issues as NTR status and branding of a terror-supporting country may have convinced North Korean leaders that the talk was going nowhere. On October 18, 2004, President George W. Bush signed into law the largely symbolic North Korean Human Rights Act (Chang, Spring 2006), which required human rights issues to be a part of any negotiations with North Korea, tied humanitarian assistance to North Korea's improvements on human rights, and authorized the U.S. to allow North Koreans to apply for U.S. refugee and asylum status even if South Korea accepts them for settlement in South Korea with South Korean citizenship.

Recent Developments

Year 2006 dawned with revelations from the U.S. regarding alleged currency counterfeiting and money laundering activities by North Korea. On January 23, 2006 a team from the U.S. Treasury Department presented South Korean officials with what was considered to be a convincing evidence that North Korea was engaged in counterfeiting and laundering U.S. dollars. On January 27, 2006, Raphael Perl, a congressional

researcher in charge of tracking Pyongyang's drug dealings and counterfeiting, stated that the U.S. completed a rough draft of an executive order that would stop any financial firms such as banks, brokerage houses, and insurance companies involved in transactions with North Korea from conducting business in the U.S.

The previous year, in tightening its grip around the financial network used to fund North Korean illicit financial activities, the U.S. had already identified the Macau-based Banco Delta Asia as Pyongyang's primary money laundering channel in September 2005, and had already induced China to close North Korea's transaction account at the bank, while a presidential decree froze the U.S. assets of 11 North Korean trading firms. The U.S. Treasury Department banned all American banks from dealing with Banco Delta Asia. Japan's Bank of Tokyo, Mitsubishi and Mizuho Corporate Bank ceased all transactions with Banco Delta Asia (Mainichi Shimbun, February 2, 2006). Korea Exchange Bank, which was the only South Korean bank that had transactions with Banco Delta Asia, cut business transactions with Banco Delta Asia as of February 1, 2006.

On Feb. 16, 2006, the Macau-based Banco Delta Asia, which the U.S. singled out as North Korea's main money-laundering channel, stopped all transactions with North Korea and requested the U.S. not adopt new rules that would ban the U.S. or other nations from conducting transactions with the bank. On March 18, 2006, the People's Bank of China issued a directive to China's financial institutions to increase vigilance against fake U.S. \$100 bills they suspected were smuggled into China from North Korea. On May 28, 2006, the U.S. banned all U.S. citizens, permanent residents, and companies based in the United States from using North Korean vessels. These latest sanctions began to have an impact on the North Korean economy as shown in North Korea's trade data later in the paper.

In May 2006, there were sporadic reports that U.S. and South Korean intelligence agencies spotted preparations for the test launch of long-range missiles by North Korea. On July 5 (North Korean date), 2006, North Korea test-launched seven missiles, of which one was the long-range Taepodong-2 type that fell to the Sea of Japan within 40 seconds after the launch. The first missile was fired at 3:32 a.m. local time. Asiana flight OZ 235, from Chicago to Incheon International Airport, flew across the air space between 2:30-3:10 a.m. The Korean Ministry of Construction and Transportation later ordered airlines using the Kamchatka route over the Russian peninsula and through North Korean airspace to take the Pacific Ocean route instead (Chang 2007). On July 5, 2006, one day after the firing of missiles by North Korea, the United Nations Security Council adopted Resolution 1540, by a 15 to 0 vote, condemning North Korea's missile tests and requiring U.N. member countries not to supply to, or purchase from, North Korea anything related to North Korea's programs on missiles and weapons of mass destruction. The resolution excluded any reference to Chapter 7 of the U.N. Charter that would have made the resolution enforceable by military force. It should also be noted that the key issue of the July 4, 2006 missile testing is not the missile, but the long-range missile. North Korea test fired short-range missiles on March 24, 2003, and again on May 1, 2005, without attracting strong reaction from the United States. On September 14, 2006, the Japan's Mainichi Shimbun newspaper reported that the Japanese government decided to ban

withdrawals and overseas remittances from accounts by organizations and individuals suspected of links to North Korea and freeze North Korean assets. This measure effectively freezes Pyongyang's assets in Japan and thus bans other overseas financial transactions that are remitted to North Korean organizations located in Japan.

On October 3, 2006, North Korea announced its plan to conduct a nuclear test "because of the pressures and sanctions from the U.S." At 10:35 a.m. on October 9, 2006, a state-run geological institute in South Korea detected a tremor of 3.58-3.7 magnitude in North Hamgyeong Province of North Korea. On the same day, North Korea's official Korean Central News Agency issued a statement, stating that "The field of scientific research in [North Korea] successfully conducted an underground nuclear test under secure conditions on Oct. 9, 2006." South Korea made a hollow statement that the test violated the 1991 Joint Declaration for the Denuclearization of the Korean Peninsula. The Korean government decided to continue with two inter-Korean business projects, i.e., development of the Kaesong joint industrial complex and package tours to the Mt.Kumgang, even if the U.N. Security Council adopts a resolution sanctioning North Korea. On October 11, Japan added new sanctions against North Korea by banning North Korean ships from entering Japanese ports, barring most, if not all, North Korean nationals from entering Japan, and importantly, banning all imports from North Korea.

On October 14 (Saturday), the U.N. Security Council passed a unanimous resolution calling for economic and diplomatic sanctions against North Korea. The resolution 1718 obligates the 192 U.N. member nations to inspect suspicious North Korean cargo and bans them from transferring goods, products, equipment and technology related to weapons of mass destruction to the North. Two key provisions of the resolution are: (a) that "All Member States shall ... freeze immediately the funds, other financial assets and economic resources which are on their territories ... as being engaged in or providing support for, including through other illicit means, DPRK's nuclear-related, other weapons of mass destruction-related and ballistic missile related programmes," and that "... all Member States are called upon to take ... cooperative action including through inspection of cargo to and from the DPRK, as necessary." On October 31, 2006, the Chinese Foreign Ministry announced that North Korea agreed to return to the stalled six-party talks. On November 12, 2006, South Korea announced its decision against participation in the Proliferation Security Initiative, which is a U.S.-led coalition of countries aimed at stopping and searching North Korean vessels suspected of carrying weapons of mass destruction and related materials in international waters.

Trends of North Korea's Trade Patterns

To see how new sanctions may impact North Korea's economy, the trend of North Korea's trade patterns is summarized in Table 1. North Korea's trade deficit against the world, excluding South Korea, during 14 years from 1992 to 2005 was \$6,773,219,318, of which no less than 34.3 percent (\$2,321,891,060) were incurred during the last three years from 2003 to 2005. If North Korea's trade deficit against South Korea were included, North Korea's trade deficit from 1992 to 2005 was \$7,043,257,318, of which no less than 42.9 percent (\$3,023,757,060) were incurred during the last three

years from 2003 to 2005. Note that the 1994 Agreed Framework between North Korea and the United States became invalid late in 2002, and no more oil has been supplied to North Korea under the Agreed Framework since that time.

Another interesting change in the trade pattern of North Korea in recent years is the number of countries with which North Korea has been trading. Assuming that a growing country tends to have a growing number of trading partner countries, North Korea appears to be experiencing some difficulties in recent years. The number of countries North Korea has been exporting to peaked in 1999 at 127 but declined to 67 in 2005, while the number of countries North Korea has been importing from peaked in 2000 at 92 but declined to 48 in 2005.

Table 2. Number of North Korea's Trading Countries

Year	NK Exports to	NK Imports from	Either/Or
1990	53	41	56
1991	58	41	59
1992	70	44	70
1993	80	55	83
1994	90	66	96
1995	100	66	103
1996	107	77	110
1997	111	82	113
1998	117	80	121
1999	127	79	130
2000	125	92	130
2001	122	86	126
2002	118	82	122
2003	113	83	119
2004	103	80	108
2005	67	48	68

Source: Derived from Comtrade.

Returning to Table 1, when the Agreed Framework was in full force in 2001, the share of North Korea's exports to China and South Korea in relation to North Korea's total exports was 27.6 percent but increased to 44.9 percent in 2005. When the Agreed Framework was in full force in 2001, the share of North Korea's imports from China and South Korea in relation to North Korea's total imports was 25.3 percent but increased to 63.4 percent in 2005.

In order to gauge the health of North Korea's global trade, a list of countries North Korea has been importing at least \$10 million from is shown in Table 3 in order of the amount, while a list of countries North Korea has been exporting at least \$10 million to is shown in Table 4 in order of the amount. The lists in the two tables cover the 16 year

period from 1990 to 2005. Discussed below are countries that exported at least \$100 million to North Korea or imported at least \$100 million from North Korea at least once during the period. Reviewed first are the countries that exported at least \$100 million to North Korea, i.e., countries that North Korea imported at least \$100 million worth of goods from.

Japan was the only country that exported more than \$100 million in 1990 and in 1991. In 1992, China and Hong Kong SAR were the only countries. From 1993 to 1997, China and Japan were the only two countries that exported more than \$100 million every year to North Korea. In 1998, China and Japan were joined by Ireland, while in 1999, China and Japan were joined by Brazil. From 2000 to 2004, the list grew and North Korea's import base appears to have expanded. In 2000, China and Japan were joined by Thailand, India, and Brazil, while in 2001, the list grew longer with Japan, China, Sao Tome and Principe, Brazil, India, Singapore, and Thailand. In 2002, the list was still long with China, Japan, India and Germany, and with Brazil barely missing the \$100 million mark. In 2003, the list consisted of China, Thailand, India, and Russia, while in 2004, the list changed to China, Russia, Brazil, India, and Netherlands. In 2005, the list included China, Russia, Thailand, and Qatar.

To summarize, North Korea has depended heavily on China and Japan with Russia joining the list of major exporters to North Korea in recent years. It is also interesting to note that a number of other countries have been exporting at least \$100 million for selected years since 2000. These countries include: Thailand, India, Brazil, Sao Tome and Principe, Singapore, Thailand, Germany, Netherlands, and Qatar.

Perhaps more important is the list of major countries to which North Korea has been exporting. Countries that imported at least \$100 million worth of goods from North Korea were: Japan alone in 1990; Mexico and Japan in 1991; China alone in 1992; China and Japan in 1993; Japan, Mexico, and China in 1994; and Japan and Mexico in 1995. The list continued to be limited in later years: Japan and Mexico in 1996; Japan, Mexico, Hong Kong, and China in 1997; Japan and Mexico in 1998 and also in 1999; Japan, Mexico, and Brazil in 2000; Japan and China, with Mauritius barely missing the \$100 million mark in 2001; China and Japan in 2002 and also in 2003; China, Japan and Germany in 2004; and China, Thailand, and Japan in 2005.

To summarize, China and Japan have been only two steady importers of North Korean products to this date. If one or both countries turn against North Korea by joining the U.N. economic sanctions, it would be difficult for North Korea not to feel the impact, at least in the short run. Japan rapidly tightened its economic relation with North Korea in during the past year or two, including total ban of imports from North Korea, over the issues of kidnapping and nuclear weapons, leaving China the only country that has a key influence on North Korea's trade

To see the long-term outlook of North Korea's trade with China, North Korea's trade figures with China for the period of 1995 to 2004 are organized in Table 5 by the level of technology as suggested by Lall [2000]. Lall classifies export products by four

technology groups: resource-based, low technology, medium technology, and high technology. North Korea's exports to China from 1995 to 2004 were mostly resource-based and some low tech products, and the amount of these resource-based and low tech export products has been increasing rapidly from \$37,578,279 in 1995 to \$563,496,059 in 2004. There was not a single high tech item of major significance that was exported by North Korea to China. Major resource-based products that were exported to China during the study period were fish, anthracite, iron ore, and zinc, while the only major low tech item that North Korea exported to China during the period was pig iron in primary form. When the amount of imports by type is regressed against total imports, the shares of resource-based imports, low-tech imports, medium tech imports, and high tech imports are found to be, respectively, 69.23 percent, 11.68 percent, 12.59 percent, and 6.49 percent. Only the t-value for 6.49 percent was not statistically significant at 10 percent level. Perhaps indicating the lack of any structural improvement of North Korea's economy, the composition of the four types of imports relative to total has been very stable.

Note that a study by the United Nations indicates that primary products and resource-based manufactures have steadily lost shares in world trade over the past several decades, falling below 50 percent in 1984 and reaching 28 percent by 2000 [United Nations 2003, p. 143]. In comparison, exports have grown faster due to the more advanced level of technology and less reliance on natural resources [United Nations 2003, p. 145]. These findings suggest that "sustained export growth tends to involve a move up the technology ladder – from simple to complex products – in addition to upgrading quality and efficiency in existing exports" [United Nations 2003, p. 146]. Based on 17 manufacturing sectors in 19 countries for the period 1965-1988, Laursen also finds that "there is a positive relationship between trade performance and the individual country's ability to move into technological sectors offering above average technological opportunity" [Laursen 1999, p. 341]. If it is true that sustained export growth tends to involve a move up the technology ladder, clearly North Korea is not likely to sustain export growth China, and the rest of the world for that matter.

Trade Deficit and Economic Sanctions

One intriguing question in the context of economic sanctions is how North Korea pays for the trade deficit. The large amount of trade deficit, unless compensated somehow, is not sustainable and will eventually lead to a decrease in North Korea's trade, which is likely to worsen the impact from the existing U.S. as well as the new U.N. sanctions against North Korea. North Korea's annual trade deficit, as calculated from Comtrade, averaged \$773,963,687 during the latest three year period from 2003 to 2005. This figure excludes North Korea's trade deficit against South Korea, since South Korea appears to consider any financial support to the North as a long-term investment rather than a trade deficit. In other words, North Korea's trade deficit against its trading partners averaged about \$800 million per year in recent years.

How has North Korea been paying for the trade deficit? Virtually, the entire deficit appears to have been financed by weapons sales, illicit activities, and funds

flowing from South Korea through joint projects. “A study by Dr. Park Chang-kwon and Dr. Kim Myung-jin at the Korean Institute for Defense Analysis (KIDA) says full implementation of the PSI would deprive the North of hard currency gains of US\$700 million-1 billion (US\$=W958) by stopping exports of weapons and illegal drugs and counterfeit money. The sum accounts for 40-50 percent of the \$2 billion the North earns through overseas transactions including inter-Korean business. North Korea’s weapons exports earn it some \$400-500 million, drug smuggling and counterfeit dollar transactions \$300-500 million, and the inter-Korean projects \$160 million, a Unification Ministry official estimates. Another \$30-100 million annually goes to the North from the General Association of Korean Residents in Japan or Chongryon.” (“Pyongyang to Sever Ties if S.Korea Joins Sanctions” in <http://english.chosun.com> October 26, 2006)) North Korea is also trying to receive as much money as it can from South Korea. For instance, as of July 1, 2004, Hyundai Asan and North Korea set the entrance fee to Mt. Kumkang at \$10 for a day trip, \$25 for a two-day trip and \$50 for a three-day trip. On May 1, 2005, these fees were raised to \$15, \$35, and \$70. On July 1, 2006, these fees were raised again to \$30, \$48, and \$80. “The Unification Ministry [of South Korea] says Hyundai paid some US\$950 million to the North since 1998; \$450 million for seven major economic cooperation projects and \$451.52 million for tourism. Every year, some \$18 million goes into the North for admitting tourists” (“Mt. Kumkang Tours – a Cash Cow for N. Korea” in <http://english.chosun.com> October 26, 2006).

In 1999, the U.S. Congressional Research Service estimated that Pyongyang was printing at least \$15 million a year in counterfeit U.S. bills (Pert 1999). The Economist Intelligence Unit is quoted to have estimated in 2003 that “North Korea earned as much as \$100 million a year from counterfeit money, while in 2005, an interagency U.S. task force estimated that “\$45 million to \$60 million in Pyongyang’s counterfeit currency (primarily in U.S. \$100 bills) is in circulation” (Tkacik 2006). An almost perfect forgery of an American banknote is called the super dollar. North Korea’s counterfeit dollars are believed to be super dollars. China is a leader in foreign direct investment in North Korea, but the amount is very small.

Another way of financing trade deficit could have been foreign direct investment. It is believed that Chinese companies are the only major players in North Korea’s foreign direct investment. In 2004, however, the total amount of foreign direct investment in North Korea was only \$59 million, of which China’s share was \$50 million (International Herald Leader 2006). Chinese investment in North Korea in 2005 is estimated to be \$85 to 90 million. Chinese investment in North Korea in 2003 was only \$1.1 million (Lankov 2005).

Still another way of financing trade deficit could have been a barter trade. During the 14 year period from 1992 to 2005, North Korea accumulated a trade deficit of \$6,773,219,318. Out of this amount, 68.1 percent (\$4,615,154,189) was against China. The trade deficit became worse over time. During the latest six year period from 2000 to 2005, North Korea accumulated a trade deficit of \$5,152,709,540 (of the 14 year total of \$6,773,219,318). Out of this amount, China’s share decreased to 36.6 percent but was still significant at \$1,884,087,622. If a barter trade were a feasible alternative, it should be

for a trade with China. Until 1991, the trade between North Korea and China was a charge account of barter between the two governments, but in 1992, the two governments completed a new trade agreement that ended the charge account of barter, although barter continued beyond 1992 accounting for a large portion of trade between the two countries. In 2003, for instance, the barter accounted for more than 66% of total trade between China and North Korea, and the rest was by cash [Zhang 2006]. The problem is that the trade deficit figure, indicated in Comtrade, is likely to be beyond and above all barter trade since barter trade does not add to trade deficit. Before 1980s, the main currency used by North Korea in global trade was Switzerland franc. Early in the 1980s, the U.S. dollar was adopted as currency in North Korea's trade, but in November, 2002, North Korea stopped using the U.S. dollar and began using Euro as currency in trade [Ban 2006].

Summary and Conclusions

The findings of this paper are summarized. First of all, North Korea is in violation of numerous U.S. laws that have invoked economic sanctions against the country. Three sanctions appear to be most damaging to North Korea. The first is the denial of the NTR status that was placed on North Korea's exports to the United States on September 1, 1951 following the outbreak of the Korean War on June 25, 1950. The second is the placement of North Korea on the list of countries that support international terrorism, which followed North Korea's explosion of Korean Air Lines 858 on November 29, 1987, killing 115 people. The third is a series of U.S. financial sanctions since 2005 that led to the February 16, 2006 announcement by the Macau-based Banco Delta Asia, which the U.S. singled out as North Korea's main money-laundering channel, that it had stopped all transactions with North Korea. How effective the October 2006 U.S. Security Council sanctions will be remains to be seen.

Secondly, North Korea's violent outbursts until the collapse of the Soviet Union in 1991 seem to have transformed into post-1991 calculated policies of developing the nuclear program. President Clinton's largely symbolic easing of U.S. sanctions following North Korea's promise on September 13, 1999 to freeze long-range missile tests may have been too high a price, at least in the minds of North Korea leaders, to pay for North Korea to give up their prized technology. The January 29, 2002 branding of North Korea by President Bush as an axis of evil may also have been enough to convince North Korean leaders that it was hopeless to improve relations with the United States at this juncture of history.

Thirdly, North Korea had expanded its trade horizon since 1991 by increasing the number of countries that it traded with, but the horizon began shrinking during the past three years. The process of shrinking may have been accelerating since 2005 for two reasons. One is the impact of U.S. sanctions. Scholars have found that sanctions have been successful in 34 percent of the cases overall, but "Efforts to impair a foreign adversary's military potential, or otherwise to change its policies in a major way, succeeded only infrequently" (Hufbauer et al., 1990, p. 93). Despite this finding, the shrinkage in terms of the number of trading partners in recent years is unmistakable. The

number of countries North Korea has been exporting to peaked in 1999 at 127 but declined to 67 in 2005, while the number of countries North Korea has been importing from peaked in 2000 at 92 but declined to 48 in 2005. The other is the observation that North Korea's exports have been all resource-based and low-tech with no indication of improvement. Sustained export growth is difficult, if not impossible, without moving up the technology ladder in export products [United Nations 2003, p. 146].

In the fourth place, with reduced revenues from military sales and counterfeiting caused by existing U.S. economic sanctions including the new Proliferation Security Initiative, with no remittances from Japan originating from organizations and individuals supporting North Korea, with the absence of any significant foreign direct investment, and with the new U.N. economic sanctions, North Korea should find its trade deficit difficult to sustain and, thus, should feel enormous financial pressure.

Finally, the crystal ball has yet to reveal itself. The road in the middle, that no one wants, points toward continuing the current state of mess in which North Korea threatens its neighbors, prompts more controversial sanctions from the global community, and tries to obtain more funds from South Korea which may be the only country that is willing to supply funds with little or nothing in return. The road to the right, that North Korea's neighbors hate, may be calling for new laws in the United States that are patterned after the Cuban Liberty and Democratic Solidarity (LIBERTAD) Act of 1996 (Chang 2005). The LIBERTAD has a tone of hate and vengeance and states that "the President should encourage foreign countries to restrict trade and credit relations with Cuba" by applying sanctions "against countries assisting Cuba." The United Nations condemned the Act as affecting the sovereignty and legitimate interests of other states by a vote of 138 to 3, with 38 abstentions (Preeg 1999, 20). It is inconceivable for the U.S. to pass a similar law against North Korea because such law, if enacted, may require sanctions against South Korea and China. The LIBERTAD is still in effect when, in fact, practically everyone agrees that the economic sanctions against Cuba should be lifted. In contrast, voices on lifting U.S. economic sanctions against North Korea have been rare and weak (Whitty et al., 2006), making additional U.S.-led or U.S.-alone economic sanctions against North Korea an easier target. Lastly, the road to the left, that requires a courageous decision from all leaders, points toward meaningful easing of economic sanctions in exchange for verifiable and ironclad promise from North Korea not to pursue nuclear programs. Review of the rocky relation between North Korea and democratic allies from September 1948 when the communist government was formed in the northern half of Korea to the present day makes it difficult for any one with an objective mind to be optimistic.

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Table 1. North Korea's Total Exports and Imports with China's & China SAR's Share

Year (1)	NK's exports to world (2)	NK's exports to China (3)	NK's imports from world (4)	NK's imports from China (5)	SK to NK from KITA (6)	SK to NK from Comtrade (7)	NK to SK from KITA (8)	NK to SK from Comtrade (9)	Share of China & SK to NK's total exports (10)	Share of China & SK to NK's total imports (11)	Deficit to the world (12)	Deficit to SK only (13)	Total deficit = World + South Korea (14)
1990	600,949,005	0	543,367,642	0	1,188,000	0	12,278,000	0	--	--	57,581,363	11,090,000	68,671,363
1991	858,839,302	0	617,700,799	0	5,547,000	0	105,719,000	0	--	--	241,138,503	100,172,000	341,310,503
1992	622,376,255	155,455,594	991,062,424	541,065,162	10,563,000	0	162,863,000	0	0.503	0.551	-368,686,169	152,300,000	-216,386,169
1993	951,203,787	297,282,586	1,312,761,934	602,297,933	8,425,000	1,178,900	178,167,000	0	0.495	0.462	-361,558,147	169,742,000	-191,816,147
1994	1,137,246,169	199,205,967	1,052,640,698	424,459,357	18,249,000	1,484,650	176,298,000	1,148,201	0.325	0.413	84,605,471	158,049,000	242,654,471
1995	923,780,724	63,431,233	1,253,638,234	466,522,360	64,436,000	8,077,217	222,855,000	1,509,670	0.290	0.403	-329,857,510	158,419,000	-171,438,510
1996	912,412,843	66,537,457	1,256,241,063	495,753,278	69,639,000	0	182,400,000	0	0.253	0.426	-343,828,220	112,761,000	-231,067,220
1997	1,335,601,257	120,602,301	1,321,545,497	532,159,777	115,270,000	0	193,069,000	332,671	0.216	0.451	14,055,760	77,799,000	91,854,760
1998	984,879,040	57,202,475	1,078,322,541	348,022,627	129,679,000	0	92,264,000	846,711	0.134	0.395	-93,443,501	-37,415,000	-130,858,501
1999	924,337,097	41,704,280	1,146,134,559	322,207,966	211,832,000	0	121,604,000	14,195,519	0.144	0.393	-221,797,462	-90,228,000	-312,025,462
2000	1,186,215,260	36,813,537	1,668,644,667	438,352,923	272,775,000	0	152,373,000	14,654,415	0.130	0.366	-482,429,407	-120,402,000	-602,831,407
2001	1,015,111,327	166,135,342	2,894,205,437	563,150,543	226,787,000	0	176,170,000	12,422,146	0.276	0.253	-1,879,094,110	-50,617,000	-1,929,711,110
2002	976,485,105	268,833,812	1,445,780,068	438,294,632	370,155,000	0	271,575,000	21,856,484	0.401	0.445	-469,294,963	-98,580,000	-567,874,963
2003	944,097,968	390,621,990	1,619,150,655	582,831,742	434,965,000	0	289,522,000	0	0.493	0.495	-675,052,687	-145,713,000	-820,765,687
2004	1,266,533,361	581,553,201	1,937,738,240	723,482,525	439,001,000	0	258,039,000	21,881,887	0.495	0.489	-681,204,879	-180,962,000	-862,166,879
2005	1,153,698,682	499,140,536	2,119,332,176	1,081,103,675	715,472,000	0	340,281,000	35,641,382	0.449	0.634	-965,633,494	-375,191,000	-1,340,824,494
92-05											-6,773,219,318	-270,038,000	-7,043,257,318
03-05											-2,321,891,060	-701,866,000	-3,023,757,060

Source: North Korea's trade data with world and China and China's SARs 1990 to 2005 from U.N. Comtrade, which excludes inter-Korea trade data; and

Inter-Korea trade from KITA; and population, exchange rate & GDP data from the Bank of Korea.

Note that NK-SK trade data from Comtrade in columns (7) and (9) are for illustration only, and not included in any calculations.

Table 2. Co-integration matrix (rank = 15)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Japan	178,890,752	Japan 254,974,891	China 543,367,642	China 622,376,255	China 951,203,787	China 1,137,246,169	China 923,780,724	China 912,412,843	China 1,335,601,257	China 984,879,040	China 924,337,097	China 1,186,215,260	China 1,015,111,327	China 976,485,105	China 944,097,968	China 1,266,533,361	China 1,153,698,682
China	493,892,902	China 543,367,642	China 622,376,255	China 951,203,787	China 1,137,246,169	China 923,780,724	China 912,412,843	China 1,335,601,257	China 984,879,040	China 924,337,097	China 1,186,215,260	China 1,015,111,327	China 976,485,105	China 944,097,968	China 1,266,533,361	China 1,153,698,682	China 1,153,698,682
USA	18,851,711	USA 48,932,000	USA 52,000,000	USA 70,000,000	USA 100,000,000	USA 150,000,000	USA 200,000,000	USA 250,000,000	USA 300,000,000	USA 350,000,000	USA 400,000,000	USA 450,000,000	USA 500,000,000	USA 550,000,000	USA 600,000,000	USA 650,000,000	USA 700,000,000
Germany	10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000
UK	5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000
France	3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000
Italy	2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000
Spain	1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000	Spain 1,000,000
South Korea	1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000	South Korea 1,000,000
India	1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000	India 1,000,000
Indonesia	1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000	Indonesia 1,000,000
Malaysia	1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000	Malaysia 1,000,000
Thailand	1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000	Thailand 1,000,000
Philippines	1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000	Philippines 1,000,000
Singapore	1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000	Singapore 1,000,000
South Africa	1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000	South Africa 1,000,000
Canada	1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000	Canada 1,000,000
Australia	1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000	Australia 1,000,000
Other	1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000	Other 1,000,000

Table 3. Co-integration matrix (rank = 15)

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China	493,892,902	China 543,367,642	China 622,376,255	China 951,203,787	China 1,137,246,169	China 923,780,724	China 912,412,843	China 1,335,601,257	China 984,879,040	China 924,337,097	China 1,186,215,260	China 1,015,111,327	China 976,485,105	China 944,097,968	China 1,266,533,361	China 1,153,698,682	China 1,153,698,682
USA	18,851,711	USA 48,932,000	USA 52,000,000	USA 70,000,000	USA 100,000,000	USA 150,000,000	USA 200,000,000	USA 250,000,000	USA 300,000,000	USA 350,000,000	USA 400,000,000	USA 450,000,000	USA 500,000,000	USA 550,000,000	USA 600,000,000	USA 650,000,000	USA 700,000,000
Germany	10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000	Germany 10,000,000
UK	5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000	UK 5,000,000
France	3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000	France 3,000,000
Italy	2,000,000	Italy 2,000,000	Italy 2,000,000	Italy 2,000,000													

Table 5. North Korea's Trade with China \$1 million+ items only in 2004 (U.S. dollars)										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
NK Exports to China										
Total Resource-Based	34,136,605	44,298,676	60,895,452	32,034,358	27,232,516	22,952,381	89,811,347	189,624,986	295,480,442	467,830,397
Total Low Tech	3,441,674	6,329,761	7,613,037	6,945,917	6,775,533	6,690,242	44,528,329	58,784,183	80,191,715	95,665,662
Total Mideum Tech	0	0	0	0	0	231,000	0	0	1,296,270	1,417,986
Total High Tech	0	0	0	0	0	0	0	0	0	0
Total	37,578,279	50,628,437	68,508,489	38,980,275	34,008,049	29,873,623	134,339,676	248,409,169	376,968,427	564,914,045
Share of Resource + Low Tech	1	1	1	1	1	1	1	1	1	1
NK Imports from China										
Total Resource-Based	246,978,789	297,975,388	296,307,449	172,220,499	138,867,076	159,105,613	259,469,501	196,302,758	319,870,421	404,376,633
Total Low Tech	28,648,047	21,004,783	20,176,037	26,206,399	23,413,697	32,607,619	41,380,193	47,387,807	54,996,200	76,305,244
Total Mideum Tech	46,697,994	35,717,706	60,567,745	32,367,558	27,460,478	44,040,914	63,365,566	55,113,592	53,893,410	84,617,541
Total High Tech	26,342,039	8,076,778	12,465,404	6,070,136	9,311,048	12,273,924	14,937,288	19,610,085	28,269,059	34,502,676
Total	348,666,869	362,774,655	389,516,635	236,864,592	199,052,299	248,028,070	379,152,548	318,414,242	457,029,090	599,802,094
Share of Resource + Low Tech	0.791	0.879	0.813	0.838	0.815	0.773	0.793	0.765	0.820	0.801