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Insurers' Climate Change Risk Management Quality and Natural Disasters

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ABSTRACT

We perform a textual analysis of insurers' climate risk disclosures and construct a climate change risk management quality index. Our index captures to what extent insurers identify, manage, and adjust their business model to climate change risk. We find that natural disasters in an insurer's home state lead to an increase in climate change risk management quality. Natural disasters in an insurer's geographic markets do not seem to influence climate change risk management in a timely way. Overall, these results are consistent with salience theories of choice.

Keywords: Climate risk, Disclosure, Textual analysis, Sentiment analysis, Insurance
JEL Classification Numbers: C23, G22, G32, Q54.

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1 Introduction

Policymakers and regulators around the globe are increasingly concerned about the effect of climate change on financial institutions and potential spillover effects on the real economy. In the United States, the California Department of Insurance started collecting detailed information on insurers' climate risk exposure and management practices in 2009, and five additional states adopted the same disclosure requirement in the following years.[1] Companies that do not fall under the requirements can submit a survey on a voluntary basis. Respondents have a combined market share of approximately 80 percent of the U.S. insurance market (NAIC Climate Risk Disclosure Survey 2020). However, there is limited empirical research on the effect of climate change risk on financial institutions in general and insurance companies in particular.[2] Most financial research on climate change risk to date has focused on its asset pricing implication (see, e.g., Bernstein et al., 2019; Baldauf et al., 2020; Choi et al., 2020; Murfin and Spiegel, 2020; Giglio et al., 2021).

The goal of our research is to examine differences in insurance companies' approaches to climate change risk management. We perform a textual analysis of insurers' climate risk disclosures and construct a climate risk management quality index that captures to what extent insurers identify, manage, and adjust their business model to climate risk. We are particularly interested in factors that can explain insurers' decisions to improve the quality of their climate change risk management approach. Our main hypothesis is that insurers' focus on climate change risk management and insurers' decisions to improve their risk management

[1]The six states with disclosure requirements based on the Climate Risk Disclosure Survey developed by the National Association of Insurance Commissioners (NAIC) are: California, Connecticut, Minnesota, New Mexico, New York and Washington. In 2021, the disclosure survey initiative was extended to a total number of 15 states. Insurer survey responses for reporting year 2021 are due November 30, 2022.

[2]There are some exceptions. Thistlethwaite and Wood (2018) perform a qualitative analysis of climate risk disclosures of 183 insurance companies for the years 2012 and 2015 and document that the majority of insurers do not integrate climate risk into their risk management process. Gatzert and Schubert (2022) categorize US and UK insurance companies into two groups based on an indicator of climate change risk awareness from the Refinitiv Eikon environmental, social and governance (ESG) database. They find that larger European insurers are more likely to exhibit climate risk awareness and that such awareness is positively associated with Tobin's Q. Ivantsova et al. (2021) provide evidence that insurance companies reduce investments in carbon-intensive bonds after the companies became subject to mandatory climate risk disclosure requirements.

approach are subject to behavioral bias.

While standard economic theories of investment choices assume that decision makers are rational and have unbiased estimates of outcome probabilities based on all available information, prior research in psychology highlights that individuals often deviate from this assumption (see, e.g., Tversky and Kahneman, 1973). Individuals tend to look for mental shortcuts and use heuristics that allow them to get away with limited attention and less effort. One such heuristic is to overweight easily accessible and salient information when estimating probabilities (Kahneman and Tversky, 1973; Tversky and Kahneman, 1973). We draw on this literature and hypothesize that salience bias could influence insurers' decision to invest more in climate change risk management.[3]

Bordalo et al. (2012) formalize a model of choice in which the decision maker's attention is drawn to salient outcomes. In the model, the decision maker overweights the probability of a rare loss events if that event is salient and acts in an extremely risk-averse manner with respect to that event. In our context, this implies that managers of insurance companies that experience a rare but salient climate related event might overestimate the probability of similar disasters in the future and invest more in improving their firms' climate change risk management approach. We refer to this prediction as the salience hypothesis. In our empirical analysis, we use natural disasters in an insurer's home state as realizations of salient climate related events. There is evidence that climate change increases the frequency and severity of natural disasters (Intergovernmental Panel on Climate Change, 2021). In addition, natural disasters arguably receive a lot of media coverage in affected states, raising their salience. Furthermore, occurrences of natural disasters are exogenous to firm and manager characteristics and, therefore, variations in firm outcomes observed after a natural disaster cannot be explained easily by unobserved heterogeneity or reverse causality.

Our sample includes all Climate Risk Disclosure Survey filings of U.S. insurers with state

[3]We use the term salience throughout the paper as defined in Taylor and Thompson (1982): "Salience refers to the phenomenon that when one's attention is differentially directed to one portion of the environment rather than to others, the information contained in that portion will receive disproportionate weighting in subsequent judgments."

regulators. Respondents have a combined market share of approximately 80 percent of the U.S. insurance market.[4] We combine the disclosure data with statutory financial filings and data on natural disasters. Our empirical analysis provides evidence that natural disasters in an insurer's home state lead to an increase in climate risk management quality. Natural disasters in an insurer's geographic markets do not seem to influence climate risk management in a timely way. Overall, these results are consistent with the salience hypothesis. While salient disasters influence insurers' decisions, non-salient disasters do not. Our main result holds for all insurance companies in the sample as well as for the subsamples of stock and mutual insurance companies, publicly-traded and privately-held stock companies, life insurers, and property and liability insurers. For publicly traded insurance companies, we also find that the existence of blockholders among their shareholders is associated with higher average climate risk management quality.

This paper makes several contributions to the literature. First, we contribute to the financial literature on climate change risk (e.g., Krueger et al., 2020; Stroebel and Wurgler, 2021). Most prior research has focused on the asset pricing implications of cimate change risk (e.g., Bernstein et al., 2019; Baldauf et al., 2020; Choi et al., 2020; Murfin and Spiegel, 2020; Giglio et al., 2021). We expand this literature by focusing on firms' climate change risk management approach and firms' decisions to improve the quality of their risk management program. Second, we contribute to the empirical literature on the effects of managers' behavioral biases (see, e.g., Baker et al., 2012). The existing literature provides strong evidence that managerial overconfidence (see, e.g., Malmendier and Tate, 2005, 2008; Campbell et al., 2011; Hirshleifer et al., 2012; Berry-Stölzle et al., 2018), reference point thinking (see, e.g., Baker et al., 2012; Dougal et al., 2015), and preferences shaped by local culture (see, e.g., Hilary and Hui, 2009; Adhikari and Agrawal, 2016; Berry-Stölzle and Irlbeck, 2021) influence managerial decisions. There are only a few articles examining managers' heuristics and salience bias.[5] Our research provides further evidence that salience bias influences man-

[4] NAIC Climate Risk Disclosure Survey 2020.

[5] Dessaint and Matray (2017) examine how managers change corporate policy if a hurricane strikes close

agerial decisions and firm outcomes. Third, we contribute to the corporate risk management literature (see, e.g., Smith and Stulz, 1985; Froot et al., 1993; Mayers and Smith, 1990; Hoyt and Khang, 2000; Hoyt and Liebenberg, 2011; Ellul and Yerramilli, 2013; Berry-Stölzle and Xu, 2018; Kamiya et al., 2021) by examining factors associated with a higher quality climate change risk management approach. Fourth, we contribute to the literature on insurance company operations (see, e.g., Gatzert and Heidinger, 2020; Fritzsch et al., 2021; Gatzert and Schubert, 2022) by examining insurers' climate change risk management approach in detail. Our results may also be of interest to state regulators who are concerned about insurers' ability to adapt to climate change and continue to provide reliable coverage to consumers.

The remainder of the paper is structured as follows. Section 2 describes the construction of our data sample as well as the definition of our measure of climate change risk management quality, and presents some descriptive statistics. Section 3 discusses our empirical strategy. Our main results are presented in Section 4 while robustness checks are given in Section 5. Section 6 concludes.

2 Sample, data, and key variables

2.1 Sample construction

Our initial sample includes all insurance companies that participated in the NAIC Climate Risk Disclosure Survey since 2012. The survey was adopted by the NAIC in 2010 and designed to be a voluntary tool for state insurance regulators, but, in case the state regulator chose to administer the survey, it is mandatory for all insurance companies that are licensed in that state and that write premiums above a certain threshold.

In 2020, disclosure was mandatory in six states with California, New York, and Wash-

to their firm headquarters. They find that these managers increase cash holdings and express being more concerned about hurricane risk. Alok et al. (2020) examine money managers that are located close to an area hit by a natural disaster. They find that those managers underweight stocks of firms located in the disaster zone relative to money managers that are located further away.

ington spearheading the initiative from its start in 2010. In 2013, Connecticut, Minnesota, and New Mexico followed requiring all insurers with direct written premiums in excess of 100 million dollars in the state based on annual Schedule T filings to complete and submit the survey on an annual basis. Insurers with written premiums below the threshold are exempted, but may participate in the survey voluntarily. Respondents include more than 1,400 insurers with a combined market share of approximately 80 percent of the U.S. insurance market.[6]

The survey asks insurers to describe how they incorporate climate risks into their risk mitigation, risk management, and investment activities. It consists of eight two-part questions. The first part needs to be answered categorically with "Yes" or "No" and the second part requires open-ended explanations. The survey questions are listed in Table 1.

– Insert Table 1 about here. –

There are two prior studies that use some data from the NAIC Climate Risk Disclosure Survey. Thistlethwaite and Wood (2018) perform a qualitative analysis of climate risk disclosures of 183 insurance companies for the years 2012 and 2015 and document that the majority of insurers do not integrate climate risk into their risk management process. Ivantsova et al. (2021) examine whether insurance companies adjust their bond portfolio after they are required to respond to the Climate Risk Disclosure Survey. They find that insurers reduce their holdings of carbon-intensive bonds in response to the disclosure requirement. To the best of our knowledge, there is no prior study that takes advantage of the complete survey data.

Next, we merge the Climate Risk Disclosure Survey data with statutory financial statements filed with state regulators. We then perform standard screens. We drop all insurer-year observations with non-positive total net admitted assets or net premiums written.[7]

The data on natural disasters come from the international disaster database EM-DAT.

[6] NAIC Climate Risk Disclosure Survey 2020.

[7] These restrictions collectively remove about 2.9% of the observations.

EM-DAT contains essential core data on the occurrence and effects of mass disasters all over the world from 1900 to the present day: "The database is compiled from various sources, including UN agencies, non-governmental organisations, insurance companies, research institutes, and press agencies."[8] Natural disasters are listed chronologically with information regarding the disaster type (e.g., drought, flood, or wildfire), the location, total damages, insured damages, etc. From EM-DAT, we retrieve data on natural disasters in the U.S. that occurred in 2012 or later.[9] We calculate the annual number of natural disasters per state as the sum of natural disasters that happened in the particular state. Total damages and total damages insured are calculated accordingly as annual sums per state. These measures are then merged with our sample based on the state where an insurance company has its main administrative office and again, based on the states in which an insurance company writes business.

We then complement our sample with state-level macroeconomic data. GDP data are retrieved from the U.S. Bureau of Economic Analysis and unemployment data from the U.S. Bureau of Labor Statistics.

Our final sample consists of 8,391 insurer-year observations from 1,419 unique insurance companies. The sample period includes the years 2012 through 2020.

2.2 Measuring climate change risk management quality

The Climate Risk Disclosure Survey includes eight questions on different aspects of climate change risk management. The questions explicitly ask insurers to explain to what extent and how they identify, manage, and adjust their business model to climate change risk. We perform a textual analysis of the survey responses to evaluate insurers' climate change risk management process.

Our approach towards quantifying an insurer's climate change risk management quality is

[8] https://www.emdat.be/.

[9] We aggregate locations to state level if a natural disaster happened on a more granular level. Locations that could not be assigned distinctly to states are left out.

straight forward. We take the individual survey responses and perform a sentiment analysis based on the Harvard General Inquirer IV-4 dictionary (see, e.g., Tetlock, 2007; Tetlock et al., 2008; Price et al., 2012; Carretta et al., 2015; Da et al., 2015; Mangee, 2018; Hubert and Fabien, 2017; Corbet et al., 2020). This dictionary includes two lists of words, one for strong, action-oriented words and one for weak or passive words (see Appendices 2 and 3). Ignoring order and punctuation, we count the number of strong words and the number of weak words in each survey response. A climate change risk management approach that is described with a larger number of strong or action-oriented words is, arguably, of higher quality than a climate change risk management approach that is described with a larger number of weak or passive words. We therefore combine the counts of strong and weak words into an overall measure of climate change risk management quality ($RMQuality$) by calculating the following ratio (e.g., Jiang et al., 2019):

$$RMQuality = \frac{StrongWords_{i,t} - WeakWords_{i,t}}{TotalWords_{i,t}} \tag{1}$$

We calculate this measure for each insurer-year observation by aggregating the word counts across all eight survey questions submitted by the insurer, as well as separately for each of the eight individual questions. Higher values of the measure indicate that an insurer has actively identified climate change risk exposures to its business model, is determined to manage the risk, and has taken action to manage and mitigate the risk, whereas lower values of the measure are associated with an insurer that is more passive in its approach towards climate change and rather pessimistic in its outlook.

2.3 Descriptive statistics

We begin with a descriptive analysis of the NAIC Climate Risk Disclosure Survey responses. In a first step, we simply count the number of words per answer. Calculating the average length of the answers across all insurers in a given year allows us to visualize the

time trend and to get a first impression of how relevant climate risk has become for insurers since 2012. Figure 1 presents the average length of the answers over time.

– Insert Figure 1 about here. –

Between 2012 and 2020 the average answer length has increased from about 200 words to more than 240 words, which corresponds to a relative increase of about 20%. While the average length of survey answers is certainly a crude measure, this time trend indicates that companies are providing more detailed information and might suggest that climate change risk has become more of a priority for insurance companies in the U.S.

There is considerable variation with respect to the average answer length of all eight survey questions across insurance companies (see Table 2). The mean length is about 238 words. However, the range is large with a minimum length of 11 words and a maximum of 1,322 words, indicating that there are substantial differences in the level of detail provided in survey responses across insurers.

Descriptive statistics for our main measure of climate change risk management quality are also presented in Table 2. The *RMQuality* measure as defined in Equation (1) can take on values between -100% and +100%. The mean of the variable is +5.02% , indicating that, on average, insurers use more strong and action-oriented words in their description of their climate change risk management approach than weak and passive words.

We also calculate two variants of Equation (1) in which we only use the number of strong words or only the number of weak words in the numerator and scale them by the total number of words. The averages of these two ratios are 5.65% and 0.62%, respectively. Insurance companies use about 9-times more strong and action-oriented words in their description of their climate change risk management approach than weak and passive words.

Figure 2 plots the distribution of insurance companies' main administrative office locations in orange as well as the number of natural disasters in each of the states in the year 2020 in blue. Larger orange dots represent larger numbers of insurance companies headquartered

in a state and darker shades of blue represent a larger number of natural disasters in the state. There appears to be a positive correlation between the two distributions. Figure 2 highlights that most insurance companies participating in the climate risk disclosure survey are headquartered in the Northeast and Midwest, and that the highest number of natural disasters in 2020 occurred in the central part of the U.S., including the Midwest, and along the states of the eastern seaboard.

– Insert Figure 2 about here. –

The average number of natural disasters is fairly high. Table 2 shows the mean and median number of natural disasters per year and state in which an insurance company is headquartered. The mean is 4.48 and the median is 4, indicating that insurers are subject to more than four natural disasters in their home state each year.

3 Estimation strategy

To examine differences in insurance companies' approaches to climate change risk management, we regress the climate change risk management quality measure on various firm specific variables. The two main variables of interest are the number of natural disasters hitting the state in which the insurer has its main administrative office in a given year, and a variable capturing the (weighted) average number of natural disasters across all states in which an insurer writes coverage. Since the largest cost of providing insurance coverage are expected losses (Cummins and Trainar, 2009), any change in the expected loss cost or distribution of catastrophic losses in states in which an insurer writes coverage has pricing and underwriting implications for the insurer and requires the insurer to carefully manage the risk associated with these changes. The frequency and severity of natural disasters is expected to increase over the next 30 years due to climate change (Intergovernmental Panel on Climate Change, 2021; Stroebel and Wurgler, 2021). If an insurer observes a larger number of natural disasters in its geographic markets, then this large number could either be

due to chance or indicating a change in the distribution of natural disasters due to climate change. In the latter case, the insurer has incentives to improve its approach of managing the consequences of climate change risk for the firm. Controlling for natural disasters in an insurer's geographic markets, natural disasters hitting the insurers home state should not provide any additional information that is relevant for pricing or underwriting. However, natural disasters arguably receive a lot of media coverage in affected states, raising their salience in these states. By focusing on natural disasters in the home state of an insurer and controlling for natural disaster in all geographic markets in which the insurer provides coverage, we can capture the incremental effect of salience. Managers of insurance companies that experience a rare but salient climate related event might overestimate the probability of similar disasters in the future and invest more in improving their firms' climate change risk management approach.

Our baseline OLS regression specification is as follows:

$$\begin{aligned} RMQuality_{i,t} = \beta_0 + \beta_1 \#NatDisHQ_{i,t} + \beta_2 \#NatDisMarket_{i,t} \\ + \beta_3 X_{i,t} + \beta_4 M_{j,t} + \alpha_i + \delta_t + \epsilon_{i,t}. \end{aligned} \tag{2}$$

$RMQuality_{i,t}$ is the climate change risk management quality of insurer i in year t as defined in Equation (1). $\#NatDisHQ_{i,t}$ denotes the number of natural disasters in the state j in which insurer i has its main administrative office in year t. $\#NatDisMarket_{i,t}$ measures the number of natural disasters in the insurers' geographic market. Our main measure is the weighted average of the number of disasters occurring in each state in which insurer i writes business in year t, using the fraction of premiums written as weights. As an alternative measure, we use the number of natural disaster occurring in an insurer's most important state market. We consider a state to be the most important market for an insurance company if the premium revenue from this market is at least 50% larger than the premium revenue from the second largest market of the particular insurer. $X_{i,t}$ and $M_{j,t}$ are various firm-specific and state-specific control variables. α_i are firm fixed effects to control for any firm

level, time-invariant factors, δ_t are year fixed effects to control for any time trends, and $\epsilon_{i,t}$ is a random error term. We account for outliers by winsorizing continuous variables at the 1^{st} and 99^{th}-percentiles. Standard errors are adjusted for heteroscedasticity and are clustered at the firm level to correct for any potential serial correlation.

The firm-level control variables include a measure of firm size. $Size$ is defined as the natural logarithm of total net admitted assets. ROE captures insurers' profitability and is calculated as the ratio of net income to total net admitted assets. $Capital2Assets$ is calculated as the ratio of policyholder surplus to total net admitted assets and captures financial leverage. $Reinsurance$ denotes the percentage of gross premiums written ceded to reinsurers and is calculated as reinsurance ceded divided by the sum of direct premiums written and reinsurance assumed. $Voluntary\ disclosure$ is an indicator variable that equals 1 if insurer i is not required to file the NAIC climate risk disclosure survey and participates voluntarily in year t.[10] $Mutual$ is an indicator variable equal to 1 if the firm is a mutual insurance company or affiliated with a mutual group. $Group$ is an indicator variable equal to 1 if the insurer is affiliated with a group. $HomeState$ is an indicator variable equal to 1 if the state in which a firm's main administrative office is located requires the NAIC Climate Risk Disclosure Survey in year t.

State-level control variables include the natural logarithm of real GDP and the unemployment rate to capture differences in economic conditions. These variables are measured for the state in which an insurer has its main administrative office.

4 Main results

Table 2 reports descriptive statistics of the variables used in the regression analysis and Table 1 in the Appendix includes all variable definitions and data sources. The average

[10]To identify the insurers disclosing voluntarily, we compare the amount of direct premiums they write in a particular state requiring the disclosure with that state's direct-premium threshold in a given year. We define $Voluntary\ disclosure$ as an indicator variable that equals 1 if insurer i does not meet the requirements for mandatory risk disclosure in any state in the particular year t but still files a disclosure.

company in the sample has a return on equity of 6%, is relatively well capitalized with a capital to assets ratio of 40%, and cedes approximately 52% of its premium revenue to reinsurance companies. About 27% of the observations in the sample are from life insurance companies, the majority are from property-liability insurance companies; filings from managed care insurance companies were excluded.

– Insert Table 2 about here. –

4.1 Baseline regression results

The baseline regression results from Equation (2) are reported in Table 3. The dependent variable is the climate change risk management quality measure $RMQuality$. We start the analysis by including only one of the variables capturing natural disasters at a time. The model in Column (1) only includes the number of natural disasters in the state the insurer is headquartered, the model in Column (3) only includes the (weighted) average number of natural disasters across the states in which the insurer writes business, and Column (2) only includes the number of natural disasters in an insurer's most important state market. The models in Columns (4) and (5) include both the number of natural disasters in the state the insurer is headquartered and a variable capturing natural catastrophes in an insurer's geographic markets. Note that the number of observations in Columns (2) and (4) is lower than in the other columns. This difference is caused by the definition of an insurance company's main market. We rank the premiums written in each state and require the premium revenue from the largest market to be, at a minimum, 50% larger than the premium revenue from the second largest market. This approach ensures that the insurer has one market that generates more revenue and is more important for the overall performance of the insurer than all other markets. The $\#NatDisMIMarket$ variable captures the number of natural disasters in the insurer's main market and is coded as having a missing value if no dominant market exists.

– Insert Table 3 about here. –

Across all five model specifications, neither of the two measures of natural disasters in the insurers' geographic markets are statistically significant. The coefficient of the variable capturing the number of natural disasters in an insurer's home state, on the other hand, is positive and significant in all three model specifications it is included, indicating that natural disasters in the home state are positively associated with improvements of an insurer's climate risk management quality. Overall, these results are consistent with the salience hypothesis. Controlling for natural disasters in an insurer's geographic markets, natural disasters occurring in the insurer's home state should not provide any additional information that is relevant for pricing or underwriting and therefore no incentives for the insurer to improve its climate change risk management approach. However, such natural disasters are arguably salient events and managers of insurance companies that experience these events might overestimate the probability of similar disasters in the future and invest more in improving the insurer's climate change risk management approach. After controlling for natural disaster in all geographic markets, the positive coefficient of the $\#NatDisHQ$ variable provides evidence that there is an incremental effect of salience.

The only other two variables that have significant coefficients in most of the model specifications are the capital to assets ratio ($Capital2Assets$) and the voluntary disclosure indicator ($Voluntary\ Disclosure$). The negative and significant coefficient of the capital to assets ratio indicates that better capitalized insurers have, on average, lower quality climate change risk management processes in place. This result is consistent with the risk management literature (see, e.g., Liebenberg and Hoyt, 2003; Hoyt and Liebenberg, 2011; Ellul and Yerramilli, 2013), which documents that capitalization and a higher quality risk management processes are substitutes. The positive coefficient of the $Voluntary\ Disclosure$ variable indicates that voluntary filers of the climate risk disclosure survey focus more on climate change risk management and have, on average, a higher quality process in place to address climate change risk.

4.2 Subsample analysis

Our sample includes both property-liability and life insurance companies. While both types of companies are exposed to climate change risk with respect to their investment portfolio, life insurers face less risk with respect to their insurance portfolio. In 2020, 79% of global insured property losses caused by natural disasters occurred in North America resulting in $69.8 billions in insured damages; in the same year, there were 478 fatalities in North America that can be attributed to natural disasters and that corresponds to about 6% of global fatalities (Swiss Re Institute, 2021). We therefore expect new information about natural catastrophes in an insurer's geographic markets to be less valuable to life insurers than to property-liability insurers and we expect life insurers to have less incentives to make any changes to their climate change risk management approach. However, the influence of salient natural disasters on managers' subjective probabilities of similar disasters occurring in the future should be comparable across property-liability and life insurers. We therefore expect to find a positive relationship between natural disasters in an insurer's home state and the quality of the insurer' climate change risk management program for both, property-liability and life insurers. Evidence supporting our salience hypothesis based on the subsample of life insurers would be stronger than evidence based on the subsample of property-liability insurers because, in the absence of the salience mechanism, life insurers have less incentives to improve the quality of their climate change risk management approach in response to natural disasters than property-liability insurers.

In addition, we also expect stock insurance companies to be more attentive and to respond faster to changes in climate related natural disasters than mutual insurance companies. Mutuals are owned by their policyholders and ownership right cannot be separately be traded, protecting mutuals from takeovers (Mayers and Smith, 1981). Takeover threats are a powerful tool to discipline managers. Bertrand and Mullainathan (2003) examine how managerial decisions change after antitakeover laws are enacted in a state. Their result supports the view that managers prefer a quiet life. We therefore expect mutuals to take

less action in response to new information about natural catastrophes in their respective geographic markets than stock insurers. Again, we argue that the influence of salient natural disasters on managers' subjective probabilities of similar disasters occurring in the future should be comparable across stock and mutual insurance companies.

– Insert Table 4 about here. –

Note that we include additional control variables into the model specifications of the subsample analysis for life and property-liability insurance companies (see Column (1) and (2) of Table 4). The model for property-liability insurance companies includes the fraction of premiums written in personal lines as an additional variable and two variables capturing diversification across products and geographic regions.[11] The two diversification variables are calculated as 1 minus the Herfindahl index of net premiums written across business lines and across states, respectively.[12] The model for life insurance companies includes a variable that captures how diversified a company is across different life insurance and annuity products. $Product\ Mix\ (Life)$ is calculated as 1 minus the Herfindahl index of net premiums written across lines of business.[13]

Table 4 presents the results. The coefficient of the $\#NatDisHQ$ variable is positive and statistically significant and the coefficient of the $\#NatDisMarket$ variable is insignificant for all four subsamples. These results support the view that there is an incremental effect of salient natural disasters on the quality of an insurer's climate change risk management approach after controlling for natural disasters in all geographic markets and that these results hold even for subsamples in which we would expect natural disaster to play less of a

[11] Personal lines are defined as private passenger auto liability, auto physical damage, and homeowners' multiple peril.

[12] We include all business lines from Underwriting and Investment Exhibits in insurer annual statements. Geographical diversity includes the Herfindahl index of net written premiums in each of the 50 U.S. states and Washington DC retrieved from annual Schedule T filings.

[13] Net premiums written are based on the "Analysis of operations by line of business" page of annual statements as the sum of lines "1 Premiums and annuity considerations for life and accident and health contracts" and "2 Considerations for supplementary contracts with life contingencies". The percentage of annuity business is calculated as the sum of premiums in individual and group annuities, and the percentage of life business is calculated as the sum of industrial life, ordinary life, group life, and credit life.

role in the absence of the salience mechanism (i.e, for life insurers and mutual companies).

5 Additional empirical analysis and robustness checks

We investigate three additional questions to further our understanding of the effect of salient natural disasters on insurers' climate change risk management quality. First, we focus on stock insurance companies and examine whether blockholders influence climate change risk management policy and whether our main result holds if we control for this potential mechanism. Second, we use the dollar amount of losses associated with natural disasters rather than the number of natural disasters to ensure that our main result is not driven by the choice of that specific measure. Third, we use alternative measures of climate change risk management quality to highlight the robustness of our main result with respect to the choice of our dependent variable.

5.1 Publicly traded insurance companies and blockholders

There is substantial empirical evidence that shareholder activism influences corporate policies and outcomes (see, e.g., Autore et al., 2019). Some activist shareholders explicitly influence corporations to improve their voluntary disclosure of climate change risk (Flammer et al., 2021) and to reduce their carbon emission (Azar et al., 2021). Of course, shareholder activism primarily impacts publicly traded stock companies. Many of the stock insurance companies in our sample are privately held. To examine whether publicly traded insurance companies differ from privately held companies with respect to their climate change risk management approach, we include a *Publicly traded* indicator into our baseline regression model and estimate the model for the subsample of stock insurance companies. Furthermore, we add a *Blockholder* indicator variable to the model. This variable is coded equal to 1 if a company has at least one blockholder holding 5% or more of the shares with the intention to

change or influence the control of the issuer.[14] Blockholders can influence corporate decisions through both direct intervention and the threat of selling their shares (see, e.g., Shleifer and Vishny, 1986; Bushee, 2001; Clifford and Lindsey, 2016). Including the *Blockholder* variable allows us to examine whether companies with blockholders tend to focus more on the quality of their climate change risk management approach than companies without blockholders. We estimate the model for all stock insurance companies as well as the for the subsamples of publicly traded and privately held stock companies.

– Insert Table 5 about here. –

The results are presented in 5. The coefficient of the *Publicly traded* indicator variable is insignificant. For the subsample of publicly traded stock companies, the coefficient of the *Blockholder* variable is positive and significant, indicating that the existence of blockholders among the shareholders is associated with higher average climate risk management quality. This result provides some evidence that governance mechanisms in general and pressure from shareholders specifically might influence corporate climate policy.

But more importantly, our main result holds even when controlling for potential effects of blockholder ownership or market forces associated with being a publicly traded stock company. In all three columns in Table 5, the coefficient of the $\#NatDisHQ$ variable capturing salient disasters in an insurers home state is significant, but the coefficient of the $\#NatDisMarket$ variable that captures natural disaters across all geographic markets in which an insurer is operating is *in*significant.

5.2 Severity of natural disasters

Next, we use the dollar amount of losses associated with natural disasters rather than the number of natural disasters to compute the three measures capturing natural disaster in an insurer's home state, natural disasters in an insurer's most important state market, and

[14] We use the blockolder data collected from SEC Form 13D and 13G filings by Harries (2021).

the weighted average of natural disaster across all state markets, using premiums written as weights. Similarly, we use the dollar amount of insured losses from those natural disasters to calculate the three measures. Both, total loss amounts as well as insured losses are from the international disaster database EM-DAT.

– Insert Table 6 about here. –

The results are presented in Table 6. Column (1) shows our baseline model for comparison. Columns (2) through (6) show the estimation results based on the measures of total damages and Columns (7) through (11) show the estimates based on the measures of insured damages. The results are comparable to our baseline results presented in Table 3 The coefficient of the *Total Damages* variable is positive and significant and the coefficient of the *Total Damages* (*Market*) variable is insignificant in all model specifications. Again, these results can be interpreted as evidence that there is an incremental effect of salient natural disasters in an insurer's home state on climate change risk management quality after controlling for natural disasters in all geographic markets. The results based on insured damages presented in Columns (7) through (11) are less pronounced, but paint a similar picture. Overall, these results further support the salience hypothesis and we can conclude that our main result is robust to alternative measures of natural disaster.

5.3 Alternative climate change risk management quality measures

As an additional robustness check, we use alternative measures of climate change risk management quality to highlight that our main result is not just driven by the choice of our dependent variable. First, we use the average length of an insurer's answers across all eight questions in the NAIC Climate Risk Disclosure Survey as an alternative, albeit crude measure capturing how much of a priority climate change risk is for the insurer.

– Insert Table 7 about here. –

The results with the average length of survey responses as the dependent variable are presented in Column (1) of Table 7. Again, the coefficient of the $\#NatDisHQ$ variable is positive and significant and the coefficient of the $\#NatDisMarket$ variable is insignificant, indicating that there is an incremental effect of salient natural disasters on an insurer's approach towards climate change risk management after controlling for natural disasters in all of the insurer's geographic markets.

We then use two variants of our main measure that are calculated only based on the number of strong words in the survey responses or only based on the number of weak words. Both measures are scaled by the total number of words. The results are presented in Columns (2) and (3) of Table 7. In the model with the ratio of strong or action-oriented words as the dependent variable, we observe similar results as in our baseline model specification. The coefficient of the $\#NatDisHQ$ variable is positive and significant and the coefficient of the $\#NatDisMarket$ variable is insignificant, indicating that there is a positive incremental effect of salient natural disasters in an insurer's home state on its climate change risk management approach after controlling for natural disasters in all geographic markets. These results provide further support for the salience hypothesis.

In the model with the ratio of weak or passive words as the dependent variable, the coefficient of the $\#NatDisHQ$ variable is insignificant. Taken together these results seem to indicate that the estimated relationship between our main measure of climate change risk management quality and natural disaster in an insurer's home state seem to be rather driven by strong and action-oriented words used to calculate the measure than by the weak or passive words that are also included.

6 Conclusion

This paper examines factors that can explain insurance companies' decisions to improve the quality of their climate change risk management approach. Our main hypothesis is that

insurers' decisions to improve their risk management approach is subject to salience bias.

While standard economic theories of investment choices assume that decision makers are rational and have unbiased estimates of outcome probabilities based on all available information, prior research in psychology highlights that individuals often deviate from this assumption and one such deviation is the salience bias. When a rare, but salient loss event occurs, a decision maker might overweight the probability of the event and act in an extremely risk-averse manner with respect to that event. In our context, this implies that managers of insurance companies that experience a rare but salient climate related event might overestimate the probability of similar disasters in the future and invest more in improving their firms' climate change risk management approach.

Our empirical analysis is based on the NAIC climate risk disclosure survey. We perform a textual analysis and construct a climate change risk management quality index. Consistent with our theoretical prediction, we find that natural disasters in an insurer's home state lead to an increase in climate risk management quality. Natural disasters in an insurer's geographic markets do not seem to influence climate risk management in a timely way. Overall, these results are consistent with the salience hypothesis. While salient disasters influence insurers' decisions, non-salient disasters do not.

References

Adhikari, B. K. and A. Agrawal (2016): "Does local religiosity matter for bank risk-taking?" *Journal of Corporate Finance*, 38, 272–293.

Alok, S., N. Kumar, and R. Wermers (2020): "Do Fund Managers Misestimate Climatic Disaster Risk," *The Review of Financial Studies*, 33, 1146–1183.

Autore, D. M., N. Clarke, and B. Liu (2019): "Activist investors and open market share repurchases," *Journal of Banking & Finance*, 107, 105614.

Azar, J., M. Duro, I. Kadach, and G. Ormazabal (2021): "The Big Three and corporate carbon emissions around the world," *Journal of Financial Economics*, 142, 674–696.

Baker, M., X. Pan, and J. Wurgler (2012): "The effect of reference point prices on mergers and acquisitions," *Journal of Financial Economics*, 106, 49–71.

Baldauf, M., L. Garlappi, and C. Yannelis (2020): "Does Climate Change Affect Real Estate Prices? Only If You Believe In It," *The Review of Financial Studies*, 33, 1256–1295.

Bernstein, A., M. T. Gustafson, and R. Lewis (2019): "Disaster on the horizon: The price effect of sea level rise," *Journal of Financial Economics*, 134, 253–272.

Berry-Stölzle, T. R., E. M. Eastman, and J. Xu (2018): "CEO Overconfidence and Earnings Management: Evidence from Property-Liability Insurers' Loss Reserves," *North American Actuarial Journal*, 22, 380–404.

Berry-Stölzle, T. R. and S. Irlbeck (2021): "Religiosity and risk taking: Is there a demand-side effect?" *Journal of Corporate Finance*, 71, 102–117.

Berry-Stölzle, T. R. and J. Xu (2018): "Enterprise Risk Management and the Cost of Capital," *Journal of Risk and Insurance*, 85, 159–201.

Bertrand, M. and S. Mullainathan (2003): "Enjoying the Quiet Life? Corporate Governance and Managerial Preferences," *Journal of Political Economy*, 111, 1043–1075.

Bordalo, P., N. Gennaioli, and A. Shleifer (2012): "Salience Theory of Choice Under Risk," *The Quarterly Journal of Economics*, 127, 1243–1285.

Bushee, B. J. (2001): "Do Institutional Investors Prefer Near-Term Earnings over Long-Run Value?" *Contemporary Accounting Research*, 18, 207–246.

Campbell, T. C., M. Gallmeyer, S. A. Johnson, J. Rutherford, and B. W. Stanley (2011): "CEO optimism and forced turnover," *Journal of Financial Economics*, 101, 695–712.

Carretta, A., V. Farina, F. Fiordelisi, P. Schwizer, and F. S. Stentella Lopes (2015): "Don't Stand So Close to Me: The role of supervisory style in banking stability," *Journal of Banking & Finance*, 52, 180–188.

Choi, D., Z. Gao, and W. Jiang (2020): "Attention to Global Warming," *The Review of Financial Studies*, 33, 1112–1145.

Clifford, C. P. and L. Lindsey (2016): "Blockholder Heterogeneity, CEO Compensation, and Firm Performance," *Journal of Financial and Quantitative Analysis*, 51, 1491–1520.

Corbet, S., Y. G. Hou, Y. Hu, C. Larkin, and L. Oxley (2020): "Any port in a storm: Cryptocurrency safe-havens during the COVID-19 pandemic," *Economics letters*, 194, 109377.

Cummins, J. D. and P. Trainar (2009): "Securitization, Insurance, and Reinsurance," *Journal of Risk and Insurance*, 76, 463–492.

Da, Z., J. Engelberg, and P. Gao (2015): "The Sum of All FEARS Investor Sentiment and Asset Prices," *Review of Financial Studies*, 28, 1–32.

Dessaint, O. and A. Matray (2017): "Do managers overreact to salient risks? Evidence from hurricane strikes," *Journal of Financial Economics*, 126, 97–121.

Dougal, C., J. Engelberg, C. A. Parsons, and E. D. van Wesep (2015): "Anchoring on Credit Spreads," *The Journal of Finance*, 70, 1039–1080.

Ellul, A. and V. Yerramilli (2013): "Stronger Risk Controls, Lower Risk: Evidence from U.S. Bank Holding Companies," *Journal of Finance*, 68, 1757–1803.

Flammer, C., M. W. Toffel, and K. Viswanathan (2021): "Shareholder activism and firms' voluntary disclosure of climate change risks," *Strategic Management Journal*, 42, 1850–1879.

Fritzsch, S., P. Scharner, and G. Weiss (2021): "Estimating the relation between digitalization and the market value of insurers," *Journal of Risk and Insurance*, 88, 529–567.

Froot, K. A., D. S. Scharfstein, and J. C. Stein (1993): "Risk Management: Coordinating Corporate Investment and Financing Policies," *The Journal of Finance*, 48, 1629–1658.

Gatzert, N. and D. Heidinger (2020): "An Empirical Analysis of Market Reactions to the First Solvency and Financial Condition Reports in the European Insurance Industry," *Journal of Risk and Insurance*, 87, 407–436.

Gatzert, N. and M. Schubert (2022): "Cyber risk management in the US banking and insurance industry: A textual and empirical analysis of determinants and value," *Journal of Risk and Insurance*, 89, 725–763.

Giglio, S., M. Maggiori, K. Rao, J. Stroebel, and A. Weber (2021): "Climate Change and Long-Run Discount Rates: Evidence from Real Estate," *The Review of Financial Studies*, 34, 3527–3571.

Harries, J. P. (2021): "Determinants of Blockholdership - A new Dataset for Blockholder Analysis," *SSRN Electronic Journal*.

Hilary, G. and K. W. Hui (2009): "Does religion matter in corporate decision making in America?" *Journal of Financial Economics*, 93, 455–473.

Hirshleifer, D., A. Low, and S. H. Teoh (2012): "Are Overconfident CEOs Better Innovators?" *The Journal of Finance*, 67, 1457–1498.

Hoyt, R. E. and H. Khang (2000): "On the Demand for Corporate Property Insurance," *The Journal of Risk and Insurance*, 67, 91–107.

Hoyt, R. E. and A. P. Liebenberg (2011): "The Value of Enterprise Risk Management," *Journal of Risk and Insurance*, 78, 795–822.

Hubert, P. and L. Fabien (2017): "Central Bank Sentiment and Policy Expectations," *Bank of England Working Paper*.

Intergovernmental Panel on Climate Change (2021): "Summary for policymakers," *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*.

Ivantsova, A., K. Kim, and X. Lin (2021): "Climate Risk Disclosure and Institutional Investors: Evidence from the Insurance Industry," *SSRN Electronic Journal*.

Jiang, F., J. Lee, X. Martin, and G. Zhou (2019): "Manager sentiment and stock returns," *Journal of Financial Economics*, 132, 126–149.

Kahneman, D. and A. Tversky (1973): "On the psychology of prediction," *Psychological Review*, 80, 237–251.

Kamiya, S., J.-K. Kang, J. Kim, A. Milidonis, and R. M. Stulz (2021): "Risk management, firm reputation, and the impact of successful cyberattacks on target firms," *Journal of Financial Economics*, 139, 719–749.

Krueger, P., Z. Sautner, and L. T. Starks (2020): "The Importance of Climate Risks for Institutional Investors," *The Review of Financial Studies*, 33, 1067–1111.

Liebenberg, A. P. and R. E. Hoyt (2003): "The Determinants of Enterprise Risk Management: Evidence From the Appointment of Chief Risk Officers," *Risk Management and Insurance Review*, 6, 37–52.

Malmendier, U. and G. Tate (2005): "CEO Overconfidence and Corporate Investment," *The Journal of Finance*, 60, 2661–2700.

——— (2008): "Who makes acquisitions? CEO overconfidence and the market's reaction," *Journal of Financial Economics*, 89, 20–43.

Mangee, N. (2018): "Stock Returns and the Tone of Marketplace Information: Does Context Matter?" *Journal of Behavioral Finance*, 19, 396–406.

Mayers, D. and J. C. W. Smith (1981): "Contractual Provisions, Organizational Structure, and Conflict Control in Insurance Markets," *The Journal of Business*, 54, 407–434.

——— (1990): "On the Corporate Demand for Insurance: Evidence from the Reinsurance Market," *The Journal of Business*, 63, 19–40.

Murfin, J. and M. Spiegel (2020): "Is the Risk of Sea Level Rise Capitalized in Residential Real Estate?" *The Review of Financial Studies*, 33, 1217–1255.

Price, S. M., J. S. Doran, D. R. Peterson, and B. A. Bliss (2012): "Earnings conference calls and stock returns: The incremental informativeness of textual tone," *Journal of Banking & Finance*, 36, 992–1011.

Shleifer, A. and R. W. Vishny (1986): "Large Shareholders and Corporate Control," *Journal of Political Economy*, 94.

Smith, C. W. and R. M. Stulz (1985): "The Determinants of Firms' Hedging Policies," *The Journal of Financial and Quantitative Analysis*, 20, 391–405.

Stroebel, J. and J. Wurgler (2021): "What do you think about climate finance?" *Journal of Financial Economics*, 142, 487–498.

Swiss Re Institute (2021): "Natural catastrophes in 2020: sencondary perils in the spotlight, but don't forget primary-peril risks," *sigma*.

Taylor, S. E. and S. C. Thompson (1982): "Stalking the elusive vividness effect," *Psychological Review*, 89, 155–181.

Tetlock, P. C. (2007): "Giving Content to Investor Sentiment: The Role of Media in the Stock Market," *The Journal of Finance*, 62, 1139–1168.

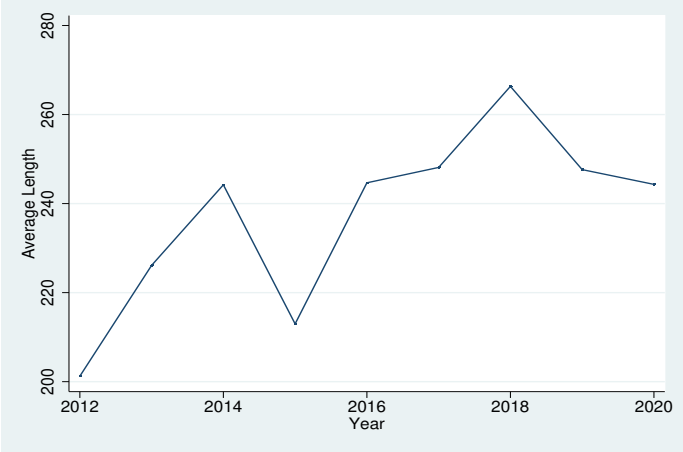
Tetlock, P. C., M. Saar-Tsechansky, and S. Macskassy (2008): "More Than Words: Quantifying Language to Measure Firms' Fundamentals," *The Journal of Finance*, 63, 1437–1467.

Thistlethwaite, J. and M. O. Wood (2018): "Insurance and Climate Change Risk Management: Rescaling to Look Beyond the Horizon," *British Journal of Management*, 29, 279–298.

Tversky, A. and D. Kahneman (1973): "Availability: A heuristic for judging frequency and probability," *Cognitive Psychology*, 5, 207–232.

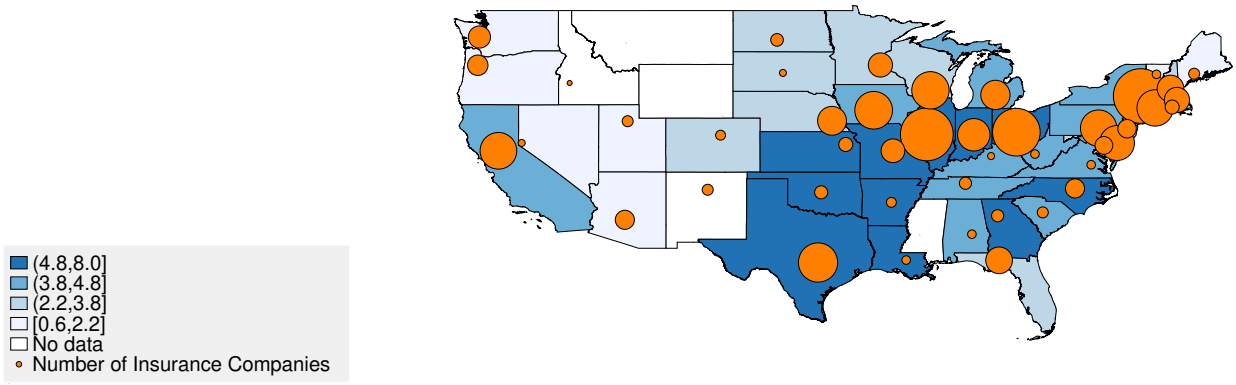
7 Tables and Figures

Figure 1: Average answer length over time



This figure illustrates the time trend of the average length of NAIC Climate Risk Disclosure Survey responses between 2012 and 2020. The average length is calculated across all questions and insurers in a given year.

Figure 2: Natural disasters and U.S. insurance hubs (2020)



This figure shows the distribution of insurance companies' main administrative office locations in orange as well as the number of natural disasters in each of the states in the year 2020 in blue. Larger orange dots represent larger numbers of insurance companies headquartered in a state and darker shades of blue represent a larger number of natural disasters in the state.

Table 1: NAIC Climate Risk Disclosure Survey Questions

Question 1	Does the company have a plan to assess, reduce or mitigate its emissions in its operations or organizations?
Question 2	Does the company have a climate change policy with respect to risk management and investment management? If yes, please summarize. If no, how do you account for climate change in your risk management?
Question 3	Describe your company's process for identifying climate change-related risks and assessing the degree that they could affect your business, including financial implications.
Question 4	Summarize the current or anticipated risks that climate change poses to your company. Explain the ways that these risks could affect your business. Include identification of the geographical areas affected by these risks.
Question 5	Has the company considered the impact of climate change on its investment portfolio? Has it altered its investment strategy in response to these considerations? If so, please summarize steps you have taken.
Question 6	Summarize steps the company has taken to encourage policyholders to reduce the losses caused by climate change-influenced events.
Question 7	Discuss steps, if any, the company has taken to engage key constituencies on the topic of climate change.
Question 8	Describe actions the company is taking to manage the risks climate change poses to your business including, in general terms, the use of computer modeling.

Table 2: Summary Statistics

Note: Summary statistics on all variables used in the multivariate ordinary least squares analyses are presented. The panel spans from 2012 to 2020. The following columns present the number of observations, mean, median, standard deviation, as well as minimum and maximum value. The variable definitions and data sources are given in Appendix 1.

	Obs.	Mean	Median	Std. Dev.	Min	Max
RMQuality (%)	8391	5.02	5.13	1.46	0.00	8.85
Strong Sentiment (%)	8391	5.65	5.72	1.39	0.74	9.51
Weak Sentiment (%)	8391	0.62	0.60	0.40	0.00	2.34
Mean Answer Length	8391	238.42	165.13	239.23	11.00	1322.38
#NatDisHQ	8391	4.48	4.00	2.73	1.00	13.00
#NatDisMIMarket	5142	4.54	5.00	2.71	0.00	13.00
Total Damages	8391	11.50	6.50	15.00	0.00	79.70
Damages Insured	8391	4.79	3.25	5.75	0.00	29.80
#NatDisMarket	8391	4.13	4.00	2.03	0.00	13.00
Size	8391	13.37	13.15	2.15	7.26	19.83
ROE	8391	0.06	0.05	0.12	-0.39	0.49
Capital2Assets	8391	0.40	0.36	0.26	0.02	1.00
Reinsurance	8391	0.52	0.51	0.38	0.00	1.00
Blockholder	8391	0.50	0.00	0.50	0.00	1.00
Voluntary Disclosure	8391	0.77	1.00	0.42	0.00	1.00
Mutual Group	8391	0.38	0.00	0.48	0.00	1.00
Group	8391	0.95	1.00	0.21	0.00	1.00
Life Dummy	8391	0.27	0.00	0.44	0.00	1.00
Product Mix (P&C)	8391	0.78	0.88	0.29	0.00	1.00
Long-tail business lines	8391	0.31	0.00	0.36	0.00	1.00
Geographical diversity	8391	0.72	0.89	0.32	0.00	1.00
% Personal lines	8391	0.20	0.00	0.33	0.00	1.00
Product Mix (Life)	8391	0.87	1.00	0.30	0.00	1.00
Home State In	8391	0.23	0.00	0.42	0.00	1.00
GDP (real)	8391	13.18	13.21	0.82	10.26	14.82
Unemployment (%)	8391	5.58	5.00	1.88	2.80	10.10

Table 3: Natural disasters and insurers' climate change risk management quality

Note: This table presents OLS regressions of the climate change risk management quality measure ($RMQuality$) on the number of natural disasters in the insurer's home state ($\#NatDisHQ$), the number of natural disasters in the insurer's geographic markets ($\#NatDisMarket$ or $\#NatDisMIMarket$) and firm-level and state-level controls. Columns (1) - (3) show the results for the single effect of the annual sum of natural disasters in the home state of the insurer, in the insurer's most important market, and the premium-weighted annual sum according to Schedule T filings, respectively. Columns (4) and (5) report the results using the annual sum of natural disasters in the home state in combination with those in the insurer's most important market and the premium-weighted natural disasters across all markets, respectively. All models include firm and year fixed effects. Variable descriptions can be found in Appendix 1. Standard errors are reported in parentheses and are adjusted for heteroskedasticity and firm-level clustering. Furthermore, the model fit (R^2) and test statistics for the joint significance of regressors (F-test) are reported at the bottom of the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	(1) RMQuality	(2) RMQuality	(3) RMQuality	(4) RMQuality	(5) RMQuality
#NatDisHQ	0.028***			0.038***	0.031***
	(0.006)			(0.009)	(0.007)
#NatDisMIMarket		0.011		-0.004	
		(0.007)		(0.008)	
#NatDisMarket			0.005		-0.013
			(0.009)		(0.010)
Size	-0.091	-0.122	-0.093	-0.124	-0.089
	(0.061)	(0.091)	(0.061)	(0.091)	(0.061)
ROE	-0.217	-0.208	-0.232	-0.177	-0.221
	(0.154)	(0.195)	(0.154)	(0.196)	(0.154)
Capital2Assets	-0.599***	-0.438	-0.614***	-0.421	-0.602***
	(0.221)	(0.266)	(0.222)	(0.265)	(0.221)
Reinsurance	0.027	0.057	0.028	0.058	0.029
	(0.111)	(0.164)	(0.111)	(0.165)	(0.111)
Voluntary Disclosure	0.123*	0.127	0.121*	0.124	0.122*
	(0.066)	(0.100)	(0.066)	(0.100)	(0.066)
Mutual Group	-0.089	-0.057	-0.098	-0.042	-0.088
	(0.084)	(0.116)	(0.084)	(0.116)	(0.084)
Group	-0.301	-0.421	-0.297	-0.366	-0.303
	(0.304)	(0.423)	(0.308)	(0.428)	(0.306)
Home State In	-0.026	-0.060	-0.035	-0.052	-0.024
	(0.087)	(0.136)	(0.087)	(0.136)	(0.087)
GDP (real)	-0.139	-0.224	-0.100	-0.252	-0.140
	(0.108)	(0.168)	(0.108)	(0.169)	(0.108)
Unemployment (%)	-0.006	-0.031	-0.025	-0.005	-0.005
	(0.022)	(0.031)	(0.022)	(0.031)	(0.022)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	8391	5142	8391	5142	8391
R^2	0.022	0.020	0.019	0.025	0.023
F-Test	3.25	2.10	2.60	2.46	3.10

Table 4: Subsample analysis

Note: This table presents OLS regression results for different subsamples. The full sample is split based on business type and organizational form. Columns (1) and (2) report the results for Life and P&C insurers, respectively. In addition to the baseline variables from Equation (1), we include a set of control variables that are specific to life and P&C insurance companies. Columns (3) and (4) show the results for stock and mutual insurers. Insurers are considered to be a mutual if they are a mutual company or if they are affiliated with a mutual insurance group. All models include firm and year fixed effects. Variable descriptions can be found in Appendix 1. Standard errors are reported in parentheses and are adjusted for heteroskedasticity and firm-level clustering. Furthermore, the model fit (R^2) and test statistics for the joint significance of regressors (F-test) are reported at the bottom of the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Business/Company Type	(1) Life	(2) P&C	(3) Stock	(4) Mutual
#NatDisHQ	0.023**	0.034***	0.027***	0.032***
	(0.011)	(0.008)	(0.009)	(0.010)
#NatDisMarket	-0.005	-0.011	0.008	-0.019
	(0.024)	(0.011)	(0.017)	(0.012)
Size	0.235	-0.208***	-0.013	-0.185***
	(0.146)	(0.067)	(0.096)	(0.069)
ROE	-0.020	-0.319	-0.251	-0.086
	(0.223)	(0.220)	(0.205)	(0.232)
Capital2Assets	0.026	-0.763***	-0.704**	-0.589***
	(0.632)	(0.223)	(0.344)	(0.226)
Reinsurance	0.157	-0.023	-0.104	0.024
	(0.169)	(0.157)	(0.151)	(0.150)
Voluntary Disclosure	0.054	0.117	0.149*	0.098
	(0.107)	(0.077)	(0.088)	(0.085)
Mutual Group	-0.464**	-0.030		
	(0.194)	(0.090)		
Group	0.000	-0.259	0.000	-0.002
	(.)	(0.288)	(.)	(0.073)
Home State In	-0.120	0.039	-0.100	-0.322
	(0.252)	(0.084)	(0.110)	(0.201)
GDP (real)	-0.095	-0.146	-0.159	-0.061
	(0.171)	(0.136)	(0.126)	(0.171)
Unemployment (%)	-0.051	0.017	0.029	-0.041
	(0.046)	(0.023)	(0.029)	(0.037)
Product Mix (Life)	0.369**			
	(0.174)			
Product Mix (P&C)		-0.257		
		(0.215)		
Long-tail business lines		0.009		
		(0.216)		
Geographical diversity		0.288		
		(0.194)		
% Personal lines		-0.234		
		(0.210)		
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	2238	6153	5089	3150
R^2	0.030	0.032	0.037	0.023
F-Test	1.72	2.69	3.04	.

Table 5: Subsample analysis: Stock companies and blockholdership

Note: This table presents OLS regression results for the subsample of stock insurance companies. We then split this sample further into publicy traded stock companies and privately held stock companies. Column (1) shows the estimation results for stock companies. Columns (2) and (3) report the results for the subsamples of publicly traded and privately held stock companies, respectively. In all specifications, the annual sum of natural disasters in the insurer's home state as well as the indicator variable for blockholdership are used as the main explanatory variables. In addition, Column (1) includes an indicator variable for publicity traded insurers and all three model specification include an indicator variable equal to 1 if a company has at least one blockholder holding 5% or more of the shares. All models include firm and year fixed effects. Variable descriptions can be found in Appendix 1. Standard errors are reported in parentheses and are adjusted for heteroskedasticity and firm-level clustering. Furthermore, the model fit (R^2) and test statistics for the joint significance of regressors (F-test) are reported at the bottom of the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Subsample	(1) Stock	(2) Public	(3) Private
#NatDisHQ	0.031***	0.030***	0.031***
	(0.007)	(0.009)	(0.011)
Blockholder	0.015	0.173*	-0.014
	(0.060)	(0.096)	(0.107)
Publicly traded	0.136		
	(0.087)		
#NatDisMarket	-0.011	-0.004	-0.023
	(0.010)	(0.015)	(0.016)
Size	0.021	-0.084	-0.028
	(0.025)	(0.083)	(0.089)
ROE	-0.137	-0.341*	0.041
	(0.156)	(0.198)	(0.287)
Capital2Assets	-0.280*	-0.482	-0.793**
	(0.158)	(0.303)	(0.334)
Reinsurance	0.047	-0.093	0.079
	(0.086)	(0.139)	(0.161)
Voluntary Disclosure	0.068	0.122	0.103
	(0.062)	(0.074)	(0.144)
Mutual Group	0.118**	-0.177**	-0.205*
	(0.055)	(0.079)	(0.115)
Group	0.878***	-0.758***	-0.562
	(0.283)	(0.153)	(0.411)
Home State In	-0.016	0.113	-0.239
	(0.070)	(0.093)	(0.165)
GDP (real)	-0.125***	-0.143	-0.279
	(0.047)	(0.129)	(0.194)
Unemployment (%)	-0.009	-0.008	-0.020
	(0.021)	(0.031)	(0.035)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	7393	4263	3130
R^2	0.020	0.040	0.022
F-Test		.	2.22

Table 6: Natural disaster damages and insurers' climate change risk management quality

Note: This table presents OLS regressions of Equation (1) using the dollar amount of total damages or insured damages rather than the number of natural disasters to capture natural disaster in the insurer's home state, main geographic market and the weighted average across all markets. In all specifications, the dependent variable is *RMQuality*. Column (1) shows the baseline model for comparison. Columns (2) - (6) report estimation results using total damages in the insurer's home state, total damages in the insurer's main state market, and market-weighted damages as main explanatory variables. Columns (7) - (11) show the results using insured damages in the insurer's home state, insured damages in the insurer's main geographic market, as well as market-weighted insured damages as main explanatory variables. All models include the full set of control variables from Equation (1) as well as firm and year fixed effects. Variable descriptions can be found in Appendix 1. Standard errors are reported in parentheses and are adjusted for heteroskedasticity and firm-level clustering. Furthermore, the model fit (R^2) and test statistics for the joint significance of regressors (F-test) are reported at the bottom of the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
#NatDisHQ	0.031***										
	(0.007)										
#NatDisMarket	-0.013										
	(0.010)										
Total Damages		0.004***			0.003**	0.004***					
		(0.001)			(0.001)	(0.001)					
Total Damages (Main Market)			0.000**		0.000						
			(0.000)		(0.000)						
Total Damages (Market)				0.000		-0.000					
				(0.000)		(0.000)					
Damages Insured							0.004*			0.005	0.005*
							(0.002)			(0.003)	(0.002)
Damages Insured (Main Market)								0.000		-0.000	
								(0.000)		(0.000)	
Damages Insured (Market)									0.000		-0.000
									(0.000)		(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8391	8391	5142	8391	5142	8391	8391	5142	8391	5142	8391
R^2	0.029	0.021	0.021	0.019	0.022	0.021	0.019	0.020	0.019	0.021	0.019
F-Test	.	3.53	2.23	2.73	2.21	3.35	2.65	1.95	2.59	1.88	2.52

Table 7: Alternative climate change risk management quality measures

Note: This table presents OLS regressions of the alternative climate change risk management quality measures on the number of natural disasters in the insurer's home state ($\#NatDisHQ$), the number of natural disasters in the insurer's geographic markets ($\#NatDisMarket$ or $\#NatDisMIMarket$) and firm-level and state-level controls. The model in Column (1) uses the average length of an insurer's answers across all eight questions in the NAIC Climate Risk Disclosure Survey as the dependent variable. The models in Columns (2) and (3) use the ratio of strong or action-oriented words and the ratio of weak or passive words as dependent variables, respectively. All models include firm and year fixed effects. Variable descriptions can be found in Appendix 1. Standard errors are reported in parentheses and are adjusted for heteroskedasticity and firm-level clustering. Furthermore, the model fit (R^2) and test statistics for the joint significance of regressors (F-test) are reported at the bottom of the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent Variable	Length	Strong	Weak
#NatDisHQ	0.007**	0.032***	0.001
	(0.003)	(0.007)	(0.002)
#NatDisMarket	-0.004	-0.008	0.004*
	(0.004)	(0.010)	(0.002)
Size	0.015	-0.024	0.071***
	(0.032)	(0.057)	(0.015)
ROE	-0.145*	-0.246	-0.024
	(0.078)	(0.157)	(0.033)
Capital2Assets	0.031	-0.478**	0.151***
	(0.109)	(0.207)	(0.053)
Reinsurance	-0.004	0.031	0.005
	(0.062)	(0.101)	(0.029)
Voluntary Disclosure	-0.042	0.150**	0.030*
	(0.031)	(0.066)	(0.015)
Mutual Group	0.021	-0.104	-0.031
	(0.031)	(0.083)	(0.023)
Group	0.273	-0.688*	-0.146
	(0.459)	(0.399)	(0.117)
Home State In	0.176***	-0.046	-0.018
	(0.047)	(0.083)	(0.022)
GDP (real)	-0.096*	-0.122	0.014
	(0.054)	(0.101)	(0.033)
Unemployment (%)	-0.028**	0.009	0.013**
	(0.012)	(0.020)	(0.006)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	8391	8391	8391
R^2	0.147	0.026	0.023
F-Test	27.02	3.78	5.19

Appendix

Appendix 1: Variable definitions and data sources (1).

The appendix presents definitions for the independent variables used in the empirical analysis. Natural disaster data are retrieved from EM-DAT, CRED / UCLouvain and accounting data are retrieved from S&P Capital IQ. Macroeconomic data are retrieved from the U.S. Bureau of Economic Analysis and the U.S. Bureau of Labor Statistics. All accounting data are collected in U.S. Dollars.

Variable	Description	Source
Accounting data		
Blockholder	Indicator variable that equals 1 for companies that have at least one blockholder holding 5% or more of the shares with the intention to change or influence control of the issuer as indicated on a Form 13D or Form 13D/A filing with the U.S. Securities and Exchange Commission	Harries (2021)
Capital2Assets	Ratio of surplus as regards policyholders to total net admitted assets (winsorized at the 1^{st} and 99^{th}-percentiles)	S&P Capital IQ
Geographical diversity	Difference between 1 and the geographic Herfindahl index of direct written premiums in each of the 50 states & Washington DC (winsorized)	S&P Capital IQ
Group	Indicator variable that equals 1 if the insurer belongs to an insurance group	S&P Capital IQ
Life dummy	Indicator variable that equals 1 for life insurers	S&P Capital IQ
Long-tail business lines	Proportion of business written in long-tailed lines. We use the following definition of long-tailed lines: farmowners' multiple peril, homeowners' multiple peril, commercial multiple peril, medical malpractice, workers compensation, product liability, auto liability, and other liability (winsorized)	S&P Capital IQ
Mutual group	Indicator variable that equals 1 if the firm is a mutual insurance company or affiliated with a mutual group	S&P Capital IQ
% Personal lines	Proportion of net premiums written in personal lines, which are defined as private passenger auto liability, auto physical damage, and homeowners' multiple peril (winsorized)	S&P Capital IQ
Product mix (Life/P&C)	Difference between 1 and the Herfindahl index of net premiums written across business lines; we calculate the variables separately for life and p&c insurance companies	S&P Capital IQ
Publicly traded	Indicator variable that equals 1 if the company itself or the parent company is publicly traded at a stock exchange	S&P Capital IQ
Reinsurance	Reinsurance ceded divided by the sum of direct premiums written and reinsurance assumed	S&P Capital IQ

Appendix 1: Variable definitions and data sources (2).

Variable	Description	Source
ROE	Net income divided by surplus as regards policyholders (winsorized)	S&P Capital IQ
Size	Natural logarithm of total net admitted assets	S&P Capital IQ
Macroeconomic data		
GDP (real)	Natural logarithm of real Gross Domestic Product, annual by state	U.S. Bureau of Economic Analysis
Unemployment	Unemployment rate (in %), annual average by state (winsorized)	U.S. Bureau of Labor Statistics
Natural disaster data		
#NatDisHQ	Annual number of natural disasters by state in which an insurer has its main administrative office	EM-DAT, CRED / UCLouvain, Brussels, Belgium
#NatDisMIMarket	Annual number of natural disasters in an insurer's most important state market; the most important state market is defined as having premium revenue that is at least 50% larger than the premium revenue from the second largest state market of that particular insurer	EM-DAT, CRED / UCLouvain, Brussels, Belgium & Schedule T filings from S&P Capital IQ
#NatDisMarket	Weighted average of the number of disasters occurring in each state in which an insurer writes business, using the fraction of premiums written as weights	EM-DAT, CRED / UCLouvain, Brussels, Belgium & Schedule T filings from S&P Capital IQ
Total damages	Nominal value of all damages and economic losses directly or indirectly related to natural disasters in the year and in the state in which an insurer has its main administrative office (winsorized)	EM-DAT, CRED / UCLouvain, Brussels, Belgium
Total damages (Main Market)	Nominal value of all annual damages and economic losses directly or indirectly related to natural disasters in an insurer's most important state market (winsorized); the most important state market is defined as having premium revenue that is at least 50% larger than the premium revenue from the second largest state market of that particular insurer	EM-DAT, CRED / UCLouvain, Brussels, Belgium & Schedule T filings from S&P Capital IQ
Total damages (Market)	Weighted average of the nominal value of all annual damages and economic losses directly or indirectly related to natural disasters occurring in each state in which an insurer writes business, using the fraction of premiums written as weights (winsorized)	EM-DAT, CRED / UCLouvain, Brussels, Belgium & Schedule T filings from S&P Capital IQ
Damages Insured	Nominal value of all insured damages and economic losses directly or indirectly related to natural disasters in the year and in the state in which an insurer has its main administrative office (winsorized)	EM-DAT, CRED / UCLouvain, Brussels, Belgium

Appendix 1: Variable definitions and data sources (3).

Variable	Description	Source
Damages Insured (Main Market)	Nominal value of all annual insured damages and economic losses directly or indirectly related to natural disasters in an insurer's most important state market (winsorized); the most important state market is defined as having premium revenue that is at least 50% larger than the premium revenue from the second largest state market of that particular insurer	EM-DAT, CRED / UCLouvain, Brussels, Belgium & Schedule T filings from S&P Capital IQ
Damages Insured (Market)	Weighted average of the nominal value of all insured damages and economic losses directly or indirectly related to natural disasters occurring in each state in which an insurer writes business, using the fraction of premiums written as weights (winsorized)	EM-DAT, CRED / UCLouvain, Brussels, Belgium & Schedule T filings from S&P Capital IQ
Survey data		
Home state in	Indicator variable that equals 1 if the state in which a firm's main administrative office is located requires the NAIC Climate Risk Disclosure Survey in the year and 0 otherwise	NAIC Climate Risk Disclosure Survey
Voluntary disclosure	Indicator variable that equals 1 if an insurer does not satisfy the requirements for mandatory risk disclosure in any state in year t but still files a disclosure	NAIC Climate Risk Disclosure Survey

Appendix 2: Word list Harvard IV-4 dictionary (strong)

ABILITY	ALLIED	BACK	CAPABLE	COMPULSION
ABLE	ALLY	BACKBONE	CAPACITY	CONCENTRATE
ABOLISH	ALMIGHTY	BACKER	CAPITAL	CONCENTRATION
ABOMINABLE	ALTER	BALANCE	CAPITALIZE	CONCRETE
ABRASIVE	AMAZEMENT	BALL	CAPTAIN	CONDEMN
ABSOLUTE	AMAZING	BAND	CAPTURE	CONFIDENCE
ABUNDANCE	AMBITION	BANISH	CARRY	CONFIDENT
ABUNDANT	AMBITIOUS	BAR	CAST	CONFINE
ABUSE	AMBUSH	BASE	CATCH	CONFIRM
ACCELERATE	AMPLE	BATTLE	CAUGHT	CONFIRMATION
ACCELERATION	AMPLIFY	BEAR	CAUSAL	CONFRONT
ACCESSION	AMPLY	BEAT	CAUSE	CONFRONTATION
ACCOMPLISH	ANCHOR	BEAUTIFY	CAVALRY	CONGREGATION
ACCOMPLISHMENT	ANTAGONISM	BELT	CEMENT	CONGRESS
ACHIEVE	ANTAGONISTIC	BENEFIT	CENTER	CONGRESSIONAL
ACQUIRE	ANTAGONIZE	BESTOW	CENTRAL	CONGRESSMAN
ACQUISITION	APPRECIABLE	BEWARE	CERTAIN	CONGRESSMEN
ACT	APPREHENSION	BIG	CERTAINTY	CONJURE
ACTION	APPROPRIATE	BLAST	CHAIRMAN	CONQUER
ACTIVE	APPROVE	BLATANT	CHAIRMEN	CONQUEROR
ADAMANT	APT	BLIND	CHALLENGE	CONSENT
ADAPT	APTITUDE	BLOC	CHAMP	CONSIDERABLE
ADAPTABILITY	ARDENT	BLOCK	CHAMPION	CONSISTENCY
ADAPTABLE	ARISE	BLOCKADE	CHAMPIONSHIP	CONSISTENT
ADAPTATION	ARM	BLOODTHIRSTY	CHANCELLOR	CONSOLIDATE
ADAPTIVE	ARMED	BLOW	CHARGE	CONSTABLE
ADD	ARMY	BLUNT	CHARISMA	CONSTANT
ADDITION	AROSE	BODY	CHIEF	CONSTITUTE
ADDITIONAL	ARREST	BOISTEROUS	CIRCLE	CONSTITUTION
ADEPT	ARROGANT	BOLD	CLEVER	CONSTITUTIONAL
ADEPTNESS	ARTICULATE	BOLDNESS	CLIMAX	CONSTRAIN
ADJUST	ASCEND	BOLSTER	CLIMB	CONSTRAINT
ADMINISTER	ASCENT	BOMB	CLOUT	CONSTRUCT
ADMINISTRATION	ASSAIL	BOND	CLUB	CONSTRUCTION
ADMINISTRATIVE	ASSAULT	BOOM	CLUSTER	CONSTRUCTIVE
ADMINISTRATOR	ASSERT	BOOST	COALITION	CONSUMPTIVE
ADMIRATION	ASSERTION	BORE	COCKINESS	CONTAIN
ADMIRER	ASSET	BOSS	COCKY	CONTEND
ADMONISH	ASSIST	BOUND	COGENT	CONTENTION
ADORN	ASSISTANCE	BOUNDLESS	COHERENT	CONTEST
ADROIT	ASSOCIATION	BOUNTIFUL	COHESION	CONTINUAL
ADROITLY	ASSURANCE	BOX	COLLABORATION	CONTINUE
ADULATION	ASSURE	BOXER	COLLAR	CONTINUITY
ADULT	ASSUREDLY	BRACE	COLLECT	CONTINUOUS
ADVANCE	ASTOUND	BRANDISH	COLLECTIVE	CONTRACT
ADVANTAGE	ATHLETIC	BRAVADO	COLONEL	CONTRIBUTE
ADVANTAGEOUS	ATOMIC	BRAVE	COMBAT	CONTRIBUTION
ADVENTURESOME	ATTACK	BRAVERY	COMBINE	CONTROL
ADVENTUROUS	ATTAIN	BRAZEN	COMBUSTION	CONTROLLER
ADVOCATE	ATTAINMENT	BREACH	COMEBACK	CONVERT
AFFINITY	ATTRACT	BREAK	COMFORT	CONVICT
AFFIRM	ATTRACTION	BRIDGE	COMFORTABLE	CONVICTION
AFFLICT	AUDACIOUS	BROAD	COMMAND	CONVINCE
AFFORD	AUDACITY	BROADEN	COMMANDER	COOPERATE
AFLOAT	AUDIBLE	BROADNESS	COMMISSION	COOPERATION
AGGRAVATE	AUSTERE	BROKE	COMMISSIONER	COOPERATIVE
AGGRAVATION	AUTHORITARIAN	BROTHERHOOD	COMMITTEE	COORDINATE
AGGRESSION	AUTHORITATIVE	BRUTALITY	COMMUNITY	COORDINATION
AGGRESSIVE	AUTHORITY	BUILD	COMPANY	COP
AGGRESSIVENESS	AUTHORIZE	BULK	COMPEL	CORE
AGILE	AUTOCRAT	BULLET	COMPENSATE	CORPORAL
AGILITY	AUTOCRATIC	BUOYANT	COMPETE	CORPORATE
AGITATE	AUTONOMOUS	BURST	COMPETENCE	CORPORATION
AGITATION	AVAIL	BUSY	COMPETENCY	CORRECT
AGREEMENT	AVENGE	BUTCHERY	COMPETENT	COUNCIL
AID	AWARD	CAN	COMPLETE	COUNTERACT
AIR	AWARE	CANDID	COMPOSURE	COUNTERACTION
ALERT	AWARENESS	CANDOR	COMPOUND	COUNTLESS
ALIVE	AWFUL	CANNON	COMPRESS	COURAGE
ALLIANCE	AXE	CAPABILITY	COMPRESSION	COURAGEOUS

COURT	DIGNIFIED	ENHANCE	FINE	GRASP
CREAM	DIGNITY	ENORMOUS	FIRE	GRAVITATIONAL
CREATE	DILIGENT	ENRICH	FIRM	GRAVITY
CREATION	DIN	ENRICHMENT	FIRMNESS	GREAT
CREATOR	DIRECT	ENSURE	FIST	GREATNESS
CROWD	DIRECTOR	ENTERPRISE	FITNESS	GRIND
CRUSH	DISCHARGE	ENTHUSIASTIC	FIX	GRIP
CRUSHING	DISCIPLINE	ENTIRE	FLAIR	GROUND
CUMBERSOME	DISPLACEMENT	ENTITLE	FLEET	GROW
CUMULATIVE	DISPOSE	EQUAL	FLEW	GROWER
CURB	DISSOLVE	EQUILIBRIUM	FLOOD	GROWN
CUT	DISTINGUISHED	EQUIP	FLOOR	GROWTH
DAMAGE	DIVIDE	ERECT	FLOURISH	GRUFF
DARING	DIVINE	ESCAPE	FLY	GUARANTEE
DAUNTLESS	DIVINITY	ESSENCE	FOCAL	GUARD
DAZZLE	DO	ESSENTIAL	FORBID	GUARDIAN
DEADLY	DOMINANT	ESTABLISH	FORCE	GUERRILLA
DEAN	DOMINATE	ETERNAL	FOREMOST	GUIDANCE
DECIDE	DOMINATION	EVER	FORESIGHT	GUIDE
DECISION	DONE	EVERLASTING	FOREVER	GUILD
DECISIVE	DOUBLE	EVERY	FORMATION	GUN
DECLARATION	DOUBTLESS	EVIDENCE	FORMIDABLE	GUNMEN
DECLARE	DRAW	EXACT	FORT	GUSTO
DEDICATE	DRIVE	EXCEED	FORTIFY	HALT
DEDICATION	DURABILITY	EXCEL	FORTITUDE	HAMPER
DEEP	DURABLE	EXCLUDE	FORTUNE	HAND
DEEPEN	DUTY	EXCLUSION	FOUGHT	HANDLE
DEFEAT	DYNAMIC	EXCLUSIVE	FOUND	HARBOR
DEFEND	EAGER	EXCUSE	FOUNDATION	HARD
DEFENDER	EARN	EXECUTION	FOUNDER	HARDY
DEFENSE	EARNER	EXECUTIVE	FRAME	HARM
DEFIANCE	EARNEST	EXERCISE	FREE	HARMFUL
DEFIANT	EDITOR	EXERT	FRUITFUL	HARSH
DEFINITE	EDUCATE	EXPAND	FRUSTRATE	HAUGHTY
DEFINITIVE	EFFECT	EXPANSE	FUCK	HEAD
DEFY	EFFECTIVE	EXPANSION	FULFILL	HEADQUARTERS
DELIBERATE	EFFECTIVENESS	EXPERIENCE	FULFILLMENT	HEAL
DELIVER	EFFICACY	EXPERT	FULL	HEALTH
DELIVERY	EFFICIENCY	EXPLOIT	FUNCTION	HEALTHY
DELUGE	EFFICIENT	EXPLOSION	FUNDAMENTAL	HEART
DEMAND	ELDER	EXPLOSIVE	FURTHER	HEARTILY
DEMOLISH	ELEVATE	EXTEND	GAIN	HEAT
DEMONSTRATE	ELIMINATE	EXTENSION	GALL	HEAVY
DEMONSTRATION	ELIMINATION	EXTENSIVE	GALLANT	HEIGHTEN
DEMORALIZE	EMANCIPATION	EXTINGUISH	GAME	HERD
DENSE	EMINENCE	EXTREME	GANG	HERO
DENSITY	EMINENT	FACE	GENERAL	HEROIC
DEPENDABILITY	EMPEROR	FACILITATE	GENIUS	HEROISM
DEPENDABLE	EMPHASIS	FACILITY	GET	HIGH
DEPLOY	EMPHASIZE	FACULTY	GIANT	HINDER
DEPRIVE	EMPHATIC	FAST	GIFTED	HIRE
DEPTH	EMPLOY	FATE	GIGANTIC	HIT
DESERVEDLY	EMPLOYER	FATHER	GLARE	HOLD
DESIGNATE	EMPOWER	FATHOM	GLIMMER	HOLDER
DESPISE	EMPOWERMENT	FEAR	GLOAT	HUGE
DESTINY	ENABLE	FEARLESS	GLORIFY	HURT
DESTROY	ENACT	FEASIBLE	GO	IMMENSE
DESTRUCTIVE	ENACTMENT	FEDERATION	GOD	IMMOVABLE
DETER	ENCLOSE	FEED	GODDESS	IMPACT
DETERMINATION	ENCOMPASS	FELLOWSHIP	GODLIKE	IMPAIR
DETERMINE	ENDLESS	FENCE	GODLINESS	IMPEDE
DETERRENT	ENDORSE	FERVENT	GONE	IMPEL
DETRIMENTAL	ENDURANCE	FERVOR	GOVERN	IMPERIAL
DEVASTATE	ENDURE	FEW	GOVERNMENT	IMPERIALIST
DEVELOP	ENERGETIC	FIERY	GOVERNMENTAL	IMPERVIOUS
DEVELOPMENT	ENERGIZE	FIGHT	GOVERNOR	IMPETUS
DEVOUT	ENERGY	FIGHTER	GRAND	IMPLEMENT
DEXTERITY	ENFORCE	FILL	GRANDEUR	IMPLEMENTATION
DICTATOR	ENFORCEMENT	FINAL	GRANT	IMPOSE
DICTATORSHIP	ENGULF	FINANCE	GRAPPLE	IMPRESS

IMPRESSIVE	IRREFUTABLE	MAKE	NEAR	PASS
IMPROVE	ISOLATE	MANAGE	NECESSARY	PASSION
IMPROVEMENT	ISSUE	MANAGEABLE	NECESSITATE	PASSIONATE
INCESSANT	JAIL	MANAGEMENT	NECESSITY	PATIENCE
INCLUDE	JAR	MANAGER	NERVE	PATIENT
INCREASE	JERK	MANAGERIAL	NETWORK	PATROL
INDEPENDENCE	JOIN	MANEUVER	NEUTRALIZE	PATRON
INDEPENDENT	JOINTLY	MANIPULATE	NEW	PATRONAGE
INDISPENSABILITY	JUDGE	MANLY	NIMBLE	PEAK
INDISPENSABLE	JUDGMENT	MANPOWER	NOBLE	PENETRATE
INDISPUTABLE	JUDICIAL	MANUFACTURE	NONCHALANT	PENETRATION
INDOMITABLE	JURISDICTION	MANUFACTURER	NORM	PERFECT
INDUCE	JUROR	MANY	NOTABLE	PERMANENT
INDUSTRIAL	JURY	MAR	NUCLEAR	PERMISSION
INDUSTRIALIZE	KEEN	MARCH	NUCLEI	PERMIT
INDUSTRIOUS	KEEP	MARCHER	NUCLEUS	PERPETUAL
INDUSTRY	KEEPER	MARK	NUMBER	PERPETUATE
INEVITABILITY	KICK	MASCULINE	NUMEROUS	PERSEVERANCE
INEVITABLE	KILL	MASS	OBJECTIVE	PERSEVERE
INFALLIBILITY	KILLER	MASSIVE	OBSTACLE	PERSIST
INFALLIBLE	KING	MASTER	OBSTRUCT	PERSISTENCE
INFANTRY	KNIFE	MASTERFUL	OBTAIN	PERSISTENT
INFILTRATION	KNOCK	MASTERY	OCCASION	PERSUADE
INFINITE	KNOWLEDGE	MATCH	OCCUPY	PHYSICAL
INFLUENCE	LABOR	MATERIAL	OFFENSIVE	PICK
INFLUENTIAL	LANDLORD	MATTER	OFFER	PISTON
INFRINGEMENT	LARGE	MATURE	OFFICER	PITILESS
INHERENT	LAST	MATURITY	OFFICIAL	PLAGUE
INHIBIT	LAUNCH	MAXIMIZATION	OFFICIATE	PLAN
INHIBITION	LAY	MAXIMUM	OFTEN	PLANT
INITIATE	LEAD	MAYOR	OMINOUS	PLEASE
INITIATIVE	LEADER	MEASURE	ONCE	PLEASED
INJUNCTION	LEADERSHIP	MENACE	OPERATE	PLENTIFUL
INNER	LEAGUE	MERCILESS	OPERATION	PLENTY
INNUMERABLE	LEGION	MERIT	OPERATIONAL	PLOT
INSIST	LEGISLATION	METHODICAL	OPERATIVE	POIGNANT
INSISTENCE	LEGISLATIVE	MIGHT	OPPOSE	POINT
INSISTENT	LEGISLATOR	MIGHTY	ORDER	POISE
INSPIRE	LENGTH	MILITARY	ORDINANCE	POLICE
INSTITUTION	LET	MILITIA	ORGANIZATION	POLICEMAN
INSTITUTIONAL	LEVEL	MINE	ORGANIZE	POLICEMEN
INSTRUCT	LIBERATION	MINIMIZE	ORIGINATE	POLICY
INSTRUCTION	LIEUTENANT	MINISTER	OUST	POLITICIAN
INSTRUCTOR	LIFT	MINISTRY	OUTFIT	POPULAR
INSTRUMENTAL	LIGHTNING	MISSILE	OUTLIVE	POSSE
INTACT	LIMIT	MOBILE	OUTPUT	POSSESS
INTEGRATION	LIMITLESS	MODIFY	OUTREACH	POSSIBLE
INTEGRITY	LION	MOLD	OUTRUN	POTENCY
INTELLECT	LIONESS	MOMENTUM	OUTSTANDING	POTENT
INTELLECTUAL	LIQUIDATE	MONITOR	OVER	POTENTIAL
INTELLIGENCE	LIQUIDATION	MONOPOLY	OVERCAME	POTENTIALITY
INTELLIGENT	LIVE	MONSTER	OVERCOME	POUND
INTENSE	LIVELY	MONSTROUS	OVERHAUL	POWER
INTENSIFY	LOAD	MONUMENT	OVERLYING	POWERFUL
INTENSITY	LOCK	MORE	OVERPOWER	PRECAUTION
INTENSIVE	LONG	MOST	OVERRUN	PRECIOUS
INTERFERE	LONGEVITY	MOVE	OVERSEER	PREDOMINANT
INTERFERENCE	LOOK	MOVEMENT	OVERTHROW	PREDOMINATE
INTERNAL	LOT	MOVER	OVERWHELM	PREEMINENT
INTERVENTION	LOUD	MUCH	OWN	PREPARE
INTIMIDATE	LOVE	MUFFLE	OWNER	PRESERVE
INUNDATE	LOWER	MULTIPLE	OWNERSHIP	PRESIDE
INVARIABLE	LUCK	MULTIPLICATION	PAINSTAKING	PRESIDENCY
INVARIABLY	MAGNIFICENT	MULTIPLY	PANDEMONIUM	PRESIDENT
INVENTORY	MAGNIFY	MURDER	PARDON	PRESIDENTIAL
INVINCIBLE	MAGNITUDE	MUSCLE	PARLIAMENT	PRESS
INVITE	MAIN	MUSCULAR	PART	PRESSURE
INVOLVE	MAINTAIN	MUSTER	PARTNER	PRESTIGE
INVULNERABLE	MAJOR	NAVAL	PARTNERSHIP	PREVAIL
IRON	MAJORITY	NAVY	PARTY	PREVALENT

PREVENT	READINESS	REWARD	SOLIDARITY	SUFFICIENT
PREVENTION	READY	RICH	SOLIDITY	SUMMON
PREVENTIVE	REAFFIRM	RIGHT	SOUND	SUPERINTENDENT
PRIDE	REALIZE	RIP	SOUNDNESS	SUPERIOR
PRIMARY	REASON	RISE	SOURCE	SUPERIORITY
PRINCE	REASSURANCE	RIVAL	SOVEREIGN	SUPPLEMENT
PRINCIPAL	REASSURE	ROAR	SOVEREIGNTY	SUPPLIER
PRIORITY	REBEL	ROBUST	SPARE	SUPPLY
PRIVILEGE	REBELLION	ROOT	SPEAR	SUPPORT
PRIVILEGED	REBUILD	ROSE	SPECTACULAR	SUPPRESS
PRIZE	RECOMMEND	ROUGHNESS	SPEED	SUPPRESSION
PROACTIVE	RECOMMENDATION	ROYAL	SPLIT	SUPREMACY
PROBE	RECONSTRUCT	ROYALTY	SPONSOR	SUPREME
PROCLAIM	RECONSTRUCTION	RUGGED	SPONTANEOUS	SURE
PROCLAMATION	RECOVER	RUIN	SPRIGHTLY	SURPLUS
PROCTOR	RECOVERY	RULE	SQUARELY	SURROUND
PROCURE	RECRUIT	RUN	SQUEEZE	SURVEILLANCE
PROCUREMENT	RECRUITMENT	SAGACITY	STABILITY	SURVIVAL
PROD	RECURRENT	SAGE	STABILIZE	SURVIVE
PRODUCE	REDEEM	SANCTION	STABLE	SUSTAIN
PRODUCTIVE	REDUCE	SATISFY	STAMP	SWIFT
PROFICIENT	REESTABLISH	SAVE	STAND	SWORD
PROFIT	REGAIN	SAVVY	STATE	SYSTEMATIC
PROFITABLE	REGIME	SAY	STATESMAN	SYSTEMATICALLY
PROFOUND	REGIMENT	SCARE	STATESMEN	TAKE
PROGRESS	REGULAR	SCARED	STATUESQUE	TALENT
PROHIBIT	REGULATE	SCATTER	STAUNCH	TALENTED
PROHIBITION	REGULATION	SEARCH	STAUNCHNESS	TALL
PROHIBITIVE	REINFORCE	SECOND	STEADFAST	TAUT
PROJECT	REITERATE	SECURE	STEADFASTNESS	TENACIOUS
PROLONG	REJECT	SEIZE	STEADILY	TENACITY
PROMINENCE	REJECTION	SELF-CONTAINED	STEADINESS	TEND
PROMINENT	RELENTLESS	SENATE	STEADY	TERMINATE
PROMOTE	RELIABILITY	SENATOR	STEEL	TERRITORIAL
PROMOTION	RELIABLE	SENIOR	STEP	THICK
PROMPT	RELIEVE	SENSATIONAL	STERN	THICKEN
PROOF	REMARKABLE	SENTENCE	STICK	THOROUGH
PROPONENT	REMARKABLY	SERENE	STIFF	THREAT
PROPRIETOR	REMOVAL	SET	STIFFLY	THREATEN
PROSECUTION	REMOVE	SETTLE	STIFLE	THRILL
PROTECT	RENDER	SEVERE	STILL	THRIVE
PROTECTION	RENEW	SEVERITY	STOICISM	THROW
PROTECTIVE	REPAIR	SHAPE	STOMACH	THRUST
PROTECTOR	REPEL	SHARP	STONE	THUNDER
PROUD	REPLENISH	SHATTER	STOOD	THWART
PROVE	REPUDIATE	SHELL	STOP	TILL
PROVIDE	REPULSE	SHELTER	STORM	TOGETHER
PROVIDENCE	REQUIRE	SHERIFF	STRAIGHTFORWARD	TOTAL
PROVOKE	REQUIREMENT	SHIFT	STRATEGIC	TOUGH
PROWESS	RESERVE	SHOCK	STRENGTH	TRADITION
PULL	RESIST	SHOOT	STRENGTHEN	TRADITIONAL
PUNISH	RESISTANCE	SHOT	STRENUOUS	TRANSFORM
PURPOSE	RESOLUTE	SHOULDER	STRICT	TRANSFORMATION
PURPOSEFUL	RESOLUTION	SHOW	STRIKE	TRAP
PURSUE	RESOLVE	SHREWD	STRINGENT	TREMENDOUS
PUSH	RESOLVED	SHREWDNESS	STRIP	TRIUMPH
PUT	RESOUND	SHRIEK	STRONG	TRIUMPHAL
QUALIFY	RESOURCE	SHUT	STRONGHOLD	TRIUMPHANT
QUEST	RESOURCEFUL	SIGNIFICANCE	STRUCK	TROOP
QUIET	RESOURCEFULNESS	SIGNIFICANT	STUBBORN	TRUST
RADIANCE	RESTORE	SIZABLE	STUBBORNLY	TRUSTWORTHY
RADICAL	RESTRAIN	SLAM	STUBBORNNESS	TYRANNY
RAGE	RESTRAINT	SLASH	STUFF	ULTIMATE
RAID	RESTRICT	SLAYER	STUN	UNANIMOUS
RAISE	RESUMPTION	SMART	STURDY	UNCHECKED
RAMPANT	RETAIN	SMASH	SUAVE	UNCONTESTED
RATTLE	RETENTION	SNATCH	SUBDUE	UNDAUNTED
RAVE	REVENUE	SOAR	SUBSTANTIAL	UNDENIABLE
RAW	REVIVE	SOBER	SUCCESSOR	UNDERMINE
REACH	REVOLUTIONARY	SOLID	SUFFICE	UNDERTAKE

UNDERTAKEN	WORLD-WIDE
UNDERTOOK	WOUND
UNDISPUTED	ZEAL
UNDOUBTED	ZEALOUS
UNDOUBTEDLY	ZEST
UNEQUIVOCAL	
UNFAILING	
UNIFICATION	
UNIFY	
UNION	
UNISON	
UNITE	
UNITY	
UNIVERSAL	
UNLEASH	
UNLIMITED	
UNMISTAKABLE	
UNMITIGATED	
UNQUESTIONABLE	
UNQUESTIONED	
UNTOLD	
UNWAVERING	
UNWILLINGNESS	
UPPERMOST	
UPRIGHT	
UPSET	
URGE	
URGENT	
UTILITY	
VANTAGE	
VAST	
VEHEMENT	
VENGEANCE	
VICTOR	
VICTORIOUS	
VICTORY	
VIGILANCE	
VIGILANT	
VIGOR	
VIGOROUS	
VIOLENCE	
VIOLENT	
VITAL	
VITALITY	
VIVACIOUS	
VIVID	
WAGE	
WANT	
WARFARE	
WARRIOR	
WAY	
WEALTH	
WEALTHY	
WEIGHT	
WELL	
WHACK	
WHIP	
WHIRL	
WHOLE	
WIDE	
WIDEN	
WIDESPREAD	
WILD	
WIN	
WINNER	
WITHHELD	
WITHHOLD	
WITHSTAND	
WON	
WORLD-FAMOUS	

Appendix 3: Word list Harvard IV-4 dictionary (weak)

ABANDON	BONDAGE	DELIRIUM	FAINT	HESITATION
ABANDONMENT	BORROW	DELUSION	FALL	HIDE
ABDICATE	BOUND	DEMISE	FALTER	HOBBLE
ABJECT	BOW	DEPEND	FAMINE	HOLE
ABSCOND	BREAK	DEPENDENCE	FATIGUE	HOLLOW
ABSENCE	BREAKDOWN	DEPENDENT	FAULT	HOPELESS
ABSENT	BRITTLE	DEPRECIATE	FEAR	HUDDLE
ABSENT-MINDED	BROKE	DEPRESS	FEARFUL	HUMBLE
ABSENTEE	BROKEN-HEARTED	DEPRESSION	FEEBLE	HUNG
ADDICT	BUCKLE	DESCEND	FEMININE	HYSTERICAL
ADDICTION	BUM	DESERT	FEVER	IGNORANCE
ADMIT	BUNGLE	DESOLATE	FEVERISH	IGNORANT
AFFLICTION	BURDEN	DESPAIR	FEW	ILL
AFRAID	CAN'T	DESPERATE	FIASCO	ILLITERATE
ALIBI	CANNOT	DESTITUTE	FICKLE	ILLNESS
ALLEGE	CAPITULATE	DEVOID	FIDGET	ILLOGICAL
ALONE	CAPTIVE	DIMINISH	FLATTER	IMITATION
AMATEUR	CAREEN	DIRE	FLATTERY	IMMATURE
AMBIVALENT	CAVE	DISADVANTAGE	FLAW	IMPLORE
ANCIENT	CEASE	DISADVANTAGEOUS	FLED	IMPRISONMENT
ANTIQUATED	CHEAP	DISASTER	FLEE	INABILITY
ANXIETY	CHEAPEN	DISASTROUS	FLIMSY	INADEQUATE
ANXIOUS	CHOKE	DISCONCERTED	FLOUNDER	INCAPABLE
ANXIOUSNESS	CHRONIC	DISCONTENT	FOIBLE	INCOMPLETE
APART	CLING	DISCORD	FOLLOW	INCORRECT
APATHETIC	CLUNG	DISCOURAGEMENT	FOOL	INDEBTED
APATHY	COLLAPSE	DISEASED	FOOLISH	INDECISION
APOLOGETIC	COMMONER	DISGRACE	FOOLISHNESS	INDECISIVE
APOLOGIZE	CONCEDE	DISGUST	FORFEIT	INDECISIVENESS
APOLOGY	CONCESSION	DISHEARTEN	FORGET	INDIRECT
APPREHENSIVE	CONFESS	DISHONEST	FORGOT	INFANT
ASHAMED	CONFESSION	DISHONOR	FORGOTTEN	INFERIOR
ASLEEP	CONFORM	DISINGENUOUS	FORLORN	INFERIORITY
ASTRAY	CONFORMITY	DISMAL	FORSAKE	INJURIOUS
ASUNDER	CONFUSE	DISORDER	FOUNDER	INJURY
ATROPHY	CONFUSION	DISORGANIZED	FRACTURE	INSECURE
AVERAGE	CONTROL	DISPENSABILITY	FRAGILE	INSECURITY
AVERT	CONVICT	DISPLEASE	FRAIL	INSIGNIFICANT
AVOID	COVET	DISPLEASURE	FRANTIC	INSTABILITY
AVOIDANCE	COWARD	DISSATISFY	FRAUD	INSTABLE
AWKWARD	CRACK	DISTRESS	FRAUDULENT	INSUFFICIENCY
AWKWARDNESS	CRAVE	DIVIDE	FRET	INSUFFICIENT
BABY	CRAWL	DIVISION	FRETFUL	INTERIM
BACKWARD	CREDULOUS	DOOM	FRUITLESS	INTOLERABLE
BACKWARDNESS	CREEP	DOUBTFUL	FUMBLE	IRRESPONSIBLE
BAIL	CREPT	DREADFUL	FUSS	KNEEL
BALK	CRUMBLE	DROOP	FUTILITY	KNELT
BANE	CRUMPLE	DROP	GENTLE	LACK
BANTER	DEAD	DROWN	GINGERLY	LAG
BARREN	DEADLOCK	DRUNK	GIVE	LAME
BASHFUL	DEARTH	DRUNKARD	GRIEF	LANGUISH
BEAT	DEATH	DRUNKEN	GUILTY	LAZILY
BEG	DEBT	DULL	GULLIBLE	LAZY
BEGGAR	DEBTOR	DUMB	HACK	LEAN
BELONG	DECAY	DYING	HAGGARD	LEAST
BEND	DECLINE	EDGE	HALFWAY	LESS
BENT	DECREASE	ELASTIC	HANDFUL	LIABILITY
BEREAVEMENT	DEFECT	ELASTICITY	HANDICAP	LIFELESS
BEREFT	DEFECTIVE	ELDERLY	HANG	LIGHT
BESEECH	DEFENDANT	EMBARRASSMENT	HAPLESS	LIMIT
BIT	DEFENSIVE	EMPLOYEE	HARD	LIMP
BLAND	DEFICIENCY	EMPTY	HARMLESS	LITTLE
BLEED	DEFICIENT	ENTREAT	HAVE	LONE
BLEMISH	DEFICIT	EQUIVOCAL	HAZINESS	LONELINESS
BLIND	DEGENERATE	ERR	HEDGE	LONELY
BLINDNESS	DEJECTED	ERRONEOUS	HELP	LONER
BLOCKHEAD	DELAY	EXCUSE	HELPLESS	LONG
BLOODSHED	DELICATE	EXPIRE	HELPLESSNESS	LOOK
BLUNDER	DELINQUENCY	FAIL	HESITANT	LOSE
BLUR	DELINQUENT	FAILURE	HESITATE	LOSER

LOSS	PEASANT	SENTIMENTAL	SUPPORT	WEARY
LOST	PERPLEX	SERVE	SURRENDER	WEE
LOW	PETITION	SERVICE	SURROUND	WHINE
LOWER	PETITIONER	SERVITUDE	SUSCEPTIBLE	WHIP
LOWLY	PHOBIA	SHABBY	TEMPORARY	WIND
MAD	PIECE	SHALLOW	TENDER	WISH
MALADJUSTED	PITIFUL	SHIFT	TENSION	WISHFUL
MALADJUSTMENT	PLEA	SHIRK	TENTATIVE	WITHDRAW
MALADY	PLEAD	SHOCK	THIN	WITHDRAWN
MEAGER	PLOD	SHODDY	TIMID	WITHDREW
MEANINGLESS	POINTLESS	SHORT	TINY	WITHER
MEDIOCRE	POLITE	SHORTAGE	TIRE	WORN
MEEK	POOR	SHORTSIGHTED	TIRED	WORRIER
MELT	POVERTY	SHRANK	TRAMP	WORRY
MENIAL	POWERLESS	SHRINK	TREMBLE	WORSEN
MERE	PRECARIOUS	SHRUNK	TRIFLE	WOUND
MIND	PREMATURE	SHY	TRIVIAL	YIELD
MINIMAL	PRESS	SHYNESS	UNABLE	
MINIMUM	PREY	SICK	UNACCUSTOMED	
MINOR	PRISONER	SICKLY	UNARM	
MINORITY	PRIVATE	SICKNESS	UNASSURED	
MISERABLE	PROCRASTINATE	SILLY	UNAWARE	
MISERY	PROCRASTINATION	SIMPLISTIC	UNCERTAIN	
MISFORTUNE	PROVISIONAL	SINK	UNCERTAINTY	
MISS	PUNY	SLAVE	UNDECIDED	
MIX	PUZZLEMENT	SLEAZY	UNDEPENDABILITY	
MODEST	QUAINT	SLENDER	UNDEPENDABLE	
MOMENTARY	QUANDARY	SLEPT	UNEASY	
MOURN	QUIT	SLIGHT	UNEMPLOYED	
MURMUR	QUITTER	SLIM	UNFAITHFUL	
MUTTER	RANDOM	SLOPPY	UNFAMILIAR	
MYSELF¿	RECOIL	SLOTH	UNFINISHED	
NAIVE	REDUCTION	SLOTHFUL	UNFIT	
NAME	REFUGEE	SLUG	UNFORTUNATE	
NARROW	REGRESS	SLUGGISH	UNGUARDED	
NEED	REGRESSION	SMALL	UNHEALTHY	
NEEDY	REGRET	SOFT	UNINFORMED	
NEGLIGIBLE	RELAPSE	SORROW	UNLUCKY	
NERVOUS	RELATIVE	SORRY	UNPREPARED	
NERVOUSNESS	RELAX	SPEECHLESS	UNRELIABILITY	
NEWBORN	RELIANCE	SPEND	UNRELIABLE	
NOMINAL	RELINQUISH	SPLIT	UNSCRUPULOUS	
NOTHING	RELUCTANT	SPORADIC	UNSOUND	
NOVICE	RELY	STAGGER	UNSOUNDNESS	
OBEY	REMOTE	STALE	UNSTABLE	
OBLIGE	REQUEST	STALL	UNSTEADINESS	
OBSOLETE	RESIGN	STARVATION	UNSTEADY	
OCCASION	RESTRICT	STARVE	UNSUCCESSFUL	
OCCASIONAL	RETREAT	STICK	UNSURE	
OLD	REVERT	STRAGGLE	UNSURENESS	
OMISSION	RIDICULOUS	STRAGGLER	UNTRAINED	
OMIT	RUIN	STRICKEN	UPSET	
ONLY	RUN	STRIFE	VACILLATE	
ORDER	RUNAWAY	STUMBLE	VAGABOND	
OVERWORKED	RUPTURE	SUBJECTION	VAGRANT	
OWE	RUSTY	SUBJUGATE	VAGUE	
PALE	SAG	SUBJUGATION	VAGUENESS	
PALTRY	SANK	SUBMISSIVE	VICTIM	
PANIC	SAP	SUBMIT	VULNERABILITY	
PARALYSIS	SCANT	SUBORDINATE	VULNERABLE	
PARALYZED	SCAPEGOAT	SUBSERVIENCE	WANTON	
PARANOID	SCAR	SUBTLE	WASTE	
PARTIAL	SCARCE	SUCCUMB	WAVER	
PASS	SCARCELY	SUCKER	WAYWARD	
PASSE	SCARE	SUFFER	WEAK	
PASSIVE	SCARED	SUFFERER	WEAKEN	
PATHETIC	SCRAMBLE	SUFFOCATE	WEAKLY	
PATIENT	SCRATCH	SUNK	WEAKNESS	
PAUSE	SCRAWL	SUNKEN	WEARINESS	
PAY	SENTIMENT	SUPERFICIAL	WEARISOME	

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