

Tomorrow's Northeast Asia



2
0
1
1

Joint U.S.-Korea Academic Studies
Volume 21

JOINT U.S.-KOREA ACADEMIC STUDIES

Volume 21, 2011

**Prospects for Emerging East Asian Cooperation
and
Implications for the United States**

Symposium Sponsored by

**Korea Economic Institute,
Korea Institute for International Economic Policy, and
School of International Service at American University**

20–22 October 2010

KEI EDITORIAL BOARD

KEI Editors: Nicole M. Finnemann
Sarah Howe
Abraham Kim
Florence Lowe-Lee

Contract Editor: Mary Marik

Cover Design: Stuart Johnson Jr.

The views expressed in this publication are those of the authors. While this monograph is part of the overall program of the Korea Economic Institute endorsed by its Officers, Board of Directors, and Advisory Council, its contents do not necessarily reflect the views of individual members of the Board or of the Advisory Council.

Copyright 2011 by the Korea Economic Institute
www.keia.org

All rights reserved, except that authorization is given herewith to academic institutions and educators to reproduce articles herein for academic use as long as appropriate credit is given both to the authors and to this publication.

Printed in the United States of America.
ISSN 1054-6944

CONTENTS

KEI Advisory Council	iv
Preface	vi
History of Korea Economic Institute Academic Symposia	vii
Prospects for Emerging East Asian Cooperation and Implications for the United States	
Tomorrow's East Asia Today: Regional Security Cooperation for the 21st Century <i>Andrew L. Oros</i>	1
U.S.-Russian-Chinese Cooperation for the Security of Korea <i>Doug J. Kim</i>	15
Korea, ASEAN, and East Asian Regionalism <i>David Arase</i>	33
The Emerging Role of South Korea on a Global Stage	
Bridging the Global Gap: Korea's Leadership Agenda for the G-20 <i>Balbina Y. Hwang and Youngji Jo</i>	53
The Future of Energy Security in Northeast Asia	
Going Global: Issues Facing South Korea as an Emerging Nuclear Exporter <i>Chen Kane, Stephanie C. Lieggi, and Miles A. Pomper</i>	79
Prospects for Creating a Great, Green Path to Power <i>George Hutchinson</i>	105
Engaging and Transforming North Korea's Economy	
Engaging and Transforming North Korea's Economy <i>William B. Brown</i>	133
Estimating the Potential Size of Inter-Korean Economic Cooperation <i>Doowon Lee</i>	149
Finding Room for a Six Party Solution to North Korea's Nuclear Crisis	
South Korea and the Six-Party Talks: The Least Bad Option? <i>Charles K. Armstrong</i>	165
Six-Party Talks and China's Goldilocks Strategy: Getting North Korea Just Right <i>Drew Thompson and Natalie Matthews</i>	179
Japanese Perspectives on the Six-Party Talks and the North Korean Nuclear Crisis <i>Michael R. Auslin</i>	195
Russia and the Six-Party Process in Korea <i>Stephen Blank</i>	207

KEI ADVISORY COUNCIL

Chair

The Honorable Stephen W. Bosworth
The Fletcher School at Tufts
University; Department of State

The Honorable James A. Kelly
EAP Associates, Inc.

Mr. Andrew B. Kim
Sit/Kim International

Members

Mr. Bradley Babson
World Affairs Council of Maine

Mr. Spencer Kim
Pacific Century Institute

Dr. Claude Barfield
American Enterprise Institute

Mr. Bruce Klingner
Heritage Foundation

Dr. John Bennett
Former KEI President

The Honorable James T. Laney
Emory University

Dr. Thomas F. Cargill
University of Nevada, Reno

Dr. Kirk W. Larsen
Brigham Young University

His Excellency Yoon-je Cho
Sogang University

His Excellency Tae-sik Lee
Former Ambassador to the U.S.

Dr. Nicholas Eberstadt
American Enterprise Institute

Dr. Young-Sun Lee
Yonsei University

Mr. Robert Fallon
Columbia Business School

Dr. Wonhyuk Lim
Korea Development Institute

Mr. Gordon Flake
Maureen & Mike Mansfield
Foundation

Mr. Paul M. McGonagle
Consultant

The Honorable Donald P. Gregg
The Korea Society

Dr. G. Mustafa Mohatarem
General Motors Corporation

The Honorable Thomas C. Hubbard
McLarty Associates

Dr. Chung-in Moon
Yonsei University

Dr. Hugh T. Patrick
Columbia University

The Honorable Ernest H. Preeg
Manufacturers Alliance/MAPI

Dr. Mitchell B. Reiss
Washington College

Mr. Evans J. R. Revere
Albright Stonebridge Group

Mr. Alan Romberg
Henry L. Stimson Center

Dr. Robert A. Scalapino
University of California, Berkeley

Dr. Jeffrey R. Shafer
Citigroup

His Excellency Joun-yung Sun
Kyungnam University

Mr. W. Robert Warne
Former KEI President

Mr. Joseph A. B. Winder
Winder International,
Former KEI President

KEI Board of Directors

Sukhan Kim, Esq.
Partner
Akin Gump Strauss Hauer & Feld

Prof. Yoon Shik Park
George Washington University

Prof. David Steinberg
Georgetown University

Officers

Amb. Charles L. Pritchard
President

Dr. Abraham Kim
Vice President

Ms. Florence Lowe-Lee
Treasurer

PREFACE

The Korea Economic Institute (KEI) in Washington, D.C., in cooperation with the School of International Service (SIS) at American University, also in Washington, D.C., cosponsored an academic symposium at SIS on 20–22 October 2010 on “Tomorrow’s Northeast Asia.” This volume contains the papers that were presented at the symposium and subsequently refined.

The 2010 symposium focused on emerging and future challenges facing Northeast Asia. Papers and discussions fell under five broad topics:

- Prospects for emerging East Asian cooperation and implications for the United States
- The emerging role of South Korea on a global stage
- The future of energy security in Northeast Asia
- Engaging and transforming North Korea’s economy
- Finding room for a six-party solution to North Korea’s nuclear crisis.

The sponsors and authors welcome comments on the material in this volume. This is the 21st in a series of annual academic symposia on Asia-Pacific economic and security issues that bring together leading academics and policy professionals from throughout the region.

Louis W. Goodman
Dean
School of International Service
American University

Charles L. (Jack) Pritchard
President
Korea Economic Institute

December 2010

HISTORY OF KOREA ECONOMIC INSTITUTE ACADEMIC SYMPOSIA

- 2010 American University, School of International Service,
Washington, D.C.
- 2009 East-West Center, Honolulu
Additional partners: Hawaii Pacific University, Pacific Forum CSIS
- 2008 New York University,
Center for Japan-U.S. Business & Economic Studies,
Stern School of Business
- 2007 University of Southern California, Korean Studies Institute
- 2006 Harvard University,
Preventive Defense Project, John F. Kennedy School of Government
- 2005 University of Washington
- 2004 College of William & Mary
- 2003 Stanford University
- 2002 University of Pennsylvania
- 2001 University of California–Los Angeles
- 2000 Johns Hopkins School of Advanced International Studies
- 1999 George Washington University
- 1998 Georgetown University
- 1997 University of Southern California
- 1996 University of Michigan
- 1995 University of Chicago
- 1994 University of California–Berkeley
- 1993 Princeton University
- 1992 Columbia University
- 1991 Indiana University
- 1990 University of California–San Diego

ESTIMATING THE POTENTIAL SIZE OF INTER-KOREAN ECONOMIC COOPERATION

Doowon Lee

ABSTRACT

Even though inter-Korean economic cooperation has been growing steadily for the past two decades, the volume of inter-Korean trade is still small compared to the other emerging Asian economies' trade volume with South Korea. This paper tries to estimate the potential size of inter-Korean trade volume on the basis of the assumption that North Korea will be a normal market economy. First, this paper estimates the bilateral gravity model of South Korea with its major trading partners, and will apply this result to inter-Korean trade. Conventional gravity models usually have three explanatory variables of GDP, GDP per capita, and distance. However, this paper has augmented this conventional model by removing GDP per capita and adding RTA (regional trade agreement) dummy and TL (trade liberalization) index. According to this augmented gravity model, inter-Korean trade volume would increase by 6 to 8 times as of 2008 if North Korea became a normal market economy. Even though there exists a substantial gap between the actual and the potential trade volumes, this gap has been narrowed during the previous two decades.

Doowon Lee is a Professor in the School of Economics, Yonsei University, Seoul, Korea.

Introduction

Since inter-Korean economic cooperation began at the end of 1980s, the volume and scope of inter-Korean economic cooperation have increased over time. Even though the magnitude of inter-Korean economic cooperation has fluctuated from time to time, mostly because of noneconomic factors, its volume has increased gradually and steadily. The total trade volume between the two Koreas was merely \$19 million in 1989 when inter-Korean trade was initiated. This figure was increased to almost \$2 billion as of 2008 and 2009.¹ Furthermore, it is believed that inter-Korean economic transactions, including trade and investment, will grow exponentially once North Korea transforms itself into a normal market economy. When North Korea becomes a normal market economy, its cheap labor and abundant natural resources are expected to attract South Korean investment, and they would be combined with South Korea's capital and technology. Also, South Korea would be a natural trading partner with North Korea given its geographical adjacency and structural complementarity. This potential has not fully materialized owing to the fact that North Korea is one of the most closed economies in the world, and its resource allocation is severely distorted by noneconomic forces.

The purpose of this paper is to estimate the potential volume of inter-Korean economic cooperation such as trade and investment. The potential for inter-Korean economic cooperation can be estimated on the basis of the assumption that North Korea will be a normal market economy. Under this assumption, we can estimate the natural amount of trade and investment between South Korea and North Korea.

The economic model this paper uses in this estimation is the gravity model. The gravity model is widely used to estimate the natural trading volume in bilateral or multilateral trade of nations. In this paper, the author will estimate the bilateral gravity model of South Korea with its major trading partners and will apply this result to inter-Korean trade and investment. According to the conventional gravity model, a nation is supposed to have larger trade volume with its trading partner if the trading partner's GDP, income level, and geographical adjacency are larger. For example, according to the estimation made by Bank of Korea, the per capita gross national income (GNI) of North Korea as of 2008 was \$1,065.² In Asia, countries such as Pakistan, Vietnam, Cambodia, and India had per capita

1 According to the South Korea's Ministry of Unification, the total volume of inter-Korean economic cooperation as of 2008 was \$1.82 billion, and in 2009 it was \$1.68 billion.

2 The Bank of Korea publishes only the per capita GNI for North Korea, which would be close to per capita GDP.

GNPs similar to that of North Korea in 2008.³ Even though these countries have per capita incomes similar to North Korea's, their trading volume with South Korea is much larger than that of North Korea. For example, the total trading volume between South Korea and India was \$15.6 billion in 2008, and the equivalent figure for Vietnam was \$9.8 billion. These figures are much larger than the 2008 inter-Korean trade volume of \$1.8 billion. The large trade volume between India and South Korea can be explained by the large population of India. However, the large difference between South Korea–Vietnam trade and South Korea–North Korea trade can not be fully explained by Vietnam's population size. Even when we consider the population factor, the per capita trade volume of South Korea–Vietnam (in other words, the bilateral trade volume of South Korea–Vietnam divided by the Vietnamese population) is significantly larger than the per capita trade volume of South Korea–North Korea. The former was \$114 and the latter was \$78 in 2008. This simple comparison demonstrates that inter-Korean trade would grow substantially once North Korea becomes a normal market economy.

The same logic can be applied to inter-Korean investment. Until now, foreign direct investment from South Korea to North Korea has been limited and largely influenced by noneconomic factors. For example, the construction of a light-water reactor (1997–2003) was interrupted by the conflict between North Korea and the United States. Also, the Mt. Kumgang tourism project (1998–2008) was halted by the death of a South Korean tourist shot by a North Korean soldier. Even though the Kaesong industrial complex project is still going on, its fate is uncertain owing to the sinking of a South Korean ship during the summer of 2010. Even though North Korea had initiated several open-door policies to attract foreign capital in the past, the policies did not apply to South Korea. As a result, investment from South Korea to North Korea has been limited and has fluctuated severely so far.

This paper does not distinguish between inter-Korean trade and inter-Korean investment as these two activities are included in inter-Korean economic cooperation. Generally speaking, however, inter-Korean economic cooperation has been largely dominated by inter-Korean trade. Therefore, in the remainder of this paper the focus will be on the estimation of inter-Korean trade.

This paper is composed of four sections. The next section provides a descriptive analysis of inter-Korean economic cooperation. That is followed by a review of the existing literature that has used the gravity model in estimating bilateral

3 According to the IMF World Economic Outlook for April 2010, the per capita GDPs of Pakistan, India, Vietnam, and Cambodia in 2008 were \$1,022, \$1,020, \$1,042, and \$825, respectively.

trade volume. The author then estimates the potential amount of inter-Korean trade using the augmented gravity model. The final section provides policy implications for future development of inter-Korean economic cooperation and summarizes the findings of this paper.

Review of the Inter-Korean Economic Transaction

Let us first briefly describe the historic evolution and current status of inter-Korean economic cooperation. When we analyze the North Korean economy, even a simple calculation such as summing up North Korean trade volume can be tricky. Several institutions publish the external trade data of North Korea. This paper relies on data published by the Korea Trade-Investment Promotion Agency (KOTRA). KOTRA publishes annual external trade data for North Korea by collecting trade data of North Korea's major trading partners. For example, KOTRA collected 79 countries' trade data with North Korea for its 2009 report. As KOTRA does not collect trade data of every country that trades with North Korea, this report does not show a comprehensive picture of North Korean trade. Nonetheless, this report is considered more reliable and consistent than other publications because KOTRA uses its field offices to verify each country's trade data with North Korea. KOTRA began to carry out this job because other data sources had made frequent mistakes, such as confusing North Korea and South Korea and combining noncommercial trade with commercial trade. According to KOTRA, inter-Korean economic cooperation has been increasing rather steadily (*Table 1*).

Even though inter-Korean economic transactions are not regarded as international trade, it is de facto conducted like international trade. Therefore, from this point on, let us assume that inter-Korean economic transactions are indeed international trade. This implies that inflow from North Korea to South Korea would be regarded as imports from North Korea to South Korea. Likewise, outflow from South Korea to North Korea would be regarded as exports from South Korea to North Korea. When we incorporate data from Table 1 with the other external trade data of North Korea, we can come up with the composition of North Korean trade across major trading partners. This result is shown in *Figure 1*.

As we can see in Figure 1, South Korea has always been a major trading partner of North Korea. In particular, in recent years, South Korea—taking roughly one-third of the North Korea's total trading volume—has become the second-largest trading partner to North Korea. Another interesting finding from Figure 1 is that North Korea has increased its dependence on trade, measured by the

Table 1: Inter-Korean Economic Transactions: Trade Inflow and Outflow, 1989–2009

Year	Inflow from North Korea to South Korea	Outflow from South Korea to North Korea	Total of inflow and outflow	Annual growth
	Won, thousands	Won, thousands	Won, thousands	Percentage
1989	18,655	69	18,724	
1990	12,278	1,188	13,466	-28.08
1991	105,719	5,547	111,266	726.27
1992	162,863	10,563	173,426	55.87
1993	178,167	8,425	186,592	7.59
1994	176,298	18,249	194,547	4.26
1995	222,855	64,436	287,291	47.67
1996	182,400	69,639	252,039	-12.27
1997	193,069	115,270	308,339	22.34
1998	92,264	129,679	221,943	-28.02
1999	121,604	211,832	333,437	50.24
2000	152,373	272,775	425,148	27.50
2001	176,170	226,787	402,957	-5.22
2002	271,575	370,155	641,730	59.26
2003	289,252	434,965	724,217	12.85
2004	258,039	439,001	697,040	-3.75
2005	340,281	715,472	1,055,754	51.46
2006	519,539	830,200	1,349,739	27.85
2007	765,346	1,032,550	1,797,896	33.20
2008	932,250	888,117	1,820,366	1.25
2009	934,251	744,830	1,679,082	-7.76

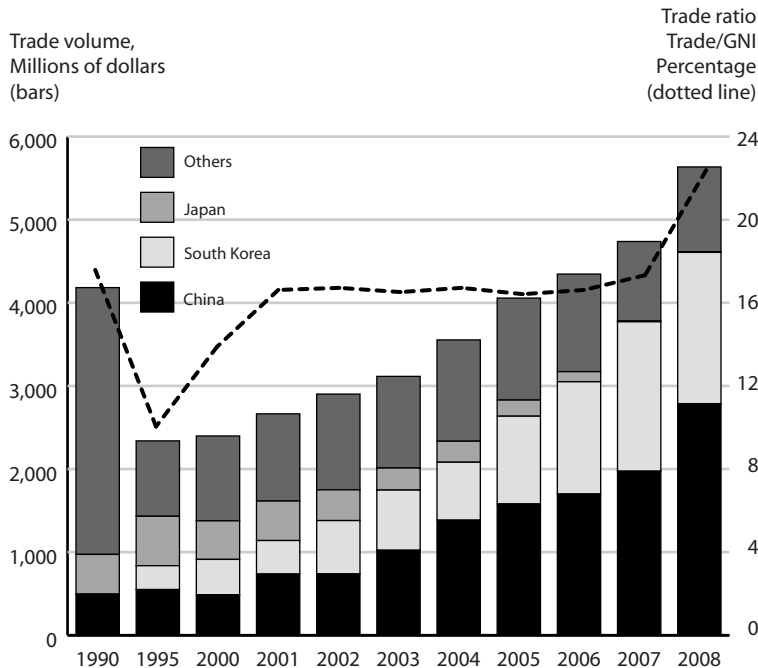
Source: KOTRA (various years).

Note: These data for Inter-Korean economic transactions do not use terms such as import and export. Because North Korea is still part of South Korea according to South Korea's constitution, inter-Korean transactions are not regarded as international trade.

total trade volume divided by its GNI, since the mid-1990s. This implies that international trade is getting to be a more and more important part of the North Korean economy, and the relative importance of inter-Korean economic trade is growing over time.

Inter-Korean economic transactions include several categories of commercial and noncommercial economic activities. When we break down these activities, we arrive at **Table 2**, which shows that inter-Korean economic transactions incorporate many different activities such as general trade, commission-based trade, economic cooperation projects, humanitarian aid, and social-cultural projects.

Figure 1: North Korea's Trade with Its Major Trading Partners, 1990–2008



Source: KOTRA, various years.

Thus, it is difficult to consider past transactions as international trade. In more recent years, however, commercial transactions are taking a more dominant share of the total inter-Korean transactions. Therefore, in estimating the potential trade volume between the two Koreas, we will regard the current level of inter-Korean economic transactions as the total trade volume between the two Koreas.

Gravity Model for Trade

Let us define the gravity model first and introduce previous studies that have used the gravity model in estimating bilateral trade volume between two countries. A gravity model is an empirical model that is widely used in estimating bilateral trade volume with a certain set of explanatory variables. This model is based on the assumption that two countries would trade more if the product of their GDPs (and also GDP per capita) were larger and the distance between the two countries were closer. Therefore, almost all gravity model literature makes use of three explanatory variables: GDP, GDP per capita, and distance. Also, many researchers try to augment this conventional gravity model by adding more

Table 2: Composition of Inter-Korean Economic Transactions, 1995–2009

Year	Commercial transactions										Total
	General trade	Commission-based processing trade	Economic cooperation				Subtotal	Noncommercial transactions	Total		
			Mt. Kumgang	Kaesong	Others	Subtotal					
1995	230.4	45.9					276.3	11.0	287.3		
1998	73.0	71.0	37.7	0.0	1.2		182.5	39.4	221.9		
1999	89.0	100.0	40.7	0.0	6.3		236.1	97.3	333.4		
2000	110.5	129.2	16.2	0.0	17.4		273.3	151.8	425.1		
2002	171.8	171.2	11.9	0.0	13.1		367.9	273.8	641.7		
2004	171.8	176.0	41.8	41.7	5.8		436.5	260.5	697.0		
2005	209.8	209.7	87.1	176.7	6.2		689.5	366.2	1,055.8		
2006	304.1	253.0	56.7	298.8	15.5		928.1	421.7	1,349.7		
2007	461.4	330.0	1,14.8	440.7	84.4		1,431.2	366.1	1,797.9		
2008	400.1	410.0		840.0			1,712.0	108.0	1,802.0		
2009	256.1	409.7	8.7	940.5	26.9		1,642.1	36.9	1,679.0		

Source: KOTRA (various years).

explanatory variables that represent trade structure, membership in regional trade agreements (RTAs), degree of trade liberalization, and so on.

The gravity model has been studied theoretically by Poyhonen (1963), Bergstrand (1985, 1989), Helpman and Krugman (1985), and Evenett and Keller (2002). Also, the gravity model has been used empirically to predict the natural trade volume between two countries. Numerous studies have made use of multilateral trade data from a group of countries; they include Rose (2004), Faruquee (2004), Frankel and Wei (1995), Filippini and Molini (2003), and Kien (2009). Also, some studies have applied the gravity model in order to examine the natural trade volume of South Korea with its major trading partners; they include Lee Young-sun (1995), Sohn and Yoon (2000), Sohn (2005), Lee Doo-won (2005), and Lee Chong-wha (2010).

Also, there has been some effort to utilize the results of the previous estimations made with the use of the gravity model. For example, Noland (2000, chap. 7) estimated the natural trade shares of North Korea as of 1990 using the gravity model of bilateral trade estimated by Frankel and Wei (1995). According to this study, the largest natural trading partner of North Korea would be South Korea.⁴ Kim (2008) estimated the potential trade dependency ratio of North Korea using the gravity model estimated by Broadman (2005). According to this study, the natural trade dependency ratio of North Korea is estimated as 30 percent, when the actual figure was only 17 percent as of 2006.⁵

Let us now establish a gravity model for South Korea's trade volume in order to estimate the natural trade volume between South Korea and North Korea. In this paper, the dependent variables are export from South Korea to its trading partners (EXPORT) and trade volume (export + import) between South Korea and its trading partners (TV). This paper estimates gravity models using the 2008 trade data of South Korea. The number of observations in this paper is the largest 50 trading partners of South Korea. First, the basic equation of the gravity model is estimated using explanatory variables of GDP of each trading partner, GDP per capita of each trading partner, and distance between South Korea and each trading partner. The results of these basic equations (1-1) and (1-2) are summarized in **Table 3**.

4 According to Noland (2000), South Korea would take 35 percent of North Korea's trade shares. The next largest natural trading partners would be Japan and China, taking 30 percent and 13 percent trade shares, respectively. As of 1990, the actual trading shares of South Korea, Japan, and China were 10 percent, 21 percent, and 23 percent, respectively.

5 The explanatory variables used in the gravity model estimation of Kim (2008) were population, GDP per capita (measured at purchasing power parity), distance, and dummy variables for East Asia, Latin America, and the Organization for Economic Cooperation and Development.

$$\begin{aligned} \text{Ln}[\text{EXPORT}_{\text{Korea},j}] = \\ C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{GDPPC}_j] + \alpha_3 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \varepsilon_j \end{aligned} \quad (1-1)$$

$$\begin{aligned} \text{Ln}[\text{TV}_{\text{Korea},j}] = \\ C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{GDPPC}_j] + \alpha_3 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \varepsilon_j \end{aligned} \quad (1-2)$$

Table 3: Estimation Results of Basic Gravity Model

Dependent variables	Trade volume (TV)	Export from South Korea (EXPORT)
Constant (C)	19.305*** (7.342)	21.256*** (9.635)
Log of GDP (GDP)	0.353*** (4.680)	0.253*** (3.900)
Log of GDP per capita (GD-PPC)	0.017 (0.183)	-0.006 (-0.074)
Log of distance (DST)	-0.736*** (-3.842)	-0.686*** (-4.170)
R ² (adjusted R ²)	0.540 (0.510)	0.503 (0.470)
F-statistics	18.012	15.491

Source: Author's data.

Notes: Sample year: 2008; included observations: 50 countries. Numbers in parentheses are t-values for each coefficient. Coefficients with *, **, *** are statistically significant at 90 percent, 95 percent, and 99 percent, respectively.

According to Table 3, the coefficient for GDPPC is positive, but its statistical significance is too weak to be considered. This is understandable given the fact that South Korea's trade volumes with a rich country like the United States and a relatively poor country like China are both large. Therefore, let us remove GDPPC from our explanatory variables in the following equations.

$$\text{Ln}[\text{EXPORT}_{\text{Korea},j}] = C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \varepsilon_j \quad (2-1)$$

$$\text{Ln}[\text{TV}_{\text{Korea},j}] = C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \varepsilon_j \quad (2-2)$$

Let us now augment equations (2-1) and (2-2) by adding two more explanatory variables that are deemed to be important in determining bilateral trade volume between South Korea and its major trading partners. They are dummy variable for RTA and index for trade liberalization (TL). The RTA dummy takes the value of 1 if the country has ratified a free trade agreement (FTA) with Korea or the

country is a member of the Asia-Pacific Economic Cooperation (APEC) as of the end of 2007. The TL index, which is published by the Fraser Institute, measures the degree of freedom to trade internationally, and it ranges from 0 to 10. For example, a country like Myanmar whose trade regime is very much closed to the rest of the world has the TL index of 1.3, when the equivalent figure for a free trade country like Singapore is 9.4.⁶ Equation (3) adds RTA, and Equation (4) adds both RTA and TL. We can expect that a country that is a member of an RTA with South Korea would trade more with South Korea. Also, a country whose trade regime is more liberalized would trade more with South Korea. By adding these explanatory variables, we can expect to improve the estimation power of the model. Estimation results of these augmented gravity models are summarized in *Table 4*.

$$\begin{aligned} \text{Ln}[\text{EXPORT}_{\text{Korea},j}] = \\ C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \alpha_3 \cdot [\text{RTA}_{\text{Korea},j}] + \varepsilon_j \end{aligned} \quad (3-1)$$

$$\begin{aligned} \text{Ln}[\text{TV}_{\text{Korea},j}] = \\ C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \alpha_3 \cdot [\text{RTA}_{\text{Korea},j}] + \varepsilon_j \end{aligned} \quad (3-2)$$

$$\begin{aligned} \text{Ln}[\text{EXPORT}_{\text{Korea},j}] = \\ C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \alpha_3 \cdot [\text{RTA}_{\text{Korea},j}] + \alpha_4 \cdot [\text{TL}_j] + \varepsilon_j \end{aligned} \quad (4-1)$$

$$\begin{aligned} \text{Ln}[\text{TV}_{\text{Korea},j}] = \\ C + \alpha_1 \cdot \text{Ln}[\text{GDP}_j] + \alpha_2 \cdot \text{Ln}[\text{DST}_{\text{Korea},j}] + \alpha_3 \cdot [\text{RTA}_{\text{Korea},j}] + \alpha_4 \cdot [\text{TL}_j] + \varepsilon_j \end{aligned} \quad (4-2)$$

Table 4 shows that, first, all the signs for coefficients are consistent with theoretical hypotheses, and they are statistically significant. As theoretical hypotheses have predicted, a country with a large GDP, close distance, an RTA membership, and a liberalized trade regime would trade more with South Korea. Second, the estimated coefficients for GDP and distance are robust as we add additional explanatory variables. Also, as we augment the basic model with additional explanatory variables, we have improved the fitness of the estimation with higher value for R². As equation (4) has yielded the best estimation result, we will use the result of equation (4) in estimating the natural size of the inter-Korean trade volume.

6 Refer to Free the World (www.freetheworld.com) for further description of the TL index.

Table 4: Estimation Results of Augmented Gravity Models

Explanatory variable	Expected sign	Equation 2 (basic)		Equation 3		Equation 4	
		Export	Trade volume	Export	Trade volume	Export	Trade volume
Constant (c)		21.280*** (9.635)	19.233*** (7.474)	19.995*** (9.682)	17.719*** (7.381)	17.264*** (7.845)	15.099*** (6.253)
Log of GDP (GDP)	+	0.251*** (4.365)	0.360*** (5.373)	0.213*** (3.938)	0.315*** (5.014)	0.273*** (4.760)	0.373*** (5.927)
Log of distance (DST)	-	-0.688*** (-4.350)	-0.728*** (-3.947)	-0.444*** (-2.698)	-0.440** (-2.299)	-0.495*** (-3.231)	-0.483*** (-2.877)
RTA dummy (RTA)	+			0.725*** (3.153)	0.853*** (3.194)	0.590*** (2.722)	0.783*** (3.290)
Trade liberalization (TL)	+					0.220** (2.298)	0.197* (1.873)
No. of observations		50	50	50	50	46	46
R ²		0.502	0.540	0.591	0.623	0.678	0.719
Adjusted R ²		0.481	0.520	0.564	0.599	0.647	0.692
F-statistics		23.736	27.569	22.146	25.379	21.609	26.277

Source: Author's data.

Notes: Numbers in parentheses are t-values for each coefficient. Coefficients with *, **, *** are statistically significant at 90 percent, 95 percent, and 99 percent, respectively.

To estimate the natural export or trade volume between the two Koreas using the result of equation (4), we need to figure out corresponding values of North Korea for GDP, distance, RTA dummy, and the TL index. According to the estimation by the Bank of Korea, the North Korean GNI as of 2008 was \$24.8 billion. Also, the distance between Seoul and Pyongyang is 128 miles. As North Korea is part of South Korea according to the South Korean constitution, the RTA dummy in equation (4) should take the value of 1. Last, we need to figure out the TL value for North Korea. Because the TL value for North Korea is not published by the Fraser Institute, we need to find a proxy value for the North Korean TL. Thus, the TL values of three countries with political and economic situations similar to North Korea's are regarded as proxies for North Korea. They are Zimbabwe, Venezuela, and Iran; and their TL values are 2.4, 3.7, 5.0, respectively. In this paper, for the sake of simplicity, TL values of 3, 4, and 5 are used. Therefore, we have estimated the natural export or trade volume between the two Koreas by inserting these figures into equation (4). The result of this estimation is summarized in *Table 5*.

Table 5: Natural Volume of Inter-Korean Export or Trade Estimated by Equation (4), in millions of dollars

	Actual (2008)	Estimated potential		
		TL=3	TL=4	TL=5
A: Export from South Korea to North Korea (gap between the actual and the potential)	888	6,812 (7.7 times)	8,489 (9.6 times)	10,578 (11.9 times)
A / North Korea's GNI	0.036	0.275	0.342	0.427
B: Total inter-Korean trade volume (gap between the actual and the potential)	1,820	10,203 (5.6 times)	12,423 (6.8 times)	15,125 (8.3 times)
B / North Korea's GNI	0.073	0.411	0.501	0.610

Source: Author's data.

As Table 5 shows, the inter-Korean export or trade volume can be substantially increased once North Korea transforms itself into a normal market economy. With regard to South Korea's exports to North Korea, they can be increased to at least eight times larger than the current level. Furthermore, if North Korea adopts more of a free trade regime, exports can increase to 12 times the current level. With regard to the total inter-Korean trade volume, it can increase anywhere from 5.6 times to 8.3 times the current level. These figures can imply that the relative importance of inter-Korean trade out of the North Korean GNI would be at least 41 percent. This ratio is substantially higher than the current level of 7 percent.

Last, let us compare the results of this paper with the previous literature on this subject. Using explanatory variables such as GDP, GDP per capita, and distance, Lee Young-sun (1995) estimated the potential inter-Korean trade volume as of 1990. Also, Sohn (2005) estimated a gravity model for South Korea using explanatory variables including TCI (trade complementarity index). The results of these previous studies and this paper are summarized in *Table 6*.

Table 6 shows that there is a wide range of gaps between the actual inter-Korean trade volume and the potential inter-Korean trade volume estimated by each gravity model. Generally speaking, however, we find that this gap has been

Table 6: Comparison of Estimation Results for Inter-Korean Trade Volume

Name of study	Base year	Explanatory variables	Actual trade volume, in millions of dollars	Estimated trade volume, in millions of dollars (gap between the actual and the estimate)
Lee Young-sun (1995)	1990	GDP, GNP per capita, distance	13	2,200 (169 times)
Sohn Chan-hyun (2005)	1995	GDP, GDP per capita, distance, TCI APEC (dummy)	287	4,303.9 (15 times)
This paper	2008	GDP, distance, RTA (dummy) TL index	1,820	10,230–15,126 (5.6–8.3 times)

Source: Author's data.

Notes: TCI = trade complementarity index; TL = trade liberalization. The estimation by Sohn (2005) is based on the assumption that North Korea's TCI with South Korea is 0.6 and that North Korea becomes a member of the Asia-Pacific Economic Cooperation (APEC).

narrowed over time. This implies that both sides have gradually exploited the potential of inter-Korean trade over time.

Policy Implications and Conclusions

Inter-Korean economic cooperation has gradually increased since the late 1980s even though it has been interrupted by noneconomic factors from time to time. It is generally agreed, however, that both sides on the Korean peninsula have not been able to exploit the potential of inter-Korean trade fully yet. Therefore, it has been the aim of this paper to examine the potential trade volume between the South and the North using gravity models. Even though similar efforts have been tried in the past, this paper differs from previous studies in several aspects. First, this paper uses gravity models augmented by additional explanatory variables such as RTA membership and a trade liberalization index. Also, this paper uses the most updated bilateral trade data of South Korea with its major trading partners. Furthermore, this paper compares its estimation result with those of the previous works and tries to find out how the two Koreas have narrowed the gap between the actual trade volume and the potential trade volume.

As a result of empirical tests, this paper concludes that there is still a wide range of gaps between the actual trade volume and the potential trade volume. As of 2008, exports from South Korea to North Korea could be increased by at least 8 to 12 times if North Korea were a normal market economy. Likewise, the total trade volume could be increased 6 to 8 times as well. If this potential were realized, trade with South Korea would take account of 40–60 percent of the North Korean GNI. Also, this potential would be enlarged if North Korea were to adopt a more liberalized trade regime.

When the result of this paper is compared with the results of previous studies, we can see that the gap between the actual trade volume and the potential one has narrowed over time. This is a positive change, which can provide more a optimistic perspective on the future.

A series of strong efforts must be made to fill the gap between the actual trade volume and the potential one. Several suggestions can be made with regard to this concern. First, the North Korean regime needs to liberalize the inter-Korean trading business, which is currently monopolized by a government-run state-owned enterprise. Second, many transaction costs such as logistics costs, communications costs, and customs clearance costs need to be reduced substantially. Third, South Korean firms need to contact and hire North Korean labor more freely so that they can take full advantage of the cheap and relatively well-educated labor force in the North. Fourth, the North Korean infrastructure needs to be improved dramatically. Without proper infrastructure, it is difficult to figure out where the comparative advantage of the North Korean economy lies. Infrastructure can include institutions such as financial institutions that are essential to increased international trade. Only when these market institutions are in place and prices are set by the market will North Korea find out its true comparative advantage. More than anything else, the political interference that has thus far greatly interrupted inter-Korean economic cooperation needs to be abandoned.

List of References

- Bergstrand J. H. 1985. "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence." *Review of Economics and Statistics* 3: 474–81.
- . 1989. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade." *Review of Economics and Statistics* 71: 143–53.

- Broadman, Harry G., ed. 2005. *From Disintegration to Reintegration: Eastern Europe and the Former Soviet Union in International Trade*. Washington, D.C.: World Bank.
- Evenett, S. J., and W. Keller. 2002. "On Theories Explaining the Success of the Gravity Model." *Journal of Political Economy* 110, no. 2 (April): 281–316.
- Faruqee, Hamid. 2004. "Measuring the Trade Effects of EMU." IMF Working Paper, no. WP/04/154. Washington, D.C.: International Monetary Fund.
- Filippini, Carlo, and Vasco Molini. 2003. "The Determinants of East Asian Trade Flows: A Gravity Equation Approach." *Journal of Asian Economics* 14: 695–711.
- Frankel, Jeffrey A., and Wei Shang-jin. 1995. "Is a Yen Bloc Emerging?" *Joint U.S.-Korea Academic Studies* 5: 145–75.
- Helpman, Elhanan, and Paul Krugman. 1985. *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy*. Cambridge: MIT Press.
- Kien, Nguyen Trung. 2009. "Gravity Model by Panel Data Approach: An Empirical Application with Implications for the ASEAN Free Trade Area." *ASEAN Economic Bulletin* 26, no. 3: 266–77.
- Kim Suk-jin. 2008. "Trade Potential and Reform Agenda of North Korea [in Korean]." *KDI Review of the North Korean Economy* 5: 3–20.
- Lee Chong-wha. 2010. "Is East Asia a Natural Trading Bloc." *Journal of Northeast Asian Economic Studies* 22, no. 1: 221–43.
- Lee Doo-won. 2005. "Potential Effect of Korea's FTA with Its Trading Partners: Estimation by Augmented Gravity Models with Panel Data." *Korean Economic Review* 21, no. 2 (Winter): 227–307.
- Lee Young-sun. 1995. "Type of Inter-Korean Economic Cooperation and Its Economic Effect [in Korean]." *Buk Han Kyung Je Non Chong* 1: 141–72.
- Noland, Marcus. 2000. *Avoiding the Apocalypse: The Future of the Two Koreas*. Washington, D.C.: Institute for International Economics.
- Poyhonen, Pentti. 1963. "A Tentative Model for the Volume of Trade between Countries." *Weltwirtschaftliches-Archiv* 90, no. 1: 93–100.
- Rose, Andrew K. 2004. "Do We Really Know That the WTO Increases Trade?" *American Economic Review* 94, no. 1: 98–114.
- Sohn Chan-hyun. 2005. "Does the Gravity Model Explain South Korea's Trade Flows?" *Japanese Economic Review* 56, no. 4 (December): 417–30.
- Sohn Chan-hyun and Yoon Jin-na. 2000. "A Gravity Model Analysis of Korea's Trade Patterns and the Effect of a Regional Economic Block [in Korean]." *Journal of International Economic Studies* 4, no. 2: 3–32.

2 Academic 0 Symposium 1 1

Prospects for Emerging East Asian Cooperation and Implications for the United States

Andrew L. Oros, Doug Joong Kim, David Arase

The Emerging Role of South Korea on a Global Stage

Balbina Hwang, Youngji Jo

The Future of Energy Security in Northeast Asia

Chen Kane, Stephanie C. Lieggi, Miles Pomper, George Hutchinson

Engaging and Transforming North Korea's Economy

Doowon Lee, William Brown

Finding Room for a Six Party Solution to North Korea's Nuclear Crisis

Charles Armstrong (on South Korea), Drew Thompson, Natalie Mathews
(on China), Michael Auslin (on Japan), Stephen Blank (on Russia)

October 20-22, 2010

Sponsored by:

The Korea Economic Institute

The Korea Institute for International Economic Policy

American University School of International Service