Leveraged and Covenant-Lite Loans, Syndicated Networks and Systemic Risk

M. Billio[a], A. Dufour[b] , A. Sina[b,*], S. Varotto[b]

[a] *University of Venice, Department of Economics, Fondamenta San Giobbe 873, 30100 Venice, Italy*

[b] *University of Reading, ICMA Centre, Henley Business School, RG6 6BA Reading, United Kingdom*

Abstract

This study provides two main contributions to the analysis of financial networks and systemic risk. First, we represent the market for syndicated loans as a dynamic financial network and extrapolate proxies of measures of interconnectedness. We find that these networks have become strongly connected cross-borders and their central financial institutions hold large shares of leveraged and covenant-lite loans. Second, we distinguish within the syndicated loans between leveraged and covenant-lite and create new measures of risk from syndicated portfolios (SY-RISK). Our analysis shows that the increasing magnitude of highly risky loans in the U.S. syndicated market is explicable mostly by the U.S. headquartered systematically relevant institutions. Also, we find that the magnitude of leveraged and covenant-lite portfolios is a valid explanatory measure of systemic risk cross-variations, and increases it during times of recession.

JEL classification: G21, C45.

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*Corresponding author e-mail address: a.sina@pgr.reading.ac.uk (Ana Sina)

1. Introduction

The Federal Reserve and other Central Institutions recognize the dangerous risks in leveraged and covenant-lite lending. In this regard, during the 24th Annual Financial Markets Conference, the current Federal Reserve Chairman Jerome H. Powell explained that: "Through the Shared National Credit Program[1], which evaluates large syndicated loans, our supervisors are continuing to work with their counterparts at the Office of the Comptroller of the Currency and the Federal Deposit Insurance Corporation to ensure that banks are properly managing the risks of losses they face from participating in the leveraged lending market.". In an interview released a year before, his predecessor Janet Yellen, expressed her thoughts about leveraged lending: "I am worried about the systemic risks associated with these loans... There has been a huge deterioration in standards; covenants have been loosened in leveraged lending.[2]" In this paper, we introduce a framework to study the syndicated loans, especially in the form of leveraged and covenant-lite loans. A syndicated loan is generally defined as a form of financing offered by two or a group of lenders, which compose the so-called syndicate. The members of the syndicate collaborate to provide funds to a single borrower. The borrowers are corporations, governments, and other institutions. Here we look at the borrowers headquartered in the U.S. market, which receive loans from institutions headquartered worldwide. In terms of issuance amount, the US borrowers receive more than half of the global outstanding amount. Leveraged loans are a type of loan borrowed to companies or individuals that have a higher risk of default, because of their considerable amounts of debt and or poor credit history. Covenant-lite loans imply generally few restrictions on the borrower and fewer guarantees for the lender. In this paper, we study the syndicated loans market by looking at it as a channel of systemic risk. We develop the analysis in two main parts. First, we represent the syndicated market as a financial network and extract the centrality position of the financial institutions. The aim is to investigate whether there is a positive relationship between centrality and systemic risk. We investigate whether a financial institution has a higher systemic risk than its peers because it is more interconnected and influential in the syndicated network. Our results confirm this argument. Overall, we find that these networks have become substantially complex. There is the presence of "hubs" around which the creation of relationships in the market revolves and a growing influence of international financial institutions.

[1]"The Shared National Credit Program (SNC) was established in 1977 by the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation and the Office of the Comptroller of the Currency (collectively known as "regulatory agencies") to provide an efficient and consistent review and classification of any large syndicated loan."

[2]FT October 25,2018. "Janet Yellen sounds alarm over plunging loan standards"

The second aim focuses on leveraged and covenant-lite loans. We examine whether a greater magnitude of leveraged and covenant-lite loans in the syndicated portfolio of a financial institution can lead it to a higher systemic risk. Especially since the global financial crisis regulators attempt to re-establish trust in the financial system. They are mainly involved in improving the models and measures useful to monitor and re-stabilize the financial system. Our purpose here is to introduce novel risk measures for the syndicated portfolios. We call these measures generally SY-RISK and propose different versions of computation. Everyone depicts the leveraged and/or covenant-lite loans share of a unique financial institution and is weighted by its market magnitude. We employ these measures (SY-RISK) to investigate whether the share of leveraged and covenant-lite loans of global lead arrangers, in addition to other sources of systemic risk such as size and level of interconnectedness, increases the financial institutions' contribution to systemic risk. Our monthly panel regression analysis of almost 100 global financial institutions spans from 2000 to 2019. We show that the magnitude of portfolios leveraged and covenant-lite loans are determinants of the systemic risk of a comprehensive group of financial institutions, especially during periods of recession. By combining the network analysis with our novel risk measures, we find a strong correlation between the central source of connectedness and low-quality portfolios.

Being that since November 2011 a spotlight is constantly on the systemically important institutions, we complement our study by looking at this group of institutions. They are among the key lenders of the global syndicated market. We distinguish the systemically relevant institutions in relationship with their region of headquarter. We find that the U.S. systemically relevant institutions are more central in the syndicated networks and contribute the most to the increasing market of leveraged and covenant-lite loans.

We conduct several robustness tests on our main regression results. First, to identify the periods of recession and non-recession in the US we use a different dummy variable from the main analysis. Then, we identify periods of recession and non-recession by considering the region of the lender. Third, we introduce two additional measures of syndication risk. Fourth, we replace the variable of systemic risk with two different measures. Lastly, we re-run the regressions by using different measures of systemic risk. Our main results for the novel measures of syndication risk are robust across all the tests.

The rest of the paper is organized as follows. In Section 2 we discuss the main papers of the literature which relate to our study. In Section 3 we describe the methodology to develop this study. In Section 4 we present the data gathered from external sources and report descriptive statistics and illustrative graphs. In Section 5 we document the main empirical findings and our robustness test. In Section 6 we conclude.

2. Literature Review

This paper has a common ground with different strands of the literature on financial intermediation and risk, to which we contribute in several ways.

First, this study relates to the growing literature on syndicated loans. Dennis and Mullineaux (2000) explain that the syndicated loan is a "centuries-old process that has shown significant growth in the 1990s". Since it blossomed (in the mid-1980s in the U.S. and with the launch of the euro currency in 1999 in the Euro-Area) this market has become significantly large, especially in the U.S. and European region [3]. Nowadays, together with the bond market, the syndicated loan market is one of the largest debt markets. Several are the factors driving this trend. Sufi (2007) analysis these factors, which are summarizable looking at the borrowers' and lenders' activity. In particular, attracted by the easy accessibility and offering of a vast type of loan products, the borrowers have proliferated so much that, among the largest 500 non-financial firms in Compustat, roughly 450 accessed the syndicated loan market between 1994 and 2002 (Sufi, 2007). From the lenders' perspective, there has been a booming increase in the presence of small- and medium-sized lead arrangers, creating a relationship with large banks. Consequently, the relationship between the borrower and the banks that compose the syndicate has changed. In the past, the borrower had a direct relationship with all the arrangers composing the syndicate. Now, the main interface for the borrower is the leading bank (or leading agent), which in turn collaborates with the other agents (Armstrong, 2003; Pascal and Missonier-Piera, 2007). In practice, the lead arrangers facilitate the creation of the syndicate and are committed to all the related processes. Empirical analysis shows that the lead banks maintain a larger share of the loan (Sufi, 2007). In particular, the lead arranger retains about 30% of each syndicated loan and sells the remaining part to a syndicate of investors (Ivashina and Scharfstein, 2010). [4]. Participants are the banks that own a share of the syndication loan, thus are part of the syndicate. Two are the main reasons that make the syndicated loans attractive for small- and medium-sized lenders. As explained in Ivashina and Scharfstein (2010), participating in these syndicates allow the lenders to share the counterparty risk. Also, this market is a goldmine for small-size lenders, because it allows them to lend money to large borrowers usually unattainable for them, and create synergies with large financial institutions. Here we documenting the progressive loan quality deterioration that characterizes the U.S. global market and documenting the shifting of more locally-based lenders collaborations, to overseas connections among the largest

[3] This market has become so relevant in some regions that a recent study by Acharya et al. (2018) show how the syndicated loans credit crunch during the European debt crisis, has affected the whole European economy in terms of investment, employment, and sales growth of firms.

[4] Many times there is also the presence of co-agents, which are usually involved in administrative tasks.

global banks and many other financial institutions.

This paper also relates to the expanding literature on syndicated loans and systemic risk. The closest paper is Cai et al. (2018), who show that the syndicated loans have beneficial and side effects for lenders. By syndicating a loan, the lenders can better diversify their portfolios across different borrowers. As pointed out in Wagner (2010) and Raffestin (2014), diversification has a side effect. Due to the increased commonalities among the banks' portfolios, there is an increased probability of systemic crises. Differently from Cai et al. (2018), we recreate the lead arrangers' portfolios by considering all the MAs that occurred in the financial sector since 1988. In terms of sample size, we almost double the number of financial institutions included in the regression analysis and enlarge the sample period up to the year 2019. Aware that when investigating systemic risk there are two main issues, which are respectively the lack of consistency in the data used to capture its global dimension, and the type of data used is different because some scholars use balance sheet data, other market price data, while others combine both of them [5], we introduce different measures. Similar to Cai et al. (2018), we use the measures of the systemic risk developed by Acharya et al. (2017) and Brownlees and Engle (2017). We also complement the existing literature about systemically relevant institutions, by analyzing their role in the U.S. syndicated leveraged and covenant-lite loans market. Bierth et al. (2015) investigates the insurance sector and finds that interconnectedness is a significant driver of large insurers' exposure to systemic risk; while, leverage contributes to insurers' systemic risk. Here we investigate the banking sector, and we find that interconnectedness, leverage, the magnitude of leveraged and cov-lite loans, are all significant systemic risk determinants.

Lastly, we add to the growing literature on financial networks. Allen and Babus (2009) argue that network theory improves our comprehension of financial systems. Using indirect measures on several different types of financial institutions, Billio et al. (2012) document an increased interrelation over the past decade in the financial system. The interest in highly interrelated financial networks is growing, especially because of their ability to show how the risk of failures contagion could propagate in the system. As shown in Acemoglu et al. (2015), if a sufficiently small negative shock occurs, a high-density network contributes to a more stable financial system; but when this threshold is overcome, highly density interconnections convey the propagation of shocks, causing a fragile financial system. These connections lead these firms to potential failure in the future. We also know from Beale, et al. (2011) that the failure of one firm hurts those firms to whom it is connected in the network model. We add to this literature by documenting the topology of the syndicated loans networks over time, in relationship with systemically relevant institutions as well as leveraged and cov-lite

[5] Cerutti, Claessens and Mc Guire (2012)

loans. Our work partially relates to Godlewski et al. (2012), who is among the few authors who apply social network analysis to investigate the French market for the syndicated bank. This market is ideal to be represented in the network form because it is characterized by the presence of many financial institutions, linked together by the common loans issued to a unique borrower. We believe that a great comprehension of this market implies studying it in the form of a financial network.

3. Methodology

In this section, we describe how we compute the variables of interest for our analysis. In Section 3.1 we develop the financial networks based on the syndicated loans and compute the centrality measures employed in the regression analysis. We briefly describe other measures of interconnectedness used in the literature we employ for further tests. In Section 3.2 we construct our measures of syndicated portfolio risk (SY-RISK), based on leveraged and covenant-lite loans. In Section 3.3 we describe the computation of other explanatory variables, commonly used in the literature and employed in our empirical analysis.

3.1. Measures on interconnectedness

3.1.1. Interconnectedness from network analysis

The importance of financial networks is nowadays well-known. As explained by Matthew O. Jackson in his speech at the AFA 2019 lecture, we can learn a lot from financial networks; who partners with who, what kind of contract they set up, how much a network is concentrated. Having networks highly concentrated around the largest financial institutions have several benefits, but having one of them failed it could be catastrophic. Financial networks provide a basis for understanding systemic effects. Also, it complements a balance sheet-based analysis, which does not tell us a lot about the financial institutions' relationships. Here we construct an empirically calibrated network for the syndicated market, which changes over time. This market is a financial network par excellence, where nodes and edges are based on loan relationships. The nodes are the financial institutions, which compose the syndicate. The edges (or linkages) between financial institutions are based on real collaborations among financial institutions, which mutually lend to a unique borrower.

We build the syndicated loan networks across years by following the framework for undirected networks. Let *N=1,2,3,...,n* be the set of lead arrangers that compose a syndicated loans market. We first build the undirected network G with the vertex set $V(G) = v_1, v_2, ...v_v$ by means of matrices. Such v *x* v adjacency matrix $A(G) = (a_{ij})_{ij}$, is a matrix representing

the connections between lead arranger i and j in the syndicated loans market. All the adjacency matrices are symmetrical, that is the connections are between lead arranger i and j, or lead arranger j and i. A connection might be equal to:

$$a_{i,j} = \begin{cases} 0, & \text{for } (x_i, x_j) \notin A(G) \text{ if no connection between lead arranger i and j occurs} \\ 1, & \text{for } (x_i, x_j) \in A(G) \text{ if one connection between lead arranger i and j occurs;} \\ > 1, & \text{for } (x_i, x_j) \in A(G) \text{ if more than one connection between lead arranger i and j;} \end{cases}$$

From the syndicated networks we compute different measures of centrality, which are employed in our regression analysis.

To depict how far and how close a lead arranger is with respect to all the other lead arrangers we compute the Farness and Closeness centralities (Bavelas, 1950) as follow:

$$Farness_{i,t} = \sum_i d_{ij}, \text{ over all j} \tag{1}$$

where d_{ij} is the lenght of the shortest path from node i to node j.

$$Nearness_{i,t} = 1/Farness_{i,t} \tag{2}$$

$$Closeness_{i,t} = Nearness_i * (nodes - 1) \tag{3}$$

The value is determined by the paths necessary to move from one node to a target node. This implies that not necessarily the lead arranger with the highest number of connections is the most central in the network.

To depict the influence of a lead arranger in a network we compute the Eigenvector centrality. The Eigenvector centrality interpretation is more sophisticated. It reflects the influence of a lead arranger in a network, and also in this case lead arrangers with few connections could have a very high Eigenvector centrality if those few connections are with very well-connected other lead arrangers. We compute it as follow:

$$EGV_{i,t} = \sum_j a_{ij} * x_j * (t - 1) \tag{4}$$

with the centrality at time t=0 being $x_j(0) = 1, \forall j$

3.1.2. Other measures of interconnectedness

To gauge the portfolio diversification and interconnectedness of our lead arrangers, we compute Cai et al. (2018) measures. First, we compute the monthly distance between two lead arrangers,

as the normalized Euclidean norm in the J-dimension space between lead arranger i and k (i $\neq$ k):

$$\|\mathrm{W}\| = \frac{1}{\sqrt{2}} * \sqrt{\sum_{\mathrm{j}} \mathrm{W_j}^2} \tag{5}$$

Where W_j=$w_{i,t}$-$w_{k,t}$ is the difference between the lead arrangers i and k (i $\neq$ k) portfolios weights. Each lead arranger portfolio weight is $w_{i,t}$. The J-dimension space consists of diversification across the U.S. and 2-digit sector industrial codes. Intuitively, a distance equal to 100 between lead arrangers i and k means that their portfolio of loans are completely different, while a distance equal to 0 means that a full match (i.e. they both issued loans to borrowers belonging to the same 2-digit SIC code or state).

Second, we use the measure of portfolios distance to compute the monthly level of interconnectedness of the lead agents, which is defined as:

$$Interconnectedness_{i,t} = [(1 - \sum x_{i,k,t} * \|W\|) * 100] \tag{6}$$

We apply the same weighting schemes of $x_{i,k,t}$ proposed by Cai et al. (2018): equal-weighted, size-weighted, relationship-weighted. The market-aggregate interconnectedness is computed as follow:

$$Interconnectedness_{i,t} = \sum \frac{1}{N_t} * interconnectedness_{i,t} \tag{7}$$

The lead arranger monthly diversification is computed as:

$$Diversification_{i,t} = [1 - \sum_{j} (w_{i,k,t})^2] * 100 \tag{8}$$

3.2. Syndicated leveraged and covenant-lite loans risk

We compute the share of leveraged and covenant-lite loans hold by each lead arranger as follows. First, for each syndicated loan on the data set, we distinguish between leveraged loans, covenant-lite loans, both leveraged and covenant-lite loans, or other loans as follow:

$$Amount_{i,t} = \begin{cases} \mathrm{Lev_{i,t}} & \text{if } l_1 = 1, c_1 = 0 \\ \mathrm{CovLite_{i,t}} & \text{if } l_1 = 0, c_1 = 1 \\ \mathrm{Lev\&CovLite_{i,t}} & \text{if } l_1 = 1, c_1 = 1 \\ \mathrm{Oth_{i,t}} & \text{if } l_1 = 0, c_1 = 0 \end{cases}$$

l_1 is a dummy variable that takes the value of one when the syndicated loan belongs to the leveraged definition or zero otherwise; similarly, c_1 takes the value of one when the loan belongs to the covenant-lite definition or zero otherwise. If both l_1=1 and c_1=1 the loan is both leveraged and covenant-lite; while if both the dummies are equal to zero the loan does not belong to any of these groups. Consequently, for each lead arranger i and month t, $\mathrm{Lev_{i,t}}$ is the issuance amount

of leveraged loans, $\text{CovLite}_{i,t}$ is the issuance amount of covenant-lite loans, $\text{Lev\&CovLite}_{i,t}$ is the issuance amount of both leveraged and covenant-lite loans, $\text{Oth}_{i,t}$ is the issuance amount of other loans that do not belong to any of these groups. It follows that the total portfolio amount of lead arranger i in month t is equal to:

$$\sum_{i=1}^{I} \text{Lev}_t + \text{CovLite}_t + \text{Lev\&CovLite}_t + \text{Oth}_t = \text{Total}_t, \tag{9}$$

The lead arrangers' issuance amounts are computed using a 12-month rolling sum.

As a next step, we denote with SY-RISK our new measures of syndicated portfolio risk and propose four different versions of them. Each version of SY-RISK allows us to measure the degree of leveraged and covenant-lite loans in the lead arrangers portfolios, by considering its portfolio magnitude on the market.

$\text{SY}-\text{RISK}_{i,t}^{\text{Lev1}}$ measures the ratio between lead arranger's leveraged loans and portfolio of syndicated loans, weighted by the lead arranger issuance amount of leveraged loans over the total syndicated leveraged issuance amount in the market. This provides us the magnitude of the lead arranger leveraged loans portfolio within the leveraged loans market.

$$\text{SY}-\text{RISK}_{i,t}^{\text{Lev1}} = \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t}}{\text{Total}_{i,t}} * \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t}}{\text{Lev}_t + \text{Lev\&CovLite}_t}; \tag{10}$$

We also compute $\text{SY}-\text{RISK}_{i,t}^{\text{Lev2}}$, which differently from $\text{SY}-\text{RISK}_{i,t}^{\text{Lev1}}$, weights the lead arranger amount of leveraged loans on the total syndicated loans amount issued in the market.

$$\text{SY}-\text{RISK}_{i,t}^{\text{Lev2}} = \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t}}{\text{Total}_{i,t}} * \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t}}{\text{Total}_t}; \tag{11}$$

We also propose two more versions of SY-RISK, which accounts also for the covenant-lite loans. $\text{SY}-\text{RISK}_{i,t}^{\text{Lev\&CovLite1}}$ measures the share of leveraged and covenant-lite loans in a lead arranger portfolio, weighted by its share in the syndicated leveraged and cov-lite loans market.

$$\text{SY}-\text{RISK}_{i,t}^{\text{Lev\&CovLite1}} = \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t} + \text{CovLite}_{i,t}}{\text{Total}_{i,t}} * \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t} + \text{CovLite}_{i,t}}{\text{Lev}_t + \text{Lev\&CovLite}_t + \text{CovLite}_t}; \tag{12}$$

$\text{SY}-\text{RISK}_{i,t}^{\text{Lev\&CovLite2}}$ measures the share of leveraged and covenant-lite loans in a lead arranger portfolio, weighted by its share in the whole syndicated loans market.

$$\text{SY}-\text{RISK}_{i,t}^{\text{Lev\&CovLite2}} = \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t} + \text{CovLite}_{i,t}}{\text{Total}_{i,t}} * \frac{\text{Lev}_{i,t} + \text{Lev\&CovLite}_{i,t} + \text{CovLite}_{i,t}}{\text{Total}_t}; \tag{13}$$

The measures are between zero and one. Nevertheless, there is never a month where a unique financial institution has a fully leveraged portfolio and represents the whole market outstanding

amount, i.e. an SY-RISK equal to one never occurs.

3.3. Measures of risk

Since the global financial crisis, multiple measures of systemic risk have been introduced in the literature. In the main analysis, we employ the financial institutions' systemic risk in billions of US dollars (SRISKb). For further robustness, we look at the financial institutions' contribution to the financial system risk (SRISK%) and the standardized measure of SRISK (sSRISK). The measure of SRISKb developed by Acharya et al. (2017) and Brownlees and Engle (2017), is defined as:

$$SRISK = E((k(D + MV) - MV|Crisis) \tag{14}$$

$$= kD - (1 - k)(1 - LRMES)MV \tag{15}$$

where: k is the regulatory capital requirement [6]; D is the book value of debt which is calculated as the book value of assets minus the book value of equity and does not change during the crisis period; LRMES (Long-Run Marginal Expected Shortfall) is the expected fractional loss of the firm equity when the market Index declines significantly in a six-month period[7]; MV is the current market capitalization of the firm. Intuitively, the SRISK measures the expected capital shortfall of the financial firm in the scenario of a systemic crisis where there is a market drop by more than 40% in a six-month period[8]. The SRISK% captures the proportional contribution of each financial institution on the total positive SRISK amount of the financial system. Financial institutions with a high SRISK% are the most affected during a crisis, and the ones that contribute the most to amplify or prolong the crisis effects in the financial system.

4. Data and summary statistics

In this section, we describe the construction of our data set and present the summary statistics. We use several different sources and merge several databases. Sections 4.1 refers to the syndicated loans, section 4.2 the measures of interconnectedness, section 4.3 our novel measures of portfolio risk, section 4.4 the measures of systemic risk and other sources of risk. We conclude with other data employed in the analysis. As will be seen, we analyze in detail the data used to develop this study. From our point of view, it's the only way to understand the dynamics that govern the syndicated loans market. This market is complex and we study how it is structured, how borrowers are spread across states and industrial sectors, which lenders play a predominant role in the system,

[6]Coherently with the literature we assume an 8% capital requirement for the U.S. banks, and, to account for accounting differences, 5.5% for the European institutions)

[7]It is calculated as 1-exp(log(1-d)*beta), where d is the six-month crisis threshold for the market index decline and its default value is 40%; and beta is the firm's CAPM beta.

[8]The threshold reflects the drop experienced in the financial market during the financial crisis of 2007-2009

and what type of portfolios they hold.

4.1. Main Data-set

Our main data-set consists of all daily global syndicated loans issued in the U.S. region which are sourced from the Thomson Reuters SDC Platinum Database. This database provides comprehensive coverage of the global syndicated loan market, with the specification for each loan whether it is a leveraged, and/or covenant-lite loan, or it does not fall into one of these two categories [9]. To make feasible the computations and manual merging among the databases employed, we focus on the U.S. region. This region alone counts for almost half of the global syndicated loan amount outstanding and has a 66% share of the global leveraged loans amount across the world, as reported in Table A.1 in the appendix. This table provides a global overview of the syndicated (and leveraged) market during 1988-2019. In terms of syndicated leveraged volume of lending in Europe, the UK is the top country and represents a quarter of the total within the region; followed by Germany, France, Spain, Netherlands, and Italy. In Asia-Pacific, China has almost double the Japanese share, which is the second-largest market. In the Middle East, the United Arab Emirates alone represents half of the regional share. The African regions are fragmented, and, as expected from the weak presence of firms in the Middle region, this accounts for the lowest issuance share.

From the U.S. global syndicated database, we analyze a large set of variables that allow us to identify at loan level its main characteristics in terms of the borrower, loan details, and syndicated members.[10] Table A.2 in the appendix describes the main variables gathered from the SDC Platinum database and organized into three main groups (i.e. borrower details, syndicated loans details, lenders details - syndicate members). [11].

Table 1 reports summary statistics for the U.S. global syndicated loans during 1988-2019, with the detail of leveraged, covenant-lite, and both leveraged and covenant-lite loans.[12]

Looking at the syndicated loans' total issuance amount, we can identify at least three trends in the U.S. market. First, from the mid-'90s to the eve of the financial crisis the market surpasses the

[9] As communicated by Thomson Reuters: "The loans are sourced from reliable sources, and, to be included in the league tables are required to be signed, syndicated and have reached general syndication close. Thomson Reuters will take a holistic view to determine whether a deal should be tracked in the investment grade, leveraged, or highly leveraged league tables and will look to a series of variables including ratings, pricing, debt ratios, and sponsor involvement to accurately determine appropriate accreditation."

[10] Any summary statistics are available upon request.

[11] Any table/information to reconcile the information about states code, industrial codes, company status, etc. is available upon request.

[12] The number of unique packages refers to what in Thomson is used to identify one or more loans that belong to the same syndicated agreement. These loans are issued on the same date and to the same borrower but for different purposes and/or with different conditions (ex. maturity, type of facility, interest rate,..). For example, in January 2019, the borrower *Charter Communications Inc* received four different loans part of the same syndicated agreement: two Term Loan A due in 2024 for respectively 1,692 and 2,350 million of US dollars, and two revolving credit facilities due in 2024 for respectively 4,000 and 750 millions of US dollars. Each of them has a different unique identifier code because they belong to the same borrower and syndicate agreement, but a common package identifier code.

trillion thresholds.[13] During the global financial crisis, the market reversed its trend. In the three years 2007-2009, the issuance amount dropped significantly by -116%. Similarly, a significant drop is registered in the number of unique borrowers (-58%), unique loans (-78%), and unique packages (-62%).[14] Nevertheless, during the years after the global financial crisis, the market bounces off and achieves a new record of above $3 trillion of syndicated loans issued in 2018. About the trend of the syndicated leveraged loans, this is more variable. On the eve of the financial crisis, the leveraged loan issuance amount achieves the first record. In 2007 the amount of loans issued in the leveraged form accounts for more than $1 trillion and represents more than half of the syndicated loans issued in the U.S. market (52%). During the global financial crisis, the leveraged loans issuance amount is significantly resized (in 2009 is roughly 295$ billion). In the years that follow the market thrived, and surpasses the pre-crisis level in 2013 and 2019, with a total leveraged loans share of respectively 54% and 55% of the whole syndicated market. A completely different shape characterizes the syndicated covenant-lite loans. Before 2006, there is no evidence of syndicated covenant-lite loans in the SDC Platinum database. In 2007, there are only 34 covenant-lite loans in the global syndicated U.S. market, accounting for 27$ billion. Almost 60% of the 27$ billions of cov-lite loans have been issued for a leveraged buy-out purpose to First Data Corp [15], a leading company in the provision of financial services (2-digit SIC 70-89) [16]. This market remains at an embryonic stage until 2012, but starting from the year 2013 these types of loans gain importance among the syndicated loans. During the last decade, the covenant-lite loans have doubled their issuance size and, as of the end of 2019, they represent almost a fourth of the global syndicated market. The last group of Table 1 represents the syndicated loans which are both leveraged and covenant-lite. These loans have the characteristic of belonging to highly risky borrowers and contain low-protective covenants for the lender. Similarly, as for the loans belonging only to the cov-lite group, the issuance trend is growing since 2007, suggesting a more pronounced deterioration of the quality standards among loans that are already highly risky themselves (as is the case for loans that are leveraged but not cov-lite, or vice versa).

[13]This is mainly driven by the booming trend in the U.S. economy, which during these years experienced one of the longest periods of economic expansion of its history. Also, the syndicated market has been characterized by an improved quality of information regarding the borrowers, as well as the reputation of the agents (Dennis and Mullineaux, 2000).

[14]As documented by Ivashina and Scharfstein (2010), the issuance amount of lending fell across all types of syndicated loans (i.e. term loans, investment grade, non-investment grade, etc.). Moreover, as investigated in Giannetti and Laeven, (2012) the collapse in the global syndicated market during this period is characterized by a so-called flight home effect. That is, lenders preferred to favor loans issued to local borrowers, instead of overseas transactions.

[15]The Company has received a cov-lite term loan B due in 2014 of 14$B and a cov-lite revolving credit facility due in 2013 of 2$B

[16]In September of the same year, the company has concluded a new syndicated agreement with the same group of lead agents (at Parent Company level: Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, Lehman Brothers, Merrill Lynch), but for two leveraged loans: a term loan and a bridge loan of respectively 6.5$ and 2.5$ billion

Our study includes the borrowers belonging to every industrial sector and the U.S.[17] We analyze the borrowers from a dual perspective, that is to which industrial sector they belong to and in which State they are headquartered. Table A.3 in the appendix shows the share distribution across industrial sectors, respectively in the whole syndicated loans market (Panel A), syndicated leveraged loans market (Panel B), and syndicated covenant-lite loans market (Panel C), computed as the issuance amount in that specific sector over the total issuance amount. The top sectors for the whole syndicated, leveraged, and cov-lite loans, are Manufacturing (20-39), Finance, Insurance, Real Estate (60-67), Transportation Public Utilities (40-49), and Services (70-89). This last one is a driving sector, especially for the leveraged and cov-lite loans.

Fig. A.1 in the appendix represents how the issuance amount in the overall syndicated market and the leveraged market is distributed across the U.S. Panel A represents the whole syndicated loans market, while Panel B focuses on leveraged loans. There is an accentuated similarity of the most relevant states (as of issuance amount and number of unique borrowers). The two figures show a stronger concentration of the syndicated activity in the U.S. located on the east coast of the region and less on the northwest side. The states Texas, California, and New York are the top three for aggregate issuance amount during the period 1988-2019 (between 8% and 15% of the total outstanding amount). Looking at the whole syndicated loans market, the States that follow in terms of importance are Illinois, New Jersey, and Pennsylvania. While in the leveraged loans market are Illinois, Pennsylvania, and Florida. It is not surprising that the states with the highest shares of issuance loans are the ones with the highest GDP level within the region [18].

The last main analysis of the SDC Platinum database concerns the lenders in the syndicated market. We restrict our analysis to the lead arrangers headquartered worldwide that issue syndicated loans to U.S. borrowers. As explained in the literature, lead arrangers retain a larger stake in the syndicated loan (Sufi, 2007) and are also active participants in almost 70% of the loans (Cai, 2010). As explained in Ivashina and Scharfstein (2010), lead arrangers hold their share of

[17]We removed from the data set the loans for which the 2-digit SIC Code is not available and/or the state where the borrower is headquartered is not mentioned. Overall, the data set is not affected by the observations drop, because they account only for less than 2% of the total issuance amount.

[18]To further investigate the relationship between industrial sectors and states, we also look at the 2-SIC across the different U.S.. Frequently, the most relevant industrial sectors by the U.S., coinciding with the leading sectors for the local GDP. About the top countries, Texas's top share belongs to the Transportation Public Utility sector (40-49), which is defined by many economists as a "super-sector", because it employees roughly 20% of the total non-farm employment in the State. The second and third largest shares belong to the sectors Mining (10-14) and Manufacturing (20-39). These statistics suggest that the most relevant sectors in the syndicated loans market reflect the main drivers of the Texas GDP, which is the top-ranked among the states for the total energy production and, despite the slight decline of the manufacturing sector over the past year, it remains one of the leading drivers. Focusing on the distribution of leveraged loans across the industrial sectors in Texas, Transportation Public Utilities (40-49) and Mining (10-14) represent the largest shares, followed by Services (70-89). Also for the second-largest states as of syndicated total and leveraged loans issuance, both California's and New York's most relevant sectors are represented by the industries that advance the two economies. During the recent years, both the States have experienced a significant drop of the share belonging to the Finance, Insurance, Real Estate (60-67) sector (roughly 15% less), partially compensated by the higher share of the Services (70-89) sector (roughly 10% more).

each loan and sell the remaining part to investors. Starting from the analysis of daily loans, we compute the lead arrangers' portfolios by aggregating the data at a monthly level. Not surprisingly, there is a strong presence of large financial institutions among the top lenders. To compute the lead arrangers' portfolios, we aggregate the amount from a Subsidiary- to a Parent-Company level. Before doing this, we correct the Parent Company data according to the pre-M&A period in which the Subsidiary has been involved, because one main issue that arises with Thomson data on syndicated loans is that they reflect the last M&As that occurred. For example, Merrill Lynch's Parent Company before September 2008 should be Merrill Lynch. But the data provided displays that the Parent Company of Merrill Lynch is Bank of America (BOA) because embeds the information of the last acquisition. We correct the data set by considering all the M&As that occurred to the financial institutions in our sample retroactively (for example for Merrill Lynch we adjusted the Parent Company before September 2008). We merge the syndicated loans database with the M&A Thomson One database. The merge of the data sets has been done mostly manually, as follows. We extract from the M&A database the following information: effective date of the M&A, acquirer ultimate parent company, target company, and description of the occurred M&A. We match the name of the acquirer and target companies with one of the lead arrangers in the SDC Platinum Database. Although for some institutions the name in the syndicated loans and M&A databases coincides, for most of them the nomenclature is different and part of the matching has been done manually. During the period 1988-2019, among the financial institutions included in our sample, we find roughly 470 companies involved in mergers and acquisitions at a parent company level [19].

4.2. Syndicated Loans Networks

The data used to calibrate the syndicated networks are extrapolated from the main data set. Each node of the network represents a lender, and the connections reflect the real loans relationships between them. In Fig. 3 we graphically present the syndicated networks of the years 2009 (Panel A) and 2019 (Panel B) [20]. We include the top 93 lead arrangers, which provides a comprehensive sub-sample of both systemically- and non-systemically relevant institutions. In the left-graphs, the nodes are dark red-colored if the financial institutions are globally systemically relevant, light-red colored if they are domestically-systemically relevant, while blue-colored if they do not belong to this group. In the right graph, the nodes are colored according to the geographic area where the financial institution is headquartered. The nodes are green for America, orange for Europe, cyan for Asia, and yellow for Australia. There are two lines of connections (edges), and the edge is colored in pink when the connection is between two lead arrangers, of which at least one of the two is a systemically relevant institution. The edge is blue when the connection is between two financial institutions, which are not in the systemically relevant group. Also, the dimension of the

[19] Table A.5 specifies some of the MAs involving some among the most relevant banks.

[20] The years 2009 and 2019 are characterized respectively by the lowest and highest network density during the sample 2001-2019.

node highlights the lead arranger share of leveraged and covenant-lite loans with respect to the market (i.e. the largest the size of the node, the highest the lead arranger's portfolio magnitude of highly risky loans). The figures show a significant increase in the complexity of the syndicated loan networks. Every period of the analysis is characterized by the presence of hubs and super-hubs, which detect a large amount of leveraged and covenant-lite loans and have central roles in the creation of loan relationships. This is evident especially for Bank of America, JPM, and Wells Fargo (which name is highlighted in white into the corresponding node). The topological feature of the networks, and especially that referring to 2019, reminds the concept of 'too interconnected to fail' (TITF), which characterizes a high concentration of the connections between few financial institutions, which are identified as super-spreaders (Markose et al., 2012). The financial crisis period is characterized by a larger distance among systemically important banks and by more local-based collaborations. The nodes related to the different geographic areas are more closed to other nodes belonging to the same area. In 2019, the systemically important institutions are very closed to the densest part of the network. Also, there is a significant increase in cross-border relationships among the top lead arrangers, and the centrality of foreign financial institutions is increasing (see for example the European and Asia financial institutions).

Table 3 reports key statistics of the syndicated networks. It includes the pre-, during, and post-global financial crisis periods. The increase in the number of connections between the top 100 institutions is remarkable, during the period 2001-2019 the increase is about 166%. Among them, systemically relevant institutions play a crucial role in creating contractual relationships in the syndicated loans market. The density is the number of actual connections over the total connections. Part of the global financial crisis period is characterized by a decreasing density, in line with the drop of the loan issuance amount during 2008 and 2009 (refer to Table 1). The highest density level of the network is achieved in 2019. Similarly, during 2017-2019 the average centrality of the financial institutions is higher.

Table A.5 in the appendix summarizes the top twenty sources of connectedness in the syndicated system, ranked according to the Eigenvector centrality. The analysis of the networks brings to light several insights. First, the largest financial institutions are among the most central source of connectedness, and they are involved in most of the mutual collaborations in the syndicated loans market. Second, the most influential lead arrangers detect the highest shares of highly risky loans in the market. This is not necessarily a piece of bad news. These central institutions are strongly monitored by the Regulator, and after the global financial crisis, they have become more resilient. Nevertheless, it could become a risk in case of insolvencies, because shocks can propagate quickly. As we know, banks holding a large share of these loans have already found themselves in trouble[21]. Looking at where the financial institutions are headquartered, we observe an overseas trend going on in the system. Until the end of the global financial crisis, there is a larger presence of U.S.-headquartered financial firms. While the post-crisis period is characterized by an increased

[21]See for instance FT June 25, 2019 "Deutsche faces big hits on US leveraged-loan losses"

presence of institutions headquartered overseas. In terms of highly risky portfolios, the aggregate share of leveraged and covenant-lite loans held by overseas institutions is increasing. Lastly, several of the top twenty financial institutions in the system are involved in M&As during the period of analysis. Frequently, the acquired or merged companies remain in the top ranking

4.3. Syndicated leveraged and covenant-lite risk

Fig. 1 shows the box plots of the monthly measures of risk SY-RISK, computed according to Eq. (8), (9), (10), and (11). The measures $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev1}}$ and $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev2}}$ are plotted during the period 1989-2019. The two additional measures of risk, $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev\&CovLite1}}$ and $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev\&CovLite2}}$ are plotted from 2007 because there are no data about global syndicated cov-lite loans before this year. The plots show the magnitude of the financial institutions' leveraged and covenant-lite portfolios within the markets. Despite both the measures of SY-RISK in Eq. (8) and (9) have a common part, weighting the financial institution ratio of risky loans by its presence in the leveraged market or whole syndicated market makes a great difference. This is the case also for Eq. (10) and (11). The measures of risk $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev2}}$ and $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev\&CovLite2}}$, which are computed by weighting the financial institutions share of risky loans with respect to the whole market, are on average low for many financial institutions. This suggests that although the financial institutions might have a great share of risky loans in their portfolio, its magnitude in terms of issuance amount with respect to the syndicated market is limited. The financial institutions' measures of risk increase significantly for $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev1}}$ and $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev\&CovLite1}}$, which measures the importance of the financial institutions within the leveraged and cov-lite markets. Despite also these two measures are low for many financial institutions, there is an increased presence of lead arrangers holding a portfolio of highly risky loans and issuing a large share of leveraged and cov-lite loans in the market. The maximum level of risk achieved by a unique financial institution is roughly 10%. The top financial institutions closed to this level are Manufacturers Hanover Corporation in 1990, Bankers Trust in 1993, and Bank of America in 2009 and 2010.

Fig. 2 shows the relationship between systemic risk and $\mathrm{SY-RISK}_{i,t}^{\mathrm{Lev\&CovLite1}}$ for six main financial institutions. For the U.S. market, we show Bank of America BofA (previously Bank of America Merrill Lynch, and Bank of America before the acquisition of Merrill Lynch), Lehman Brothers, and Citigroup. For the other regions, we include Bank of Montreal (Canada), HSBC Holdings (Europe), BNP Paribas (Europe), Santander Group (Europe), Industrial Commercial Bank of China Ltd (Asia), and Mitsubishi UFJ Financial Group (Asia). Despite that for some financial institutions, the dispersion is larger than others, the scatter plots suggest a positive relationship between the two variables in all these cases.

4.4. Systemic risk measures and sources of risk

Table 2 presents summary statistics for the main dependent variables employed in the panel regression analysis. The data are organized at a country level and include 16,134 observations of financial institutions across 24 countries worldwide[22]. The U.S. region accounts for the largest number of financial institutions in the sample, followed by the UK, Canada, and Japan. Among the financial institutions in the U.S. which contribute mostly to the increased systemic risk during the 2000-2019 period, there are JPMorgan Chase Co, Citigroup Inc, Morgan Stanley, and Bank of America Corp. Among the UK-based financial institutions, a leading role is played by Barclays PLC, Royal Bank of Scotland Group PLC, HSBC Holdings PLC, and Lloyds Banking Group PLC. In the Canadian financial system, the most systemically relevant financial institutions are the Bank of Montreal, Toronto-Dominion Bank, and Bank of Nova Scotia. The Japanese financial institutions' average level of systemic risk is mainly driven by the increased level of risk after the global financial crisis of Mitsubishi UFJ Financial Group, Mizuho Financial Group, and Summit Financial Group. In the Asian area key systemically relevant institutions are based in China (among the top there are Bank of China Ltd and China Construction Bank Corp). Lastly, the European-based financial institutions that contribute the most to increase the average value of systemic risk are headquartered in France, Germany, the UK, Italy, Switzerland, and Spain.

4.5. Other data

To develop our main analysis we gather additional data from external sources and merge them into our main dataset, which contains all the data described in the above sub-sections. First, to distinguish between periods of recession and non-recession and check whether our main results are robust, we introduce other dummy variables. For the U.S. region, we employ two dummy variables, which are respectively the USRECD and USRECDM [23]. For the analysis at the regional level, we also employ variables detecting the recession period in the Euro Area, Asia, and Australia. Table A.4 in the appendix describes each of these variables and specifies the NBER- or OECD-based periods of recession.

We investigate the possible determinants of the novel measures of syndicated risk. For this purpose, we distinguish between the systemically- or non-systemically-important institutions. Among the set of systemically relevant institutions we differentiate between globally systemically relevant banks, and domestically systemically relevant banks, and globally systemically relevant insurance. For this purpose, we introduce a categorical variable accordingly to the type of financial institution. We gather the list of Globally Systemically Important Banks (G-SIBs) by the Financial Stability

[22]As mentioned in the introduction, in the global syndicated database, the borrowers belong to the U.S., while the lenders are headquartered worldwide.

[23]We also employ the USRECDP but the dummy variable is the same as the USRECDM for the period 2000-2019

Board list published in 2019 [24] To enrich the list, we add the D-SIBs (domestically systemically important banks) and Other Systemically Important Institutions (O-SIIs) around the world by gathering information from public sources. [25].

Since the list of systemically relevant institutions has been created after the global financial crisis, we assume for each institution present in the document to be systemically relevant during the whole sample period.

5. Results

In this section, we present and discuss our main empirical findings. We start by investigating some possible determinants of our novel measures of portfolio risk. Then, we move to the core of our panel regression analysis. We aim to answer whether the centrality of a financial institution in the syndicated network and its magnitude of low-quality loans are significant in explaining systemic risk variations. We conclude with several robustness tests.

5.1. Syndication risk and Systemically Important Financial Institutions

In this section, we attempt to better understand which might be possible determinants of the magnitude of highly risky loans detected by the financial institutions in the sample. To this end, we look for several factors, based on what we observed from the summary statistics and network analysis. First, we look at the possible relationship between systemic importance and geographic location. We include three variables, which are given by the interaction of the dummy variable equal to one if the financial institution is Globally-Systemically Important Bank (G-SIBs) and the region of headquarter of the financial institution (respectively to the American, European or Asian region[26]). We add the measures of interconnectedness, total assets, the number of specializations in the syndicated market[27], the portfolio diversification. The regression model is estimated as follow:

$$\begin{aligned} SY-RISK_{i,t}^{Lev1} = \alpha &+ \beta_1(GSIBs_i * US_i) + \beta_2(GSIBs_i * EU_i) + \beta_3(GSIBs_i * ASIA_i) \\ &+ \beta_4 Interconnectedness_{i,t} + \beta_5 TotalAssets_{i,t} + \beta_6 MarketSize_t \\ &+ \beta_7 Diversification_{i,t} + \beta_8 NumberSpecializations_{i,t} \\ &+ \beta_9 SRISKb_{i,t} + e_{i.t} \end{aligned} \tag{16}$$

Given the strong similarities among the measures of syndicated risk, we report for simplicity the results when employing as a dependent variable $\mathrm{SY-RISK^{Lev1}_{i,t}}$. Similarly, we report the results

[24]Refer to the FSB list: G-SIBs, 2019.

[25]Refer to the following documents. FED, 2013; BIS, 2016; EBA (O-SIIs), 2019; Canada (D-SIBs), 2018; Australia (D-SIBs), 2013;Japan (D-SIBs), 2016

[26]The Australian region is not included in this sample as there are no GSIBs located in Australia

[27]The number of specialization is computed by following Cai et al. (2018).

for the equally-, size-, and relationship-weighted interconnectedness computed only at 2-digit sic level[28].

The results suggest that GSIBs headquartered in the U.S. contributes mostly to the historical increase of highly risky loans. As a contrary, Asian GSIBs present lower level of $SY - RISK^{Lev1}_{i,t}$. Future research may include the participation of Asian institutions on loans issued in other regions (then the U.S.). The coefficient of the European GSIBs is not statistically significant. The result could be not so surprising if we consider the great heterogeneity of the financial sectors across each country in the Region. In this regard, future research exploiting participation in highly risky lending of financial firms across European states might provide useful insights. All the coefficients of the measures of interconnectedness suggest a significant relationship between interconnectedness and $SY - RISK^{Lev1}_{i,t}$. This relationship could be understood also by looking at the topology of the networks and the presence of central financial institutions that hold large portfolios of highly risky loans.

In Table A.7 and A.8 of the appendix, we report also the regression analysis when enlarging the sample of systemically relevant institutions to the G-SIIs and D-SIBs. Given the presence of Australian D-SIBs in our sample, in table A.8 we include also this geographic location.[29] Similarly as for the Asian region, the coefficient of the interaction between D-SIBs and the Australian institutions suggests that Australian banks carry lower $SY - RISK^{Lev1}_{i,t}$.

Overall, the results obtained seem to suggest the following. The increasing magnitude of highly risky loans in the U.S. syndicated market is explicable mostly by the U.S. headquartered systematically relevant institutions. Banks and insurers located in Asia and Australia tend to decrease the magnitude of highly risky loans lend to US borrowers. The coefficients of the European region are not statistically significant and this may be induced by the diversities across the European States.

5.2. Systemic risk, syndication risk and interconnectedness

To analyze the relationship between the financial institutions' systemic risk and the novel measures of syndicated risk we estimate several models. Table A.6 shows Pearson correlation coefficients for the main variables of interest included in this analysis. Overall the coefficients are all significant at the 1% level, indicating a positive relationship between these variables. As expected, the correlation between measures of interconnectedness is high.

In our main regression analysis, we employ as a dependent variable the first difference of SRISKb (hereafter called Δ SRISKb) in billions of US dollars (hereafter called SRISKb). Despite for some financial institutions, SRISKb is stationary, for most of the leading financial institutions in the sample, this is not the case especially during periods of recession (ex. J.P. Morgan, Citigroup, Bank of America,...). As common when computing the dependent variable in first difference, the

[28]The analysis at regional level is available upon request.

[29]In the previous analysis it was not included because in the sample of G-SIBs and G-SIIs there are no financial institutions belonging to this region.

value of r2 is very low. Nevertheless, we replicated the analysis by employing also SRISBb and the interpretation of the variables of interest remains unchanged[30].

In all our models we include a common set of variables. The aforementioned dependent variable of Δ SRISKb and a set of control variables that include the recession dummy [31], total assets in billions ($), market share (%), market size in billions ($), one-period lagged SRISKb. We estimate regressions with lead arranger fixed effects to account for unobserved heterogeneity across our sample financial institutions. Standard errors are clustered at the lead arranger level.

The general form of the panel regression is as follow:

$$\begin{aligned}\Delta SystemicRisk_{i,t} = \alpha &+ \beta_1(SyndicationRisk_{i,t} * Recession_i) \\ &+ \beta_2(SyndicationRisk_{i,t} * Non - Recession_i) + \\ &+ \beta_3(Interconnectedness_{i,t} * Recession_i) \\ &+ \beta_4(Interconnectedness_{i,t} * Non - Recession_i) + \beta_5 Recession_i \\ &+ +\beta_6 RiskyLoanAmount_{i,t} + \beta_7 TotalAssets_{i,t} \\ &+ \beta_8 MarketShare_{i,t} + \beta_9 MarketSize_{i,t} \\ &+ \beta_{10} LaggedSystemicRisk_{i,t} + FinancialInstitution'_i + e_{i.t}\end{aligned} \tag{17}$$

To answer the question of whether a more central or influential financial institution in the syndicated network is more sensitive to systemic risk, we employ three measures of centrality extrapolated from the syndicated networks. Table 5 presents the result when we employ as a proxy for the interconnectedness the Eigenvector centrality (Eig-C), the Closeness centrality, and the Farness centrality (computed respectively as of Eq. 4, 3, and 1). In model specifications (1), (4), and (7) we consider as the main variable of interest the measure of centrality interacted with periods of recession and non-recession. In line with our expectations, they are all statistically significant at the 1% level, suggesting a greater propensity of central financial institutions to systemic risk increases. In the other specifications we add also $SY-RISK^{Lev1}_{i,t}$ and $SY-RISK^{Lev\&CovLite1}_{i,t}$, computed as of Eq. 10 and Eq. 12, and interacted with period of recession and non-recession. The coefficients on the different versions of SY-RISK interacted with the recession dummy are positive and statistically significant, across all the different model specifications. These preliminary analysis indicates that both $SY-RISK^{Lev1}_{i,t}$ and $SY-RISK^{Lev\&CovLite1}_{i,t}$ are good determinants of systemic risk variations. Nevertheless, the results for the Eigenvector and Farness centrality are not robust across all the models' specifications. While these centrality measures are highly correlated with each other, they measure different aspects of the financial institution's positioning. These preliminary results seem to suggest that when introducing other variables of risk, only the proxy of interconnectedness that

[30]The results are available upon request

[31]In our baseline models we employ the USRECD NBER recession dummy described in table A.4, in line with previous literature.

captures the closeness between financial institutions has some explanatory power on the model.

Testing our H0-hypothesis, we see that both the Eigenvector and Closeness centrality increases Δ SRISKb during bad times in the economy, but not during normal times, and the difference is highly significant. Similarly, a higher magnitude of risky loans in the lead arranger portfolio amplifies the effect of systemic risk variations during bad times.

To further investigate our results we employ also the equally-, size- and relationship-weighted interconnectedness, computed based on euclidean distances as explained in subsection 3.1.2. Table 6 shows the results, when computing these measures of interconnectedness across the industry (Panel A) and states aggregation (Panel B). The results are in line with the previous ones when diversifying across industries sectors. Similarly, the coefficients on the different versions of SY-RISK interacted with the recession dummy are positive and statistically significant, across the model specification. These findings confirm the goodness of the syndicated measures of syndicated risk as determinants of systemic risk variations. On other hand, the coefficients of equally- and relationship-weighted interconnectedness are not robust across all the models' specifications. Nevertheless, the results for the size-weighted interconnectedness interacted with recession are robust across any model. The results are not surprising for at least two reasons. First, intuitively among the three measures proposed based on the Euclidean distance, this embeds one of the most significant explanatory variables of SRISKb (Bostandzic and Weiß, 2018; Vallascas and Keasey, 2012; Laeven et al., 2016). Second, as shown in Varotto and Zhao (2018) a simple standardization can lead to measures of systemic risk able to predict effective periods of a financial crisis. Our regression analysis seems to suggest that standardization also has good effects in creating measures that explain systemic risk, as in the case of size-weighted interconnectedness.

In Panel B we show the results by computing the measures of interconnectedness across states aggregation (Panel B). We achieve the same conclusion on our novel measures of syndication risk, which coefficient interacted with periods of recession is statistically significant at the 1% level across all the model specifications. Nevertheless, the previous conclusions on interconnectedness are different because the measure interacted with periods of non-recession has a negative and significant coefficient in models specifications (1) to (4). The results seem to support theories on the beneficial effects of creating synergies among financial institutions and syndicating loans during non-recession periods. Nevertheless, they are not robust.

Overall our models present a low adj. R-sq. We deepened this point in several ways and conclude that by employing as a dependent variable the first difference of SRISKb to guarantee the variable stationarity, it is difficult to have a significant improvement of the adj. R-sq. In line with other studies in the literature, we re-estimate all the models also by employing the dependent variable in absolute value, which leads to a very high adj. R-sq. The interpretation of the results remains changed. [32]

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[32]The results are available upon request.

5.3. Robustness

To complement the main analysis discussed in the above section, we perform a large set of robustness tests on our main findings, by using additional data and different model specifications. All the results related to the robustness checks are available in the robustness section of the appendix.[33]

Firstly, a possible concern might be that by employing a different index to depict the periods of recession and non-recession in the U.S. economy the results are not robust. In the main analysis, the variable used to identify the periods of recession is the NBER-based dummy commonly used in the literature (refer to Table A.4). Here we employ additional variables to detect the periods of recession and non-recession. Different from the main analyses, we introduce the USRECDM variable to distinguish between U.S. recession and non-recession periods (refer to Table A.4). This NBER-based variable depicts different periods of recession from the one employed in the main analysis [34], i.e March 2001 and December 2007 are identified as recession periods, while November 2001 and June 2009 are identified as non-recession periods. Table R.1 and R.2 in the appendix show the results, which are robust.

Furthermore, concerns in this regard might be that the dummy employed in the analysis depicts periods of recession only in the U.S. economy, which is the one related to where the borrowers in the analysis are headquartered. One could argue that the sample includes a wide set of financial institutions based in the U.S., but also different regions and the recession periods identified are not related to the regions in which these institutions are based. We control for this by looking at the main geographic area in which each financial institution operates. To this extent, we identify the periods of recession and non-recession in the regions where the financial institutions are based (i.e. America, Europe, Asia, Australia). The results are reported in Table R.3 and R.4 in the robustness appendix. The conclusions about the measures of syndicated risk are not unaffected. While the measures of interconnectedness are not robust. This is not surprising because already in the main analysis we observed that the results are affected depending on how these measures are computed and which variables are added in the model. In this case, it is clear that by identifying the periods of recession differently it is possible to reach different conclusions about the impact of interconnection on systemic risk.

Regarding the novel measures of syndicated portfolio risk, it could be argued that the measure so far employed in the regression analysis, accounts for the lead arranger magnitude in the leveraged and cov-lite markets (refer to Eq. (4) and (6)), instead of its magnitude in the whole syndicated market. Then, we compute SY-RISK according to Eq. (11) and (13) and re-run the previous panel regressions. The results for the measures of syndicated risk are reported in Table R.5 and R.6 and they are robust across the numerous model specifications and variables included. The analysis points out that that the financial institutions' magnitude of risky loans in the overall market is a

[33] For simplicity in each table we include only the main variables of interest, but the full version is available upon request.

[34] For the detailed explanation refer to https://fred.stlouisfed.org/series/USRECDM.

valid explanatory variable of systemic risk.

To complement the robustness tests we replaced our main dependent variable with two alternative measures of systemic risk, respectively the Long-Run Marginal Expected Shortfall and SRISK% (Acharya et al., 2012). The results by replacing the dependent variable with ΔLRMES and ΔSRISK% are reported in tables from R.7 to R.10. The main conclusion about the interaction between the variable of syndicated risk and periods of recession remains unchanged. While, as can be seen from table R.8 and R.10, some of the coefficients of the variable interacted with periods of non-recession are significant and positive. However, the results are not robust across the numerous models estimated so we can't reach a unique conclusion for the non-recession period.

6. Conclusions

In this paper, we study the U.S. global syndicated loans market, especially in the form of leveraged and covenant-lite loans. We document the quality loan deterioration that characterizes the U.S. global syndicated loans in the last decades. Mostly concentrated in the states of Texas, California, New York, Illinois, Florida, and Pennsylvania, the main leveraged and covenant-lite borrowers belong especially to the Manufacturing (20-39), Finance, Insurance, Real Estate (60-67), Transportation Public Utilities (40-49) and Services (70-89) industrial sectors.

To better understand the mechanism driving the increased fashion of the global syndicated market we study the topology of the financial networks in this system. The historical evolution shows a leading presence of systemically relevant financial institutions, which are the key source of connectedness in the market. Very frequently, the central sources of connectedness correspond also to the financial institutions holding the highest share of leveraged and covenant-lite loans in their portfolios.

Inspired by the positive relationship between the interconnectedness and share of leveraged and covenant-lite loans, we develop four novel measures of syndicated portfolio risk. We propose different versions of SY-RISK, able to depict in different ways the magnitude of the financial institutions in the leveraged and covenant-lite markets. SY-RISK is intended to empirically show how the magnitude of the portfolio of leveraged and covenant-lite loans that a bank holds is informative about financial institutions' systemic risk variation. We show that SY-RISK can explain the systemic risk contribution of leading financial institutions in the whole market.

While our research focuses on loans issued to U.S. headquartered borrowers, it may be extended to other leading regions like Europe and Asia-Pacific. This would help to better gauge the impact of global institutions in high-risk lending. Lastly, future analysis could be on the credit risk embedded in syndicated leveraged and covenant-lite loans, looking especially at the post-Covid-19 implications.

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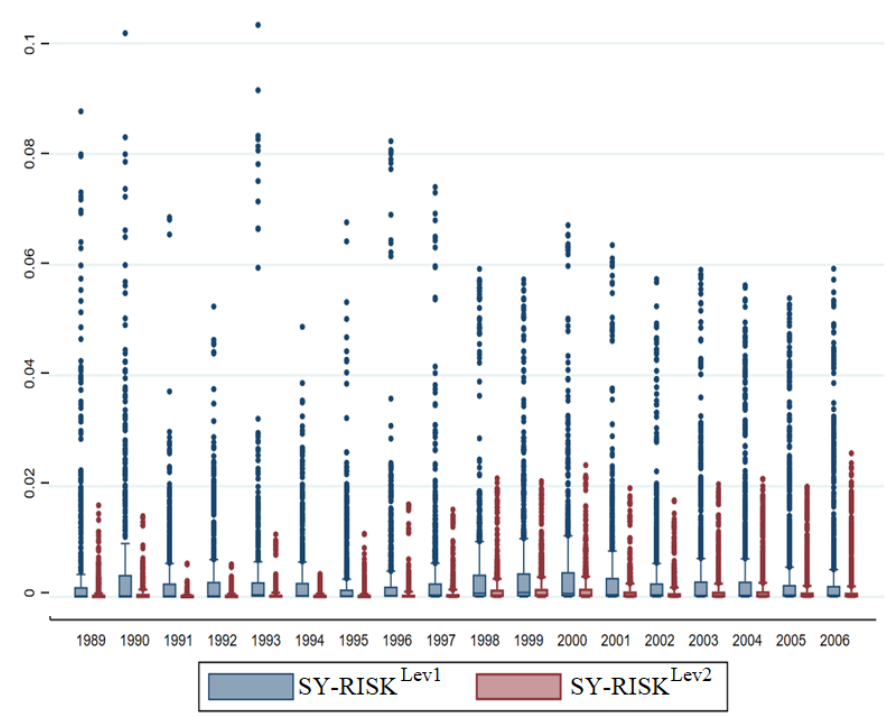
7. Figures and Tables

Figure 1

Syndicated Leveraged and Covenant-Lite Loans Based Risk Measures

These two box plots show the novel monthly measures of syndicated portfolio risk (SY-RISK). Panel A represents SY-RISK^{Lev1} and SY-RISK^{Lev2}, computed according to Eq. (8) and (9) during the period 1989-2006. Panel B shows the previous two measures of risk during the period 2007-2019, and plots also SY-RISK$^{Lev\&CovLite1}$ and SY-RISK$^{Lev\&CovLite2}$, computed according to Eq. (10) and (11).

Panel A



Panel B

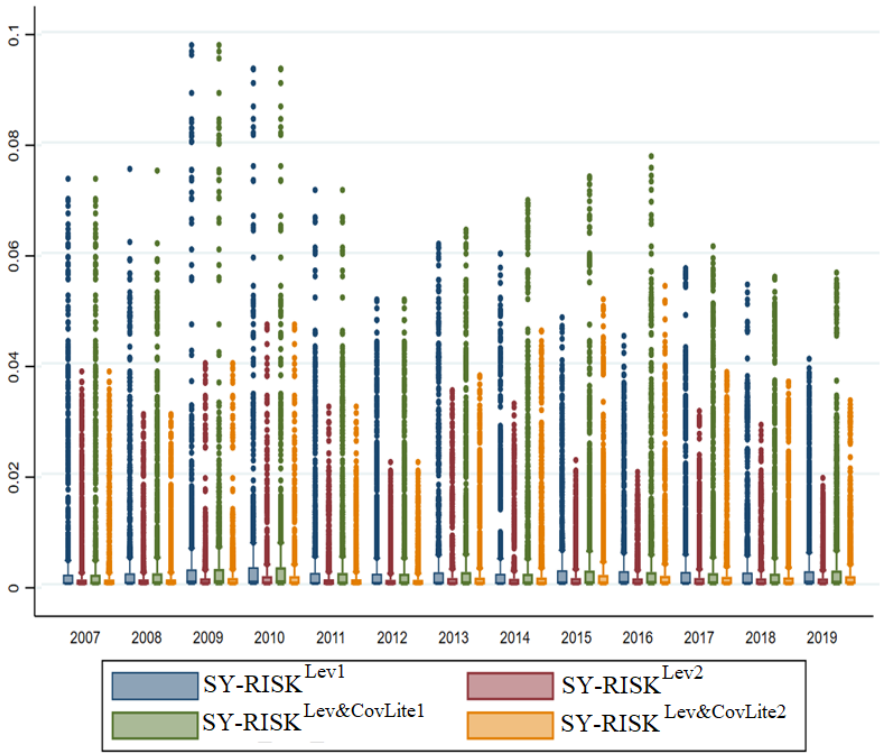


Figure 2
Leverage and Covenant-lite Loans and Systemic Risk

These scatter plots display values of the two variables SRISKb and SY-RISK$^{Lev\&CovLite1}$. The three panels include a set of financial institutions belonging to the three main regions, respectively America, Europe, and Asia. Panel A shows the U.S. banks Bank of America, Citigroup, and Lehman Brothers. Panel B shows Bank of Montreal (Canada), HSBC Holdings (Europe), and BNP Paribas (Europe). Panel C shows Santander Group (Europe), Industrial & Commercial Bank of China Ltd (Asia), and Mitsubishi UFJ Financial Group Inc (Asia).

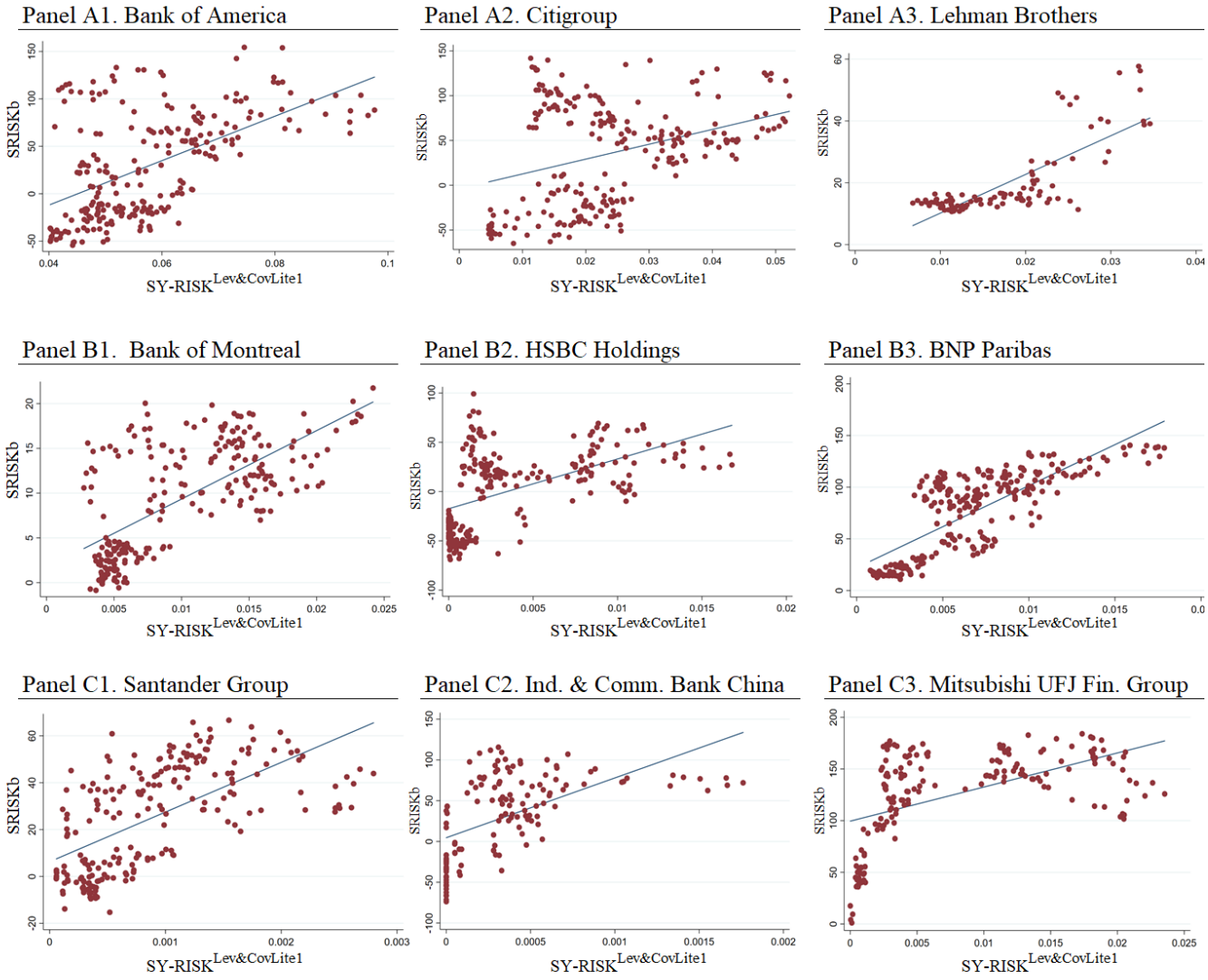
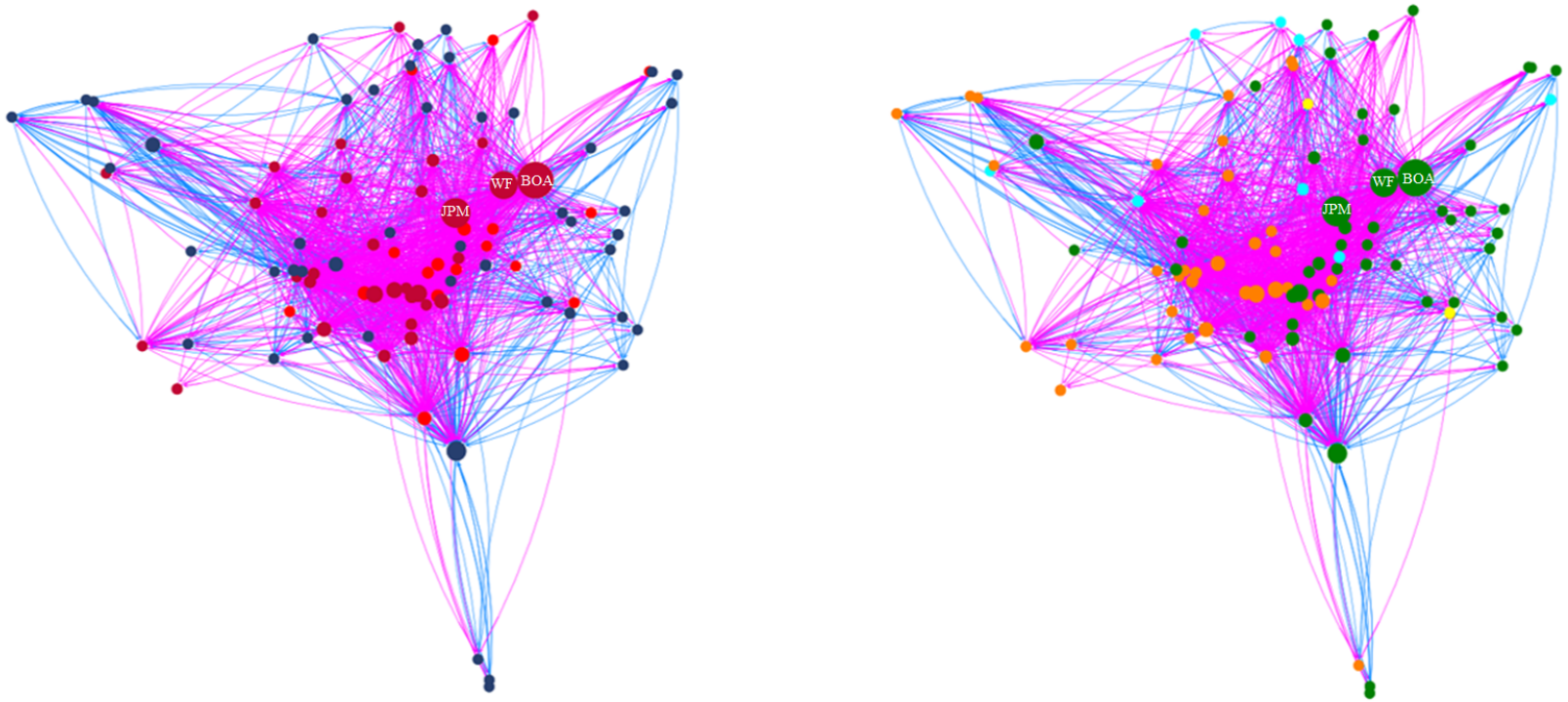


Figure 3
Syndicated Loans Networks

These figures represent the two U.S. global syndicated loans networks during the years 2009 (Panel A) and 2019 (Panel B). In the left-graphs, the nodes are dark red-colored if the financial institutions are globally systemically relevant, light-red colored if they are domestically-systemically relevant, while blue-colored if they do not belong to this group. In the right-graphs, the nodes are colored according to the geographic area where the financial institution is headquartered. The nodes are green for America, orange for Europe, cyan for Asia, and yellow for Australia. There are two lines of connections (edges), and the edge is colored in pink when the connection is between two lead arrangers, at which at least one of the two is a relevant financial institution (this is imposed as the predominant color for the representation). The edge is blue when the connection is between two financial institutions, which are not in the systemically relevant group. Also, the dimension of the node highlights the lead arranger share of leveraged and covenant-lite loans with respect to the market. The largest the size of the node, the highest the lead arranger's portfolio magnitude of highly risky loans.

Connections among globally- and domestically-systemically relevant banks, and other financial institutions	Connections among American, European, Asian, and Australian financial institutions

Panel A. Year 2009



(Continued)

Panel B. Year 2019

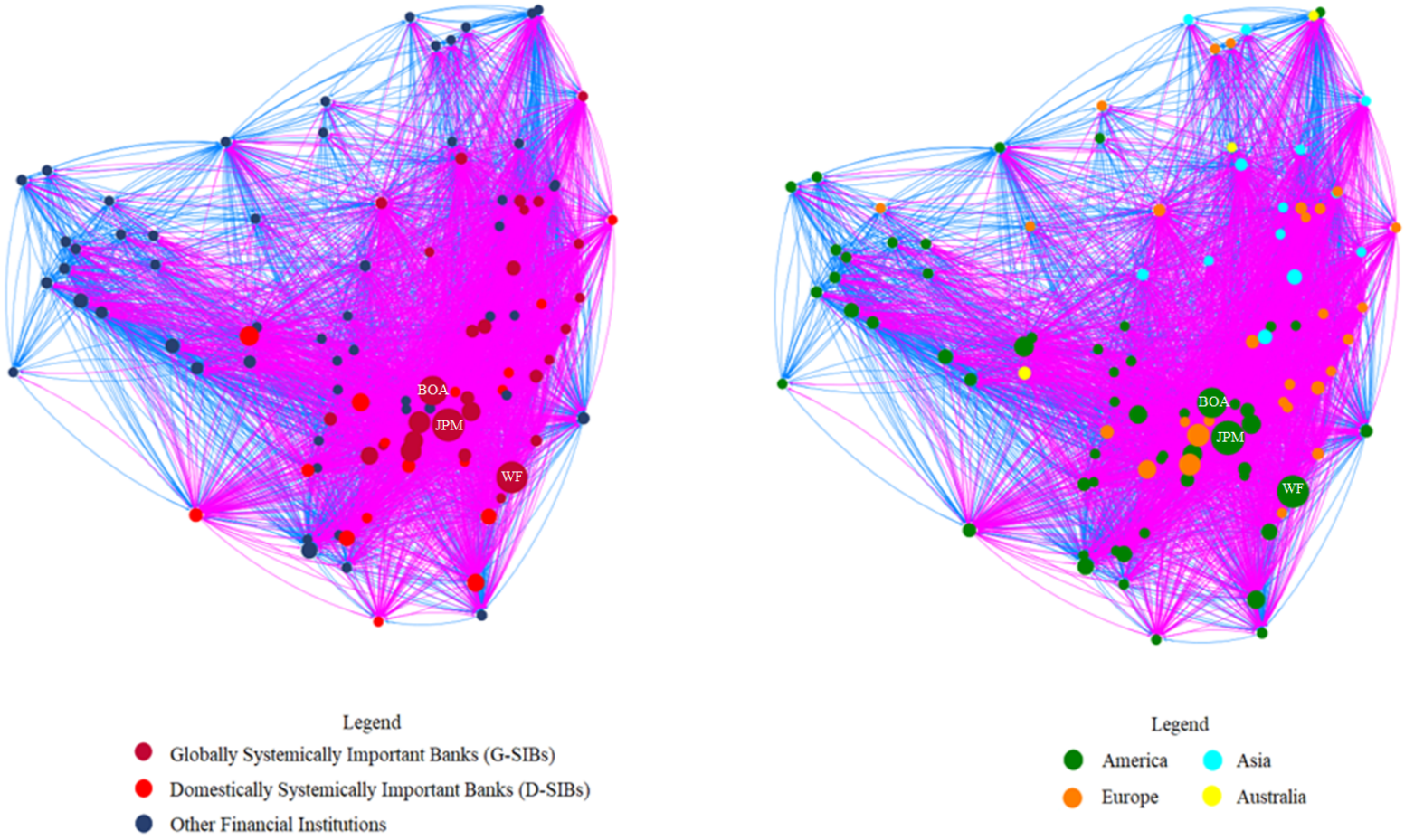


Table 1
U.S. Global Syndicated Loans: Leveraged and Covenant-Lite Loans Detail

This table presents summary statistics for the U.S. syndicated loans, detailed by leveraged, covenant-lite, and both leveraged and covenant-lite loans. All the figures are computed yearly (from January to December of the reference year). The issuance amount (B$) for each group is computed as the sum of the principal loan amount issued during the year of reference. The number of unique borrowers, loans, and packages is computed within each group (i.e. all syndicated loans, leveraged loans, covenant-lite loans, both leveraged and covenant-lite loans.). The share of leveraged, covenant-lite, both leveraged, and covenant-lite are calculated as a percentage of the total syndicated loans issuance amount.

	All Syndicated Loans				***Of which:***															
					Leveraged Loans					**Covenant Lite Loans**					*Both* **Leveraged & Cov-Lite Loans**					
Year	TOT SY Issuance amount (B$)	N. borrowers	N. loans	N. packages	Share (As % of TOT SY issuance amount)	Issuance amount (B$)	N. borrowers	N. loans	N. packages	Share (As % of TOT SY issuance amount)	Issuance amount (B$)	N. borrowers	N. loans	N. packages	Share (As % of TOT SY issuance amount)	Issuance amount (B$)	N. borrowers	N. loans	N. packages
1988	198	277	391	338	9.4%	19	30	50	39										
1989	185	305	427	400	18.6%	34	57	81	78										
1990	156	429	546	488	9.7%	15	35	43	37										
1991	187	518	678	582	4.8%	9	45	67	46										
1992	296	1,013	1,353	1,172	13.1%	39	152	226	158										
1993	442	1,156	1,566	1,336	8.5%	38	199	313	211										
1994	640	1,279	1,852	1,506	11.0%	71	196	317	212										
1995	856	2,648	4,160	3,101	18.9%	161	648	1,180	740										
1996	1,013	3,031	4,593	3,487	20.1%	204	816	1,407	891										
1997	1,223	3,252	5,285	3,779	25.8%	315	1,329	2,443	1,494										
1998	1,111	3,032	5,219	3,511	36.3%	403	1,503	2,930	1,703										
1999	1,125	2,797	4,893	3,182	33.8%	380	1,603	3,089	1,756										
2000	1,277	2,813	4,928	3,236	31.1%	397	1,554	2,969	1,725										
2001	1,284	2,666	4,438	3,091	27.5%	353	1,345	2,380	1,483										
2002	1,118	2,558	4,199	2,970	30.6%	342	1,290	2,294	1,435										
2003	1,045	2,682	4,409	3,161	36.7%	383	1,417	2,582	1,638										
2004	1,456	3,166	5,510	3,753	36.9%	537	1,669	3,265	1,961										
2005	1,667	3,455	6,055	4,026	37.2%	621	1,831	3,554	2,075										
2006	1,920	3,407	5,973	3,853	43.5%	834	1,996	3,956	2,228										
2007	2,227	3,357	6,028	3,911	52.2%	1,163	1,956	3,932	2,252	1.2%	27	12	34	14	1.2%	27	12	34	14
2008	1,396	2,783	4,431	3,169	40.0%	558	1,718	2,869	1,904	0.2%	2	1	1	1					
2009	696	1,876	2,762	2,101	42.3%	295	1,167	1,775	1,278										
2010	1,194	2,660	4,312	2,963	44.8%	535	1,432	2,549	1,580	0.1%	1	1	1	1	0.1%	1	1	1	1
2011	2,007	3,557	5,858	4,012	39.4%	790	1,918	3,474	2,135	0.4%	8	7	12	7	0.4%	8	7	12	7
2012	1,722	3,598	6,203	4,176	47.1%	812	2,170	4,072	2,541	1.7%	30	38	73	39	1.7%	29	37	70	38
2013	2,386	3,771	6,916	4,481	53.5%	1,277	2,562	5,061	3,069	12.6%	299	350	545	368	5.0%	120	195	334	203
2014	2,426	3,939	7,378	4,494	46.6%	1,131	2,507	5,048	2,829	32.5%	788	788	1,382	884	12.6%	305	445	836	487
2015	2,396	3,633	6,636	4,133	45.7%	1,095	2,285	4,410	2,550	37.3%	893	822	1,346	921	13.3%	319	427	751	463
2016	2,314	3,546	6,370	3,957	45.7%	1,058	2,255	4,259	2,523	25.7%	594	542	889	604	10.3%	238	292	513	326
2017	2,780	3,835	7,180	4,547	54.7%	1,520	2,285	4,799	2,809	24.8%	689	611	1,054	699	13.6%	377	369	705	439
2018	3,170	3,981	7,201	4,561	47.5%	1,506	2,509	4,830	2,872	24.4%	775	554	907	589	9.3%	296	305	552	321
2019	2,529	3,767	6,616	4,276	43.2%	1,093	2,215	4,207	2,552	24.2%	611	518	841	564	8.2%	207	256	449	272

Table 2

Systemic Risk Measures and Sources of Risk

This table presents summary statistics for the measures of systemic risk employed in the analysis. The statistics reported refer to the period 2000-2019 and are organized by country (the sample includes 24 countries). SRISKb is the systemic risk in billions of US dollars, SRISK\% measures the financial institutions' contribution to the financial system systemic risk, and LRMES is the long-run

State	Obs.	SRISK in $ bn					SRISK%					LRMES				
		Mean	SD	10th	50th	90th	Mean	SD	10th	50th	90th	Mean	SD	10th	50th	90th
US	6,199	6.29	24.22	-10.46	0.06	32.65	2.33	4.37	0.00	0.01	8.90	39.71	9.30	28.76	39.10	51.76
UK	1,171	28.08	44.58	-15.04	19.53	92.32	2.64	2.80	0.00	1.98	6.83	44.28	9.21	34.37	43.21	55.85
Canada	1,101	6.84	6.86	-1.12	5.45	16.85	1.72	1.25	0.00	1.59	3.47	31.40	5.97	23.28	31.80	39.05
Japan	944	64.93	51.57	4.15	54.39	137.51	8.11	7.35	1.02	6.42	19.27	37.43	16.47	27.56	37.96	49.20
France	851	58.90	35.37	17.67	58.60	110.45	6.11	3.06	2.04	6.29	9.17	52.76	8.62	43.15	51.79	64.15
Australia	695	1.01	9.80	-8.76	-0.39	13.15	0.41	0.81	0.00	0.00	1.24	36.92	10.00	23.68	36.50	49.56
Germany	696	43.66	39.07	2.32	32.74	107.83	5.97	5.22	0.17	5.35	11.61	53.31	8.56	43.28	52.93	63.72
China	573	52.58	52.80	-11.30	57.57	122.55	3.72	2.87	0.00	4.29	7.19	25.35	10.89	12.72	22.54	40.07
Italy	500	17.73	20.97	-5.66	18.06	45.97	1.55	1.37	0.00	1.75	3.31	46.07	13.01	31.20	44.10	63.46
Switzerland	460	30.30	16.34	11.80	27.87	49.96	3.58	2.03	1.76	2.66	6.74	49.78	6.42	41.78	49.47	57.84
Spain	425	17.74	19.87	-6.91	16.93	48.26	1.51	1.34	0.00	1.31	3.51	51.17	5.95	46.27	49.51	60.28
Ireland	323	2.73	6.55	-4.82	2.32	12.25	0.28	0.30	0.00	0.22	0.75	46.03	14.02	31.07	42.87	65.05
Belgium	286	15.86	12.87	1.54	14.09	37.86	1.67	1.21	0.20	1.36	3.33	48.76	12.20	35.39	46.23	65.66
Singapore	281	-0.19	2.56	-3.11	-0.27	3.54	0.06	0.09	0.00	0.00	0.21	29.04	5.03	21.82	29.18	35.36
Netherlands	273	38.55	27.17	7.16	33.29	80.12	4.13	2.51	0.82	4.32	7.87	52.67	11.90	37.97	52.52	68.78
Norway	232	3.92	4.51	-0.80	2.99	10.83	0.30	0.26	0.00	0.32	0.66	42.74	10.61	30.23	42.28	57.30
Finland	204	14.76	9.64	3.54	15.61	25.18	1.26	0.43	0.69	1.33	1.73	46.98	5.54	40.61	46.10	54.43
Sweden	181	6.56	3.66	2.44	5.59	11.54	0.85	0.73	0.32	0.61	1.87	51.12	5.43	44.59	50.82	58.30
Brazil	147	10.52	13.27	-4.78	6.64	29.42	2.82	3.05	0.00	1.59	7.41	52.72	6.63	44.89	51.75	59.53
Denmark	142	12.46	9.96	2.51	7.71	25.86	1.21	0.49	0.66	1.31	1.83	35.30	8.85	25.35	32.64	48.31
Taiwan	142	-3.02	2.70	-5.84	-4.16	1.29	0.02	0.04	0.00	0.00	0.07	32.93	3.31	29.20	32.73	37.59
Israel	120	2.90	0.70	2.02	2.87	3.79	0.56	0.74	0.20	0.30	1.51	24.36	4.14	19.07	24.37	28.94
India	114	11.97	5.58	3.78	12.31	18.81	0.90	0.37	0.51	0.86	1.41	33.86	9.73	22.27	32.94	45.14
Portugal	74	1.16	2.81	-3.50	1.95	4.21	0.12	0.10	0.00	0.11	0.24	36.52	15.87	18.42	32.78	59.85

Table 3
Summary Statistics Syndicated Loans Networks

This table presents the main statistics of the syndicated loans networks, based on loan collaborations among the top 100 active lead arrangers in the syndicated loans market. The networks are computed yearly, from 2001 to 2019. The percentage of systemically relevant banks' connection is the ratio between the number of connections of the total number of the relationship of a bank classified as systemically relevant and the total number of relationships in the sample. The network density is the ratio between the actual connections and the potential connections in the network. The Closeness and Eigenvector are measures of the centrality of the nodes.

Year	N. connections	% Syst. relevant banks conn./ total conn.	Density	Closeness centrality				Eigenvector centrality			
				Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
2001	22,316	67.6%	0.223	0.540	0.093	0.374	0.756	0.079	0.062	0.003	0.195
2002	23,096	63.4%	0.234	0.551	0.090	0.418	0.767	0.080	0.060	0.009	0.192
2003	26,960	65.0%	0.264	0.571	0.087	0.414	0.811	0.083	0.057	0.009	0.193
2004	36,498	73.1%	0.299	0.591	0.088	0.446	0.908	0.085	0.053	0.010	0.191
2005	42,070	75.3%	0.322	0.601	0.092	0.450	0.853	0.086	0.052	0.011	0.176
2006	39,794	75.5%	0.295	0.586	0.093	0.434	0.832	0.083	0.055	0.010	0.179
2007	35,376	76.0%	0.275	0.583	0.085	0.446	0.853	0.084	0.054	0.008	0.193
2008	22,386	76.2%	0.271	0.575	0.082	0.413	0.811	0.084	0.054	0.007	0.190
2009	15,930	87.1%	0.215	0.542	0.084	0.398	0.792	0.080	0.061	0.007	0.204
2010	37,962	87.5%	0.281	0.577	0.090	0.419	0.818	0.083	0.056	0.007	0.183
2011	48,728	87.9%	0.312	0.596	0.089	0.460	0.876	0.086	0.051	0.013	0.186
2012	67,886	89.1%	0.382	0.626	0.095	0.481	0.853	0.089	0.046	0.021	0.167
2013	92,812	89.2%	0.420	0.645	0.099	0.508	0.876	0.090	0.043	0.015	0.159
2014	94,160	90.7%	0.404	0.640	0.099	0.513	0.900	0.090	0.044	0.014	0.165
2015	94,674	89.6%	0.411	0.641	0.098	0.500	0.861	0.089	0.045	0.016	0.159
2016	96,580	89.0%	0.422	0.647	0.100	0.524	0.900	0.091	0.042	0.020	0.164
2017	117,166	87.7%	0.433	0.652	0.103	0.497	0.900	0.090	0.043	0.009	0.156
2018	137,612	88.1%	0.458	0.664	0.108	0.529	0.908	0.091	0.042	0.021	0.155
2019	117,472	87.0%	0.465	0.666	0.106	0.508	0.917	0.091	0.041	0.013	0.153

Table 4
Syndication Risk and Globally Systemically Important Banks (G-SIBs)

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the financial institution level (in parentheses). The dependent variable is SY-RISK ^{Lev1} . We include a set of independent variables of interest. First, we include three variables, computed as the interaction of the two dummy variables, which identify respectively if the financial institution belongs to the group of Globally- Systemically Important Bank (G-SIBs), and which is its region of headquarter (America, Europe, Asia). Also, we examine the measures of interconnectedness, total assets, the number of specializations in the syndicated market, and portfolio diversification. To verify possible issues of reverse causality we add the measure of systemic risk SRISKb. The regression model is estimated as follows: * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality	Closeness Centrality	Farness Centrality	E-W Int	S-W Int	REL-W Int
Dependent Variable: SY-RISK ^{Lev1}	(1)	(2)	(3)	(4)	(5)	(6)
G-SIBs*US	0.013***	0.012***	0.013***	0.013***	0.013***	0.013***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
G-SIBs*EU	0.002	0.002	0.002	0.003	0.003	0.003
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
G-SIBs*ASIA	-0.007**	-0.007**	-0.007**	-0.006**	-0.006**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Interconnectedness	0.000**	0.000**	-0.000**	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market Size (B$)	0.000	-0.000	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio Diversification	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of specializations	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Assets (B$)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SRISKb	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.002**	-0.014***	0.001	-0.009***	-0.007***	-0.006**
	(0.001)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Observations	15,664	15,664	15,664	15,664	15,664	15,664
Clusters	93	93	93	93	93	93
R^2	0.455	0.479	0.447	0.453	0.457	0.456

Table 5

Systemic risk, Leveraged and Covenant-Lite Loans, Network Centrality

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔSRISKb. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly proxies of interconnectedness, which are three different measures of centrality extrapolated from the syndicated loans networks (Eq. 1, 3 and 4). Recession is the USRECD NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. Lastly, the table reports the hypothesis test (H0: SY-RISK x recession - SY-RISK x non - recession = 0; H0: centrality × recession - centrality × non-recession = 0) and the hypothesis test's p-value. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality			Closeness Centrality			Farness Centrality		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.974***			0.842**			1.108***	
		(0.358)			(0.375)			(0.340)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.257			0.297			0.243	
		(0.228)			(0.215)			(0.226)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.826**			0.697*			0.947**
			(0.387)			(0.405)			(0.373)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.066			0.103			0.048
			(0.260)			(0.248)			(0.259)
Centrality × Recession	0.154***	0.078	0.067	0.106***	0.064*	0.059*	-0.016***	-0.003	-0.002
	(0.045)	(0.047)	(0.046)	(0.030)	(0.033)	(0.032)	(0.005)	(0.005)	(0.005)
Centrality × Non-recession	0.011	0.015	0.012	-0.021	-0.017	-0.016	-0.001	-0.002	-0.002
	(0.025)	(0.025)	(0.025)	(0.014)	(0.013)	(0.013)	(0.002)	(0.002)	(0.002)
U.S. Recession	-0.072	0.262	0.303	-5.853***	-3.608***	-3.275**	4.409***	1.056	0.768
	(0.209)	(0.199)	(0.198)	(1.186)	(1.365)	(1.308)	(1.087)	(0.899)	(0.872)
FI Leveraged Amount (B$)		-0.005			-0.006			-0.006	
		(0.014)			(0.014)			(0.014)	
FI Leveraged & Covenant-Lite Amount (B$)			-0.007			-0.008			-0.008
			(0.011)			(0.010)			(0.010)
Total Assets (B$)	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market Share (%)	0.120	0.008	0.090	0.147	0.031	0.111	0.126	0.017	0.095
	(0.166)	(0.227)	(0.227)	(0.173)	(0.233)	(0.233)	(0.166)	(0.228)	(0.228)
Market Size (B$)	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged SRISKb	-0.069***	-0.072***	-0.072***	-0.070***	-0.072***	-0.073***	-0.067***	-0.072***	-0.072***
	(0.011)	(0.014)	(0.014)	(0.011)	(0.013)	(0.013)	(0.012)	(0.014)	(0.014)
Constant	-1.100***	-1.120***	-1.187***	0.021	-0.189	-0.347	-0.866*	-0.702	-0.789
	(0.186)	(0.208)	(0.205)	(0.555)	(0.573)	(0.562)	(0.484)	(0.521)	(0.518)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.042	0.045	0.045	0.044	0.046	0.045	0.041	0.044	0.044
Adj. R^2	0.042	0.044	0.044	0.043	0.045	0.045	0.040	0.044	0.044
H_0(SY-RISK^{Lev1} × Recession - SY-RISK^{Lev1} × Non-Recession = 0)		0.717			0.545			0.865	
p-value		0.000***			0.005***			0.000***	
H_0(SY-RISK$^{Lev\&CovLite1}$ × Recession - SY-RISK$^{Lev\&CovLite1}$ × Non-Recession = 0)			0.760			0.594			0.899
p-value			0.000***			0.002***			0.000***
H_0(C *Recession - C *Non-Recession=0)	0.143	0.063	0.055	0.127	0.081	0.075	-0.015	-0.001	0
p-value	0.000***	0.028**	0.053*	0.000***	0.003***	0.004***	0.002***	0.710	0.941

Table 6

Systemic risk, Leveraged and Covenant-Lite Loans, (E-W, S-W, REL-W) Interconnectedness

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔSRISKb. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly portfolio interconnectedness, which is computed by three-weighting schemes, respectively equally-, size- and relationship-weighted (Eq. 4). Recession is the USRECD NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. Lastly, the table reports the hypothesis test (H0: SY-RISK x recession - SY-RISK x non-recession = 0; H0: interconnectedness × recession - interconnectedness × non-recession = 0) and the hypothesis test's p-value. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

Panel A. Industry Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		1.109***			1.047***			1.064***	
		(0.322)			(0.331)			(0.338)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.244			0.257			0.246	
		(0.231)			(0.228)			(0.228)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.936**			0.881**			0.901**
			(0.356)			(0.363)			(0.370)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.049			0.063			0.050
			(0.264)			(0.261)			(0.261)
Interconnectedness × Recession	0.041**	0.022	0.019	0.079***	0.045***	0.041***	0.051***	0.020*	0.017
	(0.018)	(0.017)	(0.016)	(0.018)	(0.016)	(0.016)	(0.013)	(0.011)	(0.011)
Interconnectedness × Non-recession	-0.007	-0.004	-0.003	0.001	0.005	0.005	0.001	0.004	0.004
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
U.S. Recession	-1.748	-0.864	-0.673	-4.133***	-1.969**	-1.727*	-2.277***	-0.384	-0.170
	(1.119)	(1.051)	(1.025)	(1.041)	(0.935)	(0.906)	(0.825)	(0.730)	(0.712)
FI Leveraged Amount (B$)		-0.006			-0.006			-0.006	
		(0.014)			(0.014)			(0.014)	
FI Leveraged & Covenant-Lite Amount (B$)			-0.008			-0.008			-0.008
			(0.010)			(0.010)			(0.010)
Total Assets (B$)	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market Share (%)	0.130	0.022	0.100	0.131	0.019	0.098	0.131	0.020	0.099
	(0.166)	(0.229)	(0.228)	(0.165)	(0.229)	(0.228)	(0.165)	(0.229)	(0.228)
Market Size (B$)	0.000	0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged SRISKb	-0.066***	-0.072***	-0.072***	-0.067***	-0.072***	-0.072***	-0.067***	-0.072***	-0.072***
	(0.012)	(0.014)	(0.014)	(0.012)	(0.014)	(0.014)	(0.012)	(0.014)	(0.014)
Constant	-0.608	-0.800*	-0.925**	-1.083***	-1.342***	-1.431***	-1.077***	-1.265***	-1.381***
	(0.401)	(0.431)	(0.436)	(0.372)	(0.376)	(0.393)	(0.316)	(0.348)	(0.354)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.040	0.044	0.044	0.041	0.045	0.045	0.041	0.045	0.045
Adj. R^2	0.039	0.044	0.044	0.041	0.044	0.044	0.041	0.044	0.044
H_0 (SY-RISK^{Lev1} × Recession - SY-RISK^{Lev1} × Non-Recession = 0)		0.865			0.790			0.818	
p-value		0.000***			0.000***			0.000***	
H_0 (SY-RISK$^{Lev\&CovLite1}$ × Recession - SY-RISK$^{Lev\&CovLite1}$ × Non-Recession = 0)			0.887			0.818			0.851
p-value			0.000***			0.000***			0.000***
H_0 (Int. *Recession - Int. *Non-Recession=0)	0.048	0.026	0.022	0.078	0.04	0.036	0.05	0.016	0.013
p-value	0.000***	0.145	0.196	0.000***	0.007***	0.012**	0.000***	0.135	0.225

(Continued)

Panel B. States Aggregation

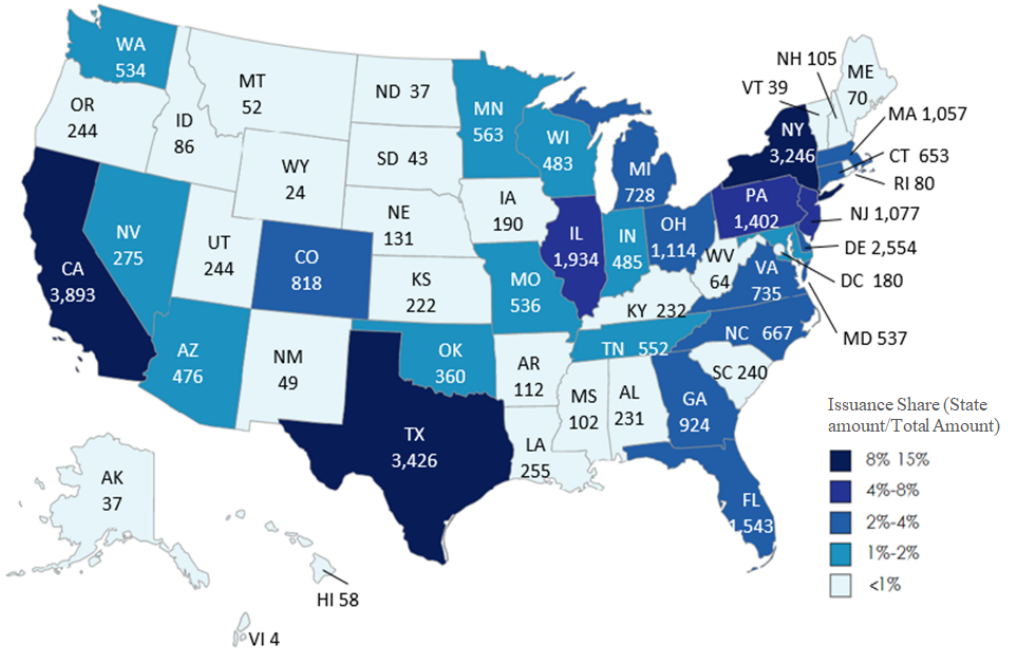
	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		1.119***			1.091***			1.069***	
		(0.320)			(0.324)			(0.333)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.243			0.253			0.250	
		(0.232)			(0.232)			(0.230)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.942***			0.916**			0.904**
			(0.354)			(0.357)			(0.366)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.048			0.057			0.054
			(0.265)			(0.265)			(0.263)
Interconnectedness × Recession	0.013*	0.008	0.007	0.043***	0.021	0.019	0.033***	0.012	0.010
	(0.008)	(0.008)	(0.008)	(0.015)	(0.013)	(0.013)	(0.009)	(0.008)	(0.008)
Interconnectedness × Non-recession	-0.007**	-0.006*	-0.006*	-0.011**	-0.007	-0.007	-0.003	-0.000	0.000
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
U.S. Recession	-0.018	-0.152	-0.134	-2.617***	-1.210	-1.089	-1.300**	-0.079	0.053
	(0.470)	(0.473)	(0.480)	(0.940)	(0.790)	(0.782)	(0.553)	(0.449)	(0.440)
FI Leveraged Amount (B$)		-0.006			-0.006			-0.006	
		(0.014)			(0.014)			(0.014)	
FI Leveraged & Covenant-Lite Amount (B$)			-0.008			-0.008			-0.008
			(0.010)			(0.010)			(0.010)
Total Assets (B$)	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market Share (%)	0.128	0.023	0.100	0.132	0.024	0.102	0.133	0.022	0.101
	(0.166)	(0.229)	(0.228)	(0.166)	(0.230)	(0.229)	(0.165)	(0.229)	(0.228)
Market Size (B$)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged SRISK	-0.066***	-0.072***	-0.072***	-0.067***	-0.072***	-0.072***	-0.067***	-0.072***	-0.072***
	(0.012)	(0.014)	(0.014)	(0.012)	(0.014)	(0.014)	(0.012)	(0.014)	(0.014)
Constant	-0.629**	-0.679**	-0.753**	-0.303	-0.565	-0.665*	-0.834***	-0.995***	-1.102***
	(0.313)	(0.333)	(0.333)	(0.366)	(0.353)	(0.356)	(0.270)	(0.284)	(0.285)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.040	0.045	0.045	0.040	0.045	0.045	0.041	0.044	0.044
Adj. R^2	0.039	0.044	0.044	0.040	0.044	0.044	0.040	0.044	0.044
H_0 (SY-RISK^{Lev1} × Recession - SY-RISK^{Lev1} × Non-Recession = 0)		0.876			0.838			0.819	
p-value		0.000***			0.000***			0.000***	
H_0 (SY-RISK$^{Lev\&CovLite1}$ × Recession - SY-RISK$^{Lev\&CovLite1}$ × Non-Recession = 0)			0.894			0.859			0.85
p-value			0.000***			0.000***			0.000***
H_0 (Int. *Recession - Int. *Non-Recession=0)	0.006	0.014	0.001	0.054	0.028	0.026	0.036	0.012	0.01
p-value	0.014**	0.082*	0.101	0.000***	0.017**	0.026**	0.000***	0.086*	0.154

8. Appendix

Figure A.1
Syndicated Loans Across the U.S. States

These figures represent the issuance amount distribution across the U.S. States. Each state refers to where the borrowers are located. Each state share is computed as the ratio between the amount issued to borrowers belonging to that U.S. State and the total issuance amount in the market. The period of the analysis is January 1988-December 2019. There are five different color tones according to the issuance amount share (the darkest color refers to the most relevant states in terms of issuance amount). The number written near the name of each state refers to the number of unique borrowers in that State during the period of analysis. Panel A and B represents resepctively the syndicated whole market and the syndicated leveraged loans market.

Panel A. Syndicated Loans Market



Panel B. Syndicated Leveraged Loans Market

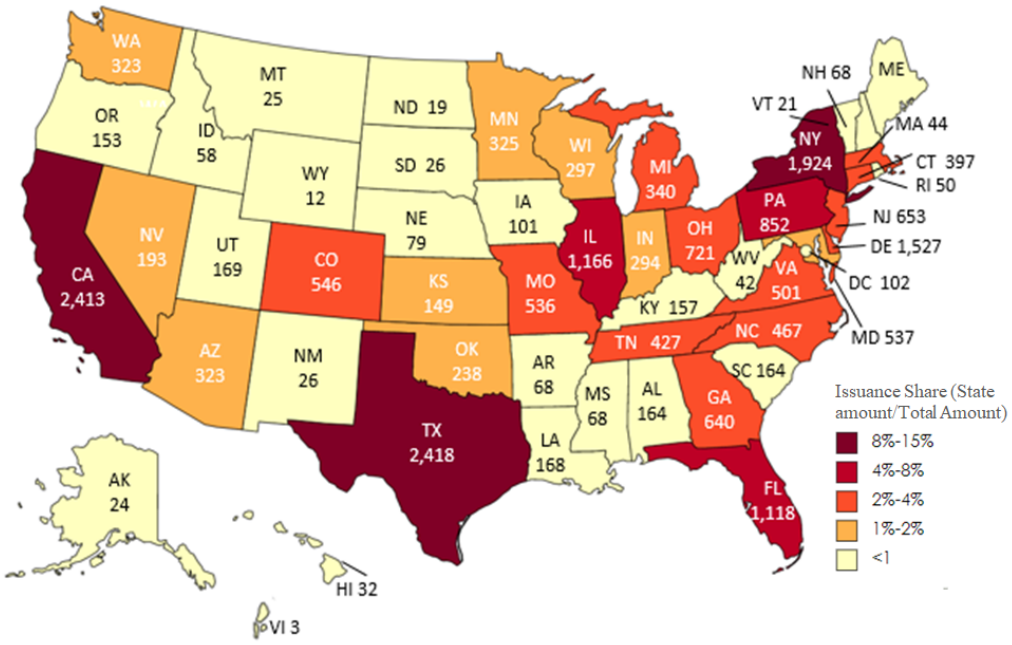


Table A.1

Global Summary Statistics for Syndicated Loans, of which: Syndicated Leveraged and Other Loans

This table presents summary statistics for the global syndicated loans market, with the detail of the leveraged- and other-loans. The regions of interest are America, Europe, Asia-Pacific, Middle-East, and Africa. For each region, there is a sub-region/state specification. The issuance amount (B$) is the raw sum of the issuance amount during 1988-2019. The amount (% over the region) is the ratio between the sub-region/state issuance amount and the total region issuance amount. The amount (% over the total world) is the ratio between the sub-region/state issuance amount and the total world issuance amount.

Region *(of which sub-region/state)*		**All syndicated loans**			***Of which:*** **Leveraged loans**			**Other loans**		
		Issuance amount (B$)	Amount (% over total region)	Amount (% over total world)	Issuance amount (B$)	Amount (% over total region)	Amount (% over total world)	Issuance amount (B$)	Amount (% over total region)	Amount (% over total world)
America	Northern America	48,608	96%	52%	18,877	99%	69%	29,730	95%	45%
	of which U.S.	*44,519*	*88%*	*48%*	*18,062*	*95%*	*66%*	*26,457*	*85%*	*40%*
	Central America	559	1%	1%	66	0%	0%	492	2%	1%
	The Caribbean	228	0%	0%	73	0%	0%	154	0%	0%
	South America	1,018	2%	1%	91	0%	0%	927	3%	1%
Europe*	Europe	25,288	100%	27%	5,806	100%	21%	19,482	100%	30%
	of which:									
	UK	*6,247*	*25%*	*7%*	*1,452*	*25%*	*5%*	*4,796*	*25%*	*7%*
	Germany	*3,307*	*13%*	*4%*	*735*	*13%*	*3%*	*2,572*	*13%*	*4%*
	France	*3,462*	*14%*	*4%*	*657*	*11%*	*2%*	*2,806*	*14%*	*4%*
	Spain	*1,911*	*8%*	*2%*	*415*	*7%*	*2%*	*1,496*	*8%*	*2%*
	Netherlands	*1,683*	*7%*	*2%*	*508*	*9%*	*2%*	*1,175*	*6%*	*2%*
	Italy	*1,388*	*5%*	*1%*	*292*	*5%*	*1%*	*1,096*	*6%*	*2%*
Asia-Pacific	Asia	12,300	83%	13%	1,661	83%	6%	10,639	83%	16%
	of which:									
	China	*1,950*	*16%*	*2%*	*537*	*32%*	*2%*	*1,414*	*13%*	*2%*
	Japan	*4,514*	*37%*	*5%*	*289*	*17%*	*1%*	*4,225*	*40%*	*6%*
	Oceania	2,463	17%	3%	351	17%	1%	2,113	17%	3%
Middle East	Middle East	1,847	100%	2%	233	100%	1%	1,614	100%	2%
	of which:									
	United Arab Emirates	*652*	*35%*	*1%*	*117*	*50%*	*0%*	*535*	*33%*	*1%*
	Saudi Arabia	*542*	*29%*	*1%*	*41*	*17%*	*0%*	*502*	*31%*	*1%*
	Qatar	*179*	*10%*	*0%*	*11*	*5%*	*0%*	*168*	*10%*	*0%*
Africa	Northern Africa	177	20%	0%	38	21%	0%	139	19%	0%
	Eastern Africa	157	17%	0%	28	15%	0%	130	18%	0%
	Middle Africa	76	8%	0%	24	13%	0%	52	7%	0%
	Western Africa	222	25%	0%	47	26%	0%	175	24%	0%
	Southern Africa	267	30%	0%	46	25%	0%	221	31%	0%
	World	**93,209**			**27,341**			**65,868**		

** The loans issued to borrowers headquartered in the Soviet Union area from 1988 to 1991 are excluded from the analysis.*

Table A.2

SDC Global Syndicated Loans Database: Variables Descriptions

This table describes the main variables extracted from the SDC Platinum global syndicated loans database and employed in the analysis. The variables are organized into three main groups: borrowers details, syndicated loan details, lenders details (syndicate members). For each variable is reported its main description.

Group	#	Variables
Borrowers details	V1	Full name
	V2	Nation where the borrower is headquartered
	V3	State where the borrower is headquartered
	V4	Committee on Uniform Security Identification Procedures code (CUSIP - 6 digits)
	V5	Primary Standard Industrial Classification Code to which the borrower belongs (SIC - 4 digits)
	V6	Primary Standard Industrial Classification Code description
	V7	Description of the company status (ex. Private, Public, etc.)
	V8	Only for public companies: ticker symbol used to uniquely identify publicly traded shares on the stock market
	V9	Primary exchange stock market where the borrowers stocks are traded
	V10	Standard & Poor's Rating
	V11	Moody's Rating
Syndicated loans details	V12	SDC deal number: it identifies each unique syndicated loan with a unique identification number
	V13	SDC package number: it identifies one or more syndicated loans issued to a unique borrower, under a unique syndicated agreement
	V14	Loan issue date
	V15	Loan maturity date
	V16	Type of Loan (eg. Rev Cred/Term Loan,…)
	V17	Purpose for which the funds received will be used (e.g. General Corporate Purposes, leveraged buyout (LBO), etc.)
	V18	Leveraged loan specification, indicating whether the loan is considered leveraged (or highly leveraged) or non leveraged
	V19	Covenant-lite loans specification, indicating whether the loan is considered covenant-lite or non cov-lite
	V20	Covenant-lite description applied to cov-lite loan (ex. target interest coverage ratio or debt/EBITDA ratio)
	V21	Covenant-lite value applied to cov-lite loan (ex. target interest coverage ratio=2; or target debt/EBITDA ratio=4)
	V22	Initial Pricing Spread above reference rate (ex. LIBOR, EURIBOR,..)
	V23	Loan principal Amount, at unique loan level ($ mil)
	V24	Loan principal Amount, at loan package level ($ mil)
Lenders details (syndicate members)	V25	Bookrunner(s), SDC code(s) and full name(s)
	V26	Mandated Arranger(s), SDC code(s) and full name(s)
	V27	Lead Agent(s), SDC code(s) and full name(s)
	V28	All Managers, SDC code(s) and full name(s)
	V29	All Managers Role (ex. Agent, co-agent, participant,..)

Table A.3

Loans Shares Across Industrial Sectors

This table presents the share of each industrial sector, computed as the ratio between the issuance amount to borrowers belonging to that sector and the total issuance amount. The data are aggregated in years-groups: 1988-1993, 1994-1999, 2000-2005, 2006-2010, 2011-2015, 2016-2019. For each industrial sector included is mentioned the 2-digit SIC code and description. Panel A, B, and C refer respectively to the entire syndicated loans, the leveraged loans, and the covenant-lite loans.

Panel A. Syndicated Loans

SIC Code and Descprition	1988-1993	1994-1999	2000-2005	2006-2010	2011-2015	2016-2019
(20-39) Manufacturing	29%	28%	28%	29%	28%	28%
(60-67) Finance, Insurance, Real Estate	29%	25%	21%	20%	19%	21%
(40-49) Transportation & Public	15%	22%	26%	21%	19%	19%
(10-14) Mining	6%	5%	5%	10%	9%	7%
(70-89) Services	8%	10%	9%	9%	12%	14%
(52-59) Retail Trade	5%	5%	4%	4%	5%	4%
(50-51) Wholesale Trade	2%	2%	2%	3%	4%	3%
(91-97) Public Administration	5%	2%	1%	1%	1%	1%
(15-17) Construction	1%	1%	2%	4%	3%	3%
(01-09) Agriculture, Forestry, Fishing	0%	0%	0%	0%	1%	0%
Total syndicated loans issuance amount ($B)	2,758	9,440	16,347	19,288	23,574	21,803

Panel B. Syndicated Leveraged Loans

SIC Code and Descprition	1988-1993	1994-1999	2000-2005	2006-2010	2011-2015	2016-2019
(20-39) Manufacturing	33%	30%	32%	30%	27%	23%
(60-67) Finance, Insurance, Real Estate	22%	15%	12%	13%	13%	17%
(40-49) Transportation & Public	14%	22%	23%	21%	18%	17%
(10-14) Mining	4%	4%	5%	8%	9%	7%
(70-89) Services	12%	16%	14%	16%	20%	24%
(52-59) Retail Trade	11%	7%	6%	5%	6%	5%
(50-51) Wholesale Trade	2%	3%	4%	3%	4%	3%
(91-97) Public Administration	1%	0%	0%	0%	1%	1%
(15-17) Construction	0%	1%	3%	3%	2%	2%
(01-09) Agriculture, Forestry, Fishing	0%	0%	0%	0%	0%	0%
Total syndicated leveraged loans issuance amount ($B)	222	1,900	3,861	5,672	7,708	7,979

Panel C. Syndicated Covenant-Lite Loans

SIC Code and Descprition	2007-2011	2012-2015	2016-2019
(20-39) Manufacturing	9%	35%	33%
(60-67) Finance, Insurance, Real Estate	8%	15%	15%
(40-49) Transportation & Public	16%	17%	19%
(10-14) Mining	0%	9%	5%
(70-89) Services	63%	15%	19%
(52-59) Retail Trade	4%	5%	4%
(50-51) Wholesale Trade	0%	3%	3%
(91-97) Public Administration	0%	0%	0%
(15-17) Construction	0%	1%	1%
(01-09) Agriculture, Forestry, Fishing	0%	0%	0%
Total syndicated covenant-lite loans issuance amount ($B)	38	2,011	2,669

Table A.4
Recession and Non-Recession periods Across Regions and States

This table presents the variables used to identify periods of recession and non-recession by regions and states. All the variables are NBER or OECD based and gathered from the FRED Economic Data Database. The period of

Region/ Country	Variable Name	Description	Recession period
US	USRECD	NBER based recession indicators for the United States from the period following the peak through the trough	April 2001-November 2001; January 2008-June 2009
US	USRECDM	NBER based recession indicators for the United States from the peak through the trough	March 2001-October 2001; December 2007-May 2009
Euro Area	EURORECD	OECD based recession indicators for Euro Area from the period following the peak through the trough	March 2001-June 2003; March 2008-June 2009; June 2011-March 2013; December 2017-December 2019
Asia	MAJOR5ASIARECD	OECD based recession indicators for Major 5 Asia from the period following the peak through the trough	October 2000-January 2002; May 2004-January 2005; January 2008-March 2009; September 2011-November 2012; January 2014-August 2016; February
Australia	AUSRECD	OECD based recession indicators for Australia from the period following the peak through the trough	January 2000-April 2003; March 2008-May 2015; May 2018-December 2019

Table A.5

Top 20 Sources of Connectedness in the Syndicted Loans Market - Leveraged and Covenant-Lite Loans

These tables show the top twenty central source of connectedness in the syndicated loans networks, based on loans collaborations among the top 160 active lead arrangers in the syndicated loans market and connections during the sub-periods: 2001-2003, 2004-2006, 2007-2009, 2010-2012, 2013-2015, 2016-2019. The financial institutions are ranked based on the highest Eigenvector centrality. Panel A includes the pre-global financial crisis period; Panel B includes the global financial crisis period and part of the post-period; Panel C includes the post-global financial crisis period. The cumulative Lev&Cov-Lite1 is the ratio between financial institutions $SY\text{-}RISK^{Lev\&CovLite1}$ and the total market $SY\text{-}RISK^{Lev\&CovLite1}$. The measure reflects the December amount of the last year for each sub-period. The notes on the bottom of the table summarize the main M&As that occurred among these financial institutions.

Panel A. Pre-Global Financial Crisis period

	2001-2003						2004-2006					
Rank	Financial Institution	Closeness centrality	Eigenvector centrality	$SY\text{-}RISK^{Lev\&CovLite1}$ / Total Market $SY\text{-}RISK^{Lev\&CovLite1}$	State	Connections/ total connections	Financial Institution	Closeness centrality	Eigenvector centrality	$SY\text{-}RISK^{Lev\&CovLite1}$ / Total Market $SY\text{-}RISK^{Lev\&CovLite1}$	State	Connections/ total connections
1	BOA	0.767	0.174	14%	U.S.	10%	BOA	0.801	0.162	10%	U.S.	11%
2	JPM	0.767	0.174	11%	U.S.	10%	JPM	0.775	0.158	10%	U.S.	10%
3	FLEET BOSTON *1	0.734	0.167	9%	U.S.	5%	WACHOVIA *3	0.763	0.157	5%	U.S.	7%
4	WACHOVIA *3	0.726	0.164	3%	U.S.	5%	CITI	0.725	0.151	5%	U.S.	7%
5	BANK ONE CORP *4	0.722	0.162	2%	U.S.	6%	BNP-PARIBAS	0.736	0.151	1%	France	3%
6	CITI	0.696	0.161	4%	U.S.	8%	CREDIT-AGRI-CIB *5	0.700	0.146	1%	France	2%
7	BNP-PARIBAS	0.685	0.158	1%	France	2%	RBS	0.694	0.146	1%	UK	3%
8	DEUTSCHE-BANK	0.675	0.158	6%	Germany	4%	MIZUHO-FINAN	0.694	0.145	1%	Japan	1%
9	SCOTIABANK	0.689	0.155	3%	Canada	3%	WF	0.687	0.142	2%	U.S.	3%
10	SUNTRUST-BK	0.668	0.152	1%	U.S.	2%	ING	0.681	0.141	0%	Netherlands	1%
11	CR LYONNAIS *5	0.675	0.152	1%	France	1%	ABN-AMRO *7	0.684	0.139	0%	Netherlands	2%
12	BANK OF TOKYO-MITS *6	0.662	0.149	0%	Japan	2%	UBS-BANK	0.668	0.139	2%	Switzerland	2%
13	WF	0.675	0.149	2%	U.S.	2%	GEC	0.681	0.138	7%	U.S.	3%
14	CREDIT-SUISSE	0.646	0.148	6%	Switzerland	3%	SCOTIABANK	0.674	0.138	1%	Canada	2%
15	ABN-AMRO *7	0.659	0.146	0%	Netherlands	2%	SUNTRUST-BK	0.671	0.137	1%	U.S.	3%
16	USBANC	0.655	0.142	2%	U.S.	2%	CREDIT-SUISSE	0.659	0.137	11%	Switzerland	2%
17	BNY	0.631	0.141	1%	U.S.	2%	KEYBANC	0.681	0.136	2%	U.S.	2%
18	RBS	0.634	0.140	0%	UK	1%	DEUTSCHE-BANK	0.659	0.135	6%	Germany	3%
19	BARCLAYS-CAP	0.619	0.139	0%	UK	2%	BANK OF TOKYO-MITS *6	0.662	0.135	0%	Japan	1%
20	KEYBANC	0.646	0.138	1%	U.S.	1%	SAM-CAPEL-HSBC	0.665	0.135	0%	UK	1%

Panel B. Global Financial Crisis period and Post-period *(continues in the next page)*

	2007-2009						2010-2012					
Rank	Financial Institution	Closeness centrality	Eigenvector centrality	$SY\text{-}RISK^{Lev\&CovLite1}$ / Total Market $SY\text{-}RISK^{Lev\&CovLite1}$	State	Connections/ total connections	Financial Institution	Closeness centrality	Eigenvector centrality	$SY\text{-}RISK^{Lev\&CovLite1}$ / Total Market $SY\text{-}RISK^{Lev\&CovLite1}$	State	Connections/ total connections
1	BOA-MERRILL *2	0.804	0.170	12%	U.S.	11%	BOA-MERRILL	0.796	0.163	11%	U.S.	11%
2	JPM	0.760	0.166	11%	U.S.	10%	RBS	0.743	0.158	2%	UK	4%
3	RBS	0.700	0.161	2%	UK	4%	MITSUBISHI-UFJ *6	0.743	0.158	1%	Japan	3%
4	CITI	0.704	0.158	6%	U.S.	6%	CITI	0.722	0.152	3%	U.S.	5%
5	WF	0.714	0.157	4%	U.S.	4%	JPM	0.754	0.151	7%	U.S.	9%
6	MITSUBISHI-UFJ *6	0.700	0.157	0%	Japan	3%	ING	0.716	0.151	1%	Netherlands	1%
7	BNP-PARIBAS	0.688	0.154	2%	France	3%	WF	0.750	0.150	7%	U.S.	9%
8	WACHOVIA *3	0.685	0.153	4%	U.S.	5%	BNP-PARIBAS	0.700	0.146	2%	France	2%
9	GEC	0.685	0.152	5%	U.S.	3%	BARCLAYS-CAP	0.690	0.145	5%	UK	4%
10	CREDIT-AGRI-CIB	0.670	0.149	1%	France	1%	USBANC	0.719	0.145	1%	U.S.	3%
11	KEYBANC	0.685	0.147	1%	U.S.	2%	DEUTSCHE-BANK	0.690	0.144	6%	Germany	3%
12	USBANC	0.673	0.147	1%	U.S.	2%	BBVA	0.687	0.142	1%	Spain	1%
13	SCOTIABANK	0.647	0.141	1%	Canada	1%	UBS-BANK	0.678	0.140	3%	Switzerland	2%
14	ING	0.650	0.141	0%	Netherlands	1%	SUM-MIT-FIN-GRP	0.661	0.137	0%	Japan	1%
15	SOC-GEN	0.633	0.139	1%	France	1%	MIZUHO-FINAN	0.667	0.137	0%	Japan	1%
16	DEUTSCHE-BANK	0.633	0.138	5%	Germany	3%	RABOBANK	0.667	0.136	1%	Netherlands	1%
17	BMO-CAPITAL	0.647	0.136	1%	Canada	1%	CREDIT-AGRI-CIB	0.675	0.136	1%	France	1%
18	BARCLAYS-CAP	0.623	0.135	2%	UK	2%	RBC-CAP-MKTS	0.670	0.135	4%	Canada	3%
19	CREDIT-SUISSE	0.620	0.135	7%	Switzerland	2%	BMO-CAPITAL	0.681	0.135	2%	Canada	2%
20	SANTANDER	0.618	0.134	0%	Spain	0%	SAM-CAPEL-HSBC	0.661	0.135	0%	UK	1%

(Continued)

Panel C. Post-Global Financial

	2013-2015						2016-2019					
Rank	Financial Institution		Closeness centrality	Eigenvector centrality	SY-RISK$^{Lev\&CovLite1}$ / Total Market SY-RISK$^{Lev\&CovLite1}$	State	Connections/ total connections	Financial Institution		Closeness centrality	Eigenvector centrality	SY-RISK$^{Lev\&CovLite1}$ / Total Market SY-RISK$^{Lev\&CovLite1}$	State	Connections/ total connections
1	BOA-MERRILL		0.862	0.154	10%	US	9%	BOA-MERRILL		0.863	0.146	8%	US	8%
2	JPM		0.804	0.147	9%	US	8%	BMO-CAPITAL		0.828	0.142	3%	Canada	3%
3	RBS		0.771	0.146	2%	UK	3%	WF		0.816	0.141	7%	US	6%
4	MITSUBISHI-UFJ	*6	0.764	0.144	2%	Japan	4%	ING		0.800	0.140	1%	Netherlands	1%
5	WF		0.771	0.141	8%	US	7%	JPM		0.804	0.140	8%	US	7%
6	SUM-MIT-FIN-GRP		0.743	0.139	1%	Japan	2%	RBC-CAP-MKTS		0.785	0.138	4%	Canada	3%
7	ING		0.743	0.139	1%	Netherlands	1%	BNP-PARIBAS		0.774	0.138	1%	France	2%
8	CITI		0.718	0.137	6%	US	5%	SUNTRUST-BK		0.788	0.137	3%	US	3%
9	SAM-CAPEL-HSBC		0.718	0.136	1%	UK	2%	CITI		0.781	0.137	4%	US	5%
10	DEUTSCHE-BANK		0.724	0.135	5%	Germany	3%	MITSUBISHI-UFJ	*6	0.785	0.136	2%	Japan	4%
11	USBANC		0.764	0.135	2%	US	3%	KEYBANC		0.777	0.135	1%	US	1%
12	BMO-CAPITAL		0.750	0.135	2%	Canada	2%	SUM-MIT-FIN-GRP		0.763	0.135	1%	Japan	2%
13	BNP-PARIBAS		0.712	0.134	1%	France	2%	FIFTH-THIRD		0.766	0.133	2%	US	2%
14	RBC-CAP-MKTS		0.718	0.133	4%	Canada	3%	DEUTSCHE-BANK		0.759	0.133	5%	Germany	3%
15	SOC-GEN		0.715	0.133	0%	France	1%	SAM-CAPEL-HSBC		0.745	0.131	1%	UK	2%
16	BBVA		0.709	0.133	1%	Spain	2%	USBANC		0.759	0.129	2%	US	3%
17	MIZUHO-FINAN		0.703	0.132	1%	Japan	2%	MIZUHO-FINAN		0.742	0.129	2%	Japan	3%
18	GS		0.706	0.132	4%	US	3%	CREDIT-SUISSE		0.735	0.128	6%	Switzerland	3%
19	CREDIT-AGRI-CIB		0.691	0.131	1%	France	2%	BARCLAYS-CAP		0.739	0.127	5%	UK	4%
20	BARCLAYS-CAP		0.703	0.131	5%	UK	4%	GS		0.726	0.126	4%	US	3%

Notes - Main M&As occured:

*1 Bank of America (BOA) merged with FleetBoston Financial in April, 2004

*2 Bank of America (BOA) acquired Merrill Lynch in September, 2008

*3 Wells Fargo (WF) acquired Wachovia Bank in December, 2008

*4 JP Morgan Chase & Co (JPM) merged with Bank One Corp in July, 2004

*5 Credit Agricole SA acquired Credit Lyonnaise SA in May, 2003 (here named CREDIT-AGRI-CIB)

*6 Bank of Tokyo-Mitsubishi, Ltd. and UFJ Bank Ltd. merged in January, 2006 and created the MUFG Bank, Ltd. (here called MITSUBISHI-UFJ)

*7 ABN-AMRO Bank N.V. was acquired by the so-called consortium RFS Holdings B.V. in October, 2007

Table A.6
Correlation Matrix

This table shows the correlations between the main variables of interest included in the panel regression analysis.

	SRISKb(US$)	SRISK%	LRMES	Total Assets	SY-RISK^{Lev1}	SY-RISK^{Lev2}	SY-RISK$^{Lev\&Cov\text{-}Lite1}$	SY-RISK$^{Lev\&Cov\text{-}Lite2}$	E-W Int. (SIC aggregation)	S-W Int. (SIC aggregation)	REL-W Int. (SIC aggregation)	Eigenvector Centrality	Closeness Centrality	Farness Centrality
SRISKb(US$)	1													
SRISK%	0.684***	1												
LRMES	0.335***	0.277***	1											
Total Assets	0.783***	0.578***	0.171***	1										
SY-RISK^{Lev1}	0.202***	0.347***	0.143***	0.337***	1									
SY-RISK^{Lev2}	0.213***	0.336***	0.142***	0.351***	0.984***	1								
SY-RISK$^{Lev\&Cov\text{-}Lite1}$	0.221***	0.364***	0.129***	0.390***	0.968***	0.957***	1							
SY-RISK$^{Lev\&Cov\text{-}Lite2}$	0.222***	0.336***	0.122***	0.404***	0.897***	0.919***	0.966***	1						
E-W Int. (SIC aggregation)	0.108***	0.079***	0.130***	0.143***	0.091***	0.097***	0.107***	0.129***	1					
S-W Int. (SIC aggregation)	0.201***	0.232***	0.147***	0.251***	0.305***	0.307***	0.317***	0.317***	0.756***	1				
REL-W Int. (SIC aggregation)	0.249***	0.304***	0.161***	0.330***	0.439***	0.433***	0.452***	0.441***	0.754***	0.795***	1			
Eigenvector Centrality	0.350***	0.431***	0.178***	0.466***	0.559***	0.534***	0.566***	0.520***	0.382***	0.596***	0.775***	1		
Closeness Centrality	0.339***	0.392***	0.144***	0.490***	0.594***	0.580***	0.624***	0.606***	0.423***	0.607***	0.766***	0.945***	1	
Farness Centrality	-0.165***	-0.343***	-0.083***	-0.258***	-0.438***	-0.400***	-0.426***	-0.352***	-0.278***	-0.472***	-0.571***	-0.798***	-0.726***	1

Table A.7

Syndication Risk, Gloablly Systemically Important Banks (G-SIBs) and Insurers (G-SIIs)

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the financial institution level (in parentheses). We include a set of independent variables of interest. First, we include three variables, computed as the interaction of the two dummy variables, which identify respectively if the financial institution belongs to the group of Globally-Systemically Important Bank (G-SIBs) or Systemically Important Insurer (SIIs), and which is its region of headquarter (America, Europe, Asia). Also, we examine the measures of interconnectedness, total assets, the number of specializations in the syndicated market, and portfolio diversification. To verify possible issues of reverse causality we add the measure of systemic risk SRISKb. The regression model is estimated as follows: * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality	Closeness Centrality	Farness Centrality	E-W Int	S-W Int	REL-W Int
Indipendent Variable: SY-RISK ^{Lev1}	(1)	(2)	(3)	(4)	(5)	(6)
G-SIBs&SIIs*US	0.011***	0.011***	0.012***	0.012***	0.012***	0.012***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
G-SIBs&SIIs*EU	0.002	0.002	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
G-SIBs&SIIs*ASIA	-0.007**	-0.007**	-0.007**	-0.006**	-0.006**	-0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Interconnectedness	0.000**	0.000***	-0.000**	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market Size (B$)	0.000	-0.000	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio Diversification	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of specializations	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Assets (B$)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SRISKb	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.002**	-0.014***	0.001	-0.009***	-0.007***	-0.006**
	(0.001)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Observations	15,664	15,664	15,664	15,664	15,664	15,664
Clusters	93	93	93	93	93	93
R^2	0.447	0.473	0.438	0.444	0.447	0.447

Table A.8

Syndication Risk, Gloablly Systemically Important Banks (G-SIBs) and Insurers (G-SIIs), and Domestically Systemically Important Banks (D-SIBs)

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the financial institution level (in parentheses). We include a set of independent variables of interest. First, we include three variables, computed as the interaction of the two dummy variables, which identify respectively if the financial institution belongs to the group of Globally- Systemically Important Bank (G-SIBs) or Systemically Important Insurer (SIIs) or Domestically Systemically Important Banks (D-SIBs) and which is its region of headquarter (America, Europe, Asia or Australia). Also, we examine the measures of interconnectedness, total assets, the number of specializations in the syndicated market, and portfolio diversification. To verify possible issues of reverse causality we add the measure of systemic risk SRISKb. The regression model is estimated as follows: * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality	Closeness Centrality	Farness Centrality	E-W Int	S-W Int	REL-W Int
Indipendent Variable: SY-RISK ^{Lev1}	(1)	(2)	(3)	(4)	(5)	(6)
G-SIBs&SIIs&DSIBs*US	0.004**	0.004*	0.004**	0.005**	0.004**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
G-SIBs&SIIs&DSIBs*EU	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
G-SIBs&SIIs&DSIBs*ASIA	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DSIBs*AUSTRALIA	-0.002**	-0.002**	-0.002*	-0.002*	-0.002	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Interconnectedness	0.000**	0.000***	-0.000**	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market Size (B$)	0.000	-0.000	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio Diversification	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of specializations	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Assets (B$)	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SRISKb	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.001	-0.013***	0.002	-0.008**	-0.007**	-0.005**
	(0.001)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Observations	15,664	15,664	15,664	15,664	15,664	15,664
Clusters	93	93	93	93	93	93
R^2	0.367	0.402	0.350	0.357	0.359	0.361

9. Robustness

Table R.1
Robustness 1: Different recession and non-recession indicator of the U.S. Systemic risk, Leveraged and Covenant-Lite Loans, Network Centrality

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔSRISKb. The independent variables of interest are SY-RISK ^{Lev1} and SY-RISK $^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly proxies of interconnectedness, which are three different measures of centrality extrapolated from the syndicated loans networks (Eq. 1, 3, and 4). Differently from the main analysis, we replace the USRECD NBER- based recession indicator with the USRECDM NBER-based indicator. Recession is the USRECDM NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality			Closeness Centrality			Farness Centrality		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		1.087***			0.937**			1.239***	
		(0.408)			(0.433)			(0.370)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.261			0.297			0.243	
		(0.216)			(0.202)			(0.219)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.946**			0.802*			1.085***
			(0.425)			(0.449)			(0.393)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.083			0.120			0.060
			(0.248)			(0.237)			(0.252)
Centrality × Recession	0.199***	0.110	0.100	0.145***	0.095*	0.091*	-0.022***	-0.008	-0.007
	(0.059)	(0.068)	(0.068)	(0.042)	(0.051)	(0.051)	(0.007)	(0.007)	(0.007)
Centrality × Non-recession	0.006	0.010	0.008	-0.019	-0.014	-0.013	-0.000	-0.001	-0.001
	(0.024)	(0.023)	(0.023)	(0.013)	(0.013)	(0.013)	(0.002)	(0.002)	(0.002)
Constant	-1.093***	-1.121***	-1.175***	-0.105	-0.363	-0.493	-1.041**	-0.856*	-0.927*
	(0.188)	(0.210)	(0.208)	(0.562)	(0.575)	(0.567)	(0.449)	(0.475)	(0.477)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.047	0.050	0.050	0.049	0.051	0.051	0.044	0.049	0.049
Adj. R^2	0.046	0.049	0.049	0.049	0.050	0.050	0.044	0.049	0.049

Table R.2

Robustness 1: Different recession and non-recession indicator of the U.S.

Systemic risk, Leveraged and Covenant-Lite Loans, (E-W, S-W, REL-W) Interconnectedness

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include lead arranger and time fixed effects. The dependent variable is ΔSRISKb. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly portfolio interconnectedness, which is computed by three-weighting schemes, respectively equally-, size- and relationship-weighted. Differently from the main analysis, we replace the USRECD NBER- based recession indicator with the USRECDM NBER-based indicator. Recession is the USCREDM NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2.

Panel A. Industry Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		1.306***			1.225***			1.233***	
		(0.332)			(0.354)			(0.362)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.231			0.246			0.237	
		(0.230)			(0.223)			(0.223)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			1.139***			1.067***	0.064***	0.027*	0.024
			(0.359)			(0.377)	(0.017)	(0.015)	(0.015)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.046			0.063	0.001	0.004	0.004
			(0.262)			(0.255)	(0.003)	(0.003)	(0.003)
Interconnectedness × Recession	0.041**	0.016	0.014	0.093***	0.049**	0.046**			1.077***
	(0.018)	(0.016)	(0.016)	(0.022)	(0.021)	(0.020)			(0.385)
Interconnectedness × Non-recession	-0.006	-0.002	-0.001	-0.000	0.004	0.004			0.052
	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)			(0.256)
Constant	-0.680*	-0.927**	-1.029**	-1.001***	-1.316***	-1.385***	-1.067***	-1.305***	-1.398***
	(0.397)	(0.420)	(0.429)	(0.375)	(0.393)	(0.407)	(0.316)	(0.348)	(0.356)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.042	0.049	0.049	0.044	0.050	0.050	0.044	0.049	0.049
Adj. R^2	0.042	0.049	0.049	0.044	0.049	0.049	0.044	0.049	0.049

(Continued)

Panel B. States Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$SY\text{-}RISK^{Lev1}$ × U.S. Recession		1.314***			1.273***			1.236***	
		(0.330)			(0.339)			(0.357)	
$SY\text{-}RISK^{Lev1}$ × U.S. Non-Recession		0.230			0.244			0.241	
		(0.231)			(0.228)			(0.225)	
$SY\text{-}RISK^{Lev\&CovLite1}$ × U.S. Recession			1.144***			1.106***			1.079***
			(0.357)			(0.364)			(0.380)
$SY\text{-}RISK^{Lev\&CovLite1}$ × U.S. Non-Recession			0.045			0.058			0.057
			(0.262)			(0.260)			(0.257)
Interconnectedness × Recession	0.011*	0.006	0.005	0.056***	0.027	0.026	0.044***	0.017	0.016
	(0.006)	(0.006)	(0.006)	(0.020)	(0.017)	(0.017)	(0.012)	(0.011)	(0.011)
Interconnectedness × Non-recession	-0.006*	-0.005	-0.005	-0.013**	-0.008	-0.008	-0.004	-0.000	-0.000
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
Constant	-0.705**	-0.767**	-0.827**	-0.198	-0.532	-0.613*	-0.813***	-1.020***	-1.107***
	(0.306)	(0.320)	(0.322)	(0.369)	(0.359)	(0.363)	(0.271)	(0.284)	(0.287)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.042	0.049	0.049	0.043	0.049	0.049	0.044	0.049	0.049
Adj. R^2	0.042	0.049	0.049	0.043	0.049	0.049	0.044	0.049	0.049

Table R.3
Robustness 3: Recession and non-recession indicator of the geographic headquarter of the lender
Systemic risk, Leveraged and Covenant-Lite Loans, Network Centrality

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔSRISKb. All regressions include lead arranger and time fixed effects. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly proxies of interconnectedness, which are three different measures of centrality extrapolated from the syndicated loans networks (Eq. 1, 3, and 4). Differently from the main analysis, we replace the USRECD NBER- based recession indicator with the indicators that reflect the headquarter of the lender. Recession is an NBER-and OECD- based indicator equal to 1 if the month falls into the recession periods in the geographic area where the financial institution is headquartered, or otherwise equal to 0. The non-recession indicator is the opposite. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality			Closeness Centrality			Farness Centrality		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.842**			0.814**			0.926***	
		(0.337)			(0.337)			(0.325)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.333			0.352			0.316	
		(0.261)			(0.249)			(0.255)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.738**			0.704*			0.804**
			(0.362)			(0.368)			(0.352)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.150			0.165			0.134
			(0.291)			(0.281)			(0.287)
Centrality × Recession	0.109***	0.072**	0.059*	0.041**	0.021	0.015	-0.009***	-0.005**	-0.004**
	(0.035)	(0.031)	(0.031)	(0.020)	(0.017)	(0.017)	(0.003)	(0.002)	(0.002)
Centrality × Non-recession	-0.006	0.001	0.001	-0.040**	-0.033**	-0.030*	0.001	0.000	-0.000
	(0.029)	(0.031)	(0.030)	(0.016)	(0.016)	(0.015)	(0.002)	(0.002)	(0.002)
Constant	-0.835***	-0.920***	-1.010***	1.153*	0.775	0.493	-1.273**	-1.040	-1.075
	(0.215)	(0.231)	(0.230)	(0.689)	(0.670)	(0.656)	(0.612)	(0.701)	(0.687)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.043	0.045	0.045	0.044	0.046	0.046	0.042	0.045	0.045
Adj. R^2	0.043	0.045	0.045	0.043	0.045	0.045	0.041	0.044	0.044

Table R.4

Robustness 4: Recession and non-recession indicator of the geographic headquarter of the lender

Systemic risk, Leveraged and Covenant-Lite Loans, (E-W, S-W, REL-W) Interconnectedness

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include lead arranger and time fixed effects. The dependent variable is ΔSRISKb. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly portfolio interconnectedness, which is computed by three-weighting schemes, respectively equally-, size- and relationship-weighted. Differently from the main analysis, we replace the USRECD NBER- based recession indicator with the indicators that reflect the headquarter of the lender. Recession is an NBER-and OECD- based indicator equal to 1 if the month falls into the recession periods in the geographic area where the financial institution is headquartered, or otherwise equal to 0. The non-recession indicator is the opposite. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2.

Panel A. Industry Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.963***			0.935***			0.922***	
		(0.335)			(0.332)			(0.337)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.286			0.299			0.296	
		(0.248)			(0.251)			(0.249)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.840**			0.817**			0.810**
			(0.361)			(0.359)			(0.363)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.113			0.121			0.118
			(0.285)			(0.286)			(0.285)
Interconnectedness × Recession	0.017*	0.007	0.005	0.040***	0.024***	0.020**	0.029***	0.015**	0.012**
	(0.009)	(0.009)	(0.009)	(0.010)	(0.008)	(0.008)	(0.007)	(0.006)	(0.006)
Interconnectedness × Non-recession	-0.010**	-0.005	-0.004	-0.004	0.004	0.005	-0.004	0.001	0.003
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)
Constant	-0.280	-0.643	-0.804*	-0.637	-1.165***	-1.324***	-0.633*	-1.014***	-1.176***
	(0.450)	(0.464)	(0.470)	(0.440)	(0.419)	(0.437)	(0.370)	(0.382)	(0.389)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.040	0.045	0.045	0.041	0.045	0.045	0.041	0.045	0.045
Adj. R^2	0.040	0.044	0.044	0.041	0.044	0.044	0.041	0.044	0.044

(Continued)

Panel B. States Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.968***			0.950***			0.924***	
		(0.336)			(0.336)			(0.338)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.284			0.295			0.300	
		(0.248)			(0.251)			(0.250)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.843**			0.828**			0.811**
			(0.361)			(0.361)			(0.364)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.112			0.119			0.122
			(0.284)			(0.286)			(0.286)
Interconnectedness × Recession	0.005	0.001	0.000	0.020**	0.008	0.006	0.020***	0.009*	0.007
	(0.006)	(0.006)	(0.006)	(0.009)	(0.008)	(0.008)	(0.006)	(0.005)	(0.005)
Interconnectedness × Non-recession	-0.007**	-0.006*	-0.006*	-0.013**	-0.007	-0.006	-0.006*	-0.002	-0.001
	(0.004)	(0.003)	(0.003)	(0.006)	(0.006)	(0.006)	(0.003)	(0.003)	(0.003)
Constant	-0.471	-0.601	-0.684*	-0.018	-0.446	-0.613	-0.477	-0.771**	-0.923***
	(0.359)	(0.382)	(0.380)	(0.441)	(0.397)	(0.397)	(0.323)	(0.319)	(0.319)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.040	0.045	0.045	0.041	0.045	0.045	0.041	0.045	0.045
Adj. R^2	0.040	0.044	0.044	0.040	0.044	0.044	0.041	0.044	0.044

Table R.5

Robustness 5: Measures of syndicated portoflio risk SY-RISK^{Lev2} and SY-RISK$^{Lev\&CovLite2}$ Systemic risk, Leveraged and Covenant-Lite Loans, Network Centrality

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔSRISKb. Differently from the main regressions, the dependent variables of interest SY-RISK^{Lev2}and SY-RISK$^{Lev\&CovLite2}$ are computed based on Eq. (11) and (13). The independent variables of interest are the monthly proxies of interconnectedness, which are three different measures of centrality extrapolated from the syndicated loans networks (Eq. 1, 3, and 4). Differently from the main analysis, we replace the USRECD NBER- based recession indicator with the indicators that reflect the headquarter of the lender. Recession is the USRECD NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2.

	Eigenvector Centrality			Closeness Centrality			Farness Centrality		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev2} × U.S. Recession		2.471***			2.175***			2.740***	
		(0.746)			(0.784)			(0.704)	
SY-RISK^{Lev2} × U.S. Non-Recession		0.477			0.530			0.469	
		(0.362)			(0.342)			(0.356)	
SY-RISK$^{Lev\&CovLite2}$ × U.S. Recession			2.019**			1.733**			2.266***
			(0.827)			(0.860)			(0.787)
SY-RISK$^{Lev\&CovLite2}$ × U.S. Non-Recession			-0.069			-0.024			-0.069
			(0.447)			(0.429)			(0.440)
Centrality × Recession	0.154***	0.070	0.058	0.106***	0.056*	0.050	-0.016***	-0.003	-0.002
	(0.045)	(0.046)	(0.046)	(0.030)	(0.032)	(0.031)	(0.005)	(0.005)	(0.004)
Centrality × Non-recession	0.011	0.017	0.015	-0.021	-0.015	-0.014	-0.001	-0.002	-0.002
	(0.025)	(0.024)	(0.025)	(0.014)	(0.013)	(0.013)	(0.002)	(0.002)	(0.002)
Constant	-1.100***	-1.116***	-1.173***	0.021	-0.287	-0.405	-0.866*	-0.662	-0.768
	(0.186)	(0.210)	(0.210)	(0.555)	(0.568)	(0.563)	(0.484)	(0.506)	(0.502)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.042	0.046	0.046	0.044	0.046	0.046	0.041	0.045	0.045
Adj. R^2	0.042	0.045	0.045	0.043	0.046	0.045	0.040	0.045	0.045

Table R.6
Robustness 6: Measures of syndicated portoflio risk SY-RISK^{Lev2} and SY-RISK$^{Lev\&CovLite2}$
Systemic risk, Leveraged and Covenant-Lite Loans, (E-W, S-W, REL-W) Interconnectedness

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include lead arranger and time fixed effects. The dependent variable is ΔSRISKb. The independent variables of interest are SY-RISK^{Lev2} and SY-RISK$^{Lev\&CovLite2}$, which are computed based on Eq. (11) and (13); and the monthly portfolio interconnectedness, which is computed by three-weighting schemes, respectively equally-, size- and relationship-weighted. Differently from the main analysis, we replace the USRECD NBER- based recession indicator with the indicators that reflect the headquarter of the lender. Recession is an NBER-and OECD- based indicator equal to 1 if the month falls into the recession periods in the geographic area where the financial institution is headquartered, or otherwise equal to 0. The non-recession indicator is the opposite. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2.

Panel A. Industry Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev2} × U.S. Recession		2.735***			2.599***			2.654***	
		(0.666)			(0.693)			(0.707)	
SY-RISK^{Lev2} × U.S. Non-Recession		0.465			0.479			0.462	
		(0.366)			(0.361)			(0.362)	
SY-RISK$^{Lev\&CovLite2}$ × U.S. Recession			2.227***			2.109***			2.169***
			(0.746)			(0.773)			(0.786)
SY-RISK$^{Lev\&CovLite2}$ × U.S. Non-Recession			-0.079			-0.067			-0.088
			(0.450)			(0.445)			(0.447)
Interconnectedness × Recession	0.041**	0.021	0.018	0.079***	0.040**	0.036**	0.051***	0.017	0.014
	(0.018)	(0.017)	(0.016)	(0.018)	(0.016)	(0.016)	(0.013)	(0.011)	(0.011)
Interconnectedness × Non-recession	-0.007	-0.003	-0.002	0.001	0.006	0.006	0.001	0.004	0.005
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
Constant	-0.608	-0.821*	-0.931**	-1.083***	-1.355***	-1.437***	-1.077***	-1.282***	-1.394***
	(0.401)	(0.430)	(0.435)	(0.372)	(0.383)	(0.399)	(0.316)	(0.351)	(0.356)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.040	0.045	0.045	0.041	0.046	0.046	0.041	0.045	0.045
Adj. R^2	0.039	0.045	0.045	0.041	0.045	0.045	0.041	0.045	0.045

(Continued)

Panel B. States Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔSRISKb	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev2} × U.S. Recession		2.755***			2.696***			2.665***	
		(0.661)			(0.672)			(0.695)	
SY-RISK^{Lev2} × U.S. Non-Recession		0.462			0.476			0.469	
		(0.366)			(0.367)			(0.364)	
SY-RISK$^{Lev\&CovLite2}$ × U.S. Recession			2.245***			2.186***			2.176***
			(0.742)			(0.751)			(0.775)
SY-RISK$^{Lev\&CovLite2}$ × U.S. Non-Recession			-0.076			-0.072			-0.081
			(0.451)			(0.451)			(0.449)
Interconnectedness × Recession	0.013*	0.007	0.006	0.043***	0.015	0.014	0.033***	0.010	0.008
	(0.008)	(0.008)	(0.008)	(0.015)	(0.013)	(0.013)	(0.009)	(0.008)	(0.008)
Interconnectedness × Non-recession	-0.007**	-0.006*	-0.006*	-0.011**	-0.006	-0.006	-0.003	0.000	0.001
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
Constant	-0.629**	-0.676**	-0.741**	-0.303	-0.579	-0.674*	-0.834***	-1.012***	-1.112***
	(0.313)	(0.330)	(0.333)	(0.366)	(0.354)	(0.357)	(0.270)	(0.285)	(0.285)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.040	0.045	0.045	0.040	0.045	0.045	0.041	0.045	0.045
Adj. R^2	0.039	0.045	0.045	0.040	0.045	0.045	0.040	0.045	0.045

Table R.7
Robustness 7: The dependent variable is ΔLRMES
Systemic risk, Leveraged and Covenant-Lite Loans, Network Centrality

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. Differently from the main analysis, we replace the dependent variable with ΔLRMES. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly proxies of interconnectedness, which are three different measures of centrality extrapolated from the syndicated loans networks (Eq. 1, 3 and 4). Recession is the USRECD NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality			Closeness Centrality			Farness Centrality		
Dependent Variable: ΔLRMES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.935***			0.989***			0.991***	
		(0.296)			(0.314)			(0.316)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.274			0.335			0.340	
		(0.203)			(0.208)			(0.219)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.955***			0.992***			0.962***
			(0.317)			(0.333)			(0.326)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.303			0.353			0.315
			(0.209)			(0.213)			(0.216)
Centrality × Recession	0.179**	0.098	0.105	0.106**	0.051	0.053	0.011	0.021**	0.021**
	(0.082)	(0.077)	(0.078)	(0.049)	(0.048)	(0.049)	(0.009)	(0.009)	(0.009)
Centrality × Non-recession	0.118*	0.116*	0.120*	0.046	0.052	0.052	0.020***	0.019***	0.019***
	(0.062)	(0.063)	(0.063)	(0.032)	(0.032)	(0.032)	(0.007)	(0.007)	(0.007)
Constant	14.117***	14.157***	14.181***	12.689***	12.377***	12.405***	11.251***	11.412***	11.441***
	(3.082)	(3.086)	(3.090)	(3.252)	(3.209)	(3.213)	(2.489)	(2.501)	(2.513)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.248	0.249	0.249	0.247	0.249	0.249	0.250	0.251	0.251
Adj. R^2	0.248	0.249	0.249	0.247	0.248	0.248	0.249	0.251	0.251

Table R.8

Robustness 8: The dependent variable is ΔLRMES

Systemic risk, Leveraged and Covenant-Lite Loans, (E-W, S-W, REL-W) Interconnectedness

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔLRMES. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly portfolio interconnectedness, which is computed by three-weighting schemes, respectively equally-, size- and relationship-weighted (Eq. 4). Recession is the USRECD NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

Panel A. Industry Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔLRMES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.984***			0.937***			0.933***	
		(0.330)			(0.311)			(0.303)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.356			0.366*			0.350	
		(0.214)			(0.218)			(0.217)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.987***			0.942***			0.936***
			(0.346)			(0.329)			(0.321)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.363*			0.375*			0.361
			(0.217)			(0.221)			(0.221)
Interconnectedness × Recession	0.026	0.010	0.011	0.057**	0.029	0.031	0.050**	0.026	0.027
	(0.031)	(0.031)	(0.031)	(0.028)	(0.025)	(0.025)	(0.023)	(0.021)	(0.021)
Interconnectedness × Non-recession	0.001	0.004	0.004	0.002	0.004	0.004	0.011	0.013	0.013
	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)	(0.010)	(0.010)	(0.010)
Constant	14.735***	14.557***	14.603***	14.749***	14.546***	14.590***	14.151***	14.008***	14.052***
	(3.314)	(3.269)	(3.284)	(3.424)	(3.381)	(3.392)	(3.356)	(3.329)	(3.339)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.246	0.248	0.248	0.247	0.248	0.248	0.247	0.248	0.248
Adj. R^2	0.246	0.248	0.248	0.246	0.248	0.248	0.246	0.248	0.248

(Continued)

Panel B. States Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (S-W) interconnectedness			Relationship-weighted (REL-W) interconnectedness		
Dependent Variable: ΔLRMES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.977***			0.948***			0.946***	
		(0.327)			(0.322)			(0.307)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.356			0.381*			0.349	
		(0.215)			(0.218)			(0.216)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.982***			0.948***			0.950***
			(0.343)			(0.338)			(0.324)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.364*			0.384*			0.360
			(0.218)			(0.220)			(0.219)
Interconnectedness × Recession	0.024	0.019	0.019	0.025	0.007	0.008	0.032*	0.013	0.014
	(0.023)	(0.023)	(0.023)	(0.031)	(0.032)	(0.032)	(0.019)	(0.018)	(0.018)
Interconnectedness × Non-recession	0.001	0.001	0.002	-0.026*	-0.024*	-0.024*	0.006	0.007	0.007
	(0.010)	(0.010)	(0.010)	(0.014)	(0.013)	(0.013)	(0.010)	(0.010)	(0.010)
Constant	14.759***	14.762***	14.785***	16.607***	16.441***	16.462***	14.525***	14.420***	14.453***
	(3.253)	(3.236)	(3.244)	(3.716)	(3.662)	(3.667)	(3.281)	(3.255)	(3.263)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.246	0.248	0.248	0.247	0.248	0.248	0.247	0.248	0.248
Adj. R^2	0.246	0.248	0.248	0.246	0.248	0.248	0.246	0.248	0.248

Table R.9

Robustness 9: The dependent variable is SRISK%

Systemic risk, Leveraged and Covenant-Lite Loans, Network Centrality

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include financial institution fixed effects. The dependent variable is ΔSRISK%. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly proxies of interconnectedness, which are three different measures of centrality extrapolated from the syndicated loans networks (Eq. 1, 3 and 4). Recession is the USRECD NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	Eigenvector Centrality			Closeness Centrality			Farness Centrality		
Dependent Variable: ΔSRISK%	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.093**			0.089*			0.092**	
		(0.045)			(0.045)			(0.044)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.046			0.049			0.050*	
		(0.030)			(0.030)			(0.030)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.082*			0.078*			0.081*
			(0.046)			(0.046)			(0.046)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.030			0.033			0.034
			(0.032)			(0.031)			(0.031)
Centrality × Recession	0.006	0.002	0.000	0.005*	0.002	0.002	-0.001	-0.000	-0.000
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Centrality × Non-recession	0.004*	0.004*	0.004*	0.001	0.002	0.002	-0.000	-0.000*	-0.000**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	0.094***	0.103***	0.093***	0.054	0.051	0.030	0.175***	0.197***	0.189***
	(0.031)	(0.029)	(0.027)	(0.082)	(0.078)	(0.074)	(0.053)	(0.047)	(0.043)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.023	0.025	0.024	0.023	0.024	0.024	0.023	0.024	0.024
Adj. R^2	0.023	0.024	0.023	0.023	0.024	0.023	0.022	0.024	0.023

Table R.10
Robustness 10: The measure of systemic risk is replaced with SRISK%
Systemic risk, Leveraged and Covenant-Lite Loans, Interconnectedness

This table reports the estimated coefficients from the panel regressions and their robust standard errors clustered at the lead arranger level (in parentheses). All regressions include lead arranger and time fixed effects. Differently from the main regressions, the dependent variable is ΔSRISK%. The independent variables of interest are SY-RISK^{Lev1} and SY-RISK$^{Lev\&CovLite1}$, which are computed based on Eq. (8) and (10); and the monthly portfolio interconnectedness, which is computed by three-weighting schemes, respectively equally-, size- and relationship-weighted. Recession is an NBER-based indicator equal to 1 if the month falls into the recession periods in the U.S. economy, or otherwise equal to 0. The non-recession indicator is the opposite. Other control variables included are: lead arranger's total assets (B$); market share as a lead arranger in the U.S. syndicated loan market (%); the market size of the syndicated loans (B$), one-month lagged SRISKb. To control for the highly risky loans hold by each lead arranger, we add the leveraged loans amount (B$), and leveraged and covenant-lite loans amount (B$). The bottom of the table reports the number of observations, fixed effects, number of clusters (i.e., financial institutions), R2, and adj. R2. * indicates that the estimated coefficient is significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

Panel A. Industry Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (E-W) interconnectedness			Relationship-weighted (E-W) interconnectedness		
Dependent Variable: ΔSRISK%	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.090**			0.094**			0.095**	
		(0.043)			(0.043)			(0.043)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.050*			0.048			0.048	
		(0.030)			(0.030)			(0.030)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.076*			0.081*			0.083*
			(0.044)			(0.044)			(0.044)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.033			0.032			0.031
			(0.032)			(0.032)			(0.032)
Interconnectedness × Recession	0.002	0.002	0.001	0.002	0.000	-0.000	0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Interconnectedness × Non-recession	0.001	0.001	0.001*	0.002***	0.002***	0.002***	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	0.081***	0.082**	0.068**	0.018	0.011	-0.001	0.071***	0.073**	0.058**
	(0.029)	(0.032)	(0.029)	(0.031)	(0.039)	(0.040)	(0.027)	(0.029)	(0.027)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.023	0.024	0.024	0.023	0.025	0.024	0.023	0.025	0.024
Adj. R^2	0.022	0.024	0.023	0.022	0.024	0.024	0.022	0.024	0.023

(Continued)

Panel B. States Aggregation

	Equally-weighted (E-W) interconnectedness			Size-weighted (E-W) interconnectedness			Relationship-weighted (E-W) interconnectedness		
Dependent Variable: ΔSRISK%	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SY-RISK^{Lev1} × U.S. Recession		0.090**			0.094**			0.095**	
		(0.043)			(0.043)			(0.043)	
SY-RISK^{Lev1} × U.S. Non-Recession		0.050*			0.048			0.048	
		(0.030)			(0.030)			(0.030)	
SY-RISK$^{Lev\&CovLite1}$ × U.S. Recession			0.076*			0.081*			0.083*
			(0.044)			(0.044)			(0.044)
SY-RISK$^{Lev\&CovLite1}$ × U.S. Non-Recession			0.033			0.032			0.031
			(0.032)			(0.032)			(0.032)
Interconnectedness × Recession	0.002	0.002	0.001	0.002	0.000	-0.000	0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Interconnectedness × Non-recession	0.001	0.001	0.001*	0.002***	0.002***	0.002***	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	0.081***	0.082**	0.068**	0.018	0.011	-0.001	0.071***	0.073**	0.058**
	(0.029)	(0.032)	(0.029)	(0.031)	(0.039)	(0.040)	(0.027)	(0.029)	(0.027)
Observations	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484	15,484
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	93	93	93	93	93	93	93	93	93
R^2	0.023	0.024	0.024	0.023	0.025	0.024	0.023	0.025	0.024
Adj. R^2	0.022	0.024	0.023	0.022	0.024	0.023	0.022	0.024	0.024