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Effects of Fiscal Instability on Financial Instability†

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This paper empirically examines how fiscal instability affects financial instability. According to an IMF forecast (2021a), the fiscal space in Korea will be steadily reduced in the future. The theoretical literature predicts that if fiscal stability is undermined, financial stability will also be in danger given that government guarantees on banks are weakened and/or sovereign bonds held in banks become riskier. This paper empirically finds the existence of this negative impact of fiscal instability on financial instability. I also find that the intensity of this fiscal-financial relationship is greater in a country where (i) its currency is not a reserve currency such as the US dollar or euro, (ii) its banking sector is large relative to government sector, and/or (iii) its private credit to GDP is high. Korea has all of these three characteristics and hence needs to put more effort into maintaining fiscal stability.

Key Word: Fiscal Instability, Financial Instability, Sovereign Bond, Implicit Government Guarantees, Noncore Currency
JEL Code: G01, G21, H60

I. Introduction

Since the 2020 Covid-19 recession, the fiscal space in Korea has been significantly reduced. According to the long-term forecast by the IMF (2021a), government debt and the budget deficit will continue to increase. This is in stark contrast to the forecasts for other advanced countries without reserve currencies in which fiscal stability will be steadily improved over the same period.

Although fiscal instability itself has attracted a considerable amount of attention, its effects on financial instability do not attract much attention despite its importance. The 2010-2014 European Sovereign Debt Crisis is an important example that shows that fiscal instability leads to financial instability. During that time, the government debt in many European countries expanded and the risk of sovereign default spiked.

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Therefore, sovereign bond prices fell, which triggered a deterioration of bank balance sheets as European banks held significant amounts of sovereign bonds. Also, the implicit government guarantees on banks became unreliable and, therefore, banks' funding conditions were also severely damaged given that capital market investors usually lend money to banks believing in the implicit government guarantees. In the end, the financial system melted down. According to Laeven and Valencia (2020), if a financial crisis occurs, it takes more than seven years for the economic growth path to recover its original trend. Therefore, Obstfeld (2013) asserts that (i) financial stability should be an objective of fiscal policy, (ii) the fiscal space should be large enough to deal with financial crises, and (iii) government debt should be reduced.

The objective of this paper is empirically to examine whether fiscal instability leads to financial instability in Korea and other advanced countries. The literature suggests two channels of the fiscal-financial relationship. The first channel of implicit government guarantees can be understood in the following way (Leonello, 2018). Banks are highly likely to obtain a government bailout when they fail because they are systemically important. That is, there exists implicit government guarantees on banks. If the fiscal space of a government is weakened for some reason, the creditability of the implicit guarantees will be undermined simply because the government does not have sufficient reserves. Therefore, capital market investors withdraw their trust in banks and hence the bank default risk rises. The second channel is related to sovereign debt. Banks are in most countries the largest investors in sovereign bonds. For instance, Korean banks hold 40% of outstanding Korean treasury bonds as of 2020. The share of sovereign bonds on bank balance sheets is also usually high. In this regard, if the sovereign default risk rises and hence the sovereign bond price falls, the asset quality of banks will be decreased and financial turmoil could therefore arise (Acharya *et al.*, 2014).

Another aim of this paper is empirically to explore the determinants of the effects of fiscal instability on financial instability in the context of Korea. The Korean economy can be distinguished from other advanced economies in the following three ways. First, the Korean currency is not a reserve currency or core currency such as the US dollar or euro[1]. Second, the banking sector is huge relative to the government sector. Third, bank loans made to households and the corporate sector relative to GDP are also very large. All three of these characteristics potentially affect the fiscal-financial relationship. First, countries with a noncore currency may be in a disadvantageous position compared to countries with a core currency in overcoming financial crises. Second, if the banking sector is large but government revenue amounts are small, the banking sector is too large to be saved by the government. Third, if bank loans given to households and nonfinancial corporations are huge and hence the debt of these economic agents is overridden, it becomes more difficult for the government to rescue the banking sector when it faces a crisis.

This paper uses the CDS premium measure as a measure of default risk or the degree of instability because it reflects the forward-looking information of market participants pertaining to the likelihood of a default. The dataset contains data on all advanced countries, including Korea, and many deposit-taking commercial banks

[1]Throughout this paper, I use the two terms core currency and reserve currency interchangeably.

headquartered in these countries for the sample period of 2003-2021.

The first main result of this paper is that an increase in the sovereign CDS premium is associated with a rise in the bank CDS premium, consistent with the two aforementioned theoretic channels. The magnitude of this influence of the sovereign default risk on the bank default risk is large and is pronounced in countries with relatively higher levels of default risk. The second main result is that this magnitude is greater if the currency of the country of interest is not a core currency, if total assets in the banking sector relative to government revenue are relatively large, or the ratio of private credit to GDP is relatively high.

These empirical findings provide important implications about the Korean economy. If fiscal stability is undermined in Korea, the financial system may experience crises more likely at a greater magnitude than in other advanced countries. To resolve this adverse link between fiscal instability and financial instability, policies should reduce banks' reliance on the government and improve their stand-alone prudence and competitiveness.

This paper is related to the literature on fiscal-financial relationships. Because the European Sovereign Debt Crisis is a historic event that highlighted the importance of the fiscal-financial link, the literature focuses on European countries. Acharya *et al.* (2014) consider Eurozone countries, north European countries, Switzerland, and the UK, finding a two-way feedback loop between fiscal instability and financial instability. De Bruyckere *et al.* (2013) also empirically examine only European countries. Demirgüç-Kunt and Huizinga (2013) consider both European and non-European countries, including Morocco, Romania, Mexico, Turkey, Hungary, Poland and other developing countries. Therefore, the outcome of their research may be less relevant to Korea. An additional difference between earlier findings and this paper is that several important characteristics of the Korean economy, such as the absence of a core currency, a large banking sector relative to the government sector, and very high private credit are addressed only in this paper.

Among the relevant papers, Acharya *et al.* (2014) is the most closely related to the current paper. They use daily CDS data to analyze very short-term *two-way* interactions between fiscal and financial instability in stressed times such as the Global Financial Crisis. Interestingly, they do not find any significant relationship between fiscal and financial instability in *normal times*. In contrast, the objective of this paper is to determine the *one-way* influences of fiscal instability on financial instability in *normal times*, as fiscal instability is currently not severe in Korea, but in the longer run obviously the fiscal space will be greatly reduced. Therefore, this paper seeks to determine whether the effect of fiscal instability on financial instability exists in normal periods.

II. Background

A. *Channels through which fiscal instability affects financial instability*

1. Implicit guarantee channel

It is well known that the failure of large-sized banks can trigger an economic crisis.

Banks offer a number of socially vital financial services, such as payments, money transfers, deposits, and loans. If a bank fails, these crucial services may no longer be properly supplied, causing significant trouble in the overall economy. Also, banks are related to nearly all economic agents, including households, corporations, and nonbank financial companies through deposits, loans, and other financial products. Therefore, bank failures can trigger chain-reaction failures of these and many other economic agents.

Due to this systemic importance, governments usually bail out troubled banks. Whenever there were system-wide financial crises, such as the 1997 Asian Currency Crisis, the 2008 Global Financial Crisis, and the 2010 European Sovereign Debt Crisis, governments rescued failed banks. That is, it is obvious that governments provide banks certain implicit guarantees. Although these guarantees are implicit and often not formalized in national laws in many countries, one cannot deny the fact that they exist.

The source of these government bailouts is taxpayer's money. Only if there is enough fiscal space can governments save banks (Komárek and Komárková, 2015). In previous financial crises, it was rare to find only one or two banks failing while other many banks remained sound. Because banks are interconnected and their business models are almost identical, if one bank fails for some reason, it is highly likely that other many banks will fail for a similar reason. Therefore, governments need a large enough fiscal space to save all of such banks at the same time during crisis periods.

Thus, fiscal instability could cause financial instability. If the fiscal space is not large enough to save all banks at the same time, many banks cannot survive crisis periods by themselves and hence could fail and be forced into a disorderly liquidation (Leonello, 2018; Caruana and Avdjiev, 2012). If capital market participants realize that governments are unable to support banks, banks' credit ratings will be downgraded and their cost of funding will thus increase. In some stressed situations, banks find it impossible to refinance, greatly increasing the likelihood of a bank default (Bobetko *et al*., 2013; Das *et al*., 2010).

2. Sovereign debt channel

If fiscal stability is undermined, a sovereign entity's ability to repay its debt will be questionable, increasing the risk of a sovereign default and in turn causing a decrease in sovereign bond prices. In many counties, banks are primary investors in sovereign bonds. For instance, Korean banks held 40% of Korean treasury bonds as of 2020. Similarly, in other countries, domestic banks are predominant investors in domestic sovereign bonds.

Because sovereign bonds are one of the major asset classes on bank balance sheets, if the sovereign bond price falls due to a surge in sovereign credit risk, the asset quality of most banks will be severely undermined, which could trigger financial turmoil (Acharya *et al.*, 2014).

B. *Current status in Korea*

Below, I shall observe the current status of fiscal stability and financial stability

in Korea. Although fiscal stability and financial stability could depend on a number of different factors, I consider the debt levels of the government and the private sector as indebtedness is easy to understand and frequently considered as important in the literature.

Until recently, South Korea has maintained a low sovereign debt level relative to other advanced countries. The ratio of government debt to GDP was only 40% in 2019. However, the fiscal space in Korea has been reduced quickly due to the Covid-19 pandemic. Even worse, the debt-to-GDP ratio of Korea is forecasted to increase continuously in the medium to longer term, whereas other advanced countries are forecasted to deleverage their sovereign debt. As a benchmark country group, I shall consider the group of advanced countries (i.e., *noncore currency country group*) that do not have core currencies such as the US dollar, euro, UK pound sterling, Japanese yen, Swiss franc, and Canadian dollar.[2] These advanced countries with noncore currencies are South Korea, Australia, the Czech Republic, Denmark, Israel, New Zealand, Norway, and Sweden.

According to forecasting by the IMF (2021a), the ratio of government debt to GDP in Korea will increase steadily to 70% by 2026 (see Figure 1). In contrast, the average debt-to-GDP ratio of other advanced countries with noncore currencies will increase only to 55% by 2023 and then will decrease thereafter.

Other forecast indicators also show that the fiscal stability of Korea will weaken over time. For instance, *net* sovereign debt, which is *gross* sovereign debt minus certain financial assets, will also increase to 40% by 2026 in Korea, while in other advanced countries with noncore currencies it will be only 14% by 2026 (IMF, 2021a). Similarly, the government budget deficit of Korea will exceed 2% of GDP by 2026, whereas for the group of advanced countries with noncore currencies, it will converge to 0% of GDP by 2026.

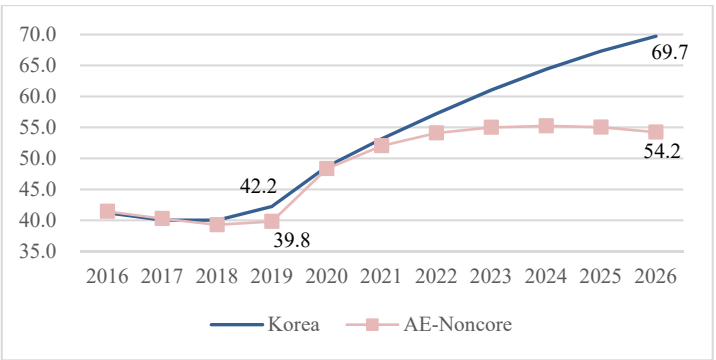

FIGURE 1. FORECAST OF THE RATIO OF GOVERNMENT DEBT TO GDP

Note: 1) The numbers for 2020 and thereafter are forecasts by the IMF (2021a), 2) AE-Noncore is the average of Australia, the Czech Republic, Denmark, Israel, New Zealand, Norway, and Sweden.

Source: IMF (2021a).

[2]Although there may be disagreement on which currency is a core currency (or reserve currency), I adopt the opinion of the Bank of Korea that US Dollar, Euro, UK Pound Sterling, Japanese Yen, Swiss Franc, and Canada Dollar are core currencies (Bank of Korea, 2018). According to the Bank of Korea, the central banks of the United States, the United Kingdom, Japan, Switzerland, and Canada, and the European Central Bank form a permanent currency swap network and, hence, their currencies can be regarded as core currencies.

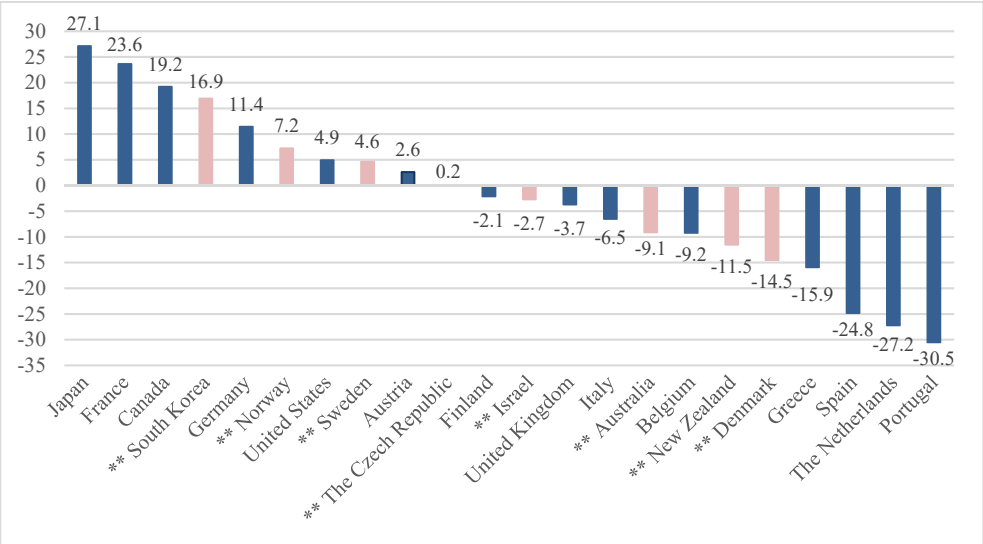

FIGURE 2. PRIVATE CREDIT TO GDP GAP (2020. 3Q)

Note: The countries with double asterisks belong to the noncore currency group.

Source: BIS (2021).

The ratio of private credit to GDP measures the volume of bank loans made to households and nonfinancial companies. The empirical literature finds that higher ratios of private credit to GDP are associated with a greater likelihood of a credit crisis (Hahm *et al*., 2013). In 2020, private credit to GDP in Korea is 212%, which is 25%p higher than the average of all advanced countries. Recently, this ratio increased rapidly in Korea (see Figure 2).

The difference between the *level* and the *trend* of the ratio of private credit to GDP is called the private credit to GDP *gap*. This credit gap measures how quickly a country's private credit increases relative to its long-term trend. According to the Bank of International Settlements, the likelihood of a credit crisis is alarming if this credit gap exceeds 10%p (BCBS, 2010). As of 2020, the credit gap in Korea was 17%p, the highest among all advanced countries with noncore currencies and 24%p higher than the average of all advanced countries.

In sum, the indebtedness of the government and of households and nonfinancial companies in Korea is not just high but also increasing rapidly. Therefore, maintaining fiscal stability and financial stability should be important policy objectives.

C. *Testable hypotheses*

The objective of this paper is to examine whether fiscal instability leads to financial instability. Fiscal instability depends on many factors, such as the credit risk of sovereign debt, tax revenues, and government spending. Therefore, fiscal instability can be defined in a number of different ways. To be more specific, this paper focuses on the default risk of sovereign debt. Similarly, with regard to financial instability, I confine my attention to the default risk of bank debt. Thus, this paper will empirically examine the following hypothesis:

Hypothesis 1. *If the default risk of sovereign bond increases, the default risk of bank bond also increases.*

If this hypothesis is correct, it will be useful to ascertain what determines the intensity of this fiscal-financial relationship. To this end, this paper considers three factors: noncore currencies, banking sector total assets to government revenue, and the private credit to GDP. In the following sections, I discuss how these factors potentially affect the magnitude of the influence of fiscal instability on financial instability. These three factors are also relevant to the Korean economy given that Korea is a country with a noncore currency and that its ratio of private credit to GDP is large and increasing rapidly. In addition, Korea is special among advanced countries in that the banking sector is very large relative to the government sector. The ratio of total assets in the banking sector over government revenue was 620% in 2017, the highest among all advanced countries (World Bank, 2017; IMF, 2021b) and substantially higher than the average (260%) in advanced countries. During the 2008 Global Financial Crisis, Iceland was unique among European countries because it decided not to bail out certain bank creditors. In that country, the banking sector was notoriously massive relative to the government sector. Even in Iceland, the ratio of total assets in the banking sector to government revenues was only 415% in 2008, meaning that the banking sector in Korea is too large for the government to bail out.

First, the intensity of this fiscal-financial relationship may depend on whether the currency of a country of interest is a core currency. If the sovereign default risk increases for a country, it is more difficult for the government to procure funds to save banks when the banks are distressed. As an alternative to sovereign debt issuance, the central bank of the country may consider issuing more money to save distressed banks, though doing so could increase the inflation rate.

The magnitude of the inflation risk may be lower if the country has a core currency because a core currency is used not just in the given country but globally. For this reason, the burden of the decreased value of money will be shared not only by citizens of the country but also by all nations around the world. In contrast, if the country does not have a core currency, only the citizens of the country must shoulder the burden of inflation. In this regard, one can expect that the value of a core currency will not decrease much even if the central bank responsible for that currency increases the rate of money issuance, whereas the value of a noncore currency will decrease by a greater magnitude when the central bank of such a currency increases money issuance by the same amount.

Therefore, if the sovereign default risk is high and banks fail, countries with a core currency can easily find funds to save distressed banks even if they cannot rely on sovereign bond issuance, whereas countries with a noncore currency are in a more difficult position with regard to saving their banks. In this sense, this paper considers the following hypothesis.

Hypothesis 2. *If the default risk of sovereign bonds increases, the default risk of bank bonds increases at a greater magnitude in countries with a noncore currency as opposed to countries with a core currency.*

Secondly, the intensity of the fiscal-financial relationship may also depend on the

size of the banking sector relative to government revenues. If the sovereign default risk rises and hence government borrowing becomes more difficult, governments may consider increasing tax rates and taxable income levels. Such an effort to increase tax revenues may be futile with regard to overcoming financial crises if the tax revenue is not enough to rescue distressed banks. In sum, if the risk of sovereign default increases and hence alternative financing arrangements such as increases in tax revenues are required when banks fail, the government's capacity to save the banking sector is low in countries where the banking sector is too large to save. In this regard, this paper considers the following hypothesis.

Hypothesis 3. *If the default risk of sovereign bonds increases, the default risk of bank bonds increases at a greater magnitude in countries where the size of the banking sector relative to government revenues is relatively large.*

Last but not least, the level of the private credit to GDP may also determine the intensity of the fiscal-financial relationship. The greater the ratio of private credit to GDP, the more banks are interconnected with the private nonfinancial sector via loans. The more bank loans there are, the more banks are exposed to outside shocks. If the sovereign default risk rises, banks are more likely to be required to overcome outside shocks by themselves without relying on government support. If the size of bank loans is relatively large, it will be more difficult for banks to deal with outside shocks by themselves. In this regard, this paper considers the following hypothesis.

Hypothesis 4. *If the default risk of sovereign bonds increases, the default risk of bank bonds increases at a greater magnitude at higher ratios of private credit to GDP.*

III. Empirical Analysis

A. *Influences of Sovereign Default Risk on Bank Default Risk*

I utilize a sovereign-bank panel dataset. I construct this dataset by combining individual datasets from Eikon, the World Bank, the BIS, Bloomberg, and Moody's. Sovereign and bank default measures are obtained from Eikon. Fiscal and financial variables are obtained from the World Bank. Information on private credit is obtained from the BIS. Bank-level financial ratios are obtained from Bloomberg, and the credit rating information is sourced from Moody's investor service.

The panel dataset covers the period from 2003 1Q to 2021 1Q and contains quarterly variables. The dataset contains information on all advanced countries except Hong Kong, Singapore, Luxembourg, and Iceland, as they are very small countries in terms of territory and population. Consequently, there are 29 advanced countries in the dataset used here.

The objective of this paper is to explore the effects of the risk of sovereign default on the risk of bank default, but not vice versa. However, bank default risk can in reverse also affect sovereign default risk. This is particularly the case during periods of financial crises (BIS, 2016). If financial crises occur, banks are highly likely to

become insolvent and hence governments typically provide massive bailout packages, causing a meltdown of fiscal stability.

However, financial instability does not have material impacts on fiscal instability during normal times. In normal times, the financial system does not face serious stability issues. Of course, it is not impossible for one or a few banks to be troubled in normal times with temporary liquidity problems. However, central banks can easily resolve such problems as the lender of last resort by providing emergency liquidity. Even if central banks do not intervene, banks are usually able to overcome these idiosyncratic problems given that the overall capital market works well, allowing them to borrow money from the capital market.

The BIS (2016) also observes that financial stability affects fiscal stability only in financial crisis periods. By looking at the movement of government debt during the period of 1970 to 2015, it can be observed that government debt was generally stable before and after financial crises, whereas debt increased dramatically only during crisis periods.

In this sense, I confine my attention to normal times. There are two major financial crises during the period of 2003 to 2021. During the 2007-2009 Global Financial Crisis, all advanced countries suffered to some extent. In contrast, only European countries suffered from the 2010-2014 European Sovereign Debt Crisis. Therefore, in the following empirical analysis, I rule out every country from the analysis for the period of 2007 to 2009. For the period of 2010 to 2014, I rule out only European countries from the analysis. For other periods, all countries are considered.

The dataset contains 84 deposit-taking commercial banks. There are two types of banking services: commercial banking and investment banking. Commercial banks take deposits and make loans and hence are conventional banks. However, typical investment banks do not take deposits but engage in intermediate securities trading or invest by themselves. My primary focus in this paper is on deposit-taking commercial banks because they are core members of the financial system. However, I shall also consider investment banks when comparisons across types of banking services are useful.

As a default risk measure, I use the credit default swap (CDS) premium. Because CDS contracts are similar to credit insurance against default risk, the corresponding premium represents the premium for default risk, making this measure an ideal measure of default risk. The CDS premium is determined in the market where CDS protection sellers and protection buyers participate and make bids and offer premia. One may also consider other measures such as the spread between the bond yield and the benchmark rate. However, it is widely accepted in the literature that the CDS premium is a better option than the yield spread for a number of reasons. First, the CDS premium is a direct measure of the default risk, while the yield spread is an indirectly constructed measure. Second, the yield spread may be flawed because it is often difficult to find an ideal benchmark rate that perfectly matches the duration. Blanco *et al.* (2005) presents a discussion of why the CDS premium is a more appropriate measure of the default risk.

Table 1 shows descriptive statistics of the variables of interest. Bank CDS is the premium on the CDS contract that protects the CDS holder from the default risk of the bank bond. Sovereign CDS is the premium on a CDS contract that hedges the default risk of a sovereign bond. In the following empirical analysis, noncore

TABLE 1— DESCRIPTIVE STATISTICS

Variables	Unit	Sample size	Mean	S.D.	Min	Max
Bank CDS	bp	1,938	91.0	94.7	9.8	1,421.5
Sovereign CDS	bp	2,372	59.4	139.5	8.4	2,826.7
Noncore currency	Dummy	2,437	0.24	0.43	0	1
Size to revenue	%	1,212	353.4	131.3	152.1	619.9
Private credit	% of GDP	2,269	176.5	45.3	107.5	401.6
NA CDS index	Bp	2,329	71.4	18.3	45.2	145.2
EU CDS index	Bp	2,305	72.5	23.4	44.2	173.0
Total assets	Million $	1,230	557,220	545,763	34,823	3,125,813
BIS	%	1,053	13.4	2.9	1.5	25.1
Leverage	%	1,230	28.2	14.9	2.1	85.5
ROA	%	1,161	0.34	0.66	-4.49	2.23

currency, size to revenue, and private credit are considered as important with regard to hypotheses 2 to 4. Noncore currency is a dummy variable whose value equals 1 if the currency of a given country is a noncore currency and 0 otherwise. Among all observations, advanced countries with a noncore currency comprise 24%, while the remaining observations are of advanced countries with a core currency. Size to revenue refers to the ratio of total assets in the banking sector to government revenue. The NA CDS index is an index that consists of premiums on major CDS contracts traded in the North American CDS market. These major CDS contracts include highly liquid sovereign CDS contracts, bank CDS contracts, and CDS contracts on nonbank companies. The EU CDS index is an index that consists of premiums on major CDS contracts traded in the European CDS market.

Sovereign CDS may depend on a number of factors, such as geopolitical shocks, macroeconomic shocks, and fiscal stability. Presumably, sovereign CDSs respond quickly and sensitively to unexpected geopolitical shocks, such as North Korean missile risks. In contrast, fiscal stability may have a relatively mild but long-standing impact on sovereign CDSs. In this regard, I shall conduct a preliminary analysis to examine whether the ratio of government debt to GDP has any effect on sovereign CDSs for the entire sample period, including crisis periods. In most cases, CDS premia are non-stationary variables. Thus, a regression based on CDSs could be highly likely to be spurious. I conduct unit-root tests of all sovereign CDSs, with the result suggesting that almost all CDSs have unit roots. However, the test results also suggest that almost no sovereign CDSs have unit roots when I consider the first difference in the CDSs. These test results imply that the sovereign CDS is an I(1)-variable.

Model 1 in Table 2 shows the result of a preliminary regression analysis in which the dependent variable is the log difference in the sovereign CDS and the independent variable of interest is the difference in government debt relative to GDP. I also include the intersection term of the *difference* in the government debt to GDP and the *level* of the government debt to GDP to examine whether there is a quadratic relationship between sovereign CDS and government debt.[3] I consider a quadratic relationship because the literature finds that debt and GDP growth or other variables

[3]If a variable y has a quadratic relationship with x, i.e., $y = a + bx + cx^2$, the total differentiation yields $\Delta y = b\Delta x + 2cx\Delta x$. In this regard, I include the intersection term of the *level* and the *difference* of the government debt to GDP in the quadratic regression analysis.

TABLE 2—GOVERNMENT DEBT AND SOVEREIGN CDS

	Model 1 (First difference)	Model 2 (Cointegration)
Dependent var. / Independent var.	Δ log Sovereign CDS	Sovereign CDS
Δ Government debt to GDP	0.01902*** (0.00570)	-
Δ Government debt to GDP * Government debt to GDP	-0.00014** (0.00005)	-
Government debt to GDP	-	16.9526*** (3.7517)
Government debt to GDP^2	-	-0.0968*** (0.0179)
Year-Quarter Fixed Effect	Yes	-
Country Fixed Effect	Yes	-
Observation (Total/Country)	1,026/26	1,185/26
R-squared	0.5326	0.6935
Threshold	69.7%	87.5%
Panel Cointegration Test	-	Passed

Note: 1) The first model examines a quadratic relationship between the log difference in sovereign CDS and the difference in the ratio of government debt to GDP. If there is a quadratic relationship between y and x, i.e., if $y = a + bx + cx^2$, the total differentiation yields $\Delta y = b\Delta x + 2cx\Delta x$. Based on this observation, I use the intersection term of the difference and the level of government debt to GDP as an independent variable, 2) The second model examines a panel cointegration relationship between the level of sovereign CDS and the level of government debt to GDP, 3) *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 4) The threshold is defined as $-b/2c$, which is the peak of the quadratic relationship, where b is the coefficient estimate of the difference in government debt to GDP in model 1 and the coefficient estimate of the level of government debt to GDP in model 2. c denotes the coefficient estimates of the corresponding interaction terms, 5) The panel cointegration test is 'passed' if the Kao test rejects the null hypothesis that there is no cointegration.

of interest often have nonlinear inverse U-shaped relationships.[4] The estimation result suggests that the higher government debt becomes, the higher the sovereign CDS as long as the debt level is less than the threshold of 69.7%.

Some readers may wonder if the ratio of government debt to GDP affects the *level* of sovereign CDS. I conduct a panel cointegration analysis to determine whether there is any long-term relationship between the ratio of government debt to GDP and the level of sovereign CDS. The Cao Panel cointegration test suggests that there exists a quadratic cointegrating relationship between these two variables. Model 2 in Table 2 demonstrates that the level of sovereign CDS is positively associated with the ratio of government debt to GDP unless the debt level exceeds the threshold of 87.5%. This finding is qualitatively consistent with the regression result of model 1.

Below, I conduct the main analysis which examines the influence of sovereign CDS on bank CDS. To this end, I estimate the following fixed-effect regression model:

$$(1) \qquad \Delta \log BankCDS_{it} = \alpha + \beta \Delta \log SovereignCDS_{it} + \gamma' x_{it} + \theta_i + \delta_t + \varepsilon_{it}$$

Here, θ_i and δ_t denote the bank fixed effect and the year-quarter fixed effect.

[4]See Arcand *et al.* (2012), Cecchetti and Kharroubi (2012), and Cournède and Denk (2015).

x_{it} is a set of control variables. In this paper, the NA CDS index and the EU CDS index are important control variables. As noted earlier, this paper aims to study the effects of the sovereign default risk on the bank default risk. If there are confounding factors that affect both risks, this influence cannot easily be captured by a regression analysis. For instance, the overall business cycle could affect both sovereign CDS and bank CDS. That is, both sovereign CDS and bank CDS are low when the economy is booming, whereas both are high when the business cycle enters a trough. I use the two CDS indices to control for these confounding factors. Because the NA and EU CDS indices consist of nearly all major CDS contracts in the world, they are expected to capture the co-movement of sovereign CDS and bank CDS as driven by the business cycle or other confounding factors. However, the co-movement of CDS indices with banks may be heterogeneous for each bank. Thus, I shall estimate the bank-specific coefficients of CDS indices using the intersection vector of the bank fixed effect and CDS indices.

At times, I also consider bank-level information on balance sheets or income statements, such as total assets, the BIS capital ratio, the ratio of total debt to total assets (i.e. the leverage ratio), and the ROA ratio. However, this information is available only for publicly listed banks in my dataset, while there are many non-listed banks in the dataset.

Table 3 shows the estimation results for a number of model specifications. In all models, it is found that sovereign CDS and bank CDS are positively associated. I consider model 1 as the benchmark because it controls for the two important control variables, the NA CDS index and the EU CDS index, and it utilizes a large sample. The result based on model 1 suggests that a 1% increase in sovereign CDS leads to a 0.33% increase in bank CDS and that this association is statistically significant at the 1% level. This empirical result suggests that hypothesis 1 is acceptable.

Models 2 and 3 contain bank-level financial statement information, which is available only for listed banks and hence utilize a smaller sample set. In these models, the magnitude of the fiscal-financial relationship is even larger at 0.43%. This result is also statistically significant at the 1% level irrespective of whether the standard error is robust or clustered at the bank level.

Occasionally, sovereign CDS is affected by geopolitical shocks. For instance, South Korean sovereign CDS tends to increase sharply when North Korea launches a missile. To control for such time-varying country-specific factors, I use an intersection vector of the year-quarter fixed effect and the country fixed effect. Model 4 shows that sovereign CDS is still positively associated with bank CDS.

Although I consider important control variables such as CDS indices and time-varying country-specific factors, one concern is possible reverse causality or the influence of uncontrolled confounding factors. However, it is found that the *current sovereign* CDS is positively associated with the *forwarded* (i.e. future) *bank* CDS (in model 5), whereas the *current bank* CDS does not have a statistically significant relationship with the *forwarded sovereign* CDS. These findings suggest that at least during non-crisis periods, fiscal stability has a meaningful impact on financial stability, but not vice versa.

As an additional robustness check against reverse causality or confounding factors, I use the system GMM approach, which utilizes lagged variables as instrumental variables. In this case, I do not rule out crisis periods because instrumental variables

TABLE 3—BASELINE RESULTS

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Baseline	Financial information	Financial information	Time-varying country shock	Forwarded dependent variable	Reverse effect
Dependent var. / Independent var.	Δ log Bank CDS	Δ log Bank CDS	Δ log Bank CDS	Δ log Bank CDS	Forwarded Δ log Bank CDS	Forwarded Δ log Sovereign CDS
Δ log Sovereign CDS	0.3281*** (0.0341)	0.4329*** (0.0603)	0.4328*** (0.0790)	0.2577*** (0.0403)	0.1952*** (0.0271)	-
Δ log Bank CDS	-	-	-	-	-	0.0396 (0.0256)
Δ log NA CDS Index × Bank Fixed Effect	Yes	Yes	Yes	-	Yes	Yes
Δ log EU CDS Index × Bank Fixed Effect	Yes	Yes	Yes	-	Yes	Yes
Year-Quarter Fixed Effect × Country Fixed Effect	-	-	-	Yes	-	-
Δ log assets	-	-0.0789 (0.1609)	-0.0789 (0.1731)	-	-	-
Δ log Leverage	-	0.0492 (0.0253)	0.0492 (0.0214)	-	-	-
Δ log BIS	-	-0.1364 (0.1717)	-0.1634 (0.1823)	-	-	-
Δ log ROA	-	0.0025 (0.0188)	0.0025 (0.0183)	-	-	-
Year-Quarter Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observation (Total/Bank/Country)	1,762/78/19	607/40/14	607/40/14	1,865/78/19	1,750/78/19	1,765/78/19
R-squared	0.5957	0.6682	0.6682	0.7974	0.5685	0.6744
Standard error	Robust	Robust	Bank-cluster	Bank-cluster	Bank-cluster	Bank-cluster

Note: 1) The dependent variable is the log difference in bank CDS except for models 5 and 6, 2) The numbers in parentheses are the Huber-White-Sandwich robust standard error or the bank-level clustered error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) In model 5, the dependent variable is the one-period *forwarded* log difference in *bank* CDS, 4) In model 6, the dependent variable is the one-period *forwarded* log difference in *sovereign* CDS and the independent variable of interest is the log difference in bank CDS.

are used. Table 4 shows the estimation result based on the system GMM approach. I consider three model specifications. In the first model, I use the second and third lags of sovereign CDS, with the lagged dependent variable as an instrumental variable. In the second model, I use the second and third lags of sovereign CDS, the lagged dependent variable, and the NA and EU CDS indices as instrumental variables. In the third model, I use the second, third, and fourth lags of sovereign CDS, the lagged dependent variable, and the NA and EU CDS indices as instrumental variables. AR(1), AR(2), and Hansen test results suggest that all three models are properly specified. The estimation result suggests that an increase in sovereign CDS leads to an increase in bank CDS and that this positive association is statistically significant at the 1% level. This result is robust to model specification.

Thus far, I have used the first difference in CDS to deal with the non-stationarity problem. Another way to address this problem is to use the level of CDS and to conduct a cointegration analysis. Although this approach is less conventional in the corporate finance literature, I examine a cointegrating relationship in an attempt to check the robustness of the main result. As noted earlier, the unit-root tests suggest that almost all sovereign and bank CDSs are I(1) variables. The Kao panel

TABLE 4—SYSTEM GMM RESULTS

Variables	Model 1	Model 2	Model 3
Δ log Sovereign CDS	0.5925*** (0.0170)	0.5891*** (0.0371)	0.5778*** (0.0368)
Lagged dependent variable	Yes	Yes	Yes
CDS Indices	Yes	Yes	Yes
IV: Lags	2, 3	2, 3,	2, 3, 4
IV: CDS Indices	-	Yes	Yes
Observation (Total/Bank/Country)	2,277/78/19	2,277/78/19	2,277/78/19
AR(1) test	Passed	Passed	Passed
AR(2) test	Passed	Passed	Passed
Hansen test of over-identification	Passed	Passed	Passed

Note: 1) The dependent variable is the log difference of bank CDS, 2) *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) Model 1 uses the second and third lags of sovereign CDS and the lagged dependent variable as instrumental variables, 4) Model 2 uses the second and third lags of sovereign CDS, the lagged dependent variable, and the NA and EU CDS indices as instrumental variables, 5) Model 3 uses the second, third, and fourth lags of sovereign CDS, the lagged dependent variable, and the NA and EU CDS indices as instrumental variables, 6) Each model passes the AR(1) test if the hypothesis that the first difference in the error term does not have a first-order serial correlation is rejected, 7) Each model passes the AR(2) test if the hypothesis that the first difference in the error term does not have a second-order serial correlation is not rejected.

TABLE 5—PANEL COINTEGRATION ANALYSIS

Variables	Model 1	Model 2	Model 3
Sovereign CDS	0.4467*** (0.0200)	0.3825*** (0.0374)	0.3347*** (0.0369)
Constant	Yes	Yes	Yes
Linear Trend	-	-	Yes
NA CDS Index	-	Yes	Yes
EU CDS Index	-	Yes	Yes
AIC automatic leads and lags selection	Yes	Yes	Yes
Observation (Total/Bank/Country)	2,256/78/19	2,231/78/19	2,223/78/19
R-squared	0.7202	0.7929	0.8356
Panel Cointegration Test	Passed	Passed	Passed

Note: 1) The dependent variable is the level of bank CDS, 2) In model 1, the independent variable is the level of sovereign CDS. In models 2 and 3, the independent variables are the levels of sovereign CDS, the North American CDS index, and the European CDS index, 3) *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 4) The numbers of leads and lags are automatically selected by the Akaike Information Criterion, 5) The panel cointegration test is 'passed' if the Kao test (or Phillips-Perron test when the linear trend is included) rejects the null hypothesis that there is no cointegration.

cointegration test suggests that there is a cointegrating relationship between sovereign and bank CDSs. This test result is robust to the inclusion/exclusion of a linear time trend and/or CDS indices. Table 5 shows the estimation result. All models show that sovereign and bank CDSs are positively cointegrated and that the estimated coefficient is similar to that in the baseline model (i.e., Model 1 in Table 3).

B. *Determinants of the Intensity of the Fiscal-financial Relationship*

1. High-risk vs. Low-risk Countries

One can argue that the baseline result is mainly driven by certain outlier countries,

TABLE 6—COMPARISON: HIGH-RISK VS. LOW-RISK

Variables	Model 1 (Low-risk country)	Model 2 (High-risk country)	Model 3 (Low-risk bank)	Model 4 (High-risk bank)
Δ log Sovereign CDS	0.2490*** (0.0388)	0.6115*** (0.0805)	0.3665*** (0.0401)	0.3597*** (0.0704)
NA and EU CDS Indices × Bank Fixed Effect	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	Yes	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes	Yes
Observation (Total/Bank/Country)	1,386/71/17	376/31/8	1,253/70/18	509/52/14
R-squared	0.5843	0.7819	0.6427	0.6882

Note: 1) The dependent variable is the log difference of bank CDS, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) Model 1 considers low-risk countries whose sovereign CDS premia are below the average of 59.4bp, while model 2 considers high-risk countries whose CDS premia are above the average, 4) Model 3 considers low-risk banks whose bank CDS premia are below the average of 91.0bp, while model 2 considers high-risk banks whose CDS premia are above the average.

such as Italy, Portugal, Spain, and Greece, which underwent from severe fiscal instability. To address this concern, I estimate the baseline empirical model separately for a high-risk group and a low-risk group, where the high-risk group consists of countries whose sovereign CDS premia are higher than the average CDS premium (59.4bp) and the remaining countries form the low-risk group.

Table 6 shows the estimation result. The result suggests that the intensity of the fiscal-financial relationship is greater in the high-risk group as opposed to the low-risk group. However, a positive and statistically significant association can be found in both groups. One can draw a policy implication for Korea from this result. Currently, South Korea is in the low-risk group because its sovereign CDS premium is 26.7bp on average as of 2020. However, if the expansionary fiscal policy due to the Covid-19 pandemic and the low fertility and mortality rates raise the sovereign default risk significantly in the future and, hence, Korea becomes a high-risk country, financial stability will be not merely undermined but will take on a larger magnitude.

2. Banks vs. Other Financial Companies

Another criticism is that the positive association between sovereign CDS and corporate CDS is not a special characteristic of the banking sector but a general property that can be observed in other financial sectors as well. This criticism is related to the argument that the corporate default risk generally increases with the sovereign default risk, as sovereign bonds are used as a benchmark when assessing the credit rating of corporate bonds. This criticism is also related to the notion that governments may bail out not just commercial banks but also other financial companies if they are too big to fail in terms of size and inter-connectedness.

To address this concern, I estimate the same empirical model for other financial companies, such as real estate firms, insurance companies, and investment banks. Table 7 shows that a 1% increase in sovereign CDS premia is associated with at most a 0.19% increase in the CDS premia of other financial corporate bonds. In comparison, the same 1% increase in sovereign CDS leads to a 0.33% increase in bank CDS. Although a positive association between sovereign CDS and corporate

TABLE 7—BANK VS. OTHER FINANCIAL COMPANIES

Industry	Coefficient	Observation (Total/Firm/Country)	R-squared
Commercial Banking	0.3281***	1,762/78/19	0.5957
Real Estate	0.1859***	1,271/44/6	0.4178
Insurance	0.1715***	1,727/58/9	0.3464
Investment Banking	0.0886***	2,829/117/16	0.3516

Note: 1) The dependent variable is the log difference of corporate CDS, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) Coefficient denotes the estimated coefficient of the log-differenced sovereign CDS, 4) For each sector regression, the product of the NA CDS index and firm fixed effect, the product of the EU CDS index and firm fixed effect, the firm fixed effect, and the year-quarter fixed effect are controlled.

CDS is observed in both the commercial banking sector and other financial sectors, the magnitude is substantially different, presumably because commercial banks play much more important roles than other financial companies in the overall economic system.

3. Moral Hazard Issue: Commercial Banks vs. Investment Banks

An additional criticism relates to the issue of moral hazard. A well-known and long-standing problem in the banking industry is that bank managers can fall prey to moral hazard under the presence of implicit government guarantees. Because banks believe that they will be rescued by the government when they fail, they have an incentive to take excessive risks ex-ante. However, if the government's promise to bail them out is less trustworthy, bank managers may be less tempted to take excessive risks. That is, if the sovereign default risk rises, the bank default risk increases due to the weakened government support on the one hand (i.e., *direct effect*), while the bank default risk may also decrease because the moral hazard problem of bank managers is relaxed on the other hand (i.e., *indirect effect*). Therefore, the relationship between the sovereign and bank default risks is a matter to be tested empirically.

A comparison of commercial banks and investment banks in terms of the intensity of the fiscal-financial relationship could be meaningful in light of the moral hazard issue. Commercial banks have standard business models that include deposit-taking and loan-making activities and hence there is little room to take excessive risks. In contrast, investment banks typically do not take deposits but rely on riskier wholesale funding and invest in stocks, bonds, derivatives, and other riskier products. Therefore, all other factors being equal, one can expect that investment banks are more exposed to the moral hazard problem than commercial banks. Given this expectation, I estimate the empirical model in (1) separately for commercial banks and investment banks.

Table 7 shows the estimation result. The result shows that the intensity of fiscal-financial relationship is as high as 0.3281 for commercial banks, while the intensity is only 0.0886 for investment banks. The intensity outcome for investment banks implies that the direct effect of an increase in the sovereign default risk on the bank default risk dominates the indirect effect. For investment banks, one can expect both direct and indirect effects, as investment bankers have more room to take risks. However, the empirical result shows that the direct effect outweighs the indirect

effect and, hence, a positive association between the dependent and independent variables is observed. With regard to commercial banks, in contrast, one can expect only a direct effect, as commercial bank managers have little room to take risks. The empirical result is consistent with this expectation, as the intensity of the fiscal-financial relationships for commercial banks is substantially greater than the intensity for investment banks.

This empirical finding does not fully address the moral hazard issue because commercial banks and investment banks may differ not simply in terms of the extent of risk-taking but also in terms of many other factors. Although this paper considers a number of important control variables, such as the North American and European CDS indexes, bank fixed effects, and time fixed effects, I hope to see more accurate comparisons in future research.

Thus far, I have shown that the greater the sovereign default risk is, the greater the bank default risk becomes. Because this result holds generally for all advanced countries, it may not provide Korea-specific implications. The Korean economy can be differentiated from those of other advanced countries in three senses. First, its currency is not a core currency. Secondly, the size of its banking sector relative to government revenues is very high. Last but not least, the ratio of private credit to GDP in Korea is relatively large compared to other countries. In the following analysis, I shall test hypotheses 2 to 4 to determine the important determinants of the fiscal-financial relationship, through which I shall draw Korea-specific implications.

4. Noncore Currency

According to hypothesis 2, an increase in the risk of a sovereign default leads to a greater increase in the risk of a bank default if the given country does not have a core currency. In order to test this hypothesis, I estimate the empirical model in (1) separately for counties with a noncore currency and those with a core currency.

Table 8 shows the estimation result. The results for models 1 and 2 suggest that in countries with a noncore currency, a 1% increase in sovereign CDS leads to a 0.76% increase in bank CDS. This magnitude is substantial given that the same 1% increase in sovereign CDS in countries with a core currency is associated only with a 0.29% increase in bank CDS. That is, the empirical result is consistent with hypothesis 2. Model 3 explicitly tests whether the difference in the magnitude is statistically significant using an interaction term for a noncore currency and sovereign CDS, with the result showing significance at the 1% level. Korea is one of the eight advanced countries here whose currency is not a core currency. This empirical analysis implies that Korea should place more emphasis on maintaining fiscal stability than countries with a core currency because the same weakening of fiscal stability could cause greater damage to the financial system.

Although I assume that US dollar, euro, UK pound sterling, Japanese yen, Swiss franc, and Canadian dollar as core currencies following the opinion of the Bank of Korea (2018), there is no exact and official standard of a core currency. Some may suggest that the Australian dollar should also be considered as a core currency. Others may believe that only the two most important currencies (i.e., the US dollar and euro) are core currencies. In addition, the euro may be special because it is commonly used by a number of different EU countries. Given this disparity in the

TABLE 8—NONCORE CURRENCY

Variables	Model 1 (Noncore)	Model 2 (Core)	Model 3 (All)
Δ log Sovereign CDS	0.7575*** (0.0655)	0.2862*** (0.0437)	0.2884*** (0.0351)
Noncore currency dummy	-	-	Yes
Δ log Sovereign CDS × Noncore currency dummy	-	-	0.3596*** (0.0493)
NA and EU CDS Indices × Bank Fixed Effect	Yes	Yes	Yes
Year-Quarter Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Observation (Total/Bank/Country)	480/16/5	1,282/62/14	1,762/78/19
R-squared	0.7660	0.5911	0.6092

Note: 1) The dependent variable is the log difference of bank CDS, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) Model 1 considers only countries with a noncore currency, 4) Model 2 considers only countries with a core currency, 5) Model 3 considers all countries.

TABLE 9—NONCORE CURRENCY: ROBUSTNESS CHECK

Variables	Model 1 (Baseline model)	Model 2 (Australia added)	Model 3 (US Dollar, Euro only)	Model 4 (Euro is missing)
Δ log Sovereign CDS	0.2884***	0.3052***	0.2508***	0.3494***
Noncore currency dummy	Yes	Yes	Yes	Yes
Δ log Sovereign CDS × Noncore currency dummy	0.3596***	0.3158***	0.2276***	0.2606***
NA and EU CDS Indices × Bank Fixed Effect	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	Yes	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes	Yes
Observation (Total/Bank/Country)	1,762/78/19	1,762/78/19	1,762/78/19	918/36/9
R-squared	0.6092	0.6028	0.6057	0.6647

Note: 1) The dependent variable is the log difference of bank CDS, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) In model 1, I define core currencies as the US dollar, euro, UK pound sterling, Japanese yen, Swiss franc, and Canadian dollar, 4) In model 2, I add the Australian dollar to the group of core currencies, 5) In model 3, I assume that only the US dollar and euro are core currencies, 6) In model 4, I use the same definition of core currencies used in model 1. However, Eurozone member countries are excluded in the regression analysis in this case.

definition of a core currency, I conduct a number of robustness checks while varying the group of core currencies. Table 9 shows that a positive and significant association between sovereign and bank CDSs is still observed when the Australian dollar is included (Model 2), when only the US dollar and euro are considered (Model 3), and when euro member countries are excluded from the sample (Model 4).

5. Banking Sector Size to Government Revenue

According to hypothesis 3, if the risk of sovereign default rises, the risk of bank default increases at a greater magnitude in countries where the size of the banking sector relative to government revenues is relatively large. To test this hypothesis, I divide countries into two groups: a large size group consisting of countries where the ratio of total assets in the banking sector to government revenues is higher than

TABLE 10—BANKING SECTOR SIZE TO GOVERNMENT REVENUES

Variables	Model 1 (Large size)	Model 2 (Small size)	Model 3 (All)
Δ log Sovereign CDS	0.2978*** (0.0405)	0.2476*** (0.0805)	0.0051 (0.1095)
Size to revenue	-	-	Yes
Δ log Sovereign CDS × Size to revenue	-	-	0.0013*** (0.0003)
NA and EU CDS Indices × Bank Fixed Effect	Yes	Yes	Yes
Year-Quarter Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Observation (Total/Bank/Country)	1,324/77/19	438/47/14	918/66/17
R-squared	0.6300	0.6610	0.6788

Note: 1) The dependent variable is the log difference of bank CDS, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) Model 1 considers only countries in which the ratio of total assets in the banking sector to government revenues is above the country average of 353%, 4) Model 2 considers only countries in which the ratio of total assets in the banking sector to government revenue is below the country average of 353%, 5) Model 3 considers all countries.

the country average of 353%, and a small size group formed by countries whose assets-to-revenue ratio is lower than the average.

Models 1 and 2 in Table 10 show the estimation result, which suggests that an 1% increase in sovereign CDS leads to a 0.30% increase in bank CDS in the large size group, while the same increase in sovereign CDS leads to only a 0.25% increase in bank CDS in the small size group. That is, the empirical result is consistent with hypothesis 3. Model 3 finds that this difference in magnitude of the fiscal-financial relationship is statistically significant at the 1% level. This finding is meaningful for Korean economy because the Korean banking sector (relative to government revenues) is larger than that of any other advanced country. That is, if government revenues were the only source of funding for bank bailouts, the Korean banking sector would be too big to save and, hence, a weakening of fiscal stability could impose a greater cost on the financial system.

6. Private Credit

A characteristic of the Korean economy is also its high level of private credit. According to hypothesis 4, with a greater intensity of the fiscal-financial relationship, a greater ratio of private credit to GDP exists. To test this hypothesis, I divide countries into a large credit group and a small credit group, where the ratio of private credit to GDP is higher than the country average of 177% in the former while it is lower than the average in the latter.

Models 1 and 2 in Table 11 demonstrate that a weakening of fiscal stability causes relatively more damage to the financial system in the large credit group as opposed to the small credit group.

TABLE 11—PRIVATE CREDIT TO GDP

Variables	Model 1 (Large credit)	Model 2 (Small credit)
Δ log Sovereign CDS	0.4207*** (0.0541)	0.2994*** (0.0524)
Private credit to GDP	-	-
Δ log Sovereign CDS × Private credit to GDP	-	-
NA and EU CDS Indices × Bank Fixed Effect	Yes	Yes
Year-Quarter Fixed Effect	Yes	Yes
Bank Fixed Effect	Yes	Yes
Observation (Total/Bank/Country)	854/69/18	908/53/11
R-squared	0.6355	0.6192
Standard error	Robust	Robust

Note: 1) The dependent variable is the log difference of bank CDS, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively, 3) Model 1 considers only countries in which the ratio of private credit to GDP is above the country average of 177%, 4) Model 2 considers only countries in which the ratio of private credit to GDP is below the country average of 177%, 5) Model 3 considers all countries.

C. *Determinants of the Implicit Government Guarantee*

Thus far, I have empirically examined how fiscal instability influences financial instability. At the core of this fiscal-financial link are the implicit government guarantees in the banking sector. In the preceding analysis, I use the coefficient of sovereign CDS as a measure of this implicit guarantee.

Another measure of the implicit guarantee is the *uplift*, which is the difference between the final credit rating and the stand-alone credit rating, where the latter is the assessment of the creditworthiness of a debtor assuming away the possibility of a government bailout. With regard to assessing bank credit ratings, Moody's initially assesses the stand-alone rating and then adjusts the credit rating by considering the possibility and magnitude of a government bailout in case of a bank failure. Therefore, the uplift metric is a direct measure of the implicit guarantee.

Figure 3 shows the uplift for each advanced country. I calculate the bank uplift value by taking the time-average of uplifts of banks for the period of 2011 to 2020 and then calculate the country uplift value by taking the average of bank uplifts for each country. The uplift for Korea is 4.5 notches, which is highest among all countries. The magnitude (4.5 notches) is substantial. Raising the credit rating by only one notch is a challenging task for debtors. Sometimes even very creditworthy debtors fail to raise this metric by one or two notches despite their diligent efforts over many years. This implies that the implicit guarantee by the Korean government for Korean banks is very powerful. In other words, Korean banks rely heavily on the government.

In Figure 4, I focus on countries whose currency is a noncore currency in order to draw more Korea-specific implications. As of 2020, Korea remains the country with the highest uplift. Interestingly, the Korean banking sector's stand-alone rating is low though not the lowest in its comparison group. This implies that Korean banks are least capable of overcoming crises on their own but rely heavily on the government.

One can argue that according to the construction, uplift is decreasing in the stand-alone rating. However, this argument is flawed. Let u, f, and s denote the uplift,

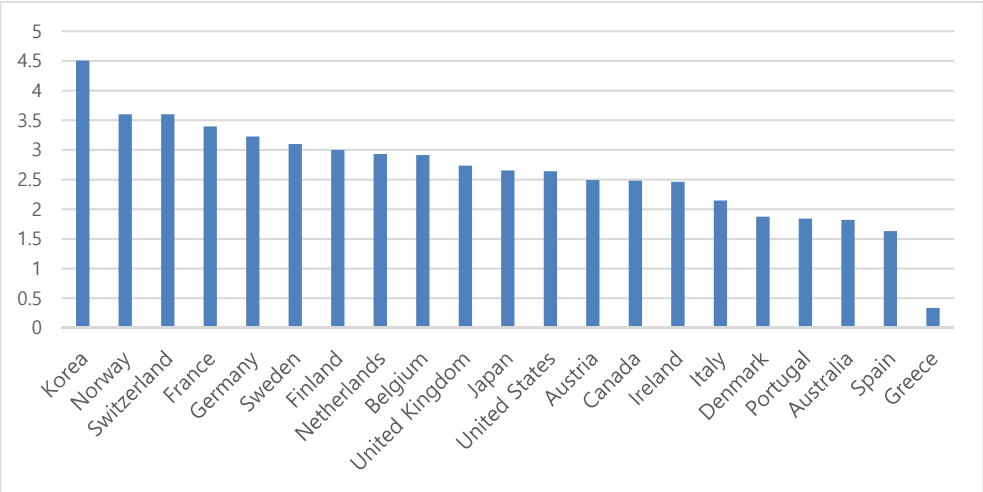

FIGURE 3. UPLIFT FOR 2011-2020

Note: I calculate the bank uplift metric by taking the time-average of uplifts of banks for the period from 2011 to 2020 and then calculate the country uplift by taking the average of the bank uplifts for each country.

Source: Author's calculation based on Moody's credit ratings.

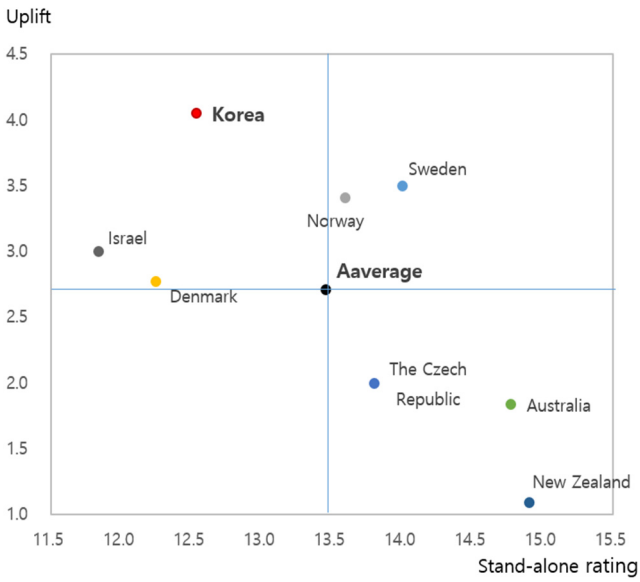

FIGURE 4. UPLIFT AND STAND-ALONE RATINGS IN 2020: COUNTRIES WITH A NONCORE CURRENCY

Note: For the stand-alone rating, one unit equals one notch in the credit rating. For instance, the highest credit rating (Aaa) is denoted as 20, the second highest (Aa1) is 19, and the lowest (C) is denoted as 0.

Source: Hwang (2021a).

final rating, and stand-alone rating. Because uplift u equals $f - s$ according to the construction, it appears to be decreasing with regard to the stand-alone rating s. However, Moody's in fact assigns the final credit rating only after adding some adjustments to the stand-alone rating, considering the possibility and magnitude of

the implicit government guarantee. In this sense, the final rating f should equal $s+i$, where i denotes the intensity of the implicit guarantee. Then, the uplift u equals $s+i-s$, which is just equal to i. Therefore, the uplift does not directly depend on the stand-alone rating. However, the implicit guarantees $i=i(s)$ can indirectly depend on the stand-alone rating. For instance, if a systemically important bank becomes weaker and therefore its stand-alone rating is downgraded, the bank becomes more likely to fail and, hence, the ex-ante likelihood that the government provides a bailout for this bank may increase.

In order to examine what determines the implicit guarantee, I conduct an empirical analysis below. I manually collect stand-alone and final credit ratings from Moody's website. In this way, I construct a quarterly database of 29 countries and 84 deposit-taking commercial banks. The time span is 2011-2020 because the stand-alone rating is released only after 2011.

In the following sections, I examine how certain different independent variables are associated with the uplift metric. Table 12 shows the fixed-effect panel regression results. In every model specification, the estimation result suggests that the uplift is negatively associated with the stand-alone rating. The magnitude of this negative relationship is economically significant, as a one notch increase in the stand-alone rating is associated with a 0.24~0.33 notch decrease in the uplift. This finding implies that governments are more likely to save banks when the banks are relatively weak. If a bank's prudence is weaker on its own, it may need to rely more on a government guarantee to persuade investors that it is creditworthy. This finding is closely related to what is described in Figure 4, where in Korea the uplift is highest while the stand-alone rating is low.

The results for models 2 and 3 suggest that the implicit guarantees are weaker, the higher the government debt to GDP ratio. This is in line with the results of the previous analysis using CDS. If the fiscal space becomes weaker due to an expansion in government debt, fiscal stability is undermined. Therefore, the government's

TABLE 12—DETERMINANT OF IMPLICIT GOVERNMENT GUARANTEES

Variables	Model 1	Model 2	Model 3
Stand-alone rating	-0.2432*** (0.0310)	-0.2757*** (0.0351)	-0.3343*** (0.0359)
Government debt to GDP	-	-0.0280*** (0.0037)	-0.0119** (0.0054)
Log assets	-	-	0.8259*** (0.2383)
BIS	-	-	-0.0430*** (0.0126)
Leverage	-	-	0.0038 (0.0035)
ROA	-	-	-0.0134 (0.0501)
Year-Quarter Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Observation (Total/Bank/Country)	2,437/84/21	2,084/84/21	865/47/17
R-squared	0.8562	0.8025	0.8444

Note: 1) The dependent variable is the uplift, 2) The standard error is the Huber-White-Sandwich robust standard error. *, **, and *** represent the 10%, 5%, and 1% levels of significance, respectively.

informal promise to bail out banks in distress is not trustworthy and, therefore, the value of the implicit guarantee is lower, causing investors to withdraw their trust from banks to some extent.

The coefficient estimates of assets and the BIS capital ratio also provide meaningful implications. The log assets result suggests that the value of the implicit guarantee is higher for a larger bank. This finding is consistent with the too-big-to-fail hypothesis. The BIS ratio result suggests that implicit guarantees are stronger for less prudent banks. This finding is in line with the observation that the uplift and stand-alone rating are negatively associated. That is, weaker banks can benefit more from the implicit guarantee.

The policy implications of the findings in Figure 4 and Table 12 are simple and clear: the Korean banking system is not very healthy on its own and relies heavily on the government's implicit guarantee. In order to improve their stand-alone competitiveness and health, Korean banks should improve their risk management and the Korean government simultaneously should maintain fiscal stability.

IV. Concluding Remarks

This paper analyzes how fiscal instability affects financial instability. Many are concerned with that the fiscal space in Korea will continue to shrink (IMF, 2021a). Fiscal instability is not merely a serious problem on its own but could also have negative spillover effects on the financial system according to the theoretical literature.

This paper empirically shows that an increase in the sovereign default risk leads to a rise in the bank default risk at an economically significant magnitude. I also take a closer look at the Korean fiscal-financial nexus and observe that Korea does not have a core currency, its banking sector is largest relative to government revenues among all advanced countries, and that private credit to GDP is higher than the average of other countries. The empirical analysis shows that all three of these characteristics contribute to magnify the intensity by which fiscal instability worsens financial instability.

The implicit government guarantee lies at the core of this adverse effect of fiscal instability on financial instability. I consider the difference between a bank's final credit rating and its stand-alone rating (i.e., uplift) as a direct measure of the implicit guarantee and find that a bank's reliance on the government is higher if the bank's stand-alone prudence is lower, its size is larger, or the fiscal space is smaller.

These empirical results imply that the Korean banking sector must reduce its reliance on the government's implicit guarantee. To this end, a special bank resolution regime based on the 'bail-in' concept should quickly be adopted. Under the bail-in regime, a failed bank will be resolved not with taxpayer's money but at the cost of the bank's creditors and shareholders. Given this bail-in regime, banks will not be bailed out by the government when they fail and, hence, the link of the fiscal-financial relationship will be cut. Therefore, even if fiscal stability is undermined, it may not cause a severe disruption in the financial system. Although Korea and other G20 countries agreed to adopt the bail-in regime in 2010

immediately after the 2008 Global Financial Crisis and considering that the United States, EU, Japan and other key jurisdictions adopted this new resolution regime thereafter, Korea remains hesitant with regard to its application.

This paper does not assert that the fiscal space in Korea is currently poor. Around the time of this publication, the CDS premium on Korean sovereign bonds is lower than the average of other advanced countries. However, it is inevitable that the fiscal space will be greatly reduced in the long run due to the low fertility and mortality rates in Korea and resulting spike in expenditures for pensions, health care, and other mandatory spending. Based on the empirical findings here, it should be stressed that we need to prepare to ensure a better future in terms of fiscal and financial stability in Korea.

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