

An Analysis of the Correlation Between the CD Interest Rates and Macroeconomic Variables : Using VAR Model

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Abstract

The spread of COVID-19 has incurred a large supply of liquidity in many countries, where the primary intentions were to recover from the bearish economy. Yet due to the differences between the 2008 Financial Crisis and the economic downturn that COVID-19 has brought - while the Financial Crisis sprang from the financial market, the impact of COVID-19 initiated from branches of the real economy and then spread to the financial market -, using the same economic policy as then is inducing some side effects. The study explores the great decoupling phenomenon and the resulting financial imbalance through empirically testing the correlation between the CD interest rates and variables from the asset market and the real economy. The analysis period has been set from September 2008 to August 2021, and we have derived an impulse response function (IRF) by conducting the ADF unit-root test, Johansen cointegration test, and VAR. As for the independent variable, the returns of the 3-month CD rate have been chosen to reflect market liquidity and investors' speculative demand. While the KOSPI stock price index and the housing sales price index were selected as the dependent variables to represent the asset market, the index of all industrial production, CPI, unemployment rate, and exchange rate have been used as the dependent variables showing the real economy. The result of our study suggests that movements in the CD interest rates have not significantly influenced the real economy, but they did cause some changes in the asset market. Thereby, one could conclude that investors' demand for funds and the increased liquidity had failed to boost the real economy, but instead had only risen the asset prices. The significance of this study is that it considered the CD interest rates, which were not dealt with that much compared to the call rate, as a variable observing the different impacts of changes in the short-term interest rates on the asset market and the real economy.

Table of Contents

- I. Introduction
- II. Literature Review
 - A. Correlation between the CD interest rates (short-term interest rates) and financial assets
 - B. Correlation between the CD interest rate (short-term interest rate) and real assets
 - C. Correlation between the CD interest rates (short-term interest rates) and macroeconomic variables
- III. Research Methodology
 - A. Data Descriptions
 - B. Model Settings
- IV. Data Analysis and Interpretation
 - A. Augmented Dickey-Fuller Test
 - B. Granger Causality Test
 - C. Johansen Cointegration Test
 - D. Impulse Response Functions
- V. Conclusion

References

I. Introduction

After the financial crisis, many countries tried to resolve the economic downturn through large-scale liquidity supply. However, contrary to the intention to supply liquidity, the real sector has recently been relatively sluggish due to COVID-19. It is a great decoupling phenomenon in which the real economy and stock prices move in different directions. In other words, this means that there is an economic imbalance. While demand from individual investors increased¹, the overall economy slowed and debt accumulated.² Based on this imbalance, this paper attempts to study the relationship between variables representing the asset market and the real economy, focusing on the CD interest rates. In particular, we look at the different aspects between the real economy and the asset market.

The Certificate of Deposit is issued in response to the demand for investment and has a relationship with the asset market because it is used to determine the loan rate. In addition, in the real sector, short-term interest rates can be said to indirectly affect the real economy because they are formed based on the benchmark interest rate that reflects the central bank's monetary policy.

The importance of the CD interest rates is explained to have a great influence on the overall economy because it is used as a base rate in large markets such as loans and derivatives.³ The CD interest rates are linked to variable rate loans, which account for most of the loans. The loan market grew 43.6% from 1,349 trillion won at the end of the first quarter of 2016 to 1,937 trillion won at the end of the first quarter of this year. As of the end of June 2021, the domestic market for interest rate-related derivatives (based on the balance of transactions) exceeds 4600 trillion won.⁴

The actual industrial production index, consumer price index, unemployment rate, and exchange rate are variables that represent the real economy. And KOSPI, housing sales price represents the asset market. First of all, according to Geun-Young Lee·Nam-Hyun Kim(2016), The CD interest rates have a correlation with housing price. In this research, variables were set as the overall industrial production index by expanding the scope of the market. Therefore, The purpose of this study is to investigate the relationship between Index of All Industrial Production and the CD interest rates. In the case of the consumer price

¹ According to the Financial Supervisory Service, about 72.6% of Korea's bank loans are variable-rate loans, and about half of the variable rates are linked to CD rates.

² Currently, Korea is the third-fastest among 43 major countries in terms of household debt ratio growth.

³ According to the Financial Supervisory Service, about 72.6% of Korea's bank loans are variable-rate loans, and about half of the variable rates are linked to CD rates.

⁴ Domestic Market Size [2015-2019], ISTANS. Written in 1995, Industrial Statistics Analysis System (ISTANS)

index, it was selected because other interest rates are affected if the base rate changes according to the appropriate rate.⁵ In particular, the CD interest rate, which is a short-term interest rate, is adjusted to reflect changes in policy rates during the same period. In the case of the unemployment rate, not only financial market indicators but also economic indicators such as the unemployment rate and economic growth rate are greatly affected by interest rates. However, considering that the impact of interest rates on unemployment⁶ has generally been studied mainly in the total category, the impact on unemployment rates may differ from before due to the unique characteristics of the CD rates. Therefore, the purpose of this study is to examine the effect of the CD rate on the unemployment rate. Finally, in the case of the exchange rate, Korea has a high ratio of foreign holdings among domestic listed companies' stocks, so the phenomenon of coordination between domestic and foreign financial and foreign exchange markets has increased significantly. In particular, the CD interest rates serve as a link to the foreign exchange, stock, currency, and bond markets on the same day.⁷ Therefore, the exchange rate was selected. Next, in the case of housing sales prices, an indicator of the asset market, the CD interest rates are used as the base rate for mortgage loans, and the KOSPI uses a stock index representing investor demand because the CD interest rates are determined in consideration of investor demand.

The analysis period is from July 2008, when the capital market changes structurally after the international financial crisis, to the latest. It will be examined through the Vector Autoregressive Model (VAR). Since monthly data for a total of 13 years were used, it can be said that the stock market and economic data are sufficiently examined.

The composition of this paper is as follows. Chapter 2 deals with prior research, Chapter 3 deals with research model design, Chapter 4 deals with the empirical analysis process and results, and Chapter 5 deals with the conclusions and limitations of this paper.

⁵ The appropriate interest rate is calculated by summing the inflation rate and the real economic growth rate.

⁶ Jung Sung Yeop, Effect of changes in policy rates on the employment rate by gender and generation.

⁷ Lee Geunyoung, An analysis of the linkage between foreign exchange, stocks, currency, and bond markets.

II. Literature review

As mentioned in the introduction, the need to analyze the ripple effect of a surge in speculative demand due to oversupply of liquidity has increased under the economic slowdown caused by COVID-19. In addition, even before COVID-19, various studies have been conducted on the correlation between interest rates and macroeconomic variables that have a significant influence on the real economy. The effects of interest rates revealed in previous papers on capital markets and macroeconomic variables are as follows.

A. Correlation between the CD interest rates (short-term interest rates) and financial assets

⁸Lee Geun-young (2009) used Rigobon and Sack (2003b)'s structured VAR model to consider the indirect effect of the ECM estimation results, confirming that positive impact on the CD interest rates increased KOSPI, IRS interest rates, treasury bond rates, and CRS interest rates, suggesting the CD interest rates.

Rigobon and Sack (2003b)⁹ used the structured GARCH model to reveal that short-term interest rates, long-term interest rates, and stock prices are linked to each other at the same time, while Rigobon and Sack ¹⁰(2004) argued that rising short-term interest rates lower stock prices and shift the yield curve upward.

According to Nam Ki-sung and Cho Hyun-jin (2020), a Vector Autoregressive model and Granger causal analysis showed that both Korea and the United States had a positive relationship between the stock market and interest rates. Korea's stock market had a high correlation with medium term note(three-year) interest rates, while the U.S stock market had a high correlation with the short-term bond(Fed rate) interest rates.

⁸ Keun Yeong Lee.(2009).An Analysis of Linkage between Foreign Exchange, Stock, Money, and Bond Markets, Journal of Korean Economics Studies 25,25(),97-133.

⁹ Roberto Rigobon, Brian Sack, Measuring The Reaction of Monetary policy to the Stock Market, Journal of Monetary Economics, Volume.118, Issue 2, 2003
Volume 51, Issue 8, 2004

¹⁰ Roberto Rigobon, Brian Sack, The impact of monetary policy on asset prices, Journal of Monetary Economics, Volume 51, Issue 8, 2004

In addition, papers that analyzed the correlation between short-term interest rates and the stock market include Bjornland and Latemo (2009)¹¹ Hong Jeong-hyo, Cho Hye-won (2010)¹², and Na Chan-hwi (2019)¹³.

B. Correlation between the CD interest rate (short-term interest rate) and real assets

Moon Kyu-hyun(2019)¹⁴ discovered the correlation between interest rates and the housing market through VECM and showed that the increase in interest rates had a negative effect on the rate of change in housing lease prices and housing sales prices.

According to Lee Geun-young and Kim Nam-hyun (2016)¹⁵, who analyzed the effect of changes in domestic interest rates on housing prices using the VAR model, showed that the CD rate hikes have the greatest impact on housing price changes compared to other short-term rate hikes, but the overall effect is not different.

A study by Jeon Hae-jeong (2014)¹⁶, which analyzed the effect of macroeconomic variables on housing sales prices through dynamic panel analysis, showed that the CD interest rates had a negative effect on housing sales prices. However, unlike before the global financial crisis, the CD interest rates and the housing sales prices generally showed a positive relationship by region because the housing market has not been activated and has remained downward overall despite the government's continued rate cut to revitalize the housing market.

¹¹ Bjornland, H. C. and Leitemo, K.(2009), “Identifying the independence between US monetary policy and the stock market”, *Journal of Monetary Economics*, 56, 275-282.

¹² Lyu Hansu, Nam Ki Sung, Bae Jong Ga, Jung Ju Sang, Kim Sun Ja. (2020). A Study on the correlation and Granger causality between stock market and major interest rates in Korea and USA. *Regional industry review*, 43(3), 381-397.

¹³ Na Chan-Hwi, A study on the factors affecting the stock return of the banking industry and financial holding companies, 2019, Seoul

¹⁴ Gyu Hyun Moon. (2019). The Effects from Interest Rates to Korean House Markets. *The Korean Journal of Financial Engineering*, 18(1), 1-20.

¹⁵ Keun Yeong Lee, Namhyun Kim. (2016). Interest Rates and Housing Prices. *KYUNG JE HAK YON GU*, 64(4), 45-82.

¹⁶ Haejung Chun. (2014). A Study on the Relationship between Macroeconomic Variables and Housing Market Focused on before-after Global Financial Crisis - Employed Dynamic Panel Analysis -. *Korea Real Estate Academy Review*, 58(0), 33-44.

Choi Cha-soon(2021)¹⁷, who analyzed the dynamic causal relationship between house price and mortgage interest rate using VECM, showed that house price and mortgage interest rate are negative, maintaining a long-term dynamic equilibrium, and fluctuating seemed to have done.

Su-min Jeon and Ki-sung Lee(2013)¹⁸ found the correlation between housing prices and household loans using VECM and revealed that there is a positive correlation in the long term between apartment prices and mortgage loans.

As a result of analyzing the correlation between mortgage loans and housing prices through VECM, Imjin(2016)¹⁹ explained that mortgage loans and housing prices have a stable positive correlation in the long run, and the impact of changes in the mortgage market appears through liquidity supply channels and optimal portfolio adjustment channels.

C. Correlation between CD interest rates (short-term interest rates) and macroeconomic variables

Kim Hyun-ui (2000) analyzed riddle time lag between changes in monetary policy on industrial production index, inflation, and corporate bond yield using the VAR model, and showed that the rise in short-term interest rates negatively affects industrial production index and inflation.

As a result of analyzing short-term interest rate fluctuations and won/dollar exchange rate fluctuations, Lee Ki-sung (2004) confirmed that the rise in short-term interest rates lowers the exchange rate and stock price.

In an empirical study on the effect of call rate fluctuations on economic variables, Park Song-chun and Cho Young-seok (2006) confirmed that short-term interest rates affect various economic variables, especially wholesale and retail sales index and industrial production index.

Kim Seok-won (2007) analyzed that in the case of deposit banks, deposit rates are adjusted relatively quickly to short-term interest rate fluctuations compared to loan rates. In particular, it was analyzed that deposit rates react more sensitively when short-term interest

¹⁷ Choi, Cha Soon.(2021). A study on the Dynamic Correlation between Housing Price and Household Loan. Journal of the Korean Real Estate Association. 60(1): 167-185

¹⁸ Jeon Sumin, Lee Kiseong. (2013). Analysis on the Dynamic Correlation between Housing Prices and Household Loan. The Journal of Eurasian Studies, 10(3), 1-27.

¹⁹ Imjin. (2016). Financial focus: Interrelationship analysis between housing prices and mortgage loans. Weekly Financial Brief, 25(14), 8-9

rates fall than when short-term interest rates rise, proving that there is an asymmetry in interest rate adjustments.

In a study analyzing the time-varying correlation and volatility between short-term interest rates and lending/deposit rates, Kim Jong-sun (2011) suggests that the increase in short-term interest rates generally affects the rise in deposit rates and lending rates, and that the fall in short-term interest rates affects the fall in deposit rates and lending rates.

Lim Yong-taek (2009) found that there is a strong causal relationship between economic growth and short-term interest rates in a study that analyzed the effectiveness of short-term interest rate adjustment policies to stabilize prices and minimize economic recession. In addition, as a monetary policy for price stabilization, it was revealed that the impact of interest rate fluctuations, such as a short-term rate hike, has the effect of lowering consumer prices over time.

The variables in this paper were set based on the strong interconnection between the asset market and macroeconomic variables observed in previously mentioned studies. This paper examined the influence of the CD interest rates more broadly by comprehensively analyzing the variables covered in each of the studies above. In addition, even though the same variables were dealt with, it was confirmed that there were some studies showing contradictory results according to the period of data. Therefore, our study reflected it in the research design process, such as setting the period and model of data.

III. Research Methodology

A. Data Descriptions

In this study, variables were set as shown in Table 1 below to analyze the effect of the CD interest rates on asset prices and the real economy. The KOSPI and the index of the housing sales price were used as variables representing the asset market, and the index of all industrial production, the consumer price index, the unemployment rate, and the exchange rate were used as variables representing the real economy.

The CD rate is an interest rate issued by banks to supply credit in response to investment demand, and it is characterized by a better reflection of investment demand than other interest rates in that it can represent the demand for investment through a rise in the CD rates. Since the CD interest rates reflect expectations for long-term interest rates and are affected by corporate investment trends, we decided that the CD interest rates are appropriate variables in analyzing the impact of market liquidity on asset prices and the real economy.

The analysis period was from September 2008, when the global financial crisis began in earnest, to August 2021, the most recent period of data available, a total of 156 monthly data were used.

<Table 1. Variable definitions and sources>

Variables	Explanation of variables	Period of data	Sources
CD	Return of 3-month CD rate	2008.09 ~2021.08 (Monthly data)	Bank of Korea Economic Statistics System
KOSPI	Composite Stock Price Index (The average return on stocks)		
H	Index of the Housing sales price		Korea Real Estate Agency
IAIP	Index of All Industrial Production		KOSTAT
CPI	Consumer Price Index		
UNEM	Unemployment Rate		

EXR	Exchange Rate		
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B. Model setting

1. ADF (Augmented Dickey-Fuller) test

Regression with non-stationary variables can lead to the problem of spurious regression. To test whether a given time series is stationary or not, an Augmented Dickey-Fuller (ADF) test should be performed. The ADF test is a unit-root test that extends the DF test method, which removes all the structural effects (autocorrelation) in the time series. In this study, we check the stationarity of time series variables using the ADF test. The three basic models are as follows:

$$\text{No constant, no time trend: } \Delta y_t = \gamma y_{t-1} + \sum_{k=1}^p \alpha_k \Delta y_{t-k} + \varepsilon_t$$

$$\text{Constant, no time trend: } \Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{k=1}^p \alpha_k \Delta y_{t-k} + \varepsilon_t$$

$$\text{Constant and time trend: } \Delta y_t = \alpha_0 + \alpha_1 t + \gamma y_{t-1} + \sum_{k=1}^p \alpha_k \Delta y_{t-k} + \varepsilon_t$$

The null hypothesis of the ADF test is that there is a unit-root. The alternative hypothesis is that the time series is stationary. If the null hypothesis is rejected, this infers that the time series is stationary.

2. Granger Causality Test

When testing using time series data, there are cases where the causal variable is not clear. Therefore, this study tests the causal relationship between two variables with the identical range of axis of time using a lag distributed model. The lag distributed model refers to a regression model that includes the currently observed value of the explanatory variable and the past observations. If the two variables are a normal time series or a time series in a cointegral relationship, which of the two variables is the cause can be determined through the setting of the regression equation as follows.

$$Y_t = \sum_{i=0}^m \alpha_i X_{t-i} + \sum_{j=0}^m \beta_j Y_{t-j} + \varepsilon_{1t}$$

$$X_t = \sum_{i=0}^m \lambda_i X_{t-i} + \sum_{j=0}^m \delta_j Y_{t-j} + \varepsilon_{2t}$$

The null hypothesis is that "it does not Granger-cause", and thus, it can be concluded that it Granger-causes when the null hypothesis is rejected. That is, if one-time series variable data for a specific time interval can linearly regress to another time series variable, the two variables granger-cause.

$$H_0 : \alpha_i = 0$$

$$H_0 : \delta_i = 0$$

3. Johansen Cointegration Test

In the above, ADF unit-root tests were performed by differentiating non-stationary time series variables. Analyzing unstable time series including unit-roots is a problem because it is highly likely to derive estimates with bias. In addition, since most actual time series data are unstable, it is essential to check the stability through the unit-root test above. However, even if it is an unstable time series, the presence of a specific type of linear combination may lead to a long-term stable balance between time series. In other words, it can be considered as a stable time series, which means that the data is in a cointegration relationship. Therefore, the number of cointegration vectors is tested through MLE(Maximum Likelihood Estimation) in multiple time series, and time-series data can be analyzed through general regression analysis techniques.

$$\Delta Y_t = \Pi Y_{t-1} + A_1^* \Delta Y_{t-1} + A_2^* \Delta Y_{t-2} + \dots + A_{p-1}^* \Delta Y_{t-p+1} + \varepsilon_t$$

$$A_j^* = -(A_{j+1} + A_{j+2} + \dots + A_p)$$

$$\Pi = A_1 + A_2 + \dots + A_p - I_n$$

The cointegration test tests the hypothesis that there are multiple cointegration relationships between N multiple variables through the confirmation of $\Pi = 0$ in $\Pi = A_1 + A_2 + \dots + A_p - I_n$ ($0 < r < n$).

$$H_0 : \text{rank}(\Pi) \leq r$$

$$H_1 : \text{rank}(\Pi) > r + 1$$

The Likelihood ratio statistics are used for the test. In this paper, we tested the cointegration relationship between variables by using the Johansen cointegration test.

4. VAR (Vector Autoregressive Model)

If it is confirmed that there is no cointegration relationship in the time series data through the Johansen cointegration test, the estimation can be performed in earnest using VAR. Vector autoregressive model VAR(p) is defined as an autoregressive process in which $X_t = (X_{1t}, X_{2t}, \dots, X_{Nt})$ composed of multivariate stationary time series which is p lag, and the two dependent variables X_t and Y_t can be defined as follows.

$$X_t = C + \theta_1 X_{t-1} + \dots + \theta_p X_{t-p} + \varepsilon_{1,t} = C + \sum_{i=1}^p \theta_i X_{t-i} + \varepsilon_{1,t}$$
$$Y_t = D + \phi_1 Y_{t-1} + \dots + \phi_p Y_{t-p} + \varepsilon_{2,t} = D + \sum_{i=1}^p \phi_i Y_{t-i} + \varepsilon_{2,t}$$

When setting the lag, the lag for estimation is set to 1, which is the BIC(Bayesian Information Criterion, =SC) criterion, because the BIC criterion usually tends to more appropriately identify the number of parameters than the AIC(Akaike Information Criterion). According to the AIC criterion, there is a possibility of overidentifying the number of parameters. On the other hand, according to the BIC standard, the sample size of the data is also reflected in the test, so it is easy to calculate using different samples.

$$BIC = \ln \left| \hat{\Sigma}_p \right| + \frac{(N^2 p + 1) \ln(T-p)}{T-p}$$

VAR can grasp the dynamic effect of changes in one variable on endogenous variables through impulse response analysis.

IV. Data Analysis and interpretation

A. Augmented Dickey-Fuller Test

The results of the ADF unit-root test conducted to understand the stability of time series data are shown in Table 2. All level variables except the CD interest rates and exchange rates failed to reject the null hypothesis that unit-roots exist at the 1% significance level. Therefore, the ADF unit-root test was performed by Logarithmic Differentiation of all variables, and the results are shown in Table 3. It was confirmed that the time series was stable because all null hypotheses were rejected at the 1% level of significance and the unit-root did not exist.

<Table 2. Level variables ADF test results>

LEVEL VARIABLE	adf_test	p-value
CD	-5.0153	0.01*
KOSPI	-1.9932	0.5792
Index of Housing sales price	-0.98036	0.9385
Index of All Industrial Production	-3.9518	0.01342
Consumer Price Index	-2.3671	0.4233
Unemployment rate	-2.6711	0.2966
Exchange rate	-4.0398	0.01*

<Table 3. Logarithmic Differentiation variables ADF test results>

First Logarithmic Differentiation variable	adf_test	p-value
CD	-5.5907	0.01*

KOSPI	-7.0472	0.01*
Index of Housing sales price	-4.5136	0.01*
Index of All Industrial Production	-8.5743	0.01*
Consumer Price Index	-4.3533	0.01*
Unemployment rate	-4.8379	0.01*
Exchange rate	-7.7858	0.01*

B. Granger Causality Test

Table 4 shows the results of the Granger Causality test, indicating matters related to the lead/lag relationship between the variables used in this research. The lag value representing the optimal lag was determined using Schwarz Criterion(SC).

<Table 4. Granger Causality test results>

CD → IAIP	0.00778 **	IAIP → CD	4.061e-07 ***
CD → H	0.01397 *	IAIP → KOSPI	0.01569 *
CD → KOSPI	0.01209 *	IAIP → EXR	0.02491 *
KOSPI → H	1.338e-05 ***	CPI → H	0.01956 *
KOSPI → IAIP	1.609e-06 ***	EXR → H	0.0144 *
H → CD	0.0004425 ***	EXR → IAIP	7.289e-05 ***
H → UNEM	0.04156 *		

remark 1. *, **, *** means 10%, 5%, and 1% significance levels, respectively.

In the case of the CD interest rates, the null hypothesis is rejected at the 5%, 1% and 1% significance levels, respectively, with the Index of all industrial production, Index of

housing sales price, and the composite stock price index, so it has a Granger causal relationship. In addition, the Index of All Industrial Production and the Index of Housing sales prices also had a granger causal relationship because they rejected the null hypothesis at a 1% significance level for the CD interest rate returns. Accordingly, it can be seen that the CD interest rates have a granger causal relationship with the Index of All Industrial Production and Index of Housing sales price in both directions.

KOSPI was found to have a granger causal relationship because it rejected the null hypothesis at the 10% significance level for the Index of All Industrial Production and Index of Housing sales prices. Since the Index of All Industrial Production also rejects the null hypothesis at the 10% significance level for KOSPI, we confirmed that it has a granger causal relationship.

Accordingly, it can be seen that there is a two-sided granger causal relationship between the composite shock price index and the index of all industrial production. The house price index rejects the null hypothesis at the 10% significance level from the unemployment rate, resulting in a granger causal relationship.

The null hypothesis was rejected at the exchange rate and 10% significance level for the entire industrial production index, and the null hypothesis production index and the null hypothesis was rejected at the 1% significance level for the entire industrial production index. As a result, there is a two-way Granger causal relationship between the index of all industrial production and the exchange rate. The consumer price index and the exchange rate rejected the null hypothesis at the 10% significance level for the house price index, confirming the granger causal relationship.

C. Johansen Cointegration Test

The optimal parallax was determined according to the BIC and Johansen Cointegration Test was performed. Table 5 shows the results of the Johansen test between time series variables. The null hypothesis that there is no cointegration relationship for all variables was not rejected at the 1% and 5% significance levels.

<Table 5. The outcome of Johansen cointegration test>

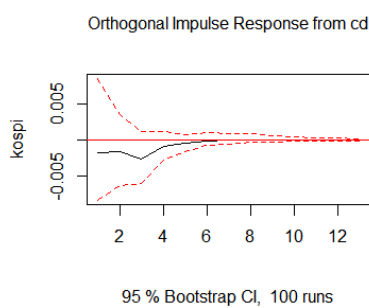
	test	10pct	5pct	1pct
$r \leq 6$	0.29	6.50	8.18	11.65

$r \leq 5$	4.54	12.91	14.90	19.19
$r \leq 4$	15.81	18.90	21.07	25.75
$r \leq 3$	19.07	24.78	27.14	32.14
$r \leq 2$	25.23	30.84	33.32	38.78
$r \leq 1$	38.24	36.25	39.43	44.59
$r = 0$	43.96	42.06	44.91	51.30

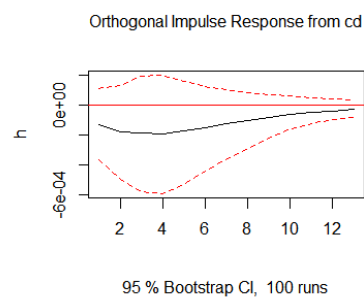
The findings indicate that there are no cointegrations in each variable. Accordingly, we conducted a time series analysis of the variables using VAR(Vector Autoregressive Model).

D. Impulse Response Function

The impulse response function is a function that indicates when the impact of the standard error of one variable is given, how many standard deviations other variables in the model respond to over time. The following table is the impulse response function of the CD interest rate based on the VAR estimation. This paper looked at the impulse response of asset price indicators and real economic indicators to the CD interest rates.



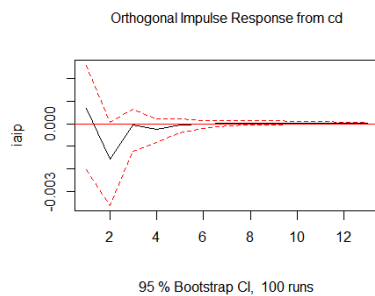
KOSPI



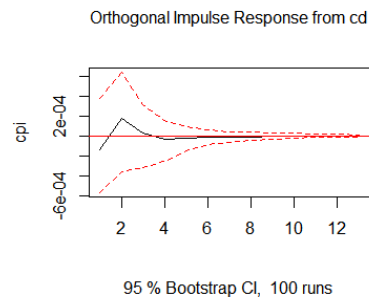
Index of the Housing sales price

The impulse response of asset price indicators due to the shock of the CD interest rates is as follows. KOSPI was continuously impacted by a negative effect and gradually

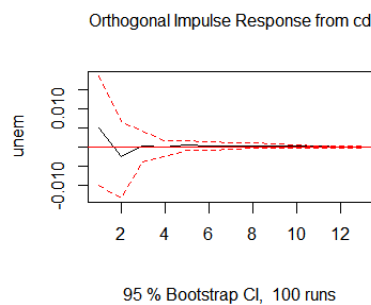
disappeared from the mid-term. The Index of the Housing sales price was negatively affected as a whole period. The degree of impulse gradually decreased after reaching a short-term low.



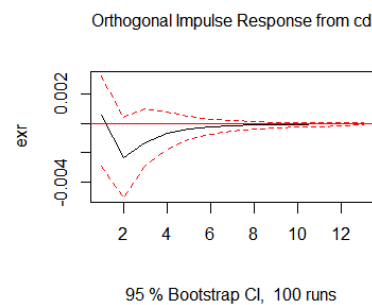
Index of All Industrial Production



Consumer Price Index



Unemployment Rate



Exchange Rate

The impulse response of real economic indicators due to the shock of the CD interest rates is as follows. The Index of All Industrial Production shows a positive impact in a very short period by the CD interest rates. Since then, it has switched to a negative shock and reaches the lowest point in the second period, but after that, the negative influence gradually decreases and the shock disappears from the mid-term.

The consumer price index shows a negative impact in the extremely short term period, and turns into a positive impact and reaches a high point. After then, it indicates a negative effect close to zero, and the impulse disappears. The unemployment rate shifts from positive to negative in a very short term period, and the impact converges to zero and disappears. The exchange rate reaches a low point due to a negative effect in the extreme period, and then the impulse gradually decreases and converges to zero in the mid-term period.

V. Conclusion

To overcome the critical situation after the global financial crisis, governments in developed countries and emerging countries avoided economic depression by promoting fiscal and monetary policies. However, the financial sector remained buoyant due to the large-scale liquidity provision, while the real sector remained relatively sluggish.²⁰ Especially after COVID-19, the economy experienced a similar crisis, demand from individual investors increased while the overall economy slowed and debt accumulated. Therefore, under these circumstances, it is necessary to analyze the impact of oversupply of liquidity and the resulting rapid increases in speculative demand on the real economy and asset markets.

The CD interest rate is the interest rate set on the Certificate of Deposit, a periodic deposit certificate that can be transferred to a third party. It is used as a base rate for short-term interest rates, variable rate bonds, stock index futures, and options markets.²¹ Since the CDs are issued in response to the demand for investment based on the base rate, it can be confirmed that there is a demand for investment through an increase in the CD prices. Therefore, the CD interest rates were judged to be suitable variables to analyze the influence of increased liquidity on the asset market and the real economy after the global financial crisis. For this reason, we used it as a major variable in this paper.

This study used the 3-month CD interest rate as an independent variable. Profits of KOSPI and the index of housing sales price were used as dependent variables representing the asset market, and the index of all industrial production, the consumer price index, the unemployment rate, and exchange rate were used as dependent variables representing the real economy. The analysis period is set from September 2008, when the global financial crisis began in earnest, to August 2021, the latest time when data was available. And monthly data were used to execute VAR shock responses.

As a result of the ADF cointegration test, the null hypothesis that all level variables except the CD interest rates and exchange rates have unit-roots at the 1% significance level was not rejected. Accordingly, as a result of conducting the ADF cointegration test after log difference, the null hypothesis was rejected at the 1% significance level, confirming that it was a stable time series without unit-roots. As a result of Johansen's cointegration test, the null hypothesis that cointegration relationships do not exist for all variables failed to reject at

²⁰ Go Jun Hyung, Jung Cheol Ho, Choi Dong Young (2018)

²¹ Kim Eun Sung, Lee Sang Hyo, Kim Jae Joon (2009). An Analysis on the influence of CD Interest Rate and Spread on Housing Transaction Index and Jeonse Rental Index. *Journal of the Architectural Institute of Korea Structure & Construction*, 25(12), 207-214.

the 1% and 5% significance levels, so it was decided to use the Vector Autoregressive Model(VAR) for time series analysis.

As a result of the Granger causality test, the CD interest rate had a two-way causal relationship with the index of all industrial production and the index of the housing sales price. It also confirmed that there is a two-way Granger causal relationship between the composite stock price index and the index of all industrial production, the index of the housing sales price and the unemployment rate, and the index of all industrial production and the exchange rate. In addition, it was confirmed that both the consumer price index and the exchange rate had a Granger causal relationship with the index of the housing sales price.

When the VAR analysis results were expressed as shock response functions, the asset price indicators, KOSPI and the housing sales price index were hit with negative (-) by the impact of the CD interest rates and then gradually decreased. All industrial production index, consumer price index, and unemployment rate, which are real economic indicators, were hit with negative or positive impact at a very short period due to the impact of the CD interest rates, their impact disappeared after the direction of the shock was reversed, and reached the lowest or highest point.

After the financial crisis, a negative impact of increased liquidity and increased asset prices was observed when demand for the CDs rose, the CD prices rose, and the CD yields fell. In other words, it can be interpreted that the movement of liquidity supplied to the market led to an increase in asset prices in the event of a fall in the CD interest rates due to an increase in price, a cause of demand and supply of the CDs. However, in the real economy sector, both the effects of negative and positive appear and in that process the shock is reversed after passing zero, and most of the shocks are extinguished in the short term and finally shows that they are not significantly affected by the CD interest rates. Therefore, the CD interest rates have a minimal effect on the real economy, but have a significant effect on asset prices, suggesting that there is a financial imbalance. In other words, from a macroeconomic point of view, it was possible to observe a phenomenon in which resources that were required to increase domestic demand did not lead to the creation of added value in the sustainable real economy. Instead, prices of some financial assets move excessively or accumulation of debt increases noticeably, resulting in downward pressure and contraction in the front of demand and supply in the real economy, which has recently been found to be a side effect of the Korean economy's low interest rate and liquidity policy.

As mentioned at the beginning of the paper's introduction, the purpose of the paper was to investigate the prolonged decline in unemployment and economic growth caused by COVID-19, and the slowing real economy and the rapid rise in the stock market.

According to previous papers, The relationship between the CD interest rates and real economic prices have been positive since the 2008 global financial crisis and have a positive relationship with the stock market represented by the asset market. However, according to a study in the text, it was confirmed that the impact of the CD interest rates on the real economy was almost zero and had a negative relationship with asset prices, and this result brings about the main topic that the introduction's hypothesis was meaningful.

The CD rate is a variable that immediately responds to apartment sales rate, monetary policy, and base rate. This index is suitable for observing the movement of the asset market and the real economy due to liquidity supply. Therefore, since the CD interest rate was used, it was found that the impact was insignificant by observing the impact on the housing sale price variable, not other asset price variables and that it did not immediately affect the real economy.

This study attempted to investigate the relationship between the real market and the asset market and other macroeconomic indicators such as unemployment and economic growth through the CD interest rates, a representative macroeconomic indicator of the sensitivity of the financial market. Although the CD interest rates account for a large portion of the domestic market, it may not be enough to explain its sensitivity without considering the proportion and frequency of use of other existing financial market indicators such as COFIX, Koribor, rate of monetary stabilization bond and financial bond rates. In addition, without considering the current financial imbalance caused by COVID-19 and the prolonged economic recession of the European Union, there is a limitation that it is difficult to fully explain the hypothesis that COVID-19 is the main cause of the market downturn. Finally, there is a limitation in that consideration of unpredictable variables was insufficient, which was completely different from the existing economy, such as variables which are new waves of financial transactions such as Bitcoin, which was created with the 4th industrial revolution.

This paper has implications in that it considered the CD interest rates as a variable observing the impact of changes in short-term interest rates on asset prices and the real economy, and empirically showed differences between the financial sector and the slow recovery considering increased liquidity and speculative demand. In particular, from a monetary policy point of view, the excessive financial imbalance leads to mid-term costs greater than short-term economic benefits due to low growth and expansion of debt burdens,

so research on various variables such as the CD interest rates is expected to contribute more to Korea's economic stabilization process.

It is also meaningful in that it empirically examined the long-term and short-term balance relationship with other variables, focusing on the CD interest rate, which has not been studied much compared to the existing call rate. Considering that most of the existing studies that analyzed the correlation between the CD interest rates and other economic variables were conducted during or close to the 2008 global financial crisis, this study which included economic data at the latest can help identify structural changes in the capital market.

Preparing to take off the limitation includes the lack of consideration of unpredictable variables and macroeconomic variable indicators, future studies hope to further enhance explanatory power through research to investigate and review the impact of monetary policies such as the 4th industrial revolution and tapering on investment and interest rate fluctuations on the real and asset markets.

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