경제학 석사학위논문

Non-Bank Financial Intermediation and Financial Stability:

Evidence from EU Countries

비은행금융중개와 금융안정:

유럽연합(EU) 국가들을 중심으로

2021년 2월

서울대학교 대학원

경제학부 경제학전공

박 경 현

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이 논문을 경제학 석사학위논문으로 제출함

2020년 10월

서울대학교 대학원

경제학부 경제학 전공

박 경 현

박경현의 석사학위논문을 인준함

2021년 1월

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Abstract

Non-Bank Financial Intermediation and Financial Stability:
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Shadow banking, or non-bank financial intermediation, has had an issue with financial stability for a decade after the global financial crisis in 2008. This paper analyzes the link between the non-bank financial sector and financial stability in eight EU countries after the financial crisis. The panel analysis using fixed-effects model shows that part of non-bank financial intermediation is positively associated with financial stability, contrary to previous beliefs on financial stability, controlling for macroeconomic variables. This finding has a policy implication that simple constraints on the non-bank financing assets may not bring financial stability.

Keywords: Non-bank financial intermediation, Financial stability, Shadow banking, EU, Fixed effects model, Panel data
Student Number: 2015-20154

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I. Introduction

Shadow banking has often been criticized as a culprit of the financial crisis. The shadow banking system played a major role in the 2007–2009 financial crisis (Gorton & Metrick, 2010). The financial crisis was attributed to the collapse of shadow banking from 2007 to 2008, by undermining the regulated banking sector (Gennaioli et al., 2013). Lysandrou and Nesvetailova (2014) presented a rather compound view. By analyzing the explosive growth of shadow banking in the pre-crisis era, they suggested a disaggregated view that the shadow banking system played a crucial role in the initial subprime phase of the crisis through their involvement with noxious securities. Meanwhile, other parts of the system were central to the inter-bank phases of the crisis through their close association with the regulated banks. The issue of shadow banking is also related to debates over macroprudential regulation and financial stability. Especially, much research has expressed concerns about financial instability issues possibly caused by shadow banking.

Although the term "shadow banking" arouses a gloomy impression of back alleys, it is, in fact, double-faced. The term "shadow banking" is now substituted with "non-bank financial intermediation" owing to the negative connotations. Non-bank financial intermediation refers to the financial system that takes part in banking activities and performs traditional banking functions outside the traditional banking system, but not strictly subject to macroprudential regulation. Thus, they are sometimes also called

lightly regulated banks or unregulated banks. Shadow banks, or non-bank financial institutions, bring many benefits to the real economy, whereas fragility in non-bank financial intermediaries can be a source of systemic risk, with the potential to amplify the wider financial cycle. The profitability of non-banks faces strong headwinds in a prolonged period of low interest rates and exposure of non-banks to credit, liquidity, and exchange rate risk has increased (Financial Stability Review, 2019). Although non-bank financing is a valuable source of financing for several firms and households, non-bank financing may become a source of systemic risk when liquidity transformation and the creation of leverage are involved (Financial Stability Board [FSB], 2019).

According to Adrian and Shin (2009), the shadow banking system has pros and cons. It grew out of the securitization of assets and the integration of banking with capital market developments, and it has profoundly influenced the global financial system. Especially, their study focused on "securitization," which was the crux of the global financial crisis. Securitization was intended for the transfer of credit risk to those better able to absorb losses, but instead, it increased the fragility of the entire financial system by allowing banks and other intermediaries to leverage by buying one another's securities. Adrian and Shin (2009) argued that in the new, post-crisis financial system, the role of securitization should be checked by more confining financial regulation. Moreover, excessive leverage and maturity mismatch must be prevented, both of which can damage financial stability.

Likewise, in the post-financial crisis era, non-bank financial intermediation is largely adopted to be kept under surveillance. Therefore, the FSB, an international body that monitors and assesses vulnerabilities affecting the global financial system, has been paying attention to non-bank financial intermediation. The FSB has conducted a global monitoring exercise to examine the non-bank financial intermediation, concerning the risk and fragility underlying in the system. Despite these concerns, the lucid linkage between non-bank financial intermediation and financial stability has not been fully illuminated.

This article aims at investigating the relationship between non-bank financial intermediation and financial stability in the post-financial crisis era using an empirical method. Although several financial reports and previous research pointed out that shadow banking may lead to financial instability, it is difficult to find ample empirical analysis covering the issue, due to obscure definition of shadow banking and difficulties in collecting accurate related data. Shadow banking is unquestionably interconnected with a regulated banking system with complexity, but it is not facile to probe its essence. Jeffers and Baicu (2013) pointed out the difficulty in gathering data to assess the interconnections between regular and shadow banking entities. Despite the rapid growth of the non-bank financing sector in emerging economies, this study focuses on eight European countries with advanced economies because western Europe constitutes considerable portions of the non-bank financing sector globally. Besides, ruminating on how the

former global financial crisis was provoked, examining the advanced economies seems more pertinent than developing ones when scrutinizing the links between lightly regulated banks and financial stability. Indeed, the shadow banking system of less-developed countries displays dissimilar aspects. This paper eventually attempts to answer the question: does non-bank financial intermediation really harm financial stability?

The remainder of this paper is structured as follows. Section II presents the previous literature about non-bank financial intermediation and financial stability. Section III provides background information about non-bank financial intermediation and some primary descriptive data of Europe related to the research. Section IV introduces an empirical model employed in the analysis, and Section V presents the estimation results. Section VI concludes the paper.

II. Literature Review

Some research presents how one part of the shadow banking system can affect financial stability empirically, whereas most previous research addresses the issue theoretically. These previous studies have attempted to build the model of shadow banking or its interconnection with the regulated banking sector. According to FSB (2012a), the interconnectedness between banks and non-bank financial institutions can be measured by banks' credit exposures to shadow banking entities and banks' dependence on funding from shadow banking entities. Shin (2009) has shown that securitization enables credit expansion through higher leverage of the financial system, and securitization itself may not enhance financial stability. The ability of the shadow banking system to increase the total credit supply leads to the importance of securitization for financial stability.

Some previous theoretical research underlined the risks and contagion effect caused by shadow banking, and therefore, shadow banking must be regulated. Jeffer and Baicu (2013) argued that under stress conditions, the contagion channels between the shadow and the regular banking systems can propagate the crisis from one system to another. Moreover, it can affect financial stability and the real economy. They presented that the financial crisis was the negative consequence of the deep interconnectedness between the shadow and regular banking systems. They assert that links between the two systems can

increase contagion and systemic risks, which may affect financial stability, and therefore, the interconnections between the two systems must be regulated. Ari et al. (2017) presented a model in which shadow banking endogenously arises and undermines market discipline on traditional banks; the liquidation of shadow banks causes susceptibility of traditional banks to liquidity risk. Gebauer and Mazelis (2019) developed a dynamic stochastic general equilibrium DSGE model featuring regulated commercial banks and unregulated shadow banks, evaluating how tighter regulation of commercial credit intermediation can result in shadow banks' higher intermediation activity. They revealed that tighter capital requirements on commercial banks increase shadow bank lending, which may have adverse financial stability effects. Coordinating the macroprudential tightening with monetary easing can limit this leakage mechanism, while still bringing about the desired reduction in aggregate lending. Macroprudential tightening decreases commercial bank credit but increases intermediation by shadow banks. Farhi and Tirole (2020) also presented a model of financial intermediation and the optimal regulation of banks when supervision reduces moral hazard and the riskiness of balance sheets. In their framework, prudential regulation and deposit insurance are complementary.

Others argue that shadow banking, or non-bank financial intermediation is beneficial or improves welfare, but it may have fragility. Gennaioli et al. (2013) suggested a model of shadow banking and securitization that banks originate, trade, and finance

both safe and risky loans. According to their model, the shadow banking system is stable and welfare-improving; however, it is fragile to crises and shortage of liquidity when investors neglect tail risks. Ordoñez (2018) showed that shadow banking improves welfare using an equilibrium model in which banks choose whether to raise funds through traditional or shadow banking activities. In this model, shadow banking benefits welfare by providing banks a channel to escape the excess regulation. Moreira and Savov (2017) built a microfinance model showing how shadow banking, as a fragile liquidity transformation, boosts asset prices and creates growth in good times at the expense of bad times. In their model, shadow banking is the transformation of risky assets into securities that become illiquid when uncertainty arises.

Some studies covered one segment of the shadow banking system. For instance, Bengtsson (2013) argued that the transmission channels through which financial instability may spread from the money market fund (MMF) sector, which is part of the shadow banking system, to the wider financial system. Many European banks obtain a substantial proportion of their funding from MMFs and rely on them for rolling over short-term debt.

Several previous studies on shadow banking have analyzed the relationship between capital requirements and shadow banking. Since capital requirements are regulations on traditional banks to achieve financial stability in terms of reducing the risk and avoiding future crises, those studies may offer a strand of financial stability and non-bank financial intermediation investigation. Using an

equilibrium model, Plantin (2015) pointed out that tightening capital requirements may spur a surge in the shadow banking activity. Deli and Hasan (2017) suggested that bank capital regulations only have a weak negative effect on loan growth. Especially, this effect is low for well-capitalized banks. Poeschl and Zhang (2018) presented a quantitative model to investigate the macroeconomic effects of bank capital requirements in traditional and shadow banking sectors. Their model revealed that tightening retail bank capital requirements increases the size and leverage of the shadow banking sector, and financial crises occur as "runs" on shadow banks.

Several empirical studies have examined financial stability and related factors. For instance, Blot et al. (2015) empirically assessed that the correlation between price stability and financial stability is negative and unstable over time. The correlation between price and financial stability increases with money supply growth; macro and micro regulations may prove to be useful to fostering financial stability. Moreover, studying the non-performing loans on the balance sheet of US banks, Pierri and Timmer (2020) investigated the potential impact of technology intensity in lending on financial stability. They showed that a higher intensity of IT-adoption led to a significantly smaller increase in non-performing loans on their balance-sheets in the crisis. This implies that technology adoption in lending can enhance financial stability through the production of resilient loans.

A few empirical studies have tried linking financial stability and non-bank financial intermediation through other channels, but

they did not straightly cover their relationships. Diallo and Al-Mansour (2017) showed the link between the insurance sector and financial stability. The insurance sector has a significantly negative relationship with financial stability. Moreover, using the shadow banking system as a channel, the insurance sector is detrimental to financial stability for countries with a high level of shadow banking assets. However, note that not all insurance sector is intrinsically part of the shadow banking system. Hussain et al. (2019) investigated how the shadow banking system impacts the real economy by generalizing the estimation equation method. They showed that the increase in the shadow banking system was related to a large increase in nominal GDP, suggesting that the shadow banking system should be regulated to stabilize the financial system more.

Bruha and Kocenda (2018) did not cover the shadow banking sector, but they analyzed the link between banking sector quality and sovereign risk in the whole European Union over 1999–2014. They showed that, in general, the stability measured by the capital adequacy ratio and size of the industry are associated with lower sovereign risk.

III. Background

Before exploring the shadow banking sector or non-bank financial intermediation, shadow banking must be defined first and its range must be narrowed down, even though it has not yet reached a plain definition in academia. FSB (2020), which has been assessing global trends and risks in non-bank financial intermediation and conducting annual monitoring since 2011, has defined the shadow banking sector in three dimensions: monitoring universe of non-bank financial intermediation (MUNFI), other financial intermediaries (OFI), and narrow measure of non-bank financial intermediation.

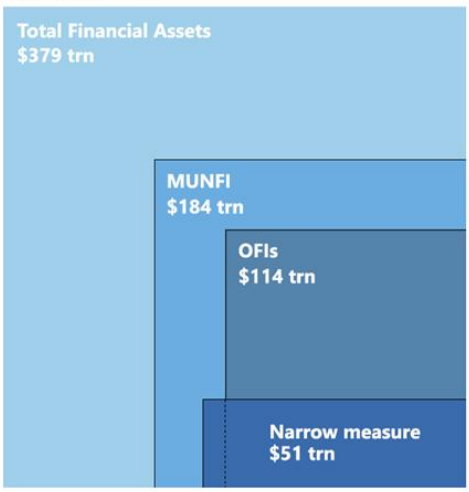
To illustrate notions, MUNFI is a broad measure of all non-bank financial intermediation. OFIs belong to other financial intermediaries, a subset of MUNFI, all financial institutions except central banks, banks, public financial institutions, insurance corporations, pension funds, and financial auxiliaries. OFIs are a wide measure of non-bank financial intermediation, and they have captured more than 30% of total financial assets in 21 key countries and the Euro area in 2018 (FSB, 2019). The narrow measure of non-bank financial intermediation is one that performs one of the five economic functions (EFs), that is, non-bank financial institutions that may pose bank-like financial stability risks.

Figure 1. Size of monitoring aggregates and composition of the narrow measure

Size of monitoring aggregates and composition of the narrow measure

At end-2018 Exhibit 0-1

Narrowing down[1]



Composition of the narrow measure[2]

Economic Functions	Size (USD trillion)	Share (%)	Change in 2018 (%)
EF1 (*collective investment vehicles with features that make them susceptible to runs*)	36.6	72.0	0.4
EF2 (*lending dependent on short-term funding*)	3.6	7.0	6.9
EF3 (*market intermediation dependent on short-term funding*)	4.5	8.8	8.7
EF4 (*facilitation of credit intermediation*)	0.3	0.6	5.0
EF5 (*securitisation-based credit intermediation*)	4.7	9.3	0.0
Unallocated	1.1	2.3	9.5
Total	**50.9**	**100**	**1.7**

[1] Total financial assets, MUNFI and OFIs are based on 21+EA Group; Narrow measure is based on the *29-Group*. [2] Net of prudential consolidation into banking groups. For additional details on these categories, see Section 4.

Source: Jurisdictions' 2019 submissions (national sector balance sheet and other data); FSB calculations.

Source: FSB (2019)

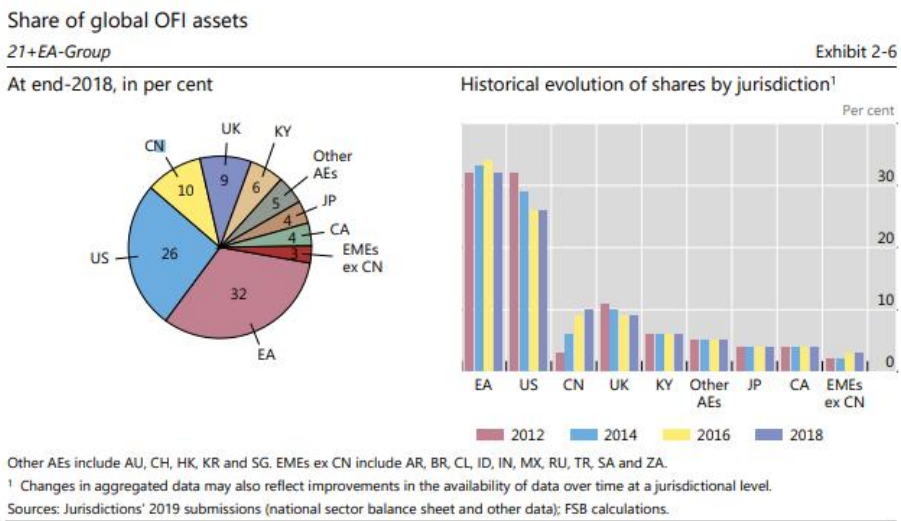
The other method to gauge the shadow banking system is developed by Harutyunyan et al. (2015). They proposed an approach to estimate the size of the shadow banking system, which is based on the expansion of the non-core liabilities encompassing both bank and non-bank financial institutions. As opposed to existing measures of shadow banking, their measures capture non-traditional funding raised by traditional banks. Non-core liabilities are procyclical and display more volatility than core liabilities for most jurisdictions in the sample.

To reiterate, this study focuses on non-bank financial

intermediation in Europe, considering the substantial size of the shadow banking sector in Europe. According to FSB (2019), the Euro area, except the United Kingdom, has the largest OFI assets share in the world. Although OFI assets have grown significantly in emerging market economies, Europe constituted the largest share of global OFI assets by 32% compared with the US of 26% at the end of 2018.

Moreover, Abad et al. (2017) argued that EU banks have significant exposures to shadow banking entities globally that are concentrated by counterparty type, with approximately 65% of the exposures to securitizations, non-MMF investment funds, and finance companies. Thus, the shadow banking system in the Euro area must be explored because more exposure to shadow banking implies reinforcing interconnectedness between two entities.

Figure 2. Share of global OFI assets



Source: FSB (2019)

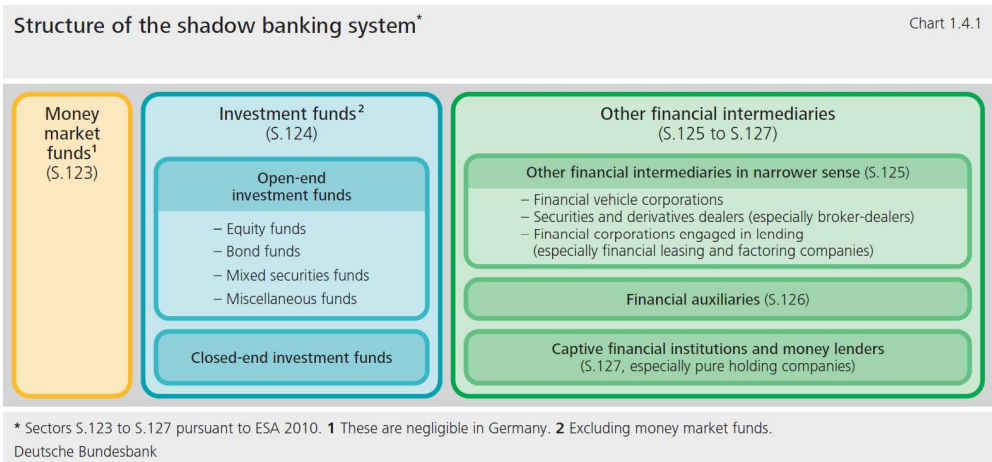
Indeed, according to the European Central Bank (ECB, 2012), the interconnection between the regulated and the non-bank-regulated segments of the financial sector has increased over recent years. Consequently, a higher risk of contagion effect exists across sectors and countries. This further raises concerns about financial stability issues in EU countries. Besides, most EU countries have created and maintained an economic and monetary union. Zielińska (2016) argued that the idea of introducing a single currency within the EU raised concerns regarding the stability of the integrated financial systems and less effective national financial supervision. Although the idea of a monetary union forced European countries to strengthen cooperation, the contagion effect would seem to be a threat to the whole system. Considering the fragility inherent in the integrated system of monetary union and financial risk that may be provoked by the strong contagion effect, shadow banking and financial stability issues cannot be stressed.

Without a doubt, the distinct aspects of shadow banking may vary between advanced and emerging economies. The shadow banking sector in advanced economies, including the United States, involves several credit intermediation steps and complex linkages within the shadow banking system and between traditional and shadow banks. By contrast, in emerging countries, these linkages are inclined to be simpler, and underground entities also comprise the main participants in the shadow banking system (Ghosh et al., 2012).

In this study, the specific classification of the shadow

banking sector follows the definition from Deutsche Bundesbank: the shadow banking system consists of three main segments, namely, MMF, investment funds, and OFIs, including financial vehicle corporations. This study follows Deutsche Bundesbank's three classifications of shadow banking. Specifically, due to the insufficiency of whole OFI data, financial vehicle corporations (FVC) data are adopted to replace OFI.

Figure 3. Structure of the shadow banking system



Source: Deutsche Bundesbank (2015)

Investment funds and MMF remain the largest OFI sub-sectors that provide credit to banks. Investment funds other than MMFs and hedge funds are the largest OFI sub-sectors, accounting for a 37% share of global OFI assets. MMFs continued its growth trend of 5% with assets increasing above their pre-crisis level (FSB, 2020), and they took part in the 5.5% share of total OFI assets in 2018.

The size of the shadow banking is often measured by the ratio of shadow banking assets to GDP by using non-core liabilities as a percentage of GDP to measure the shadow banking sector (International Monetary Fund [IMF], 2015).

Figure 4. Macro-mapping of the financial system

Macro-mapping of the financial system

21+EA-Group

Exhibit 2-1

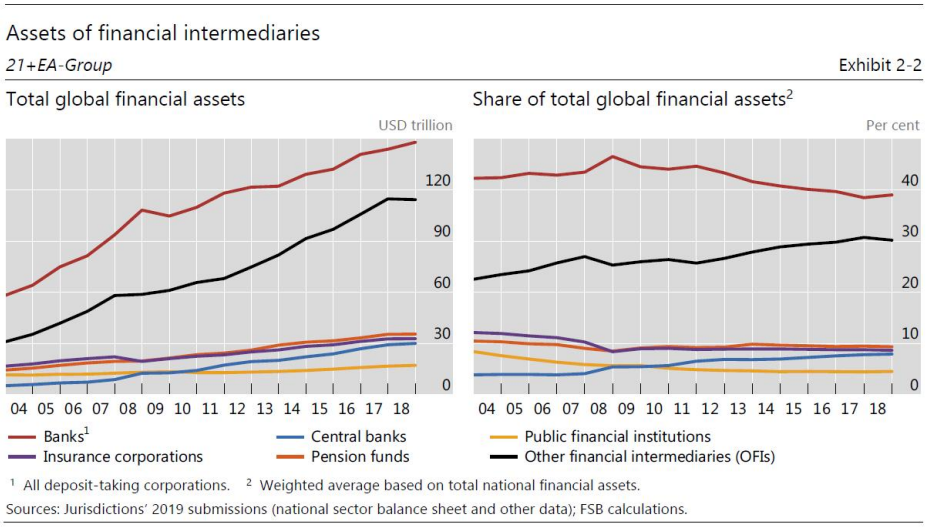
	Total global financial assets	Central banks	Banks	Public financial institu-tions	MUNFI	Insurance corpora-tions[1]	Pension funds	OFIs	Financial auxiliaries[2]
Size at end-2018 (USD trillion)	378.9	30.1	147.9	17.3	183.7	32.9	35.6	114.3	1.0
Share of total global financial assets (%)	100.0	7.9	39.0	4.6	48.5	8.7	9.4	30.2	0.3
Growth in 2018 (year-over-year, %)	1.4	2.5	2.8	3.2	-0.1	0.2	0.4	–0.4	8.8
Growth 2012-17 (annualised growth, %)	5.9	8.5	3.4	4.7	7.8	5.5	6.3	9.0	8.8

[1] For some jurisdictions, data on insurance corporations include separate accounts. [2] Financial auxiliaries are institutional units principally engaged in serving financial markets, but do not take ownership of the financial assets and liabilities they handle (SNA 2008). The figures for financial auxiliaries excludes the euro area due to reporting constraints.

Sources: Jurisdictions' 2019 submissions (national sectoral balance sheet and other data); FSB calculations.

Source: FSB (2019)

Figure 5. Assets of financial intermediaries



Source: FSB (2020)

To acquire enough panel data for the analysis, the scope of the study is restricted to eight western EU countries that have developed economies. Especially, most eastern European countries lack ample data for regression analysis. Moreover, most shadow banking data of more advanced countries have been collected after the financial crisis.

The study verifies the hypothesis that the larger is the growth of shadow banking assets, the more financial instability is promoted.

IV. Empirical Analysis

4.1. Data

The panel data used for empirical analysis were collected from the ECB, Eurostat and the OECD. They are quarterly data spanning 2009–2019, and they cover the non-bank finance sector. The final data set consists of 328 observations across eight countries. Specifically, the following eight EU countries with advanced economies were chosen for the study: Germany, Spain, France, Ireland, Italy, Luxembourg, Portugal, and the Netherlands.

These eight EU countries can be classified into two groups: those once under the European sovereign debt crisis and those not. To be specific, Spain, Ireland, Italy, and Portugal can be categorized as the first group, which underwent a debt crisis in the early 2010s. These countries are four of the six countries referred to PIIGGS that had difficulties refinancing government debt. Germany, France, Luxembourg, and the Netherlands were not directly menaced by the sovereign crises.

Table 1. General macroeconomic statistics

	GDP (current US billion$)	GDP per capita (current US$)	Population	Government gross debt (% of GDP)	Unemployment rates (%)
France	2715.52	40494	67,059,887	98.1	8.5
Germany	3845.63	46259	83,132,799	59.6	3.1
Ireland	388.70	78661	4,941,444	57.4	5
Italy	2001.24	33190	60,297,396	134.7	10
Luxembourg	71.10	114705	619,896	22	5.6
Netherlands	237.69	23145	10,269,417	48.7	3.4
Portugal	909.07	52448	17,332,850	117.2	6.5
Spain	1394.12	29614	47,076,781	95.5	14.1
Year	2019	2019	2019	2019	2019
Source	World Bank	World Bank	World Bank	Eurostat	Eurostat

As previously stated, eight western EU countries are selected for the analysis. Table 1 describes several main features of the chosen economies in 2019. The size of the economies varies: Germany has the largest economy in terms of GDP and population among eight countries, whereas Luxembourg has the smallest total GDP and population, and the largest GDP per capita. All selected countries have at least 20,000 dollars of GDP per capita.

Table 2. Data description

Variable	Description	Data sources
Financial soundness indicator (FSI)	an indicator of the current financial health and soundness of the financial institutions and financial markets	IMF
Monetary market funds (MMF)	Collective investment undertakings of which the units are close substitutes for bank deposits in terms of liquidity	ECB
Investment funds (IF)	Collective investment in stocks and bonds	ECB
Financial vehicle corporations (FVC)	An entity which carries out securitization transactions	ECB
GDP	Gross domestic product at market prices, seasonally and calendar adjusted	Eurostat
Real GDP growth	Percentage GDP change from the previous quarter, seasonally adjusted	OECD
Inflation rate	Inflation measured by consumer price index	OECD
Long term interest rate	Interest rate of government bonds maturing in ten years	OECD

Table 2 illustrates the variables used in the panel regression. They are gathered from ECB quarterly. First, the financial soundness indicator (FSI), as one of the main variables, is obtained from the IMF database to measure the financial stability of the selected economy. FSIs, which are developed by IMF, comprise a set of indicators that measure the health of a country' s financial system. Moreover, FSIs support economic and financial stability analysis. In this paper, one of the FSIs that is calculated as regulatory capital to risk-weighted assets (CAR) is chosen for the analysis. It measures the capital adequacy of deposit takers and determines the degree of robustness of financial institutions to withstand shocks. Specifically, regulatory capital to risk-weighted assets shows a significant negative correlation with the occurrence of banking crises. A coherent consolidation basis methodology ensures that FSIs are sensitive to financial sector risk exposure both within and beyond each country' s economic territory. (Navajas & Thegeya, 2013) Hence, the idea of using FSIs to measure financial stability seems reasonable. They provide insight into the financial health and soundness of a country' s financial institutions, as well as corporate and household sectors. Bruha and Kocenda (2018) also used the capital adequacy ratio to proxy the stability of the banking sector. They argued that the capital adequacy ratio is a beneficial instrument that provides the stability of the industry.

Other main variables of the model – monetary market funds, investment funds, and financial vehicle corporations – to measure

the shadow banking sector are obtained from the aggregated balance sheet of ECB data. Investment funds (IF) are the collective investment belonging to the financial corporations except for monetary financial institutions, insurance corporations, and pension funds. They can be distinguished by investment policy (equity, mixed, bond, real estate, hedge, and other funds), and by the type of fund (open-end and closed-end fund). MMF and pension funds are excluded in this investment funds data so that IF and MMF variables do not overlap. MMFs are defined as collective undertakings that are close substitutes for bank deposits in terms of liquidity. Meanwhile, FVC conducts securitization transactions, and its structure is intended to isolate the payment obligations of the undertaking from those of the originator, or the insurance or reinsurance undertaking (in the case of insurance-linked securitizations). FVC issues debt securities, other debt instruments, securitization fund units, and financial derivatives; moreover, it legally or economically owns assets underlying the issue of these financing instruments that are offered for sale to the public or sold based on private placements (ECB, 2020).

The study also considers several macroeconomic variables, such as GDP, inflation rate, and long-term interest rate, that may affect financial stability.

4.2. Empirical Model

The empirical model in this study is constructed to test the

hypothesis of whether shadow banking aggravates financial stability.

The model is mainly based on Uhde and Heimeshoff's (2009) model, which uses the random-effects model with panel data. Although they focused on market concentration and financial stability, I determined that their panel model is also relevant to analyze the link between shadow banking and financial stability. Their model presents that national banking market concentration harms European banks' financial soundness. Part of Diallo and Al-Mansour(2017)'s model investigating the connection between the insurance sector, shadow banking sector, and financial stability is also referenced to select independent variables for the estimation model.

$$Y_{it} = \alpha_{it} + \beta_1 C_{it} + \sum \beta_k x_{it,k} + \varepsilon_{it}$$

Uhde and Heimeshoff (2009) used the Z-score ratio to measure financial soundness. However, in this paper, as aforementioned in part IV-1, I use a financial soundness indicator (FSI), especially regulatory capital to risk-weighted assets (CAR), to measure financial stability since the Z-score ratio is provided annually.

C_{it} refers to three segments of the shadow banking system: MMF, investment funds, and FVC. The natural logarithm is utilized to obtain proportional differences and control for the large size of assets.

$$Y_{it} = \alpha_{it} + \beta_1 \ln(MMF_{it}) + \beta_2 \ln(IF_{it}) + \beta_3 \ln(FVC_{it}) + \sum \beta_k x_{it,k} + \varepsilon_{it}$$

I control for the general macroeconomic conditions by using GDP growth, inflation rates, and interest rates. These are variables $x_{it,k}$ indicating several macroeconomic factors that may affect financial stability and soundness. As mentioned in Part IV-1, the growth rate of gross domestic product, inflation rate, and long-term interest rate are used as independent variables. ε_{it} is an error term, and βs are parameters to be estimated.

For panel regression analysis, one of the three models - the pooled ordinary least squares (OLS), the fixed-effects model (FEM), or the random-effects model (REM) - should be determined. Unlike the model of Uhde and Heimeshoff (2009), FEM is found to be more appropriate for the study. Result of the Hausman test reveals that the fixed-effects model is more suitable than the random-effects model or the pooled OLS in this study (Appendix). Therefore, the fixed-effects model is adopted for our analysis.

V. Results

5.1. Descriptive Statistics

Table 3. Summary statistics

Variable	N	Median	Mean	Min	Max
Financial soundness indicator (FSI)	328	16.067	16.948	9.337	27.493
Monetary market funds (MMF)	328	8602	133262	12	576717
Investment funds (IF)	328	868794	1122770	25877	4836136
Financial vehicle corporations (FVC)	328	233399	240402	18793	576141
Gross domestic product (GDP)	328	229443	284948	9544	872335
Growth of GDP	328	0.3999	0.5122	−3.9115	23.3915
Inflation rate	328	1.1184	1.1909	−5.7547	3.9144
Long term interest rate	328	1.8600	2.4509	−0.5400	13.2200

Table 3 provides descriptive statistics for the dependent and independent variables. The table reports the number of observations (=N) and basic summary statistics for the variables used in the analysis. The total number of observations for each variable is 328. The amount of IF assets is significantly larger than that of MMF or FVC.

Table 4. Summary statistics for two subgroups

Variable	N	Under European debt crisis			
		Median	Mean	Min	Max
FSI	164	14.450	15.678	9.337	27.493
MMF	164	7888	106646	12	576717
IF	164	252380	525322	25877	2926171
FVC	164	325689	284833	18793	576141
GDP	164	173025	199902	41232	448369
Growth of GDP	164	0.361	0.537	−3.912	23.392
Inflation rate	164	0.785	0.971	−5.755	3.914
Long term interest rate	164	2.990	3.534	0.020	13.220
Variable	N	Not under crisis			
		Median	Mean	Min	Max
FSI	164	18.270	18.220	12.320	27.180
MMF	164	103973	159878	1750	501284
IF	164	1354327	1720218	473683	4836136
FVC	164	206109	195972	35210	479756
GDP	164	346719	369994	9544	872335
Growth of GDP	164	0.448	0.487	−1.946	4.186
Inflation rate	164	1.373	1.411	−0.241	3.615
Long term interest rate	164	0.980	1.368	−0.540	3.840

Table 4 provides the descriptive statistics for each group categorized by whether they are directly under debt crisis. Notably, the FSI of the countries under the sovereign debt crisis was considerably smaller than that of the other countries. Specifically, except for Ireland that experienced quick economic recovery with a decrease in government debt from 2015, Spain, Portugal, and Italy have substantially lower FSIs than the other four countries in the

study. This corresponds to the prediction that countries with sovereign debt crisis must undergo lower financial stability.

In addition, countries under the sovereign debt crisis tended to have lower GDP growth, lower inflation rate, and higher long-term interest rate. The GDP growth of 23.392 was from Ireland's exceptional growth in the mid-2010s, affecting the mean as an outlier.

Table 5. Correlation matrix

	FSI	MMF	IF	FVC	gGDP	INFL	IR
FSI	1.000						
MMF	0.512	1.000					
IF	0.744	0.548	1.000				
FVC	0.140	0.269	−0.084	1.000			
gGDP	0.276	0.224	0.171	0.043	1.000		
INFL	−0.150	−0.133	0.008	−0.062	−0.214	1.000	
IR	−0.597	−0.136	−0.498	0.133	−0.201	0.333	1.000

Table 5 is a correlation matrix for dependent and independent variables. The size of IF assets strongly correlates with FSI, whereas the size of MMF assets correlates moderately with FSI. FVC seems to have a weak positive relationship with FSI. For macroeconomic variables, GDP growth has a weak positive correlation with FSI. Meanwhile, inflation and interest rates showed a negative correlation with FSI. The size of MMF and IF assets have a moderately positive correlation, but not as large to indicate multicollinearity ($|\sigma| < 0.7$).

5.2. Main Findings

The main estimation results of the given fixed-effects model are presented in Table 6.

Table 6. Main estimation results

	(1) FSI	(2) FSI	(3) FSI	(4) FSI	(5) FSI
ln(MMF)	0.87721	0.87744	0.87535	0.82086	0.82238
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
ln(INV)	7.99031	7.99178	7.97932	6.8993	6.60208
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
ln(FVC)	-0.62941	-0.63047	-0.61967	-0.06642	0.03541
	(0.0651)*	(0.0665)*	(0.07242)*	(0.8569)	(0.9239)
Real GDP growth		-0.00153			-0.01392
		(0.9753)			(0.7754)
Inflation rate			-0.01643		0.19719
			(0.8331)		(0.0324)**
Long term interest rate				-0.2333	-0.32792
				(0.000)***	(0.000)***
No. of obs.	328	328	328	328	328
No. of groups	8	8	8	8	8
Wald X^2	854.04***	851.35***	851.51***	899.95***	912.85***
Adj. R^2	0.72076	0.71988	0.71992	0.73107	0.73346

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

From (1) to (5), the adjusted R-squared values are larger than 0.70, which supports that the fluctuation in the dependent variable FSI is well explained by independent variables. When all

variables are included, as in (5), adjusted R-squared is the largest, implying that real GDP growth, inflation rate, and long-term interest rate improve the fitness of the regression model.

The positive relationship between the change in the amount of MMF and IF assets, and FSI is confirmed as shown in regression (1)-(5). Moreover, financial stability measured by FSI is significantly influenced by MMF and IF assets. This counters several contentions on financial stability and non-bank financial intermediation. Non-bank financing has been widely believed to damage financial stability. However, this corresponds to Bruha and Kocenda (2018) 's finding that the capital adequacy ratio is linked with decreased sovereign risk after the global financial crisis, even though it is linked with increased sovereign risk before the crisis. This may be supported theoretically by Darracq-Paries et al. (2017) who stated that policy interventions aimed at traditional banks expand the shadow banking sector and have a positive effect on financial stability after the financial crisis. The strongest positive effect on financial stability comes from the increase in IF assets.

Interestingly, although the amounts of MMF and IF have a positive impact on financial stability in all regressions (1)-(5) significantly at the 1% level, FVC seems to have an ambiguous effect. Regressions (1)-(3) show that the amount of FVC has a negative influence on financial stability, which is statistically significant at the 10% level. When FVC on the balanced sheets increases by 1%, the FSI decreases by approximately 0.006%. By contrast, regressions (4) and (5) present that either the positive or

negative effect of FVC on financial stability is not statistically significant.

Regression (3) and (5) present that GDP growth is not statistically significant in the estimation. Inflation rates enter regression (5) significantly and positively at the 5% level, even though its influence is much smaller than MMF or IF. When an inflation rate increases by 1%, FSI boosts by only 0.002.

Notably, long-term interest rates enter regressions (4)-(5) significantly and negatively at the 1% level, suggesting that the increase in long-term interest late harms financial stability. Since lowering long-term interest rates encourages investment and is often deemed a major source of economic growth, the negative relationship between long-term interest rates and financial stability seems to make sense.

Table 7. Estimation results of two subgroups

	(6) FSI	(7) FSI
ln (MMF)	2.10708	0.36314
	(0.000)***	(0.001)***
ln (INV)	5.61939	5.39574
	(0.000)***	(0.000)***
ln (FVC)	0.38835	-1.63358
	(0.3764)	(0.003)***
Real GDP growth	0.00403	0.01284
	(0.9767)	(0.7787)
Inflation rate	0.16136	0.35176
	(0.2535)	(0.000)***
Long term interest rate	-0.86554	-0.29620
	(0.000)***	(0.000)***
No. of obs.	164	164
No. of groups	4	4
Wald X^2	597.66***	639.88***
Adj. R^2	0.78315	0.79468

***, **, and * denote statistically significance at the 1%, 5%, and 10% levels, respectively.

Table 7 presents the estimation results of each subgroup with or without a sovereign debt crisis. Regression (6) indicates the estimation result for the group of Germany, France, Luxembourg, and the Netherlands. whereas regression (7) indicates that of Ireland, Italy, Portugal, and Spain.

The positive relationship between the change in the amount

of MMF, IF, and FSI remains. Consequently, the increase in MMF and IF assets boosts the financial stability measured by FSI.

Regression (6) indicates that the influence of FVC assets in countries without debt crisis on financial stability is not statistically significant, whereas regression (7) presents that the change in the amount of FVC assets has a negative influence on financial stability significantly at the 5% level. The negative relationship between long-term interest rate and FSI still holds in both regressions (6) and (7).

VI. Conclusion

This study uses aggregate balance sheet data from eight EU countries from 2009 to 2019, after the global financial crisis, providing empirical evidence that some sectors of the shadow banking system positively affect financial stability and soundness while controlling for macroeconomic factors. In this study, I examine the effect of an increase in each segment of shadow banking or non-bank financial intermediation sector on financial stability measured by FSI.

One of the key findings is that MMF and investment funds have a positive impact on financial stability while controlling for macroeconomic factors. By contrast, FVC has a weak negative impact on financial stability. Moreover, FVC does not seem to affect financial stability when controlling for long-term interest rates. My findings are inconsistent with the view that the increase in the shadow banking sector may lead to financial instability. This is intriguing, considering its role in the global financial crisis in 2008. One of the possible interpretations is that after the financial crisis, regulation on the banking system might mitigate the fragility of shadow banking assets.

Although regulating or cutting back the non-bank financing sector has been recommended for financial stability, this study's empirical evidence shows that the expansion of the non-bank financing system, especially in the form of MMF and IF, may not degrade financial stability. This finding has a policy implication that

simple constraints on the non-bank financing assets may not bring financial stability, contrary to the arguments of Diallo and Al-Mansour (2017). The policy that intends to scale down the size of the shadow banking system may result in financial instability.

It should be remarked that FSI itself can have several limitations as a measure of financial stability or financial soundness. This means that the financial stability of the whole country may not be completely reflected. If non-bank financing data before the global financial crisis in 2008 were available, the study might have many more implications. Theoretical support on my empirical findings may be needed to link financial stability and shadow banking. Moreover, further research on eastern Europe or other developing regions will broaden the discussion.

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Appendix

A. Estimation results of pooled OLS

```
> summary(pd)
Pooling Model
Call:
plm(formula = fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl
+
    ir, data = panell, model = "pooling")
Balanced Panel: n = 8, T = 41, N = 328
Residuals:
    Min.  1st Qu.   Median  3rd Qu.     Max.
-5.74831 -1.73914 -0.73298  1.85535  8.06384
Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept) -0.077960   2.671619 -0.0292  0.976738
mmf_ln       0.214665   0.095538  2.2469  0.025326 *
inv_ln       1.262625   0.192031  6.5751 1.970e-10 ***
fvc_ln      -0.050442   0.191617 -0.2632  0.792532
gdp_growth   0.280148   0.090070  3.1103  0.002036 **
infl        -0.036173   0.154071 -0.2348  0.814527
ir          -0.539033   0.093829 -5.7449 2.137e-08 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
' ' 1
Total Sum of Squares:    5535.8
Residual Sum of Squares: 2286.1
R-Squared:       0.58704
Adj. R-Squared: 0.57932
```

F-statistic: 76.052 on 6 and 321 DF, p-value: < 2.22e-16

B. Estimation results of FEM (Fixed-effects model)

```
> summary(fe)
Oneway (individual) effect Within Model
Call:
plm(formula = fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl
+
    ir, data = panell, model = "within")
Balanced Panel: n = 8, T = 41, N = 328
Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-3.367025 -0.868160 -0.075071  1.041994  4.114642
Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
mmf_ln        0.822380   0.108762  7.5613 4.432e-13 ***
inv_ln        6.602075   0.431941 15.2847 < 2.2e-16 ***
fvc_ln        0.035410   0.370287  0.0956   0.92388
gdp_growth -0.013918   0.048727 -0.2856   0.77535
infl          0.197194   0.091758  2.1491   0.03239 *
ir           -0.327924   0.077173 -4.2492 2.831e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
' ' 1
Total Sum of Squares:    2418.7
Residual Sum of Squares: 619.04
R-Squared:      0.74406
Adj. R-Squared: 0.73346
```

F-statistic: 152.141 on 6 and 314 DF, p-value: < 2.22e-16

C. Estimation results of REM (Random-effects model)

```
> summary(re)
Oneway (individual) effect Random Effect Model
   (Swamy-Arora's transformation)
Call:
plm(formula = fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl
+
    ir, data = panell, model = "random")
Balanced Panel: n = 8, T = 41, N = 328
Effects:
                     var std.dev share
idiosyncratic 1.971     1.404 0.491
individual      2.041     1.429 0.509
theta: 0.8483
Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-3.78728 -0.97267 -0.14731   1.07857   4.63960
Coefficients:
                 Estimate Std. Error z-value   Pr(>|z|)
(Intercept) -29.785572    5.522938 -5.3931 6.927e-08 ***
mmf_ln          0.363310    0.111812   3.2493   0.001157 **
inv_ln          3.413893    0.357359   9.5531 < 2.2e-16 ***
fvc_ln         -0.071707    0.377859 -0.1898   0.849487
gdp_growth     0.010953    0.057195   0.1915   0.848138
infl            0.347467    0.105789   3.2845   0.001022 **
```

ir −0.675943 0.079205 −8.5341 < 2.2e−16 ***

−−−

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares: 2490.4

Residual Sum of Squares: 874.76

R−Squared: 0.64876

Adj. R−Squared: 0.64219

Chisq: 592.893 on 6 DF, p−value: < 2.22e−16

D. F test statistics for FEM

Fixed effect is statistically significant.

> pooltest(fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl + ir, data = panell, model = "within")

F statistic

data: fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl + ir

F = 14.867, df1 = 42, df2 = 272, p−value < 2.2e−16

alternative hypothesis: unstability

E. LM test for REM

Random effect is also statistically significant.

plmtest(pd, effect = "individual", tyype = "bp")

Lagrange Multiplier Test − (Honda) for balanced panels

data: fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl + ir

normal = 38.29, p−value < 2.2e−16

alternative hypothesis: significant effects

F. Result of Hausman test

> phtest(fe, re)

Hausman Test

data: fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl + ir

chisq = 137.66, df = 6, p-value < 2.2e-16

alternative hypothesis: one model is inconsistent.

Reject the null hypothesis that FEM and REM are equivalent. FEM is more suitable.

G. Wald test

> pwaldtest(fe)

Wald test for foint significance

data: fsi ~ mmf_ln + inv_ln + fvc_ln + gdp_growth + infl + ir

Chisq = 912.85, df = 6, p-value < 2.2e-16

alternative hypothesis: at least one coefficient is not null.

국문초록

비은행금융중개와 금융안정:

유럽연합(EU) 국가들을 중심으로

박경현

2008년의 세계 금융위기 이후 10년간 그림자 금융, 또는 비은행금융중개는 금융안정과 함께 쟁점이 되어왔다. 본 연구는 금융위기 이후 유럽연합(EU) 8개국에서의 비은행금융부문과 금융안정과의 관계를 분석하였다. 고정효과 모형을 사용하여 여러 거시경제 변수들을 통제한 패널 분석 결과, 비은행금융중개는 금융안정과 유의미한 양의 관계를 가진다는 점이 확인되었다. 이는 비은행금융중개가 증가할수록 금융안정이 저하될 것이라는 기존의 견해와 상반된다. 따라서 본 연구는 정책적으로 비은행금융자산의 크기를 제한하는 단순한 규제로는 금융안정을 달성하기 어려울 수 있음을 시사한다.

주요어: 비은행금융중개, 금융안정, 그림자금융, 유럽연합(EU), 고정효과모형, 패널자료

학번: 2015-20154