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INSURERS' INVESTMENTS BEFORE AND AFTER THE COVID-19 OUTBREAK

by Federico Apicella*, Raffaele Gallo* and Giovanni Guazzarotti*

Abstract

This paper examines the impact of the pandemic outbreak on Italian insurers' investment decisions between 2017 and 2020. By adopting a unique security-by-security holding dataset, we test how the investments of insurance companies in a single security varies when its price changes. Our findings suggest that Italian insurers on average play a stabilizing role in financial markets by increasing their exposure to securities whose price has fallen. However, their ability to weather shocks diminished on average after the pandemic outbreak, arguably as the abrupt fall of asset prices reduced insurers' balance sheet capacity to absorb short-term losses on their security holdings. Indeed, insurers' investment decisions were heavily affected by capital considerations after the pandemic outbreak: insurers did not play a stabilizing role if they had a lower solvency level and for assets more exposed to the risk of an increase in capital absorption (e.g. BBB-rated corporate bonds). Finally, insurers reduced their exposure to securities whose price had fallen for assets relating to more volatile liabilities, such as life unit-linked portfolios.

JEL Classification: G01, G11, G22, G28.
Keywords: insurance companies, investments, pandemic, financial stability, solvency ratio.
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Contents

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1. Introduction[1]

Insurance companies are important investors in financial markets and play a key role in the financing of the economy. In Europe they hold securities for €6 trillion, compared to respectively 5 and about 12 trillion for banks and investment funds (as of December 2019; Securities Holdings Statistics, ECB). Insurers are traditionally considered as long-term investors as they typically hold assets until maturity. Their peculiar liability structure makes insurance companies natural holders of illiquid assets (Chodorow-reich et al., 2021): they tend to issue stable, predictable, long-term liabilities and are not subject to runs like other institutional investors (e.g. open-end mutual funds).[2] Given their stable liability structure, insurers tend to buy assets whose price has fallen (Timmer, 2018), suffering losses on their security holdings in the short-run in order to make higher profits in the long-term.[3] Therefore, insurers are able to play a stabilizing role in periods of financial turmoil and market dislocation, acting as "shock absorbers".

However, insurers' ability to stabilize financial market relies on maintaining good financial health as they should have enough balance sheet capacity to absorb the short-term losses on security holdings and the related increase in the riskiness of assets (Chodorow-reich et al., 2021; Fache Rousová and Giuzio, 2019). If market conditions deteriorate sufficiently, insurers suffer significant losses on a large number of securities and experience a negative shock to equity, which reduces their balance sheet capacity. Indeed, since capital requirements, accounting rules, and internal risk management make insurers' capital sensitive to market price changes,[4] intermediaries face a combination of regulatory and risk management pressures during severe crisis periods that may push insurers to reduce their exposure to risky assets in order to restore their financial position (i.e. de-risking). If insurers buy less assets whose price has fallen (or even start to sell these securities) when financial markets conditions deteriorate abruptly, their ability to play a stabilizing role may diminish during a crisis, exactly when it is most valuable.

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[1] We thank M. Bucca, F. Farabullini, L. Menconi, and A. Silvagni (IVASS) for their support in data collection. The work benefited from the useful comments of F. Columba, M. Cosconati, A. De Pascalis, A. De Vincenzo, A. Di Cesare, F. Palazzo, S. Pasqualini, and the participants at the Bank of Italy and IVASS Workshop (Rome, July 2021) and at the internal seminars of our Directorate. All remaining errors are the authors' responsibility only. The views expressed are those of the authors and do not necessarily reflect those of the Bank of Italy.

[2] About 60 per cent of Italian insurers' liabilities derive from long-term with-profits life policies. These products grant holders minimum return guarantees against early redemption fees that prevent investors from withdrawing funds when prices fall.

[3] As assessed in the financial literature (Timmer, 2018), returns on securities are positively autocorrelated at short horizons but negatively correlated at longer ones. Therefore, buying securities whose price has fallen is unprofitable in the short-term, while this strategy pays off in the long run. For investors with a stable liability structure, such as insurers, it is rationale to maximize their profits by adopting a long-term strategy: buy potentially undervalued securities and wait until the prices revert.

[4] Insurers have to value their assets based on the market value.

A growing literature investigates the role played by insurers in financial markets. A first strand of literature supports the traditional view of insurance companies as market stabilizers, showing that European insurers tend to buy bonds whose price has fallen, in contrast to investment funds that usually reduce their exposure after a decline in the market value of assets (Czech and Roberts-Sklar, 2019; Timmer, 2018). However, this hypothesis has been challenged by recent financial stress episodes. Indeed, several works suggest that also insurers can take investment decisions positively correlated with market price dynamics when insurers' solvency requirements and internal risk limits become binding relatively quickly. In particular, Bank of England and Procyclicality Working Group (2014), Duijm and Steins Bisschop (2018), and Bijlsma and Vermeulen (2016) indicate that European insurers sold riskier securities during the dot-com bubble, the subprime crisis and the sovereign debt crisis, respectively.

A related strand of literature shows that insurers' investment decisions significantly rely on capital considerations (Becker and Ivashina, 2015; Ellul et al., 2011; Hanley and Nikolova, 2021; Merrill et al., 2012; Murray and Nikolova, 2021; Nanda et al., 2019). In particular, Fache Rousová and Giuzio (2019) show that European insurers may adopt strategies in contrast to their traditional role of shock absorbers for investments in public bonds when they face an increase in the risk premia of assets, since it may cause a deterioration of their solvency position. More recently, an analysis of the Deutsche Bundesbank (2020) reports that in the first quarter of 2020 sufficient capital buffers allowed German insurers to increase their holdings of risky securities more than other institutional investors.

The aim of this paper is to try to answer the following questions. First, do on average insurance companies act as shock absorbers, increasing their relative exposure to securities whose price has fallen, and to what extent this behaviour depends on insurers' liability type? Second, did the ability of insurers to stabilize financial markets diminish after the Covid-19 outbreak as a consequence of risk management constraints that became binding after the significant reduction in the value of their assets? Third, did the ability of insurers to act as shock absorbers during the pandemic depend on their financial conditions as the more recent literature would suggest? Fourth, did investment strategies vary across asset classes depending on their riskiness and regulatory treatment?

To answer these questions we focus on the Italian insurance market. Insurance companies are among the largest Italian institutional investors. As of December 2019, they managed over €900 billion of securities; their investments amounted to 52 per cent of GDP and they represented 14 per cent of the investments of the European insurance sector (Securities Holdings Statistics, ECB). We analyse a unique granular security-by-security holding dataset provided by the Italian supervisory authority (IVASS) and we test how the investments in a single security varies when its price changes. In addition to previous works on the investments of insurance companies, our data allows us to run

our models by distinguishing investments based on their corresponding liability type. Examining potential heterogeneity in the stability of liabilities across sub-portfolios provides a unique insight into the relationship between insurers' business models and their investment strategies. Moreover, we contrast pre and post Covid-19 outbreak results and we analyse the sensitivity of insurers' investment decisions to regulatory-driven incentives by exploiting cross-sectional heterogeneity across asset classes with a different regulatory treatment and across companies with different solvency levels.

We contribute to the literature on the investment decisions of insurers during crises by studying the impact of a significant shock as the pandemic outbreak. The Covid-19 outbreak is a clear case of an exogenous shock to the financial system originating in the real economy. The impact of the pandemic hit the expected profitability of firms and caused the fall of equity and bond prices. The financial turmoil in March 2020 led to a demand for safe assets (flight-to-quality) and, subsequently, to a dash-for-cash; non-government money market funds and corporate bond funds recorded significant outflows. Many asset markets became illiquid, especially the high-yield and the emerging markets segments. In the second quarter of 2020, following monetary and fiscal unprecedented policy actions, financial market conditions gradually normalized and prices stabilized, though at levels generally lower than before the start of the crisis. These developments were different from past financial crises, like the sub-prime and the sovereign debt ones, which typically started in the financial system and for which the endogenous reaction of market participants was a major driving force. The Covid-19 outbreak represents instead a much clearer set up to test the reaction of investors to price changes during a crisis.[5] Interestingly, it was the first significant shock after the entry into force of Solvency II, which raised the sensitivity of insurers' capital to the riskiness of assets. Therefore, our results allow to assessing more generally the reaction of the insurance sector when financial market conditions deteriorate abruptly and capital constraints become binding.

Moreover, several previous works consider only corporate or public bonds and aggregate information at the insurer level. In contrast, we focus on all the main asset classes, with data at the portfolio-security level. As a result, we are able to examine investment decisions on basically the whole portfolio of securities and to verify the impact of the insurers' business model, comparing different sub-portfolios associated to less (e.g. unit-linked liabilities) or more stable (e.g. with-profit) liabilities.

Our results show that Italian insurers usually increase their exposure to securities whose price has fallen for all the main asset classes, mitigating the impact of shocks on financial markets. However, we find that the insurers' ability to weather shocks diminished on average after the pandemic

[5] Differently from the sovereign debt crisis, the pandemic one also determined a rise in the uncertainty in future premium income that may have induced insurers to adopt more risk-averse investment strategies.

outbreak. In particular, from 2017 to 2019, a 1 per cent decrease in the price of an asset determined on average a 12 per cent increase of the share of that same asset in the insurer's portfolio; during the pandemic outbreak (i.e. the first half of 2020) the impact remained positive but decreased to 2 per cent.

At the same time, we show that the ability to play a stabilizing role heavily depends on the insurers' business model. Specifically, insurers did not adopt a long-term approach for investments in assets relating to more volatile liabilities: in particular, insurers *reduced* their average exposure to securities included in unit-linked portfolios following a fall in their price, both before and after the pandemic outbreak.

Finally, we find that insurers' stabilizing role also depends in crisis times on capital considerations. Less capitalized insurers did not adopt investment decisions significantly different from those of more capitalized companies before the pandemic outbreak. However, they did not play a stabilizing role during the crisis: for insurers falling in the lower solvency ratio quartile, a 1 per cent decrease in the price of an asset determined on average a reduction between 4 and 7 per cent (depending on the model specification) in the share of the same asset over the total portfolio. In addition, after the pandemic outbreak, regulatory-driven incentives also affected investment strategies for assets more exposed to the risk of an increase in capital absorption. Indeed, we find that, during the crisis, insurers did not play a stabilizing role in the corporate bond market, especially for BBB-rated bonds.

Our results fall in between the traditional view that points to the stabilizing role of insurers, and the more recent literature arguing that during a financial crisis insurers may actually contribute to market volatility, similarly to other institutional investors, like investment funds. On the one side, our paper tends to downplay the financial stability concerns related to the possible destabilizing role of insurers in a financial turmoil, showing that companies with higher capital levels continued to act as shock absorbers also during the most acute phase of the pandemic crisis. On the other side, it points to two qualifying effects that call for specific monitoring by financial authorities and that should be taken into account in evaluating policies. First, the investment strategies of insurance companies crucially depend on capital constraints that under adverse scenarios may become binding for more vulnerable companies or for more risky and capital intensive assets. This result points to a crucial role of regulation for financial stability considerations. Second, the traditional stabilizing role of insurers depends on the business model of insurers. In particular, companies that rely more on unit-linked products are less able to absorb market shocks and act as long-time investors. Therefore, shifts in the insurers' liability structure away from life not unit-linked policies may reduce their ability of stabilize financial markets.

The remainder of this paper is organized as follows. Sections 2 and 3 describe data and methodology. We present our main results in Section 4 and test their robustness to different extensions of the main model in Section 5. Section 6 concludes.

2. Data and sample

Our analysis relies upon a dataset provided by the Italian supervisory authority for insurance companies, collected for supervisory purposes. The dataset consists of quarterly, security-by-security holdings for each Italian insurance company supervised by IVASS (96 companies, as of December 2019) between the first quarter of 2017 and the third quarter of 2020. The data include both nominal and market values of each position, as well as the security type. We consider all main asset classes, namely public bonds, corporate bonds, equities, money market funds and other investment funds. Moreover, for each security we retrieved the corresponding portfolio, distinguishing investments based on their liability type: life unit-linked, life not unit-linked (or with profit) and other liabilities.[6]

We enriched the dataset with information from the Centralized Securities Database (CSDB) of the European System of Central Banks (ESCB). In particular, for each asset, we included end-of-quarter and quarterly average market prices, the outstanding amount, the country and the industry of the issuer, as well as the credit rating of the instrument.

Finally, we obtained accounting information of insurers from supervisory reports. This data includes quarterly solvency ratios, premium income and losses (distinguishing non-life, life unit-linked, and life not unit-linked), and yearly total assets and return on equity.

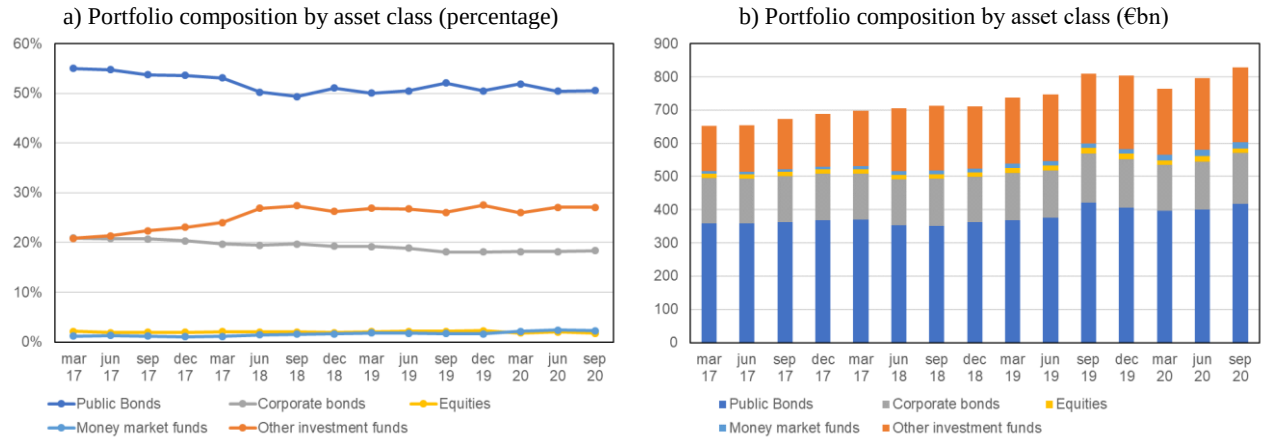
The insurers provide this data for supervisory purposes under Solvency II. The introduction of this framework in 2016 raised the sensitivity of insurers' regulatory requirements to the riskiness of their assets. Indeed, assets are valued at their market price when available or at an adjusted market price of a comparable security when it is not, while the value of the liabilities is equal to the sum of technical provisions and risk margin.[7] In our analysis, we focus on traded securities, which are on average about 84 per cent of Italian insurers' total investments. Over 80 per cent of excluded assets are not publicly issued equities. We also exclude assets with no available information in CSDB, hybrid securities, and derivative positions.

Figure 1 shows the portfolio composition of Italian insurance companies, valued at market prices. Public bonds are the main asset class, representing more than 50 per cent of the total value of the portfolio, even though their share experienced a reduction (from 55 to 50 per cent) since the beginning

[6] This category includes non-life, own funds, and general portfolios.
[7] The technical provisions' value is equal to the present value of future expected negative cash flows arising from the insurers' operation. The risk margin is computed as the product between the present value of the expected regulatory capital and the insurance's cost of capital.

of 2017 (Figure 1, panel a). The remaining investments are mainly allocated in investment fund shares and corporate bonds. The share of the former investments increased since 2017, reaching 27 per cent of the portfolio in September 2020, while the share of corporate bonds diminished from 21 to 18 per cent in the same period. Finally, money market fund shares and equities represent a negligible fraction of investments. Asset composition varies considerably across portfolios. In particular, investment fund shares represent the large majority of securities included in unit-linked portfolios (about 85 per cent of the overall assets, as of December 2019), while they account for a lower share of not unit-linked portfolios (13 per cent).

Figure 1 – The investments of Italian insurers



Note. Securities are valued at market prices. The figures show the securities included in the sample of the analysis. Therefore, they do not include not publicly traded securities, assets with no available information in CSDB, hybrid securities, and derivative positions.

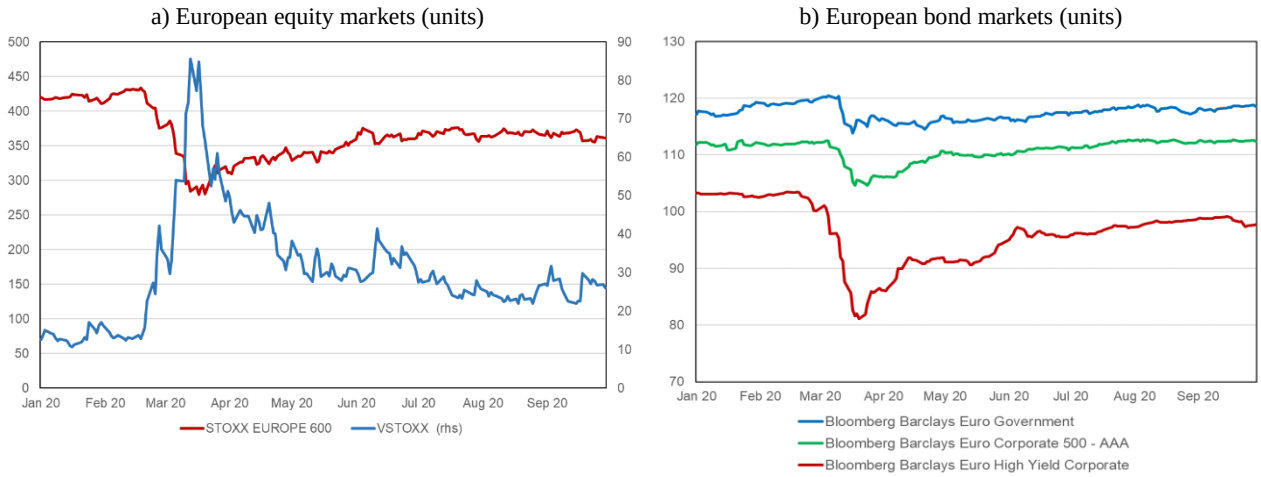
The value of insurers' investments constantly increased before the Covid-19 outbreak (Figure 1, panel b). In contrast, we observe a main drop for all asset classes (except for money market funds) in March 2020, at the beginning of the pandemic crisis. The value of investments increased above pre-crisis level in the third quarter of 2020. Therefore, we focus on the first semester of 2020 to analyze the impact of the pandemic crisis on insurers' investment decisions.

The decrease in the market value of investments observed in March 2020 followed the European financial market dynamics, reported in Figure 2. Indeed, the pandemic outbreak led to an abrupt drop in market prices across all market segments. As anticipated in Section 1, market conditions improved starting from the end of March, especially following the interventions of the monetary authorities, but market prices remained below pre-crisis levels for many asset types until the last months of 2020.

Investments are divided into portfolios relating to different liability types: own funds, life and non-life policies. The life segment includes two main type of products: with-profits policies, characterized by the fact that the insurer guarantees a minimum return to the client, and unit-linked or index-linked policies, where the investment risk is generally borne by the subscriber. Figure 3 presents the

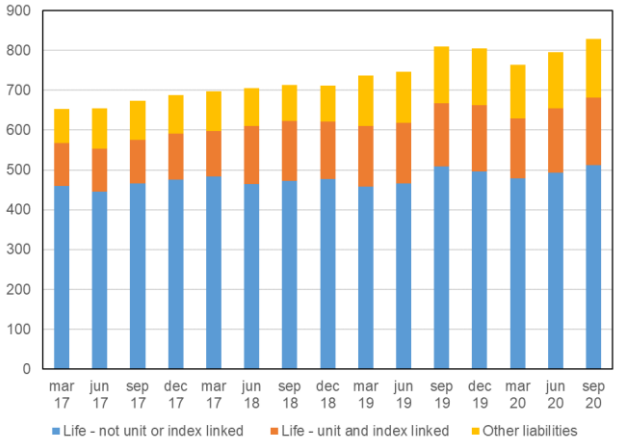
composition of insurers' investments by the corresponding liability type. Over 50 per cent of securities are relating to life not unit-linked policies, while the share of those relating to life unit-linked policies is about one fifth of the overall portfolio. The distinction between life unit-linked and not unit-linked liabilities is particularly significant also given their different volatility. Indeed, for the former policies, final investors can redeem their shares at short notice, while the latter are traditionally more stable.

Figure 2 – The European financial markets



Note. Source: Refinitiv. STOXX EUROPE 600 is an equity market index representing a fixed number of 600 companies across 17 countries of the European region. The VSTOXX index is an indicator of the implied volatility of the European equity market, reflecting the market expectations of equity volatility across all EURO STOXX 50 options over the next thirty days. The government index refers to sovereign bonds issued by Eurozone countries, while the corporate indexes refer to corporate bonds denominated in euro.

Figure 3 – Investments by corresponding liability type (€bn).



Note. Securities are valued at market prices. The "other liabilities" category includes non-life, shareholders' funds, and general portfolios.

As anticipated in Section 1, capital considerations may significantly affect insurers' investment decisions and good financial health should be a main requisite to act as shock absorbers. The solvency capital requirement (SCR) requires each insurer to hold, given its risk profile, an amount of resources

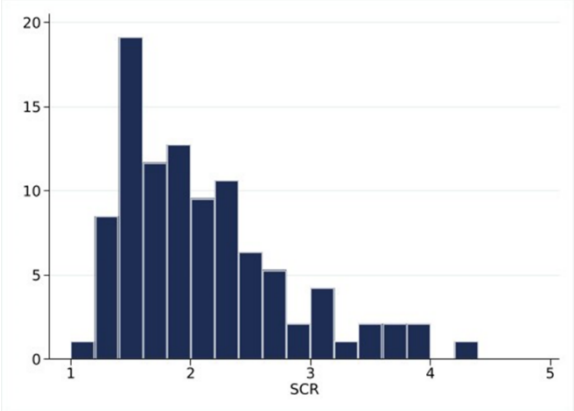
that would be sufficient in order to meet its obligations with a 99.5 per cent probability over a time horizon of one year.[8] The capital requirement is respected when own funds are equal or superior to the SCR (i.e. a solvency ratio equal to or higher than 1).

Figure 4 presents the percentage distribution of solvency capital ratios across Italian insurers, as of December 2019 (the last quarter before the shock). All Italian companies have a solvency ratio above the minimum required. However, the sample exhibits a considerable heterogeneity: while some insurers have a capitalization two, three or four times above the minimum, about 30 per cent of insurers has a ratio between 1.6 and 1.

As assessed in the literature (de Haan and Kakes, 2010), insurers usually hold much more capital than that required by supervisors. Indeed, empirical evidence suggests that insurers set higher capital targets for internal purposes, possibly in response to pressures of shareholders, rating agencies and internal risk management. Therefore, insurers are subject to internal capital constraints that become binding well before the regulatory ones. These constraints should be particularly binding for insurers with a solvency ratio closer to the regulatory minimum as they have clearly less balance sheet capacity to absorb an abrupt decline in the value of their assets.

The role played by multiple capital constraints motivates us to take into account the level of solvency ratios also in a sample of insurers with capital higher than required. Specifically, we examine whether investment decisions of relatively less capitalized companies were significantly different from those of better-capitalized intermediaries before and after the pandemic outbreak. We hypothesize that, during severe crisis periods, the ability of insurers to act as shock absorbers is negatively correlated with their solvency ratio.

Figure 4 – Distribution of insurers by solvency ratio (percentage).



Note. The figure presents the distribution of solvency ratios across Italian insurers, as of Dec. 2019. The solvency ratio is calculated as the ratio of own funds held for coverage to the solvency capital requirement established under Solvency II.

[8] The calculation of SCR for corporate bonds and sovereigns issued by not euro area countries depends on their credit ratings. In particular, the lower the bond rating, the higher the capital requirement.

3. Methodology and descriptive statistics

Our tests will empirically verify the following three main hypotheses:

H1. *Insurance companies usually act as shock absorbers, increasing their relative exposure to securities whose price has fallen.*

H2. *The ability of insurers to stabilize financial markets diminished after the Covid-19 outbreak.*

H3. *The ability of insurers to act as shock absorbers depends on their solvency: after the Covid-19 outbreak less capitalized insurers were less able to stabilize financial markets than better capitalized intermediaries.*

H4. *The ability of insurers to act as shock absorbers is lower for assets more exposed to the risk that a downgrade may lead to an increase in capital absorption (as for corporate bonds with respect to sovereign bonds).*

To test these hypotheses, first, we consider all securities held by insurers regardless of their corresponding liability type. In this step, however, we exclude assets relating to unit and index-linked policies: since gains and losses related to these products flow directly to customers, the investment decisions on corresponding assets generally lie with the policyholders (Bank of England and Procyclicality Working Group, 2014; European Commission, 2019). In addition, we exclude securities expiring in t and t_{+1} and securities issued in t as changes in the exposure to these assets may be not correlated with price changes.

We test *H1* and *H2* by estimating the model described in Eq. (1).

$$\Delta Share_{i,j,t} = \beta_1 \Delta P_{j,t}/P_{j,t-1} + \beta_2 \Delta P_{j,t}/P_{j,t-1} \cdot COVID_t + \eta_{i,j} + \varepsilon_{i,j,t} \quad (1)$$

The dependent variable, $\Delta Share$, is the change, between t and t_{-1}, in the percentage share of the portfolio of insurer i represented by asset j. Values of securities are expressed as of t_{-1} in order to avoid valuation effects. Therefore, $\Delta Share$ is estimated as:

$$\Delta Share_{i,j,t} = \left(\frac{P_{j,t-1} Q_{i,j,t}}{\sum_{s=1}^{S} P_{s,t-1} Q_{i,s,t}} - \frac{P_{j,t-1} Q_{i,j,t-1}}{\sum_{s=1}^{S} P_{s,t-1} Q_{i,s,t-1}} \right) * 100$$

where P is the market price of security j and Q represents the units of security j held by insurer i. Importantly, this measure is neutral to possible changes in the net inflows of financial resources of

insurers as long as the insurance maintain the proportion allocated to each security unaltered.[9] Moreover, consistent with Bijlsma and Vermeulen (2016), scaling by the overall amount of the portfolio and expressing the dependent variable as a share obsolete the use of time-varying controls at the insurer level as well as insurer-time fixed effects. In fact, for a given insurer, the average *ΔShare* is equal to 0 in each quarter.

$\Delta P_t/P_{t-1}$ indicates the percentage change, between t and t_{-1}, in the quarterly average price of asset j.[10] Consistent with *H1*, the coefficient of this variable should be significant and negative as we expect that insurers' investment decisions are negatively correlated with price changes.

In contrast, we expect that the coefficient of the interaction between $\Delta P_t/P_{t-1}$ and *COVID*, a dummy variable equal to 1 in the first and the second quarters of 2020, is significant and positive. Indeed the ability of insurers to stabilize financial markets should have diminished after the Covid-19 outbreak when the negative equity shock makes insurers' capital constraints more binding.

Finally, we include insurer-security fixed effects to control for observed and unobserved preference of insurers for specific securities. As a result, we observe the relationship between exposure variations and price changes across time for the same insurer-security combination.

In the second step we distinguish investments based on their corresponding liability type, estimating Eq. (1) separately for the securities included in life not unit-linked and life unit-linked portfolios. By employing this test, we verify whether the different stability of liabilities affects the ability of companies to act as shock absorbers for securities included in each portfolio.

Afterwards, in order to test *H3*, we expand Eq. (1) by interacting $\Delta P_t/P_{t-1}$ and *COVID* with *LowSCR*, a dummy that identifies less capitalized insurers (i.e. it is equal to 1 if the solvency ratio of insurer i is below the 25^{th} percentile of the distribution in the quarter before t). Eq. (2) describes the estimated model.

$$\Delta Share_{i,j,t} = \beta_1 \Delta P_{j,t}/P_{j,t-1} + \beta_2 \Delta P_{j,t}/P_{j,t-1} \cdot LowSCR_{i,t} + \beta_3 \Delta P_{j,t}/P_{j,t-1} \cdot COVID_t + \beta_4 \Delta P_{j,t}/P_{j,t-1} \cdot COVID_t \cdot LowSCR_{i,t} + \eta_{i,j} + \varepsilon_{i,j,t} \quad (2)$$

[9] For example, if net premiums collected by the insurance rise in one quarter by 5 per cent, *ΔShare* is not affected as long as the insurance raise the exposure to every existing position by 5 per cent. See, among others, Cutura et al. (2020) and Manconi et al. (2012) for the use of an analogous variable in the analysis of institutional investors' investment decisions. As a robustness, we also used the percentage change in asset holdings as the dependent variable (see Table A.1 in Appendix).

[10] The prices employed in the analysis exclude accrued interest or dividend payments (i.e., "clean" prices). We adopt contemporaneous changes in the quarterly average price of assets to take into account the abrupt repricing of securities after the pandemic outbreak. However, we highlight that our results are robust to adopting one-quarter lag price changes (observed at the end of the quarter; see Table A.1 in Appendix). In Section 5 we also present an additional robustness check to consider the bias owing to the impact of insurers' transactions on asset prices.

This model allows us to verify whether the relationship between changes in the exposure and those in prices is affected by the solvency ratio of insurers. Less capitalized insurers should not act differently than other ones in normal times (i.e., β_2 should be not significant). In contrast, consistent with *H3*, the coefficient of the triple interaction between $\Delta P_t/P_{t-1}$, *COVID*, and *LowSCR* should be significant and positive as we expect that, after the Covid-19 outbreak, the investment decisions of less capitalized insurers were more correlated with price changes than those of better capitalized intermediaries (i.e., β_4 should be significant and positive). Indeed, we hypothesize that a deterioration of market conditions reduces insurers' balance sheet capacity, especially for less capitalized ones, pushing them to reduce their exposure to risky assets in order to restore their financial position.

Moreover, in an alternative specification of the model, we also interact $\Delta P_t/P_{t-1}$ and *COVID* with *Controls*, a vector including time-varying characteristics of insurers, to control for the impact of other insurer-level factors that may affect the sensitivity of investment strategies to price changes before and after the pandemic outbreak. In this vector, to consider heterogeneity in activity, profitability and size, we adopt *LifeShare*, the ratio of life premiums to total premiums of insurer *i* in the quarter before *t*; *ROE*, the return on equity of insurer *i* in the year before *t*; *Size*, the logarithm of the total assets of insurer *i* in the year before *t*. We also introduce *Liquidity*, the ratio of losses to premium income of insurer *i* in the quarter before *t*, to take into account possible shocks in the premium income.

Finally, we test *H4* by interacting $\Delta P_t/P_{t-1}$ and $\Delta P_t/P_{t-1}\cdot COVID$ with *Corporate Bond*, a dummy variable equal to 1 for corporate bonds, and *Public Bond*, a dummy variable equal to 1 for public bonds. These interactions allow us to detect differences across asset classes both before and after the pandemic outbreak. Eq. (3) describes the estimated model.

$$\begin{aligned}\Delta Share_{i,j,t} = {} & \beta_1 \Delta P_{j,t}/P_{j,t-1} + \beta_2 \Delta P_{j,t}/P_{j,t-1} \cdot COVID_t + \beta_3 \Delta P_{j,t}/P_{j,t-1} \\ & \cdot Corporate\ Bond_j + \beta_4 \Delta P_{j,t}/P_{j,t-1} \cdot COVID_t \cdot Corporate\ Bond_j \\ & + \beta_5 \Delta P_{j,t}/P_{j,t-1} \cdot Public\ Bond_j + \beta_6 \Delta P_{j,t}/P_{j,t-1} \cdot COVID_t \cdot Public\ Bond_j \\ & + \eta_{i,j} + \varepsilon_{i,j,t}\end{aligned} \tag{3}$$

Table 1 shows a set of descriptive statistics on the main variables adopted in our analyses.[11] We observe that the average share of the insurers' portfolio represented by each asset is 29 basis points (bps). As expected, the volatility of exposure changes is limited as insurers act on average as long-term investors. In line with the financial market statistics described in Section 2, the average price changes of examined securities were significantly lower after the pandemic outbreak (-2.59 per cent on average *vs* 0.01 per cent before the pandemic).

[11] Variables are winsorized at the 1st and 99th percentiles to avoid outliers influencing the results.

Table 1 – Summary statistics

	Mean	P25	Median	P75	Std. Dev.
Share	0.29	0.01	0.05	0.16	1.14
ΔShare (%)	0.00	-0.10	0.00	0.12	3.63
$\Delta P_t/P_{t-1}$ (%)	0.01	-1.01	-0.13	1.00	3.64
$\Delta P_t/P_{t-1}$ in Q1-Q2.20 (%)	-2.59	-3.72	-1.63	-0.50	4.15
LowSCR	0.25	0.00	0.00	1.00	0.43
Liquidity	0.70	0.53	0.67	0.79	0.37
LifeShare	0.64	0.31	0.80	1.00	0.40
ROE	0.10	0.05	0.09	0.16	0.11
Size	9.27	8.21	9.58	10.64	1.90
BankShare	0.21	0.00	0.00	0.00	0.41

4. Results

4.1. The investments of Italian insurers before and after the pandemic outbreak

Table 2 shows the results obtained from the estimation of Eq. (1).[12] The estimates in column (1) indicate that, before the pandemic outbreak, an insurer on average increased their exposure by 3.6 bps, 12 per cent of the average share (29 bps), after a 1 per cent decrease in the price of asset *j*.[13] This result is consistent with *H1* as suggests that, in the period examined, Italian insurers usually increased their exposure to securities whose price had fallen and, consequently, acted as shock absorbers.

Moreover, the coefficient of the interaction between $\Delta P_t/P_{t-1}$ and *COVID* indicates that a change in market prices had a significantly different impact on insurers' investment decisions after the pandemic outbreak: a 1 per cent decrease in the price of asset *j* was associated with a small increase in the share of the same asset of 0.6 bps, 2 per cent of the average share.[14] The significant reduction in the sensitivity of insurers' investments to asset price changes suggests that the ability of insurers to stabilize financial markets may have diminished after the Covid-19 outbreak, in line with *H2*.

In column (2) we extend Eq. (1) by adding fixed effects at the issuer country level for each security, interacted with quarter time dummies. In this specification therefore we control for time-varying shocks that affect on average all securities issued in the same country. This is a particularly restrictive specification as the part of the effect associated with the widespread price reduction during the pandemic crisis is absorbed by fixed effects. The estimates in column (2) confirm our main findings,

[12] The results are robust to employing double-clustered standard errors at the insurer and security level (see Table A.1 in Appendix).

[13] Using the estimates in column (1) of Table 2, the average impact of a 1 per cent decrease in the price of asset *j* on the share of the insurer's portfolio represented by the same security before the pandemic outbreak was equal to: -0.0355*-1=0.036. Comparing this change in exposure with the average exposure to each asset, reported in Section 3, we obtain: 0.036/0.29=0.124.

[14] Using the estimates in column (1) of Table 2, the average impact of a 1 per cent decrease in the price of asset *j* on the share of the insurer's portfolio represented by the same security after the pandemic outbreak was equal to: (-0.0355+0.0299)*-1=0.006 (with a *p*-value of 0.087). The coefficient calculated by using estimates in column (2) is slightly larger (0.014) and statistically significant at the 1 per cent level.

suggesting that before (after) the pandemic outbreak a 1 per cent price decrease was associated with a 13 (5) per cent increase in the average share.

Therefore our evidence suggests that *H1* and *H2* cannot be rejected: Italian insurers usually increase their exposure to securities whose price has dropped, stabilizing financial markets; however, their ability to absorb shocks diminished after the pandemic outbreak.

Overall, we highlight that the observed loss of the ability to absorb shocks does not imply that Italian insurers provide no shock absorption during the pandemic-related financial turmoil. Indeed, insurers have on average increased their exposure to securities with negative price changes also in the first semester of 2020.

Table 2 – The investments of Italian insurers before and after the pandemic outbreak

	(1)	*(2)*
	ΔShare	*ΔShare*
$\Delta P_t/P_{t-1}$	-0.0355***	-0.0370***
	(0.0000)	(0.0000)
$\Delta P_t/P_{t-1}$·COVID	0.0299***	0.0227***
	(0.0000)	(0.0000)
Insurer·Security FE	*Yes*	*Yes*
IssuerCountry·Time FE	*No*	*Yes*
Observations	391,198	391,063
Adj R-squared	0.098	0.101

Note. Column (1) shows the results obtained from the estimation of Eq. (1). In column (2) we add issuer country-time fixed effects. The dependent variable is *ΔShare*, the change, between *t* and t_{-1}, in the percentage share of the portfolio of insurer *i* represented by asset *j*. Robust *p*-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.2. The investments of insurers by their corresponding liability type

As anticipated in Section 1, investment decisions for each investor crucially depend on its liability structure. Indeed, insurers are traditionally identified as long-term investors because they issue stable and predictable liabilities. However, there are some significant differences across insurers' liability types.

Insurance companies are directly exposed to the investment risk for assets included in life not unit-linked portfolios, while the risk is entirely borne by policyholders for life unit and index-linked policies. As anticipated in Section 3, the asset allocation of unit-linked portfolios is closely affected by the decisions of policyholders. Moreover, final investors can redeem their unit-linked policies at short notice, increasing the volatility of related liabilities. Given the limited role of insurers in the investment decisions and the lower stability of the corresponding liability, insurers may not act as shock absorbers for assets relating to unit-linked policies. For these products, given the similarities in the corresponding asset-liability matching, insurers should act as open-ended funds, which usually take investment decisions positively correlated with financial market conditions (Timmer, 2018). As

a result, we may expect that changes in the insurers' exposure to securities included in unit-linked portfolios are positively correlated with price changes.

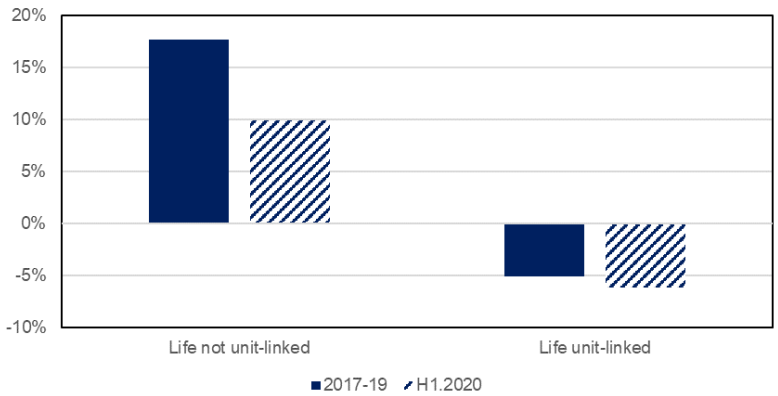
Table 3 shows the results of Eq. (1) by distinguishing portfolios based on their corresponding liability type (in columns 2 and 4 we add issuer country-time fixed effects). Figure 5 represents the same evidence by indicating the average impact of a 1 per cent decrease in the price of asset *j* on the share of the insurer's portfolio represented by the same asset, expressed as a percentage of the average share in each portfolio.

Table 3 – The investments of Italian insurers distinguishing assets by their corresponding liability type

	(1) *Life not unit-linked*	*(2)* *Life not unit-linked*	*(3)* *Life unit-linked*	*(4)* *Life unit-linked*
$\Delta P_t/P_{t-1}$	-0.0193***	-0.0277***	0.0004	0.0019**
	(0.0000)	(0.0000)	(0.5436)	(0.0111)
$\Delta P_t/P_{t-1}$·COVID	0.0157***	0.0122***	0.0028**	0.0004
	(0.0000)	(0.0022)	(0.0278)	(0.7895)
Insurer·Security FE	*Yes*	*Yes*	*Yes*	*Yes*
IssuerCountry·Time FE	*No*	*Yes*	*No*	*Yes*
Observations	243,353	243,245	301,536	301,345
Adj R-squared	0.112	0.115	0.039	0.040

Note. The table shows the results of Eq. (1) obtained by distinguishing investments based on their corresponding liability type: life not unit-linked (column 1) and life unit-linked (column 3). In columns (2) and (4) we add issuer country-time fixed effects. Investments in securities relating to the other portfolios (non-life, own funds, and general) are excluded. The dependent variable is *ΔShare*, the change, between *t* and *t-1*, in the percentage share of the portfolio of insurer *i* represented by asset *j*. Robust *p*-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Figure 5 – The average impact of a 1 per cent decrease in the price of asset *j* on the share of the insurer's portfolio represented by asset *j*, expressed as a percentage of the average share in each portfolio



Note. The average impact for each period and portfolio is calculated as the ratio of the corresponding coefficient reported in columns (2) and (4) of Table 3, multiplied by the hypothesized price change (-1 per cent), to the average share for that portfolio.

We highlight that insurers' investment decisions are significantly different across portfolios. For assets included in life not unit-linked portfolios (columns 1 and 2), a 1 per cent decrease in the price of an asset was associated with an increase in the average share of the same asset ranging from 12 to

18 per cent before the pandemic outbreak and between 2 and 10 per cent in the first half of 2020, in line with the results presented in Section 4.1.[15]

In contrast, for securities included in life unit-linked portfolios, investment decisions were positively correlated with price changes in both periods (columns 3 and 4). In particular, for securities in this portfolio, a 1 per cent price reduction was associated with a *decrease* (between 1 and 5 per cent) in the average share both before and after the pandemic outbreak. As hypothesized, the ability of insurers to act as shock absorbers heavily depends on the characteristics and stability of the corresponding liabilities.[16]

The adoption of insurer-security fixed effects in these models mitigates the potential bias associated with differences in portfolio composition across liability types. Indeed, as underlined in Section 2, investments relating to unit-linked products are mostly concentrated in fund shares, while those relating to not unit-linked policies are more diversified across asset classes.[17]

4.3. The investments of insurers by considering heterogeneity in solvency ratios

The results of Eq. (2) are reported in Table 4 and in Figure 6, which shows the average impact of a 1 per cent decrease in the price of asset *j* (expressed as a percentage of the average share), by distinguishing insurers in the lower solvency ratio quartile (*LowSCR*) and other companies.

Columns (1) and (2) present the results of Eq. (2) without and with issuer country-time fixed effects, respectively. Our evidence suggests that insurers' investment decisions depended on their capital level only in crisis times. Indeed, the not significant coefficient of the interaction between $\Delta P_t/P_{t-1}$ and *LowSCR* in both columns indicates that the sensitivity of less capitalized insurers' investments to price changes is not significantly different on average from that of other companies in normal times. This result excludes significant differences in investment decisions between the two groups of insurers before the pandemic outbreak.

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[15] In 2019 there was a reform of the accounting rules for new with-profits life contracts (separated accounts). In particular, for these contracts insurers may choose not to distribute immediately to policyholders the realized gains from security transactions and place them for up to eight years in an ad hoc reserve account. This regulatory reform may induce insurers to sell securities in separated accounts and significantly increase the correlation between asset price changes and investment decisions. However, as the reform applies only to new contracts, the effect on our results is negligible: these policies amounted to €3 billion at the end of 2020 (about 0.5 per cent of assets relating to life not unit-linked policies).

[16] Unreported results show that *H1* and *H2* hold also for investments in securities relating to the other portfolios (non-life, own funds, and general). The corresponding liabilities have usually a lower maturity than that of life not unit-linked, but are on average more stable than life unit-linked (e.g. non-life products have typically a term of one year). As a result, changes in the exposure for securities included in the other portfolios are negatively correlated with market price changes, but the insurers' ability to absorb shocks for the corresponding assets was on average lower than that for investments relating to life not unit-linked policies.

[17] An unreported robustness check confirms that our results are robust to estimating Eq. (1) by employing the samples that include only investment fund shares for both portfolios (corresponding to different types of liabilities).

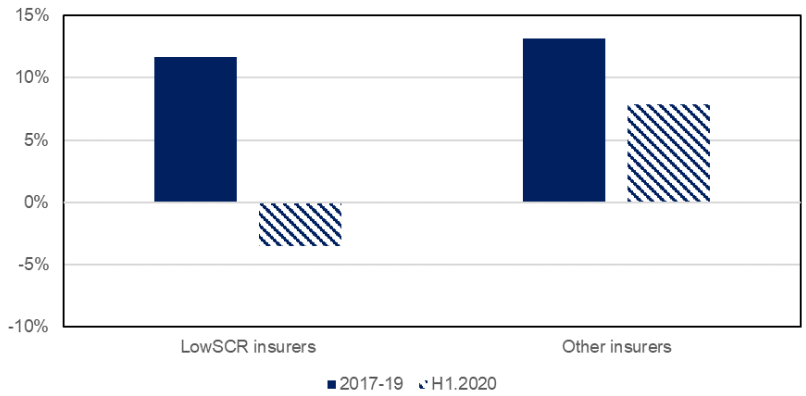
In contrast, consistent with *H3*, the coefficient of the triple interaction between $\Delta P_t/P_{t-1}$, *COVID*, and *LowSCR* is significant and positive, suggesting that, after the Covid-19 outbreak, the investment decisions of less capitalized insurers were more positively correlated with price changes than those of better capitalized intermediaries.

Table 4 – The investments of Italian insurers before and after the pandemic outbreak – heterogeneity in solvency ratios across insurers

	(1) *ΔShare*	*(2)* *ΔShare*	*(3)* *ΔShare*	*(4)* *ΔShare*
$\Delta P_t/P_{t-1}$	-0.0341***	-0.0359***	-0.1100***	-
	(0.0000)	(0.0000)	(0.0000)	
$\Delta P_t/P_{t-1}$·LowSCR	-0.0048	-0.0034	-0.0018	0.0003
	(0.3494)	(0.5111)	(0.7419)	(0.9593)
$\Delta P_t/P_{t-1}$·COVID	0.0207***	0.0144***	-0.0342	-
	(0.0000)	(0.0019)	(0.3063)	
$\Delta P_t/P_{t-1}$·COVID·LowSCR	0.0408***	0.0368***	0.0582***	0.0428***
	(0.0001)	(0.0003)	(0.0000)	(0.0002)
Controls·$\Delta P_t/P_{t-1}$·COVID	*No*	*No*	*Yes*	*No*
Insurer·Security FE	*Yes*	*Yes*	*Yes*	*No*
IssuerCountry·Time FE	*No*	*Yes*	*No*	*No*
Security·Time FE	*No*	*No*	*No*	*Yes*
Observations	391,198	391,063	391,198	343,759
Adj R-squared	0.100	0.102	0.100	0.175

Note. Column (1) shows the results obtained from the estimation of Eq. (2). In column (2) we add issuer country-time fixed effects. In column (3) we include insurer-level controls (*Liquidity*, *LifeShare*, *ROE* and *Size*) interacted with $\Delta P_t/P_{t-1}$ and *COVID*. In column (4) we add security-time fixed effects. The dependent variable is *ΔShare*, the change, between t and t_{-1}, in the percentage share of the portfolio of insurer i represented by asset j. Robust p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Figure 6 – The average impact of a 1 per cent decrease in the price of asset *j* on the share of the insurer's portfolio represented by asset *j*, expressed as a percentage of the average share – *LowSCR* and other insurers



Note. The average impact for each period and group is calculated as the ratio of the corresponding coefficient reported in column (2) of Table 4, multiplied by the hypothesized price change (-1 per cent), to the average share for each group of insurers.

In particular, before the pandemic outbreak, a 1 per cent decrease in the price of an asset was associated with an about 13 per cent increase in the average share for both groups of insurers. After the pandemic outbreak, we observe that the same reduction in market prices led to a 5-8 per cent (depending on the model specification) increase in the average share for better capitalized companies

and to a 4-7 per cent *decrease* in the average share for less capitalized intermediaries. Therefore, in line with *H3*, these results suggest that the ability of insurers to act as shock absorbers in crisis times heavily depends on their solvency ratios.

The main findings are confirmed also by including insurer-level controls (*Liquidity*, *LifeShare*, *ROE* and *Size*) interacted with $\Delta P_t/P_{t-1}$ and *COVID* (column 3) and by adding security-time fixed effects (column 4).[18]

4.4. The investments of insurers by considering heterogeneity in asset classes

In this section, we test whether Italian insurers adopt different strategies across asset classes by focusing on investment behaviors adopted for the two largest types of securities in not unit-linked portfolios: corporate and public bonds. Column (1) of Table 5 shows the results of Eq. (3) in which we interact $\Delta P_t/P_{t-1}$ and $\Delta P_t/P_{t-1}$·*COVID* with *Corporate Bond*, a dummy variable equal to 1 for corporate bonds, and *Public Bond*, a dummy variable equal to 1 for public bonds.[19] The not significant coefficients of $\Delta P_t/P_{t-1}$·*Public Bond* and $\Delta P_t/P_{t-1}$·*COVID*·*Public Bond* suggest that both before and after the pandemic outbreak insurers did not adopt significantly different strategies in the public bond market (i.e. they play a stabilizing role) with respect to those employed for investing in fund shares and equities (our base group).

In contrast, the significant positive coefficient of $\Delta P_t/P_{t-1}$·*Corporate Bond* indicates that the sensitivity of insurers' investments to asset price changes was slightly lower for corporate bonds before the pandemic outbreak. In addition, the results indicate that investments in corporate bonds were *positively* correlated with price changes after the pandemic outbreak.[20] Therefore, our evidence suggests that insurers were not able to play a stabilizing role in the corporate bond market in the first half of 2020.

We verify whether this result depends on particular financial distress cases. Indeed, a reduction in the exposure to corporate bonds may be driven by an abrupt increase in the issuers' probability of default after the pandemic outbreak. To this end, we exclude securities downgraded in t_{-1} or issued by firms in the industries mostly affected by the pandemic shock.[21] Column (2) of Table 5 shows the

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[18] Our results are also robust to using a fixed threshold to identify less capitalized insurers, which therefore does not depend on the distribution of solvency ratio across companies in each quarter. Indeed, in an unreported test we replace in Eq. (2) *LowSCR* with a dummy variable equal to 1 if the solvency ratio of insurer *i* is below 1.4 in the quarter before *t*.

[19] Unreported robustness checks suggest that the following results are confirmed both in the subsample of domestic securities and in that of foreign ones.

[20] Using the estimates in column (1) of Table 5, the average impact of a 1 per cent decrease in the price of a corporate bond *j* on the share of the insurer's portfolio represented by the same security after the pandemic outbreak is equal to: (-0.0417+0.0390+0.0183+0.0206)*-1= -0.0362.

[21] In particular, consistent with ECB (2020), we consider as the most affected sectors: manufacturing, construction, trade, transport, accommodation and food service activities.

results of this test, indicating that the exposure of insurers to corporate bonds whose price had fallen decreased after the pandemic outbreak also by using this sample restriction.

Overall, the positive correlation between investment decisions and price changes for corporate bonds in the first half of 2020 may depend on regulatory-driven incentives. Rated corporate bonds are exposed to the risk that a downgrade may lead to an increase in capital absorption for insurers as the current regulatory framework assigns a different risk weight to each rating category. This risk is greater for BBB-rated bonds as the increase in capital absorption is greater for shifts from investment grade ratings to speculative grade ones. Column (3) enriches the model estimated in column (2) by interacting $\Delta P_t/P_{t-1}$ and $\Delta P_t/P_{t-1}$·*COVID* with *BBB*, a dummy variable equal to 1 for corporate bonds with a rating between BBB+ and BBB- in t_{-1}. The not significant coefficient of $\Delta P_t/P_{t-1}$·*BBB* suggests that insurers' investment strategies were similar for all bonds before the pandemic crisis.

In contrast, after the Covid-19 outbreak, the investment decisions were positively correlated with price changes especially for BBB-rated bonds (i.e., the coefficient of $\Delta P_t/P_{t-1}$·*COVID*·*BBB* is significant and positive), suggesting that regulatory-driven incentives may significantly affect insurers' investment strategies during crisis periods.

Table 5 – The investments of Italian insurers before and after the pandemic outbreak across asset classes

	(1) *Heterogeneity across asset classes*	*(2)* *Corp. bonds (excl. downgraded and most affected)*	*(3)* *Corp. bonds (excl. downgraded and most affected) – BBB*
$\Delta P_t/P_{t-1}$	-0.0417***	-0.0245***	-0.0211***
	(0.0000)	(0.0000)	(0.0000)
$\Delta P_t/P_{t-1}$·COVID	0.0390***	0.0641***	0.0462***
	(0.0000)	(0.0000)	(0.0000)
$\Delta P_t/P_{t-1}$·Corporate Bond	0.0183***	-	-
	(0.0000)		
$\Delta P_t/P_{t-1}$·COVID·Corporate Bond	0.0206**	-	-
	(0.0107)		
$\Delta P_t/P_{t-1}$·Public Bond	0.0070	-	-
	(0.3316)		
$\Delta P_t/P_{t-1}$·COVID·Public Bond	0.0031	-	-
	(0.8619)		
$\Delta P_t/P_{t-1}$·BBB	-	-	-0.0084
			(0.2185)
$\Delta P_t/P_{t-1}$·COVID·BBB	-	-	0.0355**
			(0.0103)
Insurer·Security FE	*Yes*	*Yes*	*Yes*
Observations	391,198	190,433	190,433
Adj R-squared	0.099	0.068	0.068

Note. Column (1) shows the results of Eq. (3) obtained by interacting $\Delta P_t/P_{t-1}$ and $\Delta P_t/P_{t-1}$·*COVID* with *Corporate Bond*, a dummy variable equal to 1 for corporate bonds, and *Public Bond*, a dummy variable equal to 1 for public bonds. Additional constitutive terms of interactions are not reported. Column (2) presents the results of Eq. (1) estimated by considering only corporate bonds and excluding those downgraded in t_{-1} or issued by firms in the industries mostly affected by the pandemic shock. Column (3) shows the model estimated in column (2) by interacting $\Delta P_t/P_{t-1}$ and $\Delta P_t/P_{t-1}$·*COVID* with *BBB*, a dummy variable equal to 1 for corporate bonds with a rating between BBB+ and BBB- in t_{-1}. The dependent variable is Δ*Share*, the change, between t and t_{-1}, in the percentage share of the portfolio of insurer i represented by asset j. Robust p-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5. Robustness checks

The following tables present a set of robustness checks to confirm the validity of the main findings. For space considerations, the following tests focus on Eq. (1) but the results are also robust to adopting other models.

First, we exclude securities with a high share held by Italian insurers.[22] Indeed, the price changes of assets mostly held by insurers might be significantly affected by the investment decisions of companies. Therefore, we calculate for each security the share of the outstanding amount held by the insurance sector and we exclude those falling in the top quarter of the distribution (i.e., securities of which insurers held more than about 10 per cent of the outstanding amount in t_{-1}). Column (1) of Table 6 shows that the main findings remain unchanged also by excluding these securities.

Table 6 – The investments of Italian insurers before and after the pandemic outbreak – robustness checks

	(1) *Excl. sec. largely held by insurers*	*(2)* *Falsification test 2019*	*(3)* *Insurers partly owned by banks*
$\Delta P_t/P_{t-1}$	-0.0207***	-0.0108***	-0.0409***
	(0.0000)	(0.0000)	(0.0000)
$\Delta P_t/P_{t-1}$·COVID	0.0081**	-0.0481***	0.0351***
	(0.0202)	(0.0000)	(0.0000)
$\Delta P_t/P_{t-1}$·BankShare	-	-	0.0262***
			(0.0000)
$\Delta P_t/P_{t-1}$·COVID·BankShare	-	-	-0.0266***
			(0.0026)
Insurer·Security FE	*Yes*	*Yes*	*Yes*
Observations	268,949	391,198	391,198
Adj R-squared	0.101	0.098	0.099

Note. Column (1) shows the results of Eq. (1) obtained by excluding securities of which Italian insurers held more than about 10 per cent of the outstanding amount in t_{-1}. Column (2) reports the results of a falsification test: *COVID* is equal to 1 in the second semester of 2019. Column (3) reports the results of Eq. (1) estimated by including an interaction between $\Delta P_t/P_{t-1}$, *COVID*, and *BankShare*, which is a dummy equal to 1 if in t_{-1} a bank had a share of the capital of insurer *i* greater than 30 per cent. The dependent variable is $\Delta Share$, the change, between *t* and t_{-1}, in the percentage share of the portfolio of insurer *i* represented by asset *j*. Robust *p*-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Second, we estimate a falsification exercise to detect structural differences across insurers that may exist before the pandemic outbreak. To employ this test, we estimate Eq. (1) by considering as the date of the shock (i.e. quarters in which *COVID* is equal to 1) the second semester of 2019. Columns (2) reports the results of this test. The interaction coefficient between $\Delta P_t/P_{t-1}$ and *COVID* is negative, suggesting that the ability of insurers to stabilize financial markets had not diminished before the Covid-19 outbreak.

Third, we verify whether our results are affected by the presence of insurers partly owned by banks. Indeed, the share of insurers' capital held by banks is particularly considerable in Italy (Bank of Italy, 2021) and being part of a financial conglomerate may affect investment decisions in several ways.

[22] The results are also robust to excluding securities with a high share held by an individual insurer.

For instance, in line with Manconi et al. (2012), investors affiliated with banks may be less risk averse than others as they may benefit from an implicit support of their shareholders during market turmoil. However, given the interdependencies across financial sectors (Slijkerman et al., 2013), insurers that are part of a financial conglomerate may be potentially more exposed to the transmission of a shock originating in the banking sector.

Column (3) reports the result of Eq. (1) estimated by including an interaction between $\Delta P_t/P_{t-1}$, *COVID*, and *BankShare*, which is a dummy equal to 1 if in t_{-1} a bank had a share of the capital of insurer *i* greater than 30 per cent (results hold also by increasing this threshold to 50 and 100 per cent). We observe that our main findings also hold in this specification. Moreover, the positive coefficient of $\Delta P_t/P_{t-1}$·*BankShare* implies that, before the pandemic outbreak, insurers partly owned by banks exhibited a lower ability to play a stabilizing role than other insurance companies. However, we do not observe a significant difference in terms of investment decisions between the two groups of companies during the pandemic-related crisis. Indeed, the coefficient of the interaction between $\Delta P_t/P_{t-1}$, *COVID*, and *BankShare* has the opposite sign and approximately the same magnitude of the positive coefficient of $\Delta P_t/P_{t-1}$·*BankShare*, consequently the difference between the two groups after the pandemic outbreak (i.e. the sum of these coefficients) is about zero.

Finally, the robustness checks reported in Table A.1 in Appendix show that the results are robust to using the percentage change in asset holdings as the dependent variable (in this case we include insurer-time controls) and using a closed sample of insurers (i.e., only intermediaries operating in all considered quarters).

6. Conclusions

This paper investigates the Italian insurers' investment decisions before and after the pandemic outbreak. The analysis suggests that insurance companies usually increase their exposure to securities whose price has fallen, stabilizing financial markets and reducing the magnitude of negative shocks. However, the ability to play the role of shock absorbers heavily depends on the volatility of liabilities and financial market conditions. Indeed, we find that insurers do not play a stabilizing role for securities included in the unit-linked portfolios, which are liabilities more volatile than traditional life not unit-linked products. Moreover, the ability to act as shock absorbers significantly diminishes after a severe worsening of financial market conditions, such as that observed after the pandemic outbreak.

This last result appears to be linked to the fact that capital constraints became more binding during the crisis. Indeed, we find that during severe crisis periods the ability of insurers to act as shock absorbers is negatively correlated with their capital level: less capitalized insurers were not able to play a stabilizing role after the pandemic outbreak. This interpretation is also consistent with the

evidence that the fall in the ability to act as shock absorbers after the pandemic was larger for assets more exposed to the risk of an increase in capital absorption (e.g., BBB-rated corporate bonds).

Overall, our results have several policy implications. Our analysis points out that Italian insurers on average did not contribute to raise market volatility during a severe financial turmoil, as the pandemic-induced one. In particular, our evidence implies that insurers on average continued to act as shock absorbers also after the introduction of a new more risk-sensitive prudential framework, as Solvency II.[23] However, the ability of insurers to absorb shocks should not be taken for granted as it is heavily affected by their capital requirements. Indeed, maintaining an adequate capital level is essential to preserve insurers' ability to absorb a financial shock and, therefore, to play a stabilizing role when this function is most valuable, as during crisis periods. Our analysis contributes to explain how insurers may react also to other shocks, different from the pandemic one. In particular, our results can be extended to periods in which an abrupt and widespread fall of asset prices reduces insurers' balance sheet capacity to absorb short-term losses on their security holdings.

Finally, insurers' portfolio decisions also depend on the characteristics of their liabilities. Our results suggest that the investment decisions of a hypothetical insurance company that exclusively rely on unit-linked policies should not be very different from those of open-ended funds, which instead tend to amplify market shocks. Also in this case our analysis provides useful insights on insurers' investment behavior that will hold after the end of the health emergency.

These findings point to avenues for future research. For example, further analyses may explore the direct impact of regulatory changes on insurers' investment behavior or compare investment decisions of the Italian insurance sector with those taken by insurers in other countries.

[23] However, the regulatory framework includes a set of macroprudential stabilisers (e.g., the volatility adjustment) to mitigate the impact of shocks on insurers' solvency ratios.

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Appendix

Table A.1 – Additional results

	(1) *End of the quarter asset prices*	*(2)* *Double-clustered standard errors*	*(3)* *Closed sample*	*(4)* *Change in asset holdings*
ΔP(end of the quarter) $_{t-1}$	-0.0291***	-	-	-
	(0.0000)			
ΔP(end of the quarter)$_{t-1}$·COVID	0.0321***	-	-	-
	(0.0000)			
$\Delta P_t/P_{t-1}$	-	-0.0355***	-0.0356***	-0.6473***
		(0.0000)	(0.0000)	(0.0000)
$\Delta P_t/P_{t-1}$·COVID	-	0.0299***	0.0291***	0.3829***
		(0.0000)	(0.0000)	(0.0000)
Insurer·Security FE	*Yes*	*Yes*	*Yes*	*No*
Insurer·Time FE	*No*	*No*	*No*	*Yes*
Security FE	*No*	*No*	*No*	*Yes*
Observations	391,198	391,198	383,273	391,126
Adj R-squared	0.099	0.098	0.096	0.065

Note. Column (1) shows the results obtained from the estimation of Eq. (1) by replacing the change in quarterly average price of asset *j* with the change in asset prices at the end of the previous quarter. Column (2) presents the results of Eq. (1) by double-clustering standard errors at the insurer and security level. Columns (3) shows the results of Eq. (1) by using a closed sample of insurers (i.e. only intermediaries operating in all considered quarters). The dependent variable in columns (1)-(3) is *ΔShare*, the change, between *t* and *t-1*, in the percentage share of the portfolio of insurer *i* represented by asset *j*. Finally, in column (4) we employ the percentage change in asset holdings as the dependent variable. In this model, we add insurer-time and security fixed effects. Robust *p*-values in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

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