Foreigners in the Korean Bond Market: Is There a Conceptual Change Since COVID-19?[*]

Bobby Jungkyu Byun[**]·Jae-Seung Baek[***]

──────⟨Abstract⟩──────

This paper focuses on the financial market variables and determinants which mainly affect foreign investors' performances in the Korean bond markets. We also examine foreigners' past and present participation in the Korean bond market for the past 12 years since 2008 while breaking down the whole research period into several sub-set periods using the Lehman crisis and recent COVID-19 outbreak as major fiducial marks. We present daily regression models based on new calculation formulae to calculate foreigners' daily estimated return that includes not only realized but also unrealized profit. Daily investment results are measured by changes in the amount of foreign investment and return on their bond investment, presenting a three model regression. The paper also conducts a more in-depth analysis by using dummy variables comparing the impact of the Lehman crisis and recent COVID-19 to find out if there are any significant changes in behavior resulting from the incidents. Empirical results indicate that foreign exchange, swap basis, KTB futures index, and Korea CDS all have relevance to a certain extent for foreign investors' daily movement on bonds. Regression results not only show causality with explanatory variables but also present a significant implication that there is a change in behavior since COVID-19. Considering the historically low yields of Korean bonds, it matters to see such an incremental change in foreigners' Korean bond investment. Study implies there's a major conceptual transition and change in foreign investors' perception toward Korean government bonds and suggests Korea Treasury Bond (KTB) is now increasingly viewed as a safe investment instead of risky assets to foreign investors..

Keywords : Foreigners, Korean Bond Market, KTB, COVID-19, Lehman Crisis

** First Author, Ph. D. Candidate, Department of International Business, Hankuk University of Foreign Studies, E-mail: bobbybyun@gmail.com
*** Corresponding Author, Professor, Dept. of International Finance, Hankuk University of Foreign Studies, E-mail: jbaek@hufs.ac.kr

Ⅰ. Introduction

Foreigners' investment in the Korean bond market has continued to rise despite the COVID-19 pandemic. Since the opening of the market in the 1990s, the amount of investment in the Korean bond market by foreigners has also grown rapidly due to the development of the sheer size of the bond market itself. However, foreigners' investment growth in Korean bonds so far has come about via very different paths when compared to the rapid growth in equity (KOSPI / KOSDAQ) investment.

Foreigners already accounted for more than 42 percent of Korea's KOSPI equity market in 2005, while they represented less than one percent of the nation's listed bond market at that time. However, the trend has changed as foreigners' share in the Korean listed bond market rose to 6.5 percent as of July 2020, with the total balance of bonds mounting up to 150 trillion won.

We also see a different investment behavior after COVID-19 compared to the Lehman financial crisis. During the Lehman crisis, foreigners rapidly reduced their exposure to both Korean equity and bonds reflecting the global risk-off sentiment. However, on the heels of the Coronavirus outbreak, the actual amount of investment by foreigners in listed Korean bonds increased to our surprise in contrast to the investor reaction during the Lehman crisis.

To find out the background to this change, the study set dummy variables for both COVID-19 and Lehman Crisis. The study mainly aims to find out if there was any significant change in dependent variables before and after the events using different types of regression models.

For the empirical analysis, we try several initiatives that have not been used in other previous studies. First, the study includes unrealized gains and losses (UGL) in addition to the existing concept of realized profit (RPL) to measure foreigners' daily profit and loss based on the MTM (Mark to Market)[1] valuation principle. MTM concept is widely used by global financial institutions to calculate the daily rate of return on investment

---

1) Mark to Market (MTM) is a method of measuring the fair value of accounts that can fluctuate over time, such as assets and liabilities. In trading and investing, certain securities, such as futures and mutual funds, are also marked to market to show the current market value of these investments (www.investopia.com/terms).

and it is also used to estimate the variance in the daily rate of return of foreigners' Korean bond investment in this research. Second, for the estimation of daily bond MTM figures, the paper used the average duration of each day's foreign bond holdings along with respective YTM (yield to maturity) and convexity.

More specifically, this study includes i) investigate foreign capital investment in Korean domestic listed bond markets and ii) divide the whole period (2008.1~2020.7) into five sub-set periods (entire period, pre- and post- Lehman crisis, pre- and post- COVID-19). Also iii) calculate and compare their investment by two performance indicators such as 'daily change in net investment amount' and also 'daily change in investment return' by using OLS (Ordinary Least Squares), AR (autoregressive), and GARCH (Generalized ARCH) model and iv) to identify variables of significance that have relevance to daily foreigners' investment performance and lastly ⅴ) to find out implications and also what we have learned from the research.

Data for this research was obtained from the applications and websites of the Yonhap Infomax, Bloomberg, Korea Exchange (KRX), the Bank of Korea, and Financial Supervisory for the past 13-year period from 2008 to July 2020.

The rest of the paper proceeds as follows. In Section 2, we discuss the related literature and in Section 3, we explain the data, variables, models for the paperwork. Section 4 shows the results of the regressions. Finally, we present the summary and concluding remarks in Section 5.

Ⅱ. Related Literature

The total outstanding balance held by foreigners in the bond market has shot up by more than 20 times from 5.5 trillion won in early 2005 to 146 trillion won as of June 2020. Moreover, foreigners' share within the Korean listed bond market grew from 0.78% to 6.4% during the same period, cementing their stature as a major investor group. Foreigners' investment growth in Korean equity and bonds so far has come through very different paths. While Korea's bond market was opened to foreign investment at the same time as its equity market on the heels of the Asian Financial Crisis, it failed to attract foreign investment for a long time.

Due to the bond investment flow into Korea flowing from abroad being scarce and small largely before 2007, research on foreign bond investment in Korea was focused on explaining the reasons why they weren't a satisfactory amount of investment by foreigners in the local bond market. These studies focused on highlighting improvements in regulations and systems deemed to curb foreign investors. However, with many aspects still not able to understand from regulatory and institutional perspectives, there have since been papers claiming that foreign investment in overseas bonds increases home bias. Fidora et al. (2006) argued that the "real exchange rate volatility" in their financial assets increases bias, particularly those with less volatility in their currency exchange markets. Burger and Warnock (2006), analyzed foreign investment in 41 countries' bond markets and concluded that foreign investment in the U.S. market was the driving force behind keeping U.S. interest rates low despite the low U.S. savings rate, and argued that in developing countries, where investment is more desperate than in the U.S., resulting in a vicious cycle of more overseas borrowing.

Won and Joo (2009) study shows the following results, by analyzing the determinants of foreign investors' domestic bond investment and their impacts on the Korean bond market. First of all, foreigners' bond investment depends on arbitrage trading opportunities and country risks. The foreign bond investment has jumped on a large scale after the 2nd half of 2007. This is mainly due to the expansion of arbitrage trading opportunities and higher sensitivity to those opportunities. The increase in foreign investment was also led by the government's capital control. Furthermore, foreigners have influenced the Korean domestic bond market since the 2nd half of 2007 in quite different ways. Our study suggests that in the course of capital liberalization, the government's direct capital control may have little or even adverse effects, depending on foreigners' responses. The government should consider foreign investors' behaviors carefully when executing financial and exchange rate policies.

Regarding Korean corporate bonds, Seon and Oh (2012) investigated whether liquidity premium is adequately priced in Korean corporate bonds. They used Fama-French(1993) 2 factor model to explain Korean corporate bonds yields. Meanwhile, Kim (2008) focused on the relation between corporate bond spread and global risk sentiment. His study reveals global risk-off sentiment increases corporate bonds' credit spread dramatically preventing

corporates from sourcing capital through bond issuance. Other research results such as Kang et al. (2016) show firms with good governance have a higher possibility of obtaining investment-grade bond ratings.

The initial study of foreign investors in Korea focused on analyzing foreign investment tendencies and behavior. Kwak and Jun (2013) compared investment performances between individual, institutional and foreign investors emphasizing foreign investors' superior investment performances. Choe et al. (1999) studied trading behaviors of foreign investors based on the daily trading data before and after the Asian Financial Crisis. Based on foreigners' Korean market trading data from November end 1996 to the end of 1997, their study classified investors into three groups of foreign, domestic individual, and domestic institutional investors and examined each group's investment behaviors during the periods before and after the Asian Financial Crisis, thereby analyzing foreign investors' investment patterns in comparison with two other groups.

According to the analysis, while foreign investors exhibited the patterns of "positive feedback trading" or "herding" in the Korean market before the impact of the Asian Financial Crisis was felt by the end of 1997, such trading behaviors were much less in evidence during the crisis. On the other hand, Kho (2017) looked at growth trends in foreign investor's share of the Korean capital market since, assessing the impact of their investment and identifying their investment behaviors and characteristics. Park et al. (2008) paid close attention to the impact of exchange rates on foreign investment. Research shows foreign investors' have more tendency to hedge their investment risk when their currency risk and stock investment risk shows the same direction. Hong (2012) in his research studied the relationship between credit default swap (CDS) and the KOSPI equity market, while Cho (2015) compared Korea CDS spread with 6 other Asian countries.

In the 1990s, international bond investment research was analyzed by dividing the investment decision factors into two such as 'Pull (domestic)' and "Push (international)' factors. Related studies that deals with international cash flow movement based on the Push-Pull theorem include Fernandez-Arias (1996), Taylor and Sarno (1997) and Fernandez-Arias (1996) studied the determinants and sustainability of private capital inflows into developing countries with a median income since 1989. They argued Push

factors, not Pull factors are the major reasons for the inflow of funds into developing countries and not attributable to attractive domestic conditions developing countries.

Taylor and Sarno (1997) closely monitored the massive outflow of funds from the United States to Latin America between 1988 and 1992 and analyze the sources of the fund flow. Likewise in Fernandez-Arias' (1996) research, they also argue the global push out factors were much stronger factors than the attractiveness of the developing countries. Taylor and Sarno (1997) also cite the U.S. Interest Rate as a single factor that most significantly affects capital inflows to developing countries. Lee (2019) also studied the determinants of foreigners' domestic bond investment in the same way as Taylor and Sarno (1997) by dividing them into push and pull factors. In particular, the difference between onshore and offshore interest rates was explained as the main variables, which were the difference between the return on the Korea (Monetary Stabilization bonds) and the U.S. Treasury bonds LIBOR rate.

Hur and Lee (2011), analyzed foreign investment trends in Korean government bond investments and estimated the impact of economic variables on foreign demand for Korean government bonds using foreigner's bond investment data on MSB (monetary stabilization bonds) issued by the Bank of Korea. Also, Yang and Lee (2008) questioned whether foreigners' investment in Korean bonds, which had risen sharply since 2006, was likely to decrease after the subprime crisis caused by the collapse of Lehman Brothers in the U.S. in the second half of 2007, and argued that foreigners' investment in Korean bonds was affected in proportion to the size of profit-taking.

Ⅲ. Data and Methodology

1. Data and Hypothesis

1) Data

Based on the apparent changes in foreigners' investment patterns in Korean bonds, this study materializes the investment performance of foreigners from 2008 to July 2020 into 'daily change in net investment amount' and also 'daily change in investment return' - to find the reason for the change in their behavior on Korean bond investment.

For this purpose, foreigners' Korean bond investment statistics from 2008 to July 2020 were divided into five analysis periods based on the Lehman financial crisis and COVID-19 while 'daily change in net investment amount' and 'daily change in investment rate of return' were set as dependent variables for each model.

<Table 1> Dependent Variables

	Explanation of Variables	Unit
$\triangle NBII_t$	Change in net Bond investment amount on t day	KRW
$\triangle ABII_t$	Change in daily average Bond return on t day	%

Explanatory variables include traditional items such as 'daily change in KOSPI 200 index futures' and 'KTB (Korea Treasury Bond) futures index' which both directly represent traditional factors while more financial market-related variables such as 'daily rate of change in onshore-offshore interest rate spread', 'daily rate of change in foreign exchange', 'daily rate of change in Korea 5 year CDS (credit default swap) premium' and also 'daily rate of change in domestic swap basis (CRS‐IRS) were added to the explanatory variables list to better reflect on major global and domestic interest rate sensitivities.

KTB futures index is more stable than that of equity options because while KOSPI200 index options and KOSDAQ50 options are European styles cash options, KTB futures index options are American style option which can be exercised anytime before maturity having the advantage of providing more stability to its' underlying (KTB futures index).

Foreign capital flow has long been seeking arbitrage and one of the main attractions used to be the spread (difference in yield curve) between US$ and Korean won (KRW). We could have used various other rates to represent this variable but wanted to match close to foreign investors' average bond investment duration which tends to stay at the higher end of 3 years. In this regard, the paper also chose to use the onshore-offshore spread as the difference between 3year KTB (Korean Treasury Bond) and 3 year US Treasury. For KTB yield, we used the "Minpyung" rate which is the weighted average yield of the 3 major pricing agencies in Korea (Korea Ratings, Korea Investors Service, NICE). For US Treasury, the paper used the official daily yield from the US Treasury homepage (www.treasury.gov/resource-center).

Foreign exchange has long been regarded as a major variable impacting foreigners' investment into Korea and used the USD-KRW rate as the currency pair has the most turnover in Korea.

<Table 2> Explanatory Variables

	Underlying	Explanation of Variables
$\triangle$EIt	KOSPI200 Futures Index	Daily % change in Kospi200 Index Futures Index on t day
$\triangle$IDt	KTB Futures Index_3yr	Daily % change in 3year KTB index on t day
$\triangle$ISt	3yr KTB – 3yr UST	Daily % change in Onshore-Offshore rate spread on t day
$\triangle$FXt	USD/KRW Spot FX rate	Daily % change in foreign exchange rate on t day
$\triangle$CDSt	Korea CDS 5yr Premium	Daily % change in Korea 5yr CDS Premium on t day
$\triangle$SBt	Swap Basis (CRS-IRS)	Daily % change in domestic Swap Basis on t day
b1	dummy	COVID-19
b2	dummy	Lehman Crisis

Besides, the study includes Korea 5 year CDS (Credit Default Spread) premium for one of its' six explanatory variables as 5 year CDS benchmark is the most widely used country risk factor in finance.

For the last variable, the paper includes swap basis(CRS-IRS)[2] which is the domestic spread between cross-currency swap and interest rate swap. Swap basis refers to the difference in yield between CCS and IRS, which can be understood from all 3 perspectives such as funding rate[3], credit spread[4] and risk-free arbitrage. However, the main reason to select swap basis is that it represents a risk-free arbitrage gain[5] for foreigners that can be obtained even after removing the risk of exchange rate fluctuations (currency hedge). Thus foreign investors can enjoy the difference amount of spread for free when

---

2) Won and Joo (2009) and others used the difference between USD IRS and CRS (USD-KRW). This approach is more focused more from U$ arbitrage perspective while the paper tries to use KRW side on arbitrage as investors' duration becomes longer and arbitrage opportunity also becomes scarce.

3) For banks, swap Basis refers to interest rate financed by won to fund US$ in the domestic Korean market(funding purpose).

4) From credit point of view, swap basis refers to risk premium to exchange US$ for Korean won (credit spread).

5) For example, if the three-year USD-KRW CRS rate at a given time is 0.010%, and the KRW IRS rate is 0.860%, the three-year swap basis is (-)0.850%. In this case, foreign investors' return on KTB (Korean Treasury Bond) would be 3-year KTB offer (market) rate (for example 0.810%). plus respective swap basis (0.85%) and foreigners' total return on KTB investment would be 1.66% (0.81+0.85).

they invest in Korean assets. The last reason we selected the variable was that swap basis can signal foreign currency (usually US$) liquidity shortage in the Korean domestic money market.

Swap basis usually moves in a negative state in Korea, but if such a negative spread widens quickly and suddenly, it can also be viewed as a state of US dollar shortage in the short-term money market. Foreigners experience the widened spread as increased risk free margin similar to foreign currency loan spread.

In actual practice, interest rate swap (IRS) in the Korean Won market is a process of exchanging 91day CD floating rates into longer tenor (1~10 year) fixed rates so in some cases there are unusual cases that IRS rate tends to increase even when 91day CD rates fall. This usually happens when foreigners try to sell a fair amount of bonds and subsequently KTB yield rises (or KTB futures index fall) creating a disparity between the two rates.

<Table 3> Data Sources & Selection Criteria

This table presents the data used in this paper. Regarding the data for the empirical tests, daily rate "change" and not "levels" are used for each variable.

Data Name	Data Source	Base Criterion
Foreign investment Balance	FSS/Yonhap Infomax	daily KOSPI, KOSDAQ, Bond amount.
KOSPI200 Index Futures	KRX Website	daily market close price
KTB Futures Index	KRX Website	daily market close price
KTB 3yr Yield	KOFIA/Yonhap Infomax	daily market close
UST 3yr Yield	US Treasury website	US Treasury announcement rate
USD/KRW FX Spot	BOK/Yonhap Infomax	daily market close price
Korea CDS 5yr	Bloomberg	last trading price
Swap Basis	Yonhap Infomax	daily market close price

Source: Financial Supervisory Service: www.FSS.go.kr
        Korea Exchange: www.KRX.co.kr
        Bank of Korea: www.BOK.or.kr

<Table 4> Period of Analyses

	Description of Period	Start ~ End
1	Total Period	2008.1.1. ~ 2020.7.17.
2	Pre-Lehman	2008.1.1. ~ 2008.8.31.
3	Post-Lehman	2008.9.1. ~ 2009.8.30.
4	Pre COVID-19	2019.1.1. ~ 2020.1.31.
5	Post COVID-19	2020.2.1. ~ 2020.7.17.

This paper aims to explain how the explanatory variables affect the dependent variables during the entire analysis period of the study as shown in <Table 4> (2008. 1. 1.~2020. 7. 17.). We also focus on Leman Crisis, COVID-19 both events that could affect investment performance during the entire analysis period, and further examined how the influence of the explanatory variables on the dependent variables before and after the periods.

(1) Daily change in foreigners' net investment amount

$$NB\sqcup t = (GKBt) - (GKBt - 1)$$
$$\Delta NB\sqcup t = \frac{(N\sqcup t) - (N\sqcup t - 1)}{N\sqcup t}$$

ⅰ) Net Investment amount (KRW)

Gross investment amounts (gross balance) difference between day t and t-1

ⅱ) Daily Net Investment amount change (KRW)

Net investment amount difference between day t and day t-1

(2) Daily change in foreigners' investment return

$$AB\amalg t = [RPLt(NKB) + UPLt(GKB)/GKBt]/3$$
$$\Delta AB\amalg t = \frac{(A\amalg t) - (A\amalg t - 1)}{A\amalg t}$$

ⅰ) Net Investment return (%)

(ΣAverage rate of return by each market) / 3

ⅱ) Daily Net Investment return change (%)

Net investment return difference between day t and day t-1

<Table 5> Definitions used in Profit and Loss Calculation for Dependent Variables

	Definition of Profit & Loss in Equity and Bond
RPLt(NKB)	Foreigners' daily KOSPI realized profit(loss) amount on t day (KRW) (Only applies when NKBt < 0)
NKBt	Net foreign Korea Bond balance difference between day t and t-1 (KRW)
UPLt(GKB)	Foreigners' Korea Bond daily unrealized profit(loss) on t day (KRW)

Investment returns include both realized profit and loss as well as valuation profit and loss (MTM base calculation). MTM calculation is widely used among global financial institutions and most of foreign investors are institutional investors (Kang and Stulz, 1997; Dahlquist and Robertson, 2001; Kalev et al., 2008; Kho, 2017). Realized profit and losses (RPLt) happens only when net balance decreases from the previous day. For the actual calculation for bond MTM, the paper used daily average duration of foreigners bond holdings and their respective daily YTM change and also considered convexity for better accuracy.

(3) Bond MTM Calculation

: [YTM difference (daily) × daily Duration × daily Convexity] / 365

$$Bond(MTMPnL)t = |(-)diff(YTM)t \times Bond(Dur)t + Bond(Convex)t \times diff(YTM)t^2|/365$$
$$\text{where } diff(YTM)t = Bond(YTM)t - Bond(YTM)t-1$$

<Table 6> Definitions used for Bond MTM Valuation

	Description
Bond(MTM PnL)t	Daily Korean Bond Mark to Market Profit(loss) on foreign balance
diff(YTM)t	Daily average YTM(yield to maturity) on foreign bond holdings
Bondholder	Daily average Duration on foreign bond holdings
Bond(Convex)t	Daily average Convexity on foreign bond holdings

2) Hypothesis

The purpose of the study is to analyze explanatory variables that affect changes in daily dependent variables. Thus in this regard, dividend and interest, which are the main components of the earning of stocks and bonds are excluded from the calculation of daily returns. as they do not affect changes in daily profit or loss.

We see foreigners' Korea bond investment trend similar to that of the developed countries. Foreigners are investing in Korean treasury bonds where their YTM (yield-to-maturity) lies in the sub 1% range.

The paper divides the period of study into five sections using dummies b1 and b2

for COVID-19 and Lehman crisis to find out if there is any variation of meaningful consequence before and after the events. In this regard, the paper sets two hypotheses for the empirical results to test.

Hypothesis 1: There is a significant change due to COVID-19 (b1 dummy).
Hypothesis 2: There is a significant change due to Lehman-crisis (b2 dummy).

If b1 or b2 dummies prove to be significant from the regression results, the hypothesis will be accepted and it will be deemed that COVID-19 or Lehman crisis provided a cause for a meaningful change before and after the events.

<Table 7> Trend of Foreigners' Korean Bond Investment

	Lehman-crisis		Normal	COVID-19	
	2008-1-3	2011-1-3	2015-1-5	2020-1-3	2020-7-3
YTM (%)	5.781	3.332	2.201	1.432	0.895
Duration (yr)	1.923	2.079	2.622	3.961	3.866
Convexity	15.118	9.918	17.946	38.770	40.025
Delta	87.662	163.106	276.12	511.988	592.704

Source: Yonhap Infomax.

2. Methodology

1) Model

Multiple linear regression attempts to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to observed data. As our study lag is one day, we do not see a further advantage in 'differencing' the data for the actual empirical analysis. Moreover, we find it more useful to interpret the actual result on paper to better understand the explanatory variables' daily relationship with the 2 dependent variables.

$$\Delta dependent = \alpha + b_1 \times \Delta EI_t + b_2 \times \Delta ID_t + b_3 \times ISt + b_4 \times FX_t + b_5 \times CDS_t + b_6 \times SB_{t} + \varepsilon_t$$

$$\text{where: } \alpha \text{ is constant, } \varepsilon \text{ is residual}$$

Based on the above regression model, 2 dependents which are change in net bond investment amount and the other being change in daily bond return, the equation is formulated into 2 models as below.

ⅰ) Model 1. $\varDelta NB\amalg t$ Change in net Bond investment amount on t day
ⅱ) Model 2. $\varDelta AB\Pi t$ Change in daily average Bond return on t day

Also for each of the 2 models, there are 5 subset models for the aforementioned 5 pre-defined periods (entire period, pre-Lehman, post-Lehman, pre-COVID-19, post-COVID-19) to better find if there is any difference(or change) after the unsystematic shock. We also give a crisis dummy[6] (indicator) variable for each model to check out if there is any significant changes before and after the crises.

2) Empirical Method

(1) Multiple Linear Regression

After conducting the Pearson correlation coefficient test, initial multiple regression is held using ordinary least squares (OLS) based under the assumption the data is linear. For the analysis, the 'all-in' method would be used to look at all the variables at once instead of eliminating insignificant variables by step. We also include COVID-19 and Lehman crisis dummies to find out if there was any shift in the daily amount or return after the respective events.

(2) Backward Elimination Method

To check if auto-correlation exists within the data, the Durbin-Watson test is held. If auto-correlation is not found (p-value > 0.05) we proceed for the "Multiple Regression" procedure to find out any significance among the variables. To find the best 'fit" for the explanatory variables, the study starts with exploring the influence of explanatory variables on dependent variables through regression analysis. The actual selection procedure, for the construction of an optimal regression equation along with the investigation, this paper adopts to use backward elimination which

---

6) $b_1 = 0$ (pre COVID-19). $b_1 = 1$ (post COVID-19), $b_2 = 0$ (pre-Lehman), $b_2 = 1$ (post Lehman).

is a type of stepwise regression taking out non-significant variables by step. By fitting various explanatory variables into the regression, the model becomes empowered by having the advantage of identifying each variables' specific individual influence has on the dependent variables.

(3) AR Regression

If auto-correlation is found during the Durbin-Watson test (p-value < 0.05), the next step is to find out the stationarity of the data by using the DF(Dickey-Fuller) test. Once DF test confirms stationarity (p-value > 0.05), it will proceed for times-series regression using AR (autoregressive) model.

(4) GARCH Regression

Also in addition to AR regression, the paper conducts ARCH(1) or GARCH (1, 1) for times series. The GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model is one of the most common models used for time series and hereby the paper adopts GARCH (1,1) model for analysis. Before conducting the regression, LM(Lagrange Multiplier) test will be held to examine and ensure the heteroskedasticity of the times series' variance. Overall in this paper, every time series data shall be tested under all 3 regression models such as multiple linear regession, AR and GARCH (1, 1).

The data used for the research is 'daily incremental' based on times series, so the dependent variables might receive not only the influence from the specific day but also from the past days. The results are presumed to be highly stationary due to the daily sequence, however, it would be much safer to check the auto-correlation of error terms(or residuals).

Auto-correlation is the similarity of a time series over successive time intervals. It can lead to underestimates of the standard error and can cause you to think variables are significant when they are not as one of the key assumptions in regression is that the error terms are independent of each other. Therefore to check the assumption of independence in error terms during our regression analysis, the Durbin-Watson test is first performed to determine whether auto-correlation exists.

<Table 8> Summary Statistics

This table presents the summary statistics for the empirical analysis. The definitions of variables are as follows: ΔEIt: Daily % change in Kospi200 Index Futures Index on t day, ΔIDt: Daily % change in 3year KTB index on t day, ΔISt: Daily % change in Onshore-Offshore rate spread on t day, ΔFXt: Daily % change in foreign exchange rate on t day, $\Delta CDSt$: Daily % change in Korea 5yr CDS Premium on t day, ΔSBt: Daily % change in domestic Swap Basis on t day.

Panel A: Pre & Post Lehman crisis (unit: %)

Lehman crisis	ΔEIt		ΔIDt		ΔISt		ΔFXt		$\Delta CDSt$		ΔSBt	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	−0.080	−0.06	0.005	0.020	2.897	2.758	0.035	0.021	0.168	−0.20	0.003	0.002
Median	0.011	0.114	0.022	0.026	2.890	2.610	0.046	0.059	0.334	−0.16	0	0.020
Minimum	−4.90	−11.1	−0.68	−1.01	2.300	1.990	−2.76	−14.1	−21.3	−168	−0.69	−0.88
Maximum	4.412	9.091	0.722	0.848	3.810	4.020	3.099	9.723	17.33	133.2	0.365	0.645
St.Error	1.546	2.635	0.224	0.286	0.318	0.451	0.674	1.851	4.996	21.29	0.147	0.197
Skewness	−0.10	−0.61	0.054	−0.24	0.234	0.822	0.087	−1.22	−0.29	−1.09	−0.95	−0.77
Kurtosis	3.406	6.365	4.249	4.079	2.544	2.863	8.406	18.52	6.942	25.20	7.569	6.412

Panel B: Pre & Post COVID-19 period (unit: %)

COVID -19	ΔEIt		ΔIDt		ΔISt		ΔFXt		$\Delta CDSt$		ΔSBt	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	0.045	0.001	0.001	0.008	−0.39	0.522	0.033	−0.01	−0.04	0.005	−0.001	−0.001
Median	0.127	0.203	0.000	0.008	−0.37	0.641	0.042	0.016	−0.14	−0.03	−0.001	0.002
Minimum	−2.90	−8.09	−0.26	−0.68	−0.78	−0.14	−1.28	−3.14	−2.65	−15.2	−0.08	−0.49
Maximum	2.051	9.363	0.260	0.369	0.003	0.843	1.423	3.111	4.584	8.889	0.070	0.412
St.Error	0.940	2.628	0.078	0.132	0.210	0.287	0.392	0.768	0.823	3.004	0.024	0.107
Skewness	−0.28	0.028	−0.16	−1.46	−0.15	−1.42	0.039	−0.15	1.162	−1.10	0.105	−0.70
Kurtosis	3.034	5.378	4.162	10.85	1.819	3.505	3.642	6.779	8.516	11.21	3.351	11.83

Once the Durbin-Watson test confirms no auto-correlation in confirming independence among the residuals, we can reject and proceed for the use of the regression model. However, if somehow auto-correlation is detected, we should adopt a times series regression. From the point of view, we used AR (autoregressive) model for times series regression.

Ⅳ. Empirical Results

1. Multiple Regression Result

First, a Pearson correlation coefficient test is conducted to see the correlation between

variables (<Table 9>). The correlations mainly show a relatively large correlation between daily changes in onshore-offshore interest rates (⊿ISt) with changes in swap basis, and also changes in swap basis (⊿SBt) with changes in Korea CDS premium.

<Table 9> Pearson Correlation Analysis

This table reports the results of the Pearson correlation coefficient among the main variables. The definitions of variables are as shown in <Table 2>. The figures in parenthesis are p-values. ***, **, and * denote significance at the 1%, 5%, 10% levels, respectively.

	⊿EIt	⊿IDt	⊿ISt	⊿FXt	⊿CDSt	⊿SBt
⊿EIt	1.000					
⊿IDt	−0.099 (0.001)***	1.000				
⊿ISt	−0.023 (0.235)	0.031 (0.111)	1.000			
⊿FXt	0.045 (0.020)**	−0.017 (0.389)	−0.110 (0.001)***	1.000		
⊿CDSt	−0.025 (0.199)	0.067 (0.001)***	0.540 (0.001)***	−0.172 (0.001)***	1.000	
⊿SBt	0.019 (0.335)	0.002 (0.904)	−0.692 (0.002)***	0.213 (0.001)***	−0.766 (0.001)***	1.000

<Table 10> contains the results of multiple regression for model 1 and model 2. They are related to each other as variables linked to interest rates, but each has different roles in the market. For example, while Korea CDS premium serves as a major indicator to represent Korea's country risk, it also serves as the barometer for offshore funding in risk premium used by Korean companies when they issue global bonds or borrow loans from overseas. There are various maturities, however, 5 year is mainly used as the benchmark for CDS premium in practice. Likewise, CDS premium is the minimum risk premium required or conversely the amount of risk-free return when foreigners invest in Korean bonds. Particularly in this study which focuses on daily analysis, the significance and directional outcome can turn out to be similar but actually, the real causative factors may still be different. Therefore in this paper, the regression analysis is performed even though the correlation between the two variables is slightly higher than optimal. Also, to further examine the impact of the Lehman crisis and COVID-19

dummy variables b1 (COVID-19 dummy) and b2 (Lehman crisis dummy) are added to the regressions. When comparing before and after COVID-19, positive significance shows in daily foreign bond return since COVID-19 under a 10% significance level.

In Panel B of <Table 10>, the coefficient of '0.009' variable for b1 can be interpreted that foreigners' daily average bond return was increased around 0.009% during the post-COVID-19 period compared to the previous period. Thus, from hypothesis 2, we can reject b1 from Model 1 and below hypothesis 2 stands. The figure and results are similar and are in line with our other analysis done afterward such as AR (Autoregressive) and GARCH time-series regression.

<Table 10> Multiple Regression Results

These tables present the results of the OLS regression of model 1 and model 2. The definitions of variables are as shown in <Table 1> and <Table 2>. The figures in parenthesis are p-values. ***, **, and * denote significance at the 1%, 5%, 10% levels, respectively.

Panel A: Model 1: $\triangle$NBUt (Unit of sensitivity: KRW 100mil.)

Explanatory Variables	Total Period (08.1~20.7)	Pre Lehman (08.1~08.8)	Post Lehman (08.9~09.8)	Pre-COVID-19 (19.1~20.1)	Post-COVID-19 (20.2~20.7)
$\triangle$ISt	2.693 (0.9830)	−534.311 (0.402)	−323.157 (0.660)	1,306.434 (0.297)	−2137.587 (0.439)
$\triangle$FXt	3.252*** (0.003)	12.596 (0.670)	6.630** (0.020)	−15.684 (0.563)	43.352 (0.258)
$\triangle$CDSt	−9.389*** (0.0004)	−50.190*** (0.002)	−2.150 (0.609)	−48.727 (0.693)	−54.454 (0.614)
$\triangle$SBt	−8.933*** (0.002)	−30.594*** (0.0004)	−4.090 (0.492)	−40.134 (0.542)	−79.532* (0.091)
$\triangle$EIt	−21.917 (0.752)	−4.901 (0.976)	−323.157 (0.735)	65.647 (0.897)	−129.115 (0.593)
$\triangle$IDt	−70.599 (0.918)	2,921.968*** (0.010)	−915.433 (0.439)	9,984.971* (0.091)	−2992.248 (0.524)
b1: COVID-19 dummy	534.416 (0.297)			−515.063 (0.655)	
b2: Lehman crisis dummy	−101.551 (0.862)	−1,862.560* (0.082)			
Constant	−3,532.950** (0.006)	−11,053.150 (0.695)	−7,325.396 (0.179)	17,539.370 (0.552)	−55,838.740 (0.216)
Observations	2,628	164	252	213	113
Adj-R Sq.	0.012	0.184	0.041	−0.007	0.025

<Table 10> Multiple Regression Results (Continued)

Panel B: Model 2: ⊿ABΠt (Unit of sensitivity: %)

Explanatory Variables	Total Period (08.1~20.7)	Pre Lehman (08.1~08.8)	Post Lehman (08.9~09.8)	Pre-COVID-19 (19.1~20.1)	Post-COVID-19 (20.2~20.7)
⊿ISt	0.001 (0.340)	−0.004 (0.995)	0.006 (0.505)	0.001 (0.879)	−0.016 (0.281)
⊿FXt	−0.003*** (0.001)	0.001 (0.803)	−0.003 (0.340)	0.004 (0.725)	0.001 (0.565)
⊿CDSt	0.001*** (0.001)	−0.001 (0.495)	0.002*** (0.0002)	0.001 (0.982)	0.002*** (0.004)
⊿SBt	0.001*** (0.002)	−0.002 (0.736)	0.003*** (0.0001)	−0.001 (0.982)	0.004* (0.094)
⊿EIt	−0.004 (0.279)	0.003* (0.097)	−0.001 (0.616)	−0.001 (0.520)	0.002 (0.988)
⊿IDt	−0.017*** (0.003)	−0.008 (0.453)	−0.034** (0.024)	−0.003 (0.990)	−0.031 (0.222)
b1: COVID-19 dummy	0.018*** (0.001)			0.009* (0.062)	
b2: Lehman crisis dummy	0.005 (0.126)	−0.001 (0.936)			
Constant	0.038*** (0.001)	−0.050 (0.852)	0.061 (0.367)	−0.035 (0.747)	−0.135 (0.576)
Observations	2,628	164	252	213	113
Adj-R Sq.	0.072	−0.006	0.116	−0.024	0.080

Some other variables such as daily CDS movement and swap basis also have significance with the daily bond return during the post-COVID-19 period. However, we don't find any significance with the daily average bond amount during the period. During the period we find daily CDS movement as the explanatory variable which has significance with the bond's daily return. Lehman crisis dummy b2 has significance with bond amount. Meanwhile, USD-KRW FX change only has positive significance with bond daily amount change but a negative relationship with daily change in bond return. CDS and swap basis both have positive significance with the change in return but a negative relationship with change in the daily bond amount.

As a result, COVID-19 dummy b1 shows significance with daily change of return while Lehman dummy b2 only shows significance with daily amount change. This result

suggests strong evidence that there is an investment behavior change in foreigners' Korean bond investment.[7]

Meanwhile, KTB futures index has positive significance with daily change in amounts, it doesn't show any relevance during the post-COVID-19 period. During the post-COVID-19 period, only the swap basis has relevance with both daily bond amount change and also bond amount return. The results show that swap basis still has significance with foreigners' daily return and widened swap basis continue to provide a positive return for their investment. Daily change in CDS premium also has positive significance with daily change in return.

2. AR Regression Result

1) Model 1 $\triangle$NBIt (Change in Net Bond Investment amount)

As per the result for change in daily bond amount, explanatory variables don't show any significance with the dependent variables. None of the KOSPI200, KTB index futures, onshore-offshore interest rate difference, US$-KRW FX rate, Korea CDS premium change nor daily swap basis change show any relevance with the daily amount change of foreign investment amount in Korean bonds.

However, the interesting aspect is that b1 (COVID-19 crisis dummy) turns out to have significance with the dependent variable when regressed for the entire analysis period. Figure 1,283.2 should be interpreted differently from other coefficients as this is a level variable not a change variable like the other 6 explanatory variables. It gives you a certain idea of what kind of change happens before and after the dummy period.

'Level' variables itself suggest the amount of significance as the sensitivity 1283.2 explain there has been an average of KRW 128.3billion more daily bond investment after the COVID-19 (b1=1) period compared to that of before COVID-19 happened (b1=0). The reason why this kind of change happened need to be studied more but we expect

---

7) As of 2020.7.17., 95.4% of foreigners' bond holding are either KTB (Korea Treasury Bond) or MSB (Monetary Stabilization Bond) - this means foreigners' mainly invest in sovereign grades and lesser in credit grades. Because the amount of foreign investment and revenue do not necessarily match, each has its own meaning even if the coefficient is different.

a change in foreigners' bond investment patterns gave a certain impact on this sudden increase. Meanwhile, this result is in line with the recent foreign bond investment trend in Korea.

Foreigners' balance in equity(KOSPI) fell from 550 trillion won (Jan 2020) to 480 trillion won (April 2020) after the COVID-19 Pandemic, similar to the pattern of decline seen after the Lehman Brothers situation albeit to a more limited extent. In contrast, foreigners bought even more Korean bonds after COVID-19 broke out, showing a different pattern from their behavior during the Lehman Brothers crisis. While the outstanding value held by foreign investors in the Korean bond market stood at 130 trillion won as of January end 2020, the comparable figure climbed up every single day without an exception for the following three months.

During those months, despite a substantial drop in yield, the foreigners' market capitalization amount increased over 8.5%, reaching beyond 141 trillion won by April end. Followed by the continued trend, foreigners' total market capitalization in Korean listed bonds has reached 147.6 trillion won as of July 17, 2020. This represents over 13% growth in foreigners' market capitalization in the Korean bond (in outstanding value) from the end of January 2020.

<Table 11> AR Regression Results for Model 1 (Unit of Sensitivity: KRW 100mil.)

Table presents the results of the AR regression of model 1 using a backward estimation. The definitions of variables are as shown in <Table 1> and <Table 2>. The figures in parenthesis are p-values. 'Non-sig' means that the estimates are non-significant. ***, **, and * denote significance at the 1%, 5%, 10% levels, respectively.

Explanatory Variables	Total Period (2008.1~2020.7)
⊿ISt	non-sig
⊿FXt	non-sig
⊿CDSt	non-sig
⊿SBt	non-sig
⊿EIt	non-sig
⊿IDt	non-sig
b1: COVID-19 dummy	1283.2(0.001)***
Constant	204.8(0.011)**
No. of observations	2,628
Adj-R Sq.	0.011

2) Model 2: $\triangle AB\Pi t$ (Change in Bond Return Rate)

Model 2 results show relevance with two periods; 'the entire period' and also 'post-COVID-19 period'. Regression results with the entire period show p-value of 0.004898 under the Durbin-Watson test which is less than 0.05. This means the error terms have auto-correlation and thus cannot be regressed under Multi regression but using AR(autoregressive) model. Also to ensure the stationarity of the times series, the Dickey-Fuller test was taken before turning to AR regression. Dickey-Fuller's p-value confirms that the time series is stationary and proceeded for AR(2) model regression.[8]

KTB futures index, onshore-offshore interest rate spread, and swap basis daily movement had significance with foreigners' daily bond investment return. KTB futures index had a positive sign which is fairly strong. This was a predictable outcome as usually domestic bond investment performances are linked closely to the bond futures index. However, the result was meaningful that we could actually 'quantify' the correlation as when the daily bond futures index rises 1%, foreigners' daily bond investment return also likely increase around 0.0182% at the same time.

<Table 12> AR Regression Results for Model 2 (Unit of Sensitivity: %)

This table presents the results of AR regression of model 2. The definitions of variables are as shown in <Table 1> and <Table 2>. The figures in parenthesis are p-values. 'Non-sig' means that the estimates are non-significant. ***, **, and * denote significance at the 1%, 5%, 10% levels, respectively.

Explanatory Variables	Total Period (08.1~20.7)	Pre COVID-19 (19.1~20.1)
$\triangle$ISt	0.0016(0.006)***	non-sig
$\triangle$FXt	non-sig	non-sig
$\triangle$CDSt	non-sig	non-sig
$\triangle$SBt	-0.0208(0.005)***	-0.2243(0.011)**
$\triangle$EIt	non-sig	non-sig
$\triangle$IDt	-0.0182(0.001)***	non-sig
b1: COVID-19 dummy	0.0087(0.005)***	n/a
Constant	0.0031(0.015)**	0.0055(0.020)**
No. of observations	2,628	213
Adj-R Sq.	0.076	0.084

---

[8] Time lag of error terms needed to be checked. For this, we relied on the ACF and PACF of the residuals. By checking the lag, we chose the 2nd lag for AR(2) which is thought to be most suitable in order to avoid 'over-fitting' and to maintain the simplicity of our model.

Onshore-offshore interest rate spread using the interest rate difference between KTB 3-year and US Treasury note also shows positive significance (0.0016) while the swap basis shows negative significance with foreigners' daily bond investment return.[9] We think this is related to risk factors as when global risk issues arise, CRS tends to decrease and subsequently the swap basis also gets widened, and subsequently bond price drops due to the risk-off sentiment.[10] Post-COVID-19 regression results also showed that foreigners' daily bond investment movement has negative relevance with the daily USD-KRW foreign exchange movement. This can also be explained because once the USD-KRW foreign exchange rate goes up, the US dollar becomes stronger and foreigners' Korean bond investment MTM value will decrease in US dollar terms.

However, the most encouraging is that the COVID-19 dummy variable b1 again has significance showing around 0.087% daily increase in bond investment return the period after COVID-19. So here we can assure that there is a conceptual change since COVID-19 from the aforementioned hypothesis 1. Such kind of foreigners' daily increase in return after the COVID-19 on Korean bond investment can be viewed as part of the evidence for changed perception among foreign investors. We'd like to further observe the situation but cautiously predict the change is coming from a major conceptual transition in foreign investors' Korean asset categorization moving it into more of a safe-asset or a risk-free asset compared to the historical concept that long labeled as risky assets.

The most downside for foreigners investing in Korean bonds at the moment does not appear to be credit risk, nor lower yield nor political instability(or North Korea) related issues, but mainly foreign exchange as the official currency Korean won still is restricted and can only be settled onshore for settlement (NDF; non-deliverable) raising higher volatility concerns to foreign investors. Fidora et al. (2006) also argued that real exchange rate volatility as a key determinant of international portfolio allocation.

This increase in return can be partly attributed due to foreigners' investment in longer duration coupled with increased convexity and Delta. As of July 15, 2020, the average duration of Korean bonds held by foreigners fell just slightly short of 4 years at 3.85

---

9) -0.0208: when swap basis widens, foreigners bond investment return decrease 0.0208%.

10) We assume if Korean bonds going forward fall into safe-asset category, CRS will not likely decrease but stay put and will not give impact to swap basis and also Korean bond price will not change much at all.

years, which is much longer than the comparable figure of 1.69 years in 2005. In the same period, convexity and delta have each grown from 1.65 and 9.62 to 39.78 and 592.30. Given that delta arises from increased price volatility and convexity tend to be higher in longer-dated bonds, the increase above can be mainly caused by the longer duration of the bonds foreigners have invested in. So despite the overall decline in bond yield since COVID-19[11]), we think the increased duration and higher convexity of in bonds contributed to this result.

The fact that the b1 dummy variable is significant in both Model 1 and Model 2 can be interpreted as foreigners' investment behavior has changed since COVID-19.

These results are in line with Shin and Park's (2018) argument that long-term bonds for more than five years are the flow of global funds to more developed countries with higher credit ratings.[12]) Average duration close to 4 years means foreigners now invest more longer-dated bonds of 5 years or more years as part of their global fixed income portfolio and this can be thought as if Korean bonds have now become categorized as more of a "safe asset investment" by foreign investors. This change of pattern in Korean bond investment by foreign investors can be explained with Korea's increased role and responsibilities among global leading countries (Pull factors). However, at the same time, it also has to do with the economic recession in Europe, negative and lower interest rates around the world, and also vastly increased liquidity worldwide (Push factors).

3. GARCH regression result

1) Granger Causality

Granger causality is a method to find out whether certain variables in the past is causing any effect on other variables in the present. Granger causality test result shows four explanatory variables among total granger causes Model 2($\Delta AB\Pi t$).

---

11) This is a world-wide phenomena as EU and Japan's policy rate has long been in minus range for some time while US FEDS has also switched back to a zero-interest policy after the COVID-19 outbreak.

12) Shin and Park (2018) shows the determinants of foreign investments in Korea government bonds are different according to the maturity. Korea short-term government bonds investments with maturity less than 1-year are significantly affected by arbitrage condition and global fund flow to emerging economy. But Korea long-term government bonds investments with maturity over 5-year are influenced by global fund flow to advanced economy and credit risk.

<Table 13> Granger Causality Test

This table presents the Granger causality test results for the five explanatory variables against two dependent variables ($\triangle$NBIIt, $\triangle$ABIIt). The definitions of variables are as shown in <Table 1> and <Table 2>. ***, ** denote significance at the 1%, 5% levels, respectively.

	$\triangle$EIt	$\triangle$IDt	$\triangle$ISt	$\triangle$FXt	$\triangle$CDSt	$\triangle$SBt
$\triangle$NBIIt	0.5676	0.2754	0.847	0.7742	0.5696	0.6358
$\triangle$ABIIt	0.0067***	0.0022***	0.0096**	0.3020	0.2245	0.0345**

To further examine the relationship between the explanatory and dependent variables, we apply the conditional heteroscedasticity disturbance model (GARCH).[13]

2) GARCH regression

GARCH(1,1) model also shows similar results to AR(autoregressive) model and b1 is only relevant within Model 2 so the final result is as shown in <Table 14>. These results show that COVID-19 dummy also showed positive significance which indicates a positive increase in daily bond investment return. This means there is a positive change

<Table 14> GARCH Regression Results (Unit of Sensitivity: %)

Table presents the results of the GARCH regression of model 2. The definitions of variables are as shown in <Table 2>. The figures in parenthesis are p-values. 'Non-sig' means that the estimates are non-significant. ***, **, and * denote significance at the 1%, 5%, 10% levels, respectively.

Estimates	Total Period (2008.1~2020.7)	Pre COVID-19 (2019.1~2020.1)
$\triangle$ISt	0.0006(0.0001)***	non-sig
$\triangle$FXt	non-sig	non-sig
$\triangle$CDSt	non-sig	non-sig
$\triangle$SBt	−0.0193(0.001)***	−0.2776(0.001)***
$\triangle$EIt	non-sig	non-sig
$\triangle$IDt	−0.0368(0.001)***	non-sig
b1: COVID-19 dummy	0.0055(0.013)**	n/a
No. of observations	2,628	213
Adj-R Sq.	0.0061	0.0658

---

13) To test the ARCH model and the GARCH model, the Lagrange Multiplier (LM) test is performed. LM test shows at least a couple of orders has several p-values smaller than 0.05 for both the entire total period and also for the pre-COVID-19 periods. So we can conclude that error terms of the models have heteroscedasticity.

in foreigners' daily bond returns as the daily return turned out to be higher compared to the pre-COVID-19 period.

Ⅴ. Conclusions

In this paper, we examined foreigners' bond investment in both daily changes of amount and return focusing on the COVID-19. For the daily change in investment amount, USD-KRW foreign exchange showed positive relevance while daily Korea CDS premium change and daily change in swap basis both had negative relevance with the investment amount. The Lehman-crisis dummy showed significance while COVID-19 dummy didn't show any relevance. Meanwhile, for the daily change in investment return, USD-KRW foreign exchange had negative relevance while swap basis and Korea CDS premium change showed positive relation with bond investment return. COVID-19 showed positive significance in daily foreign bond return during the post-COVID-19 period.

COVID-19 crisis dummy turned out to have the only significance with the dependent variable. The investment return model showed much more relevance with the dependent variable; especially during the entire period and the post-COVID-19 period. KTB futures index, onshore-offshore interest rate, and swap basis daily movement have significance with foreigners' daily bond investment return. Also for the period of post-COVID-19, results show foreigners' daily bond investment movement has negative relevance with the USD-KRW foreign exchange movement. This means there is a positive change in foreigners' daily bond returns as the daily return turned out to be higher compared to the pre-COVID-19 period. In the GARCH (1,1) regression, the COVID-19 dummy also showed positive significance which indicates a positive increase in daily bond investment return.

The paper also found there has been a large increase in foreigners' investment in Korean bonds and tried to explain the reasons for this change in investor behavior. Using data since 2008, the study analyzes foreigners' investment performance by their change in daily investment amount as well as daily return. Despite the sharp decline in Korea's government bond yield since COVID-19, foreigners' daily investment return actually increased. We think longer bond investment duration and higher convexity of

188 財務管理研究

foreigners' investment contributed to the higher return. Also, the results can be interpreted as an indication that foreigners' Korean bond investment behavior has changed since the outbreak of COVID-19. And this change in foreigners' Korean bond investment behavior could be largely attributed to Korea's increased roles and responsibilities as one of the world's leading economies (Pull factors). However, we also think it has also to do with the global economic downturn coupled with negative interest rates in Europe and Japan and abundant global liquidity (Push factors).

We assume that foreigners now invest in Korean bonds mainly for portfolio diversification as well as to secure a minimum risk-free return based on their asset allocation strategy for fixed income investment. This finding means foreigners are no longer seeking additional arbitrage gain in risky developmental assets (their past goal when investing in Korean bonds) but adopting more of a safe asset or risk-free asset-based treasury fixing concept.

We found several evidences that can explain this argument. First, the COVID-19 dummy was found to be significant for changes in daily average returns in all empirical tests. Second, the dummy also presented similar figure results regarding the increased daily average return. Third, foreign investment philosophy change toward Korean bond investment can be explained by the actual investment data that indicates a greater increase in the average duration, convexity, and delta of the bonds they invested in when the bond yield dropped after the virus outbreak. Fourth, the share of sovereign-grade bonds (KTB and MSB) of foreigners' overall Korean bond investment has increased from 65% in 2005 to 95% in the year 2020[14].

Our study suggests there is a high possibility that foreign investors now no longer view Korea as a risky developing market but as a safer, developed market and this change is being reflected in their perception towards Korean bonds as well. While we still need to keep a close eye on foreigners' future investment trends, we do find a substantial difference in their recent investment behavior compared to the past, which we attribute to their conceptual change towards Korean assets in general and government bonds in particular.

---

14) We expect foreigners' investment in Korean credit bonds to rebound sharply in the near future. This is because foreigners' credit appetite for Korean bonds will increase as Korean sovereign interest rates remain low. We plan to extend our research to look into this in another study.

References

Burger, J. D. and F. E. Warnock, "Foreign Participation in Local Bond Markets," National Bureau of Economic Research, *Working Paper* 12548, (2006).

Cho, D., "Long-Memory and Market Efficiency of Asian Sovereign CDS Spread," *Journal of Korean Financial Management*, 32(3), (2015), 55-76.

Choe, H., Kho, B.-C. and R. M. Stulz, "Do Foreign Investors Destabilize Stock Markets? The Korean Experience in 1997," *Journal of Financial Economics*, 54(2), (1999), 227-264.

Dahlquist, M. and G. Robertsson (2001), "Direct Foreign Ownership, Institutional Investors and Firm Characteristics," *Journal of Financial Economics,* 59(3), 413-440.

Fernandez-Arias, E., "The new wave of private capital inflows: Push or Pull?," *Journal of Development Economics*, 48, (1996), 389-418.

Fidora, M., M. Fratzscher, and C. Thinmann, "Home Bias in Global Bond and Equity Markets_The role of real exchange rate volatility," *European Central Bank, Working Paper* Series No. 685, (2006).

Hong, C. H., "An Empirical Study on the Relationship among CDS Spread, KOSPI 200 Index Spot and Futures Markets," *Journal of Industrial Economics and Business*, 25(1), (2012), 639-656.

Hur, I. and Y. Lee, "Foreign Investment in Monetary Stabilization Bond, Before and After the Financial Crisis," *Journal of the Korean Data Analysis Society*, 13(3), (2011), 1547-1557.

Kalev, P. S., A. H. Nguyen, and N. Y. Oh, "Foreign Versus Local Investors: Who Knows More? Who Makes More?" *Journal of Banking and Finance,* 32(11), (2008), 2376-2389.

Kang, J. K. and R. M. Stulz, "Why is There A Home Bias? An Analysis of Foreign Portfolio Equity Ownership in Japan," *Journal of Financial Economics*, 46(1), (1997), 3-28.

Kang, Y. S., J. S. Yoon, and H. Kim, "The Impact of Corporate Governance on Bond Ratings," *Journal of Korean Financial Management*, 33(3), (2016), 1-28.

Kho, B. C., "Review on the impact of Stock market opening and Foreign Investors in Korea," *Business Research*, 46(4), (2017), 875-902.

Kim, D. Y., "Issue of Junk Bonds in Flight to Quality," *Journal of Korean Financial*

Management, 35(1), (2018), 1–25.

Kwak, N. G. and S. G. Jun, "Performance and Impact of Foreign Investment," *Journal of Korean Financial Management*, 30(2), (2013), 139–168.

Lee, M., "A Study on the Determinants of Foreign Investors' Domestic Bond Investment," *Finance Engineering Research*, 18(3), (2019), 59–83.

Park, J. W., Kwon, T. H. and W. B. Lee, "Foreign Investors Response to the Foreign Exchange Rate Exposure in the Korean Stock Markets," *Journal of Korean Financial Management*, 25(4), (2008), 53–78.

Shin, D. J. and E. H. Park, "A Study on Determinants of Foreign Investments in Korea Government Bonds and Effects on Korea Financial Variables," *Korea Corporation Management Association Press*, 25(4), (2018), 21–43.

Seon, J. H. and S. H Oh, "Liquidity Premium and Liquidity Proxies of Korean Corporate Bonds," *Journal of Korean Financial Management*, 29(2), (2012), 63–90.

Taylor, M. P. and L. Sarno, "Capital Flows to Developing Countries: Long–and Short–Term Determinants," *World Bank Economic Review*, 11(3), (1997), 451–470.

Won, S. Y. and S. Y. Joo, "A Study on the Determinants of Foreigners' Domestic Bond Investment and Their Impacts on the Korean Bond Market," *Korean Economic Review*, 57(3), (2009), 31–65.

Yang, Y. and H. Lee, "Research on Arbitrage Opportunities and Foreign branches and Foreigners' Korean Bond Investment," *Bank of Korea, Monthly Statistics*, 62, (2008), 55–89.

COVID-19와 국내 채권시장의 외국인 투자변화에 관한 연구[*]

변정규[**]ㆍ백재승[***]

〈요 약〉

　본 연구는 한국 채권시장에서 외국인 투자자의 실적에 주로 영향을 미치는 금융시장 변수와 요인에 관하여 살펴보았다. 이를 위해 글로벌금융위기 당시의 리먼 사태와 최근 COVID-19 사태를 주요 기점으로 삼아 전체 연구기간을 몇 개의 하위 기간으로 세분화하여 2008년 이후 12년간 외국인의 한국 채권시장 과거와 현재 투자를 조사하였다. 가설 검증을 위해 도입한 모형을 바탕으로 실현된 이익뿐만 아니라 미실현 이익까지 포함하는 외국인의 일별 예상 수익률을 계산하였다. 외국인 채권투자 성과는 투자 금액과 투자 수익률의 변화에 의해 측정하고, 세 가지 회귀모형을 사용하여 영향 요인을 분석하였다. 특히 리먼 사태와 최근의 COVID-19의 영향을 비교하는 더미 변수를 이용하여 두 사건에서 외국인들의 투자에 유의미한 변화가 있는지 알아보았다. 실증분석결과 외국인의 일별 채권 투자변동과 관련해서 외환, 스와프 기준, KTB 선물지수, 한국 CDS 프리미엄 변수가 관련성을 갖는 것으로 도출되었다. 또한 이들이 상호 간에 인과관계를 보여줬을 뿐만 아니라 COVID-19 이후 외국인들의 투자행태에 변화가 있다는 유의미한 암시를 나타냈다. 이러한 변화는 한국 국채에 대한 외국인 투자자들의 인식 변화와 큰 개념적 전환에서 오는 것이라고 추론된다. 이와 같은 본 연구의 결과는 국고채를 중심으로 한 한국의 주요 채권이 외국인 투자자들에게 위험자산이 아닌 안전자산으로 인식하는 변화가 발생하고 있다는 시사점을 제시한다.

주제어 : 외국인투자자, 한국 채권시장, 국고채, 재정증권, COVID-19, 리먼사태