A Study on Global Investors' Criteria for Investment in the Local Currency Bond Markets Using AHP Methods: The Case of the Republic of Korea

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Abstract: Global investors' investment in local currency bonds, especially Korea Treasury Bonds, has increased significantly since the mid-2000s, and their influence on bonds and financial markets has grown consistently. In this paper, we investigate global investor's priority of decision factors in investing in Korea Treasury Bonds by distributing a pairwise comparative survey to experts and analyzing the results using the analytical hierarchy process technique. For analysis, we created model frames with experts in the field of investment based on literature analysis, selected survey participants by considering their institution of their employment, work experience and region, and obtained responses. We find that investors with short-term investment propensities are more sensitive to international and domestic factors and less to risk factors, and more heavily influenced by U.S. dollar funding conditions. On the other hand, investors with long-term investment tendencies are found to be more sensitive to international and risk factors as opposed to domestic factors, and influenced by: global policy rate decisions and fiscal soundness, sovereign credit rating, possible global economic recession, and geographical risks. Our findings not only contribute to enhancing investors' understanding of the Korean bond market by discussing consensus among investors, but also provide policy implications for Korean government policymakers who need stable and sustained funding.

Keywords: local currency bond markets; Korea Treasury Bonds (KTBs); global investor's consensus; investment decision; financing risk management; analytical hierarchy process (AHP)

1. Introduction

This study aims to identify the decision factors that affect investments in local currency (LCY) bonds, and more specifically, the factors that global portfolio investors consider in investing in Korea Treasury bonds (KTBs), and provide implications for the Korean government to proactively manage financing risks and raise funds in a sustainable manner.

Since the Asian financial crisis of the late 1990s, global investors' investments in emerging economies have increased dramatically and their influence in the financial markets has expanded (Lavigne et al. 2014). This contributed greatly to reducing the currency imbalance between emerging economies' assets and debt and increasing the maturity of national debt, which eventually provided stable financing to the market and increased the efficiency of capital allocation (Peiris 2010; Kim and Jung 2015). However, it has been found that global investors' investment in LCY bonds during the global financial crisis could have a negative impact on the domestic economy (Christensen et al. 2019). This was because global investments in LCY bonds at that time were

excessively concentrated in short-term profits, making them highly vulnerable to market shocks. In fact, as market volatility increased during the global financial crisis, the outflow of global investment funds in a short period of time unnerved most emerging countries' financial markets and economy (Asian Development Bank 2018).

Therefore, the purpose of this study is to analyzes the factors that investors consider in deciding whether to invest in KTBs in order to identify the paths and patterns of global investors and to recommend how to proactively prepare for sudden capital outflow.

Development of the Republic of Korea (ROK)'s LCY bond market is remarkable. The size of LCY the bond market in the ROK has grown tremendously over the past two decades, with its outstanding balance rising from KRW 85.8 trillion as of the end of 1998 to KRW 1724 trillion as of the end of 2018. The proportion of Korean LCY bonds held by global investors has increased from 0.6 percent (KRW 4.6 trillion) in 2006 to 6.6 percent (KRW 113.8 trillion) in 2018, and the number of countries investing in the Korean LCY bond market has also increased from 19 in 2006 to 47 in 2018 (Ministry of Economy and Finance 2019).

As shown in Table 1, global investors' investments in Korean LCY bonds mostly consist of KTBs, and Monetary Stabilization Bonds (MSBs) issued by central bank of Korea (BOK). As of the end of 2018, KTBs and MSBs accounted for 75.8% and 23.0% of global investors' total LCY bond investments in Korea, respectively.

Table 1. The status of global investors' LCY bond investments.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total *	57.5	74.2	83.0	91.0	94.7	100.4	101.4	89.3	98.5	113.8
(% **)	5.6	6.6	6.9	7.0	6.8	6.9	6.5	5.6	5.9	6.6
KTBs *	28.7	47.7	60.9	56.9	58.3	65.9	67.9	72.5	77.8	86.3
(% **)	9.8	15.4	17.9	15.7	14.5	15.0	13.8	14.0	14.2	15.2
MSBs *	28.1	25.4	20	31.6	34.4	33.2	32.7	15.5	19.5	26.2
(% **)	18.3	15.5	11.9	19.4	20.8	18.7	17.9	9.2	11.4	1.3

Notes: * Amount held by global investors (unit: in trillion KRW); ** The share of global investors' bonds holding against total listed LCY bonds in Korea. Source: Ministry of Economy and Finance (MoEF).

ROK's LCY bond market is one of the most attractive markets for global investors. The size of the LCY bond market in the ROK is the world's fourth-largest, with LCY bond liquidity at the world's highest level and the country's sovereign rating at a stable level. In addition, various derivative markets for risk hedging are well developed (Asian Development Bank 2018). However, recent economic and political situations are not favorable for the Korean bond market. Concerns over trade disputes between the U.S. and China are growing, economic indicators in the ROK have worsened recently, and financial market volatility has been growing (Asian Development Bank 2019). For emerging economies that are relatively vulnerable to market volatility, it is important to be proactive against these potential risks.

With regards to methodology, we use analytic hierarchy process (AHP) techniques to prioritize the factors that influence global investors' decisions to invest in KTBs. The AHP method has been very limited so far in financial market research, and this is the first time that this methodology is being used in research on the Korean financial market. To achieve the purpose of this study, a literature review based on previous studies and in-depth interviews with experts were conducted, and AHP analysis was conducted using the pairwise comparative survey of experts with extensive investment experience in various institutions and regions.

So far, most previous studies have provided fragmentary analysis of whether certain variables influence global investors' decision to invest in KTBs by analyzing arbitrary financial and economic variables. As the result, the implications provided by these studies were limited, as they do not fully reflect the various investment decision factors of global investors, such as political risk, regulatory changes, market uncertainty, property rights, and so on. This study aims to provide policy implications

by considering a large number of variables that can affect global investors' decision-making and by surveying experts with extensive experience in investing in the Korean bond market and conducting empirical analyses based on them. This is significant in that it provides strategic insights for preemptive response to future financial crises.

The remainder of the paper is organized as follows: Section 2 provides a review of the literature. Section 3 states the framework of the methodology, and Section 4 describes the hierarchical structure. Section 5 reports the results of analysis and Section 6 concludes with implications.

2. Literature Review

To date, research on global investors' investment in Korean LCY bonds has been conducted to a limited extent. Previous studies identified arbitrage trading opportunities in the Korean bond market as one of the major reason for global investors' investment, and analyzed the impact of changes in financial market prices, such as credit default swap, interest rate and foreign exchange rate, on global investors' investment in Korean LCY bonds. However, these analyses tend to overlook factors that could seriously affect global investors' investment, such as changes in the market environment, political instability, policy uncertainty, and changes in rules and regulations.

While investments in commercial banks and private funds, which are sensitive to short-term profits, have declined in recent years, bond investments by global pension funds and central banks with long-term investment tendencies have increased significantly. Therefore, the main challenge of this study is to identify the more diverse investment goals of global investors and analyze the determinants of LCY bond investments. In this section, we provide a detailed review of the existing literature, as it is important to review each of the factors investigated in previous literature to enhance the objectivity of this study and to perform comprehensive analysis.

Exchange rate (FX) fluctuations have a direct impact on international trade as well as on cross-border financial investments. Theoretical analysis of the effects of FX volatility on international investment began in the late 1980s. Several studies of advanced and emerging countries have demonstrated that increased FX volatility has a negative impact on financial investment between countries, and that the stock, bond, commodity and FX markets are closely related to each other (Gyntelberg et al. 2014; Mun 2007; Burger and Warnock 2007). On the other hand, Kim (2012) analyzed that FX rate fluctuations do not have a significant impact on bond investments, but have a negative impact on the stock market.

Previous studies have shown that central banks' rate policies, especially the Fed's policy rate decision, have a significant impact on the bond and stock markets. Several studies examined the impact of policy rate decisions on market liquidity (Christiano and Eichenbaum 1992; Leeper and Gordon 1992). Additionally, some have studied the transmission path of central bank's interest rate policy (Bernanke and Blinder 1992; Gordon and Leeper 1994; Strongin 1995; Christiano et al. 1996). Kontonikas and Zekaite (2018) analyzed that the stock market showed greater gains when eased policy rates coincided with a recession, and when there is a bearish market with tightened credit conditions. The Fed's policy rate's impact on the Korean financial markets were also analyzed. Park and Kim (2013) concluded that the U.S. Fed's policy rate decision after the global financial crisis had a significant impact on the price of KTBs and market synchronization. Jang and Atukeren (2019) recently argued that rising bond yields may have a short-term negative impact to investors but a positive impact in the mid- to long-term.

Estrella and Mishkin (1995) argued that the yield curve slope is a useful predictor of recession and found that short-term and long-term interest rates reversed during the U.S. recession. Bordo (2008) argued that the yield curve helps predict actual economic growth and that using both the level and the slope of the curve improves the predictability.

A cross-currency basis swap spread is a liquidity premium for other currencies added to one sector of the swap, which has a significant impact on cross-border investments. In the mid-2000s, widening of the KRW basis swap spread was a major motivation for global investors to sharply increase their investment in KTBs. Many studies explained the spread of cross-currency basis swap spread through the

theory of interest rate parity (Popper 1993; Takezawa 1995; Du et al. 2018). Miron and Swannell (1991) argued that capital market imbalances could temporarily push the underlying spread out of range of reasonable prices, but quickly recover from market participants' arbitrage trading. However, Shapiro (2006) argued that excessive government intervention and regulation in the capital market could weaken the market's price-recovery capability and maintain an abnormal spread.

The TED spread refers to the difference in interest rates between the three-month Treasury bill and the three-month London Interbank Offered Rate (LIBOR). Because the U.S. Treasury Bill is a risk-free asset and US LIBOR includes bank credit risk that occurs when the International Bank borrows money, expansion of the TED spread is regarded as an increase in the risk of default on interbank loans. When global liquidity dried up during the 2007–2009 financial crisis, the TED spread reached 450 basis points. Kawaller (1997) argued that reduction of the TED spread raises asset prices, including stocks and bonds, and that the TED spread provides information to predict future interest rates.

Several studies have shown that there is a reverse correlation between the bond market and the stock market (Baele et al. 2010; Connolly et al. 2005; Bekaert et al. 2009). Campbell et al. (2013) argued that bonds could be a hedging instrument for equity that holds risk. Antonakakis et al. (2013) argued that market uncertainty is more important than fundamentals in causing volatility in stock prices, volatility in bond yields, and covariance. Lee (2002) reported that stocks and bonds were highly correlated before the Asian financial crisis, and afterwards, there was a greater correlation between the foreign exchange market and stock market volatility.

Credit default swap (CDS) is a financial derivative or contract that allows the counterparty to exchange or offset credit risk and is used as a measure of credit risk in the financial markets. Since JP Morgan started trading it in the late 90s, CDS has been studied for price models by several researchers including Hull et al. (2004) and Houweling and Vorst (2005). CDS has become a very popular way to manage credit risk. The Office of the Comptroller of the Currency (OCC) stated in a June 2018 report that the total credit derivatives market size was US$ 4.2 trillion, of which the CDS market accounted for the largest portion with US$ 3.68 trillion. Duffie (1998) argued that CDS premium and corporate bond spreads should theoretically be the same. Kim et al. (2013) said that there is a long-term correlation between CDS and bond spreads in emerging countries, while Hong (2011) argued that there is a strong correlation between CDS and FX rates in emerging countries.

Volatility in the financial market leads to less stability and efficiency in the market, which leads to worse performances by financial institutions and weakening of the effects of government's monetary policies. It also increases market uncertainty, which leads to higher market risk premium and results in a contraction of economic activity. The Chicago Board Options Exchange (CBOE) Volatility Index (VIX) is a common indicator of stock market expectations of variability implied by the S&P 500 index option. It is calculated and distributed in real time by the CBOE and is commonly referred to as the fear index or the fear gauge. There are several previous studies on market volatility. Hamilton (2003) pointed out that the volatile relationship between the oil and stock markets is highly correlated because volatility in the oil market reflects uncertainty in economic growth. Zhang and Wei (2010) argued that there is a significant causal link between volatilities in oil and gold.

There are studies that examined the impact of a country's macroeconomic indicators and fiscal soundness on investment. Bjornland and Lietemo (2009) confirmed that there is a very high correlation between the U.S.'s monetary policy and the return on investments in S&P 500. Mahmood and Dinniah (2009) looked at the relationship between the CPI, industrial production index, FX, interest rate and stock price in the six Asian countries (Malaysia, Korea, Thailand, Hong Kong, Japan and Australia) and found that macroeconomic factors and stock prices had a long-term correlation. Ang and Piazzesi (2003); Diebolda et al. (2006); Wright and Zhou (2009) argued that increased industrial output and inflation had a positive impact on bond risk premiums.

So far, there are different views on the impact that a country's fiscal deficit, government debt and economic growth have on investment. The prevailing view is that high fiscal deficit and government debt could cause high inflation, raise long-term interest rates and lead to more tax collection, which

would negatively affect economic growth. In extreme cases, it can lead to a financial crisis in the country. On the other hand, if a nation's fiscal expansion and inflow of foreign capital are used for productive investments, it can have a positive impact on economic growth in resource-poor and undeveloped countries. However, excessive capital inflows from abroad can lead to macroeconomic imbalances, such as an oversupply of total demand, overheating of the economy, inflation, rising real foreign exchange rates and worsening current account conditions. From a global investor's perspective, the level of foreign exchange reserves in a country can be an indicator of safety of an investment country. Emerging economies, which suffered from the financial crisis in the late 1990s, have significantly increased their foreign reserves since then, creating a safety net for the financial market. Aizenman and Lee (2007) argued that countries with large foreign reserves and stable foreign exchange rates could reduce potential losses to their economies in times of crisis.

It is difficult to quantify and analyze the effectiveness of certain political events. However, Nordhaus (1975) and MacRae (1977) tried to analyze the relationship between economic performance and political events. Since then, Herbst and Slinkman (1984) found a correlation between the presidential race and the primary cycle. Le and Zak (2006) argued that economic risks, policy changes and most importantly, political instability are closely correlated with capital outflows. Bilson et al. (2002) found that emerging countries with low political risk had approximately 11 percent higher returns than countries with higher political risk.

The Korean Peninsula has one of the highest geopolitical uncertainties in the world, and the potential danger of conflict still exists. In addition, geopolitical tensions between the two Koreas are a risk that investors should always pay attention to, but there is a lack of in-depth research in this topic. Ahn et al. (2010) and Kim (2011) analyzed stock price changes of inter-Korean news, and found that global investors were not sensitive to changes in inter-Korean relations. Jang and Atukeren (2019) also found that geopolitical risks on the Korean Peninsula affected global investors' investment in government bonds, but only in the short-term.

Uncertainty in the government's economic policy is another important factor that affects economic and investment decisions. Pastor and Veronesi (2012) argued that uncertainty in the U.S.'s economic policies is a risk factor that could affect stock volatility and future corporate profits. Bloom (2014); Basu and Bundick (2017) pointed out that economic policy uncertainties lead to a delay in corporate decision-making, decrease in corporate investments, and household spending, and rise in savings, which negatively affects the domestic economy. Jang and Atukeren (2019), however, claimed that economic policy uncertainties does not have a statistically significant impact on global investors' investment in KTBs.

With regards to methodology, research on financial markets using the AHP method has been rare to date. Bahmani et al. (1987) used the AHP model to analyze the priority of factors that affect global investors' investment decisions, taking into account factors such as the characteristics of the investor, nature of the investment, and alternatives to the investment. Characteristics of the investor consisted of variables such as the investor's wealth, experience, age, and utility functions. Analysis of the nature of the investment included analysis of data related to liquidity, taxation, minimum requirements, transaction costs and rate of return. Cheung and Liao (2009) used the AHP analysis method to evaluate and select a stock portfolio. They classified the criteria for stock selection into six categories: image, indicators, earnings, performance, risk, and account, and concluded that the investment's performance had the most weight amongst them. In a multi-dimensional decision-making study on corporate bond investments, Liao and Cheung (2012) analyzed investments using data on five categories: performance indicators, interest risk, credit risk, inflation risk, and liquidity.

3. Methodology

The AHP is a multiple criteria decision-making technique based on a hierarchical structure that uses eigen values and eigen vector methods to determine the relative weights of criteria and alternatives. The AHP method is a measurement that relies heavily on expert judgment to derive priority scales

(Saaty et al. 1980), helps organize problems hierarchically and make decisions based on multiple criteria through quantitative and qualitative analysis (Steiguer et al. 2003).

3.1. Decision Framework

3.1.1. Application of the AHP Method

In this paper, the analysis is performed with a five-step framework as shown in Figure 1. The following are the steps of its application:

Step 1: Identify the determinants of the investors' investment decisions through literature research and point out limitations and problems of existing studies. This was completed in the literature review section of this paper.
Step 2: By analyzing the results of the literature research and conducting expert interviews and brainstorming sessions, construct a hierarchical structure of decision-making factors.
Step 3: Design the questionnaire for pairwise comparison, distribute it to experts, and gather results.
Step 4: Check for consistency.
Step 5: Evaluate it and prioritize the factors.
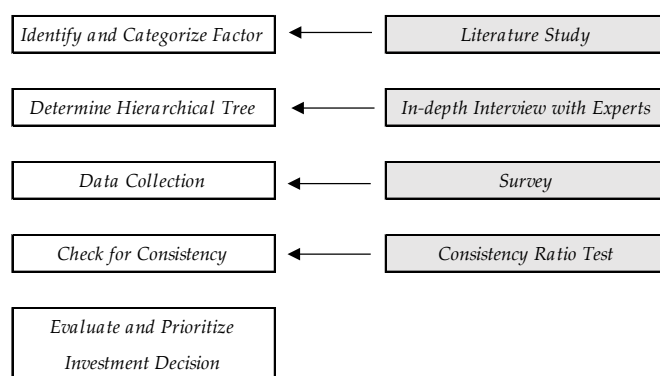
Figure 1. Flow diagram of the decision factor framework.

3.1.2. Derivation of Components

The most important feature of the AHP analysis method is to derive the relative importance of the components through layer-by-layer component separation. This is done by separating the various evaluation elements that make up the problem into more detailed elements (Triantaphyllou 2000).

With componentization completed, the AHP can now be used to construct a multi-dimensional decision-making framework that can identify factors that affect global investors' investments in government bonds. In the literature review section, we looked at the factors that affect global investors' decisions on cross-border investments, including KTBs, and extracted them into 8 factors and 42 sub-factors. This is summarized in Table 2.

Table 2. Factors affecting cross-border investment investigated in existing literature.

Factor	Sub-Factor
Interest Rate	Policy Rate, Short term Interest Rate (KRW Call and US$ LIBOR), KTB (or MSB) Yields, U.S. Treasury Yields, Turnover Ratio, Bid-Ask Spread, EMBI (Emerging Market Bond Index)
Spread and Curve	KTB (or MSB) TED CCIRS Spread, Basis Swap, US$ TED, Yield Curve Scope
FX	FX Spot (and Dollar Index), FX Swap, FX Volatility
Stock	KOSPI, Dow, S&P 200, MSCI G7, MSCI World, VIX
CDS	ROKCDS, CDX, PIIGS CDS
Oil	Crude Oil

Factor	Sub-Factor
Macroeconomic Indicators	CPI, M2, GDP, Current Account, CLI
Others	Credit Rating, Sovereign Debt, Fiscal Deficit, Foreign Reserve, Property Rights, Settlement System, Market Transparency, Political Events, Geopolitical Risk, Policy Uncertainty, Regulation, Taxation

4. Composition of Hierarchical Structure

To determine the weight of each item, the assessment criteria was set up through expert interviews and brainstorming, and the survey was conducted.

4.1. Developing the Assessment Criteria

We conducted in-depth interviews and brainstorming sessions with experts on two occasions, 17 June 2019 and 26 June 2019. A total of five experts participated in the in-depth interviews and brainstorming sessions, each with more than 30 years of experience in making an investment decision or policy decisions with regards to KTBs. At time of writing, they work for the central bank of Korea, an investment bank, an insurance company, and trust and asset management companies.

In the first session, we presented the panel with the individual factors obtaining from existing literature along with the purpose of this study. Through a three-hour brainstorming session, the panels decided to adopt the framework presented by Jang and Atukeren (2019), which has three factors: domestic, international, and risk. Further, the appropriate sub-criteria for each factor was also discussed. The four sub-criteria for domestic factors were: KTB yield, KTB TED, ROK CDS, and KRW FX. For international factors, three sub-criteria were discussed: US Treasury yield curve slope, US$ TED, and policy rate. Finally, there were seven sub-criteria for the risk category: policy uncertainty, geopolitical risk, fiscal soundness, credit rating, regulation, operational risk, and compliance risk.

In the second session, the panel had a two-hour open discussion to finalize the assessment criteria. The panel decided to add market liquidity (bid-offer spread) to the domestic factors, fear gauge (VIX) and global stock price indices to the international factors and tax and property rights to the risk factors. The panel also decided to eliminate compliance risk and operational risk as sub-criteria, as they were deemed to be insignificant and a duplicate of other factors being considered.

As a result, the three-stage working framework for AHP analysis was determined as shown in Figure 2. It consists of domestic, international and risk criteria, with five sub-criteria for each criterion.
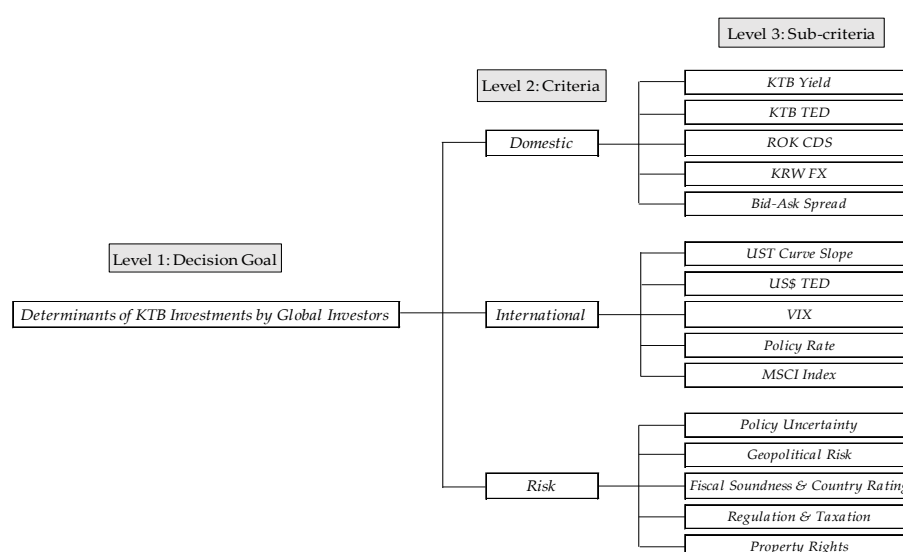
Figure 2. Hierarchical structure and composition of evaluation criteria.

The description of each criteria is shown in Table 3.

Table 3. Description by factor.

Criteria	Sub-Criteria	Description
Domestic Factors	KTBs Yield	The KTB Yield is the benchmark return on the Korean LCY bond market.
	KTB TED CCIRS Spread	The KTB TED spread is the interest rate difference between the KTB and the KRW/US$ cross currency interest rate swap, which is the KTB risk-free arbitrage spread, excluding sovereign default risks.
	ROK CDS	The ROK CDS is the Republic of Korea' Credit Default Swap that can transfer Korea's sovereign risk exposure to others.
	KRW FX	The KRW FX is KRW against US$ FX rate.
	Bid–Ask Spread	The bid-ask spread is market liquidity in the price dimension.
International Factors	UST Yield Curve Slope	The UST yield curve slope is the rate difference between long-term and short-term bonds, and an inverted yield curve is often considered a bad sign for the economy.
	US$ TED	The US$ TED is the rate difference between the three-month Treasury bill and the three-month US$ LIBOR. The TED spread is used as an indicator of credit risk.
	VIX	The CBOE variability index, VIX, is commonly referred to as the fear index.
	Policy Rate	The policy rate is the rate determined by monetary authorities such as the central bank.
	MSCI World	The MSCI World is a market cap weighted stock market index of 1,636 stocks from companies throughout the world and is intended to represent a broad cross-section of the global markets.
Risk Factors	Policy Uncertainty	Policy uncertainty is one of the risk factors for an economy that can delay spending and investment decisions by businesses and individuals.
	Geopolitical Risk	Geopolitical risks can affect or upset the domestic political and social policies of other countries, including military conflicts, civil wars, terrorist attacks, riots, sanctions, etc.
	Fiscal Soundness and Sovereign Rating	Fiscal soundness consists of debt, spending and tax revenues, and worsening fiscal soundness could lead to a sovereign debt crisis. The sovereign rating is an independent assessment of a country's creditworthiness and an implicit prediction of sovereign debt repayment ability and possible default.
	Regulations and Taxes	Regulations are rules created to control what the government or other agencies do or what people do. Taxes are compulsory financial charges of levy imposed upon taxpayers by governmental organizations in order to fund various public expenditures.
	Property Rights	Property rights are the legal rights that entities have on a property and have four components: the right to use the good, to earn an income from it, to transfer it to others, and the right to enforce property rights.

4.2. Respondent Selection and Survey

To survey the factors that affect the investment decisions of global investors in an objective and reasonable manner, the survey participants were selected in consideration of the following criteria:

- Working period: at least 15 years of investment experience
- Institution of employment: a variety in the types of institutions that the experts are employed at. At least one from each of the categories: investment banks, central bank, pension fund, insurances company, trust and asset management company, brokerage firm, government, and monetary authority.
- Location of the investment institution: a variety in the location of the institutions that the experts are employed at. At least, one from each of the categories: East Asian, South Asia, Europe, U.S., and Australia.

Based on this, a total of 28 experts were asked participate in the survey. The experts' institutions of employment consisted of the following: eight at investment banks, five at central banks, four at pension funds, four at insurance companies, three at trust and asset management companies, two at brokerages, one at the Korean government, and one at the monetary authority. As well, the location of the institutions are as follows: eight in East Asian countries, six at South East Asian countries, seven in European countries, five in the U.S., and two in Australia.

The survey was conducted from 27 June to 26 July 2019. In this study, pairwise comparison scales of 1 to 5 were used to give a clearer weight to each criterion, considering that many factors in the criteria have a close relationship with other factors due to the nature of the financial markets. A total of 28 questionnaires were distributed via e-mail or direct delivery, of which 26 received responses. The AHP method is a mathematical method for analyzing and organizing complex decisions using ratio scale measurement (De Felice et al. 2015). It has been applied in studies with small sample sizes to solicit and analyze hierarchical relationship, typically based on experts' opinion (Kil et al. 2016). Several studies reported findings using the AHP with small numbers of experts: five respondents (Peterson et al. 1995), five participants (Al-Harbi 2001), seven participants (Armacost et al. 1994), 18 participants (Mawapanga and Debertin 1996), 20 participants (Song et al. 2013), and 25 respondents (Huang and Yeh 2011).

The survey was conducted using the self-filling method by respondents. Out of the 26 responses, 20 final samples were selected. Two of the respondents were brokers who are not directly involved in investment decision and ultimately excluded from the sample in this study. In addition, three responses (two from pension funds and one from an insurance company) were excluded because individual CRs were higher than the level of threshold, 15% (CR of 3 the respondents was 39%, 20% and 16%, respectively). Finally, to ensure that the number of short-term and long-term investors are equal, one of the investment bank responses representing the highest CR (15%) was excluded. With regard to the CR allowance, Ho et al. (2005) recommended that CR be restricted to 10% or 15% for individual experts, and for group responses, the CR could be mitigated to 20% to allow for non-experts responses. Objectively, this survey sample is considered sufficiently valid for the following reasons: (1) The 20 samples used in this study showed a CR of less than 15% for individual respondents and less than 2% for group respondents. This is based on an analysis using the AHP system provided by Goepel (2013). (2) As presented in Table 4, the groups of experts who responded are well distributed by their institution of employment and the regions of their location, with every group having a frequency of 30% or less. (3) Respondents are experts with an average of 25 years of experience in investing.

Table 4. Distribution of survey respondents by classification.

Investment Institution	Frequency	%	Region	Frequency	%	Working Period	Frequency	%
Investment Bank	6	30	East Asia	5	25	10–19 years	3	15
Asset Management and Trust	3	15	South Asia	5	25	20–29 years	5	25
Central Bank	4	20	Australia	2	10	Over 30 years	12	60
Pension Fund	2	10	Europe	5	25	-	-	-
Insurance Company	3	15	U.S.	3	15	-	-	-
Monetary Authority and Gov't	2	10	-	-	-	-	-	-
Total	20	100	Total	20	100	Total	20	100

5. Empirical Results

5.1. Weights of the Factors and Attributes

Local priorities that represent the relative effects of a set of parts can be created using a pair of comparison matrices (Chen 2006). A local priority is the calculation of primary weights using the AHP's pairwise comparison, which determines the degree of weights for each variable in a percentage format that sum to 100% (Albayrak and Erensal 2004).

5.1.1. Local Weights for Level 2

As shown in Figure 3, international factors (38.1%) were considered to be most important in the analysis of factors that affect global investors' KTB investments, followed by domestic factors (37%) and risk factors (24.9%). This means that investors placed relatively more importance on direct returns on investments and hedge costs over risk factors in general.
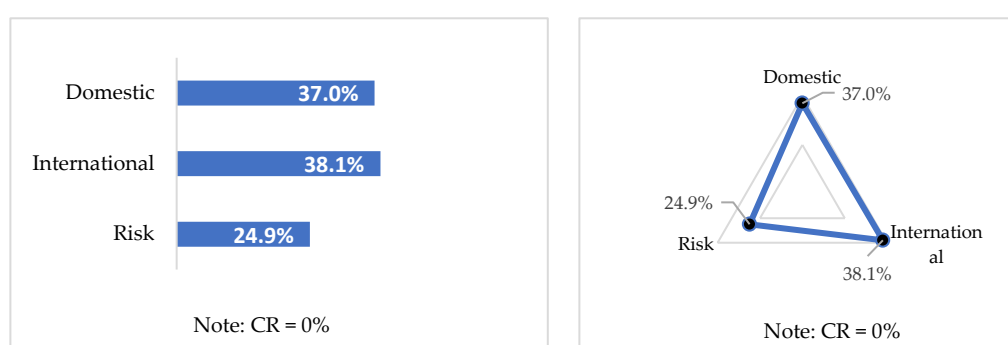
Figure 3. Local weights for level 2.

5.1.2. Local Weights for Level 3

1.   Local Weights for Domestic Factors

Domestic factors were classified into five sub-criteria: KTB yield (benchmark return on the Korean LCY bond market), KTB TED (benchmark for market arbitrage transactions), ROK CDS (benchmark for Korean sovereign default risk), KRW FX (KRW vs. US$ exchange rate) and bid-ask spread (market liquidity).

As shown in Figure 4, global investors' decision to invest in KTBs is shown to be influenced by the above variables in the following order of importance: KTB returns (29.8%), Korea CDS (23.9%), KTB TED (20.5%), KRW FX (15.1%), and bid-ask spread (10.7%).
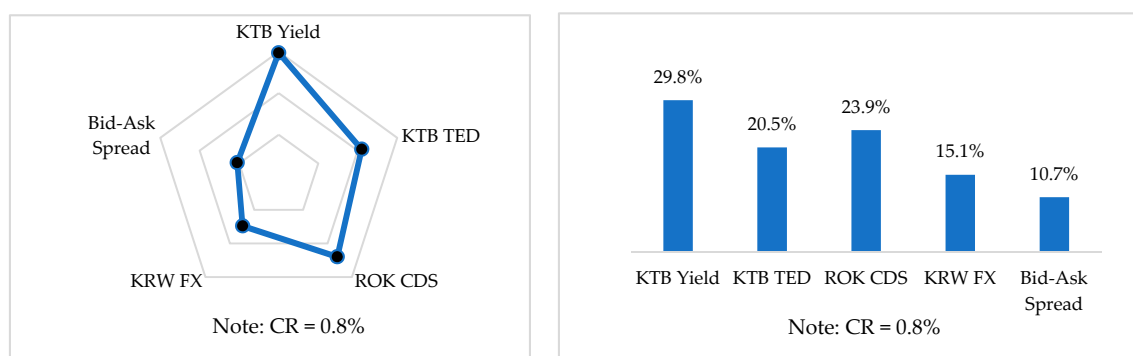
Figure 4. Local weights for domestic factors.

2.   Local Weights for International Factors

International factors are classified as U.S. Treasury yield curve slope (sign of global economic situation), US$ TED (indicator for US$ loans in inter-bank), policy rates (interest rate by U.S. Federal reserve and Bank of Korea), VIX (indicator for market volatility, fear gauge), and MSCI World (benchmark for global stock funds).

As presented in Figure 5, the policy rate (31.3%) has the most impact on global investors' decision to invest in KTBs, followed by the U.S. Treasury yield curve slope (21.9%), US$ TED spread (20.3%), VIX (14.6%), and MSCI World (11.8%).
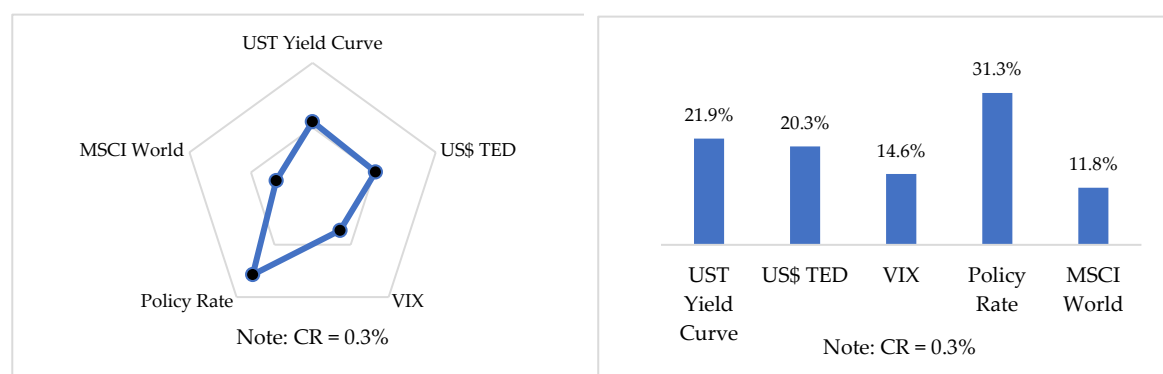
Figure 5. Local weights for international factors.

3.   Local Weights for Risk Factors

Risk factors are classified as policy uncertainty, geopolitical risk, fiscal soundness and sovereign credit rating, regulations and taxes, and property rights.

As shown in Figure 6, fiscal soundness and sovereign credit rating (24.2%), policy uncertainty (23.8%), geopolitical risk (22.7%) have larger impacts, while regulation and taxation (19.8%), and property rights (9.4%) have smaller impacts in global investors' decision to invest in KTBs.
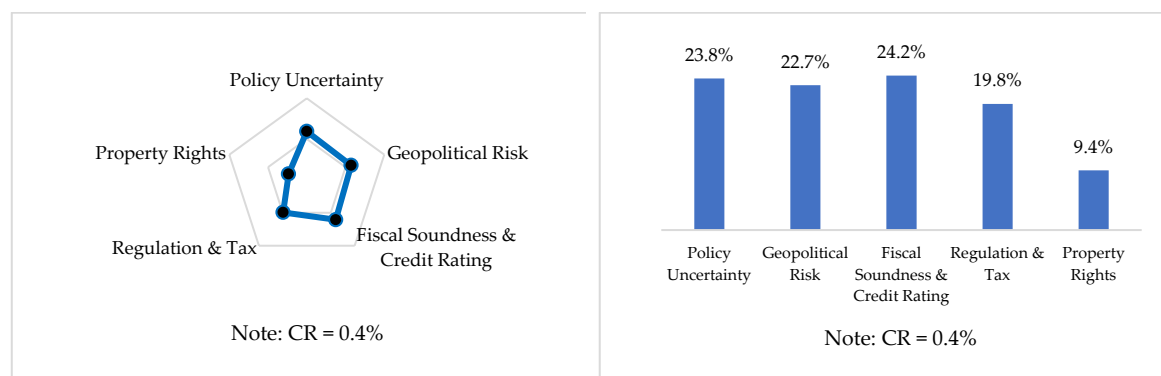
Figure 6. Local weights for risk factors.

5.1.3. Global Weights for Level 3

The global weight is a multiplication of the importance derived by each criterion. The sum of the least significant analyses of the importance of each lower layer in a single criterion equals 100%. If the local weights represent the relative rankings of the pairwise comparison at each level, the global weight is useful in determining the degree of integrated importance of the minimum unit factors for the purpose of the AHP.

As shown in Figure 7, policy rates, the KTB yield, and the ROK CDS had the greatest impacts on global investors' investment in KTBs, while property rights, the bid-ask spread, and MSCI World were found to be the least influential.
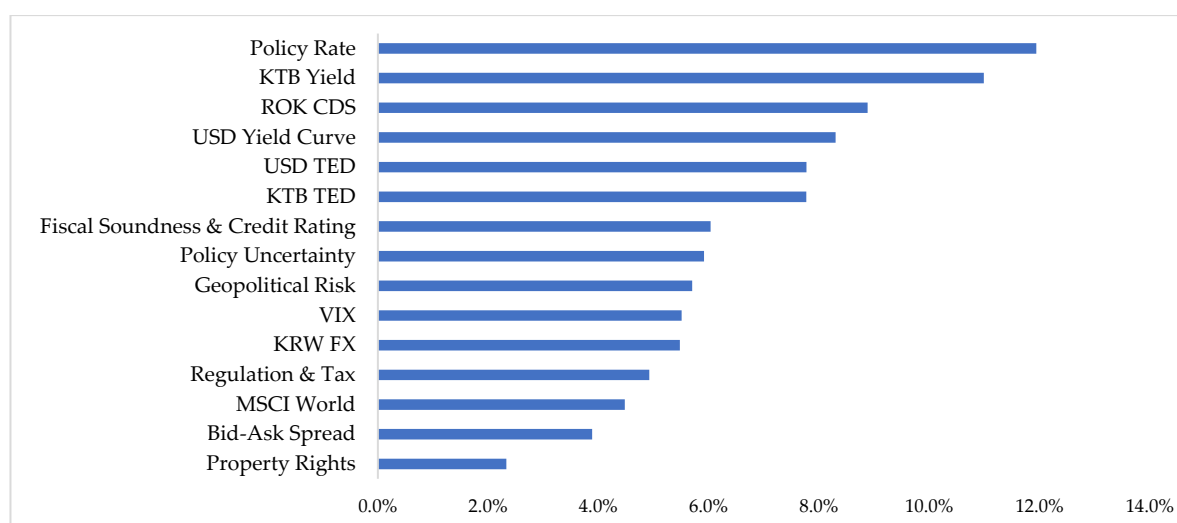
Figure 7. Global weights.

The results show that the share of KTB TED, which had been the absolute weight of KTB investments by global investors until the beginning of 2010, has recently decreased and spread for various purposes. This result is different from previous studies, which concluded that global investments in KTBs are most impacted by the KTB TED spread. Up until the early 2010s, global investors' investments in KTBs were concentrated in investments related to arbitrage transaction opportunities, but the proportion of arbitrage transactions have gradually decreased. Recently, global investors are investing in KTBs for more varied purposes, and therefore more diverse factors are influencing global investors' KTB investment decisions. Also, the importance of the impact of US$ TED, which has been one of the important factors in the past, has decreased. This translates into a decrease in the proportion of investment banks and private funds that require US$ financing in the short-term money market.

5.2. Weights of the Factors and Attributes Divided by Two Groups

To draw more sophisticated implications, we divide the respondents of the survey into two groups and compare their weights. We classified investors with short-term investment tendencies, such as investment banks and asset management companies, into group 1, and investors with long-term tendency, such as foreign central banks, pension funds and insurance companies, into group 2. Each group contained nine samples.

The purpose of this comparative analysis is to consider recent trend in the LCY government bond market. In addition, analyzing each investor's propensity is important in determining ideal policy objectives.

5.2.1. Local Weights for Level 2 between Group 1 and Group 2

As shown in Figure 8, it has been found that group 1 investors recognized importance in the order of domestic, international, and risk factors, and group 2 investors in the order of international, risk and domestic factors. In other words, both long-term and short-term investors were strongly influenced by international factors, and long-term investors perceive risk factors to be more important than domestic market factors.
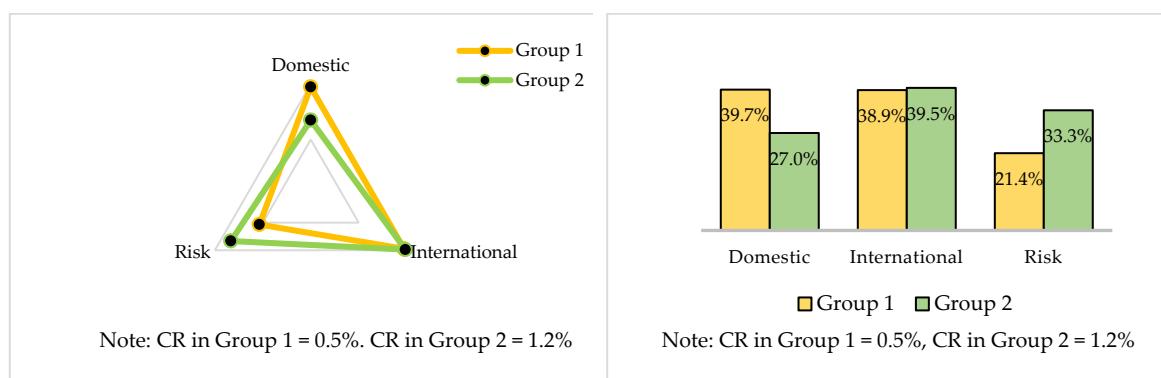
Figure 8. Local weights for level 2 between group 1 and group 2.

5.2.2. Local Weights for Level 3 between Group 1 and Group 2

1. Local Weights for Domestic Factors

As shown in Figure 9, it has been found that group 1 investors recognized the KTB TED spread to be most important criteria, followed by KTB yield, ROK CDS, KRW FX and bid-ask spread. On the other hand, group 2 investors recognized the KTB yield to be most important factor, followed by ROK CDS, KRW FX, bid-ask spread, and KTB TED. In addition, group 2 investors were not significantly affected by the KTB TED spread, a measure of arbitrage transactions, and more sensitive to ROK CDS, a measure of sovereign default risk.
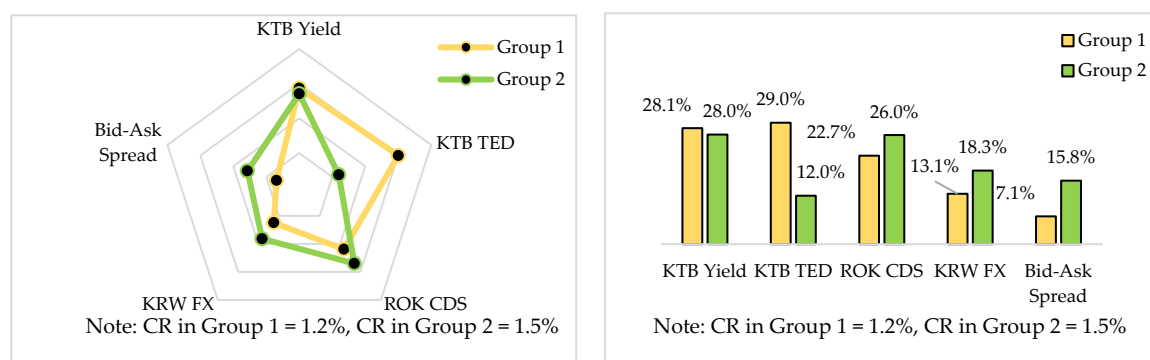
Figure 9. Local weights for domestic factors between group 1 and group 2.

2. Local Weights for International Factors

As shown in Figure 10, investors included in group 1 recognized monetary authority's policy rate to be the most important variable, followed by US$ TED, U.S. Treasury yield curve slope, VIX, and MSCI World. On the other hand, investors in group 2 responded that they considered US$ TED to be much less important. This shows that group 1 is more sensitive to US$ TED spread because of the need for US$ financing in the short-term financial market, while group 2, which does not require direct US$ funding, is more sensitive to market volatility and stock price volatility.
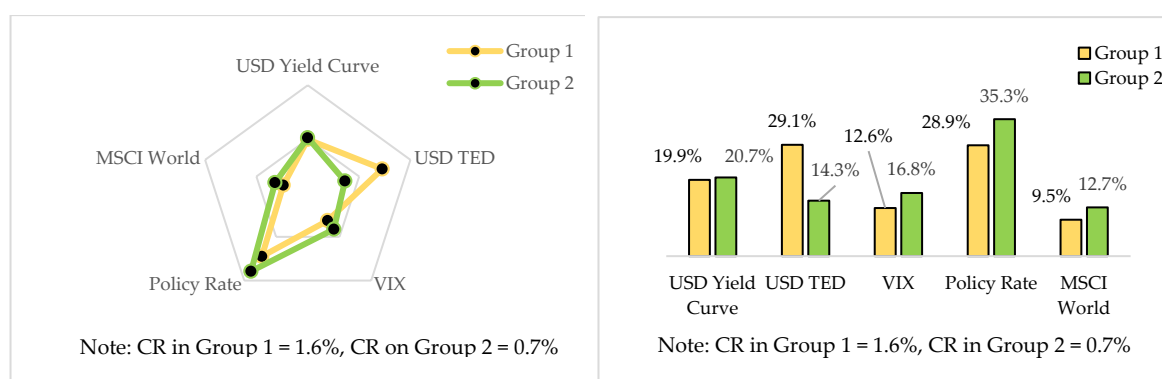
Figure 10. Local weights for international factors between group 1 and group 2.

3. Local Weights for Risk Factors

As shown in Figure 11, group 1's decision to invest in KTBs are most affected by policy uncertainty, followed by regulations and taxes, financial health and credit ratings, geopolitical risks and property rights. On the other hand, group 2's investment decisions are found to be affected most strongly by fiscal soundness and credit rating, followed by policy uncertainty, regulation and tax, and property rights. It is noteworthy that long-term investors take geopolitical risk more seriously than short-term investors.
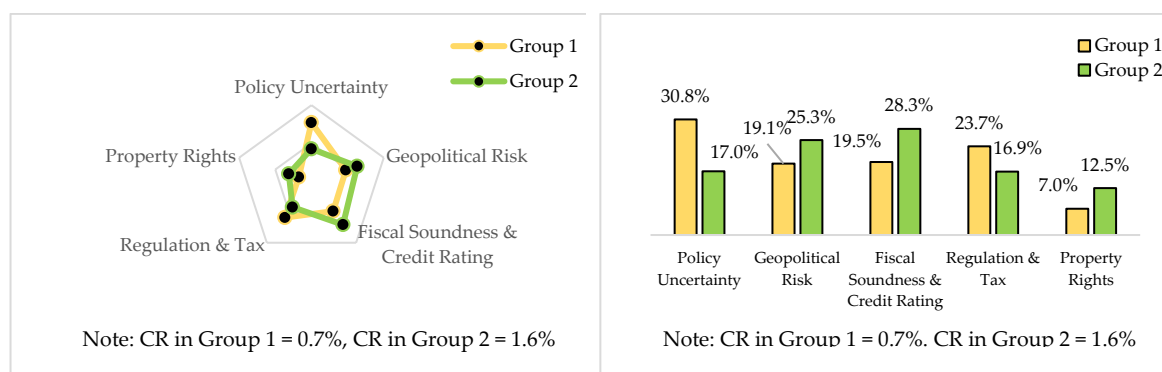
Figure 11. Local weights for risk factors between group 1 and group 2.

5.2.3. Global Weights for level 3 in Two Groups

As shown in Figure 12, for group 1 investors, who have a propensity for short-term investments, it appears that they are most affected by the KTB TED spread, KTB yield, US$ TED, and the policy rate. On the other hand, group 2 investors, who prefer long-term investment, appear to be more sensitive to the country's financial situation, geopolitical risks around the Korean peninsula, the possibility of a global economic recession, as well as the policy interest rates of monetary authorities.
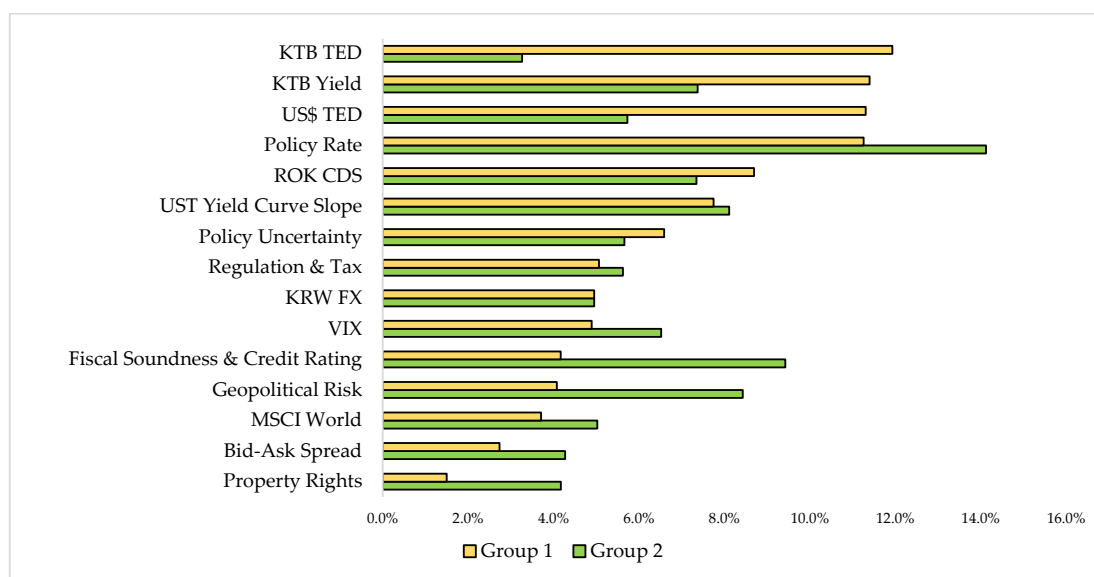
Figure 12. Global weights between group 1 and group 2.

5.3. Consensus Level

Consensus should be strictly distinguished from consistency. Goepel (2013) proposed to have consensus estimates of the AHP group consensus indicators, i.e., priorities among participants, to quantify the group's consensus. The range of these indicators is 0% to 100%. Zero percent corresponds to no consensus at all, and 100% to full consensus. This is a measure of priority homogeneity among participants and can also be interpreted as a measure of redundancy among group members (Jost 2006). Values of less than 50% indicate that there is virtually no agreement within the group and that the judgements are highly variable. Values in the range of 80% to 90% represent a prioritized overlay of group members and an outstanding judgment consensus.

As shown in Figure 13, consensus in most cases is 50% to 80%, which is a moderate level (the values of consensus, lambda, and CR are given in Table S1 in the Supplementary Materials). The consensus in the risk factors of group 1 and the domestic factors of group 2 exceeded 85%, indicating a high consensus. In addition, there is a relatively high consensus among the risk criteria, as well as level 2 criteria.
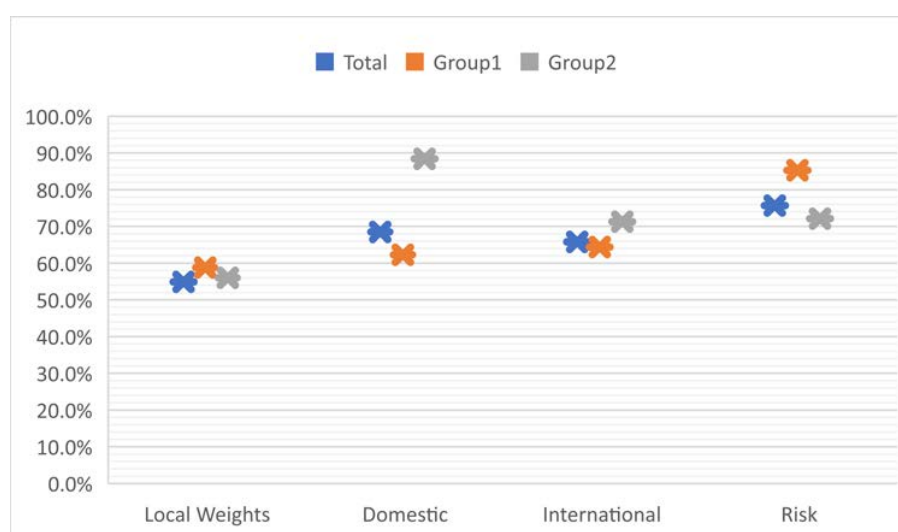

Figure 13. Consensus measure.

6. Conclusions

This study uses the AHP analysis technique to analyze the importance of decision factors that affect global portfolio investors' decision to invest in KTBs.

The hierarchical structure of AHP analysis consists of three criteria, domestic, international and risk factors, and five sub-criteria for each criterion. The domestic criterion has the following proxies as sub-criteria: KTB yields, KTB TED, ROK CDS, KRW FX, and the bid-ask spread. The international criterion consists of five sub-criteria: the U.S. Treasury yield curve slope, US$ TED, the policy rate, VIX, and MSCI World. Finally, the risk criterion has the following sub-criteria: policy uncertainty, geopolitical risks, fiscal soundness and sovereign credit ratings, regulations and taxes, and property rights. A large number of possible decision factors were found through detailed research of the existing literature. Based on this, the 15-factor criteria and the hierarchical relationship between them were determined after conducting several rounds of interviews and brainstorming sessions with experts. In addition, a survey was distributed to a panel of experts who were selected by considering the length of their professional experience institution of employment, and the institutions' locations. Based on the survey responses, the importance of local and global weightings were analyzed. To create more sophisticated analysis, we grouped the survey responses by the respondents' investment tendencies (short or long-term) and performed further analysis. This analysis is meaningful in that it provides new implications regarding recent changes in global investors' investment goals and strategies in investing in KTBs. Before the early 2010s, investments by global investors with short-term investment propensities were the absolute majority of KTB investment. However, the proportion of long-term investors has been increasing, and exceeded 50 percent as of the end of 2018 (Ministry of Economy and Finance 2019).

The main implications of this study are that global investors' decision to invest in Korean LCY bonds is not only influenced by monetary authorities' policy rate decisions and bond yields, but also by sovereign default risks, the possibility of a global recession, short-term US$ funding conditions, and the ROK's financial stability. Based on the analysis by the investor s' tendencies, investors with short-term investment tendencies, such as investment banks and asset management firms, are more sensitive to international and domestic factors and less affected by risk factors. In particular, many short-term investors are still found to be investing in KTBs for the purpose of arbitrage trading and proprietary trading, and therefore greatly influenced by US$ financing conditions. On the other hand, investors with long-term investment tendencies such as foreign central banks, pension funds and insurance companies, are found to be more sensitive to international and risk factors and less sensitive to domestic factors. In particular, global policy interest rate decisions, fiscal soundness and sovereign rating, the possibility of a global economic downturn, and geographical risks are found to be considered important by long-term investors. It is essential to increase the proportion of investors with long-term investment tendencies in order to stabilize the financial markets and to ensure sustainable government funding (Group of Thirty 2013). To do this, active management of risk factors is necessary. In particular, the ROK's government needs to improve the consistency of policies and taxation, ease market regulations, develop the secondary markets, and improve property rights.

This study was conducted with a focus on the KTB markets. Therefore, there is a limit to whether these findings can be applied to investments in LCY bond markets in other emerging and developed countries. In future research, it may be interesting to expand the scope of research to analyze and compare the decision factors in other emerging markets, and gain market insight through the propensity survey of both global and local investors. In addition, increasing the sample size and further diversifying sample groups will result in more meaningful analysis.

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