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A Study on Optimum Currency Area Possibilities on the Korean Peninsula

한반도의 최적통화지역 가능성에 관한 연구

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ABSTRACT

The last few decades have seen a period of relative openness and acceleration of North Korea's trade relations followed by a period of escalating tensions and radicalization of the autocratic regime of Kim Jong Un. Is there any prospect of pacification and reunification with South Korea based on economic grounds? In order to study such a possibility, we relied on the theory of optimum currency areas (OCA), which gained traction at the time of the creation of the Euro Zone. We applied the OCA index, developed by Bayoumi & Eichengreen in 1997, to North Korea in order to give a theoretical yet precise overview of the relevance of monetary union between North Korea and its major trade partners. Our findings show a consistency of South Korea being a preferred candidate for a monetary union relatively to other countries. While other countries like China and Russia demonstrate better performance at some points in the studied period, they showed more inconsistency over time. In regard of this index, it is however clear that the sudden creation of currency area on the Korean Peninsula would not be economically optimum, even when taking endogeneities effects into account.

Based on that recognition, we tried to draw the main policy implications regarding the project of a Korean monetary union and the outlines of the cooperation challenge that this project represents.

Keywords: Optimum currency areas, North Korea, inter-Korean relations, OCA index, monetary integration, reunification

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TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

CHAPTER I. INTRODUCTION

In *The Theory of Moral Sentiments* (1759), Adam Smith wrote: “Even during the separation, the father and the child, the brothers or the sisters, are by no means indifferent to one another. They all consider one another as persons to and from whom certain affections are due, and they live in the hopes of being some time or another in a situation to enjoy that friendship with ought naturally to have taken place among persons so nearly connected” (Smith, 1759). Those lines truly resonate with the situation on the Korean Peninsula and its two brotherly countries separated for more that 77 years now. The past decades had sparked hope for pacification, and some might have said that leaders on both side of the frontier had planted the seeds for reunification, the 2018 Inter-Korea Summit and the Panmunjeom Declaration being the most vivid and recent examples of this step further into the pacification process. Only a few years later, this perspective seems less and less conceivable and the diplomatic efforts made in the past decade appear as vain and irreversibly belonging to the past. Symptomatic of this radicalization of the Inter-Korean relation, North Korea has launched more than 95 ballistic missiles in 2022 (CNN, s.d.), the most important number in the history of the conflict. The economic partnerships and trade between the two countries have been an important aspect of their relation and a mirror that reflected the health of their diplomatic ties. Since the end of the 1980s, inter-Korean trade increased up to 2.714 billion USD in 2015 (Ministry of Unification) through general trade, humanitarian assistance and economic activities in the Gaesong Industrial Complex (GIS), a special administrative industrial region in North Korea, once a symbol of the economic cooperation between the two countries. Therefore, it is also in the

economic field that we have witnessed the deterioration of inter-Korean relations, with trade relations being almost inexistent since 2017 (Table 1).

Table 1. Inter-Korean Trade Volume by Year (USD million)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Inbound	1,044	914	1,07	615	1,21	1,452	186	0	11	0	0	0	0
Outbound	868	800	897	521	1,14	1,262	147	1	21	7	4	1	0
Total	1,912	1,71	1,97	1,136	2,34	2,714	333	1	31	7	4	1	0

Source: Ministry of Unification

As the pacification of inter-Korean relations, notably on the economic side, seems thus less and less achievable, the motives for cooperation and/or reunification remains. On the political and geopolitical aspects, it goes without saying that a proper and legal state of peace would be preferable than the current state of hostility between the two countries and the constant threat that North Korean's weapons of mass destruction represent. Politically, if time has led to a growing disinterest in the North Korean issue from the South Korean people (Table 2), still a majority of South Koreans have rather constantly seen the unification as necessary at the national level, an opinion reflected in the 64.5% of them perceiving "national benefits of unification" (Table 3).

Table 2. Indifference in North Korea 2015-2021 (% of the respondents expressing no interest in North Korea)

Year	2015	2016	2017	2018 (April)	2019 (September)	2020 (November)	2021 (April)
Disinterest	50,8	57	54,2	52,4	57,1	64,5	61

Table 3. National Benefits of Unification 2014-2021 (% of the respondents perceiving unification as beneficial for the whole country)

Year	2014	2015	2016	2017	2018	2019 (September)	2020 (November)	2021 (April)
National benefits of unification	60.5	56.9	55.9	68.8	73.9	70.3	56.4	64.5

Source: Korean Institute for National Unification

On the economic aspect, South Korea would also draw many benefits from reunification, with the most direct one probably being the business environment becoming much more favorable for investments. To give one example in the short-term, we can expect that South Korea would get rid of its so-called "Korea discount", a term describing the phenomenon of undervaluation of stocks of Korea firms relative to comparable foreign firms (Ducret & Isakov, 2020), due notably to the geopolitical instability on the peninsula. In the long-term, many researchers have tried to measure the economic benefits from reunification, as we will see in the next sections. One striking projection, among others, made about reunification is that a united Korea's GDP could exceed those of France, Germany or Japan under thirty to forty years (Kwon, 2009). But such unification would also come with considerable costs.

Given that context, the central question that arises is that of the economic opportunity of a Korean reunification, or at least of a deep cooperation between the two countries. To study this opportunity, we naturally turn toward the optimum currency area (OCA) theory, which we will further define in the following section, but that we can for now reduce to the economic theory that studies the appropriate domain which is to adopt the same currency (Mundell, 1961). Firstly because national sovereignty is fundamentally linked to the monetary sovereignty question, as Jean Bodin stated : "As for the right to [coin

money], it is of the same nature as the law, and only the one who has the power to make the law, can give legal existence to money [...] there is nothing of greater consequence after the law, than the title, value and ratio of coins" (Bodin, 1756). Secondly, because in the recent history of our economies, the OCA theory has been a prevalent economic analysis tool to study the opportunity of monetary and/or political unions, with the most prominent example of the Euro Zone and the European Union. Many questions thus exist regarding the optimum currency area possibilities on the Korean Peninsula, and the aim of this paper will therefore be to draw a first outline of the Korean unification through the prism of this theory.

The remainder of this paper is organized as follows: Chapter II presents a review of the existing theories on both OCA and Korea unification scenarios. Chapter III describes our research purpose and methodological approach. Chapter IV presents the results of our research. Chapter V introduces the policy implications of our results. Chapter VI presents our conclusions and evokes some of the limitations of our research.

CHAPTER II. LITTERATURE REVIEW

2.1. Optimum Currency Area Theory

The optimum currency area theory can be considered as a tool used to evaluate the suitability of common currency adoption, monetary union, or other monetary arrangements. “What is the appropriate domain of a currency area?”, that is the question that Robert A. Mundell asked in his grounding work that led to the development of this theory (Mundell, 1961). Masahiro Kawai defines OCA as “the ‘optimum’ geographical domain having as a general means of payments either a single common currency or several currencies whose exchange values are immutably pegged to one another with unlimited convertibility […].” (Kawai, 1991). Ronald I. McKinnon defines the word “optimum” as the way in which the area in question “gives the best resolution of three (sometimes conflicting) objectives: (1) the maintenance of full employment; (2) the maintenance of balanced international payments; (3) the maintenance of a stable internal average price level” (McKinnon, 1963).

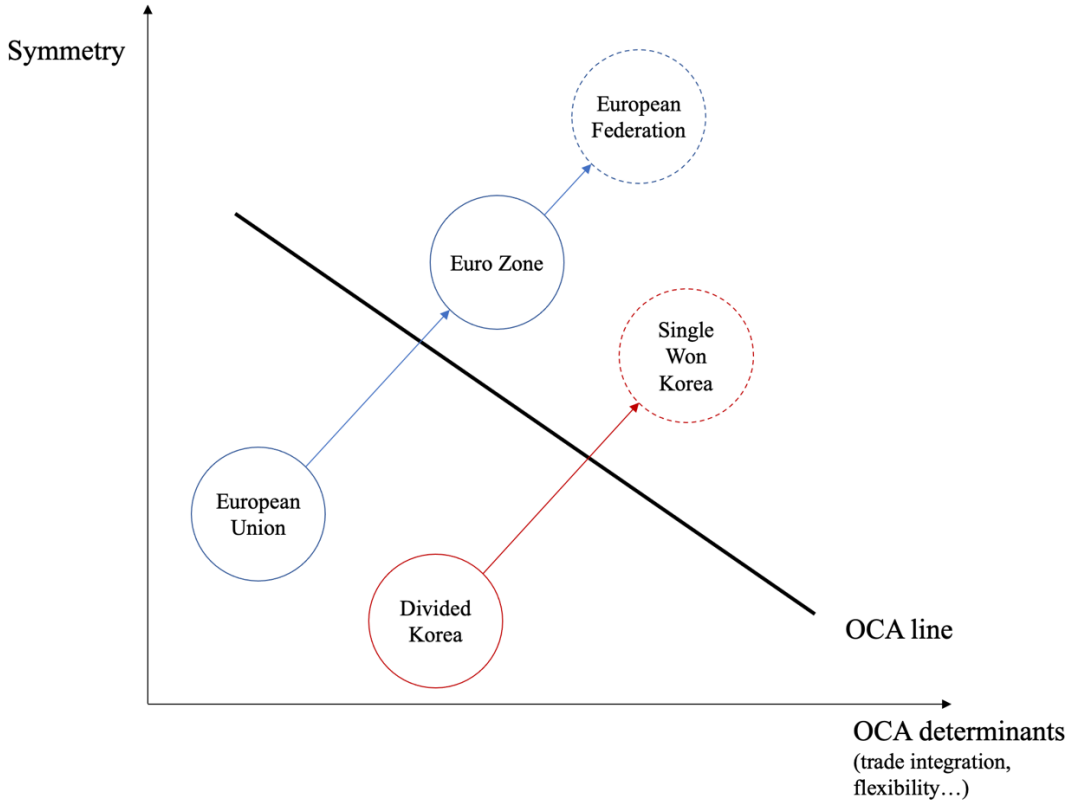
Following Robert A. Mundell’s work, a wide theory of OCA has been forged throughout the economic literature with the study of many factors. We will thus briefly list the main factors that constitute the core of this OCA theory and that are relevant for our study. An essential factor that has been studied by Mundell in the first place is the mobility of factors of production criteria (Mundell, 1961) that states that in a case of a perfect mobility of factors of production, shocks are resorbed by the migration of those factors from the area

in recession to the prosper area, thus without having to alter real factor prices or nominal exchange rate. The focus is particularly made on labor mobility, and the extent to which this criterion is relevant will depend on the capacity of the area to demonstrate rapid migration and adaptability. Then the degree of economic openness is another criterion that has been notably studied by Ronald I. McKinnon and that states that the more opened the economies are, the more they are incentivized to fix their currency (McKinnon, 1963). The changes in international prices of tradable goods are indeed transmitted rapidly in opened economies which reduces money illusion and its negative effects. In that context, monetary instruments such as devaluation would not be interesting to use. The diversification in production and consumption criteria forged by Peter B. Kenen proposes the idea that a highly diversified economy allows to dilute the effects of shocks in a particular sector without manipulating exchange rates, whereas devaluation in response of shocks in such economy would affect prices from all sectors which would be highly destabilizing (Kenen, 1969). James Ingram showed that financial integration could allow economies to let go of the use of currency adjustment to respond to shocks. In highly integrated financial markets, the capital surplus will flow to the affected area which will tame pressures on that area (Ingram, 1962). In the same range of idea, Peter B. Kenen also showed the effect of the existence of a supranational fiscal system that would allow adjustment through funds redistribution in presence of an asymmetric shock. More recently, Bayoumi and Eichengreen notably introduced an OCA index that studies the suitability of specific countries and group of countries for monetary integration by linking exchange rate variability to some of major OCA determinants, namely the difference in real output, the nature of exports, bilateral trade and economic size (Bayoumi & Eichengreen, 1997).

Finally, a major aspect of the OCA theory also revolves around the endogeneity hypothesis of OCA. By studying the benefits of countries that have formed a monetary union, Andrew Rose and Jeffrey Frankel showed that the optimality of a currency area can be observed ex-post, meaning that the very act of monetary union generates many economic benefits such as trade intensification, inflation levels convergence, cycles synchronization etc. (Frankel & Rose, 1997). By choosing to share a single currency, the countries will increase the level of the key OCA determinants such as economic integration, income correlation or flexibility (i.e., the ability for the countries of the union to adapt to shocks). The adoption of a single currency will likely facilitate trade by reducing trading costs, exchange rate risks, information cost, which will eventually improve the economic integration. Moreover some studies (Bertola, 2000) found that the adoption of a single currency is likely to accelerate flexibility in the union by fostering labor market reforms for example. Thus, endogeneity of the OCA means that those aspects (economic integration, symmetry, flexibility…) are mutually positive and improve each other in the process of monetary union. Figure 1 graphically summarizes the idea of endogeneity of OCA by showing the expected correlation between symmetry and OCA determinants. The OCA line represents all possible combinations of symmetry and integration/flexibility that will produce the same level of benefits for the region. The OCA line is downward sloping because less symmetry requires more integration/flexibility to compensate for the increase of the cost of the monetary union consequent to the decrease in symmetry. On the left side of the OCA line, there is more advantages to keep a national currency; as on the right side of the OCA line, it is more advantageous to adopt a single currency. We can assume that if endogeneity phenomena

are at work in the case of Korea, the adoption of a single currency for the two countries would generate *ex post* incentives to create a monetary union. However, we have to keep in mind that there are still disagreements in the academic world concerning the nature of this correlation.

Figure 1. Symmetry & OCA determinants Correlation in Korean & European Scenarios



Source: own elaboration, inspired by Paul De Grauwe

The OCA theory has gained importance and interest given the evolution of our international economy. The movement of European countries towards the Euro Zone during the second half of the 20th century is the most striking example, and that case has a lot to do in the development of the OCA theory. But beyond the European borders,

globalization has made all countries more integrated, more reliant on trade, more open to migration and more dependent on foreign investments, etc. Therefore, the question of monetary union and OCA has been extended to other regions such as West Africa (Balogun, 2008) or East-Asia (Moon & Rhee, 1999) and Paul Krugman suggested in 1993 that "the issue of optimum currency areas, or, more broadly, that of choosing an exchange regime, should be regarded as the central intellectual question of international monetary economics" (Krugman, 1993).

2.2. Korean Unification Literature

The question of the economic and monetary aspects of a Korean reconciliation or reunification has been studied by several economists and South Korean institutions that already give us substantial knowledge about the mechanisms and phenomenon at work in such scenarios. We will briefly evoke some of those works. Jong Wha Lee and Warwick J. McKibbin used a G-Cubed model, an intertemporal general equilibrium model to analyze the process and impact of Korean unification under the scenario of a German-like reunification (Lee & McKibbin, 2019). Their study shows that the Korean reunification would be more disruptive than in the case of the German reunification, and that South Korea would likely suffer from a decrease of its growth rate for a certain period of time. Nonetheless, they highlight the growth potential of North Korea. McKibbin, Lee, Liu and Song studied the economic impacts of a Korean unification under three scenarios: a gradual convergence; a managed chaos in the North; and chaos and crises in both Koreas (McKibbin, Lee, Liu, & Song, 2017). Their results show two distinctive differences with the German unification: the relative population is more similar and the economic metrics

differentials are higher. It also considers several policy aspects to conduct the unification process. Brandford and Philips constructed a dynamic specific factors model and identified four phases for unification: economic reform of North Korea, reduction of defense, adoption of free trade and harmonization policies, full economic integration. They notably focus on worker migration and wages issues. Funke and Strulik studied the convergence conditions and interregional transfers required for a successful unification process, through a two-region endogenous growth model (Funke & Strulik, 2005). St. Brown, Choi and Kim also based themselves on German assumptions to study the impacts of a Korean unification, notably on macro aggregates, labor migration and capital transfer policies, via a macroeconomic model of catch-up growth (St. Brown, Choi, & Kim, 2012). They conclude that South Korea would likely suffer from a loss in total factor productivity; that a limitation of migration from North to South Korea would increase South Korea per-capita GDP but decrease the total GDP of Koreas; that South Korean investment to North Korea must be facilitated through the creation of private properties and financial systems. Mun and Yoo identify three types of integration: unitary state, federation and special administrative region. Their study, based on a general equilibrium model, aims to find a more efficient wage policy than what had been applied in the German reunification process. Their result shows that the special administrative region is likely to be the most efficient way to proceed to the integration of North Korea (Mun & Yoo, 2012). Kim B.Y conducted a study in three transition and integration cases in East Europe to give conclusion regarding North Korea financial transition (김병연, 2014). Kim, Kim, Hong and Park analyzed the monetary, financial and fiscal aspects of the transition period after unification in the special administrative region scenario previously mentioned (김영찬, 김범환, 홍석기, & 박현석, 2016). Yun discusses the timing of monetary integration in

a unification scenario while trying to find out the specific policies that did not work during the German unification process, notably the labor movements between the two regions (윤덕룡, 2004). Finally, a study from the Korean Institute for Health and Social Affairs tackles the socioeconomic aspects of a reunification, in relation with the productivity gap and human capital differentials issues (최요한, et al., 2017).

CHAPTER III. PURPOSE OF RESEARCH AND METHODOLOGICAL APPROACH

3.1. Purpose of Research

The purpose of this research is to produce an OCA index based on the model of Bayoumi & Eichengreen (which will be further explained in the next section of this paper), applied to North Korea and its main trade partners, including South Korea, which can better allow us to study monetary and political union perspectives with North Korea. By studying the two consecutive periods of 2011-2015 and 2016-2020, we aim to take into account the shifts in attitude of North Korea towards the international community, and major actors of the East-Asian region (China, Russia…), in addition to the evolution of economic factors that have also been through major changes during this period of time. Our research thus aims to account for these mutations which will be reflected in the OCA index. More precisely, the creation of this index will allow us to observe in a detail manner the changes and evolution of trade patterns, exports compositions, synchronization of the economies, and economic structure similarities, thus revealing the reality of the state of economic relations with North Korea.

Based on the result of this OCA index, we will draw the main conclusions and policy implications regarding monetary integration of South and North Korea. In accordance with the theory of optimum currency areas, we will notably study policy choices on the basis of the grounding work in macroeconomics of Robert A. Mundell.

3.2. Methodological approach

In a fundamental paper, Bayoumi and Eichengreen (1997) proposed an OCA Index in order to operationalize the theory of OCA based on the determinants of nominal exchange rate variability and the analysis of the annual data of 21 industrial countries. The indexes study the specific bilateral relationships, notably Germany versus other European countries. Among five key characteristics (asymmetric disturbances to output, trade linkages, the usefulness of money for transactions, the mobility of labor, the extent of automatic stabilizers), the authors focused on asymmetric disturbances to output, trade linkages and the usefulness of money for transactions. The asymmetric disturbances to output are measured with the standard deviation of the change in the log of relative output in two studied economies and the dissimilarity of the commodity composition of exports of two monetary union candidates (based on the assumption that the specialization of economies in the same sectors of comparative advantage leads to a highest symmetry of shocks). The trade linkages are measured via the average value of exports of the studied country to the other country, scaled by GDP. The usefulness of money for transactions is measured with the arithmetic average of the log of real GDP in U.S. dollars of the two monetary union candidates (economic size is assumed to be the best measure of the benefits from a stable currency).

The estimating equation is the following:

$$SD(e_{ij}) = \alpha + \beta_1 SD(\Delta y_i - \Delta y_j) + \beta_2 DISSIM_{ij} + \beta_3 TRADE_{ij} + \beta_4 SIZE_{ij}$$

With $SD(e_{ij})$ = standard deviation of the change in the logarithm of end-year bilateral exchange rate between countries *i* and *j*

$SD(\Delta y_i - \Delta y_i)$ = standard deviation of the difference in the logarithm of the real output between countries *i* and *j*

$DISSIM_{ij}$ = sum of the absolute differences in the shares of agricultural, mineral, and manufacturing trade in total merchandize trade between countries *i* and *j*

$TRADE_{ij}$ = mean of the ratio of bilateral exports to domestic GDP for countries *i* and *j*

$SIZE_{ij}$ = mean of the logarithm of GDP measured in U.S. dollars for countries *i* and *j*

The economies that we chose to include in the estimation are North Korea's 15 top trade partners: South Korea, China, Hong Kong SAR, India, Russia, Thailand, Taiwan, Indonesia, Pakistan, Germany, Argentina, Brazil, Bangladesh, Sri Lanka. For our calculations we used GDPs expressed in 2017 U.S. dollars.

Regarding the three main trade merchandize sectors, food is defined by Bayoumi and Eichengreen as the sum of food and live animals, beverages and tobacco, and animal vegetable oils and fats. Minerals are defined as crude materials excluding fuel with mineral fuels. Manufactured goods are defined as the total of basic manufactures,

chemicals, machines and transport equipment miscellaneous manufactured goods and other goods. We used the data provided by the Korean Statistical Information Services (KOSIS) and Korean Trade-Investment Promotion Agency which included the trade volumes between North Korea and other trade partners, classified by 99 product categories (Appendix I). We then referred ourselves to the International Standard Industrial Classification of All Economic Activities (ISIC), notably the latest Rev.4. to proceed the relevant sorting of various trade products.

Later on, we will also use a gravity model of South Korea to inform our research. In regard to this gravity model, we started from the basic gravity equation including key variables. Precisely we used bilateral flow (exports and imports) between South Korea and its trading partners, the product of South Korea and its trading partners, the product per capita of South Korea and its trading partners, and the distance between the capital of the two countries. Finally, in order to take into account the importance of cultural factors and the particularity of the ethnic and historical aspect of inter-Korean relations that we aim to study, we chose to include a dummy variable which takes on a value of "1" if the trading partner is a country historically home of an ethnic group of Korean descent[1], "0" otherwise.

The estimating equation is the following:

[1] This variable thus applies for 3 trading partners according to our criteria: China, Japan and North Korea. Each country meets the criteria via the significance of respectively the Joseonjok group in China and the Zainichi Koreans in Japan. The case of North Korea is self-explanatory. It would be interesting to discuss further the relevance of this choice, however falling outside the scope of our study, it will be left for future research.

$$Ln(T_{ij}) = \alpha + \beta_1 Ln(Y_i \bullet Y_j) + \beta_2 Ln\left[\left(\frac{Y}{P}\right)_i \bullet \left(\frac{Y}{P}\right)_j\right] + \beta_3 LnD_{ij} + HIST_{ij}$$

With $Ln(T_{ij})$= logarithm of the bilateral trade flow (exports & imports) between South Korea (i) and its trading partner (Country j)

$Ln(Y_i \bullet Y_j)$= Logarithm of the product of GDPs of South Korea (i) and country j

$Ln[\left(\frac{Y}{P}\right)_i \bullet \left(\frac{Y}{P}\right)_j]$ = Logarithm of the product of GDPs per capita of South Korea (i) and country j

LnD_{ij} = Logarithm of the distance (in km) between the capital of South Korea (i) and country j

$HIST_{ij}$ = dummy variable

The top 22 trading partners of South Korea that we used for the gravity model are the following: China, United-States, Japan, Saudi Arabia, Hong Kong SAR, Australia, Singapore, Taiwan, Vietnam, Germany, Indonesia, Qatar, Russia, United Arab Emirates, India, Malaysia, Kuwait, Brazil, Thailand, Mexico, Philippine, United Kingdom. We used the data provided by the Korean Statistical Information Services (KOSIS), the World Bank, the International Monetary Fund on the period 2011-2015 and Google Maps (for the distance).

CHAPTER IV. RESULTS

The estimated equation for North Korea and its 15 top trading partners over 2011-2015 is the following (with t-statistics in parentheses):

$$SD(e_{ij}) = 1.024271 + 2.342257 * SD(\Delta y_i - \Delta y_j) + 1.03e^{-10} * DISSIM_{ij}$$

(6.60) (13.33) (4.51)

$$-1.035865 * TRADE_{ij} - 0.0075068 * SIZE_{ij}$$

(-1.91) (-2.43)

$R^2 = 0.7292$; S.E = 0.02447

The asymmetric disturbances to output, the dissimilarity of the commodity composition of exports and the trade linkages have the anticipated signs, accordingly to Bayoumi & Eichengreen's work on which we based our research, which empirically confirms our assumptions regarding the theory of OCA. The size parameters however do not have the sign expected from Bayoumi & Eichengreen's study, but it does correspond to the findings from a study closer to our subject, more precisely on OCA possibilities in East-Asia (Shin & Rhee, 2012)

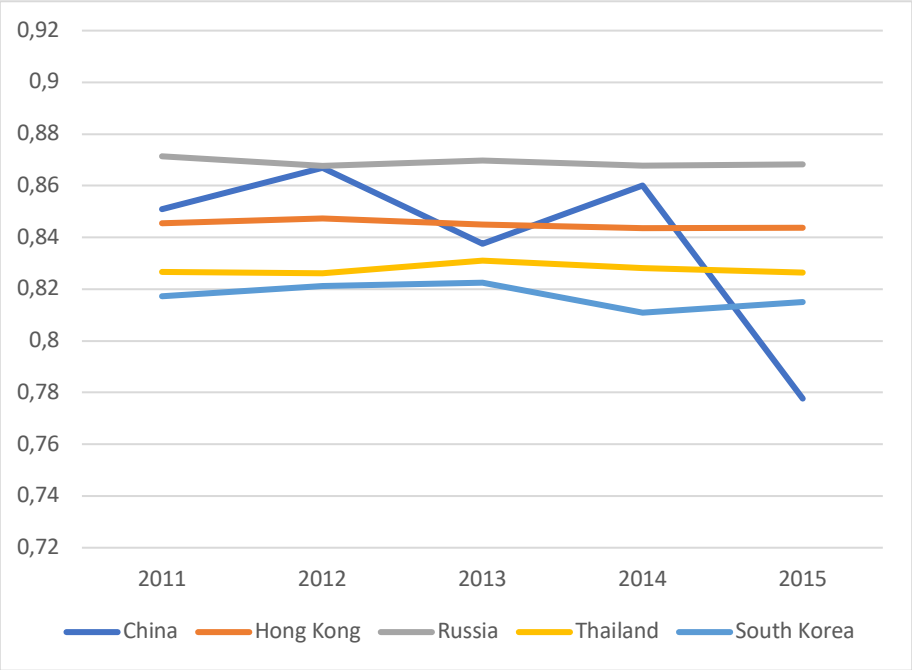
4.1. 2011-2015 Period

Next, we used this equation to obtain the predicted level of exchange rate variability which constitutes the OCA index. A high value for a given pair of countries suggests that those countries are far from OCA, meaning that a monetary union between them does not seem relevant. A smaller value, on the contrary, suggests that the two countries are closer

to OCA and thus monetary union seems more interesting. For the period 2011-2015, we obtained the following evolution of the OCA index versus North Korea, and 5 selected countries: China, Hong Kong, Russia, Thailand and South Korea.

For this period, Russia appears as the farthest country from OCA. China is far from OCA for 2011-2014, but abruptly comes closer in 2015. Hong Kong is consistently 3rd during this period, and Thailand 2nd. South Korea appears as the closest country to OCA during this period, except for 2015 when China takes the leading position.

Figure 2. OCA Index of North Korea (2011-2015)

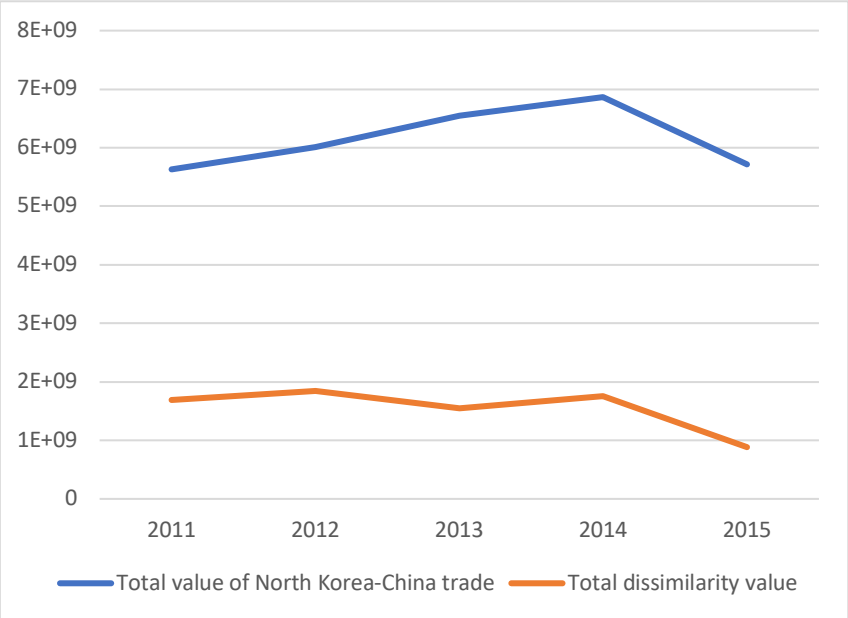


4.1.1. China

The primary factor of explanation in the position of China appears to be the dissimilarity in the composition of China's and North Korea's exports. China is the top trade partner of North Korea, but considering the high volume of trade between those two countries,

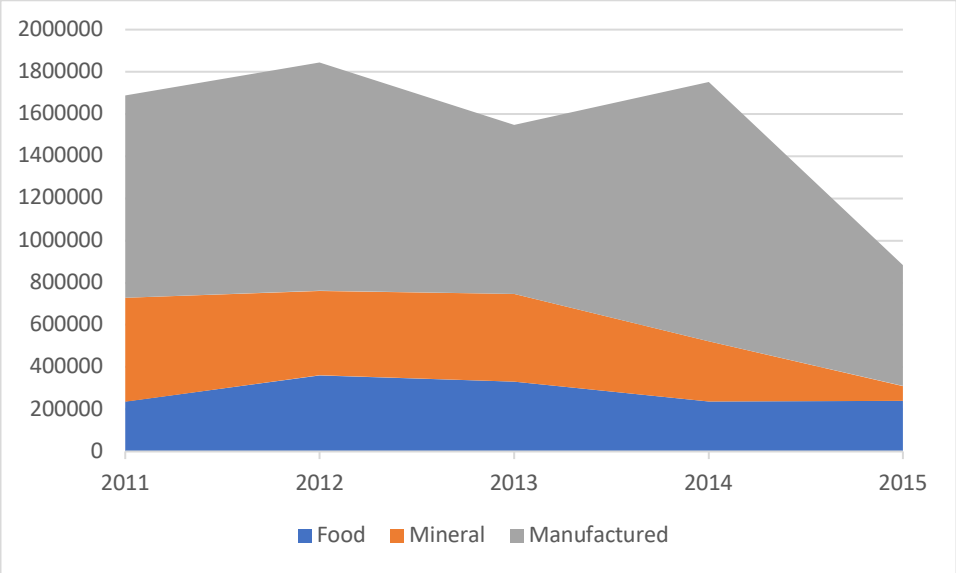
we see that the level of dissimilarity between them is subsequently very high which explains China's position in the OCA index. However, it is important to note that high trade volume does not always implies a higher dissimilarity. Between 2012-2013, we see that China gets closer to OCA, which can be explained by the value of dissimilarity: as we see on Figure 3, even though trade volume increased between China and North Korea, the total dissimilarity value decreased, which contributed to this improvement of Chinese OCA index value.

Figure 3. Comparison of North Korea-China trade and dissimilarity of exports (2011-2015)



More precisely, this improvement of dissimilarity between 2012-2013 is explained by the better symmetry in the sector of manufactured goods as we see on Figure 4.

Figure 4. Composition of total dissimilarity between North Korea and China (2011-2015)



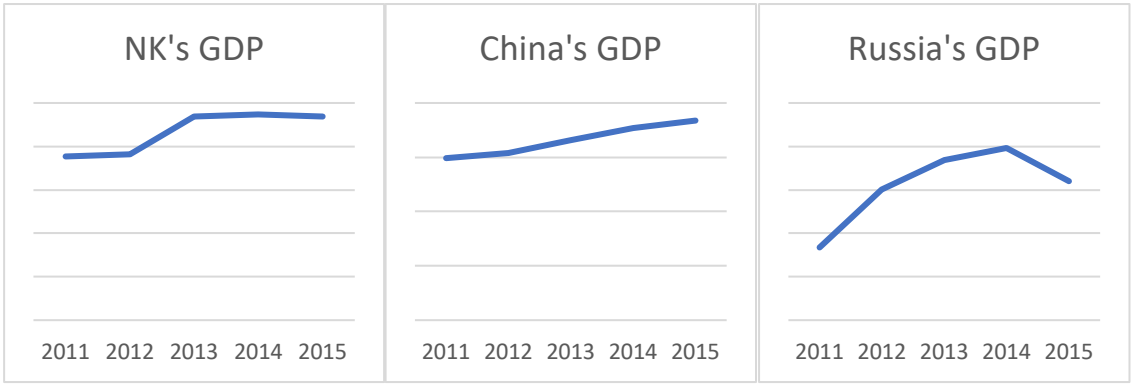
The drastic improvement of China in the OCA index in the last year of the period, 2015, can also be attributed to the decrease of dissimilarity. As we see on Figure 3, as total trade decreased, the total value of dissimilarity also decreased. On Figure 4, we can note that the value of dissimilarity decreased with a consequent part in the manufactured goods sector.

4.1.2. Russia

We explain Russia's position in the OCA index through a combination of factors. First, its dissimilarity of exports is important in total value (much more important than Hong Kong for example) and the pattern of trade between Russia and North Korea also appears structurally dissimilar. The value of the dissimilarity between Russia and North Korea is relatively much closer to the total trade value of Russia and North Korea than the value of the dissimilarity between China and North Korea is, respectively to the total Chinese-

North Korean trade. In order words, the ratio of dissimilarity value on total trade value is higher for Russia (around 0.7-0.8) than for China (0.2-0.3 and even 0.15 for the final year of the period). Second, the asymmetric differences to output are also high for Russia. If we look at the general shape of the curve of GDPs, as represented in Figure 5, we see that Russia and North Korea's cycles seem much more asymmetric than North Korea and China's for example.

Figure 5. Russia and North Korea asymmetric differences to output (2011-2015)



Third, the trade linkages are also much less important with Russia than with other countries especially China and South Korea, which constitutes a strong element in the explanation of Russia's position in the OCA index.

4.1.3. South Korea

South Korea appears as the most relevant country among the 5 chosen in the OCA index, which can be explained via several factors. First of all, on a historical perspective, if we look at the volume of trade since 2003 in Table 4, we see that the observed period 2011-2015 corresponds to high trade intensity, representative of increasing commercial cooperation between the two countries.

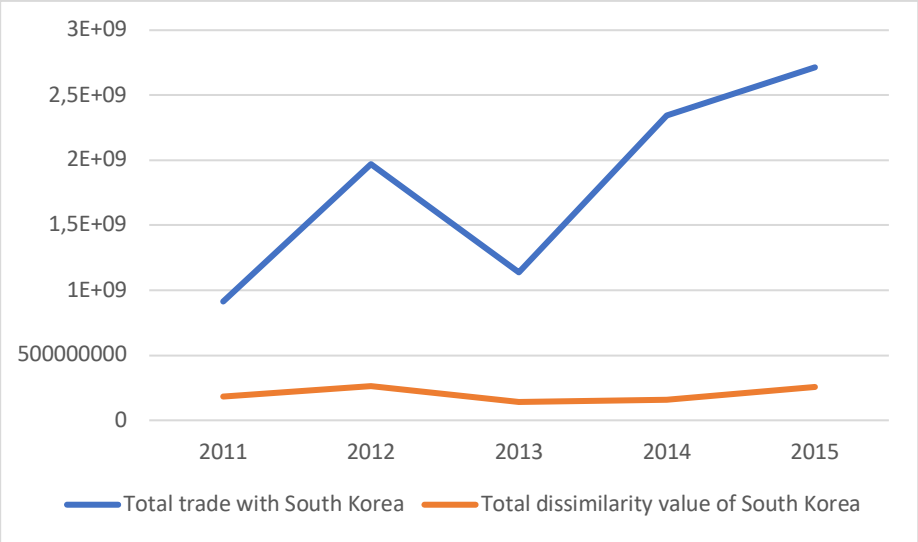
Table 4. Inter-Korean Trade Volume by Year (USD million)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Inbound	289	258	340	520	765	932	934	1,044	914	1,074	615	1,206	1,452
Outbound	435	429	715	830	1,033	888	745	868	800	897	521	1,136	1,262
Total	724	697	1,056	1,350	1,798	1,820	1,679	1,912	1,714	1,971	1,136	2,343	2,714

Source: Ministry of Unification

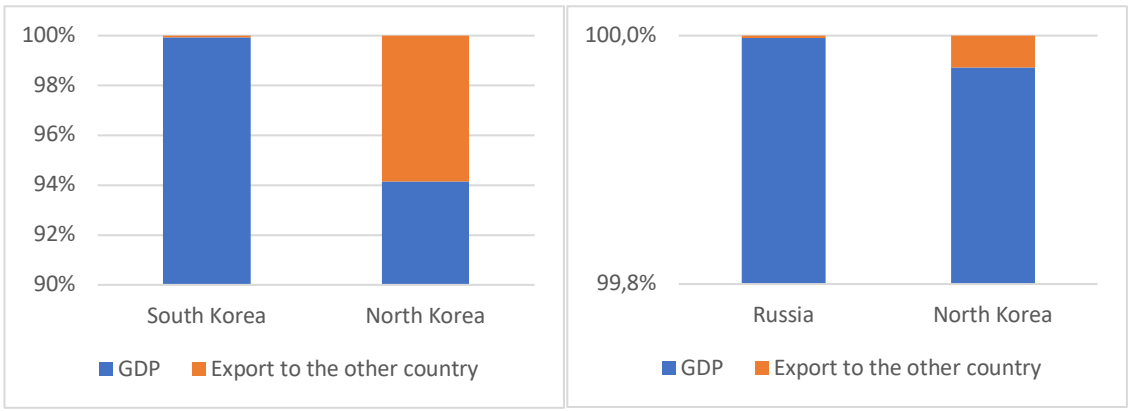
In more detail, two factors seem to explain South Korea's position the OCA index in particular. First, South Korea's dissimilarity of exports is much less important than other countries', proportionally to the volume of trade, which we can observe on Figure 6, where we can see that the total volume of trade and the total dissimilarity curves do not display significant correlation, contrary to the case of country such as Russia. This would suggest that North Korea and South Korea have relatively more similar exports structure and economic specialization which would contribute to both country sharing higher symmetry of shocks, and eventually advocate for a monetary union with this country in particular.

Figure 6. Comparison of North Korea-South Korea trade and dissimilarity of exports (2011-2015)



Second, the high trade linkages between South Korea and North Korea also represent another strong explanation factor for South Korea's position in the OCA index. As we see on Figure 7, South Korea represents a much more important market for North Korea compared to other countries such as Russia for example. Even though North Korea represents an insignificant market for exports for South Korea, the importance of the inverse relation, as we just mentioned, makes the average higher than for other countries, which drives the trade linkage parameter higher for South Korea. Given North Korea's small importance in terms of market opportunity, we understand that it really is the importance of the other country in North Korea's exports that adds the most weight for the trade linkage parameter. In other words, the values represented in the second columns in Figure 7 are what mostly (if not solely) dictates the value of the trade parameter in our model.

Figure 7. Comparison of trade linkages between North Korea and respectively South Korea and Russia (2011-2015)



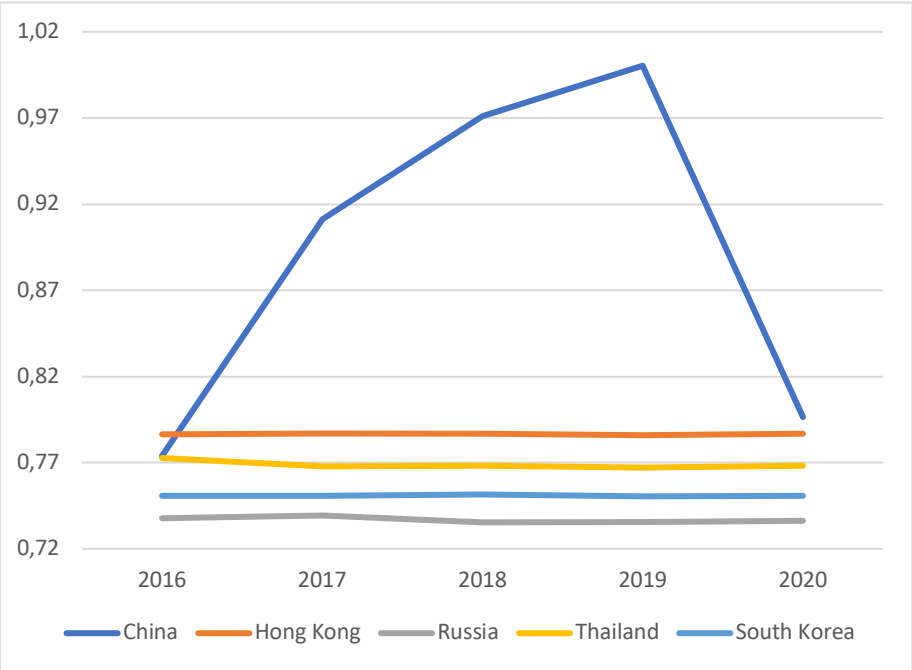
In conclusion, during this period of time, South Korea appeared as a privileged candidate for a monetary union with North Korea. This appears relatively legitimate given inter-

Korean trade importance during this period, and furthermore given the special history between the two Koreas. However, the particularity of North Korea's economic and trade relations leads to drastic changes in the OCA index explained by high variability of the main parameters that are taken into account when calculating the index. The example of China is representative of this phenomenon as the country went from penultimate to first candidate in our OCA index in only one year. Thus, if we based ourselves solely on year 2016, China would appear as the privileged candidate for a monetary union with North Korea, which would also be legitimate given North-Korea-China economic ties' importance.

4.2. 2016-2020 Period

We then used the same equation to obtain the predicted level of exchange rate variability which constitutes the OCA index for the following period of 2016-2020, for the same set of countries. Based on our calculation, the global picture is different compared to the previous period: China which was in leading position of the OCA index in 2016 declined to last position the year after and for the rest of the studied period. China even scores worse OCA index values than in the previous period. On the contrary, all other countries have known an important progression in the OCA index and seem to follow a similar trend. Russia, among all countries studied, stands out by having improved from last to first candidate in the OCA index in just one year. Overall, Russia and China have known extreme contradictory trajectories while other countries went on a similar path and globally maintained the same positions one to another.

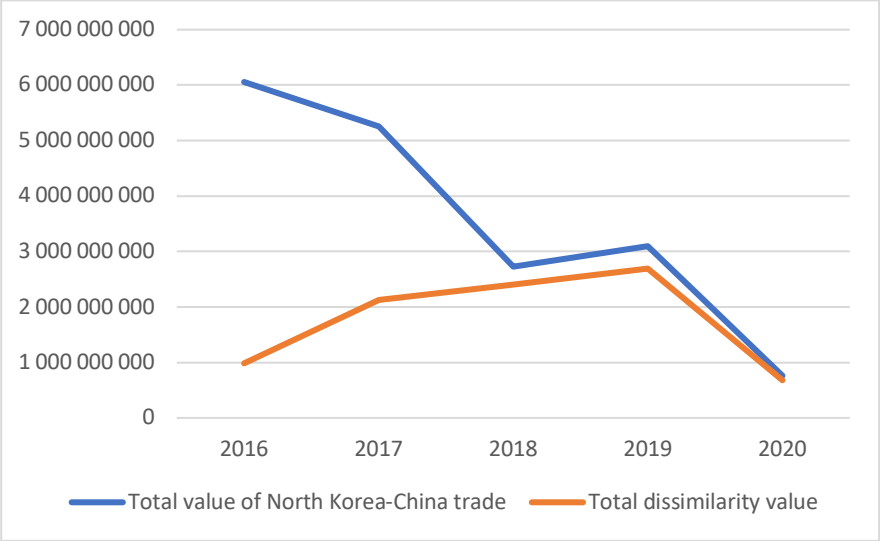
Figure 8. OCA Index of North Korea (2016-2020)



4.2.1. China

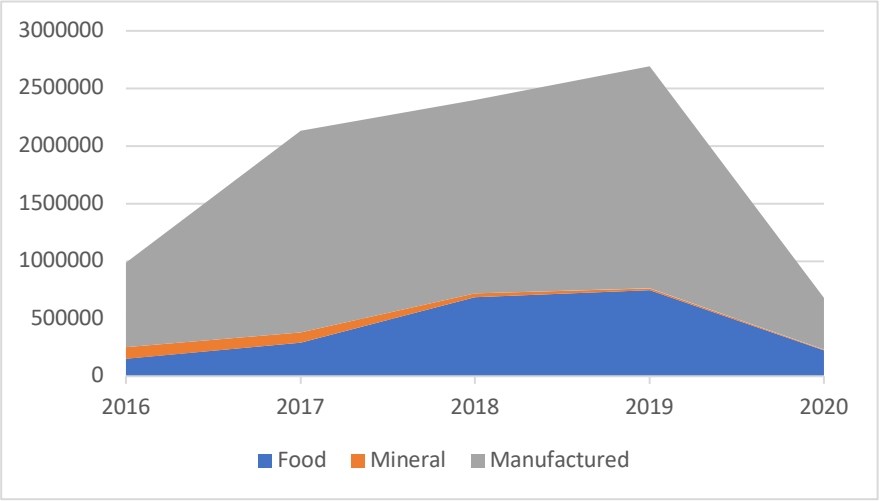
This extreme deformation of the OCA index values of China can be explained by the evolution of two parameters in particular that are also closely linked: the dissimilarity of exports and the trade linkages. The value of the dissimilarity of exports between China and North Korea indeed considerably increased during the period. From 2016 to 2018, we observed simultaneous contradictory movements of the value of dissimilarity of exports that kept increasing as the value of total trade was decreasing. From 2018 to 2020, both values evolved in the same directions, with the gap between them that kept reducing, also showing the export deformation towards China. The result of the final year can find some explanation in the Covid-19 crisis and the abrupt stop in international trade.

Figure 9. Comparison of North Korea-China trade and dissimilarity of exports (2016-2020)



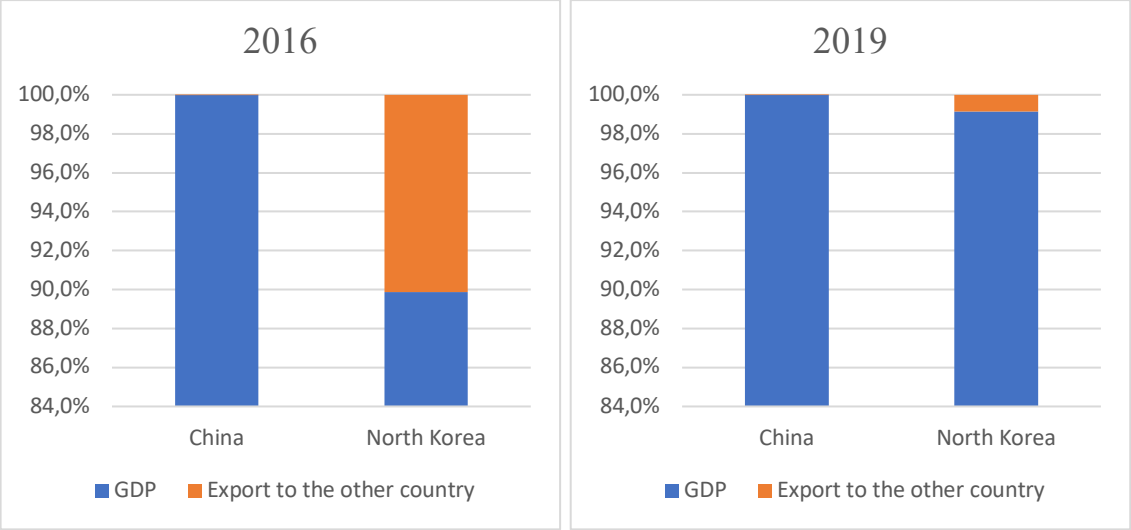
If we take a look at the three sectors analyzed in bilateral exports, we see that compared to the previous period, the dissimilarity become even more biased towards manufactured goods. However, the three sectors have known the same evolution throughout the studied years which suggests that no sector in particular led to this increased of the total dissimilarity value.

Figure 10. Composition of total dissimilarity between North Korea and China (2016-2020)



As mentioned, the other factor of explanation is the value of the trade linkages. As explained earlier, the less both countries took a large place in its counterpart's exports, the more the trade linkages (or more precisely the mean of the ratio of bilateral exports to domestic GDP of both countries) value decreased, and that is precisely what happened during the second period studied.

Figure 11. Comparison of trade linkages between North Korea and China (2016 & 2019)

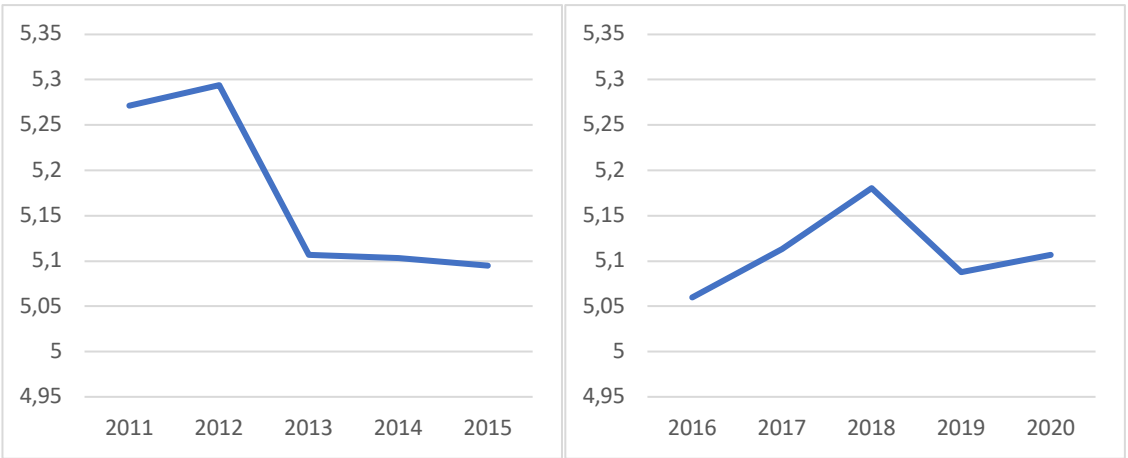


In 2020, the situation is quite different. The trade relations kept deteriorating but the value of dissimilarity, as seen in Figure 9, followed the decline of trade. That contributed to counterbalance the effect of decreasing value of trade linkages, and explains why China abruptly got closer to other candidates and improved consequently its value in the OCA index.

4.2.2. Russia

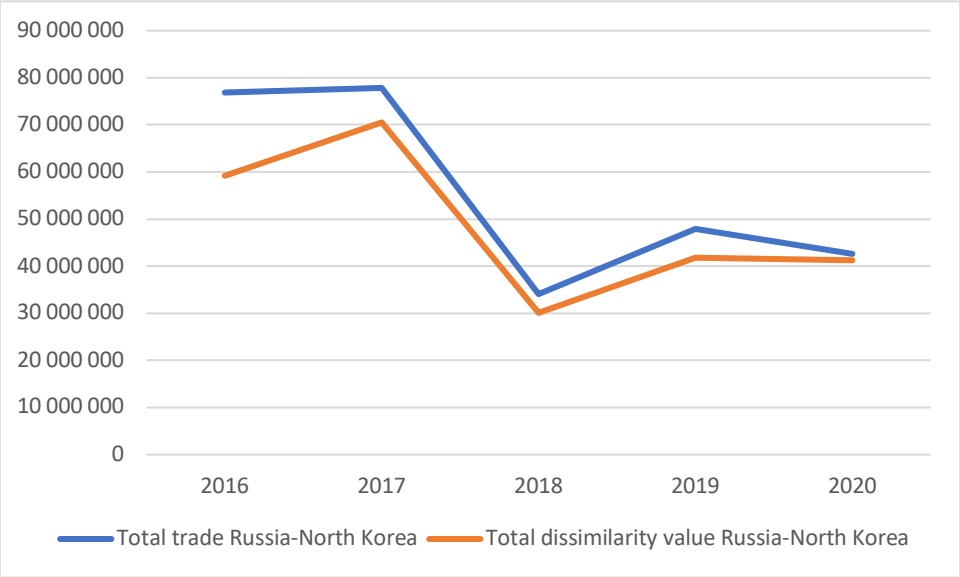
The Russian case also constitutes one of the most interesting evolution compared to the previous period. Russia indeed considerably improved its position in the OCA index. We will now see what factors can account for this radical change. First, the analysis of asymmetric disturbances to output shows that Russia and North Korea's business cycles were much more in sync during the second period, as the standard deviation of the difference in the logarithm of the real output of both countries value more than halved between the two studied periods (around 0.099 to 0.044). This also suggests that shocks affecting North Korea and Russia were more symmetric during this period. According to the theory of OCA, this improvement in terms of business cycles synchronization and symmetry of shocks would give more groundings for a monetary union, which is reflected in Russia's improved position in the OCA index. As observable on Figure 12, disturbances to output were smoothen in the second period.

Figure 12. Comparison of asymmetric disturbances to output between Russia and North Korea (Differences in the logarithms of real outputs, 2011-2015 & 2016-2020)



Second, the other factor of explanation is the significant drop in the value of dissimilarity of exports. Since 2014, the overall trade between Russia and North Korea decreased despite the will from both countries to strengthen their economic ties and the setting of ambitious goals (Zakharova, 2016), and the value of dissimilarity of exports followed the same direction rather proportionally, as we can see on Figure 13.

Figure 13. Comparison of Russia-North Korea total trade and dissimilarity of exports (2016-2020)



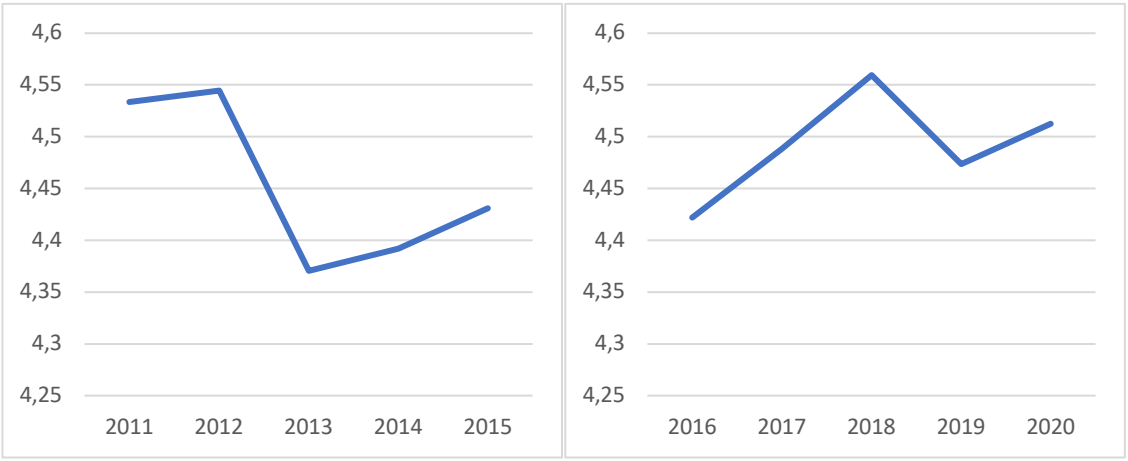
Thus, while trade relations declined, dissimilarity followed the same path and paradoxically contributed to improve Russia's position in the OCA index. It is indeed a paradox since that according to the theory of OCA, weaker trade relations should generally contribute to driving away two countries from optimality, whereas in this precise case the concomitant decline in trade and dissimilarity values brought Russia and North Korea closer to optimality. In conclusion, the higher symmetry in economic conjuncture and the relative smaller distortions in exports structure between Russia and

North Korea led to this drastic improvement of Russia's position in the OCA index for the second period studied.

4.2.3. South Korea

During the second period studied, South Korea maintained its position of privileged candidate among the studied countries, and followed the global trend of improvement of OCA index value shared by the others countries (except China). The first phenomenon at work in the improvement of South Korea's value in the OCA index is the same that we have observed for Russia's case, that is the weaker asymmetric disturbances to output. If we compare the difference in the logarithms of real outputs, as on Figure 14, we see a very similar picture as in the Russian situation. However, the magnitude of the difference between the two periods is lower than in the Russian case, and the value of the overall asymmetric disturbances on the period is also higher in the case of South Korea (around 0.050 for South Korea versus 0.044 for Russia).

Figure 14. Comparison of asymmetric disturbances to output between South Korea and North Korea (Differences in the logarithms of real outputs, 2011-2015 & 2016-2020)



Therefore, it means that business cycles were also more synchronized in the second studied period, even if the decrease in the value of standard deviation of the difference in the logarithm of the real output of both countries was not as spectacular as in the Russian case. We can also conclude to a higher symmetry in shocks affecting North Korea and South Korea. This evolution seems to be in line with the OCA theory and would again justify the relevance of a monetary union.

The second explanation is also similar to what we have observed in Russia's case but the phenomenon was even more extreme in the case of South Korea. The value of dissimilarity of exports radically decreased during the studied period as we can see on Figure 15, which appears to be the direct result of an abrupt stop in inter-Korean trade relations which fall to unprecedent lows after peaking in 2015.

Figure 15. Comparison of South Korea-North Korea total trade and dissimilarity of exports (US dollars, 2016-2020)

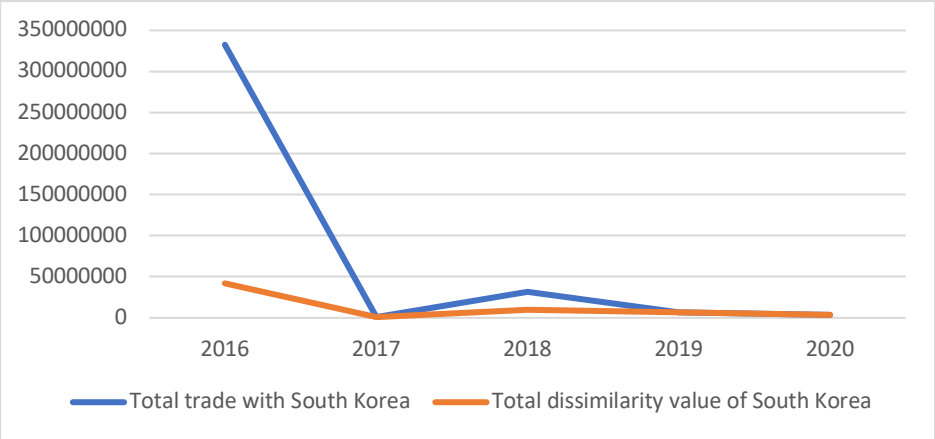


Table 5. Inter-Korean Trade Volume by Year (USD million)

Year	2015	2016	2017	2018	2019	2020	2021	2022
Inbound	1,452	186	0	11	0	0	0	0
Outbound	1,262	147	1	21	7	4	1	0
Total	2,714	333	1	31	7	4	1	0

Source: Ministry of Unification

As in the Russian case, this fall in trade exchanges explains why the value of dissimilarity of exports improved during the second period. On February 10, 2016, the South Korean government issued a statement saying that it would completely suspend the Gaesong Industrial Complex (임성택, 2016). This happened in response to the violation of the United Nation Security Council resolution constituted by the launching of the satellite Kwangmyongsong-4 considered by South Korea and its allies as a long-range ballistic missile launch. The near end of inter-Korean trade is thus the direct consequence of the escalation of tensions between the two countries at that time.

The OCA index appears paradoxical for South Korea. Indeed, when considering the consequent degradation of both diplomatic and economic relations between the two countries, one could expect that South Korea and North Korea would shift away from OCA-optimality, but the contrary seemed to have happened. We will tackle more in detail this question in the last chapter of this study, but we can already summarize our preliminary assumption by the following proposition: countries that trade less are less likely to experience high absolute dissimilarity in total of exports.

The geopolitical situation on the Korean peninsula introduces a bias in the model of the OCA index. We believe that such a relations between two countries is not a situation that

Bayoumi & Eichengreen had to account for in their index, therefore we might object that some adjustments are necessary to better reflect the optimality of a monetary union for North Korean and South Korea. In order to do so, we propose to use a gravity model of trade to estimate the volume of trade between North Korea and South Korea in a situation of normalized relations.

The estimated equation for South Korea and its 22 top trading partners over 2011-2015 is the following (with t-statistics in parentheses):

$$Ln(T_{ij}) = 2.901056 + 0.2550115 * Ln(Y_i \bullet Y_j) + 0.1753071 * Ln\left[\left(\frac{Y}{P}\right)_i \bullet \left(\frac{Y}{P}\right)_j\right]$$

(1.28) (5.69) (4.61)

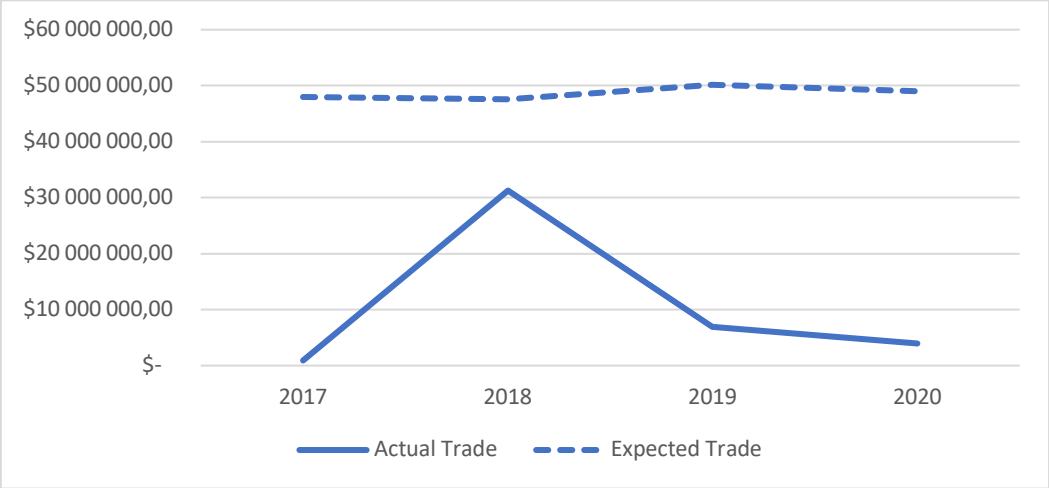
$$-0.4131473 * LnD_{ij} + 0.5864641 * HIST_{ij}$$

(-4.36) (2.14)

$$R^2 = 0.6613; \text{S.E} = 0.44434$$

All coefficients have anticipated signs, which confirms our assumptions regarding standard bilateral trade of South Korea. In particular the coefficient for historic links that we have added is positive, indicating that a shared history or culture has a positive effect on bilateral flow, which is interesting to note in our analysis of inter-Korean trade relations. Given this equation, we can estimate the inter-Korean trade volume for the period 2017-2020 based on the Gravity Model of trade of South Korea.

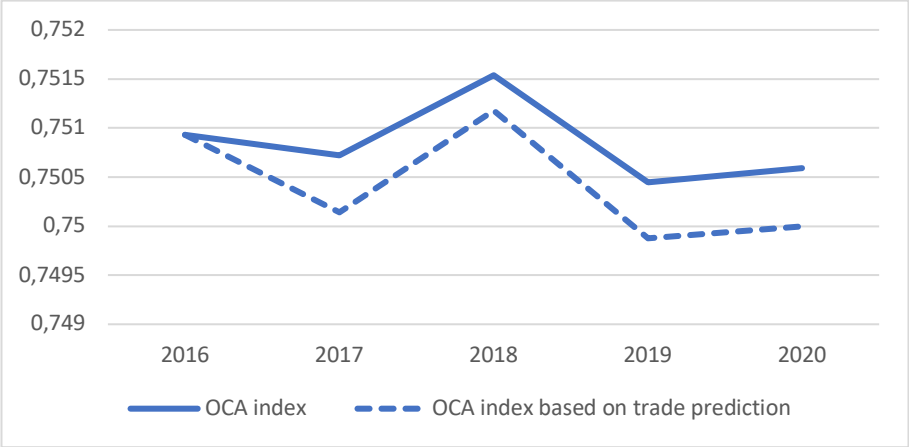
Figure 16. Expected inter-Korean volume of trade according to South Korea's Gravity model (US dollars, 2017-2020)



As excepted, trade volume would thus be much higher than what we have observed in the recent years with the quasi-absence of inter-Korean economic relations.

Then, we can input the expected trade volume in our calculation of the OCA index. More precisely, we will update the value for the trade linkages parameter, while keeping the other parameters unchanged. When applying our OCA index with this updated trade volume, we obtain this new value for South Korea, *et ceteris paribus*.

Figure 17. Expected North Korea's OCA index values for South Korea under its gravity model's assumptions



According to our assumptions, the OCA index value of South Korea would improve as expected in case of a normalization of inter-Korean relations. Although we have to interpret this result with caution since we only modified the trade linkages parameter and that other phenomenon would certainly be at work in such a configuration, this still contributes to add theoretical groundings to the necessity of pacification of inter-Korean relations.

4.3 Conclusion

As a preliminary conclusion, we see that over the two studied periods, and among the specific economies that we chose to incorporate in the OCA index, South Korea appears as a privilege candidate, especially during the time of closer economic cooperation with North Korea. Moreover, it's worth noticing that the consideration of North Korea and South Korea's proximity, both geographically, historically and culturally, would suggest reassessing downwards (i.e in the sense of an improvement) the value of South Korea in the OCA index, which omits such criteria, and that we have tried to take into account in our study.

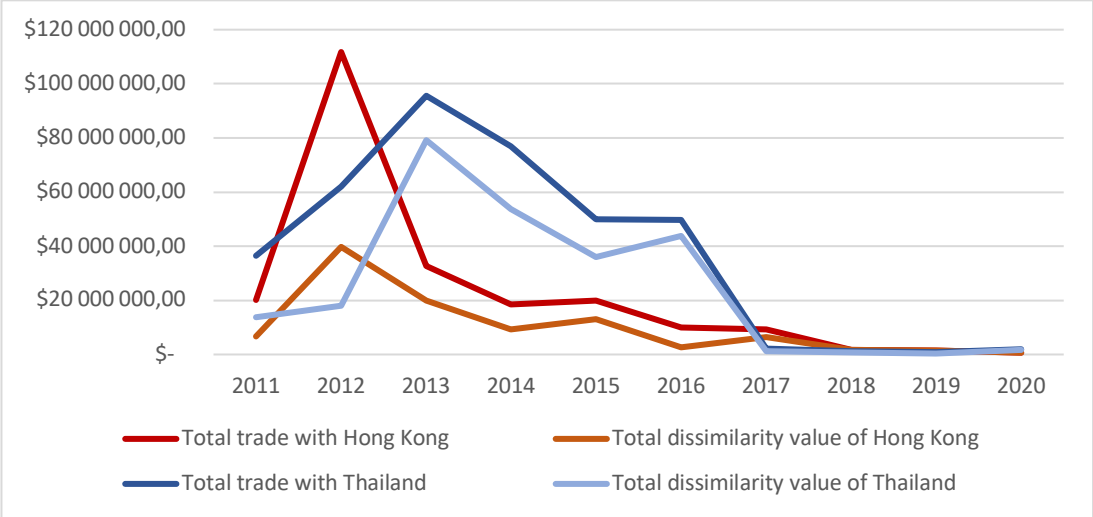
China's ambivalent position towards North Korea leads to more doubts regarding the optimality of a monetary union. If the relation between the two countries has long been associated with the Chinese idiom "When the lips are gone, the teeth will be cold" (唇亡齿寒) reflecting intricated and supportive ties between two nations "as close as lips and teeth", the reality of this relationship in recent years is more ambiguous. It has been

marked by ups and downs in the view of the other, fluctuating along international sanctions or the play of interests between great powers on the Peninsula (Revere, 2019). China is a privileged partner for North Korea but being such a disproportionately important partner also seems to lead to less optimality in terms of monetary union opportunities.

In a similar way, Russia's fear for a destabilizing potentiality coming from its North Korean neighbor could also explain in a way the inconsistency of Russia-North Korea economic ties. It becomes even more difficult to make a parallel between the state of their relations and the optimality of currency area possibilities since progress of diplomatic relations often does not seem to translate into progress of trade relations.

Regarding, Hong Kong and Thailand. We see that both countries have known similar trends during the overall studied period and can thus be associated in a same category. First of all, Thailand and Hong Kong are the two regions in the OCA index that do not have a border with North Korea. Then, we can notice that their level of trade with North Korea is very similar, relatively to China and South Korea well ahead of the rest of the countries in the ranking (until recently), and that the evolution of their respective commercial relations also underwent a similar evolution. When trying to explain their position in the OCA index, we see that the value of their respective dissimilarities plays a major role. Also, the gradual rapprochement of the total trade and the total value of dissimilarity, as it can be seen in Figure 18, common to the two countries, also partly explains why Thailand and Hong Kong have moved so closely in the OCA index.

Figure 18. Evolution of trade with North Korea for Hong Kong and Thailand (US dollars, 2011-2020)



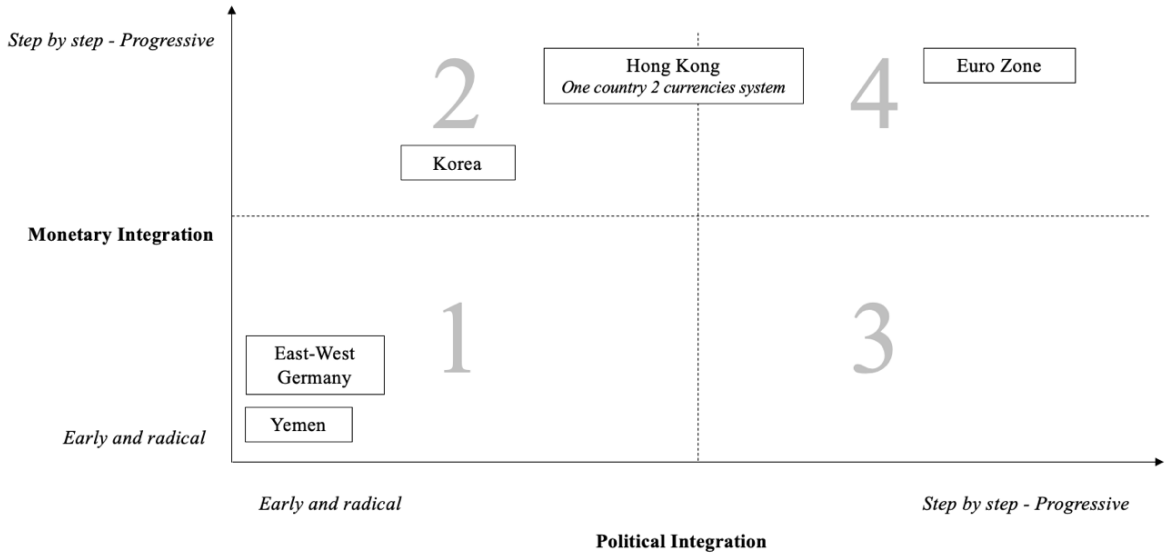
If it was therefore interesting to study the case of Hong Kong and Thailand given the extent of their trade relations with North Korea, it is also important to remember that from a political perspective it would make less sense to consider these two countries rather than South Korea, China or Russia. Apart from specific links on certain subjects, such as the use of Hong Kong as a model for the creation of the Sinuiju Special Administrative Region, or the role of Thailand in the journey of North Korean defectors as the most important transit country (Jeon, 2016), the political scope of a monetary union would be limited, and it is eventually a mainly theoretical interest that prompted us to study these two countries.

CHAPTER V. POLICY IMPLICATIONS

Given these results, we see that despite antagonized relations between North Korea and its trade partners, especially South Korea, the overall improvement of the OCA index, notably during our first studied period, is encouraging for monetary union perspectives with South Korea. However, pragmatically speaking, the OCA index values are much weaker than those from the OCA index related to European countries before the creation of the Euro Zone (Bayoumi & Eichengreen, 1997). They are also weaker than those related to prospective studies regarding optimum currency areas in the East-Asian region (Shin & Rhee, 2012). Therefore, considering the recent state of North-South Korean economic relations and the values that we have found in our OCA index, it appears highly irrelevant to think about the direct creation of a Korean monetary union in the short term. It remains nevertheless important to think about the monetary integration scenarios for the future of the Korean Peninsula. Drawing examples from economic history, we can classify the types of integration scenarios according to the length of integration on the monetary and political aspects (Figure 19). We can notably identify a gradual process on both sides (ex: the gradual process that led to the creation of the Euro Zone), or an abrupt unification on both monetary and political terms (ex: German reunification) or a special administrative region type of monetary integration (ex: Hong Kong SAR) that comprises the coexistence of two currencies. A consensus has emerged among economists regarding the Korean case which recommends a gradual monetary integration with separated monetary and economic areas, in a way similar to the Hong Kong Special Administrative Region. This process would be more progressive than the political integration (which

explains the position of Korea in the Figure 19) but would also be a prerequisite to establish a complete reunification, in a pre-Korean war sense.

Figure 19. Integration Scenarios



Source: based on the work of Moon Seong Min & Moon Woo Sik

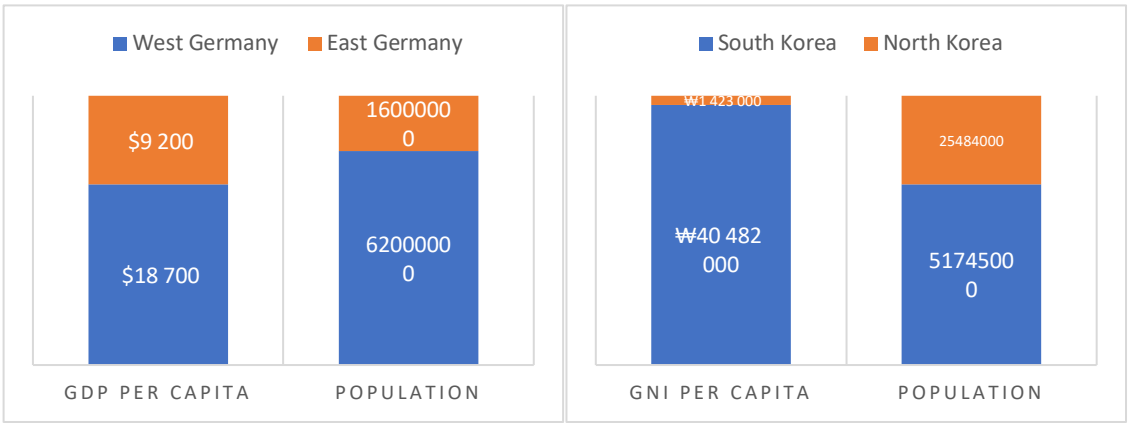
Those scenarios can inform the Korean monetary integration process, but some specificities that make the Korean case significantly different from those scenarios must be underlined.

5.1. Specificities of the Korean case when considering monetary integration

First, the differentials in major indicators between South Korea and North Korea must be definitely taken into account when designing integration plans. For instance, Figure 20

shows a comparison of the pre-reunification German situation with the current Korean situation.

Figure 20. Comparison of Germany and Korea pre-unification metrics



Source: Sleifer, 2006; Bank of Korea, 2021

North Korean's GDP per capita is relatively much lower compared to South Korea's than East Germany's was compared to West Germany's, whereas North Korean's population is relatively larger to South Korea's than East Germany's was compared to West Germany's. Therefore, the situation seems more difficult for South Korea which has to integrate a relatively larger and underdeveloped country, generating higher costs.

Second, compared to the integration of Euro Zone members, the two Koreas share profoundly deeper historical and cultural links. The depth of those links and the stakes of this reunification go beyond economic cooperation. They clearly exceed the ambition of the European project on the political level, which could suggest that the pace of this process would be much faster than that of the European Union and its monetary

integration. The notion of time and speed of integration must therefore be thought differently than for the European comparison.

Third, the central role of one particular country in the process of monetary integration can be problematic (ex: the leading role of Germany and its Bundesbank in the building of the EMU (Dyson, 2002)). It is often argued that in such situation, when a country takes a prominent role in the integration, the union in turn becomes asymmetric and biased towards that country. In the case of Korea, the situation might be quite different. Given North Korea's backwardness (see Figure 20) and its inexperience in market economy and globalized financial system, it appears inevitable for South Korea to take a leading role. By sharing its experience in quick growth and development, it will allow North Korea to rapidly achieve income convergence, industrial and infrastructural development, creation of a sound capital and money markets, a stable banking system.

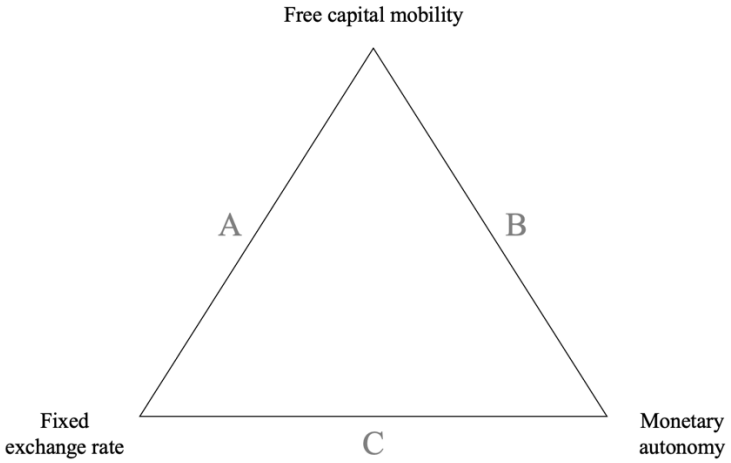
5.2 Choice of macroeconomic policies

The difficult task given to policy makers is to choose the modalities of the integration of North Korea during the separation period in a complex economic and financial environment. Robert Mundell[2], at the time he developed the theory of optimum currency areas that we have been relying on throughout our study, also developed a model of macroeconomic policy (Mundell, 1960) often summarized by the "Policy Trilemma". As seen on Figure 21, the Policy Trilemma indicates that three policy goals (free capital

[2] John Marcus Fleming developed independently the same concepts approximately contemporaneously (Boughton, 2003).

mobility, fixed exchange rate and monetary autonomy) cannot be simultaneously reached. In this context, the temporary separated North Korea region should pursue two of those goals.

Figure 21. Mundell's Policy Trilemma



Source: classic representation of the Policy Trilemma

As said earlier, the motivation for a temporarily separate North Korean special administrative region (SAR) is to allow the rapid development of the country to get closer to the South Korean development level in order to eventually reach monetary and complete political union. To give more precision about the level of development that should be achieved to proceed to monetary and complete political union, it has been suggested to wait for North Korea to reach the level of GDP per capita of Daegu Metropolitan City, which equaled 63.2% of national average at the time of the study (이영섭, 2002). Therefore, monetary autonomy appears as an indispensable tool for the region to conduct the policies that will most efficiently help achieving that result. The monetary autonomy of a North Korean SAR would allow for example a better management of inflation, support for strategic economic sectors, special lending and

management of interest rates. Taking example from the Hong Kong SAR, the North Korean SAR would keep its monetary autonomy[3].

In the early stage of the instauration of the North Korea SAR, a fixed exchange rate also appears as an important macroeconomic tool. A fixed exchange rate would help the SAR to stabilize prices and manage inflation, to stimulate the competitiveness of North Korean export products, to control the level of wages of workers in the region, to prioritize companies' competitiveness or to prevent disruptive migration flux. The exchange rate could thus be calculated by comparing the productivity of North and South Korea for example (서양원, 2008). However, this would imply heavier weight on the region's central bank which becomes likely to intervene in the foreign exchange market and thus requires important foreign exchange reserves[4]. If those two angles of the trilemma are chosen as the pursued goals by the North Korea SAR, then, according to the economic theory, it has to renounce to the mobility of capital. Indeed, if it allows capital mobility, then capital flows will be able to enter (and leave) the region freely and international investments will impact the exchange rate. Since the region postulated the fixity of the exchange rate, the central bank will be forced to use the interest rates as an adjustment variable to restore the exchange rate. The result is that the region would lose its monetary autonomy and the efficiency of its policy. In that scenario, the North Korea SAR would have to give up on capital mobility in the initial separation period, which would not come without consequences.

[3] The term of autonomy should be nuanced by the fact that, as previously said, having no experience in market economy and finance, the SAR's monetary policy will most probably be informed by South Korean expertise and guidance.

[4] To that regard, the question of whether South Korea will provide foreign exchange reserve, and if so in what proportion, should be discussed

As stated before, the ultimate goal of the separation period is to foster a rapid economic development to catch up with South Korea and consider complete integration. For this purpose, foreign investment and capital movement liberalization would be relevant and thus we understand that if the region controls it in favor of the two other goals previously mentioned, we can expect the economic development of the zone to be in consequence limited. In the end, some goals should be prioritized and a trade-off between those policies should be met. Is it better to prioritize stability or investment attraction? We believe that the unstable nature of North Korea requires extra caution and thus the use of an autonomous monetary policy and a fixed exchange rate regime in the early days of the separation period, even if that implies controlling capital mobility and hindering investments. After the initial period of stabilization, the North Korea SAR could switch to a floating exchange rates system and liberalization of capital movements. The floating exchange rate system could in this context allow a better absorption of economic shocks (as we have seen in the Chapter 2 of this paper) and foster a faster reduction of income gap between North and South Korea through an increase of the real exchange rate (김영찬, 김범환, 홍석기, & 박현석, 2016).

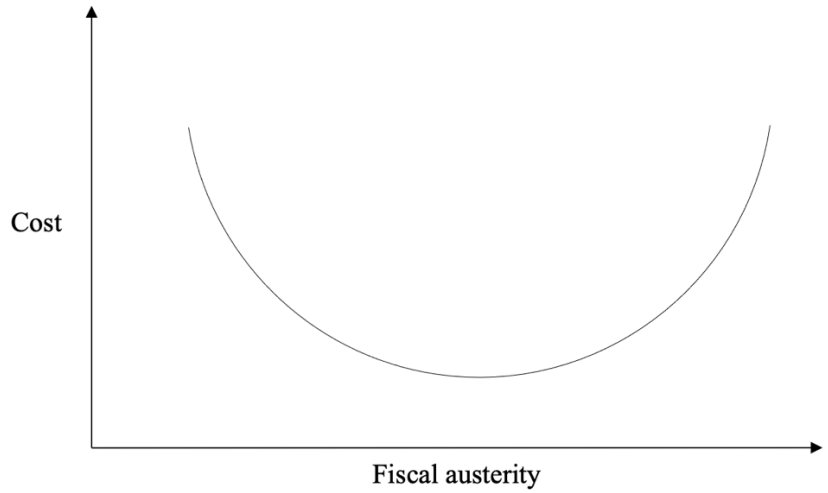
The choice to adopt a fixed exchange rate system in the early state of the separation period has an additional consequence on the fiscal policy aspect since monetary policy becomes tied to the defense of the exchange rate. In that context, fiscal policy becomes more important to pursue macroeconomic goals, and at the same time fiscal transfers are much needed to accelerate the development of North Korea, just like East Germany benefited from important fiscal transfer from West Germany after political unification. From the German reunification to the Korean Peninsula reunion, all political unions face the same

crucial question of choosing their fiscal system. Patrick Bolton and Gerard Roland in *The Breakup of Nations* even described that question as the "fundamental trade-off faced by all regions or states involved in a unification or disintegration process" (Bolton & Roland, 1997). In the Korean case and our hypothesis of temporary separation, we assume the existence of two separated fiscal systems because monetary integration would be the necessary prerequisite to a fiscal integration. In terms of chronology, a separated fiscal system appears as the only viable option since an integrated single fiscal system would add a considerable burden on South Korean public finances, which would hinder convergence and development. But to the contrary of the Hong Kong SAR where the fiscal independence is supported by an economic autonomy that allows Hong Kong's government to collect enough resource from its own economic activity, North Korea would not be able to finance its economic mutation solely through taxation. Therefore, it is expected that North Korea will be subject to important needs for fiscal transfers, even higher than in the German case.

Thus, our recommendation for fiscal policy is to maintain two independent and separated fiscal systems with central and local fiscal authorities in the North Korean SAR. The temporary fiscal system of the North Korea SAR should follow two main goals: fostering the conditions for rapid development and providing appropriate living conditions for North Koreans during the economic catch-up period. Regarding economic development, North Korea could draw example from South Korea tax system during its rapid growth (Dornbusch & Park, 1987) with a growth strategy based on the prioritization of certain key industrial sectors on a fiscal level through tax incentives and tax credit. Based on the South Korean model, the tax system would be notably characterized by tax revenue

originating mainly through corporate tax, but with a low effective tax rate on corporations (김미경, 2018), thus fostering development and competitiveness. Regarding the provision of appropriate living conditions for North Koreans, we need to remember that, even if priority is given to the development in a South Korean-like model, mobilizing fiscal resources to improve North Koreans living conditions in the short-term is beneficial for both the population's welfare and a smooth running of the separation period. The phenomenon that the government may want to avoid is disruptive population movements from the North to the South that would jeopardize the development of North Korea and the complete unification process. If reducing government spending to individuals in favor of competitiveness can effectively reduce cost of the integration process, we believe that the phenomenon is reversed after a certain point. Indeed, increasing fiscal austerity and therefore increasing the pressure on individuals of the North Korea SAR is likely to generate tensions at the border with significant population movements. The more these tensions increase, the more the cost to control the border will rise until it offsets the initial cost reduction, as visible on Figure 22. In addition, such tensions would hinder economic development, delaying the integration process and thus increasing the cost of unification.

Figure 22. Cost of fiscal authority during North Korea's integration process



Source: own elaboration

As mentioned previously, the North Korea SAR will not be able to finance its economic catch-up autonomously, thus South Korea will need to adopt a central role in the integration process through fiscal transfers to the North Korea SAR. More precisely, previous researches have estimated the unification costs between 50 and 667 billion dollars over a four-to five-year period (Wolf & Akramov, 2005) or between 2 to 5 trillion dollars over a 20-year period (Beck, 2010). Finally, fiscal transfers (in addition to technological, knowledge, and human support) to promote appropriate standard of living and interregional equity are also crucial to spark adhesion to the unification project from the North Korean population and to regain a sense of cohesion and political community on the Peninsula.

5.3. A cooperation challenge

The question of the cost of unification is relevant for fiscal policy as we have just seen, but also represents a cooperation challenge. Indeed, as the cost of unification is so important especially for the South Korean government, conflicts of interests arise. The Korean unification is an issue of collective action since both South Korea and North Korea have a common interest in unifying economically and politically in the long run. But in the short-term, both parties are incentivized to prioritize the interest of their own region. We can thus think the integration process through the prism of the game theory (Von Neunmann & Morgenstern, 1944) in which the players, South Korea and North Korea SAR have two strategy options: *cooperate* (make compromises for a smooth separation period and eventually an effective integration process) or *defect* (prioritize regional short-term interests, pursue electoral interest[5]). The element that drives the choice of strategy from both regions is the electoral incentive: both governments are incentivized by voters' support, and to that matters, the fiscal issue is a major decisive factor. In theory, South Korean politicians would gain more support by defending a position of limited financial aid to North Korean, whereas North Korea politicians would obtain more favorable opinion from North Koreans by advocating for a rapid integration process without separation period, the instauration of freedom of movement and high fiscal transfers. Korean integration strategy can be assimilated to a prisoner dilemma of which we provide the payoff matrix below:

[5] Our hypothesis is that during the political union and early integration period, democracy is established in the North Korea SAR and thus North Korea SAR's political class is subject to actual democratic votes, as in South Korea.

Figure 23. South Korea-North Korea Payoff Matrix

		South Korea	
		Cooperate	**Defect**
North Korea	**Cooperate**	3 / 3	5 / 0
	Defect	0 / 5	1 / 1

Source: own elaboration

Figure 23 shows that while it is collectively rational for both regions to cooperate because both would benefit from the separation period, it is individually rational for each region to maximize economic and political gain by advocating for policies that appeal to the interests of the electorate, thus strengthening their prospects for electoral success.

More precisely, the four situations would unfold as follow:

- If South Korea and North Korea cooperate, it implies that both regions agree on the necessity of separation period even if that means more effort from both sides in the process (higher fiscal transfers and acceptation of a separation period). In the long run, this situation would allow an efficient, faster and less costly unification.
- If South Korea defects and North Korea cooperates, it means that South Korea refuses to grant large fiscal transfers to North Korea SAR and thus benefits from lower costs in the short-term. On the other hand, North Korea, which was willing to settle, becomes disadvantaged by the lack of development aid from South

Korea. In the long run, this situation would lead to a dragging and more costly unification.

- If South Korea cooperates and North Korea defects, it means that North Korea maintains a hard line on massive fiscal transfers or immediate integration, and thus benefits from it in the short run. However, South Korea is disadvantaged in the short term by bearing a heavy fiscal burden that jeopardizes South Korean public finances. In the long run, this situation would lead to an inefficient and costly unification.
- If both South Korea and North Korea defect, it implies that South Korea refuses to grant large fiscal transfers to North Korea while North Korea refuses to settle for a separation period. In the short run, both government of South Korea and North Korea benefit from public support and electoral advantage in the short term. But in the long run, this situation would lead to high destabilization of both regions and the stalling of the integration process.

In order to overcome this noncooperative dilemma, we propose some policies to be considered. First, we believe in the primary role of communication in the integration process. Public authorities should achieve the production of an effective communication towards both South and North Korean populations in order to bring understanding on the importance of a separation period, beneficial for all parties even if it requires significant short-term efforts. The communication and the negotiation with the North Korea SAR should give guarantees that monetary integration will take place as quickly as possible according to the state of convergence. The initial economic assistance provided to the North Korea SAR by South Korea would also represent economic incentives to promote

cooperation between the parties, giving the North Korea SAR reasons not to defect in the previously mentioned framework, and finally demonstrating South Korea's willingness to carry out the integration project. Economic assistance would thus be a major part of the confidence-building process, in addition to other non-economic cooperation measures. Furthermore, we also believe that the governance of the authorities in charge of the monetary integration should be thoroughly discussed. In particular, given the cooperation issues that electoral concerns generate in the context of a Korean unification, we could rely on the conclusions drawn from the notion of time inconsistency (Kydland & Prescott, 1977). To prevent short-term issues from guiding decisions, to secure the mitigation of distortions related to the pursuit of electoral goals, and to ensure consistency in the integration process, it could make sense to give less prerogative to the elected government and establish the independence of the economic and monetary authorities in charge of the Korean integration process, similarly to the independence given to central banks (Bernanke, 2010). In the end, the challenge is to foster cooperation, efficiency, stability and equity in the whole process of integration.

CHAPTER VI. CONCLUSION

6.1. General conclusion

We used, through this study, the theory of optimum currency areas founded by Robert A. Mundell and following authors, as what we deem to be the most relevant tool of the economic analysis to explore the monetary union possibilities on the Korean Peninsula. The creation of the OCA index allowed to give a theoretical yet precise overview of the relevance of monetary union between North Korea and its major trade partners. Our findings show a consistency of South Korea being a primary candidate for a monetary union relatively to other countries while other countries like China and Russia, whose regimes appear commonly more favorable towards North Korea, showed more inconsistency over time in the OCA index (despite good performance at certain points). However, in comparison to other OCA indexes like the one originally made for the Euro Zone, it is clear that the sudden creation of a currency area on the Korean Peninsula would not be economically optimum, even when taking endogeneities effects into account. Based on that recognition, we tried to draw the main policy implications regarding the project of a Korean monetary union. The creation of the favorable macroeconomic conditions for monetary union and reunification requires to opt for a temporary separation of the two regions, and to make strategic policy choices, notably within the framework of Mundell's Trilemma. To that effect, the choice of a fixed exchange rate and monetary autonomy in the early stage of the integration process appears as the best disposition to maintain stability in the region while initiating economic convergence. In addition, a particular focus should be placed on fiscal policy as this aspect is crucial in the

implementation of a sustainable fiscal transfer structure that would allow for a rapid and efficient development of North Korea. The fiscal policy should be committed to fostering the conditions for rapid development and providing appropriate living conditions for North Koreans during the economic catch-up period. Finally, the fiscal issue of Korean unification leads us to the cooperation challenge that it also represents. Ensuring the cooperation of both parties from the beginning in the integration process is of utmost importance, but at the same time such cooperation will inevitably be challenged by individual behaviors and regional self-interests that clash with the collective good.

6.2. Limitations

The first limitation that we need to consider is the suitability of the OCA model to North Korea. The model developed by Bayoumi & Eichengreen was notably suitable for European countries, therefore capitalist countries with market economy and largely open to trade. The OCA index takes into account major aspects of economic relations between such countries: business cycles, trade volumes, etc. If business and trade were not completely absent from North Korea especially during the 2011-2015 period, as we have seen, it is evidently considerably less important than in countries such as those studied by Bayoumi & Eichengreen. Discussing business cycles and trade linkages for North Korea, therefore, does not seem as relevant as for the European Union, and we can particularly see this by comparing the figures of the original OCA index and the values obtained in our study. The gap between the values of the European OCA index and the North Korean OCA index shows that the direct application to North Korea is not as meaningful as it would be to standard capitalist countries. Therefore, since the ambition of our study was

to study the OCA possibilities on the Korean Peninsula, it could make sense for a future study to tackle the issue through the lens of South Korea. South Korea is a capitalist country with a market economy, open to international commerce, and therefore closer to the European countries for which the OCA index was designed. Thus, the study of potential partners in a monetary union between South Korea and its main trade partners in Asia would surely give us results closer to those of Bayoumi & Eichengreen and be more faithful to the OCA theory. Such a study would also be more relevant in terms of political reality because if the possibility of a pacification of inter-Korean relations seems unlikely in the short run, the question about economic and monetary cooperation in East Asia is currently much more discussed and brought to the table of cooperation negotiations between the countries of this region.

The Bayoumi & Eichengreen's OCA Index has also encountered some limitations in its technical application. The main problem with this model is that the dissimilarity of exports variable, considering the particularity of trade relations of North Korea with its partners and especially the drastic reduction of trade in the second part of the studied period, appears to closely dependent on the total trade value. The phenomenon that we witnessed is that when the total value of trade between North Korea and its partners declined significantly, the value of the dissimilarity of exports followed a similar decreased. Therefore, we see a paradox: as North Korea trade relations with its partners worsen, the value of dissimilarities with them decreases which contribute to improve the OCA index value of those countries. Indeed, countries that do not trade much consequently do not have high dissimilarities of exports. It seems that there is a contradiction in saying that countries that trade less are more likely to form a monetary union. So, is it irrelevant to use the OCA index to study North Korean currency union

possibilities? We believe that our index is still relevant for this study. If, as mentioned, a paradoxical phenomenon can emerge from the model, throughout our study we have seen that the value of total trade and dissimilarity of exports have had opposite evolutions in several cases for example in China-North Korea trade in 2011-2015. Even if total trade increased, the value of dissimilarity decreased which shows that those two values do not necessarily evolve in the same direction. It is also the case for China-North Korea trade in 2016-2020, with opposite movement in the value of total trade and dissimilarity of exports. For other countries also, those two values evolved in variable proportions, therefore it seems hard to conclude that they strictly follow the same pattern and that the model is overall irrelevant. We acknowledge that this contradictory phenomenon especially played out during the last years of our study when trade became very scarce between North Korea and its partners.

Additionally, we are aware that the issue of Korean reunification has important cultural and historical aspects that are not taken into account in Bayoumi and Eichengreen's OCA index. The exploration of the possibilities of monetary union cannot be strictly observed from an economic point of view, and this is what we have tried to capture by including a historical and cultural linkage variable in the gravity model that we have used. Further research should be made on the cultural variable implication in the optimality of a Korean currency area, and especially regarding its potentiality to unlock endogeneity effects.

Finally, it is always with humility that we must approach the Korean Peninsula issue. As I was writing this study, Professor Sheen's words said during his lecture truly resonated with me: we can conduct economic studies, document the possibilities of a reunification

from a technical point of view, but in the end, and as in any political union history, we have to accept the fact that not everything can be foreseen and that there will always be an element of uncertainty, of unknown and fortuity in these unification processes. It is our responsibility to acknowledge this limitation, and to keep producing research to increase the general knowledge on this subject, to better plan for the unification project, and to spark interest and discussion on the relations between the two Koreas. And this was the modest ambition of our study here, to add another brick to the building of inter-Korean cooperation.

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APPENDIX

APPENDIX I

Product classification, KOSIS, KOTRA

제품 분류	Product classification
01 산동물	01 Live Animals
02 식용육류	02 Edible meat
03 어류, 갑각류, 연체동물 등	03 Fish, crustaceans, mollusks, etc.
04 낙농품, 조란, 천연꿀 등	04 Dairy products, poultry eggs, natural honey, etc.
05 기타 동물성 생산품	05 Other animal products
06 산수목과 기타식물 및 인경뿌리 등	06 Mountain trees, other plants and rhizomes, etc.
07 식용채소, 구근	07 Edible vegetables, bulbs
08 식용과실, 견과류	08 Edible fruit, nuts
09 커피, 차, 향신료	09 Coffee, Tea, Spices
10 곡물	10 Grains
11 제분공업의 생산품	11 Products of the flour industry
12 종자와 과실, 공업·의약용 식물	12 Seeds and fruits, industrial and medicinal plants
13 아교, 수지 및 기타 식물성 액, 즙	13 Glues, resins and other vegetable liquids and juices
14 식물성 편조물용 재료	14 Materials for vegetable braiding
15 동식물성 유지 및 분해생산물	15 Animal and vegetable fats and decomposition products
16 육류, 어류, 갑각류 등의 조제품	16 Preparations of meat, fish, shellfish, etc.
17 당류 및 설탕과자	17 Sugars and Sugar Confectionery
18 코코아와 그 조제품	18 Cocoa and its preparations
19 곡물, 전분, 유제품, 베이커리 제품	19 Grains, Starches, Dairy Products, Bakery Products
20 채소, 과실, 견과류의 조제품	20 Preparations of vegetables, fruits and nuts
21 기타조제식료품	21 Other prepared food products
22 음료, 알코올 및 식초	22 Beverages, Alcohol and Vinegar
23 식품공업 발생 잔유물/웨이스트	23 Food industry residue/waste
24 담배	24 Cigarettes
25 소금, 황, 토석류 및 석고, 석회, 시멘트	25 Salt, sulphur, earths and stones, gypsum, lime, cement
26 광, 슬랙 및 회	26 Optical, slack and gray
27 광물성연료, 광물유	27 Mineral fuels, mineral oil
28 무기화학제품, 귀금속, 희토류금속 등	28 Inorganic chemical products, precious metals, rare earth metals, etc.
29 유기화학제품	29 Organic chemicals
30 의료용품	30 Medical supplies
31 비료	31 Fertilizer
32 염료, 안료, 페인트	32 Dyes, pigments and paints
33 조제향료, 화장품류	33 Perfume, Cosmetics
34 비누, 세제 등	34 Soap, Detergent, etc.

35 단백류물질, 아교, 촉매제	35 Proteins, Glues, Catalysts
36 화약, 화학제품	36 Gunpowder, Chemicals
37 사진용 또는 영화용 재료	37 Photography or Film Materials
38 기타 화학제품	38 Other chemicals
39 플라스틱 및 그 제품	39 Plastics and products thereof
40 고무 및 그 제품	40 Rubber and its products
41 원피와 가죽	41 Raw hides and skins
42 가죽제품, 여행용구, 핸드백	42 Leather goods, travel goods, handbags
43 모피, 인조모피 및 그 제품	43 Furs, artificial furs and articles thereof
44 나무, 나무제품, 목탄	44 Wood, wood products and charcoal
45 코르크 및 그 제품	45 Cork and articles thereof
46 짚, 에스파르토 또는 조물제품	46 Straw, esparto or artificial products
47 펄프, 폐지	47 Pulp, waste paper
48 종이, 판지 및 그 제품	48 Paper, cardboard and articles thereof
49 인쇄서적, 신문, 기타 인쇄물	49 Printed books, newspapers and other printed materials
50 견	50 Dogs
51 양모 및 그 직물	51 Wool and its fabrics
52 면	52 Textile
53 기타 식물성 방직용 섬유와 그 직물	53 Other vegetable textile fibers and fabrics thereof
54 인조필라멘트섬유	54 Man-made filament fibers
55 인조스테이플섬유	55 man-made staple fibers
56 워딩, 펠트, 부직포 등	56 wadding, felt, non-woven fabric, etc.
57 양탄자류와 바닥깔개	57 Carpets and floor coverings
58 특수직물	58 Special fabrics
59 침투, 도포, 피복, 공업용 방직용섬유	59 Impregnating, coating, covering, industrial textiles
60 메리야스편물과 뜨개질편물	60 Knitted and crocheted fabrics
61 의류/부속품(메리야스, 뜨개질편물)	61 Clothing/accessories (maryas, crocheted fabrics)
62 의류/부속품(메리야스, 뜨개질편물 외)	62 Clothing/accessories (maryas, knitting, etc.)
63 방직용섬유의 기타제품	63 Other textile products
64 신발류	64 Footwear
65 모자류	65 headwear
66 우산, 지팡이,스틱 등	66 Umbrellas, canes, sticks, etc.
67 조제우모와 솜털 및 그 제품	67 Prepared feathers and down and products thereof
68 석, 플라스터, 시멘트 등의 제품	68 stone, plaster, cement, etc. products
69 도자기	69 Porcelain
70 유리와 유리제품	70 Glass and glassware
71 보석, 귀금속류	71 Jewelry, precious metals
72 철강	72 Steel
73 철강제품	73 Steel products
74 동과 그 제품	74 Copper and its products

75 니켈과 그 제품	75 Nickel and its products
76 알루미늄과 그 제품	76 Aluminum and articles thereof
78 연과 그 제품	78 Kites and products thereof
79 아연과 그 제품	79 Zinc and its products
80 주석과 그 제품	80 Tin and its products
81 기타 비금속제품	81 Other non-metal products
82 비금속제의 공구, 도구	82 Non-metallic tools and implements
83 비금속제의 각종제품	83 Non-metal products
84 원자로, 보일러와 기계류	84 Nuclear reactors, boilers and machinery
85 전기기기, 음향, 영상설비 및 부분품	85 Electrical equipment, audio and video equipment and parts
86 철도, 궤도용 기관차, 신호설비	86 Railways, track locomotives, signal facilities
87 차량 및 그 부품	87 Vehicles and parts thereof
88 항공기 및 그 부품	88 Aircraft and parts thereof
89 선박과 수상구조물	89 Ships and floating structures
90 광학, 의료기기, 부품	90 Optics, medical devices, components
91 시계 및 부분품	91 Watches and accessories
92 악기 및 부분품	92 Musical instruments and parts
93 무기	93 Weapons
94 가구, 침대 등	94 Furniture, beds, etc.
95 완구 및 부분품	95 Toys and parts
96 기타제품	96 Other products
97 예술품	97 Artwork
99 미분류	99 Unclassified

APPENDIX 2

OCA Index versus North Korea (2011-2015)

	2011	2012	2013	2014	2015
China	0,85100447	0,8669364	0,83753352	0,86004663	0,77768243
Hong Kong	0,84559623	0,84735157	0,84502971	0,84360132	0,84381097
Russia	0,87138523	0,86768551	0,86972874	0,86781922	0,86817101
Thailand	0,82657524	0,82614682	0,83104017	0,82810645	0,8264051
South Korea	0,81722753	0,82117629	0,82250406	0,81090828	0,81503507

APPENDIX 3

OCA Index versus North Korea (2016-2020)

	2016	2017	2018	2019	2020
China	0,77394152	0,91138856	0,97118481	1,00034705	0,7966252
Hong Kong	0,78659835	0,7869147	0,78666071	0,78593386	0,78672041
Russia	0,73793199	0,73933748	0,73534594	0,73563815	0,73617745
Thailand	0,77268716	0,76800759	0,76833404	0,76714142	0,76808445
South Korea	0,75093378	0,75072464	0,75153828	0,75044681	0,75058808

APPENDIX 4

Actual and Predicted Trade Flows According to the Gravity Model of South Korea

	Actual	Predicted	Actual Trade / Predicted Trade (%)
China	220617247	120387320	183%
USA	100776732	42758627,6	236%
Japan	107999876	155107013	70%
Saudi Arabia	43936911	19549124,8	225%
Hong Kong	33283478	27945829,1	119%
Australia	34480149	27020986,6	128%
Singapore	29805688	22264489,1	134%
Taiwan	32899554	34837157,6	94%
Vietnam	18549168	13721173,7	135%
Germany	26463506	33482952,1	79%
Indonesia	30780872	17703230,9	174%
Qatar	21218368	18089653,3	117%
Russia	21157051	25404413,5	83%
United Arab Emirates	22027120	19124087,8	115%
India	20547651	19029455	108%
Malaysia	16742948	16998613,7	98%
Kuwait	18391587	15716655,2	117%
Brazil	18164333	17808652,9	102%
Thailande	13872326	17560862,6	79%

Mexico	12044757	16606723,1	73%
Philippines	10910374	15702428,6	69%
United Kingdom	8787184	29094517	30%
		Average	**117%**

한반도의 최적통화지역 가능성에 관한 연구

국문초록

지난 수십 년 동안 북한은 상대적인 개방과 무역 관계의 가속화로 인해 긴장이 고조되고 김정은 독재 정권이 급진화되는 시기를 겪었습니다. 이러한 상황에서 북한과의 화해와 통일에 경제적 근거가 있을 수 있는지에 대해 연구하고자 했습니다. 이를 위해 유로존 창설 당시 주목 받았던 최적통회지역 이론을 활용했습니다. 우리는 북한과 주요 무역 파트너 국가들 간의 통화 연합의 관련성에 대해 이론적이면서도 정확한 개요를 제공하기 위해 OCA(Optimum Currency Area) 지수를 개발했습니다. 연구 결과에 따르면 한국은 다른 국가들에 비해 상대적으로 통화 연합의 후보로 선호되는 것으로 나타났습니다. 중국과 러시아 등 다른 국가들은 연구 기간 중 특정 시점에서는 더 나은 성과를 보였지만, 시간이 지남에 따라 일관성이 떨어졌습니다. 그러나 이러한 지표를 고려하더라도 내생효과를 고려한다면 한반도에 갑자기 통화권을 형성하는 것이 경제적으로 최적이 아니라는 점은 분명합니다. 이러한 인식을 바탕으로 한반도 통화 연합 추진과 관련된 주요 정책적 시사점을 도출하고자 했습니다.

Keywords: 최적 통화 지역, 북한, 남북 관계, OCA index, 통화 통합, 통일

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