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Studies on Economic Classes of North Korea and Unification Perception of the South Koreans

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Abstract

Studies on Economic Classes of North Korea and Unification Perception of the South Koreans

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Marketization is the most prominent economic issue discussed most frequently in the North Korean economy literature. Since the ‘Arduous March’ of 1990s, marketization has been expanding to become both the most important source of income for the normal North Koreans, and the main engine for growth of the North Korean economy. Furthermore, the level of marketization in North Korea is unprecedented even in comparison to the previous examples of Soviet Union and former socialist states.

Reflecting the uniqueness and sheer size of marketization, there have been many attempts to study the phenomenon. Most of the previous studies on North Korean marketization thus far have mainly focused on topics such as estimating its size, comparative level, finding the determinants of expansion, and its contribution to growth of the North Korean economy.

However, there are only limited number of empirical studies on how the consequent factors of the marketization affect the economies of the North Korean people due to data deficiency. To overcome the difficulty, the first two chapters of

this dissertation utilizes the survey dataset of 'North Korean Refugee Survey'. The dataset is annually published by the Institute for Peace and Unification Studies (IPUS) at Seoul National University.

The first chapter explores the effect of bribe on informal income in North Korea. By selecting an instrumental variable, the 2SLS estimation results suggest that bribe increases informal income. Furthermore, subsequent IV quantile regression results show that the profitability of bribes increases with the informal income quantile. These results empirically confirm the fragility of corruption equilibrium argued by Kim (2010). Furthermore, result of the disproportionate profitability of bribes suggest that it may has contributions to informal income inequality.

The second chapter provides distributional analysis on informal income of North Korea with the same data source as the first chapter. By relative distribution analysis and median relative polarization index estimation methods, an increased level of informal income polarization during the period of market expansion is observed. More importantly, the contribution of increase in the share of lower tail distribution to overall increased polarization overwhelms that of increase in the share of upper tail distribution. The results are robust after resampling of the data, and also after matching of the samples by propensity score matching methodology which were conducted in an effort to alleviate the sample selection bias. The result of increased level of informal income inequality may put pressure for institutionalization of the markets in the long-run.

This dissertation also conducts additional analysis on the unification perceptions of the South Koreans. Specifically, the last chapter seeks to analyze growing pessimism on unification. According to statistics on unification perception of the South Koreans, there seems to be a trend where negative perceptions are growing over time. The growing pessimism is especially alarming because some

of the suggested reasons behind it, analyzed by previous literature, are increasing alienation of the North Koreans and salient pessimism among the younger generations.

In light of this, the last chapter investigates whether there exists generation effect on economic determinants of unification perception by analyzing the 'Unification Perception Survey' of IPUS. More specifically, empirical tests were conducted to discover whether the *economic competition theory*, one of the established anti-immigration sentiment theories, are a valid determinant of unification perception. The theory argues that low-skilled individuals are more likely to harbor negative attitudes toward immigration over the concerns for potential competitions with low-skilled immigrants. In addition, whether the younger generations are especially susceptible to it compared to the older generation was investigated. Results of empirical analyses suggest that there exists generation effect in the negative effect of skill level. In other words, the younger generations consider their skill levels significantly when considering unification, whereas for the older generations, the skill level turned out to be immaterial. This implies that the context in which the unification is discussed in the society should change from traditional justification of mono-ethnicity to more practical aspects of unification such as economic costs and benefits.

Keywords: North Korean Economy, Marketization, Informal Income, Bribery, Unification, Unification Perception

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Introduction

Markets in North Korea has emerged amid the 'Arduous March' of 1990s. With the near-collapsed public distribution system, markets referred to as *Jangmadang* has served as the main source of income for the North Koreans (Kim and Song, 2008; Haggard and Noland, 2010; Jeong et al., 2012; Kim, 2017). The degree of reliance on informal income of the North Korean people is unprecedented even in comparison with the Soviet Union and former socialist states (Kim, 2003). Reflecting its importance in the economy, there have been many attempts to reveal the size, functions, and its contribution on the growth of the North Korean economy (Park, 2002; Yang, 2006; Kim and Yang, 2012; Jeong et al., 2012; Lim, 2013; Kim and Yang, 2014). However, its effects on the daily economic lives of the North Korean people have often been overlooked by the previous studies mainly due to data limitations.

This dissertation attempts to explore the effects of marketization and its informality on the economic lives of the North Korean people. In addition, it investigates the possible effect of marketization on economic inequality of the North Koreans. To overcome the difficulties associated with data deficiency, 'North Korean Refugee Survey' dataset annually published by the Institute for Peace and Unification Studies is employed. The dataset only recruits the North Korean refugees who have escaped North Korea one year prior to the survey without having lived in the third country. This significantly reduces the possibility of measurement error caused by memory loss.

First, an empirical analysis was conducted on the effect of bribe on informal income. Bribery in North Korea is reported to be prevalent to the degree that it has a significant effect on people's everyday lives. Bribe is known to be a prerequisite for conducting informal economic activities (IEA) which is the main source of

income for the North Koreans.

Kim (2010) provides an effective framework on transactional relationship of bribe between the dictator, the bribe-receiving officials, and bribe-giving IEA participants. The research proposes that the bribery in North Korea seems to have reached an equilibrium where the dictator allows the officials to receive certain amount of bribe as a partial replacement of salary. The officials pay partial loyalty to the dictator and receive bribe from IEA participants to turn blind-eye. The IEA participants pay bribes and perpetuate the IEAs. The sustainability of this equilibrium may depend on the possibility of expansion of marketization and bribes.

The chapter investigates whether bribes are associated with positive return on informal income. The profitability of bribes for the IEA participant would imply the possibility of expansion in the overall size of bribery. By 2SLS estimation, this study finds that bribes are profitable. More importantly, IV quantile regression was conducted to discover that the profitability increases with the informal income quantile.

The second chapter studies informal income distribution of North Korea. It has been observed that the marketization has been expanding since Kim Jong Un came into power in 2011 attributable to lenient policy stance of the regime on the marketization. Previous studies report increases in number of markets, private financial markets, and unofficial labor markets (Hong et al., 2016; Hong, 2018; Yang and Yoon, 2016).

This chapter investigates the changes in informal income distribution during the period of market expansion. By relative distribution analysis introduced by Handcock and Morris (1998, 1999) and median polarization index estimation method introduced by Morris et al. (1994), the informal income polarization seems to have increased during the period.

As an additional study, the unification perception of the South Koreans was analyzed. Unification perception is an important issue for realization of the unification since it could potentially be one of the internal constraints. However, the South Koreans are increasingly becoming pessimistic about unification according to recent statistics.

There have been attempts to find the reasons behind the pessimistic view by previous studies. One strand of research argues that there exists changing perception of the South Koreans on the North Koreans from mono-ethnic group to an out-group who are not clearly distinguishable from non-coethnic group (Yoon and Song, 2013; Ha & Jang, 2016). Campbell (2016) argues that increased level of economic competitions and uncertainty encouraging the younger generations to reject the idea of unification. In accordance with the above arguments, Jung et al., (2022) finds that anti-immigration sentiment theories have significant explanatory power on unification issue.

Chapter 3 empirically tests if the younger generations are especially susceptible to potential economic competitions when considering unification. The results of empirical analyses suggest a possibility that *economic competition theory* could be a significant factor affecting the unification perception for the younger generations. The theory is one of the anti-immigration sentiment theories arguing that low-skilled individuals are more likely to harbor negative attitude towards immigration. The results suggest that the younger generations tend to be especially susceptible to more practical issues such as individual economic benefits of unification when forming the unification perception. This may imply that the context in which the unification is discussed in the society should change from traditional justification of mono-ethnicity to more practical discussions.

Chapter I. Bribery and Informal Income of North Korea: An Instrumental Variable Approach

1. Introduction

Bribery is one of the most unique features when explaining the North Korean economy. Because of its scale and scope, it is presumed to have many economic implications. Anecdotal evidences reported by the North Korean refugees reveal that corruption in the form bribe is deeply embedded in daily lives of the North Koreans.

Reported share of expenditure on bribes in total expenditure amounts to around 15 to 20% according to various surveys (Kim, 2010; Kim and Koh 2011). There can be many reasons for the prevalent corruption in North Korea. For example, Elbahnasawy and Revier (2012) in their cross-country analysis concludes that the degree of 'rule of law', 'development of economy', and 'freedom of expression' are the main determinants of corruption, all of which are deficient in North Korea.

Looking more closely into the country-specific reasons of corruption, one inevitably encounters the evolvement of Informal Economic Activity (IEA). More specifically, the illegal nature of the IEA might be one of the major reasons for the prevalence of bribe. Even though the IEAs in North Korea has been the main source of income from which around 70 to 90% of the household income is reportedly earned[1], the North Korean regime is yet to institutionalize it. Due to its illegality, bribe has become mandatory for significant portion of the population who

[1] Refer to Kim and Song (2008), Haggard and Noland (2010), Kim & Yang (2012), Jeong et al. (2012) for more details.

participates in IEA. Kim and Koh (2011) reports positive relationship between IEA and bribe confirming the argument.

How these bribe payments are being traded and what the transactional relationship surrounding bribe is like in the North Korean society remains to be observed. However, Kim (2010) provides insightful analysis on trade-off relationship surrounding bribe between the dictator, the officials, and the IEA participants. The research argues that corruption in North Korea seems to have reached an equilibrium. The IEA participants earn informal income in return for bribe payments, whereas bribe receiving officials turns blind eye for illegal IEAs. The dictator with insufficient financial resources to pay appropriate salary to the officials allows the officials to receive bribes as long as they remain at least partially loyal to him. In fear of punishment, the officials pay partial loyalty to the dictator. However, this equilibrium seems to be fragile. The research argues that "the self-expanding nature of bribes and markets will put high pressure on the will and the ability of officials to follow the dictator's interests" (Kim, 2010).

Whether the equilibrium is sustainable is a critical issue for the regime since the breaking of the equilibrium by market forces and betrayal of the officials may destroy socialist foundations of the society as the research analyzes. The key to the sustainability of the equilibrium seems to be "the self-expanding nature of bribes and markets". As far as the markets are concerned, its expansion is likely to be inevitable considering its importance not only to the lives of the normal people, but also to the national economy. For bribes on the other hand, IEA participants would want to pay as small amount as possible in nature, whereas the officials would want to maximize their incomes from bribes. As it is quite unlikely that the officials would choose loyalty over bribe income, whether the size of bribes will expand in the future may depend on the profitability of bribe payments for the bribe-giving IEA participants.

For IEA participants, bribe incorporates characteristics of both tax and investment. It is similar to paying taxes in a sense that everyone participating in IEA are required to pay in order to avoid punishment and to continue business. It also acts as an investment because paying bribes may provide conveniences in conducting various businesses, and opportunities to expand the businesses. The former can be considered to be unprofitable, extractive bribe, whereas the latter can be considered as profitable bribe. The overall profitability of bribe then depends on relative sizes of the two kinds. However, it is difficult to obtain such detailed information on bribes due to its undisclosed nature.

Measuring the payoff of corruption is difficult in general. For this reason, many of the previous literature studying the issue focus on discovering the determinants of bribery. Some of the examples include studying the likelihood and the amount of bribery in developing countries by income level, and socioeconomic status (Hunt, 2007; Kaufmann et al., 2008; Hunt & Laszlo, 2012; Sharma, 2018). On the contrary, there are only a limited number of researches which empirically analyze the return, or payoffs of bribes. Most of the researches measure the payoffs of bribes by qualitative variables such as public or health services (Hunt & Laszlo, 2012; Justesen & Bjornskov, 2014; Mavisakalan et al., 2021) reflecting the main reason for giving bribes in most of the developing countries which is to overcome under-developed institutions or social systems.

Contrastingly, the North Korean case provides a unique environment for quantitatively, and empirically analyzing the payoffs of bribes. First, the IEAs are essentially illegal in North Korea as previously mentioned, for which paying bribes is a necessary condition. For this reason, the payoffs of bribes in North Korea is expected to be well-reflected in informal income which is quantitatively measurable. Moreover, the North Korean refugees, in most cases, are not likely to

false-report the bribe amount or the informal income as there are no concern over any kind of punishment lowering the possibility of measurement error.

This study attempts to empirically examine whether and to what extend the bribes are profitable in North Korea. Throughout the study, I use the term 'payoff' referring to the amount of absolute return on bribe and the term 'profit' referring to the amount of surplus after deducting the bribe payments. An instrumental variable approach was employed to alleviate possible existence of endogeneity in the relationship between bribe and informal income. Analysis is then extended to IV quantile regression to investigate if there exists difference in payoffs of bribes across informal income quantiles. The results of empirical analyses provide evidence that bribe payments are profitable, and that the profitability increases with the informal income quantiles.

The rest of this paper is organized as the following. Section 2 provides information on the data used in this study, and how the main variables were constructed. Section 3 explains the empirical strategy and reports the results. Section 4 concludes the study.

2. Literature Review

Corruption problem in socialist states such as North Korea is not difficult to be observed. Previous studies suggest that corruption under socialist, authoritarian regime might be one of the reasons for the collapse of the former socialist states. Shleifer and Vishny (1993) points out the possibility of system collapse due to emergence of multiple independent agents who maximize their bribe incomes. They emphasize that "weak governments that do not control their agencies experience very high corruption levels", and that "the illegality of corruption and the need for secrecy make it much more distortionary and costly than its sister

activity, taxation". Their analysis also implies that adaptation of market mechanisms to a socialist economy may induce destabilization of the system due to creations of corruption among elites and officials. Furthermore, the results suggest close monitor of the corrupted elites and officials may be more efficient for the dictator than introducing partial reforms without democratic government.

In large part, the results of Shleifer and Vishny (1993) have implications for corruption problem in North Korea. First, marketization without full-scale transition of the economic system in North Korea can be considered to have created room for the emergence of bribes. Secondly, the prevalence of bribes in North Korea may be incorporating a significant degree of distortions in the economy, especially in the market sector. Lastly, it can provide explanation of the regime's choice to allow certain degree of bribes which the officials receive. For the dictator, a close monitoring of the bribe-receiving officials to keep the size of bribes they receive at the desired level might be a dominant strategy at least for the foreseeable future from an efficiency standpoint. Prohibiting bribes would increase economic burden on the dictator in providing appropriate salaries to the officials under the sluggish official sector, whereas loosening the monitoring would imply disintegration of the socialist economic system.

Harrison and Kim (2006) explores how corruption may have contributed to the collapse of the Soviet regime. They distinguish the quality of bribes as "loyal" and "disloyal" depending on how they are used. The "loyal" bribes refer to the bribes used to fulfill the planned production target of the enterprises. The "disloyal" bribes refer to the bribes used for personal enrichment or embezzlement. The research argues that reductions in plan tension of the Soviet economy in 1970s have induced the quality of corruption from "loyal" to "disloyal", which in turn have contributed to the collapse of the system. The result of Kim and Koh (2011) can be interpreted as an application of the above discussion to the North Korean case.

Their empirical test reveals that bribe-giving is associated with increase in probabilities of working in the informal sector and decreases the number of hours worked in the formal sector. In other words, bribes are positively associated with personal gains in the form of informal economy activities (IEAs). This effectively qualifies the corruption of North Korea as "disloyal" according to the categorization of Harrison and Kim (2006).

Furthermore, Kim (2010) provides detailed analysis on the transactional relationship of bribes between the dictator, the officials, and the market participants. He argues that there seems to exist an equilibrium of corruption between the three players. The market participants obviously pay bribes to the officials to perpetuate their market activities (or IEAs), while the officials turn blind eye on them. On the other hand, the dictator allows the officials to receive certain amount of bribe in compensation for insufficient salaries as long as the officials stay at least partially loyal to the dictator. Kim (2010) also adds that the equilibrium is fragile due to the expanding nature of markets and bribes. He asserts that increasing bribes would put pressure on the will and the ability of officials to follow dictator's interest and would cause misaligned interests of the dictator and the officials. The expanding bribes would also intensify the beliefs of the market participants that money can buy anything which is not a desired result of the dictator.

Summing the results of the studies discussed thus far, expansion of bribes seems to have significant implications for the stability of regime. The expansion would depend on the incentives of the parties involved in. For the officials, it is rather obvious that they would desire maximum income from bribes. However, the market participants would only be willing to pay as small amount as possible as bribes. Under the circumstance, the equilibrium amount of bribe would be determined by the willingness to pay bribes of the market participants which in turn would be determined by the expected payoffs of bribes.

Unfortunately, measuring the payoffs of bribes are difficult in nature. It can take various forms other than quantifiable units. Accordingly, there are only limited number of previous studies which provide empirical evidence of micro-level benefits, or payoffs of bribes. Mavisakalyan et al., (2021) analyzes individual-level data of 28 post-communist countries to find that bribing for public services worsens self-assessed health. Hunt and Laszlo (2012) studies the bribe cases in Peru and Uganda and asserts that "the benefit of bribery is avoidance of the poor service delivered to clients who refuse to bribe". Thompson and Xavier (2002) finds that hospital patients in Kazakhstan who pay bribes tend to stay longer in hospital and rate the service they receive worse.

Contrastingly in North Korea, informal income, or income from market activities are directly related to bribes. The illegal nature of IEAs, bribes are mandatory means not only to start the IEA, but also to continue the IEAs. This study takes advantage of the fact and attempts to measure the benefits, or the payoffs of bribes by informal income.

3. Data

3.1 IPUS North Korean Refugee Survey[2]

This study utilizes survey data of 'North Korean Refugee Survey' published by the Institute of Peace and Unification Studies (IPUS) at Seoul National University. The survey is conducted on an annual basis since 2011 on the North Korean refugees who have escaped North Korea one year prior to the year of survey. One of the most unique features of this survey is that it only recruits the refugees

[2] Information about the survey data stated in this section is based on IPUS (2021).

who have made a direct entry to South Korea without having lived in another country. As of 2020, the total number of samples amount to 1,137. It employs 'snowball sampling' method whereby first few samples are introduced by 'Korea Hana Foundation'[3], then further samples are recruited by chain-referrals. The questionnaire is composed of two surveys. The first survey called 'Unification Perception of the North Koreans' asks perception-based questions on unification, South Korea, North Korea, and neighboring countries. The second survey called 'Societal Change of North Korea' focuses on details of social and economic conditions of North Korea. It includes questions on general daily life conditions, marketization, income, medical conditions and education system of North Korea.

Due to the nature of the sampling strategy, the samples are non-randomly chosen resulting distortions in several demographic compositions[4]. <Table I-1> shows number of samples and basic statistics of the main demographic variables. There are several aspects of the table worth noting. First, the number of samples seem to have decreased over the years, especially recently. 2017 is the year when the tension between North Korea and international society has significantly escalated due to a series of military provocations of the North. The North Korean regime likely have had intensified overall control over the society including heightened level of securities around the Chinese border. This probably made crossing the border significantly harder than before[5]. Secondly, gender statistics

[3] 'Korea Hana Foundation' is a government institution funded by the Ministry of Unification established to provide North Korean refugees assistance in various ways for their successful settlement in South Korea. Newly entered refugees are mandated to go through certain education program prepared by the foundation prior to entering the society.

[4] The sampling bias problem will be addressed thoroughly in the later section.

[5] I have participated the survey as an interviewer and came across many refugees who have provided anecdotal evidences during the survey that the border securities have significantly intensified around 2017 and 2018. The official statistics of the North Korean refugees provided by

show that the share of females exceeds that of males consistent with the official statistics of North Korean refugee population provided by the Ministry of Unification[6]. This may reflect the fact that fleeing the country is easier for women than men who usually has official jobs and titles that make necessary arrangements to flee the country difficult, although the claim is based on testimonies of the refugees. Thirdly, samples from North Hamgyong province and Ryanggang province are over-sampled to comprise around 80% of the total sample attributable to their close proximity to the Chinese border, the main route for escaping[7]. Level of education compositions of the samples on the other hand, are relatively consistent with the census data provided by 'Socio-Economic Demographic and Health Survey (SDHS)'. The share of respondents who have graduated 'secondary' education was 68.6% on average over the survey years whereas SDHS has reported 63.2% as of 2014.

the Ministry of Unification also shows decreasing trend in the number of refugees (https://www.unikorea.go.kr/unikorea/business/NKDefectorsPolicy/status/lately/).

[6] Ministry of Unification Statistics.
(https://www.unikorea.go.kr/unikorea/business/NKDefectorsPolicy/status/lately/)

[7] According to 'Socio-Economic, Demographic and Health Survey (SDHS)' which is one of a very few data sources that provide population census of North Korea, the share of population who live in Pyongyang, North Hamgyong province and Ryanggang province were 14.1%, 9.9%, and 3.1% respectively. (UNFPA, 2014)

<Table I- 1> Demographic Statistics of IPUS North Korean Refugee Survey

Unit: Individuals, %

Year of Defection		2011	2012	2013	2014	2015	2016	2017	2018	2019	Total/Avg.
Number of Samples		127	133	149	146	138	132	87	116	109	1,137
Gender	Male	44.1	44.4	33.6	39.0	38.4	53.0	43.7	35.3	33.9	40.6
	Female	55.9	55.6	66.4	61.0	61.6	47.0	56.3	64.7	66.1	59.4
Place of Living	Pyeongyang	0.0	0.8	2.0	2.1	3.6	1.5	2.3	0.0	0.9	1.5
	Ryanggang Prov.	30.7	43.9	48.3	41.1	45.7	63.6	59.8	75.0	70.6	53.2
	N. Hamgyong Prov.	51.2	38.6	35.6	43.8	42.0	25.0	23.0	15.5	13.8	32.1
Level of Education	Non	1.6	0.8	0.0	0.7	0.0	0.8	0.0	0.0	2.8	0.7
	Elementary	3.2	0.0	2.0	2.1	0.7	2.3	6.9	0.0	1.8	2.1
	Secondary	65.4	71.4	61.7	61.0	74.6	72.0	73.6	70.7	67.0	68.6
	College	18.1	11.3	21.5	16.4	11.6	17.4	13.8	22.4	15.6	16.5
	University	10.2	16.5	13.4	19.9	13.0	7.6	5.7	6.9	10.1	11.5
Party Membership	Party Member	14.4	14.3	13.4	17.9	18.8	18.2	13.8	11.2	12.8	15.0
Official Occupation	Worker	37.0	31.6	30.9	26.0	22.5	43.9	32.2	26.7	26.6	30.8
	Farmer	8.7	3.8	7.4	4.8	9.4	3.8	11.5	3.4	5.5	6.5
	Office Clerk	4.7	9.8	12.1	8.9	10.9	6.1	6.9	8.6	5.5	8.2
	Expert	7.1	8.3	3.4	5.5	7.2	7.6	0.0	1.7	3.7	4.9
	Student	6.3	6.0	7.4	4.8	4.3	2.3	13.8	7.8	11.9	7.2
	Military	3.9	4.5	4.7	4.8	8.0	5.3	3.4	3.4	4.6	4.7
	Housewife	11.1	16.5	18.8	11.6	13.0	10.6	21.8	21.6	13.8	15.4

*Source: IPUS (2022)

3.2 Main Variables

2.2.1 Bribe Share

The objective of analysis in this study is to explore the relationship between bribe and informal income. Unfortunately, the survey does not ask for the absolute amount of bribe payment. Instead, there is a question that asks, "How much do you think the share of bribe was in total income when you were living in North Korea?". The offered options are "1: Below 10%", "2: Below 20%", "3: Below 30%", "4: Below 40%", "5: Below 50%", "6: Over 50%", "7: None". In order to construct an analyzable variable, I first have recoded the variable value to actual percentages of bribe share. Secondly, for respondents who have answered "6: Over 50%", a value of 60 was assigned which is thought to be the maximum of the reasonable share since bribe share close to 70% or over would significantly disincentivize the IEA. It is also recoded in such a way so that the variable has equal intervals between the actual values. Lastly, respondents who have answered "7: None" are excluded from the analysis. Resulting mean share of bribe in total income is calculated to be 27.8%.

Comparing the characteristics of those respondents who have experience of paying bribes and those who do not have can provide some useful information. The likelihood of paying bribes of an individual may depend on various factors other than participation in IEA. As can be seen in the following table, the composition of average age, level of education, high-paying official occupation, and party membership between the two categories are similar to one another[8]. On the contrary, there exist significant differences in characteristics when formal and informal

[8] High-paying official occupation includes military member, office clerks, and experts (teachers/professors, doctors, other high-skilled occupation). Other occupations include workers, farmers, students, housewives, and unemployed.

income are considered. Individuals who do (do not) have experience of paying bribes have lower (higher) formal income, but higher (lower) informal income. This implies that there exists a link between bribes and IEA, where participating in IEAs is associated with experience of giving bribe adding support to the previously made argument that the payoff of bribe can be measured by informal income[9].

<Table I- 2> Characteristic Comparison of Bribe Payers and Non-bribe Payers

	Bribe Share=0	**Bribe Share >0**
Age	38.57	37.23
Gender	0.68	0.58
Education (Mid/Highschool)	0.74	0.67
Education (University)	0.09	0.13
High-paying Official Occupation	0.21	0.18
Party Membership	0.15	0.15
Formal Income Incl. 0	28,394	17,783
Formal Income Excl. 0	43,844	28,892
(Share of 0 Formal Income, %)	(35.2)	(38.5)
Informal Income Incl. 0	380,098	735,838
Informal Income Excl. 0	619,967	905,752
(Share of 0 Informal Income, %)	(49.7)	(27.6)
Number of Samples	177	934
(Proportion, %)	(16)	(84)

*Note: Observations with response errors are excluded. High-paying official occupation includes military member, office clerks, and experts (teachers/professors, doctors, other high-skilled occupation). Other occupations include workers, farmers, students, housewives, and unemployed.

2.2.2 Informal Income

For the informal income variable, I utilize the question that asks for the

[9] Refer to <Table A-1>, <Table A-2>, and <Table A-3> of the Appendix section for further statistics on bribes by type of occupation, place of living, and mean informal income by bribe share, respectively.

respondents' average monthly informal income. The question reads "How much informal income have you earned on average per month when you were living in North Korea?" Respondents were asked to write down the actual amount in North Korean Won (KPW). Consistent with the fact that overwhelming proportion of North Koreans participate in IEA, the share of respondents who have reported larger than 0 average monthly informal income was 69.3%. The respondents who did not report or reported 0 average monthly informal income were omitted for analyses.

Since the price level in North Korea has been unstable, especially during the years of high levels of inflation after 2009 currency redenomination, adjusting for Consumer Price Index (CPI) is an important task. Despite the well-known fact that North Korea does not publish official economic statistics, there has been attempts to estimate CPI of North Korea. However, there is no single dataset which provides CPI for target period of this study with consistent basket of consumer goods, mainly due to data deficiency. Hence, it was unavoidable to combine CPI estimates of multiple researches to fulfill the data span of 9 years from 2011 to 2019 that this study requires. CPI estimated by Kim and Kim (2016) was used for the years 2011 and 2012 which considers only rice price due to data limitations. Choi (2021) provides price level estimates from 2013 to 2019 based on prices of food products such as rice, corn, wheat potato and bean, alcohol and tobacco products along with various living costs such as health and communications costs.

Measurement error is another concern associated with survey data. To minimize possible bias caused by measurement error, the data on informal income was cross-checked with related questions. More specifically, observations which satisfy the following conditions were omitted: i) if the respondent has answered that he/she had no formal job but reported formal income; ii) if the respondent has answered that he/she did not have informal job but reported informal income; iii)

if the respondent has answered that he/she has earned the most income from informal job but reported more formal income than informal income; iv) if the respondent has answered 'low' for their perceived social level but reported to earn more than KPW 5,000,000 as their total income[10].

Furthermore, in order to deal with statistical outliers, informal income earnings at least 2-times greater than 95th percentile in each year were omitted. Individuals who have reported less than KPW 10,000 were also omitted since it is difficult to consider the individuals as active IEA participants.

[10] As shown in <Table I-4>, individual who earns over KPW 5,000,000 can safely be considered as high-income earner.

<Table I- 3> Consumer Price Index and Summary Statistic of Real Informal Income

Unit: 2015 KPW

Year of Defection	CPI	Mean	St. Dev.	Observations
2011	48.9	535,309	930,987	84
2012	92.1	631,415	1,087,172	82
2013	116.0	587,936	1,091,294	88
2014	111.3	843,359	1,072,729	112
2015	100.0	960,417	1,285,225	96
2016	99.5	1,060,255	1,291,827	109
2017	102.7	623,020	849,595	63
2018	112.3	863,286	1,062,598	85
2019	101.7	954,816	1,127,893	62

*Note: CPI estimates stated in the table are recalculated using the estimates of Kim and Kim (2016) for 2011 and 2012, and Choi (2021) for years from 2013 to 2019.

2.2.3 Control Variables

Demographic variables considered in the analyses are age, gender, level of education, and party membership. ‘Gender’ is a dummy variable taking value 1 for females and 0 for males. There are two education dummy variables each of which captures secondary and tertiary graduates. Each of the provinces of origin of the respondents are also considered by respective region dummy variables. The summary statistics of the key variables are as the following table.

<Table I- 4> Summary Statistics of Variables

Variables	Obs.	Mean	Std. dev.	Min	Max
Age	677	37.7951	11.5167	18	73
Gender	677	0.5928	0.4916	0	1
Education: Secondary	677	0.6991	0.4589	0	1
Education: Tertiary	677	0.1063	0.3084	0	1
Party Membership	677	0.1588	0.3657	0	1
Residents of Pyongyang	677	0.0077	0.0874	0	1
Residents of Ryanggang	677	0.5314	0.4993	0	1
Residents of N. Hamgyong	677	0.3291	0.4702	0	1
Share of Bribe in Total Income	677	27.800	15.878	10	60
Informal Income	677	744,104	948,518	10,226	6,030,150

*Note: 'Gender' is a dummy variable taking value 1 if the respondent is female and 0 if male. Both education variables are dummy variables taking value 1 if the respondent has graduated respective levels of education and 0 otherwise. The place of living variables of Pyongyang, Ryanggang, and North Hamgyong are also dummy variables taking value 1 if the respondent has lived in each respective region and 0 otherwise. 'Informal Income' refers to average monthly informal income in 2015 KPW.

The total number of samples used in the analyses amounts to 677 after all necessary filtering processes. Overall compositions of the demographics have not significantly changed compared to that of before filtering[11] except of a slight decrease in the share of residents of Pyongyang.

[11] Refer to the last column of <Table I-1> for statistics before filtering.

4. Empirical Analysis

4.1 Baseline Model

The effect of bribe on informal income was empirically measured by the following OLS estimation.

$$IF_{it} = \alpha + \beta X_{it} + \tau OF_{it} + \theta bribe_{it} + \gamma_1 SB_{it} + \gamma_2 LB_{it} + \gamma_3 FB_{it} + \mu_t + \pi_r + \epsilon_{it}$$

Where IF_{it} denotes log of real informal income in 2015 KPW, and X_{it} denotes set of main demographic variables age, gender, and level of education. $bribe_{it}$ denotes the share of bribe in total income varying discretely from 10 to 60. The level of education consists of two dummy variables each capturing 'secondary' or 'tertiary' education graduates. OF_{it} represents official status of the individual consisting of log of real formal income (in 2015 KPW), high-paying official occupation dummy, and communist party membership dummy. SB_{it}, LB_{it}, and FB_{it} represent the most profitable occupation an individual ever had. Despite the survey does not explicitly ask for informality of the occupation, most of the specified occupations incorporate informality, and most profitable businesses in North Korea are usually informal. Hence, it is highly likely that there exists a strong relationship between the occupations and informal income making it an appropriate factor to control for. SB_{it} is a dummy variable capturing small-scale businesses of retail sales, individual services, individual manufacturing, and part-time jobs. LB_{it} captures large-scale businesses of wholesale, and managements of other types of stores. FB_{it} captures foreign-related businesses which involve occupations with foreign currency earnings, and deployed workers. μ_t are year-fixed effects and π_r are province level region-fixed effects referring to the last place of living when living in North Korea.

<Table I-5> presents results of the estimations. The bribe share is positive and statistically significant across all estimation models implying that bribe is positively associated with informal income. The coefficients imply that on average, 1%p increase in bribe share is associated with around 0.5 to 0.7% increase in informal income. The interpretation of the bribe share coefficients should be done with caution since the denominator of the bribe share is total income, not informal income. Moreover, endogeneity problem can exist in the relationship between bribe share and informal income which would cause bias and inconsistency in the estimations. An instrumental variable approach was taken to address the endogeneity problem in the next subsection.

Column 1 of the table shows the estimation result with only demographic controls. Statistical significances of the demographic variable coefficients imply that the younger individuals and males tend to earn more informal income. Column 2 presents the result after controlling for types of businesses. The dummy variable for small-scale business is negative and significant implying that small-scale businesses on average earns less informal income compared to other types of businesses. Columns 3 through 5 controls for official status of log of real formal income, high-paying official occupation dummy, and party membership dummy respectively, all of which did not turn out to be significant. The last column presents estimation result after controlling for all of the variables. Statistical significances and the size of the coefficients are all similar to the previous estimations except for the log of informal income and high-paying official occupation variable are now estimated to be negative and significant. This implies that the individuals who earn relatively more formal income, and who have high-paying official occupation are likely to earn less informal income, reflecting the possible substitutability of formal and informal occupation and income.

<Table I- 5> OLS Regression Results: Baseline Model

Dependent Variable: Log Informal Income	(1) Base	(2) Type of Business	(3) Formal Income	(4) Formal Occupation	(5) Party Membership	(6) All
Demographic Controls						
Age	-0.00981**	-0.00969**	-0.00989**	-0.0155***	-0.00993**	-0.0173***
	(0.00426)	(0.00439)	(0.00428)	(0.00479)	(0.00431)	(0.00518)
Gender (Female=1)	-0.199**	-0.208**	-0.238**	-0.199*	-0.194*	-0.311***
	(0.0944)	(0.0972)	(0.101)	(0.102)	(0.101)	(0.119)
Education: (Secondary=1)	-0.197	-0.285**	-0.190	-0.164	-0.197	-0.163
	(0.141)	(0.145)	(0.141)	(0.162)	(0.141)	(0.165)
Education: (Tertiary=1)	0.137	0.131	0.138	0.199	0.136	0.234*
	(0.117)	(0.119)	(0.118)	(0.126)	(0.118)	(0.128)
Type of Business (Ref. Group: Others)						
Small-scale Business		-0.447***				-0.321**
		(0.119)				(0.130)
Large-scale Business		-0.0740				-0.00726
		(0.140)				(0.151)
Foreign-related Business		-0.124				-0.128
		(0.162)				(0.170)
Official Status						
Log of Formal Income			-0.0158			-0.0320**
			(0.0126)			(0.0138)
High-paying Official Occupation				-0.248		-0.356**
				(0.164)		(0.164)
Party Membership					0.0145	0.0339
					(0.133)	(0.136)
Bribe Share						
Bribe Share	0.00770***	0.00555**	0.00738***	0.00783***	0.00770***	0.00507*
	(0.00279)	(0.00280)	(0.00282)	(0.00297)	(0.00280)	(0.00307)
Constant	13.41***	13.88***	13.50***	13.70***	13.41***	14.38***
	(0.598)	(0.597)	(0.592)	(0.622)	(0.597)	(0.622)
Observations	677	645	677	597	677	573
R-squared	0.119	0.150	0.121	0.154	0.119	0.183
Year FE	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

*Note: The number of observations may differ depending on which control variable is included in the model. Some of the control variables may contain fewer observations than others due to missing values and response errors. Small-scale business refers to retail sales, individual services, individual manufacturing, and part-time jobs. Large-scale business refers to wholesale business, and management of other types of stores. Foreign-related business captures foreign currency earning occupation, and deployed workers. High-paying official occupation dummy captures military member, office clerks, and experts (teachers/professors, doctors, other high-skilled occupation).

4.2 Instrumental Variable Approach

As briefly explained in the previous subsection, the results of <Table I-5> might incorporate endogeneity problem. In other words, there is possibility that higher informal income earners are more likely to pay higher share of bribe. This can occur quite possibly because bribe-receiving officials would seek for higher amount of bribe leading them to demand more bribe to those who earn higher informal income than those who earn lower. In this case, the level of informal income affects the bribe share which causes reverse causality. Even though the endogeneity problem may not be as severe because even if higher informal income earners pay higher *amount* of bribe, it does not mean that they pay higher *share* of bribe relative to their total income, one cannot be certain that endogeneity does not exist.

To address the issue, an instrumental variable (IV) was employed for the bribe share variable. Conventional standards for selecting the IV was applied where the selected IV should be highly correlated with the bribe share variable while uncorrelated with the error term of the endogenous regression. It also should not be a direct cause of the dependent variable, informal income, but only affect it indirectly through the endogenous regressor of bribe share.

The most likely candidate for an adequate and empirically supportable IV was found in the following question of the survey. The question asks “What was the most concerned aspect of daily life when you were living in North Korea?”, with offered options “1: To make money”, “2: To pay bribes to executives”, “3: Inspections from the police officers”, “4: Organizational life”, “5: To succeed in life”, “6: Children’s education”, and “7: Others”.

A dummy variable was constructed for the IV taking value 1 if the respondent has answered “3: Inspections from the police officials” and 0 if answered other

options. Conjectured theory behind the choice is that an individual who is most concerned of inspections from police officers is more likely to have been inspected more frequently, and that they are likely to have paid relatively higher share of their informal income as bribe than an individual who is concerned about other reasons.

There could be a concern for its relationship with informal income because the likelihood of being inspected may be higher for higher informal income earners. Even if the high informal income earners are inspected more frequently, it does not mean that that becomes the most concerned aspect of their lives. In fact, for the same amount of bribe paid, the high informal income earners are less likely to be most concerned about bribe than the low informal income earners because the higher informal income earners have larger room for bribe payments.

To provide further information on the IV, several statistics are offered in the following tables. First of all, sufficient number of observations of mostly concerned about police inspections are secured for the IV comprising 31.51% of the respondents which is the second most frequently chosen option next to the option "to make money" according to <Table I-6>. Secondly, as shown in <Table I-7>, the mean bribe-share for the respondents who have chosen the option is 31.0 which is well above average and the second highest one next to the respondents who have chosen "To pay bribes to executives". This supports to the theory that the IV is strongly correlated with the bribe share. The mean informal income of those who have chosen the option on the contrary, is the third highest among the total of seven options as presented in <Table I-8>. The reported statistics do not provide evidence on the validity of the IV with certainty, but the statistics show that the previously contemplated theory is worth an attempt. More rigorous empirical test on validity of the IV will be conducted later in the subsection.

<Table I- 6> Summary Statistics on Most Concerned Aspect of Life

Most Concerned Aspect of Life	Freq.	Proportion (%)
To make money	341	51.90
To pay bribes to executives	20	3.04
Inspections from Police Officers	**207**	**31.51**
Organizational Life	34	5.18
To succeed	14	2.13
Children's education	34	5.18
Others	7	1.07
Total	657	100

*Note: Observations which have missing value or response errors for this question are excluded.

<Table I- 7> Mean Bribe Share by Concerned Aspects

Most Concerned Aspect of Life	Mean	Std. dev.	Freq.
To make money	26.01	15.3884	341
To pay bribes to executives	36.5	16.0950	20
Inspections from Officers	**31.01**	**16.7003**	**207**
Organizational Life	21.47	14.5919	34
To succeed	27.86	11.8831	14
Children's education	26.47	16.4649	34
Others	25.71	9.7590	7
Total	27.73	16.0029	657

*Note: Observations which have missing value or response errors for this question are excluded.

<Table I- 8> Mean Informal Income by Concerned Aspects

Most Concerned Aspect of Life	Mean	Std. dev.	Freq.
To make money	615,380	835,429	341
To pay bribes to executives	1,217,206	1,300,046	20
Inspections from Officers	**891,907**	**1,006,915**	**207**
Organizational Life	660,401	616,030	34
To succeed	571,900	408,161	14
Children's education	1,007,003	1,429,941	34
Others	429,960	320,679	7
Total	740,535	939,802	657

*Note: Observations which have missing value or response errors for this question are excluded.\

The following conventional 2-stage least square (2SLS) specification was estimated using the IV.

$$bribe_{it} = \alpha + \beta X_{it} + \tau OF_{it} + \delta inspec_{it} + \gamma_1 SB_{it} + \gamma_2 LB_{it} + \gamma_3 FB_{it} + \mu_t + \pi_r + u_{it}$$

$$IF_{it} = \alpha + \beta X_{it} + \tau OF_{it} + \theta \widehat{bribe}_{it} + \gamma_1 SB_{it} + \gamma_2 LB_{it} + \gamma_3 FB_{it} + \mu_t + \pi_r + \epsilon_{it}$$

Above models are consisted of the exact same variables as the baseline model except for the IV $inspec_{it}$ which takes value 1 if the respondent has chosen the option "inspections from police officers" as their most concerned aspect of life and 0 if chosen other options. In the first stage, $bribe_{it}$ was regressed on $inspec_{it}$ to predict $\widehat{bribe}_{it}$. Then in the second stage, IF_{it} was regressed on predicted variable $\widehat{bribe}_{it}$.

The estimation results are reported in <Table I-9>. Column 1 reports the result of the first stage estimation where the IV $inspec_{it}$ is positive and statistically significant. In the second stage presented in column 2, the bribe share is positive

and statistically significant at 5% level suggesting increase in bribe share increases the informal income. More specifically, 1%p increase in bribe share in total income increases the informal income by 0.0608 log points which converts to around 6.1%. The positive significance and the sizeable coefficient of bribe share variable imply that bribes are likely to be profitable in North Korea. It also implies that the profits from the 'investment' type bribe may exceed the loss from the 'tax' type bribe. Coefficients of all control variables are estimated to be not statistically significant except for that of the age variable which shows similar result as the baseline model.

The validity of the IV is supported by the post estimation tests as reported in <Table I-10> and <Table I-11>. Durbin and Wu-Hausman test statistic rejects the null hypothesis that $bribe_{it}$ is exogenous, suggesting that there exists endogeneity justifying the IV approach. The first stage regression summary statistics support the strength of the IV estimation with the F-Statistic being around 11.4 which qualifies the conventional standard of 10.

Lastly, an additional IV estimation was conducted with IV variable taking value 1 if the respondent has chosen "To pay bribes to executives" or "inspections from officers" and taking value 0 if chosen other options. Although the newly incorporated option does not specify the branch of the government body it refers "executives", many of the respondents may have been perceived it as fairly high ranked officials. According to statistics in <Table I-7> and <Table I-8>, it seems that the respondents who have chosen "pay bribes to executive" option are those who earns high informal income and pays high share of those as bribes. In that case, there might exist stronger correlation between the probability of choosing the option and the informal income level. However, as there is no statistical certainty in the argument, additional IV estimation was conducted. The results are reported in <Table A-4> and <Table A-5> of the appendix section. Results of the estimation and the post estimation support the original IV estimation.

<Table I- 9> IV Estimation Results (2SLS)

	(1)	(2)
Stage	First Stage	Second Stage
Dependent Variables	Bribe Share	Log of Informal Income
Demographic Controls		
Age	0.0273	-0.0110**
	(0.0610)	(0.0056)
Gender (Female=1)	-2.7134*	-0.1323
	(1.5580)	(0.1551)
Education: (Secondary=1)	0.8285	0.0619
	(1.6487)	(0.1472)
Education: (Tertiary=1)	-2.1205	-0.1338
	(2.2224)	(0.1978)
Party Membership (Member=1)	-0.9623	0.0422
	(2.1051)	(0.1819)
Other Controls		
Log of Formal Income	-0.4918	0.0107
	(0.1719)	(0.0208)
Small-scale Business	-3.5975**	-0.2555
	(1.7097)	(0.1859)
Large-scale Business	-1.7898	0.0160
	(1.9005)	(0.1686)
Foreign-related Business	2.0306	-0.2662
	(2.3672)	(0.2072)
Bribe Share and Instrumental Variable		
inspec	2.3672***	
	(1.4268)	
bribe		0.0608**
		(0.0261)
Constant	34.1132***	11.9957***
	(7.2387)	(1.2449)
Observations	630	630
adj. R-squared	0.0568	-
Year FE	YES	YES
Region FE	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)
*Note: Small-scale business refers to retail sales, individual services, individual manufacturing, and part-time jobs. Large-scale business refers to wholesale business, and management of other types of stores. Foreign-related business captures foreign currency earning occupation, and deployed workers. High-paying official occupation dummy captures military member, office clerks, and experts (teachers/professors, doctors, other high-skilled occupation).

<Table I- 10> Post Estimation Tests Results of IV Estimation

Tests of endogeneity

H0: Variables are exogenous

Durbin (score) chi2(1)	=	8.03109	(p =	(0.0046)
Wu-Hausman F(1,595)	=	7.82962	(p =	(0.0053)

First-stage regression summary statistics

Variable	R-sq.	Adj. R-sq.	Partial R-sq.	F(1,599)	Prob > F
bribe	0.0988	0.0568	0.0201	11.4140	0.0008

4.3 Quantile Regression Analysis

This subsection extends the scope of analysis to investigate if the magnitude of the positive effect of bribe on informal income differs depending on the informal income level. If the profitability (or value-added) for bribe is found to be greater for higher informal income earners, it would imply that the prevalence of bribe may have contributions to the inequality level of informal income in North Korea. To empirically measure the profitability of bribe for various informal income levels, quantile regression with the same model design as the previous models was conducted. Possibility of endogeneity was also dealt with by using the same IV as in the 2SLS model. For simplicity purposes, and to secure sufficient sample size for each quantile, 25^{th}, 50^{th}, and 75^{th} quantiles were chosen for analysis.

Results of the quantile regression is presented in <Table I-11>. First, coefficients of the bribe share variables are all positive and statistically significant implying that bribe is profitable for all informal income levels. Secondly, the size of the coefficients increases as the informal income quantiles increase. The regression has estimated that 1%p increase in bribe share increases the informal

income by 4.8%, 7.2%, and 10.1%, for 25th, 50th, and 75th quantiles respectively. This increasing trend implies that the profits of bribe may have been borne disproportionately across informal income levels where the profitability increases as the informal income quantile increases.

Results of the estimations are supplemented and visualized in <Fig. I-1>. The horizontal axis represents the informal income quantiles, and the vertical axis represents the estimated coefficients of bribe for respective quantiles. The line plots the estimated coefficients of bribe share for every 5th quantile from 25th to 75th quantile. The upward sloping line suggests that the increasing trend of profits from bribe are nearly linear across the specified quantiles. However, 95% confidence interval presented by the shaded area widens as the quantile increases. In other words, the statistical significance of the positive effect of bribe on informal income becomes weaker as the standard error increases for the upper quantiles. There can be two possible reasons behind the increase in standard error. First, even if the upper and lower quantile individuals pay the same bribe share, the absolute amount of bribe obviously differs. Among the upper quantile individuals, reciprocal payoffs for exceptionally high amount of bribe may not be settled as frequently as it would for lower amount of bribe. In other words, unreturned, or largely extractive bribe may occur more frequently for upper quantile individuals. Secondly, the widening confidence interval can simply be caused by relatively small sample number of upper quantiles.

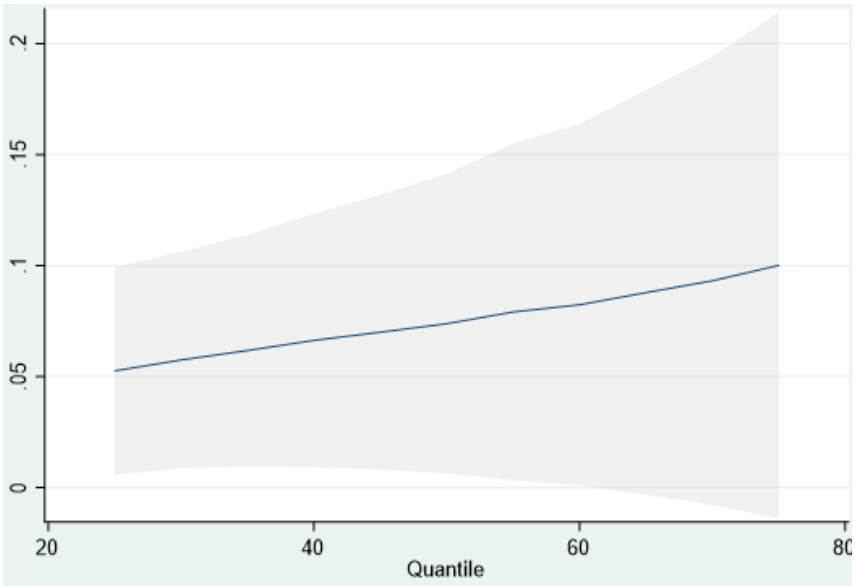
<Table I- 11> IV Quantile Regression Results

	(1)	(2)	(3)
Dependent Variable: Log of Informal Income	25th	50th	75th
Demographic Variables			
Age	-0.0139**	-0.0111**	-0.0076
	(0.0064)	(0.0056)	(0.0061)
Gender (Female=1)	-0.0954	-0.1185	-0.1465
	(0.1882)	(0.1664)	(0.1867)
Education: (Secondary=1)	0.0681	0.0272	-0.0223
	(0.1751)	(0.1670)	(0.2010)
Education: (Tertiary=1)	-0.0026	-0.1150	-0.2510
	(0.2379)	(0.1991)	(0.2075)
Party Membership (Member=1)	0.1107	0.0614	0.0018
	(0.2428)	(0.1984)	(0.1953)
Other Controls			
Log of Formal Income	0.0095	0.0091	0.0087
	(0.0246)	(0.0214)	(0.0224)
Small-scale Business	-0.2511	-0.1986	-0.1350
	(0.2045)	(0.1910)	(0.2298)
Large-scale Business	0.0260	0.0403	0.0576
	(0.2190)	(0.1782)	(0.1872)
Foreign-related Business	-0.2801	-0.2417	-0.1953
	(0.2315)	(0.2124)	(0.2504)
Bribe Share			
bribe	**0.0479****	**0.0717*****	**0.1006****
	(0.0212)	**(0.0341)**	**(0.0593)**
Constant	10.8795***	11.1980***	11.5835***
	(0.9029)	(0.8842)	(1.0282)
Observations		632	
Year FE		YES	
Region FE		YES	

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

*Note: Small-scale business refers to retail sales, individual services, individual manufacturing, and part-time jobs. Large-scale business refers to wholesale business, and management of other types of stores. Foreign-related business captures foreign currency earning occupation, and deployed workers. High-paying official occupation dummy captures military member, office clerks, and experts (teachers/professors, doctors, other high-skilled occupation).

<Figure I- 1> Visualization of Bribe Share Coefficients by Informal Income Quantiles



*Note: The vertical axis represents the estimated coefficients of the bribe share variable. Estimations were conducted for every 5th percentile from 25th to 75th percentile. Shaded area represents 95% confidence interval.

5. Conclusion

This study has attempted to provide in-depth analysis on bribery in North Korea. The expansion of marketization in conjunction with illegal nature of IEA seem to have created room for corruption to expand. A significant portion of population in North Korea seem to have experienced bribe.

In light of this, Kim (2010), in his insightful analysis on bribe, argues that there seems to exist an equilibrium for corruption between the dictator, the bribe-receiving officials, and the bribe-giving IEA participants. The dictator condones a certain level of bribe the officials receive from market participants in return for partial loyalty, whereas the officials turn blind-eye in return for bribe and pay

partial loyalty to the dictator. The IEA participants obviously pay bribe in order to perpetuate IEAs which has been the main source of their income. Kim (2010) emphasizes that the equilibrium is fragile due to the self-expanding nature of marketization and bribery.

The profitability of bribes for the IEA participants would be one of the most important factors that would determine whether the bribery will expand in the future. Measuring the payoff of bribe is difficult in general because in most cases it is difficult to be quantified. In North Korea however, bribes are given specifically to continue or expand the IEAs which earns informal income. This makes the informal income an effective and quantifiable proxy for the payoffs of bribes which enables rigorous empirical analysis on the issue.

By the instrumental variable approach, this study empirically finds that bribes are profitable. This implies possible expansion of bribery. The bribe-giving IEA participants are well-incentivized to increase bribes to the officials whenever necessary to increase their informal income and possibly to expand their businesses. In addition, through IV quantile regression, it is discovered that the profits of bribes are likely to be borne disproportionately across informal income quantiles. Bribes are found to be more profitable for individuals in the higher informal income quantiles than those in the lower.

The results suggest that the corruption equilibrium is indeed likely to be fragile as the profitability of bribes would provide sufficient incentives for IEA participants to pay increasingly higher amount of bribe. This would contribute to the overall expansion in the scale and scope of bribes in the country. Moreover, the disproportionate profitability of bribes on income quantiles might have contributions to the overall informal income inequality in North Korea.

Chapter II. Marketization and Informal Income Distribution of North Korea

1. Introduction

This study attempts to analyze the effect of expansion of marketization on informal income distribution in North Korea. Informal income distribution of a socialist state such as North Korea has not been empirically addressed thoroughly thus far mainly due to the fact that 'Informal Economy Activity (IEA)' in former socialist states have often been supplementary to the official sector. Data deficiency on informal income has also made it difficult to conduct distributional analysis. This study employs survey dataset from 'North Korean Refugee Survey' published by the Institute for Peace and Unification Studies at Seoul National University to explore how informal income distribution of North Korea has changed during Kim Jong Un era.

Amid the 'Arduous March' of 1990s, markets widely known as *Jangmadang* became the main survival strategy of the North Korean people. While the emergence of markets such as *Jangmadang* in strict, repressive, and highly controlled socialist state may seem contradictory, it was an inevitable choice for survival for the North Korean people after near-collapse of the public distribution system. Although market-related activities, also referred to as IEAs, was evident in many former socialist countries, the level of reliance on IEAs in North Korea is estimated to be unprecedented. According to numerous previous studies, the shares of income and expenditure attributable to IEAs in North Korea are estimated to be well over 70% depending on the data used (Kim and Song, 2008; Haggard and Noland, 2010; Kim and Yang, 2012; Jeong et al., 2012), whereas that of the former Soviet Union was estimated to be around 20% (Kim, 2003). Considering its size

and scope, the IEAs in North Korea seem to have replaced the official sector.

For the North Korean regime however, proliferation of marketization and IEAs may have been perceived as a dilemma from a policy standpoint. In the long-run, explicitly allowing market-related activities would pose a potential threat to the regime, whereas repressing it would undermine political support from the general public. The dilemma may have been reflected in inconsistent policy stances of the regime on marketization thus far. Jung et al. (2022) offers three periods of marketization process of North Korea based on policy stances of the regime. Period from 2001 to 2005, can viewed as market expansion period characterized by "7.1 measure" of 2002 which has bolstered market-related activities by legalizing large, composite markets called *Jonghapsijang*. The period from 2006 to 2010 however, are often evaluated as market contraction period during which the main policy objective was to repress market-related activities culminating extractive currency redenomination of 2009.

The inconsistency in marketization policies has faced a turning point when the new leader grasped the power. For newly inaugurated young leader with yet weak political base in the party, gaining support from general population might have been the utmost important task. Improving economic conditions of the public by resolving economic hardships caused by the backlash of the extractive currency redenomination became vital. Since marketization was at the heart of economic activities for normal North Koreans, Kim inevitably had to address it one way or another. Kim (2022) breaks down probable economic policy options Kim Jong Un had. First option is status quo where he only passively allows marketization. Second option is to utilize the existing market mechanisms to stimulate economic growth, but without institutionalization. The last option is to choose gradual transition from socialism to capitalism. In retrospect, Kim Jong Un seem to have chosen the second option which can be perceived as to stimulate growth without

bearing political risk. Kim Jong Un's economic policy thus far can arguably be characterized as "market-led growth within socialism" (Kim, 2022).

Kim Jong Un regime has kept relatively consistent and lenient policy stance on marketization for relatively extended period of time. Consequently, numerous evidences suggest that the informal sector has expanded from around 2013 to 2016. Hong et al. (2016) reports the number of markets is estimated to be around 404 in 2017 which is twice the number estimated in 2010 by Curtis Melvin of USKI at Johns Hopkins University. Hong (2017) argues that products leaked from factories and enterprises are actively being traded in unofficial product markets. He also reports that the private financial markets are growing since 2014. Yang and Yoon (2016) argues that unofficial labor markets have expanded from 2012 to 2015. Kim (2019) asserts that market economic activities are likely to have increased from 2012 to 2016. These evidences of market expansion suggest that there might be changes in the level of economic inequality during the period which largely depends on that of the informal income considering the overwhelming share of informal income in total income.

There exist previous studies on change in levels of economic inequality in the transition countries before and after the transition (Milanovic, 1996;1998;199; Deininger and Squire, 1996; Micklewright, 1999). They mainly argue that the level of economic inequality in those countries have increased attributable to what is called 'hollowing-out effect' where middle classes are reallocated from less unequal market of official sector to either poor unemployed sector, or higher paid private sector. The situation in North Korea, however, is different. The suggested 'hollowing-out effect' is likely to have already occurred since the marketization process has already started in the late 1990s in North Korea.

To the best of my knowledge, this is the first attempt to explore the effect of

marketization on informal income distribution of North Korea. By relative distribution analysis and median relative polarization index estimation, this study offers evidences that the expansion of marketization likely has increased the level of informal income inequality in North Korea. This implies that addressing marketization would become more difficult for the regime in the years ahead. Keeping 'market-led growth within socialism' and lenient policy stance on marketization without further administrative and/or legislative measures would worsen the informal income inequality. This might increase pressure on the North Korean regime to institutionalize the market sector.

The rest of this paper is organized as the following. Section 2 introduces the empirical methodology employed and provides results of the analyses on changes in informal income distribution. In addition, sample selection bias problem is discussed. 3 concludes the study.

2. Distributional Analysis

The analyses of this chapter employ the same data, variables, and filtering processes as Chapter 1. However, because this chapter is only interested in the informal income data, the number of observations differ from that of the previous chapter. The summary statistics of the variables used in this chapter are as the following table.

<Table II- 1> Summary Statistics of Key Variables

Variables	Observations	Mean	Std. dev.	Min	Max
Age	781	37.7951	11.5167	18	73
Gender	781	0.5928	0.4916	0	1
Education: Secondary	781	0.6991	0.4589	0	1
Education: Tertiary	781	0.1063	0.3084	0	1
Party Membership	781	0.1588	0.3657	0	1
Residents of Pyongyang	781	0.0077	0.0874	0	1
Residents of Ryanggang	781	0.5314	0.4993	0	1
Residents of N. Hamgyong	781	0.3291	0.4702	0	1
Informal Income	781	797,097	1,120,555	10,226	7,601,664

*Note: 'Gender' is a dummy variable taking value 1 if the respondent is female and 0 if male. Both education variables are dummy variables taking value 1 if the respondent has graduated respective level of education and 0 otherwise. The place of living variables of Pyongyang, Ryanggang, and Hamgyong are also dummy variables taking value 1 if the respondent has lived in each respective region and 0 otherwise. 'Informal Income' refers to average monthly informal income in 2015 KPW.

This section provides empirical analyses on how the expansion of marketization has affected the informal income distribution in North Korea. Prior to conducting empirical analyses, there are several obstacles that need to be addressed. First, from technical standpoint, the number of samples of 'North Korean Refugee Survey' data that can be utilized for empirical analyses are insufficient to conduct valid year-by-year analysis. To overcome the data limitation and to secure sufficient number of samples, I first attempt to empirically find a threshold year in which informal income distribution significantly changes to divide the years into two periods. Then the yearly samples were combined by periods. The statistical significance of the changes in informal income distribution over the two periods is then tested by 'median relative polarization' method.

However, the question remains if the observed change in the distribution is the result of market expansion. There exists no specific data which directly measures year-by-year changes of the marketization level or the level of market-

related activities. Nonetheless, it seems marketization of North Korea unequivocally has experienced expansion during Kim Jong Un era amid the perpetuated economic development strategy of 'market-led growth within socialism' according to previous studies. In the absence of any kind of redistribution system in informal income, it is reasonable to believe that the changes in informal income distribution are mainly the result of the evolvement of marketization.

2.1 Threshold Year Analysis

The following simple OLS estimation model was constructed to test if there exists a structural break in the absolute deviation from the median income.

$$Dev_{it} = \alpha + \beta X_{it} + \delta_t + \mu_r + \tau_i + \epsilon_{it}$$

Where Dev_{it} represents absolute deviation of individual i's informal income in year t from the median informal income of year t. X_{it} consists of demographic characteristics of age, gender, level of education and communist party membership. 'Gender' variable is a dummy variable taking value 1 if the individual is female and, 0 if male. There are two dummy variables each representing secondary education graduates and tertiary graduates taking value 1 if the individual belongs to the respective level of education, and 0 otherwise. The communist party membership dummy variable is also controlled for taking value 1 if the individual is a member of the communist party, and 0 otherwise. δ_t represents year dummy variables which is of the main interest in this model. μ_r is province level region-fixed effects. τ_i represents occupation-fixed effects which utilizes the question "Which of the following occupations you have experienced was most profitable when you were living in North Korea?" The offered options are "1: Retail Sales",

“2: Individual Service”, “3 Individual Manufacturing”, “4: Restaurants / Other Store”, “5 Wholesale”, “6: Foreign Currency-related”, “7: Private Financials”, “8: Part-time Jobs”, “9: Deployed Worker”, “10: Others”[12].

The estimation results are presented in <Table II-4>. First of all, the year dummy variables of 2015, 2016, and 2019 are positive and statistically significant implying that the absolute deviation of informal income from median in those years are significantly higher on average than that of the reference year of 2011. The fact that only three of the year dummy variables turn out to be statistically significant might be attributable to previously mentioned insufficient sample number. This supports the empirical strategy to find the threshold year for grouping the samples of multiple years for further analysis. In addition, all of the positive significant year dummies are those years that are fairly distant from the reference year which alludes the possibility that there has been increase in overall level of informal income inequality.

The results for demographic control variables are not statistically significant except for the gender variable. Informal incomes of the male samples are more likely to be dispersed on average than that of the female samples.

[12] Although the question does not explicitly mention the informality of the offered occupations, it is highly likely that reported income from the occupations are earned informally since IEA is known to be ‘most profitable’ economic activity in North Korea.

<Table II- 2> OLS Regression Result: Year-Fixed Effects Model

Dependent Variable: Absolute Deviation from Median	
Age	4,469
	(3,434)
Gender (Female=1)	-152,095*
	(84,482)
Education (Tertiary=1)	42,232
	(171,829)
Education (Secondary=1)	17,700
	(87,709)
Party Membership (Member=1)	-24,411
	(112,948)
Reference Year: 2011	
d2012	98,771
	(145,010)
d2013	132,798
	(148,456)
d2014	133,618
	(138,107)
d2015	270,429*
	(157,095)
d2016	359,466**
	(149,350)
d2017	33,020
	(143,423)
d2018	223,895
	(153,145)
d2019	308,748*
	(167,568)
Constant	508,208
	(388,544)
Observations	781
R-squared	0.087
Region FE	YES
Job FE	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Next, in an attempt to rigorously find the threshold year where the deviations of informal income from median display a statistically significant change, the following OLS model was constructed.

$$Dev_{it} = \alpha + \beta X_{it} + \delta yref_t + \mu_r + \tau_i + \epsilon_i$$

The dependent variable is the same as the previous model. $yref_t$ is newly created to replace year dummy variables taking value 0 for the year *t* and years before the year *t*, and 1 for the years after representing possible threshold year. For example, dummy variable $yref_{2013}$ takes value 0 for years 2011 to 2013, and value 1 for years 2014 to 2019. X_{it}, μ_r, and τ_i represent demographic controls, province-level region fixed effects, and occupation fixed effects respectively as the previous model.

The results are presented in <Table II-3>. Columns 1 through 8 presents the results of each $yref_t$ variables. As can be seen in the table, the coefficients of the threshold year variables are positive and significant for 2011 to 2014 suggesting that the most likely candidate for the threshold year would be 2014. I refer the period from 2011 to 2014 as Period 1, and the period from 2015 to 2019 as Period 2 for further analyses. The results show that the informal incomes in Period 2 is KPW 158,795 more dispersed on average from the median income than that of the informal incomes in Period 1. In other words, the informal income is more dispersed in Period 2 on average compared to Period 1. This particular threshold year coincides with introductions of economic reform policies, 'field responsibility system', and 'responsibility system of socialist enterprise'.

Around 2013 and 2014, the regime introduced series of economic policies in an attempt reform overall economic system. In 2013, "field responsibility system" was introduced in the agriculture sector reducing the number of individuals in each of the sub-team responsible for each "field"[13] from 20 to 30 individuals to 3 to 5

[13] "field" refers to a small unit of cultivated land in which each sub-team is responsible for fulfilling production targets.

individuals. In addition, each field was given some degree of autonomy to dispose produced outputs (including at markets) after paying for rent, fertilizer, and other necessary payments to the state (Jo, 2021) to increase incentives of production. In 2014, a reform policy called “responsibility management system of socialist enterprises” was introduced in the enterprise sector. It incorporated facilitation of decentralization and self-accounting of state-owned enterprises (Kim, 2022). More specifically, the policy allowed increase in the share of production target set by individual enterprises while decreasing the share of centrally planned targets (Jo, 2021). Furthermore, the reform also mobilized idle household capital for investment to the enterprises (Kim, 2022).

It is difficult to argue that the reform policies are the direct causes of proposed increase in informal income inequality. Previous studies suggest that the intensity and the scope of the reform policies fall short of those of the early Chinese and former transition economies as (Jo, 2021; Jung et al., 2022). Furthermore, there is insufficient amount of information as to what degree the reform policies were actually implemented and to what extent the policies have affected the marketization. However, it is relatively clear that the policies more or less have aimed to invigorate and adapt market mechanisms by liberalizing (at least partly) and incentivizing the productions of the economy. Hence, it is reasonable to believe that the reform policies have at least some degree of contribution to the marketization although the exact amount cannot be measured.

<Table II- 3> OLS Regression Results: Threshold Year Model

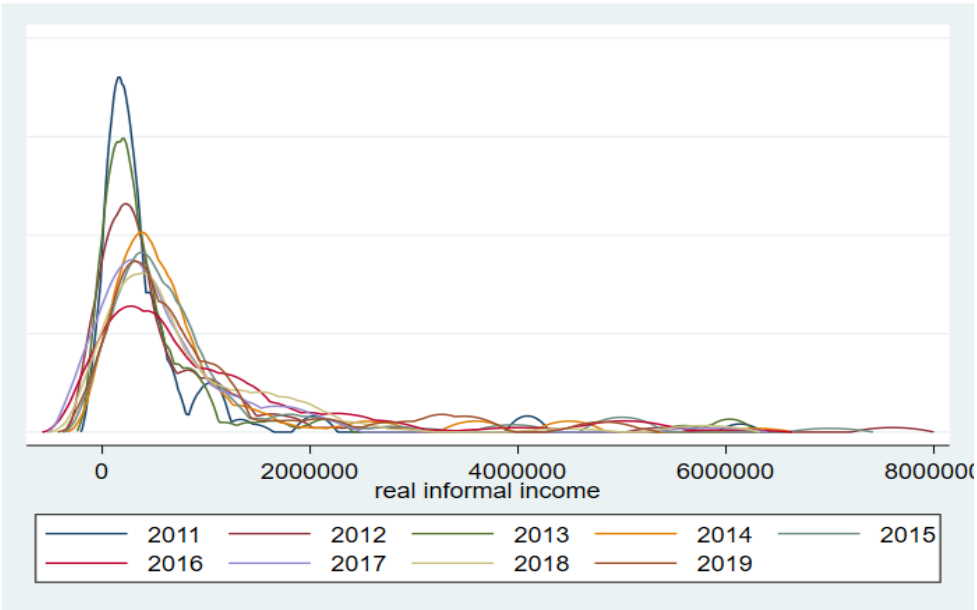
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Absolute Deviation from Median	2011	2012	2013	2014	2015	2016	2017	2018
Age	4,518	4,468	4,493	4,307	4,208	4,348	4,167	4,168
	(3,370)	(3,355)	(3,344)	(3,364)	(3,376)	(3,402)	(3,413)	(3,377)
Gender (Female=1)	-150,952*	-155,245*	-151,407*	-146,744*	-143,769*	-145,778*	-149,934*	-151,636*
	(84,865)	(84,385)	(84,378)	(84,458)	(84,622)	(84,720)	(84,616)	(84,954)
Education (Tertiary=1)	25,857	43,387	35,631	48,803	43,084	27,137	30,044	26,097
	(170,778)	(171,298)	(171,153)	(172,395)	(171,816)	(173,393)	(171,728)	(171,317)
Education (Secondary=1)	17,491	25,593	17,600	16,206	24,011	24,728	24,091	24,288
	(89,745)	(88,847)	(89,100)	(89,261)	(89,082)	(89,426)	(89,612)	(89,484)
Party Membership (Member=1)	-18,356	-19,199	-15,829	-8,127	-2,979	-11,956	-5,990	-8,951
	(112,432)	(111,990)	(111,398)	(111,606)	(111,588)	(112,442)	(112,244)	(111,387)
yref11	194,236*							
	(108,436)							
yref12		161,229*						
		(89,048)						
yref13			146,459*					
			(79,399)					
yref14				158,795**				
				(80,608)				
yref15					114,909			
					(81,013)			
yref16						4,029		
						(82,565)		
yref17							92,451	
							(95,317)	
yref18								135,491
								(134,487)
Constant	580,914	596,413*	617,470*	596,325*	708,315**	780,042**	772,032**	765,698**
	(366,029)	(355,148)	(354,181)	(356,264)	(336,237)	(344,262)	(348,484)	(351,788)
Observations	781	781	781	781	781	781	781	781
R-squared	0.078	0.079	0.079	0.080	0.078	0.075	0.076	0.076
Region FE	YES	YES	YES	YES	YES	YES	YES	YES
Occupation FE	YES	YES	YES	YES	YES	YES	YES	YES

*Note: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

2.2 Distributional Analysis

This subsection provides in-depth analysis on the change in informal income distribution before and after the threshold year of 2014. First, kernel density estimates were derived for each sample years to provide graphical representations of yearly informal income distribution. As can be seen in <Fig. II-1>, there seems to be significant changes in informal income distribution over the years in both shape and location. The peak densities are relatively higher for the years 2011, 2012 and 2013 compared to the later years. Locations of the distributions seem to be shifting rightward over time suggesting overall level of informal income has increased.

<Figure II- 1> Year-by-Year Informal Income Distributions (2011-2019)



In order to rigorously discover how the shape and location of the distribution has changed from Period 1(2011~2014) to Period 2(2015~2019), non-parametric methodology of relative distribution introduced by Handcock and Morris (1998,

1999)[14] was employed. The methodology enables identification of underlying structural breaks between the "reference group", and the "comparison group". It can well facilitate analyses of this study first because it allows both longitudinal, and also our case of cross-sectional analysis. It also decomposes the relative density of two periods into location and shape components to provide deeper understandings of the change. Location shifts refer to distributional changes as a result of proportional variations across all input data (in our case, informal income) which affects the entire distribution with the shape unaltered. Shape component on the other hand, only captures the change in distributional shape when the location shifts are accounted for. The main interest of this study is how the shape component of the informal income distribution has changed over the two period.

In addition, *median relative polarization index* (MRP) was employed to empirically test the significance of the observed change in distribution. The MRP method was introduced by Morris et al. (1994) to capture distributional change between the two groups of observations to discover if polarization level has changed, and to measure the magnitude of the change (Nissanov and Pittau, 2016). It is invariant to monotonic transformation and normalized to vary between -1 and 1, where 0 means no change in distribution from the reference year. Positive index values imply divergence of the distribution from the median, whereas negative index values imply convergence of the distribution from the median[15]. The most important property of MRP is that it can be decomposed additively into lower (LRP), and upper (URP) polarization indexes as the following.

[14] For further technical details of the methodology, see Hancock and Morris (1998, 1999), Clementi and Schettino (2013), Nissanov and Pittau (2016).

[15] For further details on technicality and computations of the index, see Morris et al. (1994).

$$MRP(F;\ F_0) = \frac{1}{2}LRP(F;\ F_0) + \frac{1}{2}URP(F;F_0)$$

Where F and F_0 represent cumulative distribution functions of the two groups. By this decomposition property, one can define the contributions of increase or decrease in lower- and upper tail polarization to the overall change in polarization. Intuitively, the MRP index reports the share of population that moved away from the median (Nissanov and Pittau, 2016). It also conducts empirical test on the significance of MRP, LRP and URP.

Utilizing both relative distribution analysis and MRP index estimation methodologies, the following results were estimated for distributional comparison. <Table II-4> and <Fig. II-2> presents the MRP index estimation result where all of the samples from each period are included.

<Table II- 4> Median Relative Polarization Index (Baseline Model)

Polarization Category	Coefficient.	t	P>t
MRP	0.2548*** (0.0636)	4.01	0.000
LRP	0.3572 *** (0.1007)	3.55	0.000
URP	0.1523** (0.0614)	2.48	0.013
Period 1 Obs.	366		
Period 2 Obs.	415		
Obs.	781		

*Note: Standard errors are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

First, MRP index estimation results show that the estimated coefficient of MRP is positive and statistically significant implying that there has been overall increase in informal income polarization between Period 1 and Period 2. The coefficient of 0.2548 implies that the informal incomes of Period 2 are 25.5% more dispersed compared to Period 1. Put it more intuitively, 25.5% of the samples have

moved away from the median informal income in Period 2.

The estimated coefficients of LRP and URP are both positive and significant implying that the share of population that belongs to lower and upper tails of the distribution had also increased in Period 2. As covered previously, due to the additive property of MRP index, the degree of contribution of LRP and URP to MRP can be obtained by dividing the respective coefficients by 2. As a result, the contributions of LRP and URP to MRP of 0.2548 are 0.1786 and 0.0762, respectively. Overall, result of the MRP index estimation imply that overwhelming portion of increase in informal income polarization is attributable to increase in the share of lower tail of the distribution, though the share of upper tail has also increased.

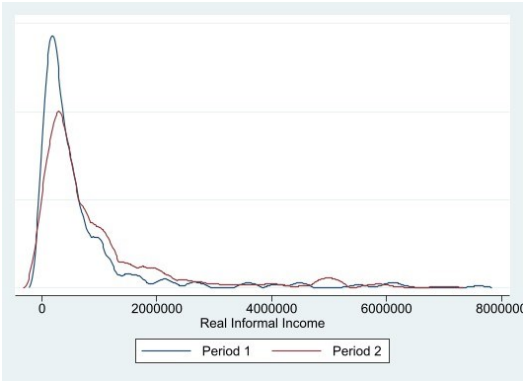
Relative distribution analysis also supports the previous result as shown in <Fig. II-2>. Panel (a) presents the comparison of informal income distributions between two periods. It is evident that the peak density is higher in Period 1, and that there has been a rightward shift of whole distribution implying that there has been an overall increase in informal income. Panel (b) provides comparison of the two densities to capture the growth rate of the upper and the lower tails of the distribution. According to the panel, the share of samples for percentiles below(above) the median is lower(higher) in Period 2 than that in Period 1. Panels (c) and (d) provide further insights by decomposing the distributional change into location and shape effects, respectively. Adjusting for the changes in shape of the distribution, Panel (c) implies a positive median income shift between the two periods showing that the share of percentiles higher(lower) than 60 have increased(decreased). The shape effect shown in Panel (d) provides direct evidence of the previous MRP results. The share of samples for percentiles below 10 has dramatically increased in Period 2 to the magnitude of as large as over 4.5 times that of Period 1. The share of samples for percentiles above 90 on the other hand,

also has increased but not as dramatically as those of the lower tail.

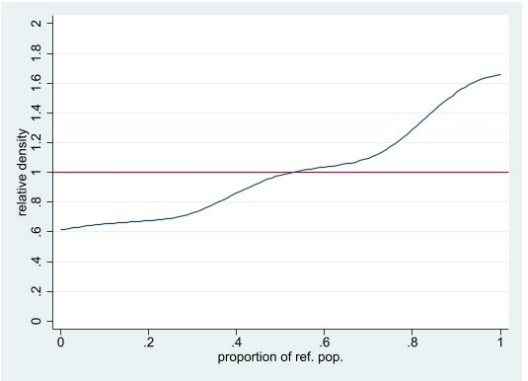
In sum, the MRP index estimation and relative distribution analysis results suggest that the overall polarization in informal income has increased from Period 1 and Period 2, largely attributable to increase in the share of samples that belong to the lower tail of the distribution. Despite the consistent results, there exist some limitations in the analyses. First, high informal income earners are relatively small in number raising questions in reliability of the empirical results for the group. This might be the reason for weaker statistical significance of the URP result in <Table II-6>. Secondly, due to the sampling strategy of 'North Korean Refugees Survey' and the nature of defection, the samples do suffer from the sample selection bias. This might undermine the representativeness of the empirical results.

<Figure II- 2> Relative Distribution Analysis (Baseline Model)

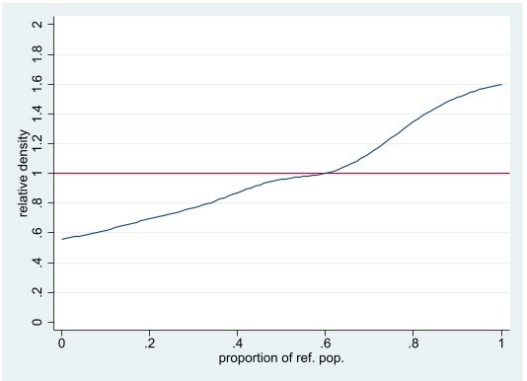
(a)



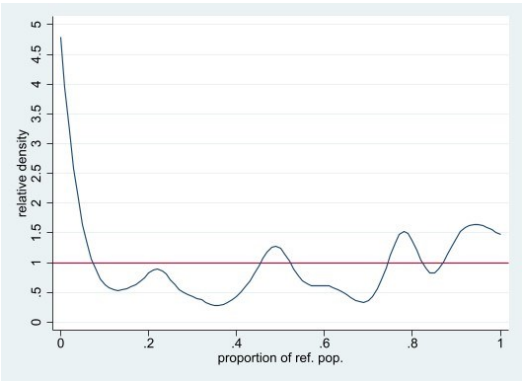
(b)



(c)



(d)



*Note: Informal Income is in 2015 KPW and unknown densities are estimated by kernel density estimates with adaptive bandwidth. Panel (a): Kernel density estimates of the informal income distributions. Panel (b): Relative distribution. Panel (c): Location effect. Panel (d): Shape effect.

2.3 Robustness Checks

In an effort to mitigate the sample selection bias, further analysis strategies were taken for robustness checks. First, resampling technique was employed to align the demographic characteristics of the two periods. Secondly, propensity score matching analysis was conducted to provide more statistically robust results.

2.3.1 Resampling

Resampling is a simple methodology to make chosen demographic composition of one group similar to that of another group. Demographic characteristics of gender measured by the share of women, place of living by the share of residents of North Hamgyong province, subjective social class measured by the share of middle and lower classes, occupation measured by the share of small-scale business participants were chosen as variables of consideration[16]. Place of living were chosen because the composition difference is fairly large. Subjective social class and occupation were chosen to reflect possible differences in economic classes of the respondents between the two periods. Although the resampling cannot mitigate the fundamental problem of representativeness, it may provide adequate environment for comparing the two groups of samples by reducing the differences in demographic compositions.

First, 200 samples were drawn from each period such that the compositions of the chosen variables are as similar as possible, where first 10% was selected

[16] 'Share of middle/upper class' variable was constructed based on the question "Which social class do you think your living standard belonged to when you were living in North Korea". A dummy variable was constructed taking value 1 if the respondent has chosen "middle class" or "upper class" and 0 if the respondent has chosen 'lower class'. 'Share of small-scale business' variable was constructed with the occupation variable which was explained previously. A dummy variable was constructed taking value 1 if the respondent has chosen "retail", "individual services", "individual manufacturing", "part-time jobs" and 0 if otherwise.

randomly. <Table II-5> compares the compositions of the chosen variables before and after the resampling. The distributional differences in all of the variables were reduced.

<Table II- 5> Summary Statistics of Selected Variables Before and After Resampling

	Before Resampling				After Resampling			
	Period	**Mean**	**Diff.**	**Freq.**	**Period**	**Mean**	**Diff.**	**Freq.**
Women	1	0.6038		366	1	0.6150		200
	2	0.5831	0.0207	415	2	0.6000	0.0150	200
	Total	0.5928		781	Total	0.6075		400
N. Hamgyong Prov.	1	0.4153		366	1	0.3900		200
	2	0.2530	0.1623	415	2	0.3300	0.0600	200
	Total	0.3291		781	Total	0.3600		400
Middle/Lower Social Class	1	0.7377		366	1	0.7400		200
	2	0.7398	-0.0021	415	2	0.7400	0.0000	200
	Total	0.7388		781	Total	0.7400		400
Small-scale Business	1	0.4595		346	1	0.4400		200
	2	0.3570	0.1025	395	2	0.4050	0.0350	200
	Total	0.4049		741	Total	0.4225		400

*Note: Share of middle/upper subjective social classes' variable was constructed based on the question "Which social class do you think your living standard belonged to when you were living in North Korea". A dummy variable was constructed taking value 1 if the respondent has chosen "middle class" or "lower class" and 0 if the respondent has chosen 'upper class'. 'Share of small-scale business' variable was constructed with the occupation variable which was explained previously. A dummy variable was constructed taking value 1 if the respondent has chosen "retail", "individual services", "individual manufacturing", "part-time jobs" and 0 if otherwise.

Next, Similar empirical analyses were conducted as in the baseline model but only with the resampled observations. <Table II-6> and <Fig. II-3> report the MRP index estimation and relative distribution analysis results, respectively. All of the estimated coefficients are positive and statistically significant in MRP index estimation as in the baseline model with only marginal differences in coefficients and t-values. All of the relative distribution analysis results shown in panels of <Fig.

II-3> show similar patterns in general as in the baseline model providing further support.

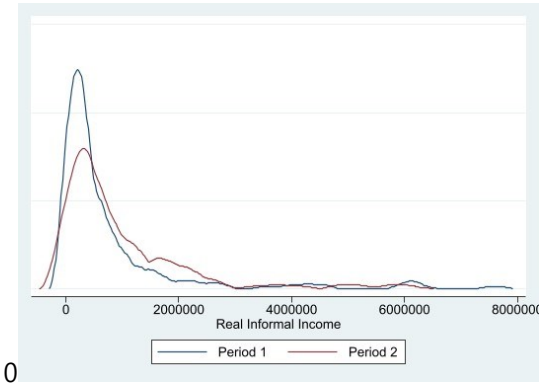
<Table II- 6> Median Relative Polarization Index (Resampled Model)

Polarization Category	Coefficient.	t	P>t
MRP	0.2399**	2.28	0.023
	(0.1053)		
LRP	0.3207*	1.82	0.070
	(0.1763)		
URP	0.1591*	1.91	0.057
	(0.0835)		
Period 1 Obs.	200		
Period 2 Obs.	200		
Obs.	400		

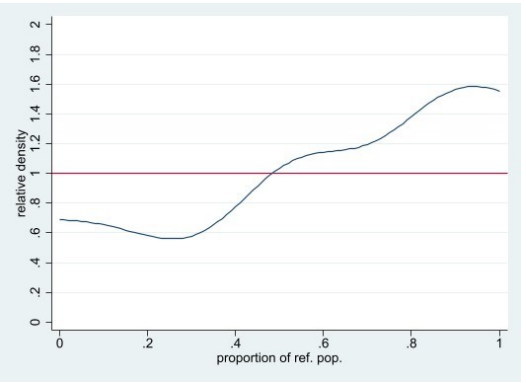
*Note: Standard errors are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

<Figure II- 3> Relative Distribution Analysis (Resampled Model)

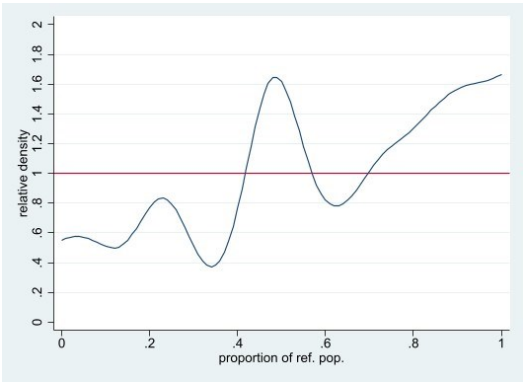
(a)



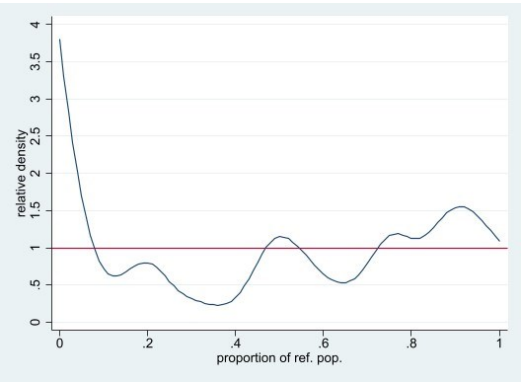
(b)



(c)



(d)



*Note: Above results only include resampled observations. Informal Income is in 2015 KPW and unknown densities are estimated by kernel density estimates with adaptive bandwidth. Panel (a): Kernel density estimates of the informal income distributions. Panel (b): Relative distribution. Panel (c): Location effect. Panel (d): Shape effect.

2.3.2 Propensity Score Matching

In order to further check the robustness of the results, propensity score matching (PSM) was conducted. The PSM methodology is a useful tool to empirically identify the treatment effect between the "control group" and the "treatment group". I apply this method to adjust the demographic compositions of the two periods. The "control group" in this case is the Period 1 samples, and the "treatment group" is the Period 2 samples. In the process, the PSM matches the samples with similar propensities based on selected control variables. As the main interest in utilizing the PSM in this study is to make the demographic compositions similar across the two periods, I mainly focus on the matching itself and the reduced bias of the selected demographic variables rather than the size of the treatment effect. After the matching, the MRP index analysis and relative distribution analysis were both conducted only with the matched samples.

Although the selected demographic variables of consideration are, in large part, similar to the previous case of resampling, minor adjustments were made in the process both to maximize the matched sample size and to maximize the number of control variables. Basic demographic variables of age, gender, and the share of small-scale business participants were considered in the same fashion as in the previous case. The level of education was newly added measured by a dummy variable capturing the secondary education graduates, whereas subjective social classes in this model was measured by a dummy variable capturing only the respondents who categorized themselves as middle class. Furthermore, place of living now includes the residents of Ryanggang province in addition to the residents of North Hamgyong province.

The PSM was conducted by one-to-one matching technique without replacement. In addition, 'conditional independence assumption (CIA)' and 'common support condition' were imposed. The CIA assumes that the treatment is

random and uncorrelated with outcome when selected observable characteristics are controlled for, and the ‘common support condition’ drops the treatment observations with higher than the maximum and lower than minimum p-score.

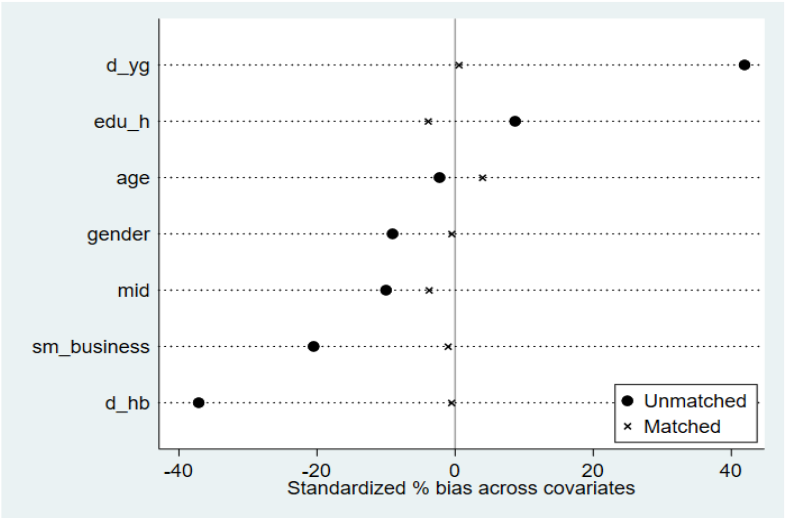
The result of the PSM estimation is reported in <Table II-7> and visualized in <Fig. II-4>. According to the ‘% bias’ column of the table, differences in all variables are significantly reduced except for ‘age’ variable. In terms of percent reduction, the discrepancies in share of Ryanggang and North Hamgyong province, share of small-scale business participant, share of middle class, and share of secondary education graduates are reduced by 98.7%, 98.5%, 94.9%, 94.2%, 62%, and 54.7% respectively.

<Table II- 7> Propensity Score Matching Results

Variable	Unmatched Matched	Mean Treated	Control	%bias	%reduced bias	t-test t	p>t
age	U	37.941	38.201	-2.30		-0.31	0.760
	M	37.92	37.468	3.90	-74.1	0.55	0.581
gender	U	.57653	.62099	-9.10		-1.23	0.221
	M	.57584	.57841	-0.50	94.2	-0.07	0.942
edu_h	U	.72194	.68222	8.70		1.18	0.240
	M	.72494	.74293	-3.90	54.7	-0.57	0.571
mid	U	.63776	.68513	-10.00		-1.35	0.177
	M	.63753	.65553	-3.80	62	-0.52	0.600
sm_business	U	.35459	.45481	-20.5		-2.78	0.006
	M	.35219	.35733	-1.1	94.9	-0.15	0.881
d_hb	U	.25255	.42566	-37.1		-5.05	0.000
	M	.24936	.25193	-0.6	98.5	-0.08	0.934
d_yg	U	.625	.41983	41.9		5.67	0.000
	M	.62725	.62468	0.5	98.7	0.07	0.941

*Note: 'edu_h' is a dummy variable taking value 1 if the respondent has graduated secondary education, and 0 otherwise. 'mid' is a dummy variable that takes value 1 if the respondent considers him/herself belonging to 'middle' class and takes value 0 if otherwise. 'sm_business' is a dummy variable taking value 1 if the respondent is a participant of a small-scale business and 0 otherwise. 'd_hb' and 'd_yg' both take value 1 if the respondent has lived in North Hamgyong and Ryanggang province respectively, and 0 if lived in other regions.

<Figure II- 4> Propensity Score Matching Results



*Note: 'edu_h' is a dummy variable taking value 1 if the respondent has graduated secondary education, and 0 otherwise. 'mid' is a dummy variable that takes value 1 if the respondent considers him/herself belonging to 'middle' class and takes value 0 if otherwise. 'sm_business' is a dummy variable taking value 1 if the respondent is a participant of a small-scale business and 0 otherwise. 'd_hb' and 'd_yg' both take value 1 if the respondent has lived in North Hamgyong and Ryanggang province respectively, and 0 if lived in other regions.

Reductions in the biases seem to be significant effectively reducing the sample selection bias caused by the demographic differences between the two periods. The number of samples for each period after the matching is 77 which amounts to 154 in total. The matched samples are fairly evenly distributed across the years as shown in <Table II-8>.

<Table II- 8> Number of Samples by Year after Matching

Year of Defection	Observations
2011	17
2012	17
2013	16
2014	27
2015	22
2016	21
2017	16
2018	7
2019	11
Total	154

Next, the MRP index estimation and the relative distribution analysis were conducted. The MRP index estimation result is slightly different from those of the previous results, but the direction and the significance of the coefficients largely remain consistent as presented in <Table II-9> and <Fig. II-5>. MRP is positive and statistically significant still suggesting the increase in informal income polarization where most of which is attributable to the increase in the share of lower tail distribution. A noticeable difference in the result is that the coefficients of both MRP and LRP are larger than before, and the coefficient of URP is now not significant. This might be due to the decreased number of samples, but the fact that the coefficient of MRP, which represents the degree of increased polarization is larger after the matching providing additional support to the previous results.

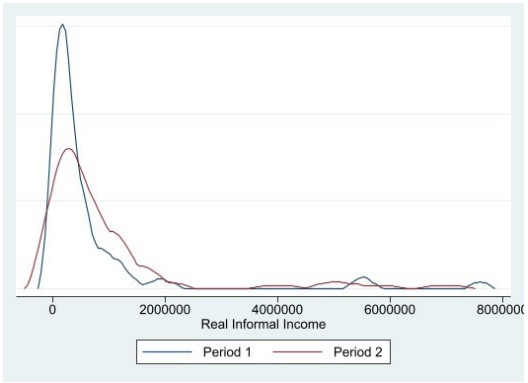
<Table II- 9> Median Relative Polarization Index (PSM Model)

Polarization Category	Coeff.	t	P>t
MRP	0.4164***	4.30	0.000
	(0.0968)		
LRP	0.7190***	5.62	0.000
	(0.1279)		
URP	0.1138	0.87	0.388
	(0.1315)		
Period 1 Obs.	77		
Period 2 Obs.	77		
Obs.	154		

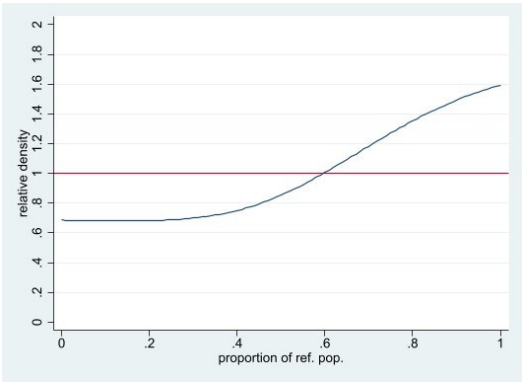
*Note: Standard errors are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

<Figure II- 5> Relative Distribution Analysis (PSM Model)

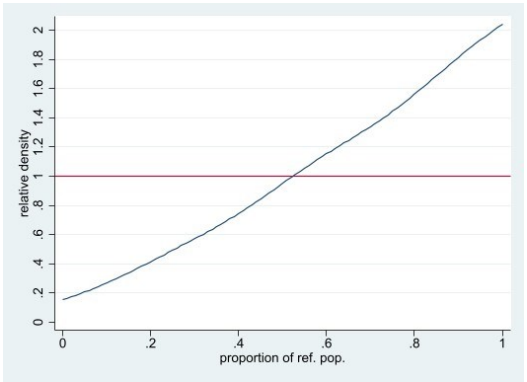
(a)



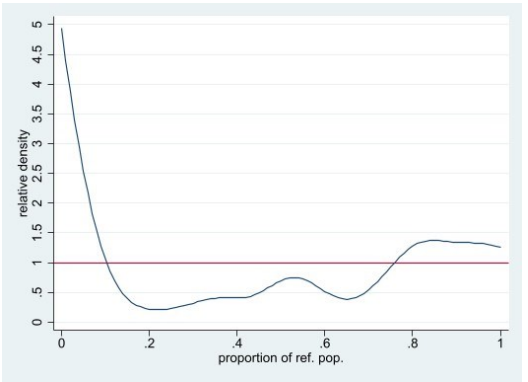
(b)



(c)



(d)



*Note: Above results only include the matched observations. Informal Income is in 2015 KPW and unknown densities are estimated by kernel density estimates with adaptive bandwidth. Panel (a): Kernel density estimates of the informal income distributions. Panel (b): Relative distribution. Panel (c): Location effect. Panel (d): Shape effect.

<Table II-10> summarizes the results of MRP index estimations conducted thus far. They robustly suggest increased polarization of the informal income. More importantly, they also offer the possibility that the main cause of the increased polarization is increase in the share of lower tail. The coefficients of URP on the other hand are relatively small in all cases compared to the LRP coefficients and its significance is case-dependent.

<Table II- 10> Median Relative Polarization Index Results (Summary)

	MRP	LRP	URP
All Samples	0.2548***	0.3592***	0.1523**
	(0.0636)	(0.1007)	(0.0614)
Resampled	0.2399**	0.3207*	0.1591*
	(0.1053)	(0.1763)	(0.0835)
PSM	0.4164***	0.7190***	0.1138
	(0.0968)	(0.1279)	(0.1315)

*Note: Standard Errors are in parentheses.

3. Discussion

Despite the efforts made to mitigate evident sample selection bias, the focus was on adjusting for the difference in demographic compositions between the two periods. However, it is difficult to argue that the previous robustness checks completely eliminate the sample selection bias. In other words, proposed results of increased informal income polarization may be due to unobserved differences in sample characteristics across the periods. If so, the representativeness of the result cannot be secured.

To address the remaining concern over sample selection bias, I refer to widely discussed research of Borjas (1987) which provides theoretical and empirical analyses on selection problem of the U.S. immigrants. He argues that if the

inequality level of third-world home country is higher than that of the U.S., then low-income earners of home country have much greater incentives to emigrate to the U.S. than the high-income earners leading to so-called *negative selection bias*. The logic behind the theory is that if the inequality level in home country is high, low-income earners are likely to choose emigration to the U.S where it "insures low-income workers against poor labor market outcomes while taxing high income workers" (Borjas, 1987) relative to their home country. To the low-income earners, emigration may be income-maximizing behavior since mean income level is higher in advanced country such as the United States. The protection provided by stronger redistribution system provides further incentive for the low-income individuals. Based on those two factors, low-income individual can secure as least as much income as he/she would earn in home country. Borjas (1987) also provides empirical analysis employing U.S. immigration data to conclude that "immigrants with high incomes in the U.S. relative to their measure skills come from countries that have high levels of GNP, low levels of income inequality, and politically competitive system". (Borjas, 1987)

The *negative selection bias* theory has significant implications to this study as fleeing from North Korea, in a sense, can be considered as a special case of immigration. However, in order to apply the theory to the result of this study, several preconditions have to be met. First, expected mean income in South Korea needs to be larger than the mean informal income that the North Korean refugee earns. Secondly, the information of the first assumption has to be known by the potential defectors prior to fleeing the country.

The first precondition obviously holds because it is well known that not only the average living standard is incomparably higher in the South than in the North, but also the redistribution system of the South is much stronger than that of the North where it is extremely weak due to the incapacitated Public Distribution

System. It is highly likely that the second precondition also holds because there exist numerous anecdotal evidences from North Korean refugees that they do seldomly (either directly or indirectly) communicate with their family members who live in the North[17]. Moreover, various South Korean media contents, which is known to be watched or heard by many North Koreans, might have provided information on life in the South[18].

If expansion of marketization has increased inequality level in informal income, it implies that there are less fortunate market participants who became worse off compared to the pre-expansion period. According to the *negative selection theory*, it is a rational choice for those individuals to choose to flee from the North, in which the basic living standard is not secured, to the South where the basic living standard is protected by the redistribution system. In this case, previously reported results suggesting increased share of low tail individuals coincides with the above analogy implying that the inequality level in informal income in North Korea has increased over time.

4. Conclusion

This study attempts to explore the effect of expansion of marketization on the informal income distribution in North Korea. It is reported that marketization in North Korea has consistently expanded since Kim Jong Un came into power in 2011. The economic development strategy of Kim Jong Un regime has reportedly

[17] According to the 'North Korean Refugee Survey' data, 41% of the refugees have answered that they had previously defected family member in South Korea prior to the defection, and 57% of the respondents have answered that they seldomly communicate with the North.

[18] According to the 'North Korean Refugee Survey' data, overwhelming 87% of the refugees have answered that they have encountered South Korean TV programs, movies, and music.

been ‘market-led growth within socialism’ where it has kept lenient policy stance on marketization. Introductions of economic reform policies, namely, “field responsibility system” and “responsibility management system of socialist enterprises” are prime examples of the regime’s policy stance on marketization.

‘North Korean Refugee Survey’ data annually produced by the Institute for Peace and Unification Studies at Seoul National University was employed to empirically analyze the evolutions of informal income distribution in the years of market expansion. Methodologically, relative distribution analysis and median relative polarization index estimation were conducted.

Due to sample insufficiency, an OLS regression model was constructed to find that there has been a structural break in average deviations of informal income between 2011 to 2014 and 2015 to 2019. Resulting threshold year of 2014 coincides with the year of introductions of the economic reform policies suggesting the possibility of intensified market-related activities inflicted by the reform policies might have contributions to the increased inequality level.

The subsequent analyses on the informal income distributions of the two periods reveal that there has been a statistically significant increase in informal income inequality. In addition, the contribution of increase in the share of lower tail informal income earners is larger than that of increase in the share of upper tail informal income earners.

Further analyses employing resampling technique and the PSM methodology, in an effort to address the sample selection bias, also report similar results. According to the *negative selection theory* introduced by Borjas (1987), the overwhelming contribution of increase in the share of lower tail samples implies overall increase in informal income inequality of North Korea.

The results have policy implications. More unequal informal income not only

would undermine the long-term sustainability of marketization, but also would heighten the political discontent of the public. Consequentially, it may increase pressure on the North Korean regime to institutionalize the market sector as introductions of redistribution function, and/or appropriate market management mechanisms for fair competition are called for to address the inequality problem.

Chapter III. Economic Status and Unification Perception of the South Koreans

1. Introduction

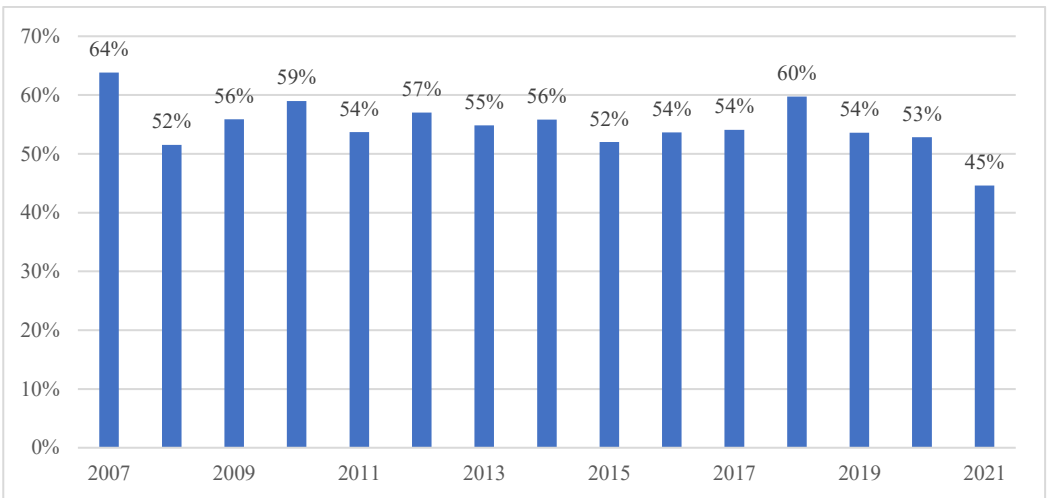
The Korean peninsula has been divided for over 70 years. Since the division, reunification has been discussed mainly in the context of reunifying the mono-ethnic group. However, it has been perceived as an almost unachievable goal thus far due to both internal constraints such as stark differences in political, economic, and social systems, and external constraints such as volatile changes in international politics surrounding the peninsula.

From this perspective, unification perception of the South Koreans can be considered as one of the internal constraints. It is an important issue since public support is a necessary condition for reunification. Without it, reunification is a farfetched goal even if other constraints were to be fulfilled. But perception in general is not only difficult keep track of, but also difficult to understand the mechanism of. Especially so for the unification issue which is vulnerable to countless economic, political, and social factors both domestic and foreign.

Nonetheless, there are some statistics which report growing pessimistic unification perception of the South Koreans. According to the 'Unification Perception Survey' conducted annually by the Institute for Peace and Unification Studies (IPUS) at Seoul National University, the proportion of optimistic view on unification seems to be at a decreasing trend. <Fig. III-1> presents yearly proportion of the survey respondents who have chosen either the unification is "very necessary" or "necessary". In 2007, 64% of the respondents have shown their optimistic view on unification, whereas only 45% of the 2021 respondents were optimistic.

Although it is difficult to completely understand the reason for pessimistic unification perception of the South Koreans, one of the compelling reasons would be changing perception on North Koreans from ethnic to multicultural. There have been numerous studies which explored the issue. Lee (2011) argues that there is an increasing number of South Koreans who defines 'Korean' with civic identity such as 'following the law and social rules' rather than 'having ancestral origin'. Yoon & Song (2013) reports that perceptions and emotions of the South Koreans on the North Korean defectors originate in large part from their perceptions on multiculturalism rather than mono-ethnicity. Ha and Jang (2016) reports that individuals with high ethnicity are more likely to harbor negative attitudes toward migrants from North Korea and less likely to believe that reunification is necessary.

<Figure III- 1> Proportion of Positive Unification Perception by Year

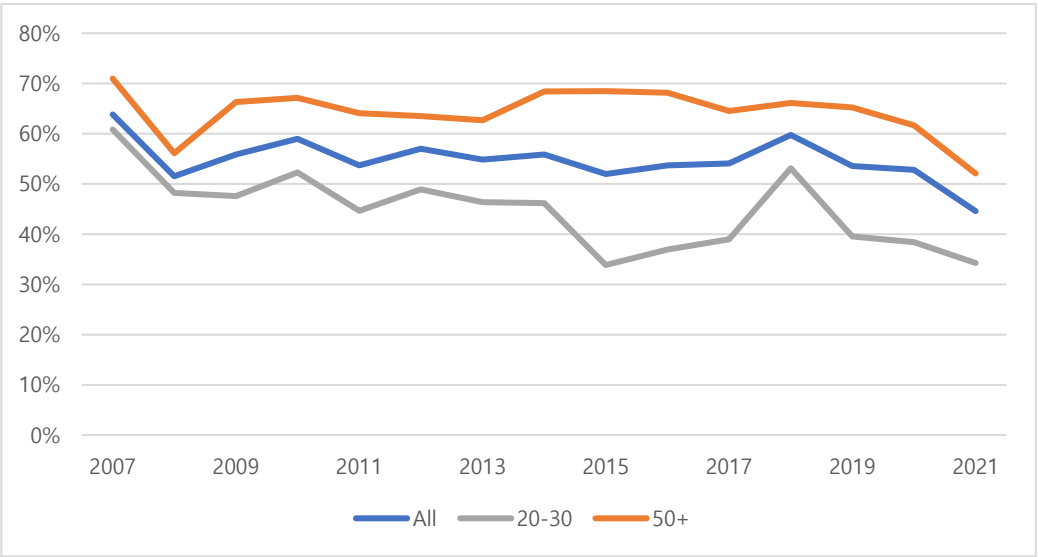


*Source: IPUS Unification Perception Survey.

The decreasing trend of unification perception is especially alarming according to Kim (2019). The study employs pseudo panel methodology to analyze the time invariance of the unification perception. It concludes that the younger

generations tend to have relatively negative unification perception compared to the older generations, and more importantly, it is not likely to change in the future. <Fig. III-2> reports positive unification perception trends by year and age group. It is evident that the positive unification perception of the respondents who are in their 20s and 30s are consistently lower than that of the respondents who are in their 50s and older. The difference seems to be widening over time.

<Figure III- 2> Positive Unification Perception by Year and Age Group



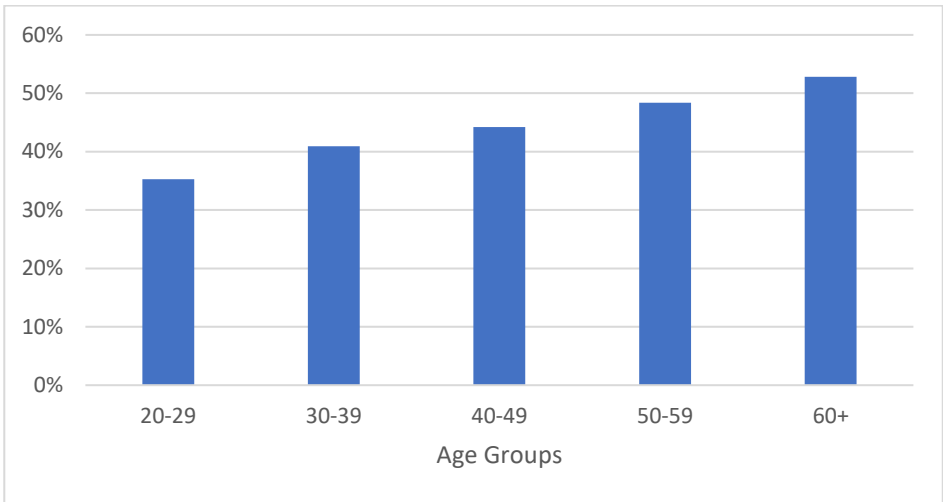
*Source: IPUS Unification Perception Survey.

In addition, Campbell (2016) points out the generational differences in considering unification. She argues that weaker nationalism towards the North, and increased economic competitions and uncertainty might have encouraged the younger generation to reject the idea of unified Korea. Park et al. (2016) also argues that the younger generations in South Korea form the unification sentiment based on relatively more pragmatic determinants such as expected benefit from the reunification rather than ethnic-based justification.

Arguments of the previously mentioned studies imply that unification issue of the Korean peninsula growingly resemble immigration issue of the advanced countries. Jung et al,, (2021) empirically verifies the hypothesis that existing, verified anti-immigration sentiment theories have explanatory power on unification perception of the South Koreans.

Combining the previous discussions, the question can be raised if the change in perception on the North Koreans are salient among the younger generations. <Fig. III-3> provides hint to the question. According to the same IPUS survey data, proportion of respondents who have chosen mono-ethnicity as the most important reason for unification decreases as with the age group. This represents a research gap of whether the explanatory power of the anti-immigration sentiment theories is especially stronger among the younger generations. This has important implications in gauging the future changes in unification perception of the South Koreans. If the younger generations consider aspects similar to those of the anti-immigration theories when forming unification perception significantly more than the older generations, it would imply that the traditional justification of unification, ‘mono-ethnicity’, would lose its persuasiveness in the future. It would demand serious discussions on practical aspects of unification such as economic cost and benefits.

<Figure III- 3> Mono-ethnicity as Main Reason for Unification by Year and Age Group



*Source: IPUS Unification Perception Survey.

This study intends to empirically test the hypothesis that the younger generations are more susceptible to one of the anti-immigration theories when considering the unification compared to their older counterpart. To narrow the scope of analysis, I intend to explore age-specific effect and cohort(generation)-specific effect of 'economic competition theory', which is one of the frequently discussed theories in anti-immigration literature, on unification perception. 'Age-specific effect' refers to the effect of expected duration of economic activities of an individual on the sensitivity to expected level of economic competition after unification when forming unification perception. 'Cohort-specific effect' refers to the effect of generation-specific past and present socioeconomic experiences on the susceptibility to expected level of economic competition after unification when forming unification perception.

If the age-specific effect is found to be significant, it implies that the susceptibility to economic competition when considering unification would be

mitigated as the individuals become older. On the other hand, if the cohort-specific effect is found to be significant, the susceptibility to economic competition is likely to perpetuate in the future. This study claims that the latter case is significant.

The rest of this study is organized as the following. Section 2 explains the data employed for empirical analysis along with introductions of main variables of analysis which includes several anti-immigration sentiment theories. Section 3 reports the results of empirical analysis, and Section 4 makes concluding remarks.

2. Data

2.1 Unification Perception Survey

The 'Unification Perception Survey' published by the Institute for Peace and Unification Studies (IPUS) at Seoul National University is a survey data published on an annual basis since 2007. Each year, around 1,200 individuals are randomly selected by 'multi-stage stratified sampling' methodology based on population census. A total of 18,017 individuals have been sampled through 16 years until 2022. Due to data availability of variables that this study utilizes, samples from 2008 to 2020, or 2012 to 2020 were actually used depending on regression models. The survey questionnaire is consisted of eight sections which cover a wide range of topics of unification perception, perception on North Korea, perception on North Korea policy, perception on North Korean refugees, and perception on the South Korean society.

Due to the stratified sampling technique, the 'Unification Perception Survey' data secures representativeness of the population. <Table III-1> compares demographic statistics of the data for the time period of 2008 to 2022 and 2015 South Korean census data. As can be seen in the table, the average age, gender composition, and share of residents of each province-level regions are well-

represented by the survey data.

<Table III- 1> Summary Statistics of Demographics

Age and Gender

Variable	Obs	Mean	Std. dev.	Min	Max	Official Stat. (2015 Census)
Age	16,817	43.084	13.646	19	74	43.5
Gender	16,817	0.493	0.500	0	1	0.500

Place of Living (Province-level)

Region	Freq.	Percent	Official Stat. (2015 Census)
Seoul	3,104	18.46	18.36
Busan	1,183	7.03	6.43
Daegu	868	5.16	4.61
Incheon	964	5.73	5.68
Gwangju	567	3.37	2.84
Daejeon	595	3.54	2.86
Ulsan	483	2.87	2.17
Gyunggi	3,547	21.09	26.31
Gangwon	573	3.41	2.94
Chungbuk	585	3.48	3.15
Chungnam	753	4.48	4.91
Jeonbuk	661	3.93	3.47
Jeonnam	644	3.83	3.45
Gyungbuk	897	5.33	5.10
Gyungnam	1,065	6.33	6.41
Jeju	328	1.95	1.30
Total	16,817	100	100

2.2 Variable Construction

As briefly explained in the previous section, the main objective of this study involves the unification perception of the South Koreans as the dependent variable. Among the questions offered in the questionnaire of the survey, the question that asks for the degree of necessity of unification that the respondent evaluates is considered to most comprehensively and accurately represent unification perception of the respondents. The question asks, "How much do you think that unification is necessary?", and offers options in 5 scale from "1: Not necessary at all" to "5: Very necessary".

The main independent variables in this study are the variables which proxy the skill levels of individuals. Numerous previous studies in the anti-immigration sentiment literature assert that individuals' skill level is one of the determinants of anti-immigration perception. So-called *economic competition theory* explains that high-skilled individuals are more likely to harbor positive attitude on immigration, whereas low-skilled individuals are more likely to harbor negative attitude (Mayda, 2006; Scheve & Slaughter, 2001). This relationship is explained by *Heckscher-Ohlin model* and *Factor Proportions Analysis* which are widely discussed theories in international economics. The logic is rather simple. General form of immigration is that individuals in the lower income country emigrates into the higher income country. This increases the competition level in the low-skill labor market in the hosting country caused by increased supply of low-skilled immigrants, which brings down the wage of the particular workers. Hence, low-skilled individuals tend to harbor negative perception on immigration, whereas high-skilled individuals tend to harbor positive perception[19].

[19] The *human capital theory* also argues similar trend. It claims that less-educated individuals tend to harbor negative attitude towards immigration, whereas more-educated individuals tend to

Contrastingly, there have been studies which imply that high income earners tend to have negative perception on immigration over the concerns on excessive fiscal burden associated with influx of low-skilled immigrants (Facchini & Mayda, 2009). This theory is also of interest in this study. Whether which one of the two contradicting theories of economic competition and welfare effect is significant would especially be interesting if it differs across age, or generation.

To capture the individuals' skill level, a dummy variable that represents low-skilled workers was constructed using the question that asks for the respondents' current occupation. The offered options include agriculture/fishery, entrepreneur, sales, skilled manufacturing, general manufacturing, office clerk, management, expert/freelancer, housewife, student, armed forces/police, retired/unemployed, and others. The dummy variable takes value 1 if the respondent has chosen "sales", "special manufacturing", and "general manufacturing" and value 0 if chosen other options. Unfortunately, the survey data does not include objective indicators such as hourly wages or other variable that can reconciled with international standards for skill level of the occupations which could have provided more objectivity in capturing the low-skilled individuals[20]. In addition, level of educations of the respondents were also employed. The variable ranges from "1: Below Elementary", to "5: Graduate School and Beyond".

Other control variables include political orientation, multicultural tolerance, expectations on crime and ideological confrontation problem of the South Korean society after unification. First of all, individuals' political orientation is controlled

harbor positive attitude.

[20] Various combinations of low skill occupations were tested. For example, "special manufacturing" which could be considered as high skill occupation, but the empirical results were unchanged.

for. Unification is a strong bi-partisan problem in South Korea in which political affiliation is expected to be a significant factor. The *political affiliation theory* of the anti-immigration literature also argues that individuals who lean toward conservative political value tend to harbor negative perception on immigration, whereas individuals who lean toward progressive political value tend to harbor positive perception (Rustenbach, 2010). In line with the political orientation, satisfaction level of policy on North Korea is also included.

Multicultural tolerance is also one of the interested variables. Previous studies on mono-ethnicity of the South Koreans claim that the South Koreans increasingly alienate the North Koreans as prolonged division has resulted in stark differences in political, economic, and social systems and values between the two countries (Chun, 2015; Yoon & Yang, 2013; Ha & Jang 2016). If the claim is true, individuals with high multicultural tolerance would also have positive perception on unification. Multicultural tolerance of an individual is measured by the question "How much do you agree on the opinion that having diverse races and cultures is good for a country in general?" The options range from "1: Very much disagree, to "5: "Very much agree."

As a contrasting theory, individuals' sense of mono-ethnic unification is also considered. The question asks for the individuals' subjective opinion on the main reason for unification. The options include "1: Because we share the same ethnic background", "2: To end the separated family problem", "3: To eliminate the risk of another war", "4: For the well-being of the North Koreans", "5: For the South Korean economy to advance", and "6: Other reasons". The 'mono-ethnicity' variable was constructed taking value 1 if the respondent has chosen the mono-ethnicity (option 1) as the main reason for unification, 0 if chosen other options.

Expectations of various aspects of the society after unification most obviously would affect the individuals' unification perception. Namely, expectations on crime

problem and on the expected degree of the ideological confrontation. The two variables commonly take scales from 1 to 5 representing “a lot worse” to “a lot improve”, respectively.

The level of income is also considered in the analysis. However, the question only asks for the family income, not the individual income. Moreover, the question offers ranges of incomes instead of asking the respondents to write the actual number. It was recoded with the median number of each respective offered option in 10,000s. For example, “3: 2,000,000 ~ 2,990,000” was recoded as 250. <Table III-2> provides summary statistics of the variables explained thus far. In addition, <Table A-6> in the appendix explains how the original data are recoded.

<Table III-3> presents the average value of unification perception variable by the independent variables to provide information on general tendencies of the samples. As can be seen, presumed theories of *economic competition theory*, *political affiliation theory*, and hypothesis on multicultural tolerance seem to be valid. The individuals with low skill occupation, low level of education, affiliation to conservative political values, less tolerance for multi-culture, and worse expectations on crime and ideological confrontation problems tend to have lower average value of unification perception (negative perception on unification)[21]. Moreover, the trend seems to be clear that the younger generations have relatively pessimistic unification perception compared to the older generations.

[21] For level of education, respondents who have below elementary and elementary levels of education tend to have positive unification perception. This is likely the result of relatively high share of older generations included in those two options who tend to have much higher unification perception compared to the younger generation. The younger generations are extremely unlikely to have those two levels of education in South Korea.

<Table III- 2> Summary Statistics of Variables of Interest

	Variables	Observations	Mean	Std. dev.	Min	Max
Dependent Variable	Unification Necessity	16,871	3.502	1.158	1 Not Necessary	5 Very Necessary
Independent Variables	Level of Education	16,767	3.353	0.757	1 Below elementary	5 Graduate and beyond
	Household Income	16,769	3,741,308	1,556,274	250000	7500000
	Political Orientation	16,814	2.946	0.837	1 Progressive	5 Conservative
	Low Skill Occupation	12,760	0.359	0.480	0 Others	1 Low-skill Occupation
	Expectations on Crime Problem after Unification	16,808	2.145	0.918	1 A Lot Worse	5 A Lot Improve
	Expectations on Ideological Confrontation after Unification	16,810	2.133	1.066	1 A Lot Worse	5 A Lot Improve
	Multi-culture Perception	11,999	3.547	0.873	1 Not Tolerant at all	5 Very Tolerant
	Mono-ethnicity as the Most Important Reason for Unification	16,704	0.432	0.495	0 No	1 Yes

Note: Above statistics have the year range of the actual regression (2007~2020) model. Some of the variables are recoded for better interpretation of the regression results. 'Household Income' variable originally had 12 discrete options each having certain income range but it is recoded to the median amount of each of the option. ‘Mono-ethnicity as the most important reason for unification’ question originally provides 5 other options of “To resolve separated family issue”, “To lower the probability of another war”, “To improve life qualities of the North Korean people”, “For South Korean economy to thrive”, and “Others” and the dummy variable was created which takes value 1 if the respondent has chosen mono-ethnicity as the most important reason, takes value 0 if chosen other answers.

<Table III- 3> Summary Statistics of Unification Necessity by Independent Variables

Variables	Options	Mean	Std. dev.
Age Group	20	3.233	1.145
	30	3.418	1.137
	40	3.634	1.156
	50	3.706	1.133
	60+	3.834	1.116
Gender	Male	3.682	1.165
	Female	3.400	1.133
Level of Education	Below Elementary	3.752	1.109
	Elementary	3.669	1.171
	Highschool	3.497	1.154
	University	3.540	1.156
	Graduate	3.926	1.173
Political Orientation	Very Progressive	3.970	1.254
	Progressive	3.698	1.127
	Neutral	3.464	1.120
	Conservative	3.498	1.197
	Very Conservative	3.337	1.372
Low-skill Occupation	No	3.628	1.162
	Yes	3.431	1.159
Multi-culture Tolerance	Not Tolerant at All	3.117	1.426
	Somewhat Tolerant	3.345	1.189
	Neutral	3.376	1.132
	Tolerant	3.546	1.102
	Very Tolerant	3.891	1.166
Expectations on Crime Problem After Unification	A Lot Worse	3.192	1.222
	Somewhat Worse	3.560	1.121
	No Change	3.696	1.092
	Somewhat Improve	3.882	1.066
	A Lot Improve	3.828	1.148
Expectations on Ideological Confrontation After Unification	A Lot Worse	3.246	1.199
	Somewhat Worse	3.546	1.117
	No Change	3.612	1.098
	Somewhat Improve	3.965	1.036
	A Lot Improve	4.174	1.054

*Note: Above statistics have the year range of the actual regression (2007~2020) model.

3. Empirical Analysis

3.1 Baseline Model

First, the following ordered logit estimation model was constructed to test the significance of skill-proxy variables of the low skill occupation dummy variable, and the level of education variable.

$$UNI_{it} = \alpha + \beta_1 X_{it} + \beta_2 NK_{it} + \beta_3 POL_{it} + \beta_4 ETH_{it} + \beta_5 MC_{it} + \gamma SKILL_{it} + \mu_r + \delta_t + \varepsilon_{it}$$

Where the dependent variable UNI_{it} represents the perceived unification necessity of the individual ranging from "1: Not necessary at all" to "5: Very necessary". X_{it} is set of demographic variables of age, gender dummy (1: female, 0: male), marital status dummy (1: married, 0: single or widowed), and household income. NK_{it} represents individuals' satisfaction level of policy on North Korea ranging from "1: Not satisfied at all" to "5: Very satisfied". POL_{it} represents the political affiliation of the individual in a scale from "1: Very progressive", to "5: Very conservative". ETH_{it} is a dummy variable representing the mono-ethnic belief of the individual taking value 1 if the individual considers the mono-ethnicity as the most important reason for unification and 0 if chosen other options. MC_{it} measures the degree of individuals' tolerance on multi-culturalism ranging from 1 to 5. $SKILL_{it}$ includes two skill-proxy variables. The low- skill occupation takes value 1 for presumable low-skill occupation and 0 otherwise. The level of education variable ranges from 1 to 5 each representing below elementary, elementary, high school, university and beyond graduate school respectively. μ_r represents province-level region-fixed effects and δ_t represents year-fixed effects[22].

[22] For details on the actual questions used and the recoding process of the variable values, refer to "2.2 Variable Construcion" subsection.

The estimation results are reported in <Table III-4>. Columns 1 and 2 include the level of education variable, and columns 3 and 4 include low-skill occupation dummy variable as a proxy for skill level. Columns 2 and 4 are to verify the results by controlling for multi-culture tolerance variable considering the fact that the data on the variable is only available from 2011. Column 5 reports the estimation where all of the independent variables are included and controlled for. First of all, two skill-proxy variables are all statistically significant. The low-skill dummy variable is negative and statistically significant at 1% level and the level of education variable is positive and statistically significant at 1% level. Results of the two skill-proxy variables suggest that low-skilled and less-educated individuals tend to harbor negative unification perception[23].

Results of the control variables are generally in line with the theories and analyses suggested in the previous literature covered in Section 2. First, it is estimated that respondents who are relatively older tend to have positive perception on unification. In terms of gender, male respondents are more likely to be positive about unification. Moreover, progressive respondents are relatively more likely to harbor positive perception compared to their conservative counterpart. Higher satisfaction on North Korea policy is associated with relatively positive perception. Respondents who consider mono-ethnicity as the most important reason for unification tend to feel that unification is necessary. Respondents who have higher tolerance on multi-culture also tend to have positive unification perception. Lastly, respondents who expect the problems of crime and ideological confrontation to be improved after unification tend to have positive unification perception. Demographic control variables of marital status and household income are estimated to be either weakly or not significant.

[23] Size of the coefficients in ordered logit estimation does not represent the marginal effects of the independent variables on the dependent variable. For marginal effects estimation, refer to <Table A-7>

<Table III- 4> Ordered Logit Estimation Results (Baseline Model)

	(1)	(2)	(3)	(4)	(5)
	Level of Education		Low-skill Occupation		All
Demographic Variables					
Age	0.0280***	0.0153	0.0770***	0.0452***	0.0337**
	(0.00800)	(0.00951)	(0.0110)	(0.0129)	(0.0131)
Age^2	0.000110	0.000257**	-0.000500***	-0.000120	7.09e-05
	(8.71e-05)	(0.000103)	(0.000117)	(0.000136)	(0.000141)
Gender	-0.431***	-0.392***	-0.486***	-0.443***	-0.410***
	(0.0287)	(0.0343)	(0.0340)	(0.0402)	(0.0405)
Marital Status	-0.0418	0.0259	-0.0869	-0.0291	-0.0229
	(0.0471)	(0.0564)	(0.0530)	(0.0635)	(0.0637)
Household Income	-0.00201*	-0.00110	0.00149	0.00221	-0.000379
	(0.00110)	(0.00133)	(0.00125)	(0.00147)	(0.00156)
Skill Proxy Variables					
Level of Education	0.299***	0.253***			0.223***
	(0.0254)	(0.0316)			(0.0372)
Low-skill Occupation			-0.167***	-0.188***	-0.140***
			(0.0350)	(0.0408)	(0.0415)
Other Control Variables					
Mono-ethnicity		0.284***		0.302***	0.311***
		(0.0345)		(0.0402)	(0.0403)
Political Orientation		-0.224***		-0.222***	-0.218***
		(0.0234)		(0.0269)	(0.0269)
NK Policy Satisfaction		0.336***		0.342***	0.345***
		(0.0277)		(0.0318)	(0.0319)
Multi-culture Tolerance		0.238***		0.258***	0.252***
		(0.0217)		(0.0250)	(0.0251)
Crime Expectation		0.139***		0.123***	0.121***
		(0.0227)		(0.0265)	(0.0266)
Ideological Conf. Expectation		0.240***		0.265***	0.262***
		(0.0199)		(0.0229)	(0.0230)
Observations	16,717	11,894	11,950	8,790	8,768
Year FE	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)
*Note: Estimations with low-skill occupation variable excludes the respondents who are students, retired, and unemployed. Estimations with multi-culture tolerance has lower number of samples due to the fact that the question was included in the questionnaire since 2011.

3.2 Age Effect Model

One of the research questions was if susceptibility of economic competition when considering unification differs across generations. To begin delving into the issue, ‘age interaction model’ was constructed to investigate the issue.

The model shares the same dependent and independent variables but each of the skill-proxy variables are interacted with age. The results are as shown in <Table III-5>. Columns 1 and 2 represent level of education interaction, and low-skill occupation interaction estimations respectively.

Coefficient of level of education interaction variable is negative and significant implying that the positive effect of education level on unification perception decreases as the age increases. This suggests that the education effect is stronger for the younger generations compared to the older generation. In other words, less educated younger generation individual is more likely to form negative unification perception compared to less educated older generation individual. In addition, low-skill occupation interaction variable is positive and significant suggesting the negative low-skill effect is weaker among the older generation. Analogous to the result of level of education interaction variable, it implies that the negative effect of low-skill occupation is stronger among the younger generations, and weaker among the older generations.

<Table III- 5> Ordered Logit Estimation Results (Age Interaction Model)

	(1) Edu Int.	(2) Low-skill occupation Int.
Demographic Variables		
Age	0.0516***	0.0312***
	(0.00591)	(0.00252)
Gender	-0.396***	-0.448***
	(0.0343)	(0.0401)
Marital Status	-0.00486	-0.0113
	(0.0522)	(0.0566)
Household Income	-0.00109	0.00230
	(0.00133)	(0.00147)
Skill Proxy Variables		
Level of Education	0.439***	
	(0.0920)	
Level of Education x Age	-0.00400**	
	(0.00175)	
Low-skill Occupation		-0.492***
		(0.143)
Low-skill Occupation x Age		0.00689**
		(0.00315)
Other Control Variables		
Mono-ethnicity	0.283***	0.300***
	(0.0345)	(0.0402)
Political Orientation	-0.221***	-0.222***
	(0.0233)	(0.0268)
NK Policy Satisfaction	0.336***	0.340***
	(0.0277)	(0.0318)
Multiculture Tolerance	0.238***	0.259***
	(0.0217)	(0.0250)
Crime Expectation	0.138***	0.122***
	(0.0227)	(0.0265)
Ideological Conf. Expectation	0.240***	0.266***
	(0.0199)	(0.0229)
Observations	11,894	8,790
Year FE	YES	YES
Region FE	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)
*Note: Estimations with low-skill occupation variable excludes the respondents who are students, retired, and unemployed. Estimations with multi-culture tolerance has lower number of samples due to the fact that the question was included in the questionnaire since 2011.

However, question remains if the weakening age effect of skill-proxy variables develop continuously as the age increases, or if it begins to take place discretely starting at certain age or age group. To further explore the issue, three age group dummy variables were created to capture 20s and 30s, 40s and 50s, and lastly, 60s and older. The age blocks were chosen based on average degree of economic activities. It is reasonable to distinguish 20-30s as preparation period, 40-50s as prime period, and 60s+ as retirement period. Each dummy variable was interacted with the low-skill occupation variable which is relatively more direct measure of skill level. The results are reported in <Table III-6>. Columns 1, 2, and 3 each represent the result for 20-30s, 40-50s, and 60+ age group interaction estimations.

The age dummy variable results suggest that the negative effect of low-skill occupation on unification perception is significantly weakens for the 60+ age group compared to the rest of the age groups. This suggests the possibility that the age effect might only be applicable for those who are close to their retirements. The positive significance of the 60+ age group interaction may also suggest that there exists concern over fiscal burden among the older generations which is known as the welfare effect in the anti-immigration literature.

<Table III- 6> Ordered Logit Estimation Results (Age Group Interaction Model)

	(1) 2030	(2) 4050	(3) 60+
Demographic Variables			
Gender	-0.430***	-0.425***	-0.429***
	(0.0404)	(0.0404)	(0.0404)
Marital Status	0.0877	0.0942*	0.0865
	(0.0553)	(0.0552)	(0.0552)
Household Income	-0.000909	-0.000957	-0.000915
	(0.00157)	(0.00157)	(0.00157)
Level of Education	0.177***	0.178***	0.172***
	(0.0357)	(0.0357)	(0.0357)
Age Group Dummy Variables (Ref. Group: Under 20s)			
2030 Group	0.131	0.120	0.0747
	(0.429)	(0.427)	(0.423)
4050 Group	0.835*	0.891**	0.795*
	(0.428)	(0.431)	(0.425)
60+ Group	1.364***	1.375***	1.175***
	(0.431)	(0.432)	(0.433)
Low-skill Occupation Dummy Variables / Interaction Terms			
Low-skill Occupation	-0.145***	-0.110**	-0.221***
	(0.0534)	(0.0552)	(0.0442)
Low-skill x 2030 Group	-0.0551		
	(0.0813)		
Low-skill x 4050 Group		-0.123	
		(0.0805)	
Low-skill x 60+ Group			0.398***
			(0.121)
Observations	8,768	8,768	8,768
Year FE	YES	YES	YES
Region FE	YES	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)
*Note: All of the previous control variables are controlled for, and the resulting coefficients and significances are similar of the variables are almost identical to the previous models.

3.3 Generation Effect Model

Next, I attempt to test if there exists generation (or cohort) effect. Generation effect is difficult to capture with repeated cross-sectional data such as the data this study employs. To capture the generation effect most accurately, a panel dataset is

usually required. In an attempt to overcome the difficulty, I take advantages of large number of samples that 'Unification Perception Survey' has. Similar to a pseudo panel methodology, cohort IDs were assigned to track certain group of samples as shown in <Table III-7>. Each cohort ID (CID) tracks the individuals who falls into the 3-year interval cohort group over the survey years. In addition, a new CID was introduced every 4th year to include newly entered adults. Obviously, individuals with the same CID are not only different individuals each year, but also different across the years. However, considering the sample size and stratified sampling technique, individuals in a CID group are considered to represent the respective groups. The 3-year interval was selected by considering trade-off between bias and variance which is often considered in a conventional pseudo panel methodology. The number individuals in each CID should be large enough to secure representativeness. On the other hand, excessive size of cohort would decrease the number of CIDs which would incorporate imprecise estimation. The resulting number of observations per CID over the years is presented in <Table III-8>.

<Table III- 7> Cohort ID Assignment

2007

Age	19~21	22~24	25~27	....	64~66
PID	11	12	13	....	26

2008

Age	20~22	23~25	26~28	....	65~67
PID	11	12	13	....	26

↓

2010

Age	19~21	22~24	25~27	28~30	....	67~69
PID	10	11	12	13	....	26

<Table III- 8> Number of Samples by Cohort ID

CID	Birth Year	Observations	Percent
7	2000 ~ 1998	157	0.89
8	1997 ~ 1995	323	1.83
9	1994 ~ 1992	612	3.46
10	1991 ~ 1989	843	4.77
11	1988 ~ 1986	998	5.64
12	1985 ~ 1983	986	5.58
13	1982 ~ 1980	1,175	6.65
14	1979 ~ 1977	1,118	6.32
15	1976 ~ 1974	1,113	6.29
16	1973 ~ 1971	1,388	7.85
17	1970 ~ 1968	1,426	8.07
18	1967 ~ 1965	1,304	7.38
19	1964 ~ 1962	1,343	7.60
20	1961 ~ 1959	1,256	7.10
21	1958 ~ 1956	1,125	6.36
22	1955 ~ 1953	958	5.42
23	1952 ~ 1950	668	3.78
24	1949 ~ 1947	536	3.03
25	1946 ~ 1944	249	1.41
26	1943 ~ 1941	103	0.58
	Total	17,681	100

The CIDs were then divided into three subsamples by generations to conduct subsample analysis with the same empirical model as the baseline model. Each of the three subsamples represent age groups of 20-30s, 40-50s, and 60+ in year 2008. This model would test the statistical significance of low-skill occupation variable for each subsample. Results of the subsample estimations are presented in the following table.

<Table III- 9> CID Subsample Estimation Results

	(1)	(2)	(3)
CID	CID 11-17	CID 18-22	CID23+
Age in 2008	20-30s	40-50s	60+
Demographic Variables			
Age	0.0488***	0.0240***	0.00416
	(0.00543)	(0.00812)	(0.0109)
Gender	-0.373***	-0.486***	-0.597***
	(0.0610)	(0.0758)	(0.204)
Marital Status	-0.0779	-0.191	0.549
	(0.0775)	(0.208)	(0.382)
Household Income	-0.00336	0.00119	-0.00590
	(0.00239)	(0.00294)	(0.00770)
Level of Education	0.300***	0.241***	-0.0469
	(0.0593)	(0.0676)	(0.126)
Skill Proxy Variables			
Low-skill Occupation	-0.226***	-0.126	0.227
	(0.0630)	(0.0780)	(0.190)
Other Control Variables			
Mono-ethnicity	0.290***	0.342***	0.410**
	(0.0606)	(0.0738)	(0.188)
Multi-culture Tolerance	0.252***	0.322***	0.282***
	(0.0365)	(0.0470)	(0.101)
Political Orientation	-0.262***	-0.234***	0.0732
	(0.0433)	(0.0452)	(0.0966)
NK Policy Satisfaction	0.259***	0.303***	0.590***
	(0.0466)	(0.0565)	(0.153)
Crime Expectation	0.0913**	0.0843*	0.105
	(0.0412)	(0.0492)	(0.111)
Ideological Conf. Expectation	0.284***	0.178***	0.388***
	(0.0348)	(0.0411)	(0.110)
Observations	3,866	2,675	509
Year FE	YES	YES	YES
Region FE	YES	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

It is evident that coefficient of the low-skill occupation variable is negative and statistically significant only in column 1. This implies that the tendency for low-skilled individuals to form negative unification perception may only be applied to the younger generations. However, the concern still exists that the age effect within the subsamples are not completely eliminated. To mitigate the concern, age variable was interacted with low-skill occupation variable for each CID subsample which turned out to be not statistically significant as reported in <Table A-8> in the appendix.

The results thus far suggest the possibility that there exists generation effect in the susceptibility of economic competition when considering unification. The skill-proxy variable only turned out to be significant for the individuals who were born in 1970s and onward. This in part, confirms the arguments made by previous studies on changing unification perception of South Korea. The *economic competition theory* is one of the theories that reflects practical aspects of immigration, or unification in case of this study. Reported results of this study that younger generations may be relatively more susceptible to economic competition when considering unification is, in a sense, in line with the claimed argument that unification issue in South Korea is changing from ethnic issue to practical issues.

3.4 Limitations

Although the argument this study attempts to make is supported by empirical analyses, it should be interpreted with caution. First, the statistical significance of the skill-proxy variables does not assure that *economic competition theory* unequivocally holds in unification issue. There may as well be other channels through which individual skill affects unification perception. The reported results only suggest that one of those channels could be the *economic competition theory*. This is because skill level and education level of an individual does not directly

and solely measure individuals' concerns over expected economic competition after unification.

In line with the above discussion, unification issue in South Korea is a highly complicated one. Accordingly, there could be a diverse type of unification that each individual in South Korea imagines when they encounter the word 'unification'. This opens up possibility that there could be individuals who does not consider a complete economic integration of the two Koreas at least in the short-run, which this study implicitly assumes, when they imagine unification. There also could be individuals who thinks unification is not achievable at least in several decades. In these cases, those individuals would not consider economic factors at all. Admittedly, it is very difficult to control for all of the possible forms of unification to derive accurate empirical results.

4. Conclusion

Unification perception is an important issue since it could act as an internal constraint to the realization of unification. Recently however, a decreasing trend in unification perception among the South Koreans are observed, especially among the younger generations. One possible cause according to the previous studies is that the South Koreans are increasingly alienating the North Koreans. This implies that the unification issue in South Korea might increasingly resemble global issue of immigration. This changing perception on the North Koreans and unification might especially be salient among the younger generations.

This study has attempted to empirically test if *economic competition theory*, one of anti-immigration theories, could explain unification perception of the South Koreans. More importantly, existences of age effect and generation effect were tested to discover the differences in efficacy of the *economic competition theory* in

the process of forming unification perception across generations. The results suggest that there exists generational difference in susceptibility of skill level when considering unification. Individual's skill level turned out to be a statistically significant variable for unification perception among the younger generations, whereas for the older generations it did not.

The results suggest a possibility that the low-skilled individuals of the younger generations are especially susceptible to future economic competitions with low-skilled North Korean labor force after unification. This provides an empirical support for the argument of Campbell (2016) claiming that increased economic competitions and uncertainty might have encouraged the younger generation to be skeptical about unification.

Ever since the division of the peninsula, mono-ethnicity has been the single most important justification of unification in South Korea. However, there seems to exist possibility that the younger generations seem to increasingly consider more practical aspects of unification according to the results of this study. If this is true, it calls for a fundamental change in the context of discussions on unification to turn the increasing pessimistic perception of unification around.

Concluding Remarks

This dissertation has aimed to explore economic issues surrounding the Korean peninsula. First, issues on marketization of North Korea are explored from economic classes' perspective employing the 'North Korean Refugees Survey' of IPUS at Seoul National University. The last chapter has investigated how skill levels differentially affect unification perception across generations employing 'Unification Perception Survey' of the above institution. The following results and implications were derived.

The first chapter investigates the effect of bribe on informal income in North Korea. It provides empirical evidence that bribes in North Korea increases informal income. By 2-stage least square estimation, 1%p increase in bribe is estimated to increase informal income by 6.1% on average. In addition, IV quantile regression has estimated that the profitability of bribes increase as the informal income quantile increases. In other words, individuals who earns higher level of informal income have potentials to earn more in return for bribe than those who earns lower level of informal income.

The results imply that overall size of bribe in North Korea is likely to expand as IEA participants are well-incentivized to increase the bribe payments. This empirically supports the argument made by Kim (2010) where the corruption equilibrium between the dictator, the officials, and the IEA participants are a fragile one. The increase in the overall size of bribes would eventually misalign the interests between the dictator and the officials as they find it lucrative. The IEA participants on the other hand would continue giving bribes as long as it stays profitable. Moreover, the unequal return on bribes depending on the informal income level may have contributions to informal income inequality.

The second chapter intended to explore the changes in informal income

distributions during the time of market expansion. By relative distribution analysis and median relative polarization index estimation methodologies, increase in informal income polarization between the period 2011 to 2014 and 2015 to 2019 was observed. Moreover, increase in the polarization is found to be largely attributable to increase in the share of lower tail distribution. The results are robust to resampling technique and propensity score matching estimation which have dealt with the sample selection bias. The *negative selection theory* by Borjas (1987) also supports the suggested increase in informal income polarization of North Korea. The theory analyzes immigrants of the United States and argues that as the inequality level increases in home country relative to the hosting country, lower income earners have much more incentive to decide to emigrate than higher income earners. As fleeing from North to South can be considered as a special case of immigration, the theory is applicable to the result of this study. The overwhelming contribution of increase in lower informal income earners to overall increase in polarization observed in the analyses may be in line with the *negative selection theory* which lends support to the argument that the level of informal income inequality has increased in North Korea.

The suggested increase in informal income inequality has policy implications. It may eventually put pressure on the institutionalization of the markets as increase in inequality can not only be a political burden for the regime but also can undermine the sustainability of marketization which has been the main engine for growth of the North Korean economy.

The last chapter has addressed the pessimistic unification perception of the South Koreans. Recent survey statistics on the unification perception report a decreasing trend of unification necessity. According to various previous studies, the decreasing trend is salient among the younger generations, and is attributable to increasing alienation of the North Koreans. This study has attempted to

empirically verify if the younger generations do evaluate economic factors especially sensitively when considering the unification. More specifically, it intends to find evidence that the *economic competition theory*, one of established anti-immigration sentiment theories, is a valid determinant of unification perception. The theory states that low-skilled individuals are more likely to harbor negative attitudes toward immigration over the concerns of potential competition with low-skilled immigrants.

Through various regressions incorporating skill level proxies, this study finds that there exists generation effect on the tendency of low-skilled individuals having negative unification perception. In other words, the younger generations saliently consider their skill levels more when considering the unification as opposed to the older generations, among which the skill levels did not turn out to be a significant factor. This suggests that the *economic competition theory* might be at work only for the younger generations.

This result supports the argument of Campbell (2016) that there exists a generational difference in considering unification where increased economic competitions and uncertainty might have encouraged the younger generations to be pessimistic about unification. The results also suggest that there should be a change in the context in which the unification is discussed in the society from a traditional justification of mono-ethnicity, to discussing more practical issues of unification such as individual and national economic costs and benefits.

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Appendix

<Table A- 1> Mean Bribe Share by Type of Occupation

Most Profitable Job	Mean Bribe (%)	Std. dev.	Freq.
Retail Sales	26.030	15.036	199
Individual Miscellaneous	29.394	17.310	33
Individual Manufacturing	29.000	16.827	20
Restaurants, Shops	29.412	14.778	17
Wholesale	26.724	15.253	116
Foreign Currency (Trade)	30.333	16.452	90
Financials	32.162	15.659	37
Part-time Works	27.059	18.793	51
Deployed Worker	36.250	19.955	8
Others	32.519	16.531	216
Total	**28.653**	**16.282**	**787**

*Note: Observations which did not have entry for any of the above options and response errors are excluded from the statistics. Observations with 0 bribe share is also excluded.

<Table A- 2> Mean Bribe Share by Place of Living

Region	Mean Bribe Share (%)	Std. dev.	Freq.
Pyeongyang	28.57	16.104	14
Nampo	30.00	21.213	5
Kaesong	35.00	21.213	2
S. Pyongan Prov.	20.00	13.009	14
N. Pyongan Prov.	34.38	18.246	16
S. Hamgyong Prov.	23.27	14.633	49
N. Hamgyong Prov.	27.43	16.176	288
Jagang Prov.	10.00	0.000	1
Ryanggang Prov.	29.48	16.317	464
S. Hwanghae Prov.	30.00	18.516	8
N. Hwanghae Prov.	25.00	12.693	10
Gangwon Prov.	35.00	14.337	10
Total	**28.400**	**16.231**	**881**

*Note: Observations which did not have entry for any of the above options and response errors are excluded from the statistics. Observations with 0 bribe share is also excluded.

<Table A- 3> Mean Informal Income by Bribe Share

% Bribe	Mean Informal Income	Std. dev.	Freq.
10	522,905	826,898	229
20	638,839	1,219,865	201
30	532,691	783,565	197
40	824,888	1,269,142	92
50	619,788	1,006,592	68
50+	844,323	1,532,486	96
Total	**625,348**	**1,077,401**	**883**

*Note: Observations which reported 0 for either the informal income or the bribe share are excluded from the statistics.

<Table A- 4> Additional IV Estimation Results

Stage	(1) First Stage	(2) Second Stage
Dependent Variables	bribe	log of informal income
Demographic Controls		
Age	0.0284	-0.0110**
	(0.0610)	(0.0056)
Gender (Female=1)	-2.6783*	-0.1270
	(1.5502)	(0.1497)
Education: (Secondary=1)	0.9601	0.0608
	(1.6464)	(0.1486)
Education: (Tertiary=1)	-1.8554	-0.1292
	(2.2144)	(0.1993)
Party Membership (Member=1)	-1.1971	0.0448
	(2.0891)	(0.1828)
Other Controls		
log of formal income	-0.4761	0.0116
	(0.1714)	(0.0192)
small-scale business	3.3298**	-0.2478
	(1.6893)	(0.1754)
large-scale business	-1.8138	0.0196
	(1.8790)	(0.1677)
foreign-related business	1.9209	-0.2695
	(2.3593)	(0.2079)
Bribe Share and Instrumental Variable		
inspec2	5.8132***	
	(1.3861)	
bribe		0.0626**
		(0.0211)
Constant	31.6752	11.9299***
	(7.2784)	(1.1303)
Observations	630	630
adj. R-squared	0.0667	-
Year FE	YES	YES
Region FE	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)
*Note: Small-scale business refers to retail sales, individual services, individual manufacturing, and part-time jobs. Large-scale business refers to wholesale business, and management of other types of stores. Foreign-related business captures foreign currency earning occupation, and deployed workers. High-paying official occupation dummy captures military member, office clerks, and experts (teachers/professors, doctors, other high-skilled occupation).

<Table A- 5> Post Estimation Results of Additional IV Estimation

Tests of endogeneity

H0: Variables are exogenous

Durbin score chi2(1)	=	13.3637	(p = 0.0003)
Wu-Hausman F(1,600)	=	13.0032	(p = 0.0003)

First-stage regression summary statistics

Variable	R-sq.	Adj. R-sq.	Partial R-sq.	F(1,601)	Prob > F
bribe	0.1082	0.0667	0.0303	18.8089	0.0000

<Table A- 6> Recoded Variables

Income

Household Income	Before	After
Less than 49	1	25
50~99	2	75
100~149	3	125
150~199	4	175
200~249	5	225
250~299	6	275
300~349	7	325
350~399	8	375
400~499	9	450
500~599	10	550
600~699	11	650
700+	12	750

Low skill dummy variable

Occupation	Before	After
Agriculture/Fishery	1	0
Entrepreneur	2	0
Sales	3	1
Special Manufacturing	4	1
General Manufacturing	5	1
Office Clerk	6	0
Management	7	0
Expert/Freelance	8	0
Housewife	9	Omitted
Student	10	Omitted
Armed Forces/Police	11	0
Retired/Unemployed	12	Omitted
Others	13	0

Mono-ethnicity

Reason for Unification	Before	After
Mono-ethnicity	1	1
For separated families	2	0
To lower the possibilities of War	3	0
For North Korean people	4	0
For South Korean economy to thrive	5	0
Others	6	0

<Table A- 7> Marginal Effects of Skill-proxy Variables

Level of Education

Options	dy/dx	Std. Error	z	95% Conf. Int.	
V. Unnec	-0.0091	0.0011	-8.04	-0.0113	-0.0069
Unnec	-0.0331	0.0039	-8.43	-0.0408	-0.0254
Neutral	-0.0232	0.0028	-8.19	-0.0287	-0.0176
Nec	0.0245	0.0030	8.25	0.0187	0.0303
V. Nec	0.0409	0.0049	8.40	0.0313	0.0504

Low-skill Occupation

Options	dy/dx	Std. Error	z	95% Conf. Int.	
V. Unnec	0.0068	0.0014	4.98	0.0041	0.0095
Unnec	0.0238	0.0047	5.04	0.0146	0.0331
Neutral	0.0177	0.0035	5.00	0.0108	0.0247
Nec	-0.0169	0.0034	-4.99	-0.0235	-0.0103
V. Nec	-0.0315	0.0062	-5.05	-0.0437	-0.0193

*Note: The marginal effects of each category of the dependent variables are estimated at the means of covariates.

<Table A- 8> CID Subsample Estimation Results (Age Interaction Model)

	(1)	(2)	(3)
PID	PID 11-17	PID 18-22	PID23+
Age in 2008	2030	4050	60+
Demographic Variables			
Age	0.0479***	0.0176*	-0.00360
	(0.00632)	(0.00997)	(0.0190)
Gender	-0.374***	-0.485***	-0.604***
	(0.0611)	(0.0758)	(0.205)
Marital Status	-0.0786	-0.181	0.539
	(0.0775)	(0.209)	(0.381)
Household Income	-0.00335	0.00122	-0.00585
	(0.00239)	(0.00294)	(0.00768)
Level of Education	0.300***	0.240***	-0.0530
	(0.0593)	(0.0675)	(0.128)
Low-skill Occupation			
Low-skill Occupation	-0.315	-1.117	-0.470
	(0.364)	(0.885)	(1.313)
Low-skill x Age	0.00231	0.0179	0.0108
	(0.00926)	(0.0158)	(0.0199)
Other Control Variables			
Mono-ethnicity	0.290***	0.344***	0.404**
	(0.0606)	(0.0738)	(0.188)
Multi-culture Tolerance	0.252***	0.322***	0.285***
	(0.0365)	(0.0469)	(0.101)
Political Orientation	-0.262***	-0.233***	0.0714
	(0.0433)	(0.0452)	(0.0967)
NK Policy Satisfaction	0.260***	0.302***	0.585***
	(0.0466)	(0.0566)	(0.153)
Crime Expectation	0.0912**	0.0842*	0.104
	(0.0412)	(0.0493)	(0.111)
Ideological Conf. Expectation	0.285***	0.177***	0.390***
	(0.0348)	(0.0412)	(0.110)
Composite Index	0.00204	-0.000633	-0.00902*
	(0.00161)	(0.00211)	(0.00472)
Observations	3,866	2,675	509
Year FE	NO	NO	NO
Region FE	YES	YES	YES

*Robust standard errors in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

국문초록

북한의 경제계층과 한국민의 통일의식에 관한 연구

시장화는 최근 북한 경제 관련 연구에서 가장 활발히 논의되고 있는 주제 중 하나이다. 1990년대의 '고난의 행군' 이후 시장화는 북한 일반주민들의 가장 중요한 소득원으로 자리잡고 있으며, 국가경제 차원에서도 경제성장에 가장 큰 동력으로 자리잡고 있을 것으로 추정된다. 또 북한의 시장화 규모는 이전 사회주의국가들에 비교해 보아도 그 규모와 비중이 유례없이 큰 것으로 추정되고 있다.

이러한 북한 시장화의 독특함과 규모를 반영하여 그 동안 북한 시장화에 대한 많은 선행연구들이 진행되었다. 관련 연구들은 북한 시장화에 대하여 주로 규모 추정, 비교분석, 시장화 확대의 결정요소, 그리고 북한의 경제성장에 대한 기여 등을 분석하여 왔다.

하지만 시장화와 동반하여 생겨난 여러 경제적 요인들이 실제 북한 주민들의 삶에 어떠한 영향을 미쳤는지에 대한 정량적, 실증적 연구는 관련 자료 부족으로 인해 아직 많이 이루어지지 않고 있다. 이 논문은 이러한 자료부족에 대한 어려움을 극복하기 위하여 서울대 통일평화연구원에서 매년 발표되고 있는 '북한이탈주민 의식조사' 자료를 활용하여 다음 두 가지의 연구를 수행한다.

첫 번째 장에서는 북한의 뇌물이 시장소득으로 대표되는 비공식소득에 미치는 영향에 대하여 알아본다. 도구변수(Instrumental Variable)를 활용한 2SLS 추정 결과 뇌물은 비공식소득을 증가시키는 경향이 있는 것

으로 나타났다. 추가로 진행된 도구변수 분위수 회귀분석(IV quantile regression) 결과 뇌물의 수익성은 비공식소득 분위가 높을수록 높은 것으로 추정되었다. 이러한 추정결과는 Kim (2010) 연구가 주장하는 북한의 부패 균형(corruption equilibrium)의 취약성(fragility)을 실증적으로 뒷받침한다고 할 수 있다. 또한 뇌물의 비공식소득 수준에 따른 차별적 수익성은 북한 주민 수입의 대부분을 차지하고 있는 비공식소득의 불평등에 기여하고 있을 것으로 추정된다.

두 번째 장은 앞선 분석과 같은 자료를 활용하여 북한의 비공식소득에 대한 분포분석을 진행한다. '상대분포분석(relative distribution analysis)' 방법과 '중위상대양극화 지수(median relative polarization index)' 방법을 통하여 시장화 확대 기간 동안 북한의 비공식소득이 더욱 양극화되었음을 보인다. 또한 이러한 양극화의 대부분은 상위 소득 분포의 상대적 비중 증가보다는 하위 소득 분포의 상대적 비중 증가에 기인하는 것으로 파악되었다. 이러한 결과는 이번 설문조사 자료가 내포하고 있는 표본선택편향(sample selection bias)에 대응하기 위한 표본의 '재추출(resampling)' 처리와 '성향점수매칭(propensity score matching)' 방법론 적용 이후에도 강건한 것으로 나타났다. 북한의 비공식소득의 양극화 확대는 장기적으로 시장의 제도권 편입에 대한 압력 요인으로 작용할 수 있음을 시사한다.

마지막으로 이 논문은 한국인의 통일의식에 대한 분석을 진행한다. 최근 한국인의 통일의식에 대한 통계자료에 의하면 통일에 대한 부정적 인식이 늘어나고 있는 추세에 있는 것으로 나타난다. 통일의식과 민족의식에 대한 선행 연구들은 이러한 부정적 통일의식 확산의 원인을 주로 북한주민들에 대한 '타자화', 그리고 늘어나는 젊은세대의 부정적 통일의식에서 찾고

있다.

또한 최근 일부 연구들은 북한주민들에 대한 타자화로 한국사회에서의 통일문제가 점차 일반적인 이민문제화 되고 있음을 주장한다. 이러한 측면에서 이 연구는 일반적인 '반이민정서 이론(anti-immigration sentiment theories)' 중 하나인 '경제적 경쟁 모형(economic competition theory)'을 주요 분석대상으로 설정한다. '경제적 경쟁 모형'은 저숙련 노동자의 경우 향후 기대되는 저숙련 이민자와의 노동시장 경쟁에 대한 우려로 이민에 대하여 비교적 부정적 태도를 취할 가능성이 높음을 설명하는 모형이다.

이 연구는 위 모형이 한국인의 통일의식에도 유의한 영향을 미치는지 살펴보고, 특히 기성세대 대비 젊은세대에서 더 유효하게 작용하고 있는지에 대한 실증분석을 진행한다. 실증분석 결과 저숙련 집단일수록 통일에 대한 필요성 인식이 상대적으로 낮은 것으로 추정되었으며, 이러한 경향에는 '세대효과'가 존재하는 것으로 나타났다. 즉, 젊은세대의 경우에는 통일의식 형성에 자신의 숙련도가 유효한 변수인 것으로 추정된 반면, 기성세대의 경우에는 유효하지 않은 변수인 것으로 추정되었다. 이러한 결과는 젊은세대 일수록 통일을 보다 실질적인 측면에서 바라보고 있을 가능성을 제기한다. 또한, 이는 우리사회에서 논의되고 있는 통일에 대한 담론이 기존의 전통적인 '한민족 통일'에 대한 것에서 경제적 비용과 편익 등 통일의 보다 실질적인 측면에 대한 것으로 변화해야 함을 시사한다.

주요어: 북한경제, 시장화, 비공식소득, 뇌물, 통일, 통일의식
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