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Did COVID-19 change life insurance offerings?

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Abstract

The profitability of life insurance offerings is contingent on accurate projections and pricing of mortality risk. The COVID-19 pandemic created significant uncertainty, with dire mortality predictions from early forecasts resulting in widespread government intervention and greater individual precaution that reduced the projected death toll. We analyze how life insurance companies changed pricing and offerings in response to COVID-19 using monthly data on term life insurance policies from Compulife. We estimate event-study models that exploit well-established variation in the COVID-19 mortality rate based on age and underlying health status. Despite the increase in mortality risk and significant uncertainty, the results generally indicate that life insurance companies did not increase premiums or decrease policy offerings due to COVID-19. Nonetheless, we find some evidence that premiums differentially increased for individuals with very high risk and that some policies were removed for the oldest of the old.

KEYWORDS

2019 novel coronavirus, COVID-19, SARS-CoV-2, severe acute respiratory syndrome 2, term life insurance

1 | INTRODUCTION

Since the 2019 novel coronavirus (SARS-CoV-2) first emerged, there has been substantial uncertainty regarding the magnitude of the increase in mortality risk. In March 2020, a highly cited study from Imperial College (Ferguson et al., 2020) reported that uncontrolled spread of coronavirus in the United States could lead to 2.2 million fatalities, based on key assumptions such as 80% of the population ultimately getting COVID-19 and an infection fatality rate (IFR) of 0.9%. The modeling led to widespread action by policymakers in the United States and other countries to reduce transmission; within 3 days of the publication, California implemented the first-in-the-nation shelter-in-place order (Friedson et al., 2020), and most other states followed quickly thereafter.

As of March 2021, the COVID-19 death toll in the United States has been substantially below this projection. The difference between the most pessimistic forecasts and actual fatalities is likely due to changes in behavior—such as better handwashing, staying home more, and wearing facemasks or social distancing when outside the home—that are partly voluntary and partly induced by government suppression and mitigation policies (Courtemanche et al., 2020; Hsiang et al., 2020; Lyu & Wehby, 2020). While the average IFR has been the subject of debate in the literature due to different methods of accounting for undetected mild or asymptomatic infections, most studies put it in the range of 0.5% to 1%—similar to the rate used by the Imperial College report, and an order of magnitude deadlier than the flu (Abbott & Douglas, 2020; Meyerowitz-Katz & Merone, 2020).

The duration and magnitude of increased mortality risk from COVID-19 are contingent on many uncertain events, such as the availability and efficacy of vaccines (Corum et al., 2020), the ability to implement technological innovations like pooled testing (Augenblick et al., 2020; Mandavilli, 2020), at-home testing, and contact tracing, and innovations in treating those who contract COVID-19 with therapeutics like Remdesivir (Beigel et al., 2020). In addition to these factors, health messaging has been conflated with political considerations, contributing to more uncertainty.

Underlying uncertainty about the direct and indirect effects of the virus, policy missteps, incorrect forecasts, and uncertainty about longer-run consequences all provide challenges for the life insurance industry, which relies on accurate estimates of mortality risk. In this study, we use monthly data on approximately 800,000 policies from 96 distinct companies listed on Compulife, a key distributor of life insurance quotes, to analyze the influence of COVID-19 on both term life insurance pricing and policy offerings. One key prediction is that insurance premiums should respond to exogenous changes in overall risk, which is precisely what happened due to COVID-19. Such short-run changes are well documented for automobile insurance, where reductions in driving and accident claims led to premium refunds early during the pandemic (Scism, 2020).

To analyze the influence of increased mortality risk on life insurance premiums and offerings, we exploit well-known and widely accepted variation in mortality risks from COVID-19 originating from age and comorbidities.[1] Those with chronic conditions or advanced age are far more likely than others to be hospitalized or die from the virus (CDC, US Centers for Disease Control, and Prevention, 2020). Early evidence from mainland China estimated IFR of 7.8% for those aged over 80 and over, 4.28% for those aged 70–79, and 1.93% for those aged 60–69, compared to 0.03% for young adults aged 20–29 (Verity et al., 2020). As a consequence, the direct health consequences of the virus (such as through mortality) and indirect effects (such as through foregone preventative care, mental health consequences, or rising obesity) are far more pronounced for older,

[1] There also appear to be stark COVID-19 disparities in the United States by race and ethnicity (Benitez et al., 2020; Selden & Berdahl, 2020), where the causes are only partially explained by current economic, health, and transmission factors.

less-healthy individuals than for younger, healthier individuals, especially for mortality in the short-run.[2]

This variation in mortality risk allows for the construction of treatment and control groups that we analyze using event-study models. Specifically, we estimate hedonic insurance pricing models by comparing the changes in premiums of policies offered to older individuals to those of policies offered to younger individuals. In addition, we compare the response of policies offered to relatively healthy younger individuals compared to relatively unhealthy older individuals (e.g., individuals in the lowest health category and those that smoke). This estimation approach allows us to difference out variation in pricing that might have occurred due to pandemic-induced changes in the bond and stock markets (which influence the profitability of life insurance products). In addition to analyzing changes in premiums, we also estimate the impact of the pandemic on policy offerings.

Overall, the analysis shows that life insurance companies generally did not respond to the changes in mortality risk by increasing premiums or reducing policy offerings for those that experienced the greatest change in mortality risk. However, we do find evidence that policies with the lowest prices and those offered to smokers in the worst health category did differentially increase premiums for policies offered to older individuals. This implies that the lack of an overall response is caused in part by market competition. In addition, we find that policies offered to the oldest of the old (age 75+) were differentially removed from the market consistent with Hendren (2013).

Although one might initially have expected large effects on life insurance premiums for the high-risk groups, several explanations—in addition to market competition—may account for the lack of meaningful overall responses. First, life insurance premiums account for the rise in mortality, unconditional on the infection. Although the case fatality rate (CFR) or IFR is much higher than other illnesses like the flu, there have been unprecedented steps such as lockdowns and behavior changes that should reduce the probability of infection. Put differently, with extensive underwriting, there should be very little adverse selection from individuals who currently have COVID-19 being able to successfully obtain policies (Cawley & Philipson, 1999; Harris & Yelowitz, 2014) and conditional on not yet receiving the diagnosis, mortality risk has not significantly increased.[3] Second, it is possible that even a "high-risk" life insurance customer who purchases a policy listed in our data is quite different from those who are currently dying from COVID-19 in terms of mortality risk. To date, more than one-third of deaths nationwide are from those residing in nursing homes (NYT, 2020), individuals who almost certainly would be rejected if applying for a new term life insurance policy. Recent commentary suggests that even accounting for excess deaths in New York City, the increased odds of death in 2020 for a 70-year-old are approximately 1 in 30 (NYC DOHMH, 2020; Rosenkranz, 2020). Third, even sizable transitory increases in risk would reflect small increases in annual premium as the price increase is spread over the term of the policy (e.g., 15 years).

[2]That said, some other possible health consequences arising from the spread of the virus include reduced economic activity, less pollution, fewer car accidents, more drug use, more domestic violence, and less capacity in the health care system for non-COVID-19 issues, some of which certainly affects younger and healthier groups. Almond (2006) shows long-lasting consequences from the 1918 influenza pandemic. In addition, some of the precautions that individuals take against COVID-19 might also reduce the harm from other illnesses like influenza (Luhnow & Uribe, 2020; Olsen et al., 2020).

[3]Early in the pandemic, life insurance companies rapidly changed their underwriting guidelines, postponing issuance of life insurance for applicants with a COVID-19 diagnosis or exposure. For example, as of April 2020, AIG would only consider applicants 30 days after a full recovery from COVID-19 and a return to previous health status (BUA, 2020). See https://www.buaweb.com/news/AIG-underwriting-updates.html.

Another potential possibility for the lack of strong effects in our analysis is that the pandemic risk was largely in line with expectations and already taken into account in the premium structure. Several industry studies in the decade before the coronavirus pandemic recognize the need for pricing pandemic risk into life insurance premiums (e.g., SOA, 2007; Swiss, 2007), where once in 100-year benchmarks like the 1918 flu pandemic are considered in formulating appropriate reserve requirements. Pandemics, far more than other risks like natural disasters, industrial accidents, or terrorist attacks, pose solvency issues for insurers due to correlated risks (Huynh et al., 2013). By pricing in pandemic risk, overall insolvency issues from the coronavirus pandemic are unlikely to arise from life insurance claims; indeed, actual life insurance claims have been in line with the pre-COVID-19 scenarios (Richter & Wilson, 2020). However, given the rarity of pandemics (approximately 3%–4% per year per Huynh et al., 2013), the realized distribution of age-specific excess mortality can vary from one pandemic to the next; for example, the 1918 flu pandemic disproportionately affected young adults. Thus, the mortality pattern that emerged in early 2020 opens the possibility for life insurance companies to adjust their premiums based on observable characteristics like age and health because "the contributions to a mutual pooling arrangement or the premiums paid to a private insurer would need to vary based on the expected losses of each entity." (Hartwig et al., 2020).

The paper is organized as follows. Section 2 gives an overview of the life insurance market and a theoretical model of pricing. Section 3 describes the Compulife data. Section 4 presents the empirical specifications and results, and Section 5 concludes.

2 | BACKGROUND AND THEORY

The fundamental purpose of life insurance is to protect family members—often surviving spouses—against earning losses due to a breadwinner's mortality (Harris & Yelowitz, 2018), although there are hybrid life insurance products that also serve other purposes such as tax planning and investing. Life insurance coverage in the United States is widespread, with approximately 70% of households having some form of life insurance coverage in either the individual or group markets (Harris & Yelowitz, 2017). The two markets differ in that individual market premiums are experience-rated with extensive underwriting, while group markets typically have some form of community rating and guaranteed issue. There is considerable discussion of adverse selection and asymmetric information in the individual term life insurance market (see Cawley & Philipson, 1999; Harris & Yelowitz, 2014; He, 2009, 2011; Hedengren & Stratmann, 2016), and there are explicit mechanisms in contracts to discourage moral hazard (e.g., riders on suicide for the first several years).

Life insurance markets have evolved over the years, and many companies offer premium quotes online, which in turn allows for lower search costs, greater comparison shopping, and more vigorous price competition (Brown & Goolsbee, 2002). Industry studies find that one-half of all adults sought life insurance information online in recent years, and nearly one-third attempted to purchase coverage.[4] Although some features of term life insurance—such as a

[4] https://www.iii.org/fact-statistic/facts-statistics-life-insurance

company's reputation and financial health—may enter into purchasing decisions, the key factors that contribute to annual premiums are the face value of the policy, term length, and probability of death proxied by measurable risk factors such as age, sex, underlying health, and risk behavior. Term life insurance policies would then appear to be much like a commodity, where policies from different companies are very close substitutes for each other. In an online setting, with comparison shopping, small premium adjustments may lead to leapfrogging, which in turn could dramatically affect demand. Of course, life insurance companies screen most customers extensively offline in the individual market (e.g., medical exams), potentially leading to reclassification risk (Handel et al., 2015), which is not observable in the data on policy offerings. In such a market, where there is clearly an exogenous increase in mortality for defined groups—such as those who are older and less healthy in 2020 (relative to earlier years and other groups)—we would expect larger premium increases.[5] It is also possible for insurers to withdraw policies—essentially universal rejection for various groups—if the regulatory environment, competitive market pressure, or private information (Hendren, 2013) made premium increases infeasible. Of course, given that different companies make different projections about the overall aggregate risk from COVID-19, the magnitude of adjustment might be quite different. Nonetheless, it is hard to envision another market where the consequences of making a forecasting mistake are higher or where those making premium adjustments are more expert on mortality consequences.

To understand the influence of an increase in mortality risk on premiums, we use a basic model of term life insurance pricing in a competitive market where companies set premiums such that the expected net present value (ENPV) of premiums equals the ENPV of payouts from the company's perspective.[6] The following equation presents the ENPV of total premiums, D, for level annual premiums, d.

$$ENPV\,(D) = d\sum_{t=0}^{T-1}\left[\beta^{t}\prod_{j=0}^{t}(1-\rho_j)\right] \tag{1}$$

T is the term length in years, β is the discount factor, ρ_t is the annual probability of death (with $\rho_0 = 0$). The equation merely discounts future premium payments and takes into account that annual premiums are only collected conditional on survival.

The next equation represents the expected net present value of costs, C, for a term life insurance policy with face value v.

$$ENPV\,(C) = v\sum_{t=1}^{T}\left[\beta^{t-1}\rho_t\prod_{j=1}^{t-1}(1-\rho_j)\right] \tag{2}$$

Setting Equation (1) equal to Equation (2) and solving for the annual premium gives the following expression for term life insurance premiums

$$d = v\frac{\sum_{t=1}^{T}\left[\beta^{t-1}\rho_t\prod_{j=1}^{t-1}(1-\rho_j)\right]}{\sum_{t=0}^{T-1}\left[\beta^{t}\prod_{j=0}^{t}(1-\rho_j)\right]} \tag{3}$$

[5]"Premiums for life insurance and annuity products generally are not subject to regulatory approval, although regulators may seek to ensure that policy benefits are commensurate with the premiums charged." See https://www.naic.org/documents/consumer_state_reg_brief.pdf.
[6]See Mao et al. (2004), for an example of a more sophisticated life insurance pricing model.

We use this simplified framework and resulting solution to get a sense of how large the premium response theoretically should be based on the expectation of a transitory shock to mortality risk. As inputs for 1-year probability of death, we use general actuarial tables from the Social Security Administration.[7] Based on the simplified model, a 10 year $100,000 term policy for a 60-year old male, with a 3% discount rate, would have an annual premium of $1550.[8] If life insurance companies anticipated a 10% increase in mortality risk for the first year of a policy, then the model implies a 0.9% increase in premiums (to $1564). Consequently, the 1-year mortality shock elasticity of premiums is 0.09 for a 10-year term policy for a 60-year-old male. As the term of the policy increases, the responsiveness to an increase in the 1-year mortality risk lessens. For example, holding all the other above conditions constant, the elasticity is 1.00, 0.19, 0.06, and 0.04 for 1, 5, 15, and 20-year policies, respectively. The elasticity is nearly identical for policies sold to different aged individuals.

If life insurance companies anticipated that the increased mortality risk would extend past the first year, then the responsiveness of term premiums significantly increases (e.g., 10-year term policy with 2 years of increased mortality has an elasticity of premiums of 0.20). Furthermore, the elasticity of premiums increases as the discount rate increases, but are unchanged with different face values.

Overall, the premium response of life insurance companies is contingent on the projected increase in mortality rates, the anticipated persistence of the increased risk, the term length, and discounting.

Using statistics on actual deaths involving COVID-19 and deaths from all causes as reported by the CDC, the mortality rate for individuals aged 15–34 increased by 2.8% while the mortality rate for individuals aged 55–74 increased by 10.6%.[9] Taken together with the elasticity, for a 10-year term policy, the model predicts that premiums would increase by 0.95% for a 60-year-old and 0.25% for a 20-year-old. A back-of-the-envelope calculation implies that an analysis comparing the old to the young would result in premiums differentially increasing by 0.70% for the old relative to the young.

3 | DATA

We use data from Compulife to analyze the influence of the pandemic on life insurance premiums and offerings.[10] Compulife is a quotation software used by life insurance agents to compare premiums and generate quotes for potential customers. We use monthly data from January 2014 to February 2021 from 96 companies and 814,730 unique policies.[11] The Compulife database has information on at least one subsidiary for 19 out of the top 25 groups/companies in terms of market share.[12]

[7]See https://www.ssa.gov/oact/STATS/table4c6.html.

[8]An annual premium of $1550 is higher than premiums offered for 60-year old males listed on Compulife, except for individuals in "regular" health who are smokers. This difference in premiums is likely a result of life insurance companies not offering policies to individuals in "poor" and "very poor" health who greatly influence mortality rates for the general population captured in the Social Security actuarial tables.

[9]See https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm#AgeAndSex. Accessed September 4, 2020.

[10]See Cawley and Philipson (1999), Hendel and Lizzeri (2003), Cox et al. (2013), and Koijen and Yogo (2015) for additional studies that conduct analysis using Compulife data.

[11]To enhance the data quality, we make some minor corrections and remove outliers as outlined in Appendix A.

[12]The National Association of Insurance Commissioners reports on the top groups/companies in terms of market share for life insurance in 2019. See https://www.naic.org/documents/web_market_share_life_fraternal.pdf?81. Compulife data do not contain information on Dai-Ichi Life Holdings Inc Group, Globe Life Inc Group, Metropolitan Group, Penn Mutual Group, State Farm Group, or Voya Financial Group during the main analysis period. The report on market share does not differentiate based on product type, which explains the omission of, for example, Voya Financial group as it sells employer-sponsored life insurance but does not sell individual term life insurance.

In addition to company and policy names, these data provide information on the general characteristics of the policy, including term length, face value, smoking status, health category (Regular, Regular Plus, Preferred, and Preferred Plus), gender, and age at purchase. New purchasers of life insurance taper off drastically for individuals older than 60, with very few new policies initiated for individuals older than 70 (Harris & Yelowitz, 2014). Given the distribution of new purchasers, in the main analysis we specifically use data extracted on premiums and offerings for individuals from age 20 to 70 in 5-year increments (i.e., 20, 25, ..., 70).[13]

Premiums vary both based on the company issuing the policy and policy characteristics. Nonetheless, the vast majority of premium variation is based on general characteristics. A model that regresses the general characteristics (indicators for age, health category, term, face value, etc.) on log premiums has an R^2 of 0.98 using our estimation sample.[14]

In the main analysis, we restrict the data to common term lengths, including 10, 15, and 20-year term policies, which reduces the total policy count to 610,880 policies. Of those unique policies, 402,943 policies started being offered and were removed in the sample window, with only 48,580 policies active for the entire 86 months. For the 216,364 policies that were offered in January 2014, 88% were active 1-year later, with 70% still active after 2 years. By 2020 only 27% of those initially in the sample were offered on Compulife. Overall, the median duration of a policy being offered is 18 months.

Firms that actively change their policy offerings might be more likely to be responsive to changes in expected mortality resulting from the pandemic. To gauge the premium change activity level in a company, we analyze the frequency of premium adjustments from 2014 to 2019, before the pandemic. We analyze policies that are offered for more than 13 months to capture annual price adjustments. As our metric for premium change activity, we use the proportion of policies that experienced a premium change over a year. The median company altered 13.5% of their policies' premiums with an average of 27.8%. We define a company as active if they are in the upper quartile of premium change activity (>44.4%).

In addition to actively changing premiums, a company might respond to variations in the market or risk by no longer offering a particular policy and potentially replacing it with a new one. Hendren (2013) notes that in some contexts, including life insurance, companies choose not to sell insurance to potential customers who have certain observable, often high-risk characteristics. Such rejections, potentially withdrawing policies in our context, can be explained by private information, where premium adjustments are not sustainable. To measure activity on this extensive margin, we aggregate the number of times a company changes a policy offering (i.e., add or drop a policy) annually. We then take the ratio of the median annual changes to the median number of policies offered.[15] Over a year, the median company altered the equivalent of 14.6% of their median policies offerings. We define a company as being active in offerings if the company is in the top quartile of alterations (greater than 49.5%).[16]

[13] Policies offered for common term lengths (e.g., 10, 15, and 20 years) dwindle significantly for policies offered to individuals older than 70, with only 1-year term policies available for 85-year-old individuals.

[14] A model that excludes the indicator for smoking has an R-squared of 0.93, and a model that excludes health status has an R-squared of 0.97. The R^2 is insensitive to the exclusion of observations from 2020.

[15] We do not count initial inclusion or exit from Compulife as changes as we do not know if the policies were already in effect or if they continue after the company stopped listing with Compulife. If a company is only listed for a portion of a year, we scale the changes assuming the observed months are typical of the year.

[16] There is a weakly positive correlation between the two activity metrics (0.15) indicating some companies that both actively adjust premiums and actively alter offerings, with the majority of active companies primarily focusing on one or the other.

4 | EMPIRICAL ANALYSES

4.1 | Premium adjustments

Before estimating a formal regression, we first plot changes in premiums over time. To do this, we first create an index to normalize premiums such that modifications can be viewed as percent changes. The premium index for policy i in time t is given by:

$$Premium\_Index_{it} = \frac{Annual\_Premium_{it}}{Annual\_Premium_{it_0}} \times 100 \tag{4}$$

where t_0 is the premium in the first month of the estimation sample. We then get a measure of premiums at the company level ($Premium\_Index_{jt}$) by averaging the premium index ($Premium\_Index_{it}$) across all policies within a company. The main reason to use the average index rather than the average of premiums is that policies with larger premiums (e.g., higher face values) would implicitly receive more weight in an average of the premiums. A change in the index represents the average percent change in premiums rather than the change in dollar amounts.

Figure 1a plots the average of the company premium indexes for a balanced panel of policies offered from January 2019 until February 2021.[17] The figure shows minimal changes on average premiums from January 2019 to February 2021. There is a small overall increase in the average premium index in 2020 and the beginning of 2021, which would be consistent with a premium response to COVID-19. Nonetheless, one of the most substantial increases in the index occurs from November to December 2019, which predates meaningful news of the pandemic.[18]

To better understand any change in premium in 2020 and 2021, we investigate further and narrow the sample window to December 2019 to February 2021. Of the 74 companies that continuously offered policies for the shorter window, 49 did not change premiums and only 15 had higher premium indexes in February 2021 relative to December 2019. Table 1 reports the changes for companies that altered premiums from December 2019 to February 2021. As shown, the increase in premiums is attributed mainly to the premium changes of 5 out of 74 companies analyzed for the table.

Theory would suggest that life insurance companies would be most likely to adjust premiums for the demographic that experienced the greatest change in mortality risk and that companies would be less likely to increase premiums for demographics that do not experience significant changes in mortality risk. With this in mind, Figure 1b plots the change in premiums for the oldest individuals in the main sample compared to younger individuals whose mortality is less affected by the virus. Mortality rate changes from COVID-19 gradually increase (at an increasing rate) with age. Consequently, we exclude policies offered to individuals aged 40 to 55 in these figures as well as the regression analysis to compare individuals that experienced modest changes in mortality risk to individuals that experienced much greater increases from COVID-19.[19] As shown in the figure, the increase in premiums in 2020 occurred more for younger individuals than the older individuals, inconsistent with a COVID-19 explanation.

In addition to age, COVID-19 disproportionately increases the risk for individuals who have pre-existing conditions or smoke. Figure 1c compares the change in premiums for older

[17]For this balanced panel, there are 62 companies and 103,161 policies.

[18]Premiums for a given month are released the first of the month. Consequently, changes in premiums in December 2019 would predate the earliest news of COVID-19.

[19]The main empirical findings are not sensitive to this exclusion with only marginal changes to the point estimates. See Appendix Table A1.

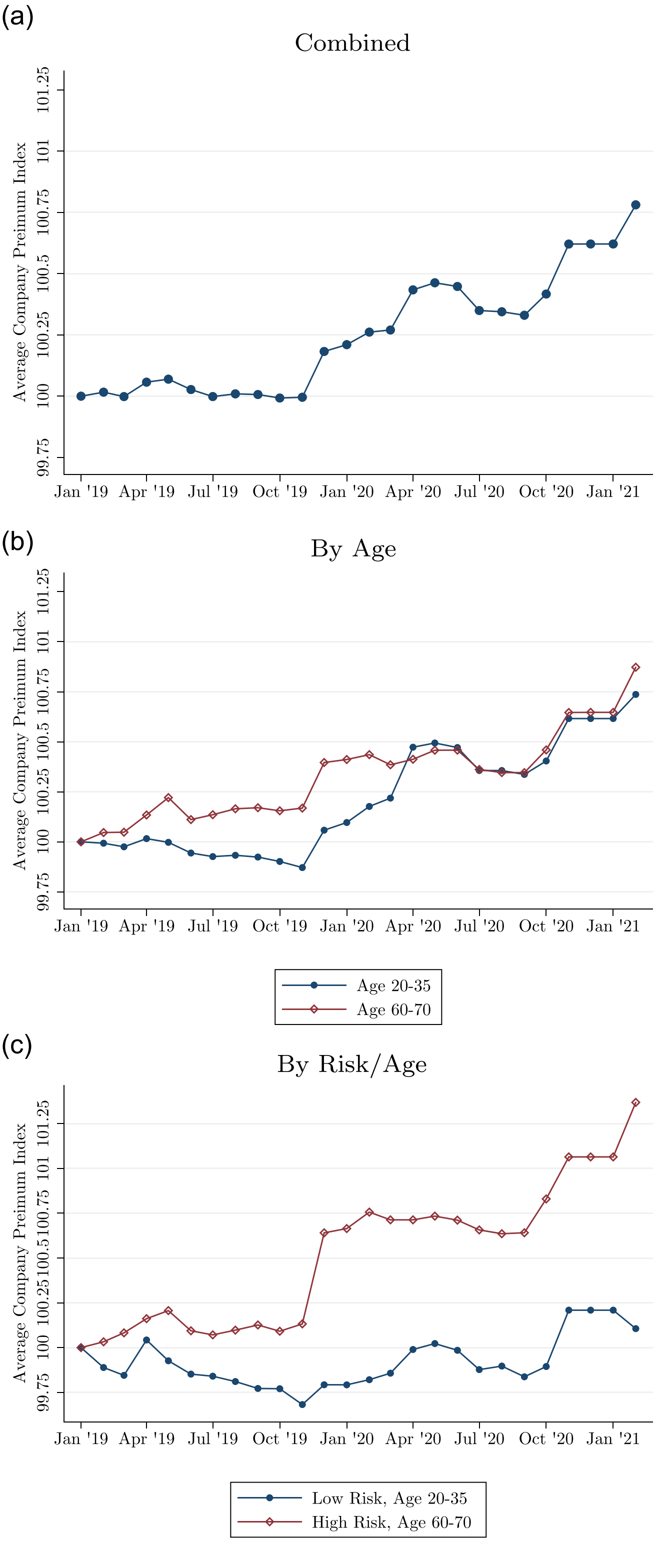

FIGURE 1 (See caption on next page)

individuals in the worst health category (Regular) that smoke to younger individuals in the best health categories (Preferred and Preferred Plus) that do not smoke. As shown, the premiums for high-risk older consumers do not experience any meaningful change from January to September 2020, whereas there is a slight increase in the early months of 2020 for low-risk younger policies. The early months of 2021 show an increase in premiums for high-risk policies with a slight decrease in premiums for low-risk policies. Nonetheless, these figures do not provide any compelling evidence of changes in premiums caused by COVID-19.

Our formal empirical strategy relies on the assumption that COVID-19-induced changes to the stock and bond markets influenced the profitability of policies sold to both younger and older individuals. Under this assumption, our empirical specification differences out the shock to financial assets by using policies offered to younger individuals as controls for those offered to older consumers. We hypothesize that any differential changes in premiums would be the result of differences in age-specific mortality risk. The following equation illustrates the event study specification we use to estimate the impact of COVID-19 on life insurance premiums.

$$\log(Premium_{it}) = \alpha_i + \gamma_t + \sum_s \beta_s Older_i \times 1[s = t] + \varepsilon_{it} \tag{5}$$

where $\log(Premium_{it})$ is the log of annual premiums for policy i in month t and $Older_i$ is an indicator for policies offered to individuals aged 60, 65, or 70. $1[s = t]$ is an variable equal one if $s = t$ and zero otherwise for $s \in$ [Jan 2019, Feb 2021]. α_i and γ_t, respectively, represent policy and month/year fixed effects. The coefficients of interest are β_s, which represent the monthly treatment effects relative to the base month of December 2019 (directly before the earliest information about COVID-19). If the monthly treatment effects are positive for months in 2020 or 2021, then there is evidence that life insurance companies differentially increased premiums for the old relative to the young. Any statistical significance for months in 2019 would indicate potential violations of the parallel trends assumption. Standard errors are clustered at the company level to account for coordinated pricing strategies inside a company.

Figure 2 illustrates the finding from the main event study. As shown, there is no evidence of differential increases in premiums for the old relative to the young. Also, the point estimates before COVID are statistically insignificant, which provides evidence supporting the parallel trends assumption.

Table 2 reports the findings of several subsample analyses, with the main dependent variables being interactions of months in 2020 and 2021 with an indicator for the policy being sold to older individuals (age 60–70).[20] Specifically, we analyze companies that have the largest market shares, companies that are the most active in terms of modifying premiums and offerings, and those with different AM Best ratings. Across each of these subgroups, there is not a statistically significant increase in premiums for the old relative to the young. (Companies that actively changed premiums actually marginally decreased prices for the old relative to the young in March.) The latter two

FIGURE 1 Average company premium changes. The figure presents the average company premium index from January 2019 to July 2020 originating from a balanced panel of 10, 15, and 20-year term policies that were continuously offered from July 2019 until February 2021. Low Risk is defined as individuals in the worst health category (Regular) that smoke and High Risk is defined as individuals in the best health categories (Preferred and Preferred Plus) that do not smoke [Color figure can be viewed at wileyonlinelibrary.com]

[20]Similar results are found if we estimate a full event study with interactions for the months in 2019 as well.

TABLE 1 Premium changes by company (Index = 100 in December 2019)

	2019	2020												2021	
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Nationwide	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	112.4
John Hancock NY	100.0	100.0	101.4	101.4	101.4	101.4	101.4	101.4	112.0	112.0	112.0	112.0	112.0	112.0	112.0
Pruco Co of New Jersey	100.0	101.4	101.4	101.4	101.4	101.4	101.4	101.4	110.3	110.3	110.3	110.3	110.3	110.3	110.3
Assurity	100.0	100.0	100.0	100.0	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2
AAA	100.0	100.4	100.5	100.5	100.5	100.5	100.5	100.5	100.5	100.5	100.5	107.2	107.2	107.2	107.2
Fidelity Life Association	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	103.4	103.4	103.4	103.4
United States Life NY	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	102.8	102.8	102.8	102.8	103.1
Pacific	100.0	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3	102.9	102.9	102.9	102.9	102.9
United of Omaha	100.0	100.5	100.5	100.5	102.8	102.8	102.8	102.8	102.8	102.8	102.8	102.8	102.8	102.8	102.8
William Penn Co of NY	100.0	100.0	100.0	101.9	101.9	102.3	102.3	101.7	101.7	101.8	101.7	103.1	103.1	103.1	102.0
Nationwide Life and Annuity Insu	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	101.2
Columbian	100.0	100.0	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
John Hancock USA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.6	100.6	100.6	100.6	100.6	100.6	100.6
Savings Bank Mutual of MA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.2	100.2	100.2	100.2
Centrian	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.2	100.2	100.2	100.2
Sagicor	100.0	100.0	100.0	100.0	100.0	100.0	100.5	100.5	100.5	99.9	99.9	99.9	99.9	99.9	99.9
Lincoln National	100.0	100.0	100.0	99.7	99.7	100.1	100.1	100.1	100.1	100.2	100.2	100.2	100.2	100.2	99.8
Pruco	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.6	99.6	99.6	99.6	99.6	99.6	99.6
Banner	100.0	100.0	100.0	100.2	100.2	100.5	100.5	101.0	101.0	100.6	100.6	100.6	100.6	100.6	99.3
Protective	100.0	100.0	99.8	99.8	99.8	99.8	99.5	99.5	99.4	99.4	99.4	99.4	99.4	99.4	99.2

(Continues)

TABLE 1 (Continued)

	2019	2020												2021	
	Dec	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**
Ameritas Corp of NY	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.1	99.1	99.1	99.1	99.1	99.1	99.1	99.1
Penn Mutual	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.8	98.8
Massachusetts Mutual	100.0	100.0	100.0	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7
American General	100.0	100.0	100.3	100.3	100.3	100.3	98.9	98.9	98.9	98.9	98.9	98.9	98.9	98.9	97.9
Ameritas Corp	100.0	100.0	100.0	100.0	100.0	100.0	100.0	94.9	94.9	94.9	94.9	94.9	94.9	94.9	94.9

Note: The sample used to generate the table includes policies that were continuously active from December 2019 to February 2021 with premiums normalized to 100 in December 2019. We report the average of these indexed premiums across companies. We only present the 24 companies that changed their premiums out of 74 companies analyzed. The table is sorted descending based on the February 2021 premium index.

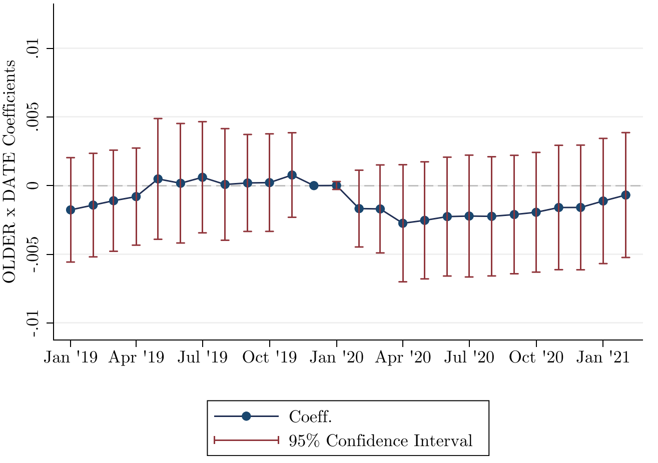

FIGURE 2 Event study, influence of COVID on log premiums. The unbalanced panel includes 10, 15, and 20-year term policies listed on Compulife from January 2019 to February 2021 that were offered to individuals aged 20, 25, 30, 35, 60, 65, and 70. There were 57,161 unique policies from 32 companies and 755,904 total observations. Controls included policy and month fixed effects and standard errors were clustered at the company level [Color figure can be viewed at wileyonlinelibrary.com]

columns of Table 2, use additional variation in health status that theoretically could differentially increase premiums. For both of these specifications, we use policies sold to younger non-smokers in the best health categories as the control group. For the treatment group, we use older individuals in the worst health category and older individuals in the worst health category that also smoke for the treatment groups, respectively. The main statistically significant premium effect is observed from October 2020 to February 2021, ranging from 0.9% to 1.4% for the specification that uses policies sold to relatively unhealthy older smokers as the treatment group. These results indicate that life insurance companies differentially increased premiums for individuals with very high risk (worst health older smokers), whereas premiums in general remained unaffected.

The theoretical model predicts that shorter-term policies should, all else equal, have larger responses to temporary mortality shocks. Also, it is reasonable to assume that companies might be more sensitive regarding policies with higher face values as they represent larger potential losses per policy. Consequently, we analyze and present policies stratified by term length and face value in Table 3. Across each of the specifications, there is no evidence that COVID-19 caused differential increases in premiums for the old relative to the young. Of the 140 event study coefficients presented in this table, virtually all are "wrong-signed" (negative), with point estimates very close to zero (often changes of 0.4% or less), with standard errors that preclude the possibility of large premium increases.

One possible explanation for the lack of response in premiums from the pandemic is that market competition prevents companies from increasing premiums. Conditional on policy characteristics (face value, term length, etc.) and applicant risk (age, sex, health, etc.), life insurance very much resembles a commodity, where consumers are likely to be extremely sensitive to price. To explore this possibility, we analyze if there are differential responses by low-price leaders and other market participants. We restrict the sample to companies with either A++ or A+ AM Best Ratings to decrease the chances that differences in premiums result from different likelihoods of default. Within a particular product type (e.g., 15-year term, age 30, male, nonsmoker, preferred health), the median difference between the lowest price and the second-lowest price is 1.2% (mean of 5.2%), with 22.6% of unique product types having at least two firms that offer the lowest price. If the low-price leader increased premiums such that their product was no longer the cheapest, they could lose a considerable share of price-sensitive customers. Alternatively, it could be argued that firms with the low price advantage have a small amount of latitude to increase their premiums without as much concern for losing customers.

TABLE 2 Premium response to COVID-19: dependent variable log premiums

	Top	Top modifier of		AM best rating		Young healthy and older	
Sample	**Share**	**Premiums**	**Offerings**	**A to A++**	**B+ to A−**	**Rg health**	**Rg health/ smoker**
Older ×							
Jan 2020	0.001	−0.004	−0.002	−0.000	0.001	0.001	0.003
	(0.004)	(0.005)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)
Feb 2020	−0.003	−0.009	−0.007	−0.002	0.001	−0.001	0.002
	(0.005)	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)	(0.004)
Mar 2020	−0.004	−0.010*	−0.007	−0.002	0.001	−0.002	0.001
	(0.005)	(0.005)	(0.005)	(0.002)	(0.003)	(0.004)	(0.004)
Apr 2020	−0.005	−0.009	−0.008	−0.002	−0.007	−0.002	0.001
	(0.005)	(0.005)	(0.005)	(0.003)	(0.010)	(0.004)	(0.005)
May 2020	−0.005	−0.008	−0.008	−0.002	−0.007	−0.002	0.001
	(0.005)	(0.006)	(0.005)	(0.003)	(0.010)	(0.004)	(0.005)
Jun 2020	−0.004	−0.008	−0.007	−0.001	−0.008	−0.001	0.002
	(0.005)	(0.006)	(0.005)	(0.003)	(0.010)	(0.004)	(0.005)
Jul 2020	−0.004	−0.008	−0.007	−0.001	−0.008	−0.001	0.002
	(0.006)	(0.006)	(0.006)	(0.003)	(0.010)	(0.004)	(0.005)
Aug 2020	−0.001	−0.007	−0.007	−0.001	−0.008	0.004	0.007
	(0.007)	(0.007)	(0.006)	(0.003)	(0.010)	(0.004)	(0.005)
Sep 2020	−0.001	−0.006	−0.007	−0.001	−0.007	0.004	0.008
	(0.007)	(0.007)	(0.006)	(0.003)	(0.010)	(0.004)	(0.005)
Oct 2020	−0.001	−0.006	−0.007	−0.001	−0.007	0.004	0.009*
	(0.007)	(0.007)	(0.006)	(0.003)	(0.011)	(0.004)	(0.005)
Nov 2020	−0.001	−0.004	−0.008	0.000	−0.010	0.005	0.010*
	(0.007)	(0.007)	(0.006)	(0.003)	(0.011)	(0.004)	(0.005)
Dec 2020	−0.001	−0.004	−0.008	0.000	−0.010	0.005	0.010*
	(0.007)	(0.007)	(0.006)	(0.003)	(0.011)	(0.004)	(0.005)
Jan 2021	−0.001	−0.002	−0.007	0.001	−0.010	0.006	0.011**
	(0.007)	(0.008)	(0.007)	(0.003)	(0.011)	(0.004)	(0.005)

TABLE 2 (Continued)

	Top	Top modifier of		AM best rating		Young healthy and older	
Sample	**Share**	**Premiums**	**Offerings**	**A to A++**	**B+ to A−**	**Rg health**	**Rg health/ smoker**
Feb 2021	0.001	−0.001	−0.005	0.001	−0.010	0.009**	0.014***
	(0.006)	(0.007)	(0.006)	(0.003)	(0.011)	(0.004)	(0.005)
Observations	1,238,887	906,561	1,115,742	2,587,414	424,442	1,099,770	846,397
Policies	96,244	56,598	90,464	171,972	20,562	73,497	57,208
Companies	29	18	25	62	17	94	94

Note: The unbalanced panel includes 10, 15, and 20-year term policies listed on Compulife from January 2019 to February 2021 that were offered to individuals aged 20, 25, 30, 35, 60, 65, and 70. Top Share refers to companies listed in the top 25 for market share (or whose parent company is listed) by National Association of Insurance Commissioners. The top modifier of premiums and offerings indicate companies in the top quartile of activity respectively based on changes from 2014 to 2018. AM Best Ratings are indicators of a companies ability to meet financial obligations. The second to last column includes policies sold to younger individuals (age 20–35) who do not smoke in the best health categories and older individuals in the worst health category. The last column further restrict the policies sold to older individuals to those that smoke. Policy and month fixed effects were included but not reported here. Standard errors are clustered at the company level and are shown in parentheses.

***$p < .01$.

**$p < .05$.

*$p < .1$.

Products that do not have the low price advantage and compete across different dimensions (e.g., customer service, additional riders, etc.) might have more flexibility to increase their prices in response to the pandemic. Alternatively, those without a price advantage might be unwilling to increase their price as there already exists cheaper options for their potential customers.

To analyze if life insurance policies with the low price behave differently, we estimate regression models that limit the sample based on the product's price ordering in December 2019, immediately before the first news of COVID-19. Table 4 presents results first for policies that did not offer the lowest premium within a given product type and shows no statistically significant response. The second column reports results for analysis using only policies that offer the lowest within product premium. For this subset of policies, there is a statistically significant increase in premiums for policies offered to an older group relative to policies offered to younger individuals, with point estimates implying that annual premiums raised by 0.2 to 1.1% between March 2020 and February 2021. The last column further restricts the sample to policies that had the low price advantage, with the next lowest premium being at least 1% more expensive. Consistent with the gap allowing for more adjustments, the premium for policies offered to older individuals increased more relative to changes in premiums offered to younger individuals with the highest monthly effect of a 1.6% relative increase in premiums. In both of the lowest price specifications, there were not statistically significant responses in the early months of 2020 consistent with the timing of information on COVID-19 and its likely effects on US residents.

Overall, the results imply that the premium response was minimal due to COVID-19, with some evidence that price competition inhibited life insurance companies from adjusting their premiums in response to increased mortality risk.

TABLE 3 Log premium response by term length and face value

	Term length			Face value						
	10-year	**15-year**	**20-year**	**$100k**	**$250k**	**$500k**	**$750k**	**$1m**	**$5m**	**$10m**
Older ×										
Jan 2020	0.000	0.000	−0.000	0.001	0.000	−0.000	−0.000	−0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Feb 2020	−0.002	−0.001	−0.001	−0.001	−0.001	−0.002	−0.002	−0.002	−0.001	−0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Mar 2020	−0.002	−0.001	−0.001	−0.002	−0.001	−0.002	−0.002	−0.002	−0.001	−0.001
	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Apr 2020	−0.003	−0.002	−0.002	−0.003	−0.002	−0.003	−0.003	−0.003	−0.002	−0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
May 2020	−0.003	−0.002	−0.002	−0.003	−0.002	−0.002	−0.003	−0.003	−0.002	−0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Jun 2020	−0.002	−0.002	−0.002	−0.003	−0.001	−0.002	−0.003	−0.002	−0.002	−0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Jul 2020	−0.003	−0.002	−0.002	−0.003	−0.002	−0.002	−0.002	−0.002	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Aug 2020	−0.003	−0.002	−0.001	−0.004	−0.002	−0.002	−0.002	−0.002	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Sep 2020	−0.003	−0.002	−0.001	−0.003	−0.002	−0.002	−0.002	−0.002	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)

TABLE 3 (Continued)

	Term length			Face value						
	10-year	**15-year**	**20-year**	**$100k**	**$250k**	**$500k**	**$750k**	**$1m**	**$5m**	**$10m**
Oct 2020	−0.003	−0.002	−0.001	−0.003	−0.002	−0.002	−0.002	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Nov 2020	−0.002	−0.001	−0.000	−0.002	−0.002	−0.002	−0.002	−0.001	−0.000	−0.000
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Dec 2020	−0.002	−0.001	−0.000	−0.002	−0.002	−0.002	−0.002	−0.001	−0.000	−0.000
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Jan 2021	−0.002	−0.000	0.000	−0.002	−0.002	−0.002	−0.001	−0.001	0.000	0.000
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Feb 2021	−0.002	0.001	0.000	−0.001	−0.002	−0.001	−0.001	−0.000	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	1,122,496	1,086,892	988,149	387,980	457,978	466,152	464,661	482,700	469,608	468,458
Policies	74,108	71,580	64,756	22,299	30,529	31,278	31,019	32,218	31,575	31,526
Companies	91	83	91	80	90	88	84	88	83	81

Note: The unbalanced panel includes 10, 15, and 20-year term policies listed on Compulife from January 2019 to February 2021 that were offered to individuals aged 20, 25, 30, 35, 60, 65, and 70. Policy and month fixed effects were included but not reported here. Standard errors are clustered at the company level and are shown in parentheses.

TABLE 4 Price competition: Dependent variable log premiums

	Not lowest price	Lowest price	Lowest price ⩾ 1% gap
Older ×			
Jan 2020	−0.001	0.001	0.004
	(0.003)	(0.001)	(0.004)
Feb 2020	−0.003	0.000	0.004
	(0.003)	(0.001)	(0.004)
Mar 2020	−0.005	0.002*	0.006
	(0.004)	(0.001)	(0.004)
Apr 2020	−0.005	0.002*	0.006
	(0.004)	(0.001)	(0.004)
May 2020	−0.005	0.003*	0.007
	(0.004)	(0.002)	(0.004)
Jun 2020	−0.005	0.004*	0.007*
	(0.004)	(0.002)	(0.004)
Jul 2020	−0.006	0.007*	0.013**
	(0.004)	(0.004)	(0.006)
Aug 2020	−0.003	0.008**	0.013**
	(0.005)	(0.004)	(0.006)
Sep 2020	−0.003	0.008**	0.013**
	(0.005)	(0.004)	(0.005)
Oct 2020	−0.003	0.008**	0.013**
	(0.005)	(0.004)	(0.005)
Nov 2020	−0.002	0.011**	0.014**
	(0.005)	(0.005)	(0.006)
Dec 2020	−0.002	0.011**	0.014**
	(0.005)	(0.005)	(0.006)
Jan 2021	−0.002	0.012**	0.016**
	(0.005)	(0.005)	(0.006)
Feb 2021	−0.001	0.011***	0.014**
	(0.004)	(0.004)	(0.005)
Observations	1,221,372	33,648	11,115

TABLE 4 (Continued)

	Not lowest price	Lowest price	Lowest price ⩾ 1% gap
Policies	64,523	1513	486
Companies	35	30	17

Note: The unbalanced panel includes 10, 15, and 20-year term policies listed on Compulife from January 2019 to February 2021 that were offered to individuals aged 20, 25, 30, 35, 60, 65, and 70. The sample is restricted to companies with A++ or A+ AM Best Ratings. Premium comparisons in December 2019 were used to determine if the policy was the low price leader or not. Policy and month fixed effects were included but not reported here. Standard errors are clustered at the company level and are shown in parentheses.

***$p < .01$.

**$p < .05$.

*$p < .1$.

4.2 | Policy offerings

Rather than changing premiums for a policy that became riskier due to COVID-19, companies could have responded by not offering the policy to new customers. There do not appear to be any regulatory hurdles to discontinue offering a policy to new customers. Given the looming uncertainty surrounding COVID-19 that makes products difficult to price, this option might be attractive for policies targeting demographics at a higher risk of death from COVID-19.

In an innovative study, Hendren (2013) explores circumstances under which insurance companies reject applicants rather than adjusting premiums. In our context, with the changing mortality risk with COVID-19 in 2020 and 2021 relative to earlier years, withdrawing life insurance offerings for applicants with observable characteristics such as older age or poorer health is creating a new "rejection" group. Hendren argues that private information known by potential applicants—beyond what can be captured by their observable characteristics—has a key role in such rejections. Much like Hendren's motivation with long-term care insurance, there are specific factors and preferences related to the pandemic—such as the ability or willingness to be vigilant about COVID-19 safety—that are difficult for an insurance company to obtain and verify.

Indeed, underwriting guidelines did change in recognition of the pandemic (BUA, 2020). Companies generally postponed offerings (e.g., created new rejection groups) based on a combination of age, health status, and face value. For example, AIG postponed the issuance of policies for those over age 75 and for those aged 66-75 inclusive of "medical flat extras" (essentially risks that the standard rating tables do not cover).

We once again analyze 10, 15, and 20-year term policies from January 2019 to February 2021. If a company either starts or stops listing policies on Compulife, we do not have data on any of their policy offerings. We hesitate to assume that all of the policies were discontinued if not listed on Compulife. Consequently, we restrict the analysis to the 78 companies that continuously listed policies on Compulife during the sample period.[21]

Figure 3 plots the proportion of all policies that were active for each month based on age groups. As shown, there is a slight decrease in offerings for younger

[21]We also require that a policy be offered at least once in the sample period.

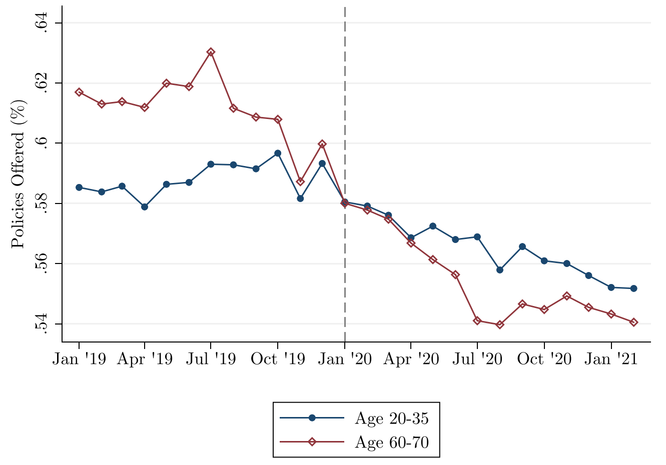

FIGURE 3 Proportion of policies offered by month and age group. The figure shows the proportion of the 199,685 unique policies that were actively offered on Compulife for the 78 companies that continuously listed policies on the platform from January 2019 to February 2021 by age group [Color figure can be viewed at wileyonlinelibrary.com]

individuals over time, whereas there is a larger decrease in offerings to older individuals. Nonetheless, the decrease in net policies offered to older individuals begins *prior* to any news of COVID-19.

To estimate the impact of COVID-19 on offerings formally, we use an event study specification analogous to the model used to estimate the pandemic's influence on premiums.

$$Active_{it} = \alpha_i + \gamma_t + \sum_s \beta_s Older_i \times 1[s = t] + \varepsilon_{it} \tag{6}$$

Where $Active_{it}$ is an indicator for a company offering policy i on Compulife at time t.

Figure 4a presents the results of the base specification. While the point estimates are statistically significant (at the 10% level) and negative in 2020, consistent with a COVID-19 effect, there is also evidence of a pretrend, which violates a main assumption of the analysis. To control for this pretrend, we first estimate a model with *Active* as the dependent variable and age-group fixed effects (i.e., older and younger) and age-group by month trends using data from the preperiod, January 2019 to December 2019 (Kleven et al., 2014). We generate residuals for the full time period using the estimated coefficients and then use these residuals as the dependent variable for the event study presented in Figure 4b.[22] As shown, after controlling for linear pretrends, there is no statistically significant evidence of differential policy removal for the old relative to the young due to the pandemic.

Table 5 presents the results for several different subsets, with each specification accounting for a linear pretrend as described above. In the table, there is no evidence of differential decreases in offerings for the elderly. The only statistically significant

[22]We use this method rather than directly including a group by month trend in the specification, as the group by year trend could absorb any potential treatment effect, thus attenuating any result.

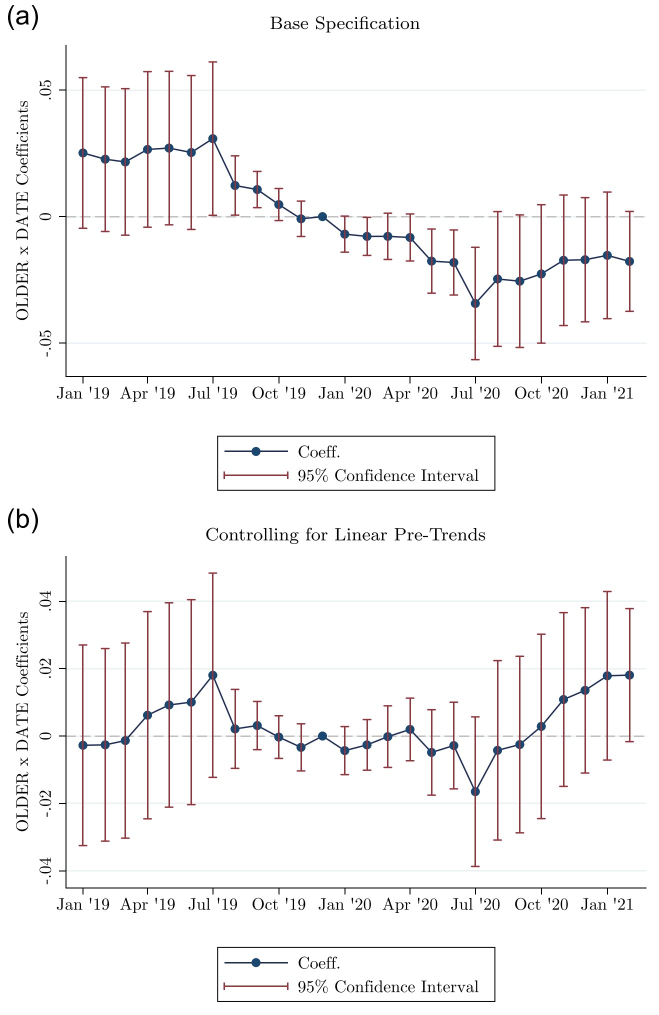

FIGURE 4 Event study, influence of COVID on offerings. The sample includes 10, 15, and 20-year term policies for individuals aged 20, 25, 30, 35, 60, 65, 70 that appeared at least once from January 2019 to February 2021. Only policies from companies that continuously listed policies on Compulife during the sample period were included. There were 199,685 unique policies from 78 companies for a total of 5,191,810 observations. Controls included policy and month fixed effects and standard errors were clustered at the company level. In panel (a), the dependent variable is an indicator for the policy actively being offered in a given month. In panel (b), the dependent variable is the residuals that result from an estimation of an indicator of policy offering on age-group (i.e., younger and older) fixed effects and age-group by date linear trends on the pretreatment period (2019) [Color figure can be viewed at wileyonlinelibrary.com]

results indicate that, if anything, offerings to the oldest individuals actually increased for top share companies and those that adjusted offerings frequently.

Table 6 further analyzes changes in offerings based on term length and face value. Stratifying by term length does not change the main findings. However, there is some evidence that companies differentially decreased policy offerings for the largest face value policies (≥$1 million). For $1 million term policies, offerings decreased for the elderly by

TABLE 5 Subsample analysis: The influence of COVID-19 on policy offerings

Sample	Top Share	Top modifier of Premiums	Top modifier of Offerings	AM best rating A to A++	AM best rating B+ to A−	Young healthy and older Rg health	Young healthy and older Rg health/ smoker
Older ×							
Jan 2020	−0.010	0.007	−0.006	−0.007	−0.008	−0.012	−0.012
	(0.017)	(0.010)	(0.020)	(0.011)	(0.011)	(0.013)	(0.013)
Feb 2020	−0.004	0.009	−0.000	−0.004	−0.012	−0.010	−0.011
	(0.018)	(0.009)	(0.020)	(0.011)	(0.012)	(0.013)	(0.013)
Mar 2020	0.005	0.009	0.008	−0.001	−0.012	−0.005	−0.005
	(0.017)	(0.009)	(0.019)	(0.011)	(0.013)	(0.014)	(0.014)
Apr 2020	0.011	0.005	0.015	0.001	−0.011	−0.002	−0.002
	(0.017)	(0.007)	(0.019)	(0.011)	(0.013)	(0.014)	(0.013)
May 2020	−0.005	−0.005	0.010	−0.007	−0.008	−0.008	−0.007
	(0.020)	(0.014)	(0.020)	(0.012)	(0.012)	(0.014)	(0.014)
Jun 2020	−0.001	−0.005	0.016	−0.005	−0.007	−0.016	−0.014
	(0.019)	(0.015)	(0.020)	(0.012)	(0.012)	(0.018)	(0.018)
Jul 2020	−0.007	−0.026	0.018	−0.018	−0.024	−0.029	−0.028
	(0.019)	(0.020)	(0.018)	(0.014)	(0.016)	(0.021)	(0.020)
Aug 2020	0.015	−0.006	0.039	−0.004	−0.025	−0.010	−0.009
	(0.025)	(0.030)	(0.023)	(0.016)	(0.016)	(0.025)	(0.025)
Sep 2020	0.017	−0.006	0.044*	−0.003	−0.020	−0.007	−0.006
	(0.024)	(0.030)	(0.023)	(0.016)	(0.016)	(0.025)	(0.025)
Oct 2020	0.028	−0.007	0.055**	0.003	−0.019	−0.000	0.001
	(0.025)	(0.030)	(0.024)	(0.016)	(0.016)	(0.025)	(0.025)
Nov 2020	0.044*	0.002	0.068***	0.012	−0.016	0.011	0.011
	(0.024)	(0.027)	(0.022)	(0.016)	(0.015)	(0.025)	(0.025)
Dec 2020	0.050**	0.001	0.070***	0.015	−0.018	0.013	0.014
	(0.022)	(0.027)	(0.022)	(0.015)	(0.015)	(0.025)	(0.025)
Jan 2021	0.057**	0.003	0.078***	0.019	−0.012	0.022	0.023
	(0.023)	(0.028)	(0.022)	(0.015)	(0.015)	(0.025)	(0.025)
Feb 2021	0.054***	−0.011	0.071***	0.019	−0.007	0.020	0.019
	(0.016)	(0.020)	(0.017)	(0.013)	(0.014)	(0.022)	(0.021)
Observations	2,556,112	1,388,270	2,545,088	4,560,400	505,102	1,807,676	1,410,942
Policies	98,312	53,395	97,888	175,400	19,427	69,526	54,267

TABLE 5 (Continued)

Sample	Top Share	Top modifier of Premiums	Offerings	AM best rating A to A++	B+ to A−	Young healthy and older Rg health	Rg health/ smoker
Companies	25	15	23	57	15	78	78
Percent active	0.47	0.60	0.44	0.55	0.81	0.57	0.56

Note: As the dependent variable, the specifications use the residuals that result from an estimation of an indicator of policy offering on age-group (i.e., younger and older) fixed effects and age-group by date linear trends on the pretreatment period. The sample includes 10, 15, and 20-year term policies for individuals aged 20, 25, 30, 35, 60, 65, 70 that appeared at least once from January 2019 to February 2021. Only policies from companies that continuously listed policies on Compulife during the sample period were included. Policy and month fixed effects were included but not reported here. Standard errors are clustered at the company level and are shown in parentheses.

***$p < .01$.

**$p < .05$.

*$p < .1$.

1.6, 1.7, and 3.0 percentage points, respectively for May, June, and July 2020. This decrease in the largest face value policies could represent increased scrutiny of policies that could represent the biggest losses for a company. Alternatively, the statistically significant result could merely be the product of random chance given the large number of reported estimates.

Overall, the offerings analysis indicates that the pandemic did not cause widespread adjustments to offerings.

4.3 | The New York market

In the main analysis, we use quotes from the entire United States. In general, companies offer the same life insurance policy to residents of all or almost all states, limiting analysis that uses geographic variation in the pandemic's severity. New York, however, presents an interesting case study as it was harder-hit early on by the pandemic and also because the life insurance regulatory structure leads to subsidiaries being created specifically to offer policies to residents of New York (Pottier & Sommer, 1998).

We analyze policies offered in New York but not in New Mexico to isolate policies that have a greater potential to respond to the early effects of COVID-19 specific to New York.[23] Table 7 presents the results for both changes in premiums and offerings.[24] As illustrated, life insurance companies did not increase premiums or differentially discontinue policies offered to older individuals, consistent with the main analysis. These results indicate that companies did not significantly alter premiums or offering even in localities that were impacted the most early on in the pandemic.

[23]We selected New Mexico because it is the default state in the Compulife software. Nonetheless, there is significant overlap in policies offered across the United States due in part to the Interstate Insurance Compact. Only a handful of states—including New York—do not participate in the compact. See https://www.insurancecompact.org/about.htm for more information.

[24]The table reports point estimates for analysis starting in March 2019 rather than January 2019 as in the main analysis due to an insufficient number of companies in the offering specification to cluster at the company level and estimate all of the coefficients.

TABLE 6 Policy offering analysis by term and face value

	Term length			Face value						
	10-year	**15-year**	**20-year**	**$100k**	**$250k**	**$500k**	**$750k**	**$1m**	**$5m**	**$10m**
Older ×										
Jan 2020	−0.004	−0.008	−0.012	−0.008	−0.008	−0.007	−0.007	−0.009	−0.006	−0.007
	(0.013)	(0.010)	(0.008)	(0.017)	(0.013)	(0.012)	(0.011)	(0.009)	(0.007)	(0.007)
Feb 2020	−0.004	−0.004	−0.011	−0.004	−0.005	−0.006	−0.006	−0.011	−0.004	−0.005
	(0.013)	(0.010)	(0.009)	(0.018)	(0.013)	(0.012)	(0.011)	(0.009)	(0.007)	(0.007)
Mar 2020	−0.001	−0.001	−0.010	0.004	−0.002	−0.002	−0.002	−0.010	−0.005	−0.006
	(0.013)	(0.011)	(0.009)	(0.019)	(0.013)	(0.012)	(0.012)	(0.009)	(0.008)	(0.008)
Apr 2020	0.002	0.002	−0.009	0.008	0.001	0.000	0.001	−0.009	−0.003	−0.005
	(0.013)	(0.010)	(0.009)	(0.018)	(0.013)	(0.011)	(0.011)	(0.008)	(0.007)	(0.007)
May 2020	−0.006	−0.007	−0.014	−0.001	−0.004	−0.007	−0.006	−0.016*	−0.009	−0.010
	(0.014)	(0.011)	(0.009)	(0.019)	(0.014)	(0.012)	(0.012)	(0.009)	(0.009)	(0.009)
Jun 2020	−0.005	−0.004	−0.011	0.002	−0.006	−0.000	−0.001	−0.017*	−0.009	−0.010
	(0.014)	(0.011)	(0.009)	(0.019)	(0.015)	(0.013)	(0.012)	(0.010)	(0.009)	(0.009)
Jul 2020	−0.018	−0.020	−0.021	−0.020	−0.025	−0.014	−0.014	−0.030**	−0.017	−0.018*
	(0.014)	(0.014)	(0.013)	(0.021)	(0.016)	(0.015)	(0.014)	(0.011)	(0.010)	(0.010)
Aug 2020	−0.006	−0.007	−0.010	0.000	−0.010	−0.002	−0.002	−0.019	−0.008	−0.009
	(0.016)	(0.016)	(0.014)	(0.024)	(0.018)	(0.016)	(0.016)	(0.013)	(0.012)	(0.012)
Sep 2020	−0.006	−0.005	−0.006	−0.001	−0.005	−0.001	−0.001	−0.019	−0.005	−0.007
	(0.016)	(0.016)	(0.014)	(0.024)	(0.018)	(0.016)	(0.016)	(0.013)	(0.012)	(0.012)

TABLE 6 (Continued)

	Term length			Face value						
	10-year	**15-year**	**20-year**	**\$100k**	**\$250k**	**\$500k**	**\$750k**	**\$1m**	**\$5m**	**\$10m**
Oct 2020	−0.001	0.001	−0.001	0.010	0.002	0.005	0.006	−0.013	−0.004	−0.005
	(0.017)	(0.016)	(0.015)	(0.024)	(0.019)	(0.016)	(0.016)	(0.013)	(0.012)	(0.012)
Nov 2020	0.006	0.009	0.008	0.025	0.010	0.014	0.014	−0.007	0.003	0.000
	(0.016)	(0.016)	(0.014)	(0.023)	(0.018)	(0.016)	(0.015)	(0.013)	(0.011)	(0.011)
Dec 2020	0.010	0.013	0.008	0.032	0.010	0.018	0.018	−0.005	0.005	0.002
	(0.015)	(0.015)	(0.014)	(0.023)	(0.018)	(0.015)	(0.015)	(0.012)	(0.011)	(0.011)
Jan 2021	0.014	0.017	0.012	0.037	0.018	0.023	0.022	−0.002	0.007	0.004
	(0.015)	(0.015)	(0.014)	(0.023)	(0.018)	(0.015)	(0.015)	(0.012)	(0.011)	(0.011)
Feb 2021	0.011	0.015	0.020*	0.021	0.016	0.021	0.028*	0.006	0.008	0.005
	(0.014)	(0.012)	(0.011)	(0.021)	(0.014)	(0.013)	(0.014)	(0.011)	(0.012)	(0.012)
Observations	1,811,732	1,789,866	1,590,212	533,208	757,874	780,312	778,778	800,696	771,030	769,912
Policies	69,682	68,841	61,162	20,508	29,149	30,012	29,953	30,796	29,655	29,612
Companies	75	70	75	68	76	74	73	75	70	68
Percent Active	0.58	0.58	0.58	0.67	0.57	0.56	0.56	0.57	0.57	0.57

Note: As the dependent variable, the specifications use the residuals that result from an estimation of an indicator of policy offering on age-group (i.e., younger and older) fixed effects and age-group by date linear trends on the pretreatment period. The sample includes 10, 15, and 20-year term policies for individuals aged 20, 25, 30, 35, 60, 65, 70 that appeared at least once from January 2019 to February 2021. Only policies from companies that continuously listed policies on Compulife during the sample period were included. Policy and month fixed effects were included but not reported here. Standard errors are clustered at the company level and are shown in parentheses.

*$p < .1$.

**$p < .01$.

TABLE 7 Influence of COVID-19 on New York policies

Dependent variable	Log premiums		Policy offered	
April 2019	−0.002	(0.005)	−0.002	(0.007)
May 2019	−0.002	(0.005)	0.004	(0.004)
June 2019	−0.002	(0.005)	0.004	(0.004)
July 2019	−0.003	(0.005)	0.005	(0.004)
Aug 2019	−0.004	(0.004)	0.002	(0.003)
Sep 2019	0.001	(0.001)	0.003	(0.003)
Oct 2019	0.001	(0.001)	0.003	(0.003)
Nov 2019	−0.000	(0.000)	0.003	(0.003)
Jan 2020	0.000	(0.000)	−0.007	(0.009)
Feb 2020	−0.006	(0.006)	−0.006	(0.009)
Mar 2020	−0.008	(0.006)	−0.006	(0.009)
Apr 2020	−0.009	(0.007)	−0.005	(0.009)
May 2020	−0.008	(0.007)	−0.017	(0.015)
Jun 2020	−0.008	(0.007)	−0.016	(0.015)
Jul 2020	−0.009	(0.007)	−0.032	(0.022)
Aug 2020	−0.009	(0.009)	−0.031	(0.022)
Sep 2020	−0.008	(0.009)	−0.031	(0.022)
Oct 2020	−0.008	(0.009)	−0.030	(0.022)
Nov 2020	−0.008	(0.009)	−0.019	(0.019)
Dec 2020	−0.008	(0.009)	−0.018	(0.019)
Jan 2021	−0.008	(0.009)	−0.017	(0.019)
Feb 2021	−0.007	(0.008)	−0.038	(0.025)
Observations	755,904		1,199,611	
Policies	57,161		52,157	
Companies	32		23	

Note: The sample is restricted to policies that were offered in New York but not in New Mexico. The panel includes 10, 15, and 20-year term policies listed on Compulife from April 2019 to February 2021 that were offered to individuals aged 20, 25, 30, 35, 60, 65, and 70. Only policies from companies that continuously listed policies on Compulife during the sample period were included in the policy offered specification. As the dependent variable for the offering specification, we use the residuals that result from an estimation of an indicator of policy offering on age-group (i.e., younger and older) fixed effects and age-group by date linear trends on the pretreatment period. Standard errors are clustered at the company level and are shown in parentheses.

4.4 | Policies listed for the oldest of the old

The main sample includes policies sold to individuals between the ages of 20 and 70, which captures the vast majority of commonly purchased policies (Harris & Yelowitz, 2014). In this section, we analyze the response for policies sold to individuals aged 75, 80, and 85, who experience the greatest

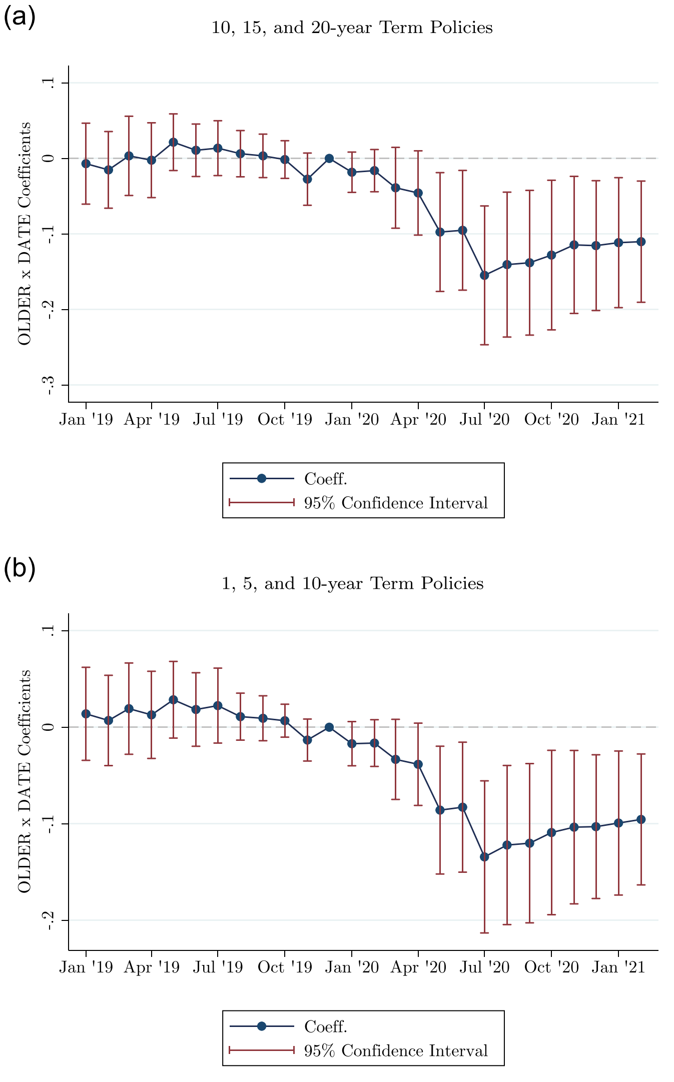

FIGURE 5 Event study, influence of COVID on offerings for age 75+. The sample includes term policies for individuals aged 20, 25, 30, 35, 75, 80, and 85 that appeared at least once from January 2019 to February 2021. Only policies from companies that continuously listed policies on Compulife during the sample period were included. There were 139,200 unique policies from 80 companies for a total of 3,619,200 observations for the specification presented in panel (a). There were 60,077 unique policies from 78 companies for a total of 1,562,002 observations for the specification presented in panel (b). Controls included policy and month fixed effects and standard errors were clustered at the company level. The dependent variable is an indicator for the policy actively being offered in a given month [Color figure can be viewed at wileyonlinelibrary.com]

increase in mortality risk due to COVID-19. Given the large mortality risk, both the number of policies and companies offering policies are comparatively small for these advanced ages.[25]

For analysis of premium changes for policies sold to individuals aged 75 through 85 compared to policies sold to younger individuals (aged 20–35), we find no significant

[25] Appendix Figure A2 illustrates the distribution of policies and the number of companies that offer policies by age.

response to COVID. However, when we analyze policy offerings, we find that offerings significantly decreased for the oldest age group starting in May 2020, as shown in Figure 5. In contrast to the null result for the main specification, this oldest group experienced significant decreases with point estimates, implying that the oldest policies offerings differentially decreased in July by 15.5 percentage points for the sample using 10, 15, and 20-year term policy and by 13.4 percentage points for 1, 5, and 10-year policies (more typical term lengths for the oldest age groups). These large results indicate that companies decreased offerings to the most vulnerable, but it likely influenced a small minority of atypical purchasers.

5 | CONCLUSION

The coronavirus pandemic has created unparalleled short-run disruption across virtually every segment of society, both in the United States and elsewhere. If the earliest predictions of the increase in mortality rate from COVID-19 would have come to fruition, then theory suggests that life insurance companies would have been forced to significantly adjust life insurance premiums or offerings to account for the increased risk. Our findings—from an analysis starting with nearly 100 companies and over 800,000 policies—suggest minimal observable adjustments through February 2021. Nonetheless, we do find evidence that low price leaders raised premiums in response to increased mortality risk, premiums were raised for unhealthy older smokers, and policies offered to individuals age 75 and above were differentially removed from the market. Overall, these results are consistent with a combination of market competition in life insurance and anticipation of meaningful precautionary behavior to contain the spread among the vulnerable, leading to only modest short-run increases in mortality risk.

Our expectation is that market-driven adjustments in the life insurance industry represent some of the most informed expectations on the path of the pandemic. Nonetheless, our findings of relatively small adjustments in the term life insurance market—perhaps unexpected—should not be interpreted as dismissing the individual risk from COVID-19, especially for more vulnerable members of society. Although there are a host of reasons that could explain our results, the most likely one is that as of early March 2021, there have been approximately 28.8 million confirmed cases and 523,850 fatalities in the United States, in a country with 330 million individuals and 2.8 million annual deaths.[26] The most dire mortality forecasts—using either the CFR or IFR—rely on much larger percentages of the population being infected.

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[26] See https://covid.cdc.gov/covid-data-tracker/#datatracker-home.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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