ON THE "DOUBLE LEVERAGE" OF US INSURANCE GROUPS

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Abstract

We show that a high degree of "double leverage" inside US insurance groups affects in a negative way their financial strength. Double leverage occurs when the parent firm finances the purchase of subsidiaries' equity using external debt proceeds, i.e., without changing its stand-alone capital. The previous evidence shows that the double leverage of US Bank Holding Companies leads the firms to become riskier (Bressan, 2018b) and less efficient (Bressan et al., 2021). While regulators give instructions for the assessment of double leverage inside banking groups, in the insurance sector this topic has not received enough attention from either regulators or scholars. This article aims to fill this lack of knowledge by using data from the balance sheets of US insurance groups during the years 2000–2021, showing that indicators for the solvency and the performance of insurers decrease significantly in measures of double leverage. These findings deliver important implications for future policymaking. As we analyze accounting data from consolidated balance sheets, we argue that regulators should more carefully consider whether consolidation rules are sufficiently informative about the financial stability of insurance groups. This is an important task in relation to the systemic relevance of insurance corporations. Finally, this article is a starting point for follow-up research testing, for example, the link of double leverage to captive insurance (Weterings, 2014) and reinsurance (Park & Xie, 2014; Bressan, 2018a).

Keywords: Insurance Groups, Double Leverage, Financial Strength

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1. INTRODUCTION

An insurance group is made up by a parent firm with one or multiple operating subsidiaries, all doing insurance businesses. A few aspects of insurance groups have not been covered extensively by the academic literature, and, in particular, the empirical evidence is quite limited, as there are only a few articles that have constructed data sets for samples of insurance groups. This task is of paramount importance because acquiring knowledge about insurers could deliver to policymakers some relevant insights for future policies, and, at the same time, it would spur follow-up scientific research.

In this article, we consider the funding of equity from the parent to the subsidiaries inside insurance groups. Our goal is to examine the relationship between the financial strength of insurance groups and their so-called "double leverage". "Double leverage" occurs as the parent uses debt proceeds to acquire shares in the subsidiaries' equity, i.e., without increasing in a proportional way its stand-alone capital. Regulators give instructions for the monitoring of double leverage inside banking groups (Basel Committee on Banking Supervision et al., 2012; Board of Governors of the Federal Reserve System, Division of Banking Supervision and Regulation, 2016), as they are concerned that a high degree of double leverage would make banking groups financially more unstable, due to the lack of a sufficient buffer of capital against potential distress.

In the insurance market, though, this topic has not been addressed, primarily because in the US the regulation of insurers is heterogeneous across states. We find it plausible to ask whether also the financial health of insurance groups would be weaker when the parent firm is not well capitalized compared to its exposure to the subsidiaries' risk. To test this hypothesis, we examine a large sample of US insurance groups during 2000–2021 by using the information from the consolidated financial statements and the parent-only financial statements, so that we are able to quantify investments of the parent into the subsidiaries' equity and non-equity liabilities. The data span all segments of the insurance business: financial guaranty insurance, life and health insurance, mortgage guaranty insurance, multiline insurance, property and casualty insurance. Our main finding is that indicators for the financial strength and the performance of insurance groups decrease in measures for their degree of double leverage.

Overall, our results suggest that insurance groups are financially much weaker when the parent-subsidiary financing of equity results into a high degree of double leverage. Therefore, we illustrate that insurance groups have similar behavior to Bank Holding Companies, as in the academic literature has been documented recently by Bressan (2018b), who shows that the double leverage of US Bank Holding Companies induces the firms to have low levels of capital while a high incentive to take on risk, in line with the argument that double leverage creates opportunities for "arbitrages" of regulatory capital. The results should call for the attention of policymakers. Given the systemic relevance of insurers (Acharya et al., 2009; Weiß & Mühlnickel, 2014), we argue that double leverage effects could ultimately lead to negative consequences on the stability of the entire financial system.

We organize the paper as follows. In Section 2 we report the definition of double leverage that regulators use as they give recommendations to banking groups. As we are interested to test this view on insurers, we also establish the link between our results to the previous research on insurance groups. In Section 3 we describe our empirical data, while in Section 4 we present results from regressions. Section 5 concludes the study.

2. LITERATURE REVIEW

Inside a business group, "double leverage" denotes the circumstance in which the parent issues debt and uses the proceeds to acquire equity of the subsidiaries. A high degree of double leverage indicates that the parent holds a large share of the subsidiaries' equity, while the stand-alone (unconsolidated) equity of the same parent remains relatively small. Regulators give recommendations to Bank Holding Companies and financial conglomerates on how they should monitor the degree of double leverage by providing evidence in the assessment of consolidated capital because high double leverage could lead to overstating the capital which is effectively available to the group (Basel Committee on Banking Supervision et al., 2012; Board of Governors of the Federal Reserve System, Division of Banking Supervision and Regulation, 2016)[1]. In fact, the main concern of regulators is that groups could use double leverage to economize on the consolidated capital, to the point that huge losses could harm their financial stability[2].

According to the regulators, the issue of parent-subsidiary funding of equity inside financial groups is an important matter, yet academic researchers have given this topic only very limited attention. Bressan (2018b) uses data on Bank Holding Companies in the US to illustrate that the increasing double leverage (as measured by the so-called "double leverage ratio") correlates negatively with measures for risk-taking and consolidated capital. The author argues that Bank Holding Companies use double leverage to make arbitrages of regulatory capital, i.e., they can undertake highly risky investment projects without facing the need of issuing additional equity that would offset the wider risky exposure. The findings of Bressan et al. (2021) corroborate this argument, as the authors use a multi-directional efficiency analysis to show that Bank Holding Companies with a high degree of double leverage are also less efficient.

The theme of double leverage has not been treated by academic articles analyzing the behavior of insurers. Arguably, the main reason may be related to the regulation of insurance companies in the US, which is different across the states, thus there is not a unique set of rules which instructs the monitoring and the discipline of capital inside

[1] In the US, a Bank Holding Company is structured into a holding company (i.e., the parent company) "that has control over a bank" (i.e., the subsidiary company), and is required to register with the Board of Governors of the Federal Reserve System according to the discipline of the Bank Holding Company Act of 1956 (12 U.S.C. 1841 et seq.). Typically, Bank Holding Companies include also non-bank financial subsidiaries, i.e., subsidiaries operating in the business of insurance and asset management. The Board of Governors of the Federal Reserve System defines the double leverage of Bank Holding Companies the circumstance in which "debt is issued by the parent company and the proceeds are invested in subsidiaries as equity" (Board of Governors of the Federal Reserve System, Division of Banking Supervision and Regulation, 2016, section 1050.0).

[2] The Joint Forum on Financial Conglomerates dictates principles for the regulation of financial conglomerates and denotes "double gearing" as a situation in which "the same capital is used simultaneously as a buffer against risk in two or more legal entities" (Basel Committee on Banking Supervision et al., 2001, p. 13).

insurance groups, like instead for Bank Holding Companies[3].

However, despite the lack of a homogeneous regulation of the insurance market, practitioners in the industry seem to be aware that high double leverage could constitute a problem for well-functioning insurance groups. In fact, the capital structure of insurance parent companies can have a "significant impact on the overall financial strength of (their) insurance company subsidiaries", with the consequence that "a double leverage not offset by mitigating factors can lead to an unfavorable view of an organization's capital structure and/or the quality of capital" (AM Best[4], 2014). An increasing degree of double leverage could also end up to weaken the creditworthiness of an insurance group, as the parent company will have to rely on dividends paid by the subsidiaries in order to repay the external debt raised to purchase the subsidiaries' equity: "If interest received from operating subsidiary companies is insufficient to meet a holding company's external interest and principal repayment obligations, the holding company may suffer a strain on liquidity" (Standard & Poor's, 2013).

The goal of this article is to test empirically whether the financial strength of insurance groups is correlated to their degree of double leverage. The development of large insurance corporations provides several challenges for academic researchers and policymakers. The following analysis, in particular, contributes to improving our knowledge about an aspect of the behavior of insurers that hasn't been treated sufficiently in the recent academic and regulatory debate.

A few articles have examined the "internal capital markets" of insurance groups. In fact, internal capital markets are a key dimension of business groups (Lamont, 1997), and the evolution of huge insurance corporations has prompted scholars to examine this aspect. For example, Powell et al. (2008) find evidence that transactions inside the internal capital market of insurance groups, whether accomplished via reinsurance contracts or transfers of capital, play a significant role in the investment behavior of the affiliated insurers. Moreover, the results suggest that internal capital markets are efficient, as capital reveals to be allocated to the subsidiaries with the best-expected performance. Niehaus (2018) shows that intra-firm capital transfers (in terms of capital contributions and shareholder dividends) inside life insurance groups correlate significantly with the companies' performance and capitalization. Schlütter and Gründl (2012) develop a model showing how insurance groups implement a system of internal transfers of capital, e.g., through reinsurance contracts, guarantees, or profit and loss transfer agreements, where all of them would help insurance groups to diversify their risk. Asimit et al. (2013) derive optimal functional forms for the transfer of risk among group affiliates by means of reinsurance, discussing consequences on capital efficiency and the welfare of policyholders. Finally, Kartasheva (2021) provides an overview of the characteristics of insurance groups worldwide, with a focus on the link between their performance to their growing levels of complexity and geographical diversification.

Overall, these previous articles examine the transfer of assets among firms inside the same group, but they don't consider the parent-subsidiary financing either empirically or in their discussions. To fill this gap of knowledge, we focus our attention on this aspect, and in the next sections, we will examine the parent holdings of subsidiaries' liabilities inside US insurance groups.

3. RESEARCH METHODOLOGY

3.1. Data

We use the platform S&P Capital IQ. To obtain data on insurance groups, we select companies classified to be "US insurance statutory", for which we could find annual information from the consolidated balance sheet and the so-called "parent-only" information[5].

The sample covers the time horizon 2000–2021 and is representative of the broad insurance market. Table 1 reports the composition of the sample following the classification used by S&P Capital IQ for the insurance sector and for the business focus. The majority of our companies operate in the sector of property and casualty insurance (79% of the sample), while in terms of their business focus the companies concentrate on personal lines insurance (26%), commercial lines insurance (22%), and commercial liability insurance (20%). In Appendix (Table A.1), we include the complete list of our companies' names grouped into insurance sectors.

[3] Insurance in the United States is regulated by the states. This system of regulation stems from the McCarran-Ferguson Act of 1945, which describes state regulation and taxation of the insurance industry as being in "the public interest", and it has preeminence over federal law. Therefore, each state has its own set of statutes and rules. State regulators monitor the financial health of companies licensed to provide insurance in their state through analysis of the detailed annual financial statements that insurers are required to file and periodic onsite examinations. All insurance companies are subject to capital and surplus requirements, which also vary widely by state. In some states, solvency requirements differ also across individual lines of insurance. The National Association of Insurance Commissioners (NAIC) is a voluntary association composed of state insurance regulators for all 50 states, the District of Columbia and five US territories. The NAIC provides a forum for the development and implementation of uniform policy. The NAIC has the responsibility to develop model rules and regulations for the industry, but many of which must be approved by state legislatures before they can be implemented.

[4] AM Best is the largest credit rating agency in the world specializing in the insurance industry.

[5] S&P Capital IQ sources the information on the consolidated group as well the parent-only information based on the companies' data from public disclosure and from the companies' websites. The collection methodology of S&P Capital IQ is to source information from audited consolidated financial statements and notes to the consolidated financial statements. The financial statements of the parent company (in S&P Capital IQ called "parent-only" statements) should generally be presented in the same report with the reporting entity's consolidated financial statements (e.g., U.S. Securities and Exchange Commission (SEC) filings). ASC 810-10-45-11 provides the authoritative basis for parent company financial statements under US Generally Accepted Accounting Principles (GAAP).

Table 1. The sample of US insurance groups during 2000–2021 by the insurance sector and business focus

Insurance sector	*N*	*% of sample*
Financial guaranty	51	5.22
Life health	9	0.92
Mortgage guaranty	71	7.27
Multiline	59	6.04
Property casualty	775	79.32
Title	12	1.23
Business focus	***N***	***% of sample***
Commercial financial lines	114	11.67
Commercial general liability	100	20.24
Commercial lines	216	22.11
Commercial medical malpractice	25	2.56
Commercial property	132	13.51
Commercial workers compensation	33	3.38
Large reinsurance	86	8.80
P&C minimum NPW	15	1.54
Personal lines focus	256	26.20
Total	977	100

Note: N is the total number of observations.

3.2. Dependent variables

To assess the financial strength of our insurance groups we use the following two quantities that approximate their financial leverage. The first is the consolidated leverage ratio that we denote with *LS*, i.e., the ratio of liabilities over policyholder surplus. Liabilities are the benefits that the company owes its policyholders, while the policyholder surplus is the difference between the company's assets and liabilities. *LS* approximates the solvency of the insurer, i.e., the ability of an insurance company to meet its long-term obligations. The National Association of Insurance Commissioners (NAIC) says that the quantity measured by *LS* "provides a cushion for absorbing losses" (NAIC, 2011, p. 7). In fact, when *LS* is low it means that the company disposes only of a relatively high buffer of capital to cover losses. By contrast, if *LS* is high, it will be less likely that the company could be solvent.

Our second measure for leverage is the so-called "Kenney ratio" (or "insurance leverage") that we call *NPS*, i.e., the ratio of net premiums written to policyholder surplus. The net premiums written are the insurer's gross premiums written less reinsurance ceded. Regulators monitor the behavior of the quantity *NPS* to assess the solvency of insurers, and a high value of *NPS* would signal the need to put the company under close scrutiny because it would indicate that the company bears substantial risk compared to the policyholder surplus. According to the NAIC, the usual range for the ratio can be up to three hundred percent. Instead, a low *NPS* is considered a sign of financial health because the insurer is theoretically using its capacity to write more policies. In the literature, for example, Klein et al. (2002) measure the leverage of insurers testing alternatively *LS* and *NPS*. However, the authors argue that it would be more appropriate to assess the financial strength of insurers by using *LS* instead than *NPS*, as *NPS* assumes the policyholder surplus is dedicated to support only the current business of the insurer, which seems not much plausible. In reality, the insurer surplus is available to bond the promises on policies sold during previous years as well as the future obligations of the firm. In our sample, the median values of *LS* and *NPS* are respectively 2.7 and 0.8. Overall, these values suggest that we examine firms that are relatively healthy from a financial perspective.

We regard *LS* and *NPS* as our main indicators for financial strength. To provide more extensive empirical evidence, we also show results for a few more indicators of solvency, which we construct following the guidelines that we find in the regulation of insurers or within academic articles. First, we compute *PS* as the ratio of gross premiums to surplus, which "reflects its policyholders' surplus exposure on all business written on a direct or assumed basis, without considering the effect of reinsurance" (NAIC, 2011, p. 7). For example, *PS* is the measure for underwriting leverage analyzed by Fields et al. (2012).

Then, we define *SA* to be the ratio of policyholder surplus to total assets. In doing this, we follow the suggestion of Fields et al. (2012) who use *SA* to assess the capitalization of insurance companies. When a company is well capitalized, it will also be more likely to remain solvent and exhibit a high value of *SA*. Consistently, for example, Downs and Sommer (1999), Cummins et al. (2001), and Fields et al. (2012) use the quantity *SA* to examine the risk undertaken by insurers.

The "cover ratio" *CR* denotes the ratio of total assets to premiums written. A solid company has a high *CR*. It can be shown that *CR* is directly related to the Kenney ratio that we compute with *NPS* (Kahane, 1979), therefore we use *CR* to test the robustness of the main empirical outcomes.

Moreover, we examine the performance of our groups. To gauge this aspect, we use the so-called "combined ratio" (also known as "composite ratio", or "statutory ratio"). In the insurance industry, the combined ratio is a key measure of profitability from the operating business, as it only measures profits earned through daily underwriting activities and excludes investment-related income. In the literature, we find, for example, that Grace and Hotchkiss (1995) analyze the combined ratio of property-liability insurers, showing that this quantity was strongly correlated with indicators for the general economic outlook during 1974–1990. More specifically, in our notation *COMBR* sums the incurred losses to the loss adjustment expenses plus other underwriting expenses, and divides this number by the earned premiums. The smaller is *COMBR* the better is the underwriting performance of an insurer, as it means that the firm has earned considerable premiums in respect to the dividends paid to its policyholders. In our sample the median *COMBR* is 0.9, which suggests that overall our firms perform well.

Finally, we define *ROA* to be the ratio of the net income to average assets, and this is the measure largely employed in the industry as well in the literature to assess profitability across both financial and non-financial sectors.

3.3. Measures for "double leverage"

Here, we assess the degree of double leverage inside the group. This means that we want to quantify the parent holdings of subsidiaries' equity *in relative* terms, i.e., in respect to the capital available to the group. We suggest the following three alternatives. First, we define with *DLR* the parent-company-only investments in subsidiaries (at cost and net of any liabilities to subsidiaries) divided by the consolidated equity. The numerator of *DLR* is made up of equity, fixed maturity security investments, and derivative investments held by the parent company. Equity includes par value, paid-in capital, retained earnings, and other adjustments to equity. Minority interests may be included, per relevant accounting standards (e.g., FAS 160 for US GAAP which includes minority interest for fiscal years starting after December 15, 2008). We consider *DLR* to be our main measure for double leverage, therefore we report in Table 3 the average *DLR* across subsamples identified by the insurance sector and business focus.

We can't observe striking differences in the average *DLR* across groups, yet the most important insight that we obtain from Table 3 is that the degree of double leverage is substantial in the overall US insurance market. In fact, *DLR* is above 1.1 in the large majority of the sample. This means that inside our groups parent firms are much largely exposed to their subsidiaries' equity, while the consolidated capital remains relative small. For Bank Holding Companies regulators argue that a double leverage ratio above 1 is a signal that calls for attention, requiring the reporting Bank Holding Company an integration to the standard capital assessment Office of the Comptroller of the Currency, (formerly the Office of Thrift Supervision) (2009).

To give an overview over time, we plot in Figure 1 the sample mean of *DLR* by years. The pattern is quite stable, as *DLR* does not change widely over time. During 2000–2001 *DLR* is on average 1.08. It raises afterwards, as during 2002–2021 it stays always above 1.1. Figure 2 displays the mean value for the quantities that we employ as numerator and denominator of *DLR*, i.e., respectively the parent-company-only investments in subsidiaries (at cost and net of any liabilities to subsidiaries) and the consolidated equity. The effect of the global financial crisis of 2007–2008 is evident in the figure, as the consolidated common equity declined sharply in 2008, which led *DLR* to 1.15, i.e., a 4.5% increase compared to the pre-crisis *DLR* in 2006 equal to 1.10. Overall, the values in Table 3 along with the Figures 1 and 2 provide motivation to our study, as they show that double leverage inside US insurers had a considerable magnitude and persisted over the time during the years 2000–2021. Therefore, it becomes important to establish whether the high degree of double leverage leads to frictions in the behavior of insurance groups, in a similar way to what happens inside banking groups.

In alternative to *DLR*, we test also additional two quantities, that we determine by changing the denominator of *DLR*. The number *INV SUBS EP* divides the parent-company-only investments in subsidiaries (at cost and net of any liabilities to subsidiaries) over the parent-only equity, while *INV SUBS AMDP* divides the parent-company-only investments in subsidiaries (at cost and net of any liabilities to subsidiaries) over the parent-only total liabilities, which we compute by subtracting the parent-only debt from the parent-only assets. Evidently, the descriptive statistics for these three variables reported in Table 2 are close to each other, yet it is helpful to test all these three quantities to verify that the observed effects are sufficiently robust. The dependent variables and the measures for double leverage that we have outlined in this section are all constructed from the book value of consolidated and parent-only financial statements.

Table 2. The variables for US insurance groups during 2000–2021

Variables	*Mean*	*Median*	*p1*	*p99*	*St. dev.*	*N*
DLR	1.1210	1.1261	0.4522	1.7325	0.2316	977
INV SUBS EP	1.1011	1.1043	0.4522	1.7321	0.2247	977
INV SUBS AMDP	1.0423	1.0557	0.1418	1.6124	0.2178	793
INV SUBS PC	14.6926	14.8407	10.7228	19.0412	1.7449	977
CONSOL EQ	14.6156	14.7254	10.6091	19.0500	1.7182	977
DEBTSUBS PC	0.0130	0.0000	0.0000	0.2645	0.0445	977
LS	3.5770	2.7851	0.3484	16.3002	2.9724	977
NPS	0.9037	0.8049	-0.0074	2.7674	0.6021	878
PS	1.1493	0.9619	-0.0009	4.4642	0.8500	795
SA	0.2851	0.2642	0.05781	0.7416	0.1405	977
CR	4.6397	4.0691	1.3542	14.9221	2.7043	711
COMBR	0.9546	0.9555	0.2273	2.3461	0.3198	871
ROA	0.0255	0.0234	-0.1526	0.1483	0.0422	970

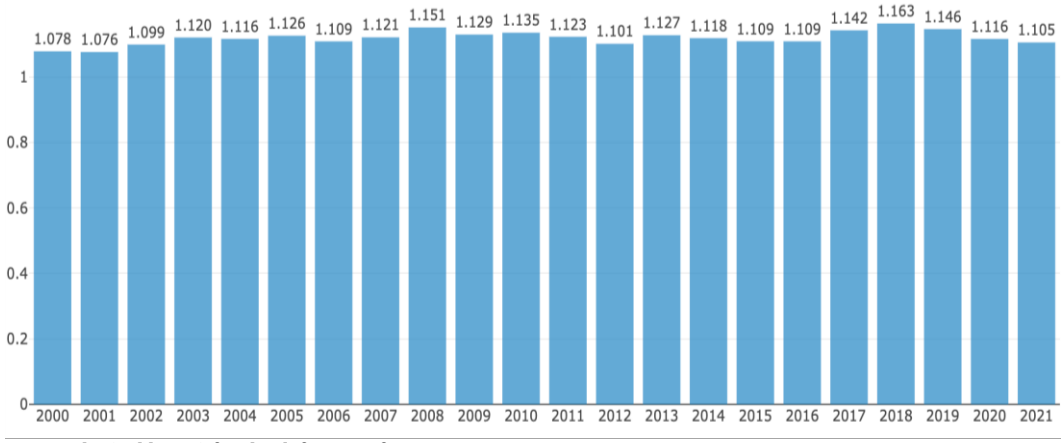
Note: See Appendix (Table A.2) for the definition of all variables. p1 is the first percentile, p99 is the ninetieth percentile, St. dev. is the standard deviation. N is the total number of observations.

Table 3. The double leverage ratio (*DLR*) of US insurance groups during 2000–2021 by the insurance sector and business focus

Insurance sector	***DLR***	***N***
Financial guaranty	1.026	51
Life health	1.284	9
Mortgage guaranty	1.181	71
Multiline	1.076	59
Property casualty	1.122	775
Title	1.215	12
Business focus	***DLR***	***N***
Commercial financial lines	1.153	114
Commercial general Liability	1.156	100
Commercial Lines	1.157	216
Commercial medical malpractice	1.006	25
Commercial property	1.097	132
Commercial workers compensation	.9308	33
Large reinsurance	1.055	86
P&C minimum NPW	1.185	154
Persol lines focus	1.129	256
Total	1.121	977

Note: See Appendix (Table A.2) for the definition of DLR. N is the total number of observations.

Figure 1. Average *DLR* of US insurance groups



Note: See Appendix (Table A.2) for the definition of DLR.

Figure 2. Sample averages in millions of US dollars inside US insurance groups

Table 4 reports the pair-wise correlation coefficient among all the variables that we use in our analysis. In particular, we note that *DLR* is positive and significantly correlated to *LS*, *NPS*, and *PS*, whose value decreases in the company's financial strength. Instead, the correlation is negative with *CR* and *SA*, which are quantities that increase in the company's degree of solvency. In the next Section 4, we will examine these patterns more deeply by performing regressions.

Table 4. Correlation among the variables inside US insurance groups

	DLR	*INV SUBS EP*	*INV SUBS AMDP*	*LS*	*NPS*	*PS*	*SA*	*CR*	*COMBR*	*ROA*	*INV SUBS PC*	*CONSOL EQ*	*DEBTSUBS PC*
DLR	1												
INV SUBS EP	0.9680***	1											
INV SUBS AMDP	0.8121***	0.8334***	1										
LS	0.198***	0.2196***	0.0722*	1									
NPS	0.394***	0.4258***	0.3461***	0.2085***	1								
PS	0.269***	0.2983***	0.1758***	0.2259***	0.8643***	1							
SA	-0.2751***	-0.2923***	-0.1390***	-0.7310***	-0.3842***	-0.3981***	1						
CR	-0.1635***	-0.1484***	-0.0910**	0.3252***	-0.5268***	-0.5414***	-0.0703*	1					
COMBR	0.0975**	0.1041**	0.1223**	0.1674***	0.1301***	0.1222***	-0.2626***	-0.0373	1				
ROA	-0.1968***	-0.2039***	-0.1885***	-0.3022***	-0.107**	-0.0996**	0.4754***	0.0387	-0.7156***	1			
INV SUBS PC	-0.0910***	-0.1194***	-0.0973***	0.0925***	-0.3477**	-0.4181**	-0.0480	0.0102	-0.1048***	0.0863***	1		
CONSOL EQ	0.0786**	0.0476	0.0475	0.1177***	-0.2942***	-0.3738***	-0.0855***	0.0182	-0.0914***	0.0608*	0.9716	1	
DEBTSUBS PC	-0.0357	-0.0275	-0.1910***	0.0594*	0.0007	0.0654*	-0.0930***	0.0078	0.0526	-0.0383	-0.0193	-0.0205	1

*Note: * p < 0.05, ** p < 0.01, *** p < 0.001. See Appendix (Table A.2) for the definition of all variables.*

4. RESULTS

Here, we conduct regressions. We use the subscripts *j* and *t* to denote respectively the group and the year, and we summarize with the following eq. (1) a set of linear regressions that we use in order to quantify the effect of double leverage on the financial strength of insurance groups:

$$Financial\ strength_{s,j,t} = \alpha_0 + \alpha_1 double\ leverage_{d,j,t} + \tau_t + \psi_j + \omega_{j,t} \quad (1)$$

The subscript *s* indicates the proxy for financial strength out of *LS*, *NPS*, *PS*, *SA*, *CR*, *COMBR*, and *ROA*. Each one of the dependent variables is regressed separately on the proxies for double leverage that we denote with the subscript *d*, i.e., *DLR*, *INV SUBS EP*, and *INV SUBS AMDP*. τ_t and ψ_j are time and firm fixed effects, while $\omega_{j,t}$ is the error term.

For more clarity in reporting the results, we separate the outcomes as follows. In Table 5 we report estimates for the dependent variables which are decreasing quantities in the company's financial strength, i.e., the variables *LS*, *NPS*, and *PS*. Instead in Table 6 the value of the dependent variables *SA* and *CR* increase in the company's financial strength. Finally, Table 7 reports the models for *COMBR* and *ROA* which approximate the group's performance.

Table 5. The effect of double leverage on the financial strength of US insurance groups — Dependent variables decrease in financial strength

	(1) $LS_{j,t}$	(2) $LS_{j,t}$	(3) $LS_{j,t}$	(4) $NPS_{j,t}$	(5) $NPS_{j,t}$	(6) $NPS_{j,t}$	(7) $PS_{j,t}$	(8) $PS_{j,t}$	(9) $PS_{j,t}$
$DLR_{j,t}$	2.5446* (1.2861)			1.0604*** (0.2813)			0.9850** (0.4535)		
$INV\ SUBS\ AMDP_{j,t}$		0.9270 (1.1792)			1.0777*** (0.3385)			0.7410 (0.5853)	
$INV\ SUBS\ EP_{j,t}$			2.9030** (1.3201)			1.1863*** (0.2930)			1.1301** (0.4565)
Observations	977	793	977	878	709	878	795	638	795
R-squared	0.0531	0.0221	0.0624	0.1667	0.1327	0.1923	0.0900	0.0522	0.1073
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1. See Appendix (Table A.2) for the definitions of all variables included in the models. The subscript j denotes the insurance group. The subscript t denotes the year. N is the total number of observations. Standard errors are clustered at the group level and are reported in parentheses.*

Table 6. The effect of double leverage on the financial strength of US insurance groups — Dependent variables increase in financial strength

	(1) $SA_{j,t}$	(3) $SA_{j,t}$	(4) $SA_{j,t}$	(5) $CR_{j,t}$	(7) $CR_{j,t}$	(8) $CR_{j,t}$
$DLR_{j,t}$	-0.1646*** (0.0521)			-1.8998** (0.9365)		
$INV\ SUBS\ AMDP_{j,t}$		-0.0850 (0.0594)			-1.2091 (1.4259)	
$INV\ SUBS\ EP_{j,t}$			-0.1810*** (0.0554)			-1.7205* (0.9991)
Observations	977	793	977	711	566	711
R-squared	0.0843	0.0259	0.0946	0.0494	0.0302	0.0449
Controls	Yes	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1. See Appendix (Table A.2) for the definitions of all variables included in the models. The subscript j denotes the insurance group. The subscript t denotes the year. N is the total number of observations. Standard errors are clustered at the group level and are reported in parentheses.*

Table 7. The effect of double leverage on the performance of US insurance groups

	(1) $COMBR_{j,t}$	(3) $COMBR_{j,t}$	(4) $COMBR_{j,t}$	(5) $ROA_{j,t}$	(7) $ROA_{j,t}$	(8) $ROA_{,t}$
$DLR_{j,t}$	0.1399** (0.0601)			-0.0352*** (0.0116)		
$INV\ SUBS\ AMDP_{j,t}$		0.1857** (0.0843)			-0.0367** (0.0167)	
$INV\ SUBS\ EP_{j,t}$			0.1565** (0.0658)			-0.0379*** (0.0110)
Observations	871	702	871	970	788	970
R-squared	0.0815	0.0901	0.0833	0.1100	0.1070	0.1130
Controls	Yes	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1. See Appendix (Table A.2) for the definitions of all variables included in the models. The subscript j denotes the insurance group. The subscript t denotes the year. N is the total number of observations. Standard errors are clustered at the group level and are reported in parentheses.*

Overall, the results in Tables 5, 6, and 7 reveal that the financial strength of insurance groups decreases in their degree of double leverage. The positive and significant coefficients of *DLR* on *LS* and *NPS* indicate that highly double-levered groups are less capitalized (i.e., have high leverage),

therefore would be less solvent. This result is corroborated by finding a negative and highly significant sign of *DLR* inside the models for *SA* and *CR*, whose value decreases in the company's solvency.

Inside Table 7 the signs of *DLR* on *COMBR* and *ROA* are highly significant and indicate that the increasing double leverage leads to worse performance. As the firm performance is correlated positively to the insolvency rate (Chen & Wong, 2004), the findings of Table 7 corroborate the hypothesis that insurance groups become financially unstable through double leveraging.

In order to verify more deeply the plausibility of this argument in our data, we now focus on the models for *LS*, *CR*, and *COMBR*, where the coefficients on *DLR* from the previous tables were much high and significant compared to other dependent variables. In the first two rows of Table 8, we regress the quantities on *INV SUBS PC* and *CONSOL EQ*, which denote respectively the natural logarithm of the parent-company-only investments in subsidiaries (at cost net of any liabilities to subsidiaries), and the natural logarithm of consolidated equity. In this way, we estimate separately the effects of the numerator and the denominator of *DLR* on the company's financial strength and performance.

We observe that the coefficients on *INV SUBS PC* and *CONSOL EQ* are not significant on *LS*. Instead, in the equations for *CR* and *COMBR* the estimated sign is opposite to the sign we estimated on *DLR* inside Tables 5, 6, and 7. Therefore, the outcomes in Table 8 support the argument that double leverage effects depend considerably on the *relative* exposure of the parent firm to subsidiaries, i.e., compared to the group capital availability.

Finally, in the third row of Table 8, we estimate equations on *DEBTSUBS PC*, which divides by the consolidated capital the parent holdings of principal amounts outstanding on debt-financed by subsidiaries. We find that *DEBTSUBS PC* has a negative impact on the group performance, while it does not sort statistically significant effects on the solvency measures. This evidence corroborates our claim that the double leverage effect we document through the analysis is a consequence of the financing of subsidiaries' equity rather than subsidiaries' debt.

Our interpretation of the findings presented in Tables 5 to 8 is that by double leveraging insurance groups can issue high levels of debt, ultimately becoming financially unstable. We already mentioned in Section 3 that our measures for double leverage are based on the book value of balance sheet items. Therefore, our results suggest that the rules for the consolidation of balance sheets would not be sufficient to capture the detrimental effect that double leverage sorts on the financial health of insurance groups, in line with the evidence inside Bank Holding Companies documented by Bressan (2018b) and Bressan (2018a).

Table 8. Regressions for variables approximating the financial strength (columns 1–6) and the performance (columns 7–9) of US insurance groups

	(1) $LS_{j,t}$	(2) $LS_{j,t}$	(3) $LS_{j,t}$	(4) $CR_{j,t}$	(5) $CR_{j,t}$	(6) $CR_{j,t}$	(7) $COMBR_{j,t}$	(8) $COMBR_{j,t}$	(9) $COMBR_{j,t}$
INV SUBS PC$_{j,t}$	0.2073 (0.2090)			0.5648** (0.2260)			-0.0153* (0.0091)		
CONSOL EQ$_{j,t}$		0.1676 (0.2051)			0.6173*** (0.2253)			-0.0183* (0.0104)	
DEBTSUBS PC$_{j,t}$			4.4100 (3.8663)			8.2309 (12.6291)			0.5162** (0.2055)
Observations	977	977	977	711	711	711	871	871	871
R-squared	0.0290	0.0233	0.0189	0.1432	0.1610	0.0311	0.0774	0.0794	0.0745
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1. See Appendix (Table A.2) for the definitions of all variables included in the models. The subscript j denotes the insurance group. The subscript t denotes the year. N is the total number of observations. Standard errors are clustered at the group level and are reported in parentheses.*

5. CONCLUSION

We illustrate that US insurance groups are financially weaker and exhibit a worse performance when they have a high degree of double leverage, i.e., when the parent holds a huge share of the subsidiaries' equity while disposing of relatively low stand-alone capital.

The topic of double leverage has been considered by regulators issuing instructions to Bank Holding Companies and financial conglomerates for the assessment of capital. In the insurance sector instead, this issue has not received sufficient attention. Our analysis reveals that the occurrence of double leverage could potentially harm the financial stability of insurance groups, therefore the findings deliver important insights for the future actions of policymaking.

As we document empirical evidence based on accounting figures from the consolidated balance sheets, we encourage regulators to monitor more carefully that consolidation rules could not leave gaps for arbitrages of capital and excessive risk-taking, as was documented for Bank Holding Companies by Bressan (2018a) and Bressan (2018b)[6].

A deeper understanding of the link between double leverage and insurers' solvency would also help to interpret the systemic role of large insurance corporations, following the debate surrounding the systemic relevance of insurers (Cummins & Weiss, 2014; Berdin & Sottocornola, 2015; Kaserer & Klein, 2019). For example, Gehrig and Iannino (2018)

[6] Using data about mergers in the insurance industry Mühlnickel and Weiß (2015) document that consolidation may have destabilizing effects on insurers, thus making them systemically riskier. Using data from the banking industry De Nicoló et al. (2004) find that consolidation does not yield safer firms or a more resilient banking system, while it leads to an increase in systemic risk. Gong et al. (2018) show evidence that the consolidation rules for the treatment of minority-owned affiliates inside Bank Holding Companies may lead to reporting capitalization levels that do not adequately reflect the risk of the corporation.

document a significant build-up of systemic risk in the European insurance sector due to the increasing number of interconnections among companies. Our findings suggest investigating the contribution to the systemic risk of large insurers from the financing of equity between parent and subsidiaries.

One limitation of our approach is that we do not quantify the effects from double leverage using market valuations, given that our sample includes both traded and not traded insurers. For example, Bressan (2018b) uses data from publicly traded US Bank Holding Companies to examine whether measures of double leverage affect the probability of distress measured by the z-score. Finally, our article leaves the tasks for the future academic research. The possible extension of our study would be to test whether also inside insurance groups market-based measures of solvency are significantly related to the degree of double leverage. One first task is to employ market valuations to test double leverage effects using market-based measures of distress. Furthermore, it would also be interesting to analyze empirically whether the double leverage of insurance groups is affected by captive insurance (Weterings, 2014) and reinsurance (Park & Xie, 2014; Bressan, 2018a).

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APPENDIX

Table A.1. The insurance groups analyzed following the insurance sector classification of S&P Capital IQ

Insurance groups	*Insurance companies*
Financial Guaranty Insurance:	Ambac; Assured Guaranty; MBIA.
Life & Health Insurance:	Genworth.
Mortgage Guaranty Insurance:	Essent; MGIC; PMI; Radian; National MI.
Multiline Insurance:	American National; Kemper; The Hartford.
Property & Casualty Insurance:	AIG; Alleghany; Allstate Corp; AMERISAFE; Arch Capital; Argo; Aspen; Assurant; AXIS; Berkshire Hathaway; Loews; Coaction; Conifer Insurance; Chubb; Employers; Enstar; Everest Re; FEDT; First Acceptance; Global Indemnity; Great American Insurance; Hallmark; Heritage Insurance; HCI Group; Horace Mann; James River Group Holdings; Mercury Insurance; Markel; MMIC Insurance; Old American; PartnerRe; ProAssurance; Progressive; ReissanceRe; RLI; Selective; The Cincinti Insurance Company; The Hanover Insurance Group; The National Security Group; Tiptree; Travelers United Fire Group; United Fire Group; UPC Insurance; Universal Insurance Holdings; W. R. Berkley.
Title Insurance:	First American.

Table A.2. Definition of variables

Variable	*Definition*
Dependent variables of the regressions	
LS	The ratio of consolidated liabilities over policyholder surplus. The policyholder surplus is the difference between the consolidated assets and consolidated liabilities.
NPS	The ratio of net premiums written to policyholder surplus. The policyholder surplus is the difference between the consolidated assets and the consolidated liabilities.
PS	The ratio of gross premiums to policyholder surplus. The policyholder surplus is the difference between the consolidated assets and the consolidated liabilities.
SA	Policyholder surplus to total assets. The policyholder surplus is the difference between the consolidated assets and the consolidated liabilities.
CR	The ratio of total assets to gross premiums written.
COMBR	"Combined ratio", i.e., the sum of incurred losses, loss adjustment expenses plus other underwriting expenses, divided by the earned premiums.
ROA	The ratio of net income to total assets.
Independent variables of the regressions	
DLR	The ratio of parent-company-only investments in subsidiaries (at cost, and net of any liabilities to subsidiaries) to consolidated equity.
INV SUBS EP	The ratio of parent-company-only investments in subsidiaries (at cost, and net of any liabilities to subsidiaries) to parent-company-only equity.
INV SUBS AMDP	The ratio of parent-company-only investments in subsidiaries (at cost, and net of any liabilities to subsidiaries) to parent-company-only liabilities, computed as parent-company-only assets net of parent-company-only debt.
INV SUBS PC	The natural logarithm of parent-company-only investments in subsidiaries (at cost, and net of any liabilities to subsidiaries).
CONSOL EQ	The natural logarithm of consolidated equity.
DEBTSUBS PC	The ratio of parent-company-only holdings of principal amounts outstanding on debt-financed by subsidiaries to consolidated capital.
Controls	
Time fixed effects	A set of dummy variables taking value of one in year *t*, while zero otherwise.
Company fixed effects	A set of dummy variables taking value of one for company *j*, while zero otherwise.