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A re-examination of the US insurance market capacity to pay catastrophe losses in 2024*

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Abstract. The goal of this research is to assess the insurance industry ability to absorb catastrophe losses and evaluate its capacity to spread risk across insurers. Dionne and Desjardins (2022) showed that the US insurance industry capacity to pay catastrophe losses was higher in 2020 than it was in 1997. Insurers could pay 98% of a $200 billion loss in 2020, compared to 81% in 1997. In this document, we consider the following research question: Is the capacity still adequate after three years of turbulence? Climate risk events have caused average home premiums to increase by 22% from 2020 to 2023 (The Guardian, December 2024). Was it sufficient to maintain market capacity?

Keywords: Catastrophe losses, insurance market capacity, premiums increase, insurer capital, insured losses.

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Introduction

In their theoretical analysis, Cummins et al. (2002) demonstrate that, given a fixed level of total industry resources, the condition for maximizing capacity is for all insurers to maintain underwriting portfolios—net of reinsurance—that are perfectly correlated with aggregate industry losses. This conceptualization of capacity, first proposed by Borch (1962) for reinsurance, depends on two main components: the level of capital and the extent of industry-wide diversification. Specifically, how much surplus and equity capital are available, and how effectively is the risk of insurance losses distributed across the market?

Dionne and Desjardins (2022) reestimated the correlation coefficient proposed by Cummins et al. (2002) and reassessed the capital capacity of the US insurance industry using data through the end of 2020. They showed that the US insurance industry capacity to pay catastrophe losses was higher in 2020 than it was in 1997. Insurers could pay 98% of a $200 billion loss in 2020, compared to 81% in 1997. In this document, we consider the following research question: Is the capacity still adequate after three years of turbulence? We update the estimation for the year 2024 with data ending in 2023.

To this end, we estimate response functions for the U.S. property-liability insurance sector by selecting samples of insurers and calibrating the parameters of the regression models. These response functions are computed for various values of total industry losses observed across different years. The goal is to assess the industry ability to absorb catastrophe losses and evaluate its capacity to spread risk across insurers.

The estimated correlation coefficient between an individual insurer's losses and aggregate industry losses captures factors such as whether the insurer underwrites catastrophe-exposed business, operates in catastrophe-prone regions, or is incidentally spared in specific events. To the extent that loss correlations may overstate or understate the true risk exposure due to such idiosyncrasies, our estimates should be interpreted as approximations. Climate risk events have caused average home premiums to increase by 22% from 2020 to 2023 (The Guardian, December 2024). Was it sufficient to maintain market capacity?

1. Raw data

The data used in this analysis are drawn from the statutory annual statements filed by insurers with the National Association of Insurance Commissioners (NAIC). In the original study by Cummins et al. (2002), capacity estimates were based on data through 1997—the most recent available at that time—with parameters estimated using data from 1983 to 1997, yielding 15 annual observations per insurer.

Our measure of losses for capacity estimation is net losses incurred, defined as direct losses incurred plus losses from reinsurance assumed, minus losses from reinsurance ceded. While direct losses reflect payments made directly to policyholders, net losses adjust for the effects of reinsurance transactions. Accordingly, our estimates do not account for the direct impact of the reinsurance sector on capacity, although potential indirect effects are discussed in conclusion. Hereafter, we use "net losses" as shorthand for "net losses plus loss adjustment expenses."

Two data series are available. Full-time samples (FTS) are companies that are present in the samples for the entire period and have net losses and equity capital strictly greater than 0 each year. Non-full-time sample (NFTS) is for companies that are not present in each year of the analysis period. Regression models are estimated from FTS data to provide parameter estimates for firms that are not in the full-time samples. Parameters for these companies are computed by inserting their 1997, 2005, 2014, 2020 and 2023 financial data into the regression models. Observations for net admitted assets and total liability had to be strictly greater than zero, while those for cash and short-term investments and for liquid assets had to be greater than or equal to zero.

Table 1 presents total net loss and total equity capital data over time for all insurers in the non-full-time sample, as well as for groups and unaffiliated companies separately. At this stage, the only distinction between these categories is the number of firms, but it will be informative to explore their respective diversification behavior. We also compare our data with those reported by Cummins et al. (2002) for 1997. Our estimates are closely aligned: Cummins et al. (2002) report $202 billion in total net losses for 2,256 insurers, while our data indicate $210 billion in total net losses for 2,286 insurers that year.

Total net losses increased to $461 billion for 1,787 insurers in 2020, while total industry capital reached $1.109 trillion. By 2023, total net losses had grown to $633 billion for 1,753 insurers, with total capital rising to $1.231 trillion. The ratio of total net losses to total capital, a key indicator of industry leverage, was 56.2% in 1997, peaked at 59.9% in 2005, before declining to 51.4% in 2023. These figures reflect the changing relationship between industry risk exposure and capital adequacy over time.

Table 1:
Total net losses and Total equity capital by year
($000 omitted)

Insurance industry	Net losses incurred	Equity capital	Number of firms
1997			
Cummins et al. 2002 study			
Groups & unaffiliated companies	201,905,979	370,993,421	1,248
All companies	201,905,979	370,993,421	2,256
Our database			
Groups & unaffiliated companies	209,800,900	373,035,693	1,179
All companies	209,800,900	373,035,693	2,286
2005			
Groups & unaffiliated companies	311,568,085	520,451,387	1,200
All companies	311,568,085	520,451,387	2,152
2014			
Groups & unaffiliated companies	349,123,503	803,479,225	1,064
All companies	349,123,503	803,479,225	1,923
2020			
Groups & unaffiliated companies	461,350,387	1,109,446,572	992
All companies	461,350,387	1,109,446,572	1,787
2023			
Groups & unaffiliated companies	633,173,155	1,231,167,185	986
All companies	633,173,155	1,231,167,185	1,753

Note: NFTS: Non-full-time sample. This sample contains insurers that are not present in each year of the time period.

Table OA1.1 in Online Appendix OA1 presents summary statistics on net losses and loss adjustment expenses incurred annually for all companies. As shown in the table, the number of companies increased from 2,214 in 1990 to a peak of 2,256 in 1997, then declined to 2,101 by 2003. It rose again to 2,246 in 2008 before decreasing steadily to 1,753 by 2023. The average net losses generally show an upward trend over the period, with a few exceptions.

The coefficient of variation (CV) is a standardized measure of dispersion that expresses the standard deviation of a dataset as a proportion of its mean. It is calculated as the standard deviation divided by the mean. A higher CV indicates greater relative variability, while a lower CV indicates less relative dispersion. Figures 1 and 2 display the CVs for the NFTS and the FTS samples 1, 2, and 3, for both net losses and equity capital.

Between 1990 and 1992, the CV of losses and loss expenses incurred remained around 6.44, rising to 6.76 in 1992. The CV rose to 6.33 in 2002 before declining to 6.17 in 2003 and gradually decreasing to 5.75 by 2008, with a slight uptick to 6.27 in 2005. From 2009 to 2016, the CV increased from 6.00 to 6.16. The CV then decreased to 5.11 in 2020 before rising again to 5.42 in 2021 and 5.86 in 2023.

This trend suggests that relative variability in losses and loss expenses incurred was generally higher during the 1990s and early 2000s, followed by a gradual decline through the 2010s and early 2020s. The lower CV observed in the most recent years implies more stable losses relative to their mean, which could reflect improved underwriting practices and better risk management. Conversely, the higher CV in earlier years may reflect greater volatility driven by changing market conditions, cyclical factors, or variations in reserve adequacy. Understanding the underlying drivers of these shifts would require further investigation into firm-level practices, market trends, and macroeconomic conditions across the period.

Summary statistics for equity capital—another key variable in measuring industry capacity—are provided in Table OA1.2 in Online Appendix OA1 for the same time period. On average, equity capital exhibits a consistent upward trend over the years, with a few exceptions. Specifically, declines are observed from 2000 to 2002 relative to 1999, in 2008 compared to 2007, and in 2022 compared to 2021. The CV fell to 6.09 in 2008, then rose from 6.20 to a high of 9.46 by 2023.

This suggests that relative dispersion in equity capital was stable through the 1990s and early 2000s but became more pronounced in recent years, especially after 2008. The sharp increase through the 2010s and into the 2020s points to greater variability in equity capital across insurers, potentially reflecting differences in firm-specific capital management strategies.

By comparison, the CV of losses and loss adjustment expenses incurred followed a declining trend after the early 2000s, reaching lower levels of relative variability in the most recent years. This contrast implies that while losses and loss expenses have become more stable and predictable, the equity capital of insurers has exhibited increasing relative volatility. This may highlight a divergence between underwriting and capital-side risks in the insurance sector, with underwriting becoming steadier and capital positions more variable due to changing investment returns, capital allocation decisions, or external financial shocks.

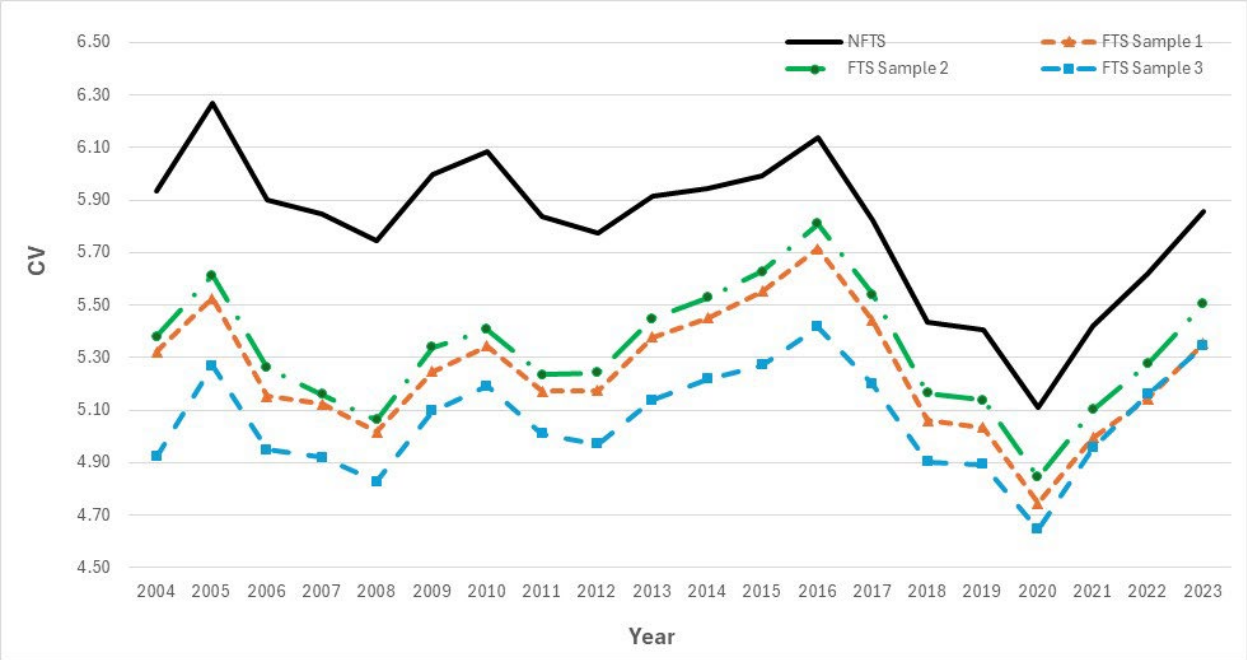

Figure 1: CV of losses and losses expenses incurred, 2004-2023

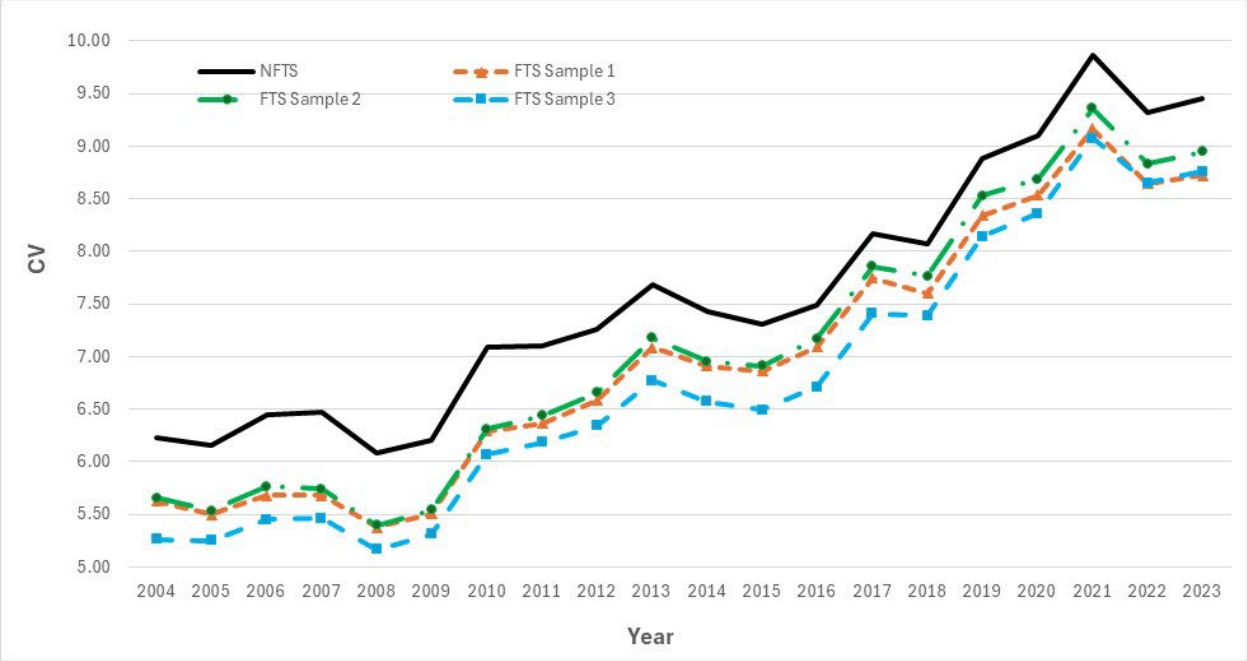

Figure 2: CV of equity capital, 2004-2023

2. Sample selection

Cummins et al. (2002) used a 15-year period to estimate their parameters for the year 1997. Our objective, in this section, is to replicate their 1997 results and to add estimations for the years 2005, 2014, 2020 and 2023. It was not possible to create a 15-year database for the same time period as in Cummins et al. (2002) to make a direct comparison with the year 1997. Our data period is from 1990 to 2023, while their data period is from 1983 to 1997. One way to compare our results to theirs is to employ the observations from line 2 to line 11 in column 28 of "Schedule P – Part 1 – Summary" of the NAIC reports, that contain historical data on previous years and can provide 10 annual observations on the companies for the four years of our study. We label this sample "Sample 1." Note that Cummins et al (2002) used 15 annual observations from line 11 only of the NAIC reports.

One question that then arises is how the results might differ from using 10 annual observations, rather than the 15 in their study, and from a different period. To answer this question, we first estimate our parameters over 10 years. We concentrate the comparison on four 10-year periods, respectively from 1996 to 2005, from 2005 to 2014, from 2011 to 2020, and 2014 to 2023, using

this time the data at line 11 only, in column 28 of "Schedule P – Part 1 – Summary" of the NAIC reports, providing 10 annual observations on the companies. We label this sample "Sample 2." The details are presented in Online Appendix OA2. We compare these results from Sample 2 with those from Sample 1, to verify how parameter estimates can be affected by the type of data used in the estimations (lines 2 to 11 in Sample 1, versus line 11 only in Sample 2).

Second, again for the years 2005, 2014, 2020 and 2023, we estimate the parameters for fourth 15-year periods, from 1991 to 2005, from 2001 to 2014, from 2006 to 2020 and from 2009 to 2023, with the values from line 11 only of column 28 in "Schedule P – Part 1 – Summary" of the NAIC reports, providing 15 annual observations on the companies. We call this sample "Sample 3." The details are presented in Online Appendix OA3. We then compare these results with those estimated from Sample 2, to verify how parameters can be affected by the length of the estimation period.

All main estimates presented in the following discussion are derived from Sample 1. Sample 2 and Sample 3 are for robustness analysis. They show that results in Sample 1 are not dependent on the type of data (lines 2 to 11, instead of line 11 only) nor on the estimation methodology (10 years instead of 15 years).

3. Data in the three samples

Sample 1, the FTS, includes 803 insurance groups and unaffiliated companies and a total of 1,445 companies in 2023. These represent 81% and 82%, respectively, of the comparable populations not included in the FTS for that year. In 2020, these shares were slightly higher—85% for groups and 84% for all companies. Historically, the proportion of groups in the FTS was 74% in 1997, 71% in 2005, and 79% in 2014, while the corresponding percentages for all companies were 73% in both 1997 and 2005, and 80% in 2014.

FTS Sample 2 (Table OA2.1) included more companies than Sample 1: 46 in 2005, 31 in 2014, 61 in 2020, and 82 in 2023. The increases for groups and unaffiliated companies were 13, 23, 36, and 45, respectively, indicating a gradual widening in coverage between samples 1 and 2 over time.

Samples 1 and 2 each provide 10 annual observations per insurer, while Sample 3 (Table OA3.1) offers 15. Although Sample 3 consistently includes fewer companies, the gap has narrowed over time. In 2005, it had 264 fewer companies than Sample 1 and 310 fewer than Sample 2; by 2023, these gaps decreased to 25 and 107, respectively. Similar convergence is observed for groups and unaffiliated companies, where Sample 3 trailed Sample 1 by 106 in 2005 and only 8 in 2023.

Table 2a presents total net losses and equity capital from Sample 1 across selected years. In 1997, net losses totaled $201 billion for 1,667 companies, rising to $455 billion in 2020 (1,509 companies), and reaching $627 billion in 2023, with equity capital at $1.210 trillion. The ratio of net losses to equity capital fluctuated: 56.7% in 1997, 60.6% in 2005, 44.0% in 2014, 41.9% in 2020, and 57.8% in 2023, reflecting varying levels of industry leverage. Similar results for Sample 2 and Sample 3 are presented in Table 2b for samples 2 and 3.

Tables OA2.1 and OA3.1 provide similar metrics for samples 2 and 3, respectively. In Sample 3, net losses grew from $287 billion in 2005 (1,314 companies) to $448 billion in 2020 and $622 billion in 2023 (1,420 companies). Despite rising losses, the loss-to-capital ratio declined from 61% in 2005 to 42% in 2020, before increasing to 52% in 2023.

The FTS Sample 1 captures a large share of the U.S. insurance market, with its representativeness increasing over time. Sample 2 includes slightly more firms, and Sample 3—though initially smaller—is gradually converging in size. Across all samples, total net losses have risen from 1997 to 2023, but the industry capital position has generally strengthened, as indicated by a declining or stabilizing ratio of net losses to equity capital. These patterns reflect increased data coverage over time and improved industry capitalization, despite growing loss exposures.

Across both figures, the CVs for the NFTS are consistently higher than those of the FTS, for both financial indicators. This suggests NFTS tend to experience greater relative volatility in both their losses incurred and capital levels. Among the FTS samples, Sample 3 shows, in figures 1 and 2, the lowest CVs, indicating more stable financial behavior, while Sample 2 has the highest CVs, pointing to greater variability; Sample 1 falls in between.

For equity capital, the CVs of samples 1 and 2 are relatively similar from 2004 to 2021, but from 2021 to 2023, the CVs of samples 1 and 3 become more aligned. This shift may reflect increased

dispersion in Sample 2 or greater capital stability in Sample 3. In general, the CV for equity capital increases over time, particularly in recent years, which may signal rising uncertainty or more volatile capital management practices in industry.

Regarding net losses, the CV exhibits a clear pattern: a sharp peak in 2005, likely linked to large-scale catastrophes; a decline in 2008, possibly due to the financial crisis; a renewed increase in 2016; and another drop in 2020, perhaps influenced by reduced exposure and changes in claim patterns during the COVID-19 pandemic. Overall, these results highlight the varying degrees of financial stability across firm samples and the increasing relative volatility observed in recent years, particularly for capital. This may warrant further investigation into the underlying drivers of volatility and its implications for capital adequacy, risk management, and regulatory oversight.

Table 2a: FTS Sample 1
Total net losses and Total equity capital
($000 omitted)

Sample	Net losses incurred	Equity capital	Number of firms
1997			
Groups & unaffiliated companies	201,252,911	355,097,195	877
All companies	201,252,911	355,097,195	1,667
2005			
Groups & unaffiliated companies	301,274,767	496,797,400	853
All companies	301,274,767	496,797,400	1,578
2014			
Groups & unaffiliated companies	343,463,626	780,443,239	844
All companies	343,463,626	780,443,239	1,574
2020			
Groups & unaffiliated companies	455,137,413	1,085,524,198	841
All companies	455,137,413	1,085,524,198	1,509
2023			
Groups & unaffiliated companies	627,007,128	1,210,558,307	803
All companies	627,007,128	1,210,558,307	1,445

Table 2b: Summary statistics from FTS Sample 2 and Sample 3:
Total net losses and total equity capital ($000 omitted)

Sample	Net losses incurred	Equity capital	Number of firms
2020 Sample 2			
Groups & unaffiliated companies	455,145,860	1,087,840,856	877
All companies	455,145,860	1,087,840,856	1,570
2020 Sample 3			
Groups & unaffiliated companies	448,309,430	1,069,230,397	784
All companies	448,309,430	1,069,230,397	1,407
2023 Sample 2			
Groups & unaffiliated companies	627,585,187	1,213,561,248	848
All companies	627,585,187	1,213,561,248	1,527
2023 Sample 3			
Groups & unaffiliated companies	622,484,177	1,194,453,428	795
All companies	622,484,177	1,194,453,428	1,420

4. Capacity estimation

Let $L_t = \sum_{i=1}^{N} L_{it}$ be the total industry net losses in year *t,* and L_{it} the net loss of insurer *i* in period *t*. The estimator of the mean of net losses for the industry is equal to $\bar{L} = 1/T \sum_{t=1}^{T} L_t$ and the estimator of the variance of net losses for the industry is equal to $\hat{\sigma}^2 = \frac{1}{T-1} \sum_{t=1}^{T} \left(L_t - \bar{L}\right)^2$. We write $\hat{\sigma}$ for the standard deviation of the net losses for the industry. Table OA1.6 in Online Appendix OA1 presents the total net losses, along with their means and standard deviations, for the FTS Sample 1 over the 1990–2023 period. Corresponding statistics for Sample 2 over the 1990–2023 period are reported in Table OA2.4 of Online Appendix OA2. For Sample 3, the data covering the 2004–2023 period are provided in Table OA3.4 of Online Appendix OA3.

Detailed values for $\hat{\sigma}_i$ are presented in Table OA1.6 in Online Appendix OA1 for sample 1. On average, the standard deviation of net losses incurred by individual companies remained below $30 million from 1990 to 2001. In 2021, the standard deviation increased to $59 million, followed by $69 million in 2022 and $81 million in 2023. This upward trend in recent years reflects growing

variability in company-level losses, potentially due to increasing exposure to large-scale events or shifts in underwriting practices.

From 1990 to 1992, the CV of the raw standard deviation of net losses incurred increased from 5.31 to 5.64, then declined to 5.49 in 1993 and 1994. It continued to decrease from 5.24 in 1995 to 3.71 in 1999, followed by a slight increase to 3.72 and then 3.83 in 2002. The CV subsequently fell from 3.69 in 2003 to 3.47 in 2008, then rose steadily to 5.09 by 2017. Finally, it decreased to 4.49 in 2021 and increased again to 4.96 in 2023.

This suggests that the relative variability of the raw standard deviation of net losses incurred was generally higher during the early 1990s, then trended downward through the early 2000s. The upward movement after 2008, especially through 2017 and into the early 2020s, implies greater volatility or dispersion in losses across insurers. This pattern could reflect increased exposure to catastrophic events, economic fluctuations, or other market factors that have introduced more heterogeneity into the industry loss experience in recent years. In contrast to earlier periods of declining CVs, these later increases suggest that insurers' losses have become more variable relative to their mean, potentially requiring more cautious capital allocation and risk management going forward. Detailed values for $\hat{\sigma}_i$ are presented in Table OA2.7in Online Appendix OA2 for sample 2 and Table OA3.7 in Online Appendix OA3 for sample 3.

The correlation coefficient between company *i*'s losses and the industry losses is estimated using the following formula:

$$\hat{\rho}_i = \frac{\frac{1}{T-1}\sum_{t=1}^{T}\left(L_{it} - \bar{L}_i\right)\left(L_t - \bar{L}\right)}{\hat{\sigma}_i \hat{\sigma}}. \tag{19}$$

Detailed values for $\hat{\rho}_i$ in Sample 1 are presented in Table OA1.7 in Online Appendix OA1.

As shown in Table OA1.7, the average correlation coefficient between company i's losses and aggregate industry losses was 0.5996 in 1990. It declined to 0.4071 by 1999, increased to 0.4606 in 2005, decreased again to 0.3683 in 2010, and then climbed significantly to 0.5524 in 2023. These fluctuations suggest changes in how closely individual companies' loss experiences align

with broader industry trends—potentially driven by diversification strategies, reinsurance arrangements, or shifts in market composition. Detailed values for $\hat{\rho}_i$ are presented in Table OA2.8 in Online Appendix OA2 and in Table OA3.8 in Online Appendix OA3 for Sample 3.

5. Detrended parameter estimates

The detrended estimates are based on the residuals from the time trend regressions. The reason for computing the detrended estimators is that property liability insurance losses are subject to a strong positive time trend. Thus, the raw estimates of the loss standard deviation capture trend-related growth in losses across the years. Differences in losses across the years due to this trend effect are thus anticipated loss fluctuations and should not be included when measuring the effect of catastrophes and other types of random shocks on the insurance market capacity.

By measuring capacity using both the raw and detrended parameters, we can isolate potential time-trend bias. Detrended estimates of $\hat{\sigma}_i^2$ and $\hat{\sigma}^2$ are obtained by applying formulas (2) and (3) to the estimated residuals ε_{it} and ε_i, both obtained from (1). The detrended estimate of $\hat{\rho}_i$ is obtained by applying formula (4) to the estimated residual series ε_{it}, and ε_i from (1).

To obtain the detrended parameter estimates, we first conduct the following regressions:

$$L_{it} = \alpha_{0i} + \alpha_{1i} t + \varepsilon_{it}$$

$$L_t = \alpha_0 + \alpha_1 t + \varepsilon_t . \qquad (1)$$

The detrended estimator of the variance of losses for the industry is equal to

$$\det \hat{\sigma}^2 = \frac{1}{T-1} \sum_{t=1}^{T} \left(\hat{\varepsilon}_t - 0 \right)^2 . \qquad (2)$$

We write *det* $\hat{\sigma}$ for the detrended estimator of the standard deviation of the losses for the industry. The detrended estimator of the variance of losses for company *i* is equal to

$$\det \hat{\sigma}_i^2 = \frac{1}{T-1} \sum_{t=1}^{T} \left(\hat{\varepsilon}_{it} - 0 \right)^2 . \qquad (3)$$

The detrended correlation coefficient between company *i*'s losses and the industry losses is estimated using the following formula:

$$\det \hat{\rho}_i = \frac{\frac{1}{T-1}\sum_{t=1}^{T}\left(\hat{\varepsilon}_{it}-0\right)\left(\hat{\varepsilon}_t-0\right)}{\det \hat{\sigma}_i \det \hat{\sigma}}. \quad (4)$$

Detailed detrended values for the standard deviation and the estimated correlation coefficient $\hat{\sigma}_i^2$ and $\hat{\rho}_i$ are presented in Tables OA1.8 and OA1.9 in Online Appendix OA1 for Sample 1, Tables OA2.9 and OA2.10 in Online Appendix OA2 for Sample 2, and Tables OA3.9 and OA3.10 in Online Appendix OA3 for Sample 3.

As expected, detrending reduces both the magnitude of standard deviations in losses and the correlations between individual companies' losses and total industry losses. Because the reduction in correlations is more pronounced than the reduction in standard deviations, the estimated loss payments based on detrended parameters are expected to be lower than those based on raw data.

According to Table OA1.8, in Sample 1, the mean detrended standard deviation of net losses incurred per company was under $15 million from 1990 to 2000. It increased to approximately $22 million by 2007 and remained above $25 million thereafter—with few exceptions—reaching $28 million in 2020, nearly triple the 1990 value.

The coefficient of variation (CV) for the detrended standard deviation of net losses increased from 3.39 in 1990 to 4.31 in 1997, then declined to 3.55 by 2004, and then surged to 5.44 in 2023. These fluctuations indicate that the relative variability of detrended losses has been cyclical, with notable peaks in the late 1990s, mid-2010s, and again in 2023.

In contrast, the CV of the raw standard deviation showed a more stable or declining pattern prior to its recent rise. The greater sensitivity of the detrended CV suggests that, once long-term trends are removed, short-term shocks and cyclical effects become more visible, and the underlying volatility remains significant.

Across all samples, the detrended standard deviation generally increases over time. In 2023, Sample 3 reports the highest detrended variability, followed by Sample 1 (groups and

unaffiliated companies), while Sample 2 (all companies) shows the lowest values. This pattern suggests that relative variability is most pronounced in Sample 3 and least in Sample 2.

Table OA1.9 shows that the average detrended correlation between a company's losses and overall industry losses declined from 0.2020 in 1990 to 0.0891 in 2007, before rising again—to 0.1760 in 2008 and 0.2419 in 2020. It increased sharply to 0.3648 in 2023. These detrended correlations are significantly lower than those in the raw data (Table OA1.7), indicating that much of the correlation in raw data is due to shared long-term trends.

For Sample 1, detrended correlation generally increases over time, except for a temporary dip in 1997. For samples 2 and 3, correlations in 2005 were higher than in 2014 but lower than in 2023, indicating a U-shaped trend. In 2023, Sample 1 shows the highest average detrended correlation, followed by Sample 3, with Sample 2 reporting the lowest.

Detrending reduces both the standard deviation and correlation of net losses, with a more significant impact on correlations—leading to lower estimated loss payments compared to raw data. Over time, the detrended standard deviation of net losses has increased, particularly after 2000, while its coefficient of variation (CV) has fluctuated, peaking in 2023. Detrended correlations between company and industry losses declined until 2007 but have risen sharply since, especially in recent years. Sample 3 shows the highest variability and lowest correlation early on but converges over time. Sample 1 generally exhibits the highest detrended correlation and variability in 2023, suggesting stronger alignment with industry-wide loss patterns after detrending.

6. Regression models for parameter estimations

Regression models are used to estimate parameters for companies that do not have complete data over the full study period—referred to as the NFTS companies. The estimation approach involves modeling the parameters of FTS companies as dependent variables, using their financial characteristics as explanatory variables. The resulting regression equations are then used to compute fitted parameter values for the NFTS firms by inserting their corresponding

financial characteristics in the estimated regression component. These fitted values are subsequently used to evaluate the insurance industry capacity.

Because the parameters to be estimated are subject to censoring—specifically, the standard deviation is bounded below at zero, and the correlation coefficient is bounded between –1 and 1—we apply Tobit models (censored normal regressions) to obtain consistent estimates.

For the 1997 market, regression results are reported in Table OA1.10a for the standard deviation and in Table OA1.11a for the correlation coefficient. For 2005, results are provided in Tables OA1.10b and OA1.11b. Similar results for the years 2014, 2020, and 2023 are presented in Panels c, d, and e of Tables OA1.10 and OA1.11, respectively.

For Sample 2, the regression results are reported in Table OA2.11a for the standard deviation and in Table OA2.12a for the correlation coefficient for the year 2005. Similar results for the years 2014, 2020, and 2023 are presented in Panels b, c, and d of Tables OA2.11 and OA2.12, respectively.

For Sample 3, the corresponding regression results are shown in Table OA3.11a for the standard deviation and in Table OA3.12a for the correlation coefficient for 2005. Results for 2014, 2020, and 2023 appear in Panels b, c, and d of Tables OA3.11 and OA3.12.

Using the fitted regression equations, we estimate standard deviation and correlation parameters for NFTS companies. Table OA1.12 presents summary statistics of the standard deviation of net losses incurred by year for the NFTS sample in Sample 1. Table OA1.13 reports the corresponding statistics for the correlation coefficient between a company's losses and industry losses. Detrended values are presented in Tables OA1.14 and OA1.15, respectively.

For Sample 2, Table OA2.13 provides summary statistics of the standard deviation of net losses for the NFTS sample by year, while Table OA2.14 reports the correlation coefficients. The corresponding detrended values are shown in Tables OA2.15 and OA2.16.

Similarly, for Sample 3, the yearly summary statistics of the standard deviation and correlation coefficient for the NFTS sample are provided in Tables OA3.13 and OA3.14. Detrended values are presented in Tables OA3.15 and OA3.16.

Table 3 presents the average values of both raw and detrended parameter estimates—specifically, the standard deviation and the correlation coefficient—for all companies, as well as for groups and unaffiliated companies, based on FTS and NFTS data from Sample 1. As expected, the detrended values of the standard deviation σ and the correlation coefficient ρ are significantly lower than their raw counterparts, reflecting the removal of long-term trends and structural shifts over time.

Detrended standard deviations and correlations are notably higher in 2020 and 2023 compared to earlier years, suggesting increased volatility and a stronger alignment of company losses with industry-wide losses in recent periods. Across most years, detrended σ values are higher for groups and unaffiliated companies than for all companies, indicating greater variability in losses within these subgroups.

In contrast, detrended correlation coefficients are generally lower for groups and unaffiliated companies compared to the full set of companies, implying that their losses tend to be less synchronized with aggregate industry losses. However, there are notable exceptions: for the NFTS sample in 1997 and the FTS sample in 2005, the detrended correlation for groups and unaffiliated companies exceeds that of all companies. These deviations may reflect specific market conditions or structural changes affecting these subsets during those years.

As expected, detrending reduces the magnitude of loss standard deviations and the correlations between companies' and industry losses. Because detrending leads to larger reductions in correlations than in the standard deviations, we expect the estimated loss payments to be lower for the detrended parameter estimates than for the raw estimates.

Table 3: Detrended and raw parameter estimates: Property liability insurance industry with values from Sample 1

Case	Average				Number of firms
	Detrended sigma × 10^8	Detrended correlation	Raw sigma × 10^8	Raw correlation	
1997					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.1766	0.1141	0.3703	0.5092	877
All companies	0.1311	0.1257	0.2536	0.4390	1,667
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.2066	0.1243	0.4320	0.4899	1,179
All companies	0.0955	0.1004	0.2935	0.4376	2,286
2005					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.3198	-0.0077	0.6241	0.5110	853
All companies	0.2157	0.0545	0.3969	0.4609	1,578
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.3629	0.0352	0.7009	0.4765	1,200
All companies	0.1582	0.0409	0.4245	0.4399	2,152
2014					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.3872	0.1162	0.6258	0.3927	844
All companies	0.2582	0.1621	0.3912	0.4039	1,574
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.4202	0.1233	0.6817	0.3489	1,064
All companies	0.2113	0.1337	0.4156	0.3848	1,923
2020					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.4135	0.1690	0.8693	0.4282	841
All companies	0.2804	0.2419	0.5348	0.4668	1,509
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.4299	0.1716	0.9699	0.4138	992
All companies	0.2368	0.2093	0.5811	0.4487	1,787
2023					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.5737	0.3378	1.4013	0.5151	803
All companies	0.3695	0.3648	0.8140	0.5524	1,445
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.6648	0.3262	1.6598	0.4820	986
All companies	0.3046	0.3876	0.9007	0.5189	1,753

Note: FTS: Full-time samples. NFTS: Non-full-time sample.

Tables OA2.2 and OA3.2 report the corresponding raw and detrended parameter estimates for Sample 2 and Sample 3, respectively.

In Sample 2, Table OA2.2 shows that the average detrended standard deviation increases over time: it is higher in 2014 than in 2005, and higher still in 2020. This upward trend holds regardless of the sub-sample considered. However, this pattern does not apply to the detrended correlation coefficient, which is lower in 2014 than in both 2005 and 2020, indicating non-monotonic behavior.

Table OA2.2 presents the average raw and detrended parameter estimates for both FTS and NFTS companies in Sample 2, disaggregated by all companies and by insurance groups and unaffiliated companies. In 2023, both detrended standard deviations and correlations are higher than in previous years. As expected, detrending reduces the magnitudes of both parameters—more so for correlations than standard deviations. Consequently, estimated loss payments based on detrended data are lower than those based on raw data. Additionally, standard deviation estimates tend to be larger for individual companies than for insurance groups.

Similarly, Table OA3.2 reports the average raw and detrended parameter estimates for both FTS and NFTS companies in Sample 3. As in Sample 2, the highest detrended standard deviations and correlations occur in 2023.

Across all samples, the detrended standard deviation shows a clear upward trend over time. In 2023, Sample 3 exhibits the highest values, followed by Sample 1 (groups and unaffiliated companies), with Sample 2 (all companies) showing the lowest. This suggests that relative variability is most pronounced in Sample 3 and least in Sample 2.

For Sample 1, the average detrended correlation increases over time, with the exception of 1997, which exceeds 2005. After 2005, the upward trend resumes through 2014, 2020, and 2023. In samples 2 and 3, the detrended correlation follows a U-shaped pattern—higher in 2005, lower in 2014, and rising again in 2023.

When comparing detrended correlations across samples in 2023, Sample 1 reports the highest values, followed by Sample 3, with Sample 2 generally showing the lowest. An exception is found among NFTS companies, where Sample 3 has a lower correlation than Sample 2.

Overall, detrending consistently reduces both standard deviations and correlations, with a more pronounced impact on the latter. This results in lower estimated loss payments. Detrended standard deviations rise steadily across all samples, peaking in 2023. Detrended correlations generally increase over time in Sample 1 and follow a U-shaped pattern in samples 2 and 3. In 2023, Sample 1 shows the strongest average correlation, while among NFTS firms, Sample 2 slightly surpasses Sample 3.

7. Response function for industry capacity

The empirical response function, computed over a range of potential aggregate industry losses (L), illustrates how much insurers would collectively pay under various stress scenarios. Figures 3, 4, and 5 present the response for Sample 1 (FTS companies) for the years 1997, 2020, and 2023, while earlier years (2005 and 2014) and corresponding results for NFTS firms appear in Online Appendix OA1. Each figure shows insurer payments rising with industry-wide losses, starting from expected values and extending into more extreme events. The total loss ranges are year-specific, reflecting changes in capital and observed loss levels—from $200–500 billion in 1997 to $660 billion–1.46 trillion in 2023. The analysis focuses primarily on the detrended response functions for all companies, which offer a clearer picture of the industry underlying capacity by stripping out long-term trends. Compared to the Borch (1962) benchmark represented by the 45 degree line—which assumes perfect correlation and equal capitalization—empirical response functions reflect real-world diversification and capitalization heterogeneity.

In 2023, based on detrended data for Sample 1, insurers could fully cover industry losses up to $660 billion (the actual total loss including non-catastrophe loss that year). As losses rise, coverage declines: to 98.2% at $860 billion, 89.6% at $1,160 billion, and 78.8% at $1,460 billion. In Sample 2, the corresponding proportions are lower—97.3%, 86.6%, and 74.1%—while Sample 3 shows slightly higher coverage than Sample 2, but still below Sample 1, with 97.2%, 87.1%, and 76.0%, respectively. For 2020, the capacity levels are lower overall: Sample 1 shows 97.6% at $660 billion, 82.7% at $960 billion, and 66.3% at $1,260 billion. Sample 2 performs worse, with 94.9%, 79.4%, and 61.6%, while Sample 3 lies between the two, with 96.2%, 78.6%, and 63.7%. These comparisons reveal a consistent hierarchy—Sample 1 highest, followed by Sample 3, then Sample 2—and also show that 2023 levels exceed those in 2020.

The industry ability to absorb increasingly large losses improved notably between 2020 and 2023, as indicated in Table 4. For example, in 2020, Sample 1 firms could cover 88.5% of a $400 billion loss and 77.1% of a $600 billion loss. In 2023, this increased to 89.6% at $500 billion, 86.5% at $600 billion, 78.8% at $700 billion, and 74.4% at $800 billion, pointing to a stronger capital base. Capacity does erode under extreme tail scenarios, indicating persistent limits despite overall strengthening. Realized capacity metrics—defined as the ratio of the empirical to theoretical maximum response—reinforce this trend. In 1997, Sample 1 firms could pay 93% of a $100 billion loss and 81% of a $200 billion loss, consistent with prior findings (Cummins et al., 2002). These levels rose to 99.5% and 97.7% in 2020, and further to 99.8% and 98.2% in 2023, confirming that while full absorption of catastrophe losses remains a challenge, the industry resilience has improved substantially over time.

Table 4 Capacity from Sample 1 with detrended values

	%			
1997	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	99.0	90.8	77.6	67.1
All companies	93.3	81.3	70.9	62.2
Insurance industry (NFTS)				
Groups & unaffiliated companies	94.7	87.9	77.3	67.0
All companies	94.6	82.8	72.4	63.5
	%			
2005	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	97.9	90.5	82.2	75.3
All companies	95.3	85.1	74.3	65.0
Insurance industry (NFTS)				
Groups & unaffiliated companies	95.8	90.7	83.3	77.1
All companies	97.3	89.2	80.3	72.9
	%			
2014	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	99.2	96.6	91.5	85.5
All companies	98.5	94.6	87.8	80.5
Insurance industry (NFTS)				
Groups & unaffiliated companies	97.7	94.8	90.5	85.2
All companies	99.0	95.7	89.7	83.1

	%					
2020	100 billion	200 billion	300 billion	400 billion	500 billion	600 billion
Insurance industry (FTS)						
Groups & unaffiliated companies	99.7	98.3	96.0	91.7	87.1	82.1
All companies	99.5	97.7	94.1	88.5	82.7	77.1
Insurance industry (NFTS)						
Groups & unaffiliated companies	98.9	97.3	94.9	91.2	86.5	82.1
All companies	99.9	98.8	96.0	91.1	85.9	80.8
	%					
2023	100 billion	200 billion	300 billion	400 billion	500 billion	600 billion
Insurance industry (FTS)						
Groups & unaffiliated companies	99.9	98.6	96.6	94.0	91.3	88.7
All companies	99.8	98.2	95.8	92.7	89.6	86.5
Insurance industry (NFTS)						
Groups & unaffiliated companies	97.7	95.7	93.5	90.8	88.3	85.8
All companies	99.8	98.4	96.0	92.9	89.9	88.8

Conclusion

The main objective of this study was to update the observed capacity of the US property liability insurance industry to cover catastrophe losses in 2024 and verify how this capacity has evolved since 1997. We also presented all the important steps in data management and model estimation for those wanting to replicate the analysis or update the results, given that climate risk will undoubtedly become an increasingly important research subject over the coming years.

Our results cannot correspond to the Borch's theoretical prediction of perfect correlation obtained in a perfect market environment. They consider the different frictions in the insurance market, including transaction costs, asymmetric information, and insurers' relative exposure to climate risks. Moreover, insurers are unevenly capitalized. Finally, most insurers are not perfectly diversified geographically and may have their exposures concentrated in a subset of states that are disproportionately exposed to weather events. The estimated correlations should consider all these imperfections and be used to obtain the industry real capacity.

Equity capital in the US insurance industry increased from $373 billion in 1997 to $1.23 trillion in 2023 in the NFTS, and the ratio of net losses over capital decreased from 66% to 51$, indicating

a better capitalization in 2023. These ratios from raw data do not necessarily measure the capacity of the insurance industry to cover additional unforeseen large events in a given year, because they do not consider correlations between individual loss and aggregate loss. The industry response functions for 2023 are presented in Table 4 for Sample 1 data with detrended parameters. Results indicate that the insurance industry can cover 98% of a $200 billion loss and 96% of a $300 billion loss. Table 4 also indicates that the capacity for a $300 billion loss would have been 77% in 1997 (about 90% in 2014). Table 4 also shows that the capacity available to groups and unaffiliated companies is always higher than for all companies with FTS data. This increased capacity can be attributed to the higher absolute value of industry capitalization and, probably, the higher concentration of equity among the largest insurers as a result of consolidations.

Many extensions of our analysis can be considered. Reinsurance is important to diversify climate risks around the world over time. To date, the two levels of industry capacity have been studied separately in literature. It has been documented that the presence of reinsurance can affect insurers' behavior (Desjardins et al., 2022). It would be interesting to analyze how insurers with more reinsurance coverage can obtain more capital and be more aggressive in tackling weather events. The opposite causality link is also of interest.

In conclusion, yes, the industry capacity was sufficient to compensate insured losses in 2024, where insured catastrophe losses were estimated at $140 billion in the US. It would have been more difficult to cover total economic losses of $320 billion (Munich Re, 2025). Insurance coverage for these losses is still low, partly because premiums are very high. Despite large industry capacity to compensate insured losses, society's welfare losses related to climate change remain very important. Society faces a difficult puzzle: Very high premiums are necessary to maintain industry capacity but these premiums limit insurance demand.

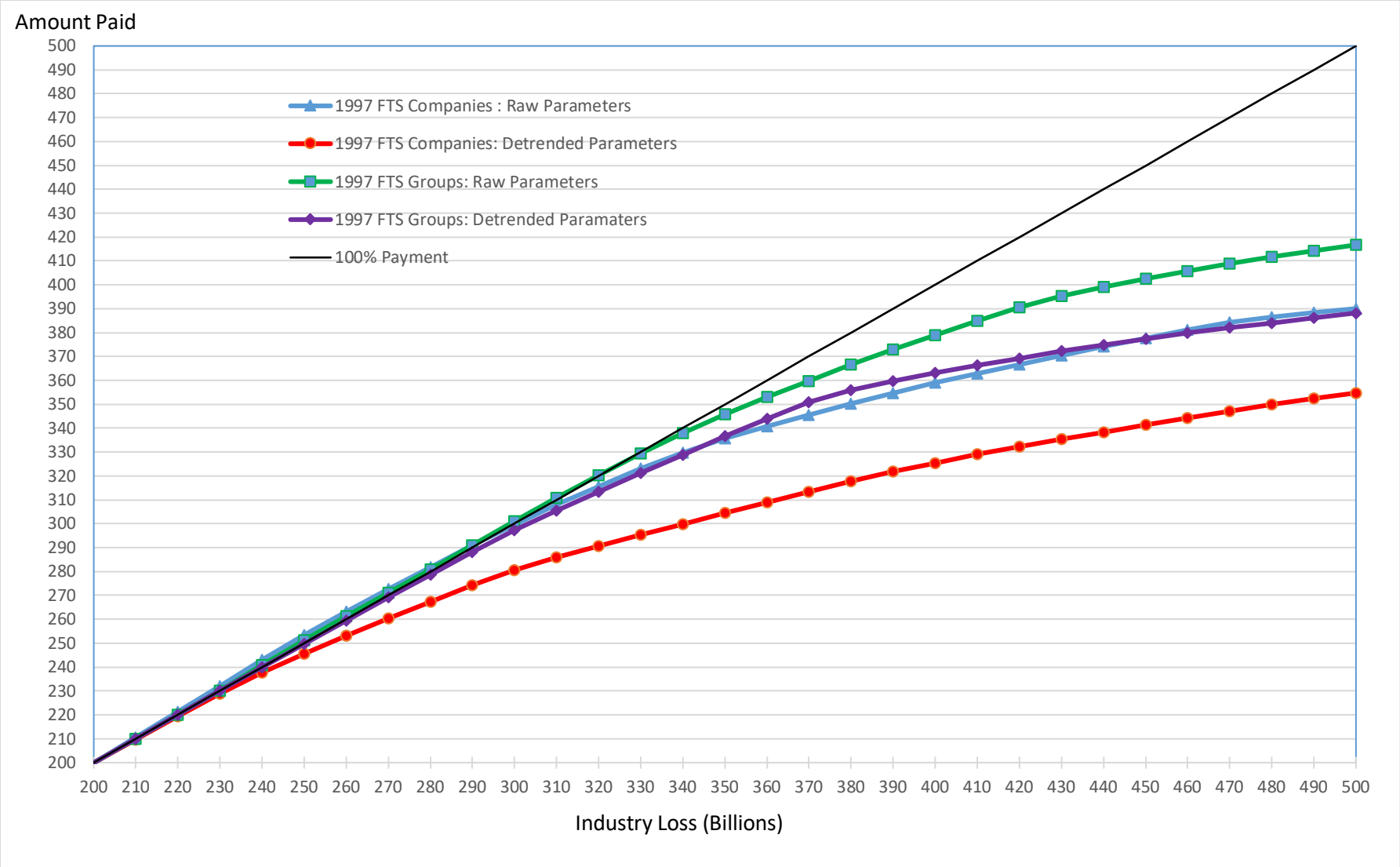

FIGURE 3: Industry capacity in 1997 (FTS sample 1)

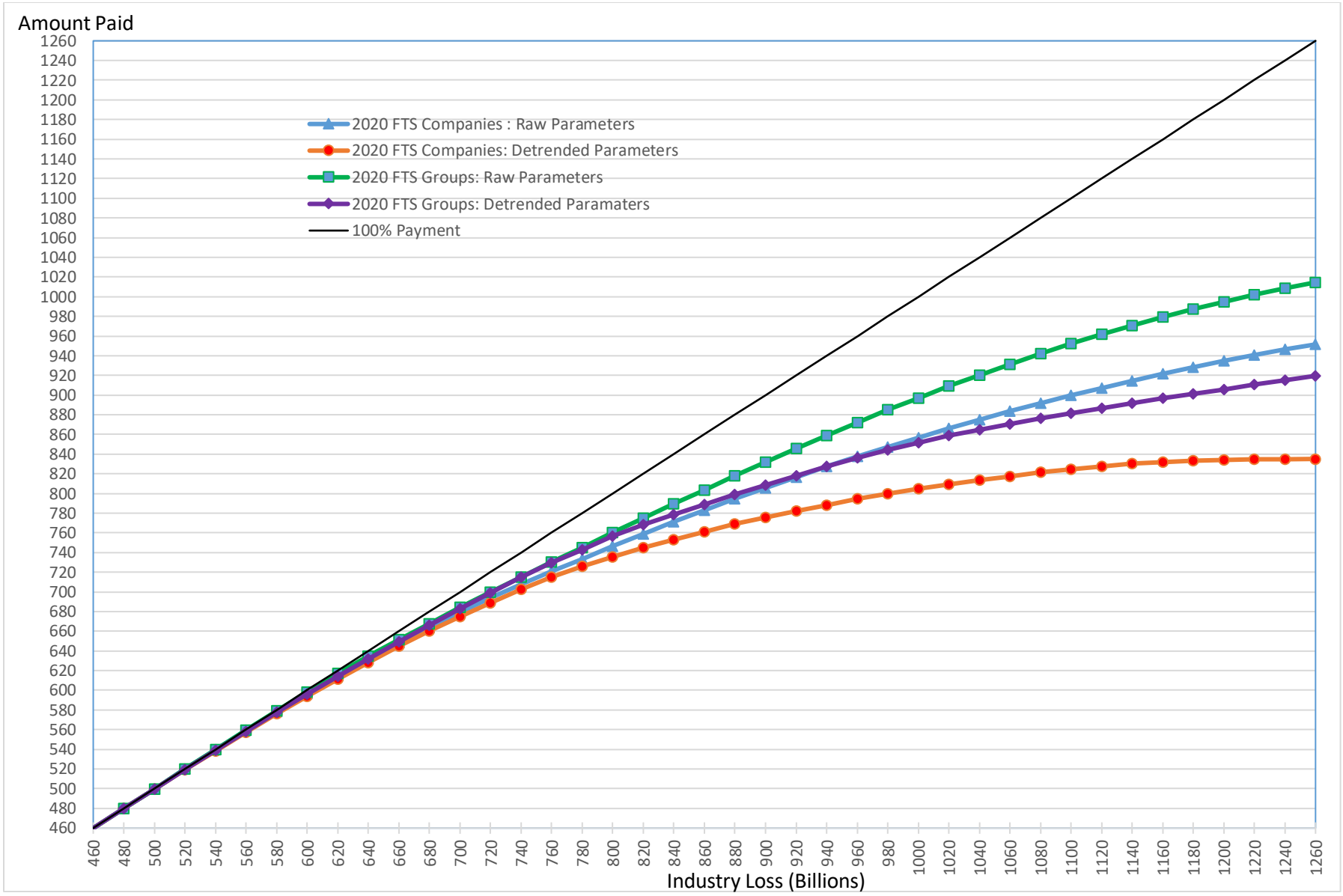

FIGURE 4: Industry capacity in 2020 (FTS sample 1)

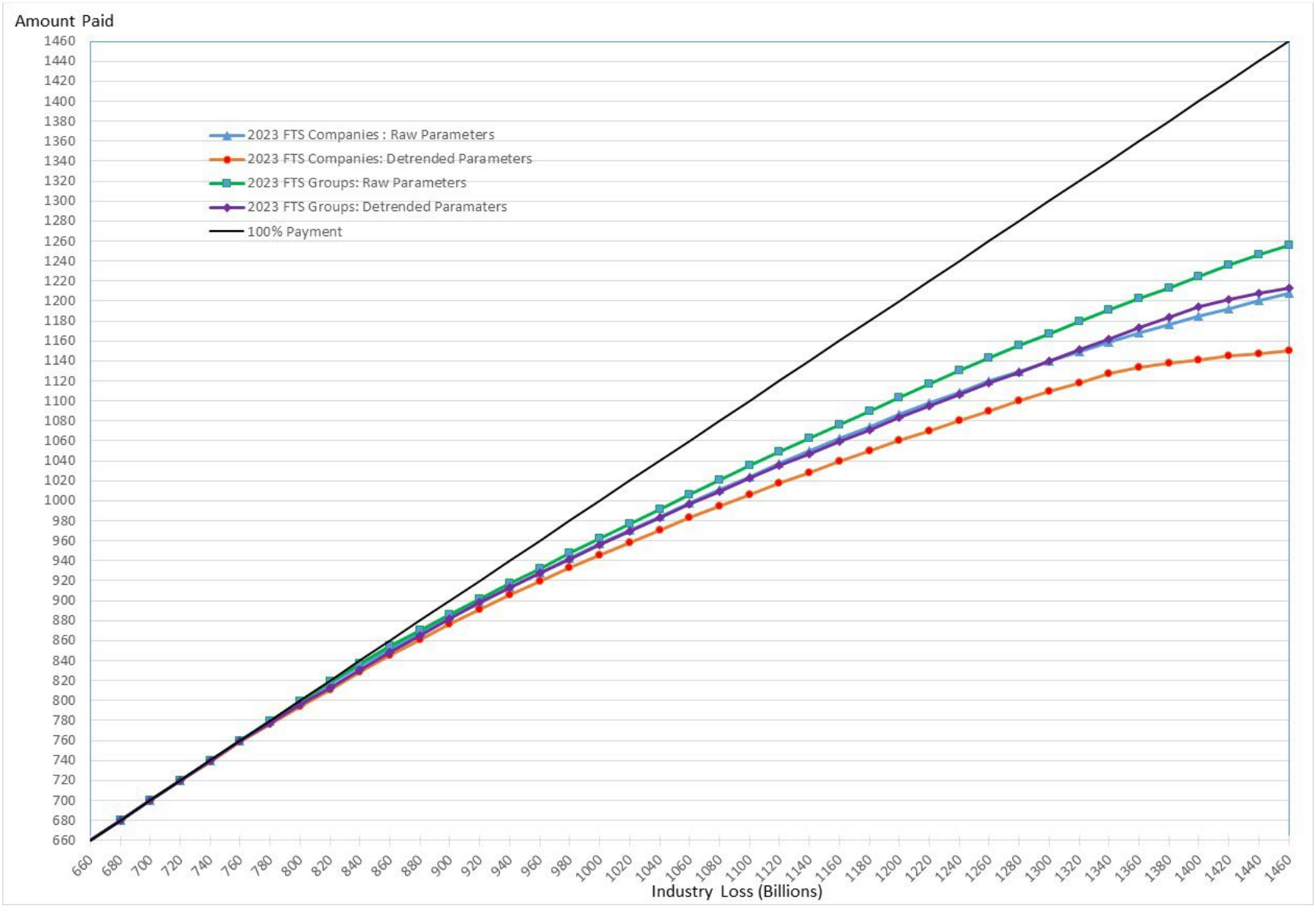

FIGURE 5: Industry capacity in 2023 (FTS sample 1)

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A re-examination of the US insurance market's capacity to pay catastrophe losses in 2024

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6 August 2025

Online appendix

Online appendix OA1

Table OA1.1: NFTS Companies
Summary statistics: Net losses and loss expenses incurred by year (1990–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Max	CV
1990	2,214	177,715,603	80,269.02	517,537.57	16,958,127	6.4475
1991	2,241	182,530,805	81,450.60	524,570.85	17,027,661	6.4404
1992	2,255	198,401,990	87,983.14	594,516.08	18,314,940	6.7572
1993	2,252	190,413,917	84,553.25	554,470.02	19,155,972	6.5576
1994	2,267	208,572,216	92,003.62	625,799.82	21,810,622	6.8019
1995	2,280	204,910,538	89,873.04	600,634.17	21,432,510	6.6831
1996	2,285	215,009,405	94,096.02	619,391.36	21,454,575	6.5825
1997	2,286	209,800,900	91,776.42	594,148.82	20,713,399	6.4739
1998	2,277	221,006,627	97,060.44	613,220.30	21,053,347	6.3179
1999	2,213	227,814,550	102,943.76	637,275.50	21,203,854	6.1905
2000	2,165	241,115,798	111,369.88	702,301.10	23,335,985	6.3060
2001	2,137	265,470,813	124,225.93	770,202.56	25,798,108	6.2000
2002	2,103	265,383,948	126,193.03	799,293.80	27,672,128	6.3339
2003	2,101	277,826,866	132,235.54	815,773.37	27,807,298	6.1691
2004	2,143	291,800,571	136,164.52	807,959.99	27,059,473	5.9337
2005	2,152	311,568,085	144,780.71	907,532.39	29,846,734	6.2683
2006	2,193	294,508,283	134,294.70	792,433.87	25,459,006	5.9007
2007	2,223	312,562,459	140,603.90	821,870.35	26,371,754	5.8453
2008	2,246	356,466,021	158,711.50	912,082.83	28,142,990	5.7468
2009	2,207	325,036,521	147,275.27	883,359.23	28,701,847	5.9980
2010	2,163	323,710,757	149,658.23	910,450.20	29,717,899	6.0835
2011	2,119	358,938,218	169,390.38	988,525.45	30,474,865	5.8358
2012	2,069	347,978,308	168,186.71	971,028.53	30,204,525	5.7735
2013	2,016	334,899,331	166,120.70	982,821.13	31,447,613	5.9163
2014	1,923	349,123,503	181,551.48	1,078,925.03	32,970,073	5.9428
2015	1,953	363,651,857	186,201.67	1,115,894.90	34,203,391	5.9929
2016	1,911	388,339,598	203,212.77	1,247,026.09	38,768,776	6.1366
2017	1,864	425,020,127	228,015.09	1,327,374.43	38,816,047	5.8214
2018	1,825	443,081,776	242,784.53	1,319,597.25	36,187,577	5.4353
2019	1,805	454,609,413	251,861.17	1,361,103.60	36,311,052	5.4042
2020	1,787	461,350,387	258,170.33	1,319,821.69	31,865,776	5.1122
2021	1,787	510,827,176	285,857.40	1,549,446.10	39,398,537	5.4203
2022	1,778	579,301,489	325,816.36	1,830,930.26	47,965,604	5.6195
2023	1,753	633,173,155	361,194.04	2,114,985.89	57,003,028	5.8555

Note: NFTS: Non-full-time sample CV: Coefficient of variation

Tab8 OA1.2: NFTS Companies
Summary statistics: Equity capital by year (1990–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Min	Max	CV
1990	2,214	168,699,803	76,196.84	472,348.72	8.34	17,889,083	6.1991
1991	2,241	186,953,810	83,424.28	510,424.41	3.46	19,721,100	6.1184
1992	2,255	195,366,490	86,637.02	500,682.73	58.07	18,751,400	5.7791
1993	2,252	218,854,119	97,182.11	571,898.35	39.87	21,269,733	5.8848
1994	2,267	228,726,898	100,894.09	573,638.35	64.39	21,143,917	5.6855
1995	2,280	271,399,696	119,034.95	713,469.10	61.41	25,119,972	5.9938
1996	2,285	302,009,404	132,170.42	853,921.86	3.31	30,053,793	6.4608
1997	2,286	373,035,693	163,182.72	1,114,775.27	57.68	37,608,322	6.8315
1998	2,277	408,329,034	179,327.64	1,219,263.15	0.56	41,766,158	6.7991
1999	2,213	411,257,453	185,837.08	1,293,516.87	25.09	45,762,499	6.9605
2000	2,165	382,656,656	176,746.72	1,226,322.77	10.79	43,690,982	6.9383
2001	2,137	357,016,769	167,064.47	1,047,019.00	143.50	37,989,956	6.2672
2002	2,103	354,836,839	168,728.88	956,411.83	64.29	31,600,585	5.6683
2003	2,101	425,132,845	202,347.86	1,220,459.15	44.44	39,980,587	6.0315
2004	2,143	477,012,027	222,590.77	1,388,012.85	0.77	46,144,211	6.2357
2005	2,152	520,451,388	241,845.44	1,489,481.92	107.24	50,187,253	6.1588
2006	2,193	590,617,960	269,319.64	1,735,785.29	246.48	58,034,268	6.4451
2007	2,223	635,480,464	285,866.16	1,849,520.83	147.83	63,577,269	6.4699
2008	2,246	573,351,953	255,276.92	1,553,939.71	18.16	53,273,952	6.0873
2009	2,207	637,141,361	288,691.15	1,791,981.96	161.83	58,180,271	6.2073
2010	2,163	681,298,430	314,978.47	2,233,559.24	7.94	68,437,054	7.0911
2011	2,119	677,006,054	319,493.18	2,268,255.59	45.51	70,155,428	7.0995
2012	2,069	717,940,204	346,998.65	2,521,352.06	15.41	78,861,515	7.2662
2013	2,016	788,520,342	391,131.12	3,007,903.53	0.13	97,226,052	7.6903
2014	1,923	803,479,225	417,825.91	3,106,439.27	1.15	93,997,652	7.4348
2015	1,953	817,507,744	418,590.76	3,058,316.60	1.85	89,828,619	7.3062
2016	1,911	855,520,039	447,681.86	3,355,687.24	77.63	101,285,906	7.4957
2017	1,864	913,820,807	490,247.21	4,003,976.83	77.10	128,562,566	8.1673
2018	1,825	902,810,027	494,690.43	3,991,042.47	106.64	122,471,087	8.0678
2019	1,805	1,034,756,900	573,272.54	5,092,094.30	256.15	167,718,679	8.8825
2020	1,787	1,109,446,600	620,843.07	5,648,877.36	167.44	187,762,294	9.0987
2021	1,787	1,250,038,582	699,517.95	6,902,873.06	106.70	239,470,233	9.8680
2022	1,778	1,164,739,472	655,084.07	6,103,695.07	181.82	207,276,468	9.3174
2023	1,753	1,231,167,185	702,320.13	6,640,788.96	67.18	225,582,882	9.4555

Note: NFTS: Non-full-time sample. CV: Coefficient of variation

Sample 1

Table OA1.3: FTS companies Sample 1
Summary statistics: Net losses and loss expenses incurred by year (1990–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Max	CV
1990	1,389	171,374,407	123,380	649,457	16,958,127	5.2639
1991	1,444	176,052,958	121,920	649,801	17,027,661	5.3297
1992	1,461	190,313,741	130,263	734,674	18,314,940	5.6399
1993	1,488	181,856,782	122,216	678,362	19,155,972	5.5505
1994	1,503	198,108,492	131,809	764,545	21,810,622	5.8004
1995	1,560	195,420,453	125,270	722,705	21,432,510	5.7692
1996	1,624	206,486,353	127,147	731,219	21,454,575	5.7510
1997	1,667	201,252,911	120,728	692,404	20,713,399	5.7352
1998	1,677	210,282,050	125,392	710,668	21,053,347	5.6676
1999	1,663	216,479,256	130,174	731,245	21,203,854	5.6174
2000	1,639	229,485,981	140,016	802,925	23,335,985	5.7345
2001	1,636	256,830,748	156,987	876,945	25,798,108	5.5861
2002	1,615	257,085,229	159,186	908,798	27,672,128	5.7090
2003	1,595	268,3442,00	168,241	932,563	27,807,298	5.5430
2004	1,596	279,0725,93	174,858	930,456	27,059,473	5.3212
2005	1,578	301,274,767	190,922	1,055,190	29,846,734	5.5268
2006	1,589	285,720,875	179,812	926,317	25,459,006	5.1516
2007	1,604	300,912,718	187,601	960,956	26,371,754	5.1223
2008	1,626	345,168,298	212,281	1,065,100	28,142,990	5.0174
2009	1,613	316,309,049	196,100	1,028,716	28,701,847	5.2459
2010	1,596	315,294,344	197,553	1,055,586	29,717,899	5.3433
2011	1,609	351,449,025	218,427	1,129,794	30,474,865	5.1724
2012	1,612	341,523,488	211,863	1,096,009	30,204,525	5.1732
2013	1,604	327,588,106	204,232	1,098,294	31,447,613	5.3777
2014	1,574	343,463,626	218,211	1,189,212	32,970,073	5.4498
2015	1,632	357,822,910	219,254	1,217,658	34,203,391	5.5536
2016	1,609	381,780,711	237,278	1,355,884	38,768,776	5.7143
2017	1,591	419,052,497	263,389	1,433,222	38,816,047	5.4415
2018	1,548	437,005,166	282,303	1,428,620	36,187,577	5.0606
2019	1,531	448,059,984	292,658	1,473,351	36,311,052	5.0344
2020	1,509	455,137,413	301,615	1,431,263	31,865,776	4.7453
2021	1,505	507,331,056	337,097	1,683,452	39,398,537	4.9940
2022	1,471	574,015,941	390,222	2,006,956	47,965,604	5.1431
2023	1,445	627,007,128	433,915	2,323,038	57,003,028	5.3537

Note: FTS: Full-time samples.

Table OA1.4: FTS companies Sample 1

Summary statistics: Equity capital by year (1990–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Min	Max	CV
1990	1,389	158,546,901	114,144.64	592,570.59	8.34	17,889,083	5.1914
1991	1,444	173,829,187	120,380.32	630,474.05	3.46	19,721,100	5.2374
1992	1,461	177,377,546	121,408.31	606,605.98	58.07	18,751,400	4.9964
1993	1,488	199,444,022	134,034.96	688,739.67	46.89	21,269,733	5.1385
1994	1,503	208,409,100	138,662.08	692,173.81	0.67	21,143,917	4.9918
1995	1,560	251,900,679	161,474.79	850,780.97	61.41	25,119,972	5.2688
1996	1,624	286,667,232	176,519.23	1,008,369.56	3.31	30,053,793	5.7125
1997	1,667	355,097,195	213,015.71	1,300,376.16	118.38	37,608,322	6.1046
1998	1,677	386,753,275	230,622.11	1,415,157.58	251.35	41,766,158	6.1363
1999	1,663	389,497,489	234,213.76	1,486,770.79	25.09	45,762,499	6.3479
2000	1,639	362,829,587	221,372.54	1,405,263.36	10.79	43,690,982	6.3480
2001	1,636	340,892,569	208,369.54	1,192,500.53	204.58	37,989,956	5.7230
2002	1,615	334,593,012	207,178.34	1,086,254.63	64.29	31,600,585	5.2431
2003	1,595	403,289,846	252,846.30	1,394,916.36	165.53	39,980,587	5.5169
2004	1,596	454,269,314	284,629.90	1,601,547.77	0.77	46,144,211	5.6268
2005	1,578	496,797,400	314,827.25	1,731,283.16	107.24	50,187,253	5.4992
2006	1,589	568,217,331	357,594.29	2,030,838.99	246.48	58,034,268	5.6792
2007	1,604	612,255,763	381,705.59	2,168,536.61	345.91	63,577,269	5.6812
2008	1,626	549,738,270	338,092.42	1,818,159.44	65.92	53,273,952	5.3777
2009	1,613	611,689,263	379,224.59	2,087,473.24	161.83	58,180,271	5.5046
2010	1,596	657,498,627	411,966.56	2,592,473.12	265.60	68,437,054	6.2929
2011	1,609	655,961,572	407,682.77	2,595,877.20	67.60	70,155,428	6.3674
2012	1,612	697,411,163	432,637.20	2,849,514.46	15.41	78,861,515	6.5864
2013	1,604	761,466,077	474,729.48	3,364,615.16	0.13	97,226,052	7.0874
2014	1,574	780,443,239	495,834.33	3,426,861.01	1.15	93,997,652	6.9113
2015	1,632	793,579,779	486,262.12	3,338,676.08	1.85	89,828,619	6.8660
2016	1,609	827,568,694	514,337.29	3,649,783.39	77.63	101,285,906	7.0961
2017	1,591	888,790,475	558,636.38	4,327,584.27	77.10	128,562,566	7.7467
2018	1,548	880,890,563	569,050.75	4,327,085.99	186.58	122,471,087	7.6040
2019	1,531	1,013,362,400	661,895.76	5,522,467.07	256.15	167,718,679	8.3434
2020	1,509	1,085,524,198	719,366.60	6,140,746.89	167.44	187,762,294	8.5363
2021	1,505	1,233,489,392	819,594.28	7,515,179.34	106.70	239,470,233	9.1694
2022	1,471	1,140,569,269	775,370.00	6,702,928.31	181.82	207,276,468	8.6448
2023	1,445	1,210,558,307	837,756.61	7,306,410.97	67.18	225,582,882	8.7214

Note: FTS: Full-time samples.

Table OA1.5: FTS Sample 1
Distribution of total net losses
($000 omitted)

Year	L_{t-9}	L_{t-8}	L_{t-7}	…	L_{t-2}	L_{t-1}	L_t	$\bar{L}$	$\hat{\sigma}$
1990	74,414,479	83,740,459	92,568,162	…	146,335,428	163,586,889	171,374,407	120,913,611	32,903,590.43
1991	83,456,062	92,599,368	106,045,142	…	162,886,621	169,301,376	176,052,958	130,553,840	32,23,3624.03
1992	92,647,718	106,321,361	116,924,431	…	167,742,711	172,767,662	190,313,741	140,389,509	32,023,954.40
1993	106,624,102	117,284,584	120,830,527	…	170,884,525	187,390,339	181,856,782	148,807,477	28,859,195.62
1994	117,281,706	120,793,434	130,361,714	…	183,781,628	178,171,262	198,108,492	156,871,828	27,663,010.22
1995	121,330,023	130,267,248	143,809,787	…	177,237,140	197,522,574	195,420,453	164,675,826	25,874,409.05
1996	130,295,151	143,751,177	162,636,588	…	195,939,244	193,721,909	206,486,353	172,447,814	23,554,485.11
1997	142,545,496	161,646,113	166,091,936	…	191,438,008	204,564,120	201,252,911	178,148,915	19,667,790.98
1998	161,030,019	165,514,511	166,444,345	…	202,457,275	198,605,104	210,282,050	183,547,688	17,292,994.45
1999	164,989,834	166,273,270	178,394,896	…	198,414,779	210,943,074	216,479,256	188,527,211	18,264,410.77
2000	161,832,267	173,916,592	166,783,739	…	211,492,329	217,357,930	229,485,981	192,683,234	22,168,897.95
2001	170,383,410	164,129,958	185,343,855	…	220,814,423	233,343,042	256,830,748	201,983,453	29,073,939.09
2002	163,329,224	185,170,740	183,094,367	…	239,890,904	259,079,558	257,085,229	212,658,198	32,582,651.46
2003	183,262,364	181,666,295	195,65,1689	…	258,870,910	248,895,008	268,3442,00	221,525,533	31,952,779.09
2004	181,247,887	195,657,075	195,804,754	…	249,198,170	255,045,500	279,0725,93	230,678,192	32,486,977.37
2005	195,532,170	196,212,105	218,380,744	…	253,15,6354	266,200,435	301,2747,67	242,261,707	32,992,657.69
2006	194,896,671	217,107,302	229,258,222	…	260,102,398	288,520,118	285,720,875	248,864,739	29,024,525.31
2007	218,297,148	230,639,185	249,137,841	…	284,400,126	276,740,621	300,912,718	258,617,191	24,527,774.20
2008	230,948,463	250,138,181	265,457,113	…	272,743,918	296,362,660	345,168,298	270,459,274	31,990,072.95
2009	249,301,425	264,911,266	252,434,049	…	291,826,043	339,738,585	316,309,049	276,746,310	30,730,051.47
2010	260,192,930	248,596,078	246,233,069	…	334,570,606	308,943,902	315,294,344	279,230,518	31,041,645.17
2011	254,896,045	252,473,633	256,596,353	…	306,270,626	312,770,589	351,449,025	289,465,005	34,480,509.44
2012	251,604,283	256,078,212	277,317,579	…	311,243,831	344,377,981	341,523,488	296,430,383	34,502,524.19
2013	256,171,787	277,855,414	263,854,070	…	344,027,261	332,653,260	327,588,106	302,814,683	30,658,420.27
2014	275,473,365	261,702,820	281,133,928	…	330,284,145	319,968,627	343,463,626	308,114,802	28,219,214.04
2015	262,810,797	283,430,758	324,298,418		321,953,494	339,536,074	357,822,910	317,548,288	28,806,727.83
2016	281,248,062	322,324,631	301,047,232		338,865,315	353,057,645	381,780,711	327,348,569	28,576,765.23
2017	320,898,234	299,501,944	302,693,023		352,497,619	376,839,754	419,052,497	339,753,084	36,047,844.99
2018	299,397,701	305,594,617	339,504,878		376,006,361	411,181,111	437,005,166	350,443,564	45,028,499.77
2019	303,558,374	337,364,597	326,187,667		408,728,464	429,581,444	448,059,984	362,752,208	50,129,294.12
2020	336,081,747	324,629,134	314,403,406		427,517,806	443,105,545	455,137,413	375,896,543	52,807,309.53
2021	324,304,115	313,179,248	331,797,920		443,572,891	444,440,068	507,,331,056	391,836,738	64,088,345.16
2022	309,477,454	327,256,442	343,301,511		434,733,865	498,522,658	574,015,941	412,539,285	81,351,550.30
2023	322,716,901	337,990,339	363,390,201		488,085,172	562,810,910	627,007,128	437,679,949	97,127,902.44

Note: Sum of the observed losses of company *i* incurred in year *t–9* up to *t* (L_{t-9}, … L_t). $\bar{L}$ and $\hat{\sigma}$ of losses for the industry by year (1990–2023).

Table OA1.6: ($\hat{\sigma}_i$) FTS Companies Sample 1
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1990	1,389	28,896.89	153,266.69	1.90	4,117,902.16	5.3039
1991	1,444	28,285.71	153,603.01	1.52	4,175,781.98	5.4304
1992	1,461	29,001.89	163,666.97	1.32	4,184,769.02	5.6433
1993	1,488	28,271.59	155,126.49	0.70	4,047,432.60	5.4870
1994	1,503	28,031.22	153,805.97	6.11	4,160,714.72	5.4870
1995	1,560	27,289.46	143,088.30	5.86	4,038,217.10	5.2434
1996	1,624	26,691.71	126,921.89	7.04	3,531,777.62	4.7551
1997	1,667	25,357.20	107,760.08	6.26	2,859,433.91	4.2497
1998	1,677	24,385.01	94,739.98	6.07	2,403,336.98	3.8852
1999	1,663	24,602.95	91,232.49	2.53	2,056,463.79	3.7082
2000	1,639	26,284.24	97,870.52	3.52	2,142,909.44	3.7235
2001	1,636	29,277.32	110,785.74	0.97	2,408,613.36	3.7840
2002	1,615	31,747.85	121,748.78	0.32	2,825,926.51	3.8349
2003	1,595	34,310.36	126,525.62	0.32	2,826,442.64	3.6877
2004	1,596	36,925.36	131,901.68	5.08	2,847,132.67	3.5721
2005	1,578	39,687.63	146,392.88	0.67	3,301,741.99	3.6886
2006	1,589	39,690.58	140,673.87	0.67	2,822,807.25	3.5443
2007	1,604	39,863.78	139,858.88	0.67	2,595,686.90	3.5084
2008	1,626	44,203.38	153,565.17	5.95	2,339,542.42	3.4741
2009	1,613	43,552.17	151,460.50	1.03	1,957,636.38	3.4777
2010	1,596	41,513.42	145,298.42	1.16	2,006,493.32	3.5000
2011	1,609	43,143.13	153,674.77	0.67	2,483,517.16	3.5620
2012	1,612	42,065.40	147,767.89	0.67	2,369,475.80	3.5128
2013	1,604	40,145.20	140,878.39	5.33	2,261,733.09	3.5092
2014	1,574	39,122.05	154,097.32	0.57	3,419,126.79	3.9389
2015	1,632	39,291.84	173,303.39	0.95	4,486,420.20	4.4107
2016	1,609	40,432.54	201,018.55	0.47	5,194,632.04	4.9717
2017	1,591	44522.55	226,404.97	0.32	6,170,229.88	5.0852
2018	1,548	49,860.80	241,902.79	0.32	6,760,598.56	4.8516
2019	1,531	51,999.15	249,680.68	0.32	7,041,168.30	4.8016
2020	1,509	53,481.45	243,722.37	0.32	6,800,905.57	4.5571
2021	1,505	59,410.74	267,050.73	0.42	6,897,245.95	4.4950
2022	1,471	69,236.28	320,798.70	0.42	6,903,820.34	4.6334
2023	1,445	81,403.04	403,597.88	0.82	8,539,414.34	4.9580

Note: Standard deviation of losses for a company by year (1990–2023).

Table OA1.7: ($\hat{\rho}_i$) FTS Companies Sample 1

Year	N	Mean	Std	Min	Max	CV
1990	1,389	0.5996	0.4984	-0.9138	0.9967	0.8312
1991	1,444	0.5720	0.5153	-0.9281	0.9970	0.9009
1992	1,461	0.5505	0.5176	-0.9385	0.9974	0.9402
1993	1,488	0.5172	0.5262	-0.9816	0.9924	1.0174
1994	1,503	0.5085	0.5442	-0.9721	0.9919	1.0702
1995	1,560	0.5034	0.5490	-0.9712	0.9908	1.0906
1996	1,624	0.4866	0.5569	-0.9303	0.9853	1.1445
1997	1,667	0.4390	0.5859	-0.9579	0.9862	1.3346
1998	1,677	0.4151	0.5987	-0.9718	0.9836	1.4423
1999	1,663	0.4071	0.5952	-0.9523	0.9823	1.4620
2000	1,639	0.4143	0.5882	-0.9399	0.9909	1.4197
2001	1,636	0.4505	0.5600	-0.9416	0.9909	1.2431
2002	1,615	0.4629	0.5558	-0.9536	0.9960	1.2007
2003	1,595	0.4619	0.5492	-0.9699	0.9925	1.1890
2004	1,596	0.4681	0.5327	-0.9564	0.9900	1.1380
2005	1,578	0.4606	0.5235	-0.9447	0.9922	1.1366
2006	1,589	0.4277	0.5247	-0.9100	0.9830	1.2268
2007	1,604	0.3964	0.5265	-0.9245	0.9765	1.3282
2008	1,626	0.3975	0.5087	-0.8969	0.9773	1.2797
2009	1,613	0.3633	0.5344	-0.8786	0.9757	1.4710
2010	1,596	0.3683	0.5427	-0.9556	0.9765	1.4735
2011	1,609	0.4105	0.5590	-0.9363	0.9895	1.3618
2012	1,612	0.4181	0.5593	-0.9606	0.9839	1.3377
2013	1,604	0.3838	0.5450	-0.9173	0.9677	1.4200
2014	1,574	0.4039	0.5000	-0.8938	0.9644	1.2379
2015	1,632	0.3974	0.4970	-0.8992	0.9740	1.2506
2016	1,609	0.3875	0.5015	-0.9024	0.9801	1.2942
2017	1,591	0.4329	0.5129	-0.9589	0.9813	1.1848
2018	1,548	0.4767	0.5218	-0.9776	0.9832	1.0946
2019	1,531	0.4854	0.5263	-0.9830	0.9926	1.0843
2020	1,509	0.4668	0.5402	-0.9929	0.9921	1.1572
2021	1,505	0.4884	0.5407	-0.9569	0.9972	1.1071
2022	1,471	0.5233	0.5333	-0.9375	0.9954	1.0191
2023	1,445	0.5524	0.5174	-0.9719	0.9959	0.9366

Note: Correlation coefficient between company *i*'s losses and the industry losses by year (1990–2023).

Table OA1.8: ($det\hat{\sigma}_i$) FTS Companies Sample 1
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1990	1,389	10,725.43	36,358.13	1.18	707,207.31	3.3899
1991	1,444	10,644.01	33,107.90	1.23	510,089.40	3.1105
1992	1,461	12,054.57	46,534.36	0.94	1,131,199.48	3.8603
1993	1,488	13,233.55	51,719.14	0.57	1,258,690.85	3.9082
1994	1,503	13,418.34	51,782.24	5.80	1,255,141.69	3.8591
1995	1,560	13,292.76	54,485.09	5.27	1,357,146.75	4.0989
1996	1,624	13,189.24	53,465.60	6.00	1,372,895.41	4.0537
1997	1,667	13,110.83	56,459.72	5.77	1,464,568.60	4.3063
1998	1,677	13,343.78	55,477.03	5.22	13,55,153.35	4.1575
1999	1,663	13,724.02	57,107.97	2.44	1,325,129.18	4.1612
2000	1,639	14,704.94	58,948.87	3.38	1,208,974.12	4.0088
2001	1,636	16,236.37	65,147.14	0.77	1,413,865.68	4.0124
2002	1,615	17,404.10	69,619.16	0.29	1,699,290.42	4.0002
2003	1,595	19,254.78	73,631.27	0.27	1,641,447.78	3.8241
2004	1,596	20,276.28	72,043.03	4.41	1,046,982.82	3.5531
2005	1,578	21,568.18	76,328.53	0.50	1,335,272.97	3.5389
2006	1,589	21,587.37	77,857.41	0.50	1,353,014.05	3.6066
2007	1,604	22,025.38	82,061.92	0.50	1,579,697.25	3.7258
2008	1,626	25,487.28	95,739.56	4.54	1,714,096.76	3.7564
2009	1,613	26,191.50	96,580.23	0.93	1,597,155.77	3.6875
2010	1,596	26,020.38	96,160.44	1.11	1,651,997.08	3.6956
2011	1,609	25,762.17	92,713.73	0.64	1,776,210.43	3.5988
2012	1,612	24,949.79	90,806.59	0.62	1,689,905.59	3.6396
2013	1,604	25,309.53	96,704.64	4.69	1,863,772.96	3.8209
2014	1,574	25,818.21	107,436.31	0.54	2,0408,39.11	4.1613
2015	1,632	24,632.51	97,704.53	0.81	1,878,516.44	3.9665
2016	1,609	23,644.81	99,665.42	0.47	2,089,036.67	4.2151
2017	1,591	24,386.03	98,191.02	0.30	1,948,005.82	4.0265
2018	1,548	25,392.86	91,481.23	0.31	1,606,395.66	3.6026
2019	1,531	26,424.46	93,703.10	0.32	1,345,644.65	3.5461
2020	1,509	28,043.87	106,060.33	0.32	1,974,576.45	3.7819
2021	1,505	28,772.89	116,452.86	0.41	2,828,092.78	4.0473
2022	1,471	31,187.38	147,716.55	0.42	4,104,962.44	4.7364
2023	1,445	36,948.32	200,851.66	0.73	5,775,088.33	5.4360

Note: Detrended standard deviation of losses for a company by year (1990–2023).

Table OA1.9: ($det\hat{\rho}_i$) FTS Companies Sample 1

Year	N	Mean	Std	Min	Max	CV
1990	1,389	0.2020	0.4308	-0.9210	0.9654	2.1327
1991	1,444	0.1696	0.3666	-0.9140	0.9497	2.1616
1992	1,461	0.1576	0.3550	-0.8516	0.8855	2.2525
1993	1,488	0.0822	0.4071	-0.8278	0.9336	4.9526
1994	1,503	0.1064	0.3829	-0.8121	0.8649	3.5987
1995	1,560	0.0785	0.4507	-0.9411	0.8798	5.7414
1996	1,624	0.1116	0.3703	-0.7928	0.8750	3.3181
1997	1,667	0.1257	0.2949	-0.8784	0.8786	2.3461
1998	1,677	0.1460	0.2634	-0.7633	0.8850	1.8041
1999	1,663	0.1169	0.2648	-0.8019	0.8629	2.2652
2000	1,639	0.1267	0.3323	-0.8331	0.8939	2.6227
2001	1,636	0.1898	0.4559	-0.8794	0.9336	2.4020
2002	1,615	0.1400	0.3675	-0.8739	0.9405	2.6250
2003	1,595	0.1084	0.3746	-0.8803	0.9450	3.4557
2004	1,596	0.0124	0.4518	-0.8877	0.9185	36.4355
2005	1,578	0.0545	0.4367	-0.9248	0.9380	8.0128
2006	1,589	0.0308	0.4824	-0.9093	0.9160	15.6623
2007	1,604	0.0891	0.4211	-0.9270	0.9461	4.7262
2008	1,626	0.1760	0.5158	-0.8990	0.9782	2.9307
2009	1,613	0.1781	0.4872	-0.8561	0.9492	2.7355
2010	1,596	0.1727	0.4424	-0.8937	0.9414	2.5617
2011	1,609	0.2120	0.3531	-0.8162	0.9433	1.6656
2012	1,612	0.1746	0.3142	-0.8069	0.8978	1.7995
2013	1,604	0.1481	0.3848	-0.8110	0.9172	2.5982
2014	1,574	0.1621	0.3728	-0.7425	0.8999	2.2998
2015	1,632	0.1571	0.4035	-0.8010	0.9262	2.5684
2016	1,609	0.1924	0.3552	-0.7835	0.9462	1.8462
2017	1,591	0.2791	0.4496	-0.8749	0.9703	1.6109
2018	1,548	0.2522	0.5055	-0.9404	0.9636	2.0044
2019	1,531	0.2670	0.5085	-0.9369	0.9790	1.9045
2020	1,509	0.2419	0.4857	-0.9657	0.9845	2.0079
2021	1,505	0.2062	0.3978	-0.8702	0.9471	1.9292
2022	1,471	0.3046	0.4499	-0.9198	0.9684	1.4770
2023	1,445	0.3648	0.5053	-0.9536	0.9793	1.3851

Note: Detrended correlation coefficient between company *i*'s losses and the industry losses by year (1990–2023).

Table OA1.10a: FTS Sample 1
Tobit censored (Lb=0) model
Standard deviations: Net losses incurred 1997

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.1490 7.69	-0.1919 -11.29	0.2099 4.57	0.1017 4.67
Ln (equity capital)	0.0231 10.19	0.0120 10.00	0.0403 7.34	0.0184 7.07
Ln (net losses incurred)	0.0039 2.16	0.0016 1.66	0.0016 0.35	0.0010 0.46
Short / Asset	0.0837 4.97	0.0431 4.83	0.1362 4.05	0.0649 4.07
Liquid asset / Asset	-0.0389 -1.79	-0.0237 -2.06	-0.0423 -0.81	-0.0242 -0.98
Sigma	0.0975 57.74	0.0515 57.73	0.1622 41.88	0.0769 41.88
Log likelihood	1,515	2,578	351	1,006
AIC	-3,019	-5,144	-690	-1,999
No. of observations	1,667	1,667	877	877

Note: Short = Cash + cash equivalent and short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.10b: FTS Sample 1
Tobit censored (Lb=0) model
Standard deviations: Net losses incurred 2005

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.1952 9.39	-0.3165 -14.58	0.3666 6.43	0.1891 6.39
Ln (equity capital)	0.0353 11.62	0.0194 12.22	0.0629 8.05	0.0334 8.26
Ln (net losses incurred)	0.0058 2.37	0.0016 1.27	0.0048 0.72	0.0005 0.14
Short / Asset	0.1117 5.28	0.0501 4.52	0.2186 4.35	0.1084 4.16
Liquid asset / Asset	-0.0401 -1.61	-0.0302 -2.31	-0.1309 -1.91	-0.0729 -2.05
Sigma	0.1270 56.17	0.0665 56.17	0.2356 41.30	0.1222 41.30
Log likelihood	1,017	2,038	23	583
AIC	-2,022	-4,065	-33	-1,153
No. of observations	1,578	1,578	853	853

Note: Short = Cash + cash equivalent and short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.10c: FTS Sample 1
Tobit censored (Lb=0) model
Standard deviations: Net losses incurred 2014

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.1687 8.32	-0.4161 -13.74	0.3041 5.66	0.1896 5.80
Ln (equity capital)	0.0318 10.03	0.0219 9.79	0.0558 6.89	0.0333 6.76
Ln (net losses incurred)	0.0081 2.99	0.0045 2.31	0.0087 1.17	0.0048 1.07
Short / Asset	0.1147 4.65	0.0745 4.27	0.2026 3.70	0.1115 3.35
Liquid asset / Asset	-0.0033 -0.95	-0.0140 -0.80	-0.0842 -1.29	-0.0584 -1.47
Sigma	0.1361 57.74	0.0962 56.10	0.2437 41.08	0.1484 41.08
Log likelihood	-1,800	1,451	-6	413
AIC	906	-2,890	24	-813
No. of observations	1,574	1,574	844	844

Note: Short = Cash + cash equivalent and short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.10d: FTS Sample 1
Tobit censored (Lb=0) model
Standard deviations: Net losses incurred 2020

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.2520 8.12	-0.4745 -15.72	0.4290 5.26	0.2014 7.49
Ln (equity capital)	0.0548 9.62	0.0286 11.95	0.1012 6.94	0.0439 9.14
Ln (net losses incurred)	0.0035 0.75	0.0005 0.24	-0.0015 -0.12	-0.0016 -0.40
Short / Asset	0.1366 3.61	0.0664 4.19	0.3182 3.47	0.1191 3.94
Liquid asset / Asset	-0.0729 -1.93	-0.0337 -2.13	-0.1428 -1.44	-0.0771 -2.36
Sigma	0.2187 54.93	0.0917 54.93	0.4068 41.01	0.1340 41.01
Log likelihood	152	1,465	-437	497
AIC	-293	-2,917	886	-981
No. of observations	1,509	1,509	841	841

Note: Short = Cash + cash equivalent and short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.10e: FTS Sample 1
Tobit censored (Lb=0) model
Standard deviations: Net losses incurred 2023

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.3153 6.46	-0.6132 -10.53	0.4290 5.26	0.2014 7.49
Ln (equity capital)	0.0655 6.95	0.0310 6.47	0.1012 6.94	0.0439 9.14
Ln (net losses incurred)	0.0221 2.79	0.0081 2.02	-0.0015 -0.12	-0.0016 -0.40
Short / Asset	0.1535 2.51	0.0732 2.35	0.3182 3.47	0.1191 3.94
Liquid asset / Asset	-0.0139 -0.23	-0.0097 -0.31	-0.1428 -1.44	-0.0771 -2.36
Sigma	0.3659 53.76	0.1861 53.76	0.4068 41.01	0.1340 41.01
Log likelihood	-597	380	-437	497
AIC	1,207	-747	886	-981
No. of observations	1,445	1,445	841	841

Note: Short = Cash + cash equivalent and short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.11a: FTS Sample 1
Tobit censored (Lb=-1 Ub=1) model
Correlation coefficient: Net losses incurred 1997

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.6155 4.74	-0.2556 -2.33	0.6311 3.95	0.2908 2.85
Ln (equity capital)	-0.1854 -13.14	0.0190 2.48	-0.1413 -7.83	0.0136 1.18
Ln (net losses incurred)	0.2038 15.94	-0.0043 -0.63	0.1747 10.61	0.0057 0.54
Short / Asset	-0.2251 -2.42	-0.1419 -2.81	-0.2748 -2.83	-0.1130 -1.82
Total liability / Asset	-0.4826 -5.45	0.0834 -1.76	-0.3800 -3.53	-0.0273 -1.83
Liquid asset / Asset	0.4003 3.31	0.0761 1.16	0.4446 2.93	-0.0809 -0.83
Sigma	0.5370 57.74	0.2909 57.74	0.4651 41.88	0.2976 41.78
Log likelihood	-1,329	-307	-573	-181
AIC	2,672	628	1,160	376
No. of observations	1,667	1,667	877	877

Note: Short = Cash + cash equivalent and short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.11b: FTS Sample 1
Tobit censored (Lb=-1 Ub=1) model
Correlation coefficient: Net losses incurred 2005

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.6000 5.61	-0.8631 -5.11	0.5953 4.18	0.1979 1.41
Ln (equity capital)	-0.1516 -12.32	0.0446 3.83	-0.1308 -8.24	0.0426 2.72
Ln (net losses incurred)	0.1982 17.61	-0.0054 -0.51	0.1689 11.22	-0.0206 -0.80
Short / Asset	-0.0315 -0.42	-0.0528 -0.74	-0.1854 -2.08	0.0206 0.23
Total liability / Asset	-0.1839 -2.15	0.1523 1.88	-0.1963 -1.79	0.0301 0.28
Liquid asset / Asset	0.3515 3.84	0.1314 1.52	0.3753 3.00	-0.1618 -1.31
Sigma	0.4529 57.74	0.4283 56.18	0.4168 41.30	0.4101 41.30
Log likelihood	-989	-901	-464	-542
AIC	1,992	1,816	942	917
No. of observations	1,578	1,578	853	853

Note: Short = Cash + cash equivalent and short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.11c: FTS Sample 1
Tobit censored (Lb=-1 Ub=1) model
Correlation coefficient: Net losses incurred 2014

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.7600 6.66	-0.3682 -2.53	0.8444 5.30	0.5688 4.62
Ln (equity capital)	-0.0953 -7.78	0.0301 3.11	-0.0875 -4.96	0.0108 0.79
Ln (net losses incurred)	0.1344 11.59	0.0074 0.81	0.1314 7.60	0.0292 2.19
Short / Asset	-0.4214 -5.07	-0.1676 -2.55	-0.3617 -3.60	-0.0359 -0.46
Total liability / Asset	-0.1707 -1.82	0.0085 0.12	-0.3479 -2.68	-0.1818 -1.81
Liquid asset / Asset	0.0359 0.39	-0.0816 -1.13	0.0416 0.32	-0.1818 -1.81
Sigma	0.4587 56.11	0.3621 56.11	0.4462 41.08	0.3444 41.08
Log likelihood	-1,007	-635	-516	-298
AIC	2,027	1,283	1,047	610
No. of observations	1,574	1,574	844	844

Note: Short = Cash + cash equivalent and short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.11d: FTS Sample 1
Tobit censored (Lb=-1 Ub=1) model
Correlation coefficient: Net losses incurred 2020

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.8806 7.36	-0.2092 -1.04	0.9784 6.06	0.5976 4.14
Ln (equity capital)	-0.0933 -6.18	-0.0160 -1.12	-0.1059 -5.21	-0.0258 -1.42
Ln (net losses incurred)	0.14.91 10.85	0.0670 5.19	0.1676 8.99	0.0840 5.04
Short / Asset	0.0093 0.11	-0.1831 -2.28	-0.0451 -0.40	-0.0054 -0.05
Total liability / Asset	-0.0757 -0.75	-0.0529 -0.56	-0.3499 -2.64	-0.4080 -3.45
Liquid asset / Asset	-0.0941 -1.00	0.1362 1.55	-0.0165 -0.13	0.0387 0.33
Sigma	0.4942 54.92	0.4649 54.92	0.4936 41.01	0.4413 41.01
Log likelihood	-1,077	-984	-600	-505
AIC	2,168	1,983	1,213	1,025
No. of observations	1,508	1,508	841	841

Note: Short = Cash + cash equivalent and short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.11e: FTS Sample 1
Tobit censored (Lb=-1 Ub=1) model
Correlation coefficient: Net losses incurred 2023

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	1.1820 11.12	1.4122 6.81	0.9784 6.06	0.5976 4.14
Ln (equity capital)	-0.1362 -9.81	-0.1173 -7.89	-0.1059 -5.21	-0.0258 -1.42
Ln (net losses incurred)	0.2054 16.03	0.1553 11.31	0.1676 8.99	0.0840 5.04
Short / Asset	-0.2226 -3.02	-0.2702 -3.42	-0.0451 -0.40	-0.0054 -0.05
Total liability / Asset	-0.4416 -4.72	-0.6535 -6.51	-0.3499 -2.64	-0.4080 -3.45
Liquid asset / Asset	0.0042 0.05	-0.1612 -1.85	-0.0165 -0.13	0.0387 0.33
Sigma	0.4407 53.76	0.4720 53.76	0.4936 41.01	0.4413 41.01
Log likelihood	-866	-966	-600	-505
AIC	1,746	1,945	1,213	1,025
No. of observations	1,445	1,445	841	841

Note: Short = Cash + cash equivalent and short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA1.12: ($\hat{\sigma}_i$) NFTS company Sample 1
Raw parameter estimates
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1990	2,214	38,262.78	122,647.24	1.9002924	4,117,902.16	3.2054
1991	2,241	37,257.02	124,521.22	1.5238839	4,175,781.98	3.3422
1992	2,255	38,491.61	133,002.82	1.3165612	4,184,769.02	3.4554
1993	2,252	36,727.27	127,275.28	0.6992059	4,04,7432.60	3.4654
1994	2,267	36,419.91	126,388.33	6.1110101	4,16,0714.72	3.4703
1995	2,280	34,511.77	119,377.04	5.8585171	4,038,217.10	3.4590
1996	2,285	31,921.98	107,770.91	7.0364132	3,53,1777.62	3.3761
1997	2,286	29,353.53	92,700.48	6.2618776	2,859,433.91	3.1581
1998	2,277	27,553.65	82,005.49	6.0745370	2,403,336.98	2.9762
1999	2,213	27,112.82	79,766.38	2.5298221	2,056,463.79	2.9420
2000	2,165	28,947.64	85,853.00	3.5213634	2,142,909.44	2.9658
2001	2,137	31,521.77	97,563.02	0.9660918	2,408,613.36	3.0951
2002	2,103	34,955.22	107,517.57	0.3162278	2,825,926.51	3.0759
2003	2,101	36,983.62	111,073.02	0.3162278	2,826,442.64	3.0033
2004	2,143	39,145.19	114,745.54	5.0782762	2,847,132.67	2.9313
2005	2,152	42,452.05	126,396.80	0.6749486	3,301,741.99	2.9774
2006	2,193	41,618.41	120,717.28	0.6749486	2,822,807.25	2.9006
2007	2,223	41,733.10	119,734.33	0.6749486	2,595,686.90	2.8690
2008	2,246	46,170.06	131,774.17	5.9451194	2,339,542.42	2.8541
2009	2,207	46,099.45	130,553.41	1.0327956	1,957,636.38	2.8320
2010	2,163	43,566.03	125,713.44	1.1595018	2,006,493.32	2.8856
2011	2,119	44,877.34	134,718.38	0.6749486	2,483,517.16	3.0019
2012	2,069	43,282.95	131,184.67	0.6749486	2,369,475.80	3.0309
2013	2,016	41,625.23	126,549.29	5.3343749	2,261,733.09	3.0402
2014	1,923	41,562.38	140,125.61	0.5676462	3,419,126.79	3.3715
2015	1,953	42,465.51	159,136.71	0.9486833	4,486,420.20	3.7474
2016	1,911	45,077.36	185,334.98	0.4714045	5,194,632.04	4.1115
2017	1,864	49,273.18	210,090.70	0.3162278	6,170,229.88	4.2638
2018	1,825	55,019.29	223,799.95	0.3162278	6,760,598.56	4.0677
2019	1,805	56,922.55	230,947.71	0.3162278	7,041,168.30	4.0572
2020	1,787	58,114.23	224,898.94	0.3162278	6,800,905.57	3.8699
2021	1,787	63,838.10	245,847.61	0.4216370	6,897,245.95	3.8511
2022	1,778	76,097.31	293,019.15	0.4216370	6,903,820.34	3.8506
2023	1,753	90,073.64	367,808.83	0.8164966	8,539,414.34	4.0834

Note: Standard deviation of the net losses and loss expense incurred for a company by year (1990–2023). NFTS: Non-full-time sample.

Table OA1.13: ($\hat{\rho}_i$) NFTS company Sample 1
Raw parameter estimates

Year	N	Mean	Std	Min	Max	CV
1990	2,214	0.5441727	0.4222848	-0.9137534	0.9967239	0.7760
1991	2,241	0.5353007	0.4349050	-0.9280519	0.9969796	0.8124
1992	2,255	0.5205230	0.4366218	-0.9384972	0.9974125	0.8388
1993	2,252	0.4966674	0.4463094	-0.9815604	0.9937107	0.8986
1994	2,267	0.4837493	0.4634369	-0.9721156	0.9920304	0.9580
1995	2,280	0.4852563	0.4711936	-0.9712140	0.9908177	0.9710
1996	2,285	0.4709582	0.4835533	-0.9302615	0.9933658	1.0267
1997	2,286	0.4376478	0.5104966	-0.9579326	0.9890006	1.1665
1998	2,277	0.4190612	0.5216771	-0.9717621	0.9836439	1.2449
1999	2,213	0.4104522	0.5242314	-0.9523313	0.9822703	1.2772
2000	2,165	0.4102226	0.5215430	-0.9398921	0.9909369	1.2714
2001	2,137	0.4362449	0.5007022	-0.9416348	0.9929707	1.1478
2002	2,103	0.4435981	0.4977894	-0.9536398	0.9975875	1.1222
2003	2,101	0.4445977	0.4899440	-0.9698603	0.9924989	1.1020
2004	2,143	0.4492404	0.4715302	-0.9564016	0.9900277	1.0496
2005	2,152	0.4399406	0.4610354	-0.9446858	0.9922169	1.0479
2006	2,193	0.4106590	0.4573220	-0.9099513	0.9829975	1.1136
2007	2,223	0.3894431	0.4553844	-0.9245297	0.9764916	1.1693
2008	2,246	0.3829737	0.4406763	-0.8968988	0.9772564	1.1507
2009	2,207	0.3537403	0.4626468	-0.8785671	0.9756570	1.3079
2010	2,163	0.3621326	0.4715820	-0.9556466	0.9764595	1.3022
2011	2,119	0.3962341	0.4936443	-0.9363437	0.9894695	1.2458
2012	2,069	0.4008681	0.5007567	-0.9605558	0.9839189	1.2492
2013	2,016	0.3697069	0.4919099	-0.9172777	0.9676735	1.3305
2014	1,923	0.3847622	0.4591986	-0.8938171	0.9644265	1.1935
2015	1,953	0.3804337	0.4602265	-0.8991615	0.9740115	1.2097
2016	1,911	0.3723453	0.4663885	-0.9023961	0.9801297	1.2526
2017	1,864	0.4150154	0.4806087	-0.9589268	0.9812657	1.1581
2018	1,825	0.4542618	0.4896486	-0.9775956	0.9831742	1.0779
2019	1,805	0.4627841	0.4933521	-0.9830116	0.9925968	1.0661
2020	1,787	0.4487483	0.5038403	-0.9929358	0.9920923	1.1228
2021	1,787	0.4667867	0.5044336	-0.9568684	0.9971721	1.0807
2022	1,778	0.4953330	0.4952886	-0.9375136	0.9953992	0.9999
2023	1,753	0.5188955	0.4828914	-0.9719031	0.9958836	0.9306

Note: Correlation coefficient between company *i*'s losses and the industry losses by year (1990–2023). NFTS: Non-full-time sample.

Table OA1.14: ($det\hat{\sigma}_i$) NFTS company Sample 1
Detrended parameter estimates
($000 omitted)

Year	N	Mean	Std	Max	CV
1990	2,214	6,728.83	29,257.70	707,207.31	4.3481
1991	2,241	6,858.52	27,057.34	510,089.40	3.9451
1992	2,255	7,810.08	37,892.02	1,131,199.48	4.8517
1993	2,252	8,744.02	42,500.36	1,258,690.85	4.8605
1994	2,267	8,896.24	42,633.23	1,255,141.69	4.7923
1995	2,280	9,095.05	45,485.69	1,357,146.75	5.0011
1996	2,285	9,373.88	45,465.02	1,372,895.41	4.8502
1997	2,286	9,560.70	48,560.46	1,464,568.60	5.0792
1998	2,277	9,826.42	47,968.19	1,355,153.35	4.8816
1999	2,213	10,313.17	49,855.85	1,325,129.18	4.8342
2000	2,165	11,132.28	51,673.05	1,208,974.12	4.6417
2001	2,137	12,429.90	57,410.96	1,413,865.68	4.6188
2002	2,103	13,365.49	61,445.85	1,699,290.42	4.5974
2003	2,101	14,617.50	64,676.44	1,641,447.78	4.4246
2004	2,143	15,100.77	62,793.10	1,046,982.82	4.1583
2005	2,152	15,815.33	66,048.27	1,335,272.97	4.1762
2006	2,193	15,641.74	66,966.50	1,353,014.05	4.2813
2007	2,223	15,892.36	70,396.61	1,579,697.25	4.4296
2008	2,246	18,451.61	82,246.92	1,714,096.76	4.4574
2009	2,207	19,142.22	83,373.26	1,597,155.77	4.3555
2010	2,163	19,199.50	83,383.46	1,651,997.08	4.3430
2011	2,119	19,561.74	81,531.38	1,776,210.43	4.1679
2012	2,069	19,438.89	80,813.34	1,689,905.59	4.1573
2013	2,016	20,137.15	86,855.45	1,863,772.96	4.3132
2014	1,923	21,132.54	97,702.17	2,040,839.11	4.6233
2015	1,953	20,583.85	89,775.93	1,878,516.44	4.3615
2016	1,911	19,908.16	91,853.33	2,089,036.67	4.6139
2017	1,864	20,814.47	91,120.88	1,948,005.82	4.3778
2018	1,825	21,538.71	84,740.50	1,606,395.66	3.9343
2019	1,805	22,413.21	86,813.81	1,345,644.65	3.8733
2020	1,787	23,681.14	97,985.88	1,974,576.45	4.1377
2021	1,787	24,232.34	107,378.33	2,828,092.78	4.4312
2022	1,778	25,802.40	134,868.38	4,104,962.44	5.2270
2023	1,753	30,456.82	182,885.82	5,775,088.33	6.0048

Note: Standard deviation of the net losses and loss expense incurred for a company by year (1990–2023). NFTS: Non-full-time sample.

Table OA1.15: ($det\ \hat{\rho}_i$) NFTS company Sample 1
detrended parameter estimates

Year	N	Mean	Std	Min	Max	CV
1990	2,214	0.2781808	0.3592429	-0.9209922	0.9653702	1.2914
1991	2,241	0.1264858	0.3000271	-0.9140278	0.9497207	2.3720
1992	2,255	0.1139938	0.2917959	-0.8516414	0.8854926	2.5598
1993	2,252	0.0569551	0.3327689	-0.8277511	0.9336180	5.8427
1994	2,267	0.0750903	0.3148311	-0.8121191	0.8648718	4.1927
1995	2,280	0.0637089	0.3734274	-0.9410842	0.8797552	5.8615
1996	2,285	0.0860960	0.3146927	-0.7928493	0.8750357	3.6551
1997	2,286	0.1004699	0.2552813	-0.8783818	0.8785840	2.5409
1998	2,277	0.1172023	0.2312362	-0.7632664	0.8850160	1.9730
1999	2,213	0.0937146	0.2331614	-0.8018692	0.8629390	2.4880
2000	2,165	0.1157753	0.2900869	-0.8331105	0.8938851	2.5056
2001	2,137	0.1858119	0.4000348	-0.8794337	0.9335801	2.1529
2002	2,103	0.1446309	0.3227987	-0.8738738	0.9405484	2.2319
2003	2,101	0.0915308	0.3277983	-0.8802984	0.9450020	3.5813
2004	2,143	0.0109722	0.3898800	-0.8876626	0.9185149	35.5334
2005	2,152	0.0409253	0.3745939	-0.9247678	0.9380241	9.1531
2006	2,193	0.0240918	0.4107498	-0.9092729	0.9159738	17.0494
2007	2,223	0.0671553	0.3594331	-0.9269736	0.9461053	5.3523
2008	2,246	0.1383559	0.4431221	-0.8989508	0.9782475	3.2028
2009	2,207	0.1357633	0.4223417	-0.8560899	0.9491884	3.1109
2010	2,163	0.1280531	0.3872975	-0.8937372	0.9414009	3.0245
2011	2,119	0.1631250	0.3197033	-0.8161589	0.9433125	1.9599
2012	2,069	0.1368132	0.2863053	-0.8069051	0.8977753	2.0927
2013	2,016	0.1194555	0.3478439	-0.8110476	0.9172229	2.9119
2014	1,923	0.1337121	0.3425770	-0.7424994	0.8999028	2.5620
2015	1,953	0.1344723	0.3723624	-0.8009574	0.9262495	2.7691
2016	1,911	0.1628272	0.3329922	-0.7835434	0.9462250	2.0451
2017	1,864	0.2407150	0.4255881	-0.8749021	0.9703195	1.7680
2018	1,825	0.2176152	0.4727134	-0.9403670	0.9635569	2.1722
2019	1,805	0.2322394	0.4755866	-0.9369384	0.9789978	2.0478
2020	1,787	0.2092650	0.4528360	-0.9657171	0.9845398	2.1639
2021	1,787	0.1773083	0.3711923	-0.8701800	0.9471216	2.0935
2022	1,778	0.2875797	0.4127498	-0.9198410	0.9683838	1.4353
2023	1,753	0.3875861	0.4675672	-0.9536465	0.9793043	1.2064

Note: Correlation coefficient between company *i*'s losses and the industry losses by year (1990–2023). NFTS: Non-full-time sample.

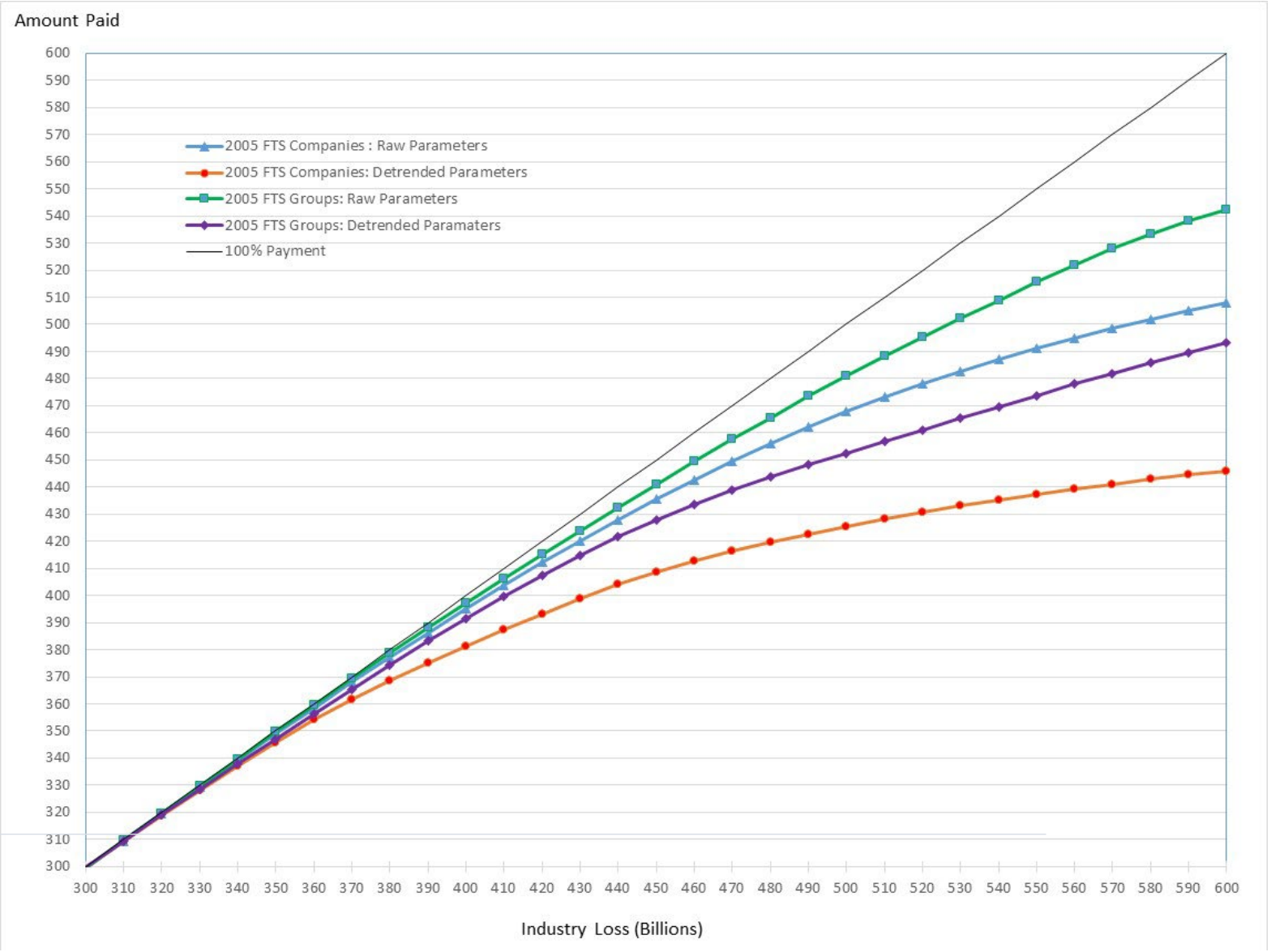

Figure OA1.1: Industry capacity, 2005 (FTS sample 1)

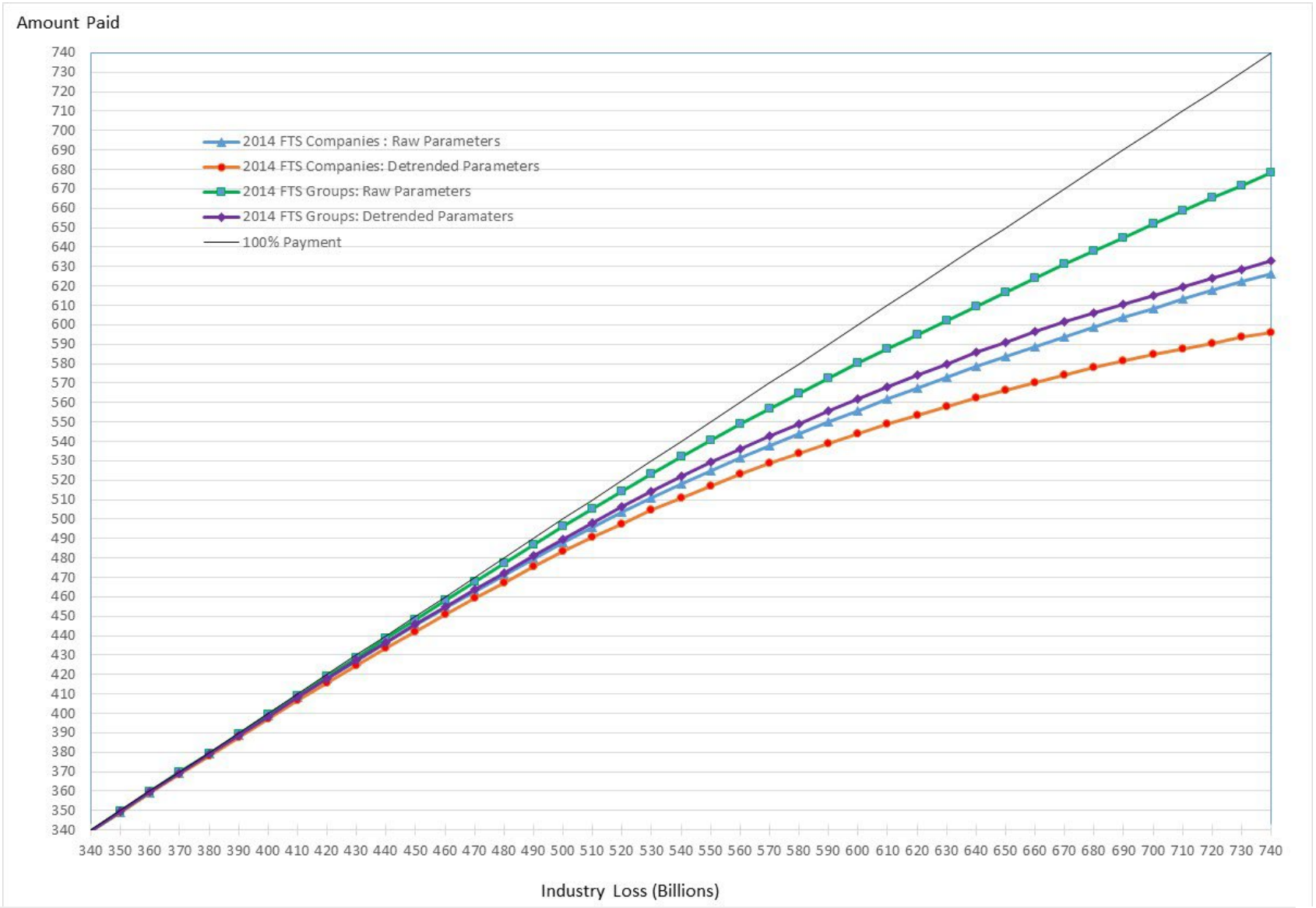

Figure OA1.2: Industry capacity, 2014 (FTS sample 1)

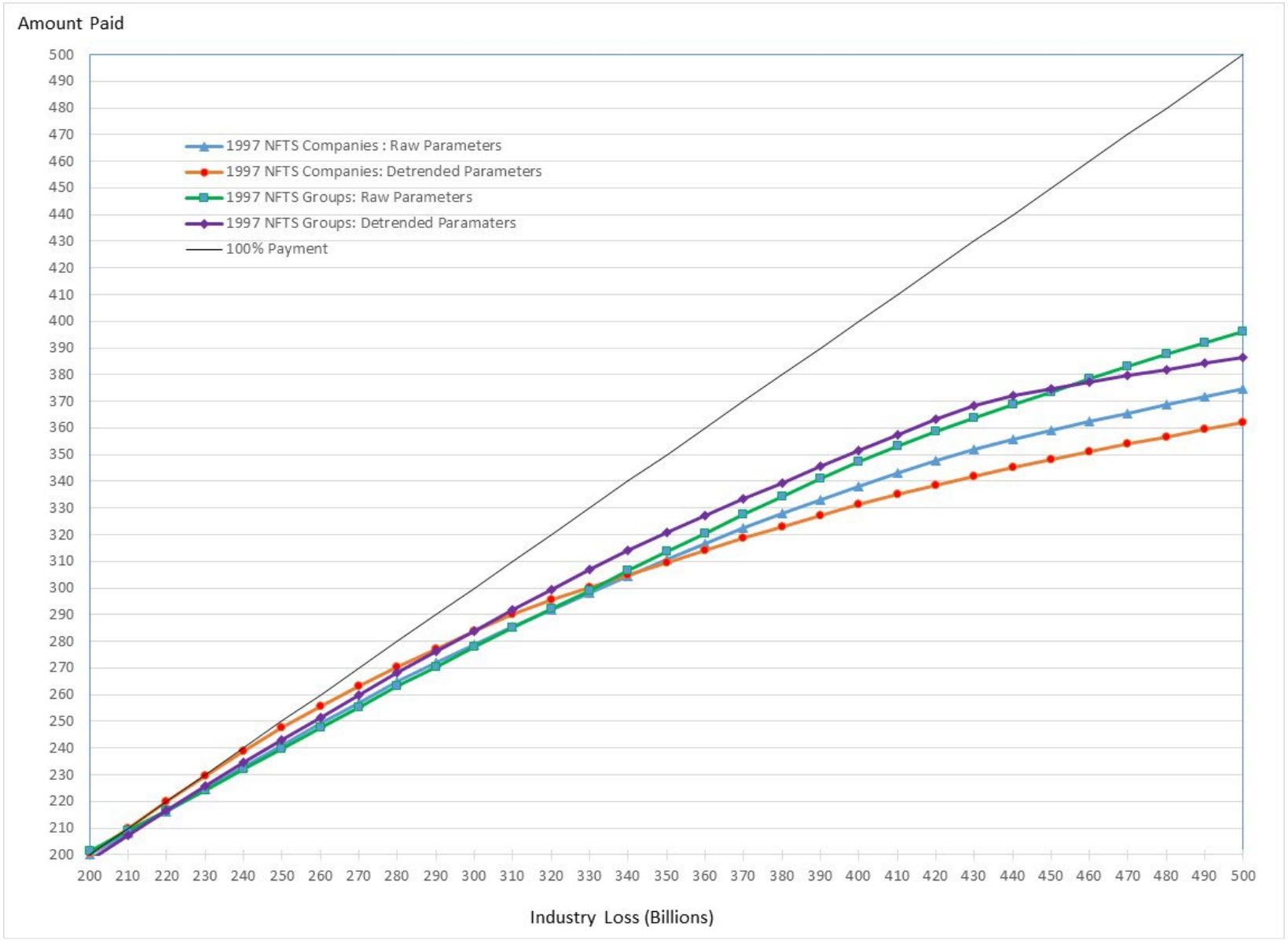

Figure OA1.3: Industry capacity, 1997 (NFTS sample 1)

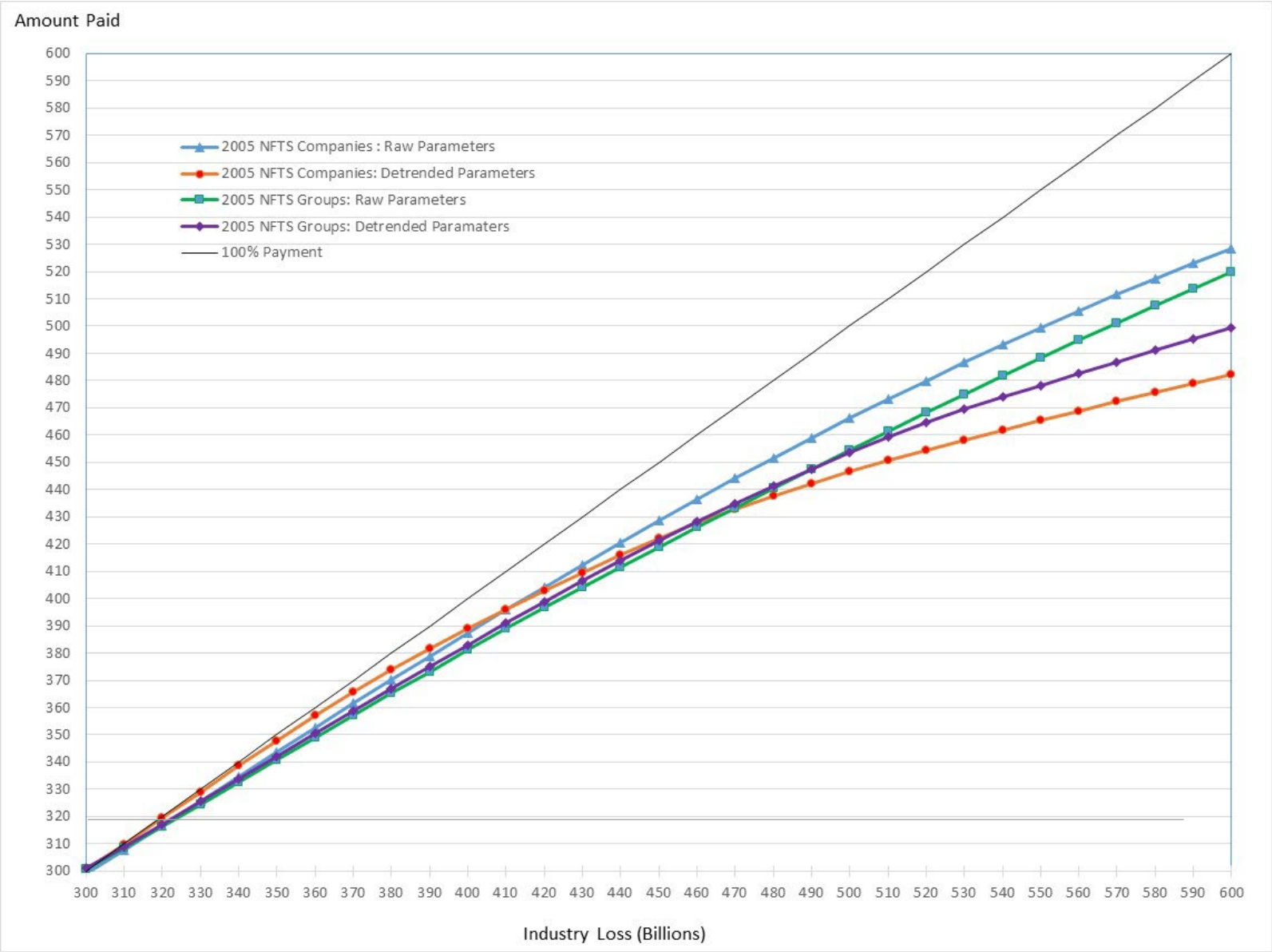

Figure OA1.4: Industry capacity, 2005 (NFTS sample 1)

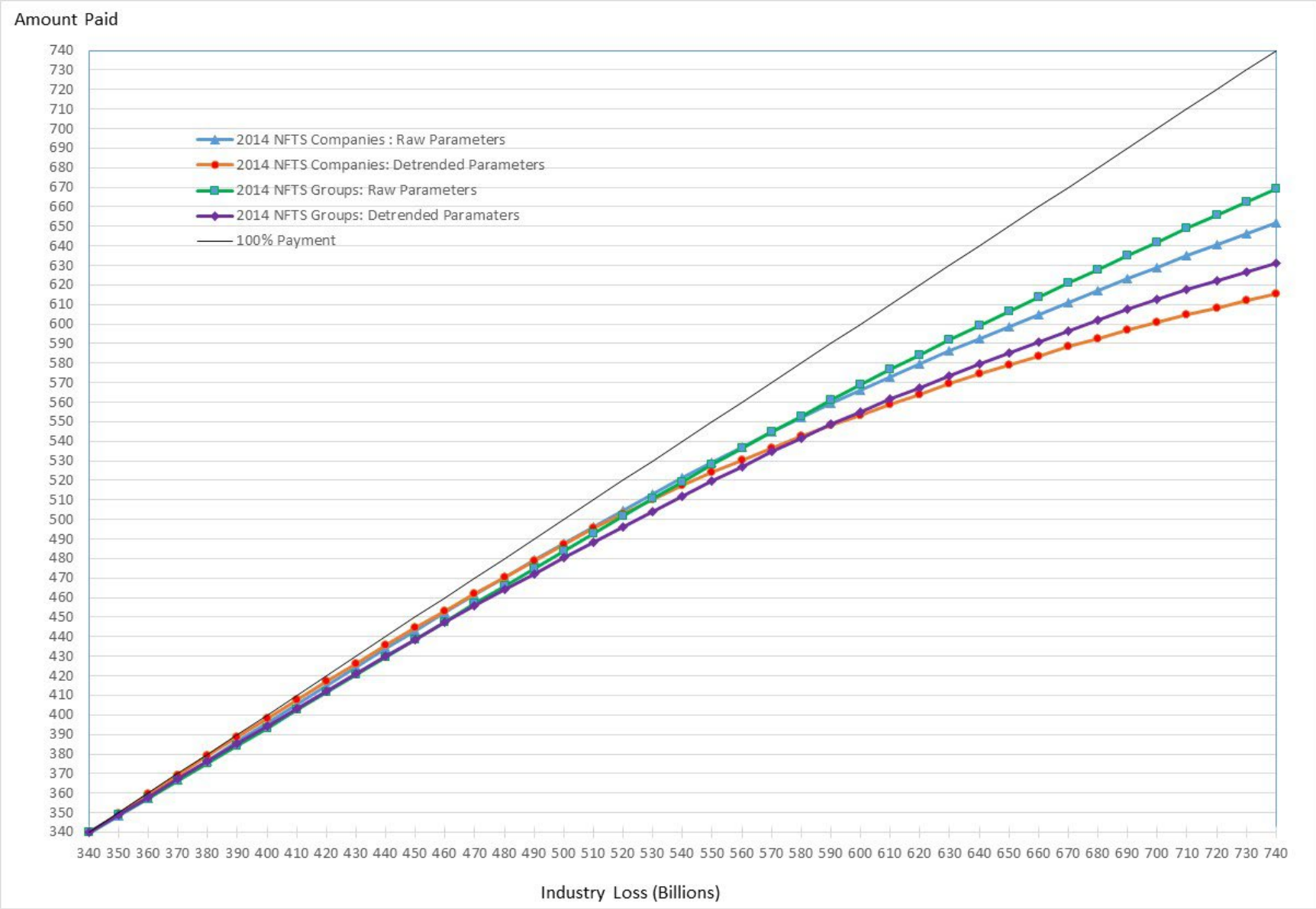

Figure OA1.5: Industry capacity, 2014 (NFTS sample 1)

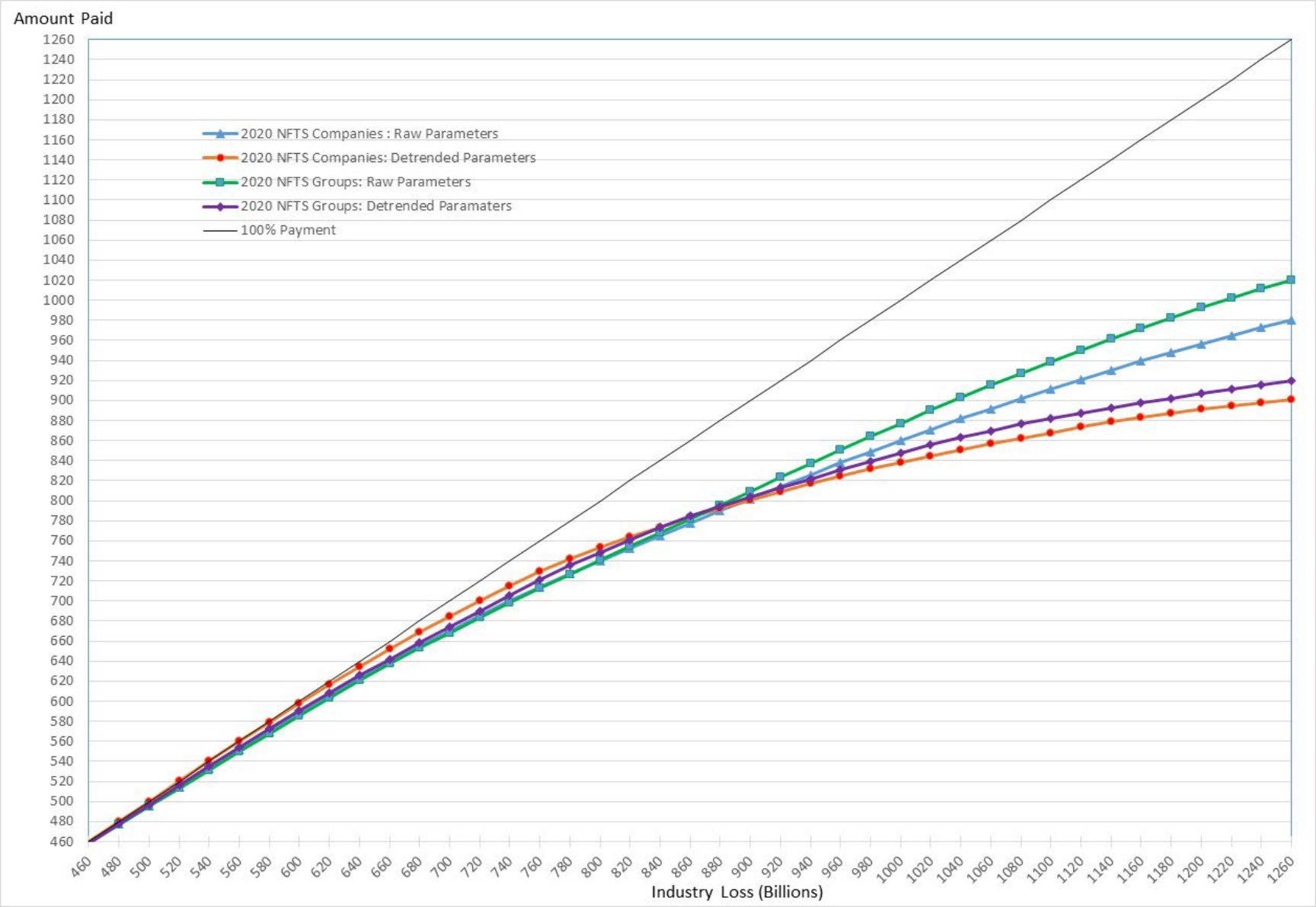

Figure OA1.6: Industry capacity, 2020 (NFTS sample 1)

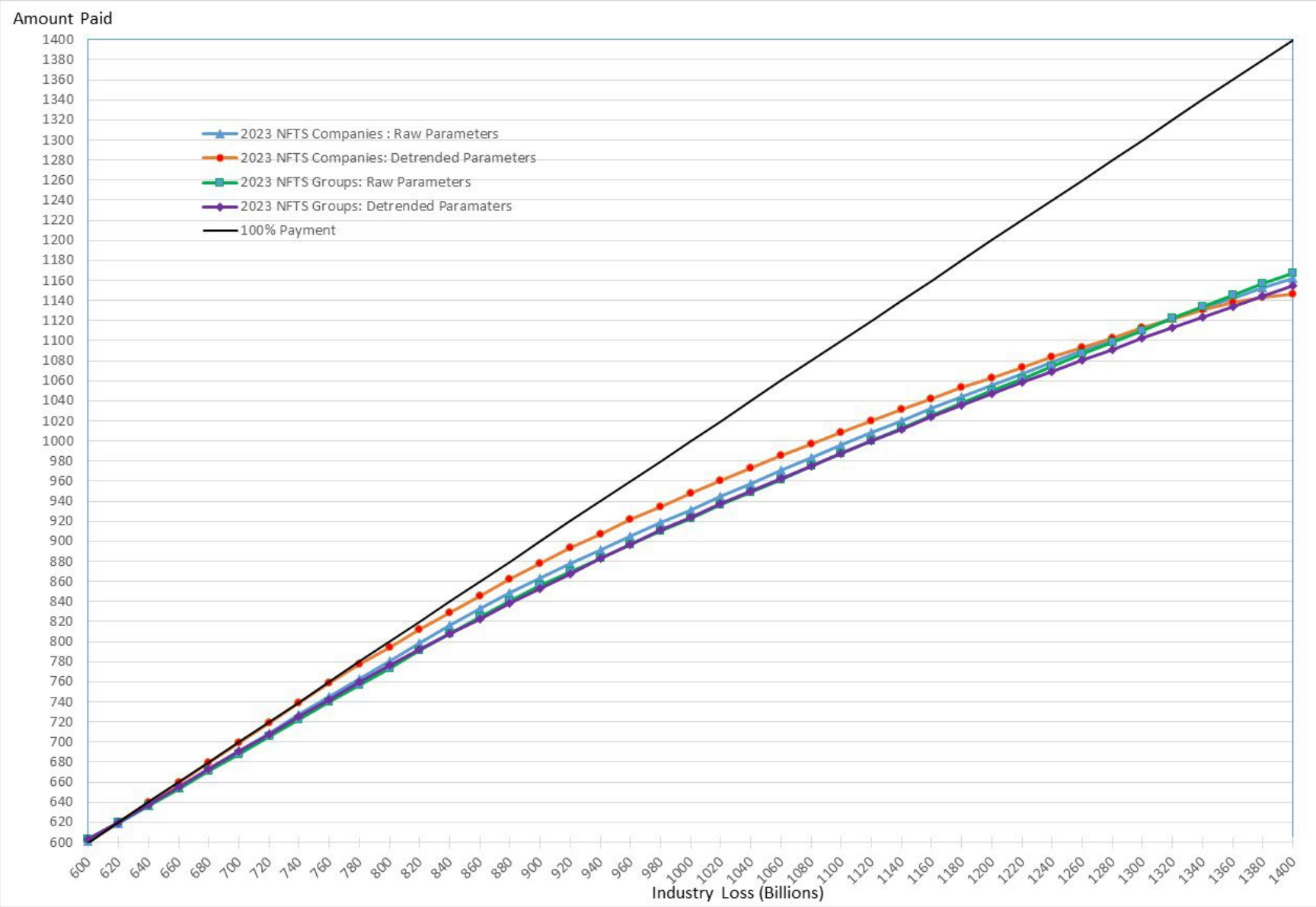

Figure OA1.7: Industry capacity, 2023 (NFTS sample 1)

Online appendix OA2 – Sample 2

Table OA2.1 report net losses and equity capital for FTS Sample 2 for different years for all companies and groups and unaffiliated companies.

In 2005, FTS Sample 2 included 46 more companies than Sample 1 (Table 2). This difference is 31 companies in 2014, 61 in 2020, and 82 in 2023. Similarly, for group and unaffiliated companies, the increases compared to Sample 1 were 13 in 2005, 23 in 2014, 36 in 2020, and 45 in 2023. These findings show that the gap between Sample 2 and Sample 1 steadily widens over time.

Table OA2.1: FTS Sample 2
Summary statistics: Losses and equity capital
($000 omitted)

	Insurance industry FTS		Number of firms
Sample	Net losses incurred	Equity capital	
2005			
Groups & unaffiliated companies	301,056,222	500,640,175	866
All companies	301,056,222	500,640,175	1,624
2014			
Groups & unaffiliated companies	341,865,660	782,443,692	867
All companies	341,865,660	782,443,692	1,605
2020			
Groups & unaffiliated companies	455,145,860	1,087,840,856	877
All companies	455,145,860	1,087,840,856	1,570
2023			
Groups & unaffiliated companies	627,585,187	1,213,561,248	848
All companies	627,585,187	1,213,561,248	1,527

To estimate the industry observed response function, we need, for each company *i*, to calculate the standard deviation of the net losses ($\hat{\sigma}_i$) and the correlation coefficient between company *i*'s losses and the industry losses ($\hat{\rho}_i$). In Table OA2.2, on average, the detrended standard deviation is higher in 2014 than in 2005 and is higher in 2020 than in 2014, regardless of the sample. This is not the same pattern for the detrended correlation coefficient. It is lower in 2014 than in 2005 and 2020 for Sample 2.

By inserting the financial characteristics of the NFTS firms into the estimated equations, we obtain fitted parameters of the standard deviation and correlation coefficient. We use these values for companies not in the FTS sample, called the NFTS estimates. On average, the detrented standard deviation are lowest than those from FTS sample, as so for Sample 1 and Sample 2.

The average value of the raw and detrended parameter estimates for all companies and groups and unaffiliated companies are presented in Table OA2.2 for FTS and NFTS data in Sample 2. The detrended standard deviations and correlations are higher in 2023.

As expected, detrending reduces the magnitudes of loss standard deviations and the correlations between companies and industry losses. Because detrending leads to larger reductions in correlations than the standard deviations, we expect the estimated loss payments to be lower for the detrended parameter estimates than for the raw estimates. The standard deviation estimates tend to be larger for the companies' sample than for groups sample.

Table OA2.2: Detrended and raw parameter estimates:
Property-liability insurance industry with values from Sample 2

	Average				
Case	Detrended sigma × 10^8	Detrended correlation	Raw Sigma × 10^8	Raw Correlation	Number of firms
2005					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.2928	0.2042	0.6211	0.4954	866
All companies	0.2136	0.1894	0.4092	0.4349	1,624
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.3290	0.2168	0.7048	0.4812	1,201
All companies	0.1612	0.1735	0.4309	0.4334	2,152
2014					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.3717	0.1097	0.5793	0.2760	867
All companies	0.2767	0.1240	0.4004	0.2587	1,605
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.3986	0.1157	0.6318	0.2787	1,064
All companies	0.2309	0.1042	0.4230	0.2651	1,923
2020					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.4015	0.1554	0.8217	0.3483	877
All companies	0.3005	0.1941	0.5470	0.3680	1,570

Insurance industry (NFTS)					
Groups & unaffiliated companies	0.4208	0.1635	0.8973	0.3496	992
All companies	0.2640	0.1734	0.5927	0.3675	1,787
2023					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.5431	0.2779	1.3318	0.4356	848
All companies	0.3709	0.2928	0.7979	0.4709	1,527
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.6135	0.2756	1.5164	0.4258	986
All companies	0.3231	0.3042	0.8580	0.4601	1,753

Note: FTS: Full-time samples. NFTS: Non-full-time sample.

The response functions are calculated for various values of *L*, the total industry net loss. The response functions for the insurance industry Sample 2 are shown in figures OA2.1 to OA2.4 respectively for 2005, 2014, 2020 and 2023. This sample is composed of firms that have FTS. The horizontal axis measures possible values for aggregate insurance industry net losses. The vertical axis measures the expected payout of all firms considered.

The figures show the estimated amounts that would be paid for the industry losses, spanning from the actual expected losses adding unexpected losses for a given year: spanning from $300 billion to $600 billion in 2005; from $340 billion to $740 billion in 2014; from $460 billion to $1,260 billion in 2020 and from $660 billion to $1,460 billion in 2023. These limits were chosen for total losses and loss expenses for the US property-liability insurance industry and the total equity capital. Four response curves are shown in the figures based on raw and detrended parameters for group and company sample. Our main interpretation will be for detrended parameters for all companies.

Figure OA2.1 shows that in 2005, the response curve based on detrended FTS data from Sample 2 begins to diverge from the 45° line at approximately $350 billion. In 2020, the divergence point shifts to around $620 billion—the same level observed in Sample 1. By 2023, the response curve begins to diverge at approximately $800 billion.

The corresponding figures for realized capacity are reported in Table OA2.3. Realized capacity is calculated as the ratio, at a given loss level, of the value of the response curve E(L)ZE(L)ZE(L)Z to that of the maximum capacity curve E(L)CE(L)CE(L)C. In 2005, companies in FTS Sample 2

were able to cover 96.5% of a $100 billion loss, but only 86.0% of a $200 billion loss. By 2020, the realized capacity increased to 99.4% for a $100 billion loss and further to 99.5% in 2023.

Regarding larger loss scenarios, the industry appears capable of covering 85.8% (86.3% for NFTS) of a $400 billion loss in 2020, and 86.6% (86.7% for NFTS) of a $500 billion loss in 2023.

Table OA2.3: Capacity from Sample 2 with detrented values

	%			
2005	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	99.5	96.9	91.3	84.9
All companies	96.5	86.0	73.2	62.4
Insurance industry (NFTS)				
Groups & unaffiliated companies	94.8	89.9	84.0	77.4
All companies	97.2	87.7	74.9	64.0
	%			
2014	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	99.4	97.5	93.3	88.5
All companies	99.6	92.3	84.8	77.3
Insurance industry (NFTS)				
Groups & unaffiliated companies	97.5	94.4	90.4	84.9
All companies	97.9	92.9	85.5	78.1

	%					
2020	100 billion	200 billion	300 billion	400 billion	500 billion	600 billion
Insurance industry (FTS)						
Groups & unaffiliated companies	99.9	98.9	96.3	93.5	90.5	86.9
All companies	99.4	97.3	92.3	85.8	79.4	73.0
Insurance industry (NFTS)						
Groups & unaffiliated companies	98.8	97.4	94.8	90.9	86.2	81.4
All companies	99.4	97.5	92.8	86.3	79.9	73.5
	%					
2023	100 billion	200 billion	300 billion	400 billion	500 billion	600 billion
Insurance industry (FTS)						
Groups & unaffiliated companies	99.7	98.0	95.6	92.8	89.8	86.7
All companies	99.5	97.3	94.1	90.5	86.6	82.8
Insurance industry (NFTS)						
Groups & unaffiliated companies	98.2	96.1	93.5	90.4	87.4	83.1
All companies	99.6	97.4	94.4	90.8	86.7	89.4

Tables OA2.4 and OA2.5 present the summary statistics for net losses and equity capital,

respectively, over the entire period. Both tables show a marked decline in the number of reporting companies after 2015. Additionally, the mean value of net losses generally increases over time, although with some exceptions.

From 1999 to 2023, the coefficient of variation (CV) for net losses and loss adjustment expenses fluctuates between a low of 4.84 in 2020 and a high of 5.80 in 2016. Other notable CV values include 5.06 in 2008, 5.10 in 2021, 5.14 in 2019, and 5.16 in 2007. Elevated variability is also observed in 2002 (5.78), 2000 (5.73), and 2023 (5.50), suggesting ongoing exposure to volatile or extreme loss events.

In comparison, the CV of equity capital remains relatively stable in earlier years but increases notably in more recent years. From 1999 to 2015, the CV of equity capital remains below 7.0, with the exception of 2013 (7.18). However, from 2016 to 2018, the CV rises to 7.17, 7.85, and 7.77, respectively, and continues to increase between 2019 and 2023, ranging from 8.53 in 2019 to a peak of 9.36 in 2021. In 2023, the CV of capital stands at 8.95.

This comparison suggests that while net losses have become more variable over time, especially since the mid-2000s, the variability of equity capital has also risen—particularly in the post-2015 period—potentially reflecting growing capital management challenges and heightened sensitivity to financial shocks within the industry.

Table OA2.4: FTS Sample 2
Summary statistics: Net losses and loss expense incurred by year (1999–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Max	CV
1999	1,544	212,438,498	137,590	757,791	21,203,854	5.5076
2000	1,587	225,907,905	142,349	815,376	23,335,985	5.7280
2001	1,607	253,852,110	157,966	884,635	25,798,108	5.6002
2002	1,597	251,871,393	157,715	912,182	27,672,128	5.7837
2003	1,590	263,898,977	165,974	932,012	27,807,298	5.6154
2004	1,614	277,595,068	171,992	925,436	27,059,473	5.3807
2005	1,624	301,056,223	185,379	1,040,565	29,846,734	5.6132
2006	1,649	285,021,697	172,845	909,631	25,459,006	5.2627
2007	1,670	305,571,487	182,977	944,153	26,371,754	5.1600
2008	1,687	349,086,306	206,927	1,047,719	28,142,990	5.0632
2009	1,682	317,512,832	188,771	1,007,971	28,701,847	5.3396
2010	1,657	317,669,976	191,714	1,036,488	29,717,899	5.4064
2011	1,654	352,088,151	212,871	1,114,624	30,474,865	5.2361
2012	1,657	341,834,579	206,297	1,081,353	30,204,525	5.2417
2013	1,650	328,008,464	198,793	1,083,151	31,447,613	5.4486
2014	1,605	341,865,660	213,000	1,177,529	32,970,073	5.5283
2015	1,652	355,257,530	215,047	1,210,053	34,203,391	5.6269
2016	1,643	379,480,446	230,968	1,341,852	38,768,776	5.8097
2017	1,626	416,136,535	255,927	1,418,030	38,816,047	5.5408
2018	1,599	435,339,900	272,258	1,406,274	36,187,577	5.1652
2019	1,584	446,855,787	282,106	1,449,262	36,311,052	5.1373
2020	1,570	455,145,860	289,902	1,404,425	31,865,776	4.8445
2021	1,566	506,954,586	323,726	1,651,634	39,398,537	5.1020
2022	1,548	574,439,283	371,085	1,958,181	47,965,604	5.2769
2023	1,527	627,585,187	410,992	2,261,833	57,003,028	5.5034

Note: FTS: Full-time samples.

Table OA2.5: FTS Sample 2
Summary statistics: Equity capital by year (1999 – 2023)
($000 omitted)

Year	N	Sum	Mean	Std	Min	Max	CV
1999	1,544	377,480,687	244,482	1,536,869	25	45,762,499	6.2862
2000	1,587	356,613,757	224,709	1,424,376	11	43,690,982	6.3388
2001	1,607	336,281,904	209,261	1,200,718	205	37,989,956	5.7379
2002	1,597	332,190,630	208,009	1,090,473	64	31,600,585	5.2424
2003	1,590	401,918,481	252,779	1,395,280	178	39,980,587	5.5198
2004	1,614	454,092,007	281,346	1,591,076	1	46,144,211	5.6552
2005	1,624	500,640,175	308,276	1,707,467	107	50,187,253	5.5388
2006	1,649	570,139,430	345,749	1,994,003	246	58,034,268	5.7672
2007	1,670	618,632,479	370,439	2,126,157	346	63,577,269	5.7396
2008	1,687	558,533,592	331,081	1,785,998	18	53,273,952	5.3944
2009	1,682	620,945,162	369,171	2,045,296	162	58,180,271	5.5402
2010	1,657	668,415,731	403,389	2,545,199	266	68,437,054	6.3095
2011	1,654	657,117,910	397,290	2,557,653	68	70,155,428	6.4377
2012	1,657	698,883,584	421,776	2,808,191	18	78,861,515	6.6580
2013	1,650	762,244,817	461,967	3,315,283	3	97,226,052	7.1764
2014	1,605	782,443,692	487,504	3,391,295	2	93,997,652	6.9564
2015	1,652	792,376,136	479,647	3,316,182	5	89,828,619	6.9138
2016	1,643	826,890,719	503,281	3,610,239	78	101,285,906	7.1734
2017	1,626	885,922,479	544,848	4,279,545	77	128,562,566	7.8546
2018	1,599	876,509,832	548,161	4,256,301	348	122,471,087	7.7647
2019	1,584	1,008,161,393	636,466	5,429,071	256	167,718,679	8.5300
2020	1,570	1,087,840,856	692,892	6,021,632	167	187,762,294	8.6906
2021	1,566	1,232,716,872	787,176	7,368,827	107	239,470,233	9.3611
2022	1,548	1,145,195,510	739,790	6,536,054	182	207,276,468	8.8350
2023	1,527	1,213,561,248	794,736	7,109,638	67	225,582,882	8.9459

Note: FTS: Full-time samples.

Table OA2.6: FTS Sample 2
($000 omitted)

Year	L_{t-9}	L_{t-8}	L_{t-7}	...	L_{t-2}	L_{t-1}	L_t	$\bar{L}$	$\hat{\sigma}$
1999	165,070,465	170,786,238	184,559,286	...	195,296,312	204,940,511	212,438,498	189,188,950	15,086,455.69
2000	169,044,072	182,945,640	175,071,000	...	204,056,437	211,235,200	225,907,905	194,024,959	16,917,085.67
2001	180,157,538	172,929,731	189,671,597	...	210,601,349	225,345,347	253,852,110	201,453,818	23,768,580.37
2002	170,489,993	187,214,152	184,695,417	...	223,615,354	252,384,755	251,871,393	206,650,371	27,876,263.67
2003	182,186,123	180,720,081	191,924,880	...	247,674,936	248,844,558	263,898,977	212,585,817	30,762,693.73
2004	180,717,787	191,686,565	187,613,988	...	249,584,084	264,876,831	277,595,068	222,366,403	35,073,580.34
2005	189,079,385	185,854,742	195,691,116	...	264,371,383	279,672,688	301,056,223	233,253,214	40,542,289.84
2006	184,255,757	193,931,510	202,213,799	...	277,984,038	299,539,190	285,021,697	241,321,486	40,446,703.10
2007	194,995,044	203,566,942	219,021,827	...	302,929,771	287,966,565	305,571,487	255,198,659	39,923,130.87
2008	203,130,587	218,956,067	245,963,471	...	288,675,720	305,638,305	349,086,306	270,846,560	43,859,714.49
2009	218,545,048	245,245,982	246,902,682	...	303,210,282	347,495,020	317,512,832	281,705,995	38,617,557.67
2010	242,227,275	244,167,692	261,959,350	...	346,196,652	317,617,671	317,669,976	290,007,323	33,708,500.25
2011	242,638,805	261,116,871	279,328,695	...	316,273,507	316,694,629	352,088,151	299,841,348	34,405,314.98
2012	259,705,338	277,829,914	298,305,935	...	314,543,576	349,617,044	341,834,579	308,125,942	29,817,333.68
2013	270,828,434	291,861,579	278,740,530	...	342,927,007	335,200,701	328,008,464	309,431,752	25,470,658.89
2014	288,309,451	275,423,468	288,637,587	...	331,967,567	325,840,340	341,865,660	312,610,604	23,467,858.46
2015	276,772,479	289,259,581	327,531,252		326,847,280	343,908,770	355,257,530	321,220,378	25,025,958.16
2016	285,742,186	319,393,996	298,815,048		339,508,063	352,235,648	379,480,446	326,154,782	27,685,472.28
2017	316,516,023	297,633,725	303,841,529		351,236,303	3783,02,584	416,136,535	338,579,195	35,813,920.94
2018	294,846,357	300,754,974	332,201,422		377,036,313	414,953,036	435,339,900	348,724,284	46,787,638.49
2019	299,074,452	332,908,907	326,028,851		412,998,178	433,211,784	446,855,787	362,843,563	51,625,156.21
2020	329,207,928	322,613,672	316,855,527		431,989,804	446,283,800	455,145,860	377,105,854	54,409,930.12
2021	323,572,418	318,365,600	335,572,251		4475,58,112	456,450,121	506,954,586	395,889,965	64,879,075.01
2022	312,058,972	330,165,170	342,748,145		449,380,840	501,339,682	574,439,283	415,376,745	81,677,824.54
2023	325,724,697	336,433,952	362,179,246		487,847,969	559,780,368	627,585,187	437,775,196	96,783,629.83

Note: Sum of the observed losses of company *i* were incurred in year *t-9 up to t* ($L_{t-9, \ldots} L_t$). Mean of $\bar{L}$ and $\hat{\sigma}$ of losses for the industry by year (1999–2023).

Table OA2.7: ($\hat{\sigma}_i$) FTS Sample 2
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1999	1,544	26,774.97	90,884.93	2.92	1,887,885.58	3.3944
2000	1,587	26,982.13	92,322.88	3.52	1,855,958.00	3.4216
2001	1,607	29,591.51	103,418.28	4.97	2,066,663.63	3.4949
2002	1,597	30,896.90	112,312.69	5.06	2,560,266.88	3.6351
2003	1,590	33,703.91	122,554.42	3.97	2,806,037.96	3.6362
2004	1,614	36,841.30	133,013.21	1.87	2,995,902.86	3.6104
2005	1,624	40,915.22	151,152.87	0.70	3,422,909.26	3.6943
2006	1,649	40,987.29	150,013.49	0.84	3,244,337.70	3.6600
2007	1,670	42,595.97	146,446.10	0.95	2,888,558.78	3.4380
2008	1,687	46,074.53	156,299.92	3.37	2,503,745.18	3.3923
2009	1,682	44,656.56	147,912.05	0.95	1,864,819.90	3.3122
2010	1,657	42,512.52	141,914.36	0.95	2,031,191.09	3.3382
2011	1,654	42,007.39	142,784.27	0.95	2,540,712.37	3.3990
2012	1,657	41,031.27	139,621.27	0.95	2,507,130.26	3.4028
2013	1,650	40,151.10	139,458.39	0.95	2,305,921.62	3.4733
2014	1,605	40,040.84	152,558.30	2.62	3,237,178.54	3.8101
2015	1,652	41,091.38	176,521.87	2.16	4,527,884.46	4.2958
2016	1,643	40,905.07	195,205.11	2.18	5,430,884.19	4.7721
2017	1,626	45,859.72	226,003.67	2.21	6,471,322.48	4.9282
2018	1,599	50,353.93	246,378.31	0.63	7,152,922.33	4.8929
2019	1,584	53,758.50	259,416.98	0.32	7,557,199.84	4.8256
2020	1,570	54,704.29	258,010.65	0.32	7,458,306.70	4.7165
2021	1,566	60,426.44	275,404.90	0.32	7,607,520.88	4.5577
2022	1,548	69,037.50	317,069.78	0.32	7,603,268.18	4.5927
2023	1,527	79,792.52	376,056.65	0.48	7,666,116.56	4.7129

Note: Summary statistics: Standard deviation of the net losses and loss expense incurred for a company by year (1999–2023).

Table OA2.8 ($\hat{\rho}_i$) FTS Sample 2

Year	N	Mean	Std	Min	Max	CV
1999	1,544	0.3705	0.5926	-0.9704	0.9715	1.5995
2000	1,587	0.3387	0.6082	-0.9324	0.9808	1.7957
2001	1,607	0.3510	0.5875	-0.9315	0.9924	1.6738
2002	1,597	0.3726	0.5960	-0.9556	0.9923	1.5996
2003	1,590	0.3881	0.5970	-0.9607	0.9960	1.5383
2004	1,614	0.4146	0.5956	-0.9691	0.9958	1.4366
2005	1,624	0.4349	0.5992	-0.9494	0.9970	1.3778
2006	1,649	0.4355	0.5943	-0.9534	0.9922	1.3646
2007	1,670	0.4196	0.5873	-0.9715	0.9914	1.3997
2008	1,687	0.4098	0.5755	-0.9611	0.9924	1.4043
2009	1,682	0.3711	0.5749	-0.9408	0.9792	1.5492
2010	1,657	0.3380	0.5684	-0.9254	0.9766	1.6817
2011	1,654	0.3272	0.5628	-0.9218	0.9750	1.7200
2012	1,657	0.2849	0.5711	-0.9060	0.9663	2.0046
2013	1,650	0.2483	0.5526	-0.8908	0.9602	2.2255
2014	1,605	0.2587	0.5399	-0.9139	0.9645	2.0870
2015	1,652	0.2683	0.5509	-0.9181	0.9763	2.0533
2016	1,643	0.2763	0.5663	-0.9166	0.9884	2.0496
2017	1,626	0.3304	0.5752	-0.9506	0.9909	1.7409
2018	1,599	0.3734	0.5901	-0.9704	0.9933	1.5803
2019	1,584	0.3842	0.5910	-0.9683	0.9939	1.5383
2020	1,570	0.3680	0.5974	-0.9893	0.9932	1.6234
2021	1,566	0.4090	0.5984	-0.9807	0.9955	1.4631
2022	1,548	0.4405	0.5901	-0.9800	0.9947	1.3396
2023	1,527	0.4709	0.5740	-0.9837	0.9965	1.2189

Note: Summary statistics: Correlation coefficient between company *i*'s losses and the industry losses by year (1999–2023).

Table OA2.9 ($det\hat{\sigma}_i$) FTS Sample 2
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1999	1,544	15,798.16	61,008.32	2.42	1,272,861.08	3.8617
2000	1,587	15,662.30	57,834.02	3.48	1,107,651.96	3.6926
2001	1,607	17,338.25	61,978.94	4.45	1,200,026.42	3.5747
2002	1,597	17,355.34	61,533.16	4.28	1,484,939.05	3.5455
2003	1,590	19,127.21	67,005.05	2.79	1,552,538.52	3.5031
2004	1,614	19,932.05	67,633.61	1.49	1,331,008.48	3.3932
2005	1,624	21,363.40	74,383.13	0.69	1,155,583.79	3.4818
2006	1,649	21,703.47	82,753.86	0.79	1,751,475.90	3.8129
2007	1,670	23,698.51	89,233.89	0.73	1,989,581.17	3.7654
2008	1,687	26,215.40	97,727.73	3.16	1,916,812.61	3.7279
2009	1,682	27,117.42	94,761.94	0.81	1,571,607.28	3.4945
2010	1,657	27,101.86	94,103.59	0.87	1,349,008.72	3.4722
2011	1,654	263,50.62	90,395.60	0.91	1,417,577.44	3.4305
2012	1,657	26,158.76	90,288.02	0.93	1,574,857.32	3.4515
2013	1,650	26,738.89	97,494.14	0.95	1,611,686.73	3.6462
2014	1,605	27,666.94	112,710.31	2.21	2,429,124.08	4.0738
2015	1,652	27,091.33	115,621.59	1.97	2,651,584.09	4.2678
2016	1,643	25,035.16	108,121.21	1.95	2,701,452.59	4.3188
2017	1,626	26,552.23	115,419.67	2.17	2,759,258.24	4.3469
2018	1,599	27,241.44	110,994.39	0.58	2,351,454.89	4.0745
2019	1,584	28,838.47	113,206.06	0.31	2,052,079.98	3.9255
2020	1,570	30,046.08	126,283.29	0.30	2,665,761.81	4.2030
2021	1,566	30,224.60	125,193.73	0.29	2,704,738.67	4.1421
2022	1,548	32,568.62	148,361.50	0.27	3,723,259.33	4.5554
2023	1,527	37,089.70	193,324.00	0.40	5,427,463.21	5.2123

Note: Summary statistics: Detrended Standard deviation of the net losses and loss expense incurred group and unaffiliated company by year (1999–2023).

Table OA2.10 ($det\ \hat{\rho}_i$) FTS Sample 2

Year	N	Mean	Std	Min	Max	CV
1999	1,544	0.0639	0.2892	-0.9113	0.8791	4.5258
2000	1,587	0.0891	0.3859	-0.8849	0.9062	4.3311
2001	1,607	0.1676	0.5157	-0.9165	0.9580	3.0770
2002	1,597	0.1927	0.4944	-0.9363	0.9480	2.5656
2003	1,590	0.2140	0.4913	-0.9213	0.9719	2.2958
2004	1,614	0.1994	0.4436	-0.9029	0.9617	2.2247
2005	1,624	0.1894	0.4238	-0.9140	0.9613	2.2376
2006	1,649	0.0900	0.3726	-0.8897	0.9629	4.1400
2007	1,670	0.0815	0.4219	-0.8997	0.9724	5.1767
2008	1,687	0.0909	0.3538	-0.9130	0.9225	3.8922
2009	1,682	0.1448	0.3292	-0.8825	0.9015	2.2735
2010	1,657	0.1400	0.3846	-0.8880	0.8960	2.7471
2011	1,654	0.1508	0.3500	-0.8845	0.9175	2.3210
2012	1,657	0.1303	0.3238	-0.6725	0.9169	2.4850
2013	1,650	0.1201	0.3501	-0.7315	0.9034	2.9151
2014	1,605	0.1240	0.3289	-0.7816	0.8887	2.6524
2015	1,652	0.1176	0.3667	-0.7871	0.9252	3.1182
2016	1,643	0.1613	0.3546	-0.8494	0.9574	2.1984
2017	1,626	0.2215	0.4672	-0.9046	0.9710	2.1093
2018	1,599	0.1937	0.5248	-0.9577	0.9690	2.7093
2019	1,584	0.2043	0.5231	-0.9672	0.9739	2.5605
2020	1,570	0.1941	0.4931	-0.9699	0.9829	2.5404
2021	1,566	0.1609	0.4154	-0.8872	0.9226	2.5817
2022	1,548	0.2361	0.4737	-0.9317	0.9758	2.0064
2023	1,527	0.2928	0.5408	-0.9529	0.9927	1.8470

Note: Summary statistics: Detrended Correlation coefficient between group and unaffiliated company *i*'s losses and the industry losses by year (1999–2023).

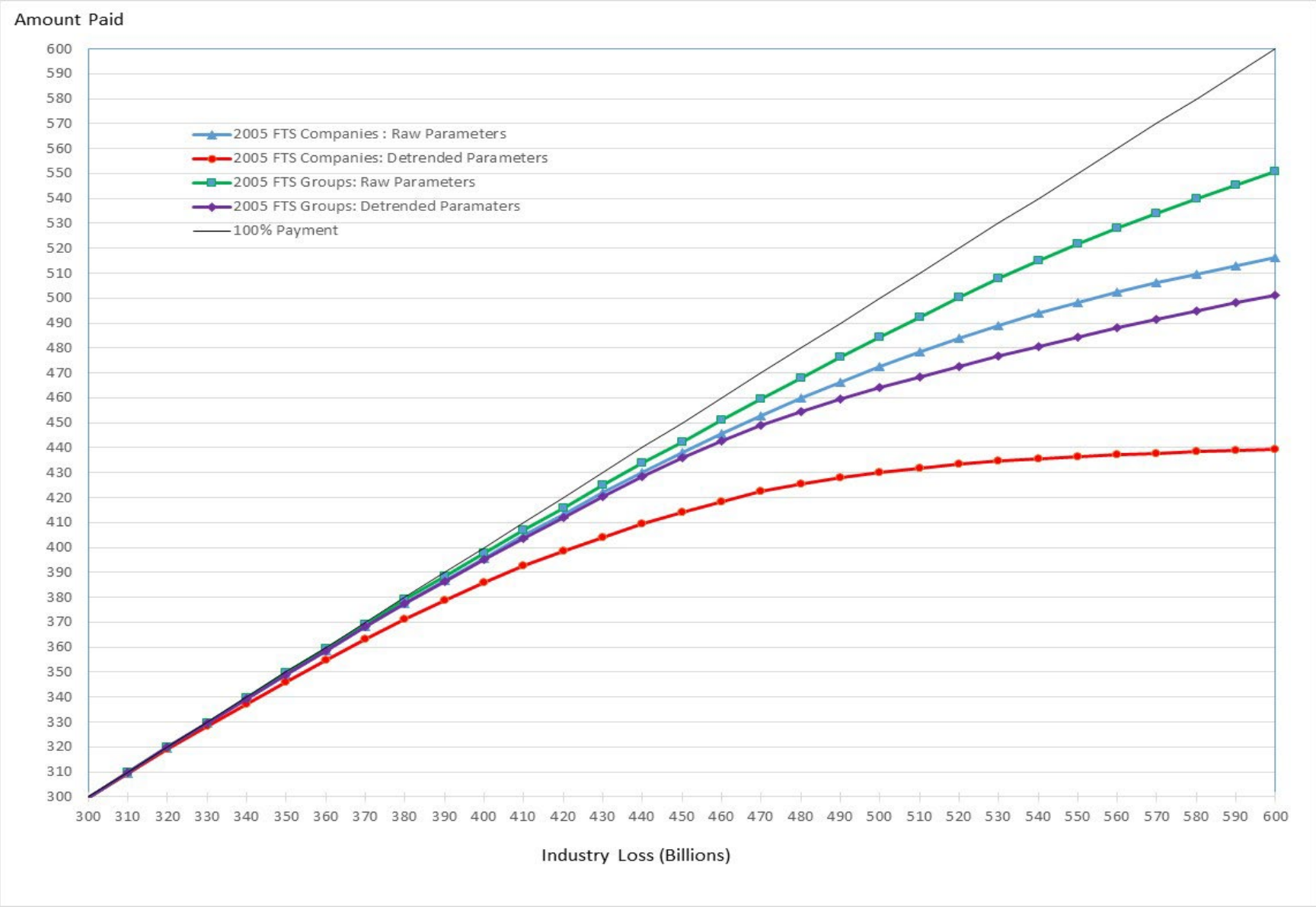

Figure OA2.1: Response functions national net loss, 2005 (FTS Sample 2)

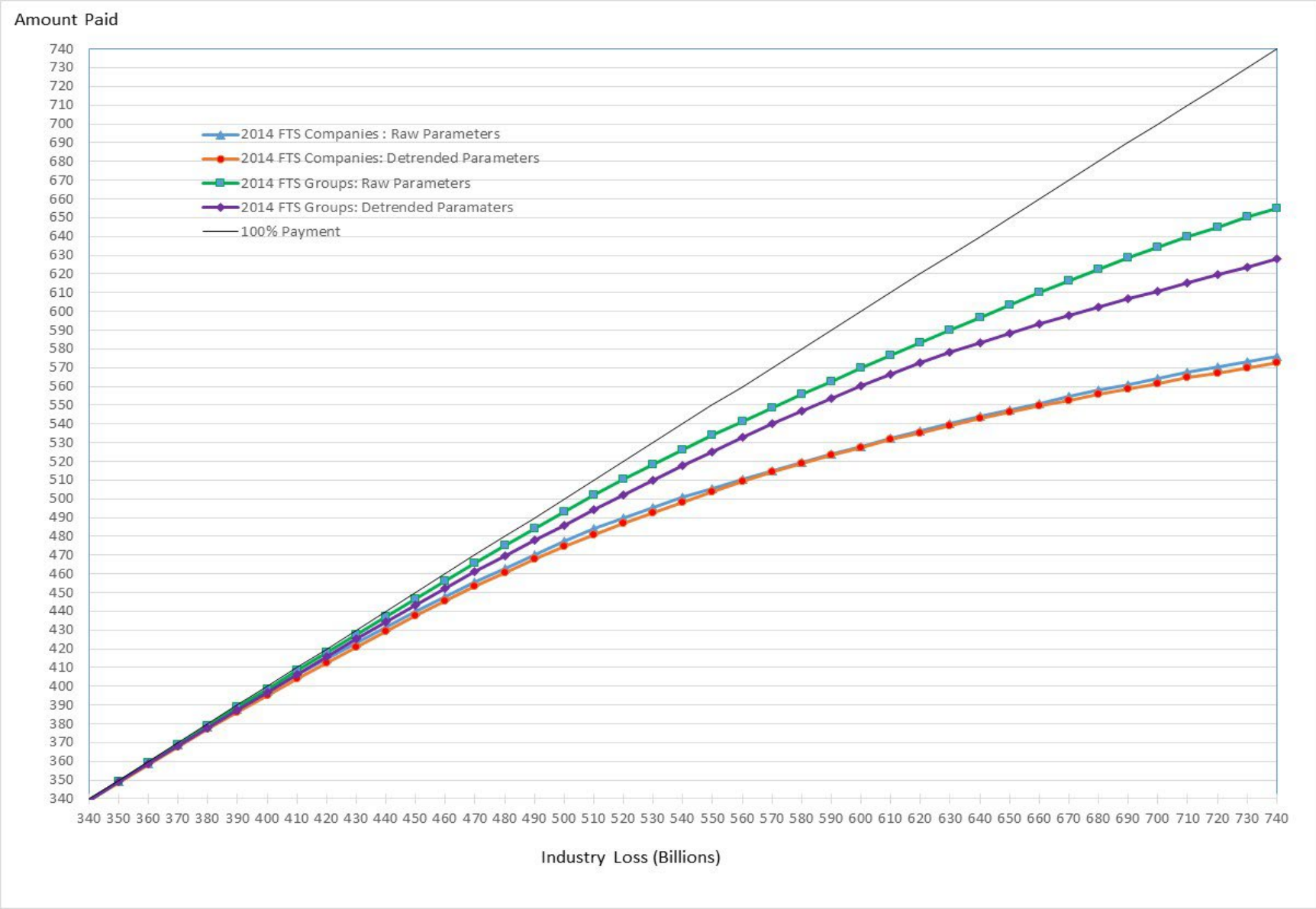

Figure OA2.2: Response functions national net loss, 2014 (FTS Sample 2)

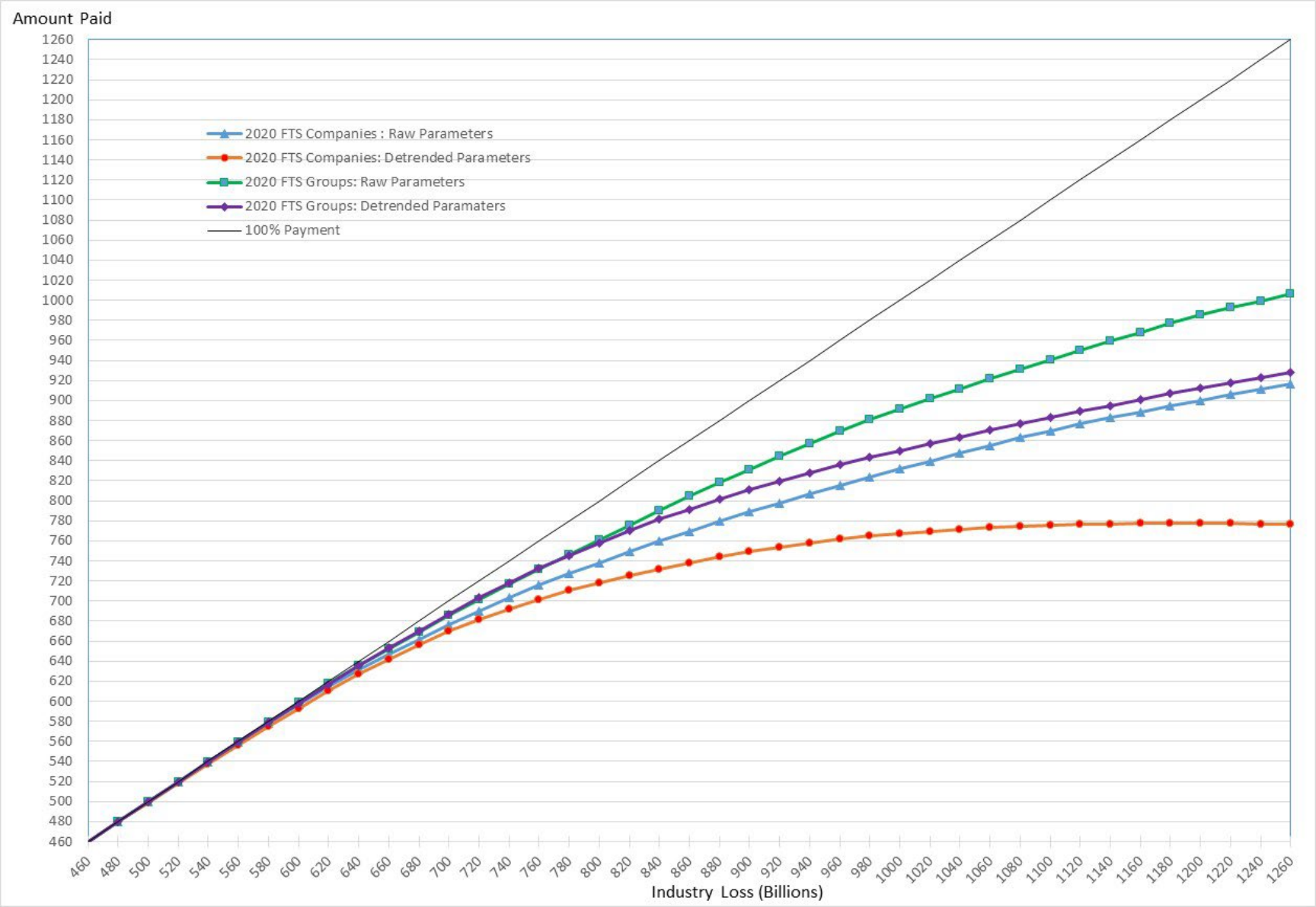

Figure OA2.3: Response functions national net loss, 2020 (FTS Sample 2)

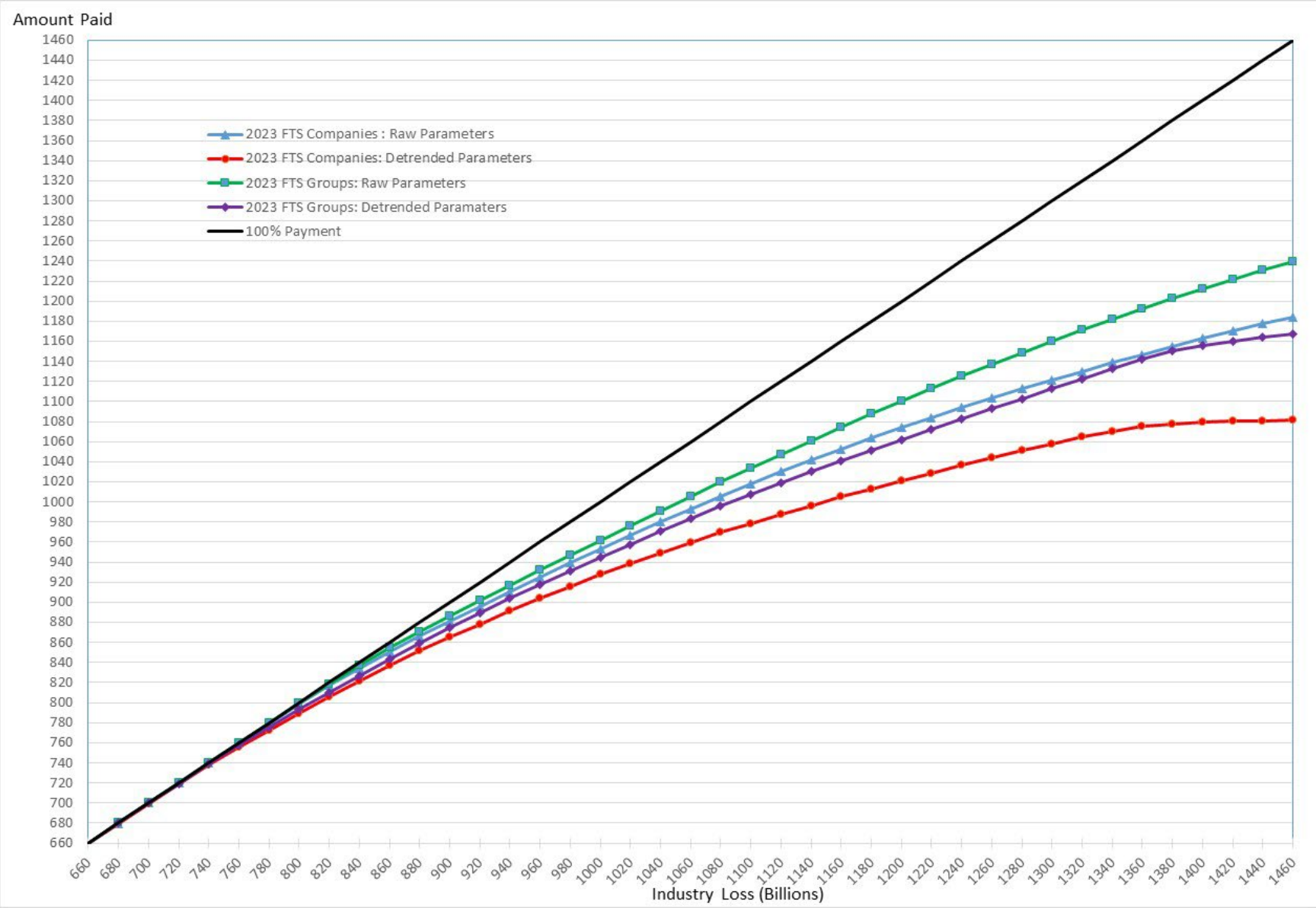

Figure OA2.4: Response functions national net loss, 2023 (FTS Sample 2)

Regression models for parameters estimations

Table OA2.11a: Sample 2
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2005

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.2099 10.21	-0.3193 -15.45	0.3720 6.11	0.1717 6.21
Ln(equity capital)	0.0385 13.07	0.0202 13.94	0.0636 7.78	0.0296 7.98
Ln(net losses incurred)	0.0042 1.90	0.0007 0.61	0.0050 0.75	0.0010 0.35
Short / Asset	0.1041 5.07	0.0454 4.49	0.2094 4.01	0.0889 3.75
Liquid asset / Asset	-0.0503 -2.04	-0.0319 -2.63	-0.1338 -1.83	-0.0649 -1.96
Sigma	0.1308 56.99	0.0645 56.98	0.2614 41.62	0.1187 41.61
Log likelihood	999	2,148	-67	617
AIC	-1,986	-4,284	145	-1,221
No. of observation	1,624	1,624	866	866

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.11b: Sample 2
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2014

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.1749 8.72	-0.4333 -13.87	0.2763 5.62	0.1693 5.79
Ln(equity capital)	0.0344 11.53	0.0246 10.96	0.0537 7.68	0.0323 7.76
Ln(net losses incurred)	0.0054 2.25	0.0029 1.63	0.0049 0.80	0.0031 0.85
Short / Asset	0.1192 5.24	0.0824 4.82	0.1821 3.95	0.1027 3.75
Liquid asset / Asset	-0.0336 -1.38	-0.0185 -1.01	-0.0747 -1.25	-0.0442 -1.24
Sigma	0.1346 56.65	0.1013 56.65	0.2241 41.64	0.1334 41.64
Log likelihood	941	1,398	66	517
AIC	-1,870	-2,784	-121	-1,021
No. of observation	1,605	1,605	867	867

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

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Table OA2.11c: Sample 2
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2020

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.2585 7.85	-0.5220 -14.83	0.4102 5.22	0.1917 6.39
Ln(equity capital)	0.0561 10.43	0.0305 11.86	0.0913 7.38	0.0404 8.55
Ln(net losses incurred)	0.0038 0.93	0.0017 0.89	0.0034 0.34	0.0023 0.60
Short / Asset	0.1486 3.83	0.0803 4.33	0.2937 3.52	0.1208 3.78
Liquid asset / Asset	-0.0716 -1.79	-0.0320 -1.67	-0.1251 -1.31	-0.0575 -1.57
Sigma	0.2331 56.03	0.1115 56.03	0.3887 41.88	0.1485 41.88
Log likelihood	59	1,217	-416	428
AIC	-105	-2,421	843	-844
No. of observation	1,570	1,570	877	877

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.11d: Sample 2
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2023

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.3171 7.32	-0.6167 -11.54	0.5111 3.81	0.2160 4.09
Ln(equity capital)	0.0685 8.77	0.0329 7.99	0.1380 5.93	0.0524 5.72
Ln(net losses incurred)	0.0166 2.68	0.0061 1.86	0.0179 0.92	0.0067 0.88
Short / Asset	0.1560 2.98	0.0765 2.77	0.4572 3.14	0.1564 2.73
Liquid asset / Asset	-0.0245 -0.45	-0.0183 -0.64	-0.0007 -0.00	-0.020 -0.30
Sigma	0.3381 55.26	0.1782 55.26	0.6945 41.18	0.2736 41.18
Log likelihood	-511	467	-894	-104
AIC	1,033	-922	1,800	220
No. of observation	1,527	1,527	848	848

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.12a: Sample 2
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2005

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.4089 3.58	-0.1515 -0.97	0.7585 4.88	0.3115 2.46
Ln(equity capital)	-0.1336 -10.52	-0.0058 -0.57	-0.1317 -7.88	-0.0252 -1.83
Ln(net losses incurred)	0.1863 16.88	0.0315 3.51	0.1830 11.84	0.0542 4.26
Short / Asset	0.0036 0.04	0.0346 0.53	-0.1417 -1.49	0.0685 0.87
Total liability / Asset	0.0968 1.08	0.1542 2.11	-0.0678 -0.57	0.0130 0.13
Liquid asset / Asset	0.3973 4.02	0.0597 0.74	0.1571 1.15	0.0198 0.18
Sigma	0.5092 56.99	0.4142 56.99	0.4754 41.62	0.3916 41.62
Log likelihood	-1,208	-873	-858	-417
AIC	2,431	1,760	1,184	848
No. of observation	1,624	1,624	866	866

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.12b: Sample 2
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2014

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.3881 3.18	-0.4621 -3.67	0.8262 4.89	0.4284 4.03
Ln(equity capital)	-0.1221 -9.87	0.0231 2.89	-0.1318 -7.36	0.0063 0.56
Ln(net losses incurred)	0.1435 12.77	0.0123 1.69	0.1612 9.42	0.0258 2.40
Short / Asset	-0.2770 -3.32	-0.0756 -1.40	-0.2037 -2.05	-0.0018 -0.03
Total liability / Asset	-0.0763 -0.78	-0.0554 -0.87	-0.3668 -2.69	-0.3054 -3.56
Liquid asset / Asset	0.2057 2.09	0.1122 1.76	-0.0877 -0.63	-0.0441 -0.50
Sigma	0.4937 56.66	0.3200 56.66	0.4834 41.64	0.3036 41.64
Log likelihood	-1,145	-449	-600	-197
AIC	2,303	911	1,214	408
No. of observation	1,605	1,605	867	867

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.12c: Sample 2
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2020

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.5834 4.68	-0.3984 -2.06	0.7702 4.60	0.3949 2.71
Ln(equity capital)	-0.0751 -5.34	0.0099 0.78	-0.1091 -5.67	0.0061 0.36
Ln(net losses incurred)	0.1323 10.86	0.0366 3.33	0.1708 9.84	0.0422 2.80
Short / Asset	0.0432 0.49	-0.0583 -0.73	0.0349 0.31	0.0972 0.98
Total liability / Asset	0.2411 2.36	-0.0015 -0.02	-0.0091 -0.07	-0.1132 -0.96
Liquid asset / Asset	-0.0517 -0.52	0.0706 0.78	-0.0562 -0.40	-0.0137 -0.11
Sigma	0.5316 56.02	0.4797 56.02	0.5285 41.88	0.4600 41.88
Log likelihood	-1,235	-1,074	-685	-563
AIC	2,484	2,162	1,384	1,141
No. of observation	1,570	1,570	877	877

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.12d: Sample 2
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2023

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.8868 7.94	1.1581 5.67	0.8433 5.33	1.0009 6.64
Ln(equity capital)	-0.0955 -7.20	-0.0988 -7.17	-0.1194 -6.17	-0.0941 -5.11
Ln(net losses incurred)	0.1672 14.18	0.1385 11.31	0.1841 10.51	0.1474 8.84
Short / Asset	-0.1053 -1.40	-0.2334 -2.98	-0.1037 -0.99	-0.0839 -0.84
Total liability / Asset	-0.0200 -0.21	-0.5306 -5.31	-0.1184 -0.92	-0.5926 -4.85
Liquid asset / Asset	-0.0487 -0.56	-0.2083 -2.32	0.0413 0.31	-0.1243 -0.98
Sigma	0.4855 55.26	0.5042 55.26	0.5012 41.18	0.4770 41.18
Log likelihood	-1,063	-1,121	-617	-575
AIC	2,140	2,256	1,249	1,165
No. of observation	1,527	1,527	848	848

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA2.13: ($\hat{\sigma}_i$) NFTS Sample 2
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1999	2,210	29,506.48	76,887.20	2.9154759	1,887,885.58	2.6058
2000	2,165	29,397.51	79,836.69	3.5213634	1,855,958.00	2.7158
2001	2,137	31,696.41	90,428.06	4.9665548	2,066,663.63	2.8529
2002	2,103	33,629.08	98,680.05	5.0563491	2,560,266.88	2.9344
2003	2,099	36,285.77	107,472.07	3.9721251	2,806,037.96	2.9618
2004	2,142	38,910.48	116,296.65	1.8737959	2,995,902.86	2.9888
2005	2,152	43,085.32	132,200.84	0.6992059	3,4229,09.26	3.0683
2006	2,193	42,747.27	130,946.48	0.8432740	3,244,337.70	3.0633
2007	2,223	43,208.34	127,692.89	0.9486833	2,888,558.78	2.9553
2008	2,246	46,586.26	136,223.28	3.3730962	2,503,745.18	2.9241
2009	2,207	45,200.06	129,888.20	0.9486833	1,864,819.90	2.8736
2010	2,163	42,926.18	124,808.42	0.9486833	2,031,191.09	2.9075
2011	2,119	42,625.19	126,767.07	0.9486833	2,540,712.37	2.9740
2012	2,070	42,123.77	125,538.76	0.9486833	2,507,130.26	2.9802
2013	2,015	42,024.62	126,983.77	0.9486833	2,305,921.62	3.0217
2014	1,922	42,303.06	140,027.85	2.6161889	3,237,178.54	3.3101
2015	1,952	44,756.80	163,155.91	2.1602469	4,527,884.46	3.6454
2016	1,911	45,320.68	181,844.03	2.1832697	5,430,884.19	4.0124
2017	1,867	50,803.46	211,890.08	2.2110832	6,471,322.48	4.1708
2018	1,825	55,409.37	231,633.67	0.6324555	7,152,922.33	4.1804
2019	1,805	59,029.28	244,075.17	0.3162278	7,557,199.84	4.1348
2020	1,787	59,267.73	242,734.58	0.3162278	7,458,306.70	4.0956
2021	1,787	64,429.61	258,587.13	0.3162278	7,607,520.88	4.0135
2022	1,778	74,204.19	296,896.27	0.3162278	7,603,268.18	4.0011
2023	1,753	85,801.38	352,099.55	0.4830459	7,666,116.56	4.1037

Note: Summary statistics: Raw Standard deviation of the net losses and loss expense incurred for a company by year (1999–2023).

Table OA2.14: ($\hat{\rho}_i$) NFTS Sample 2

Year	N	Mean	Std	Min	Max	CV
1999	2,210	0.3835	0.5051	-0.9704	0.9715	1.3171
2000	2,165	0.3549	0.5302	-0.9324	0.9808	1.4939
2001	2,137	0.3591	0.5179	-0.9315	0.9924	1.4422
2002	2,103	0.3772	0.5273	-0.9556	0.9923	1.3979
2003	2,099	0.3920	0.5270	-0.9607	0.9960	1.3444
2004	2,142	0.4174	0.5255	-0.9691	0.9958	1.2590
2005	2,152	0.4334	0.5295	-0.9494	0.9970	1.2217
2006	2,193	0.4290	0.5236	-0.9534	0.9922	1.2205
2007	2,223	0.4162	0.5152	-0.9715	0.9914	1.2379
2008	2,246	0.4061	0.5048	-0.9611	0.9924	1.2430
2009	2,207	0.3714	0.5066	-0.9408	0.9792	1.3640
2010	2,163	0.3429	0.5006	-0.9254	0.9766	1.4599
2011	2,119	0.3271	0.5009	-0.9218	0.9750	1.5313
2012	2,070	0.2896	0.5141	-0.9060	0.9663	1.7752
2013	2,015	0.2557	0.5026	-0.8908	0.9602	1.9656
2014	1,922	0.2651	0.4966	-0.9139	0.9645	1.8733
2015	1,952	0.2726	0.5099	-0.9181	0.9763	1.8705
2016	1,911	0.2823	0.5282	-0.9166	0.9884	1.8711
2017	1,867	0.3297	0.5402	-0.9506	0.9909	1.6385
2018	1,825	0.3702	0.5560	-0.9704	0.9933	1.5019
2019	1,805	0.3788	0.5573	-0.9683	0.9939	1.4712
2020	1,787	0.3675	0.5632	-0.9893	0.9932	1.5325
2021	1,787	0.4039	0.5643	-0.9807	0.9955	1.3971
2022	1,778	0.4317	0.5552	-0.9800	0.9947	1.2861
2023	1,753	0.4601	0.5406	-0.9837	0.9965	1.1750

Note: Summary statistics: Raw Correlation coefficient between company *i*'s losses and the industry losses by year (1999–2023).

Table OA2.15: ($det\ \hat{\sigma}_i$) NFTS Sample 2
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
1999	2,210	11,037.27	51,501.66	1.6873092E-8	1,272,861.08	4.6662
2000	2,165	11,480.86	49,994.20	1.2808325E-9	1,107,651.96	4.3546
2001	2,137	13,038.17	54,261.66	1.487163E-11	1,200,026.42	4.1618
2002	2,103	13,179.49	54,128.87	8.450219E-11	1,484,939.05	4.1071
2003	2,099	14,488.93	58,886.86	1.09997E-11	1,552,538.52	4.0643
2004	2,142	15,018.83	59,329.96	9.538021E-13	1,331,008.48	3.9504
2005	2,152	16,121.82	65,263.00	7.677228E-13	1,155,583.79	4.0481
2006	2,193	16,319.67	72,364.00	4.756371E-10	1,751,475.90	4.4342
2007	2,223	17,803.20	78,012.67	1.83634E-10	1,989,581.17	4.3819
2008	2,246	19,690.73	85,446.69	2.21409E-10	1,916,812.61	4.3394
2009	2,207	20,666.74	83,523.15	6.075651E-11	1,571,607.28	4.0414
2010	2,163	20,761.81	83,154.18	8.846025E-15	1,349,008.72	4.0052
2011	2,119	20,568.16	80,599.99	1.23586E-10	1,417,577.44	3.9187
2012	2,070	20,939.64	81,449.57	4.219499E-12	1,574,857.32	3.8897
2013	2,015	21,895.37	88,817.72	8.1952557E-8	1,611,686.73	4.0565
2014	1,922	2,3103.77	103,502.50	1.676807E-8	2,429,124.08	4.4799
2015	1,952	22,927.71	106,809.40	0.000014226	2,6515,84.09	4.6585
2016	1,911	21,524.21	100,625.57	3.4815672E-7	2,701,452.59	4.6750
2017	1,867	23,124.76	108,076.18	8.1102733E-7	2,759,258.24	4.6736
2018	1,825	23,867.98	104,277.78	3.552285E-10	2,351,454.89	4.3689
2019	1,805	25,307.55	106,466.13	3.9606036E-9	2,052,079.98	4.2069
2020	1,787	26,397.51	118,769.56	5.189889E-8	2,665,761.81	4.4993
2021	1,787	26,486.70	117,614.17	2.5810386E-8	2,704,738.67	4.4405
2022	1,778	28,355.58	138,858.66	0.000021412	3,723,259.33	4.8970
2023	1,753	32,308.13	180,852.54	0.0052901	5,427,463.21	5.5977

Note: Summary statistics: Detrented Standard deviation of the net losses and loss expense incurred by year (1999–2023).

Table OA2.16: ($det\ \hat{\rho}_i$) NFTS Sample 2

Year	N	Mean	Std	Min	Max	CV
1999	2,210	0.0561308	0.2419988	-0.9113002	0.8791261	4.3113
2000	2,165	0.0829784	0.3306470	-0.8848727	0.9062199	3.9847
2001	2,137	0.1492890	0.4486326	-0.9165006	0.9579918	3.0051
2002	2,103	0.1769855	0.4321266	-0.9362879	0.9480210	2.4416
2003	2,099	0.1841322	0.4309459	-0.9213306	0.9719303	2.3404
2004	2,142	0.1734907	0.3879521	-0.9028957	0.9617352	2.2362
2005	2,152	0.1664388	0.3705514	-0.9139766	0.9613169	2.2264
2006	2,193	0.0698362	0.3249339	-0.8896857	0.9628554	4.6528
2007	2,223	0.0624265	0.3671784	-0.8996794	0.9724440	5.8818
2008	2,246	0.0726045	0.3082824	-0.9130245	0.9224714	4.2461
2009	2,207	0.1107048	0.2938225	-0.8825206	0.9014672	2.6541
2010	2,163	0.1072923	0.3417404	-0.8879953	0.8960446	3.1851
2011	2,119	0.1178442	0.3153727	-0.8845190	0.9175202	2.6762
2012	2,070	0.1048357	0.2941345	-0.6725480	0.9169408	2.8057
2013	2,015	0.1000450	0.3196648	-0.7315389	0.9034360	3.1952
2014	1,922	0.1042828	0.3038340	-0.7816404	0.8886744	2.9136
2015	1,952	0.1030059	0.3390722	-0.7870556	0.9251872	3.2918
2016	1,911	0.1393747	0.3332437	-0.8494264	0.9573621	2.3910
2017	1,867	0.1947610	0.4415163	-0.9046197	0.9709898	2.2670
2018	1,825	0.1713428	0.4947873	-0.9576501	0.9689824	2.8877
2019	1,805	0.1817952	0.4937008	-0.9672119	0.9739209	2.7157
2020	1,787	0.1734089	0.4655057	-0.9698640	0.9829143	2.6844
2021	1,787	0.1444200	0.3913864	-0.8871730	0.9225627	2.7101
2022	1,778	0.2229592	0.4438255	-0.9316515	0.9757753	1.9906
2023	1,753	0.3041672	0.5076554	-0.9529413	0.9926646	1.6690

Note: Summary statistics: Detrented Correlation coefficient between company *i*'s losses and the industry losses by year (1999–2023).

Table OA2.17: FTS Groups and unaffiliated companies Sample 2
Summary statistics: Net losses and loss expense incurred by year (1999–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Min	Max
1999	842	212,438,498	252,302.25	1,343,736.71	1	27,172,137
2000	849	225,907,905	266,087.05	1,440,232.62	1	29,576,579
2001	868	253,852,110	292,456.35	1,636,866.86	1	35,272,293
2002	857	251,871,393	293,898.94	1,693,498.46	1	36,550,548
2003	854	263,898,977	309,015.20	1,742,723.97	1	36,142,636
2004	863	277,595,068	321,662.88	1,785,084.77	1	34,527,770
2005	866	301,056,223	347,639.98	1,993,280.34	2	38,802,151
2006	867	285,021,697	328,744.75	1,835,138.59	2	34,552,444
2007	901	305,571,487	339,147.04	1,933,145.88	1	37,115,057
2008	887	349,086,306	393,558.41	2,270,790.97	1	43,841,026
2009	872	317,512,832	364,120.22	2,110,662.50	1	43,148,612
2010	864	317,669,976	367,673.58	2,123,863.00	2	44,304,427
2011	852	352,088,151	413,249.00	2,352,879.13	1	47,704,237
2012	868	341,834,579	393,818.64	2,257,076.56	2	45,231,091
2013	885	328,008,464	370,631.03	2,143,519.05	1	44,975,965
2014	867	341,865,660	394,308.72	2,283,272.68	1	47,090,286
2015	887	355,257,530	400,515.82	2,354,187.96	1	47,884,283
2016	893	379,480,446	424,950.11	2,581,203.02	2	53,294,126
2017	885	416,136,535	470,210.77	2,852,907.50	1	57,033,235
2018	880	435,339,900	494,704.43	2,849,788.90	1	52,921,588
2019	872	446,855,787	512,449.30	2,943,917.11	1	52,235,775
2020	877	455,145,860	518,980.46	2,939,039.93	1	52,557,754
2021	864	506,954,586	586,752.99	3,465,746.08	2	58,681,190
2022	857	574,439,283	670,290.88	4,096,703.07	2	68,832,963
2023	848	627,585,187	740,076.87	4,519,132.06	2	83,277,428

Table OA2.18: ($\hat{\sigma}_i$) FTS Groups and unaffiliated companies Sample 2
($000 omitted)

Year	N	Mean	Std	Min	Max
1999	842	35,445.74	144,592.80	2.92	2,433,491.10
2000	849	37,221.16	146,263.11	3.52	2,048,966.23
2001	868	41,196.30	175,758.39	4.97	2,664,535.89
2002	857	44,220.03	200,303.20	5.06	3,473,703.88
2003	854	48,305.80	218,868.02	3.97	3,527,033.66
2004	863	54,889.60	255,223.62	1.87	3,982,968.44
2005	866	62,114.42	295,908.63	0.70	5,041,392.33
2006	867	62,943.70	305,475.53	0.84	5,670,628.35
2007	901	62,777.68	308,142.98	0.95	6,376,623.55
2008	887	70,003.48	336,430.31	3.37	6,914,804.88
2009	872	66,676.43	306,677.79	0.95	6,180,918.76
2010	864	61,850.94	270,039.27	0.95	4,832,031.99
2011	852	63,053.60	271,422.13	0.95	3,913,752.26
2012	868	59,124.25	255,582.50	0.95	4,054,974.74
2013	885	58,275.49	256,126.89	0.95	3,986,484.49
2014	867	57,926.90	255,284.55	4.64	3,876,707.40
2015	887	60,008.28	280,002.45	2.41	4,470,181.66
2016	893	58,290.38	286,576.14	2.49	5,076,876.38
2017	885	67,540.26	348,077.41	2.72	6,503,066.81
2018	880	75,833.13	396,058.31	0.63	7,383,658.90
2019	872	82,265.77	432,867.04	0.32	8,1434,04.02
2020	877	82,170.44	434,594.04	0.32	8,251,043.15
2021	864	947,74.35	535,252.83	0.32	10,541,127.42
2022	857	112,749.68	669,588.88	0.32	12,801,432.48
2023	848	133,175.42	767,631.54	0.88	11,236,696.84

Note: Summary statistics: Raw Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (1999–2023).

Table OA2.19: ($\hat{\rho}_i$) FTS Groups and unaffiliated companies Sample 2

Year	N	Mean	Std	Min	Max
1999	842	0.4582021	0.5397633	-0.9703992	0.9714910
2000	849	0.4256767	0.5621793	-0.9323654	0.9807786
2001	868	0.4207913	0.5513787	-0.9192239	0.9868139
2002	857	0.4447435	0.5630046	-0.9555623	0.9897574
2003	854	0.4599169	0.5611528	-0.9607217	0.9956393
2004	863	0.4782765	0.5557820	-0.9691315	0.9959253
2005	866	0.4953638	0.5583144	-0.9493773	0.9943744
2006	867	0.4865091	0.5606947	-0.9533898	0.9950528
2007	901	0.4751910	0.5588997	-0.9593293	0.9851949
2008	887	0.4600376	0.5625427	-0.9216893	0.9877887
2009	872	0.4241771	0.5584742	-0.9014436	0.9843718
2010	864	0.3754707	0.5582730	-0.9084753	0.9850996
2011	852	0.3549288	0.5499201	-0.9176632	0.9851497
2012	868	0.3149773	0.5438706	-0.9001097	0.9797809
2013	885	0.2726843	0.5281308	-0.8962236	0.9685895
2014	867	0.2760357	0.5258044	-0.9139016	0.9552408
2015	887	0.2753037	0.5390516	-0.9180757	0.9646192
2016	893	0.2695586	0.5587759	-0.8979984	0.9884284
2017	885	0.3210043	0.5602746	-0.9641799	0.9884347
2018	880	0.3586351	0.5818723	-0.9774711	0.9929838
2019	872	0.3747197	0.5911957	-0.9806438	0.9938098
2020	877	0.3482611	0.6020103	-0.9869020	0.9931503
2021	864	0.3675293	0.6185183	-0.9806519	0.9970526
2022	857	0.3937178	0.6123351	-0.9799718	0.9947245
2023	848	0.4355811	0.5831876	-0.9836974	0.9957601

Note: Summary statistics: Raw Correlation coefficient between groups and unaffiliated company *i*'s losses and the industry losses by year (1999–2023).

Table OA2.20: ($det\ \hat{\sigma}_i$) FTS Groups and unaffiliated companies Sample 2 ($000 omitted)

Year	N	Mean	Std	Min	Max
1999	842	19,020.50	88,296.15	2.4151598	1,825,332.40
2000	849	20,016.86	89,401.74	3.4836801	1,620,662.00
2001	868	21,742.95	98,791.32	4.4517617	1,855,937.03
2002	857	22,631.63	100,952.76	4.2767872	1,999,336.88
2003	854	25,770.04	117,038.69	2.7915216	2,010,766.79
2004	863	27,470.07	127,957.68	1.4889040	2,420,617.83
2005	866	29,277.77	133,992.35	0.6904837	2,506,470.52
2006	867	29,434.85	138,184.14	0.7905162	2,124,213.03
2007	901	30,812.45	139,737.91	0.7302967	2,339,614.99
2008	887	34,947.51	149,017.01	3.1620647	2,477,974.45
2009	872	37,667.34	162,064.09	0.8090398	2,581,477.57
2010	864	38,383.42	174,528.64	0.8668997	3,260,453.37
2011	852	38,394.00	175,765.77	0.9078780	3,139,550.30
2012	868	36,426.63	161,431.88	0.9341987	2,518,030.14
2013	885	37,815.94	163,440.79	0.9470848	2,232,425.46
2014	867	37,168.95	152,497.37	4.6310328	2,213,480.30
2015	887	36,482.97	148,366.09	1.9691219	2,067,127.39
2016	893	33,005.58	133,797.96	1.9498770	2,051,858.56
2017	885	37,232.92	165,654.40	2.6598397	2,381,809.06
2018	880	37,599.64	163,018.78	0.5779332	2,297,066.22
2019	872	40,150.12	172,294.01	0.3113996	2,466,507.10
2020	877	40,152.19	172,814.13	0.3026260	2,632,140.22
2021	864	40,558.92	180,760.32	0.2889666	2,544,100.32
2022	857	45,296.31	222,551.09	0.2696799	3,760,115.25
2023	848	54,310.31	300,862.57	0.8181444	6,426,057.54

Note: Summary statistics: Detrented Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (1999–2023).

Table OA2.21: ($det\ \hat{\rho}_i$) FTS Groups and unaffiliated companies Sample 2

Year	N	Mean	Std	Min	Max
1999	842	0.0737906	0.2976860	-0.9113002	0.8809932
2000	849	0.0880346	0.3777057	-0.8848727	0.9062199
2001	868	0.1744023	0.4880856	-0.9165006	0.9584600
2002	857	0.2138801	0.4684246	-0.9355147	0.9344357
2003	854	0.2406392	0.4665278	-0.9147893	0.9570180
2004	863	0.2193823	0.4155582	-0.9028957	0.9617352
2005	866	0.2041872	0.4046419	-0.9139766	0.9275936
2006	867	0.0685664	0.3684314	-0.8896857	0.9554446
2007	901	0.0630561	0.4170703	-0.8996794	0.8945646
2008	887	0.0664739	0.3495255	-0.9130245	0.8875683
2009	872	0.1319914	0.3119212	-0.8294105	0.8955433
2010	864	0.1287995	0.3765150	-0.7584445	0.9147744
2011	852	0.1430629	0.3413696	-0.8047673	0.9100181
2012	868	0.1257701	0.3126331	-0.6604502	0.9035408
2013	885	0.1140450	0.3301017	-0.7208757	0.8915942
2014	867	0.1097407	0.3128532	-0.7816404	0.8635014
2015	887	0.1062847	0.3486837	-0.7870556	0.9130083
2016	893	0.1271336	0.3599488	-0.8494264	0.9489242
2017	885	0.1946553	0.4674133	-0.9073442	0.9672222
2018	880	0.1626788	0.5066650	-0.9266609	0.9606080
2019	872	0.1778420	0.5035217	-0.9615062	0.9796879
2020	877	0.1553911	0.4739425	-0.9698640	0.9666069
2021	864	0.1136421	0.4046705	-0.8871730	0.9377776
2022	857	0.2131508	0.4645255	-0.8760147	0.9836682
2023	848	0.2779086	0.5180328	-0.9529413	0.9729935

Note: Summary statistics: Detrented Correlation coefficient between groups and unaffiliated company *i*'s losses and the industry losses by year (1999–2023).

Table OA2.22: ($\hat{\sigma}_i$) NFTS Groups and unaffiliated companies Sample 2
($000 omitted)

Year	N	Mean	Std	Min	Max
1999	1,152	38,900.38	124,582.14	2.9154759	2,433,491.10
2000	1,108	39,807.47	128,962.07	3.5213634	2,048,966.23
2001	1,118	45,268.13	155,839.06	4.9665548	2,664,535.89
2002	1,091	49,651.31	178,598.03	5.0563491	3,473,703.88
2003	1,114	54,186.42	192,872.24	3.9721251	3,527,033.66
2004	1,178	62,202.87	219,764.34	1.8737959	3,982,968.44
2005	1,201	70,478.44	252,625.42	0.6992059	5,041,392.33
2006	1,225	72,531.37	258,482.10	0.8432740	5,670,628.35
2007	1,272	72,603.05	260,832.26	0.9486833	6,376,623.55
2008	1,269	81,090.81	282,839.06	3.3730962	6,914,804.88
2009	1,232	75,442.76	259,288.88	0.9486833	6,180,918.76
2010	1,203	68,157.48	229,846.95	0.9486833	4,832,031.99
2011	1,171	68,140.55	232,509.90	0.9486833	3,913,752.26
2012	1,132	64,133.30	224,799.15	0.9486833	4,054,974.74
2013	1,116	63,644.70	229,133.63	0.9486833	3,986,484.49
2014	1,064	63,177.52	231,520.02	4.6427961	3,876,707.40
2015	1,070	66,635.88	256,155.81	2.4129281	4,470,181.66
2016	1,054	65,298.45	265,069.91	2.4855136	5,076,876.38
2017	1,022	75,398.49	325,293.20	2.7162065	6,503,066.81
2018	1,010	84,736.63	371,349.75	0.6324555	7,383,658.90
2019	995	92,141.77	406,967.84	0.3162278	8,143,404.02
2020	992	89,728.53	409,764.70	0.3162278	8,251,043.15
2021	992	106,551.06	501,258.11	0.3162278	10,541,127.42
2022	993	129,877.79	624,733.56	0.3162278	12,801,432.48
2023	986	151,642.76	714,775.40	0.8755950	11,236,696.84

Note: Summary statistics: Raw Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (1999–2023).

Table OA2.23: ($\hat{\rho}_i$) NFTS Groups and unaffiliated companies Sample 2

Year	N	Mean	Std	Min	Max
1999	1,152	0.4533342	0.4698575	-0.9703992	0.9738872
2000	1,108	0.4276573	0.4991161	-0.9323654	0.9807786
2001	1,118	0.4149191	0.4936483	-0.9192239	0.9868139
2002	1,091	0.4395369	0.5062441	-0.9555623	0.9928669
2003	1,114	0.4527352	0.5007823	-0.9607217	0.9956393
2004	1,178	0.4693005	0.4848601	-0.9691315	0.9959253
2005	1,201	0.4812208	0.4839047	-0.9493773	0.9943744
2006	1,225	0.4703294	0.4822171	-0.9533898	0.9950528
2007	1,272	0.4637776	0.4775477	-0.9593293	0.9851949
2008	1,269	0.4469821	0.4782414	-0.9216893	0.9877887
2009	1,232	0.4120101	0.4760261	-0.9014436	0.9843718
2010	1,203	0.3698930	0.4769318	-0.9084753	0.9850996
2011	1,171	0.3417709	0.4736752	-0.9176632	0.9851497
2012	1,132	0.3091556	0.4795520	-0.9001097	0.9797809
2013	1,116	0.2733970	0.4727783	-0.8962236	0.9685895
2014	1,064	0.2787078	0.4775763	-0.9139016	0.9552408
2015	1,070	0.2801329	0.4939387	-0.9180757	0.9646192
2016	1,054	0.2765563	0.5177067	-0.8979984	0.9884284
2017	1,022	0.3214266	0.5250343	-0.9641799	0.9884347
2018	1,010	0.3576589	0.5470414	-0.9774711	0.9929838
2019	995	0.3698607	0.5573500	-0.9806438	0.9938098
2020	992	0.3495761	0.5685190	-0.9869020	0.9931503
2021	992	0.3651321	0.5811462	-0.9806519	0.9970526
2022	993	0.3888480	0.5732178	-0.9799718	0.9947245
2023	986	0.4258075	0.5451809	-0.9836974	0.9957601

Note: Summary statistics: Raw Correlation coefficient between groups and unaffiliated company *i*'s losses and the industry losses by year (1999–2023).

Table OA2.24: ($det\ \hat{\sigma}_i$) NFTS Groups and unaffiliated companies Sample 2 ($000 omitted)

Year	N	Mean	Std	Min	Max
1999	1,152	22,011.39	76,034.52	2.4151598	1,825,332.40
2000	1,108	22,417.68	78,790.40	3.4836801	1,620,662.00
2001	1,118	24,493.40	87,596.89	4.4517617	1,855,937.03
2002	1,091	25,391.91	90,023.16	4.2767872	1,999,336.88
2003	1,114	29,054.00	103,142.80	2.7915216	2,010,766.79
2004	1,178	31,386.90	110,170.51	1.4889040	2,420,617.83
2005	1,201	32,898.45	114,376.62	0.6904837	2,506,470.52
2006	1,226	33,591.02	116,907.65	0.7905162	2,124,213.03
2007	1,272	34,315.82	118,279.02	0.7302967	2,339,614.99
2008	1,269	38,544.66	125,317.90	3.1620647	2,477,974.45
2009	1,232	41,377.35	137,021.21	0.8090398	2,581,477.57
2010	1,203	43,105.23	148,563.25	0.8668997	3,260,453.37
2011	1,171	42,908.09	150,577.41	0.9078780	3,139,550.30
2012	1,132	40,109.63	141,970.02	0.9341987	2,518,030.14
2013	1,116	41,330.59	146,216.50	0.9470848	2,232,425.46
2014	1,064	39,863.88	138,274.99	4.6310328	2,213,480.30
2015	1,070	39,195.50	135,701.59	1.9691219	2,067,127.39
2016	1,054	35,285.53	123,761.11	1.9498770	2,051,858.56
2017	1,024	40,094.02	154,633.42	2.6598397	2,381,809.06
2018	1,010	40,523.59	152,872.97	0.5779332	2,297,066.22
2019	995	43,391.11	162,023.92	0.3113996	2,466,507.10
2020	992	42,080.48	162,898.62	0.3026260	2,632,140.22
2021	992	43,345.89	169,219.64	0.2889666	2,544,100.32
2022	993	49,802.52	207,546.82	0.2696799	3,760,115.25
2023	986	61,354.29	280,069.04	0.8181444	6,426,057.54

Note: Summary statistics: Detrented Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (1999–2023).

Table OA2.25: ($det\ \hat{\rho}_i$) NFTS Groups and unaffiliated companies Sample 2

Year	N	Mean	Std	Min	Max
1999	1,152	0.0931507	0.2567889	-0.9113002	0.8809932
2000	1,108	0.1084120	0.3329742	-0.8848727	0.9062199
2001	1,118	0.1888922	0.4323385	-0.9165006	0.9584600
2002	1,091	0.2246220	0.4167042	-0.9355147	0.9344357
2003	1,114	0.2483449	0.4099204	-0.9147893	0.9570180
2004	1,178	0.2258472	0.3569273	-0.9028957	0.9617352
2005	1,201	0.2167726	0.3452684	-0.9139766	0.9275936
2006	1,226	0.0916111	0.3124010	-0.8896857	0.9554446
2007	1,272	0.0896285	0.3540254	-0.8996794	0.8945646
2008	1,269	0.0902788	0.2947609	-0.9130245	0.8875683
2009	1,232	0.1378985	0.2631364	-0.8294105	0.8955433
2010	1,203	0.1396687	0.3201347	-0.7584445	0.9147744
2011	1,171	0.1488828	0.2918409	-0.8047673	0.9100181
2012	1,132	0.1313155	0.2742947	-0.6604502	0.9035408
2013	1,116	0.1220889	0.2947764	-0.7208757	0.8915942
2014	1,064	0.1157216	0.2830714	-0.7816404	0.8635014
2015	1,070	0.1147983	0.3183565	-0.7870556	0.9130083
2016	1,054	0.1344597	0.3322788	-0.8494264	0.9489242
2017	1,024	0.2017260	0.4357763	-0.9073442	0.9672222
2018	1,010	0.1722915	0.4740943	-0.9266609	0.9606080
2019	995	0.1859773	0.4723639	-0.9615062	0.9796879
2020	992	0.1635044	0.4464262	-0.9698640	0.9666069
2021	992	0.1216691	0.3785298	-0.8871730	0.9377776
2022	993	0.2150519	0.4328375	-0.8760147	0.9836682
2023	986	0.2756218	0.4818625	-0.9529413	0.9729935

Note: Summary statistics: Detrended Correlation coefficient between group and unaffiliated company *i*'s losses and the industry losses by year (1999–2023).

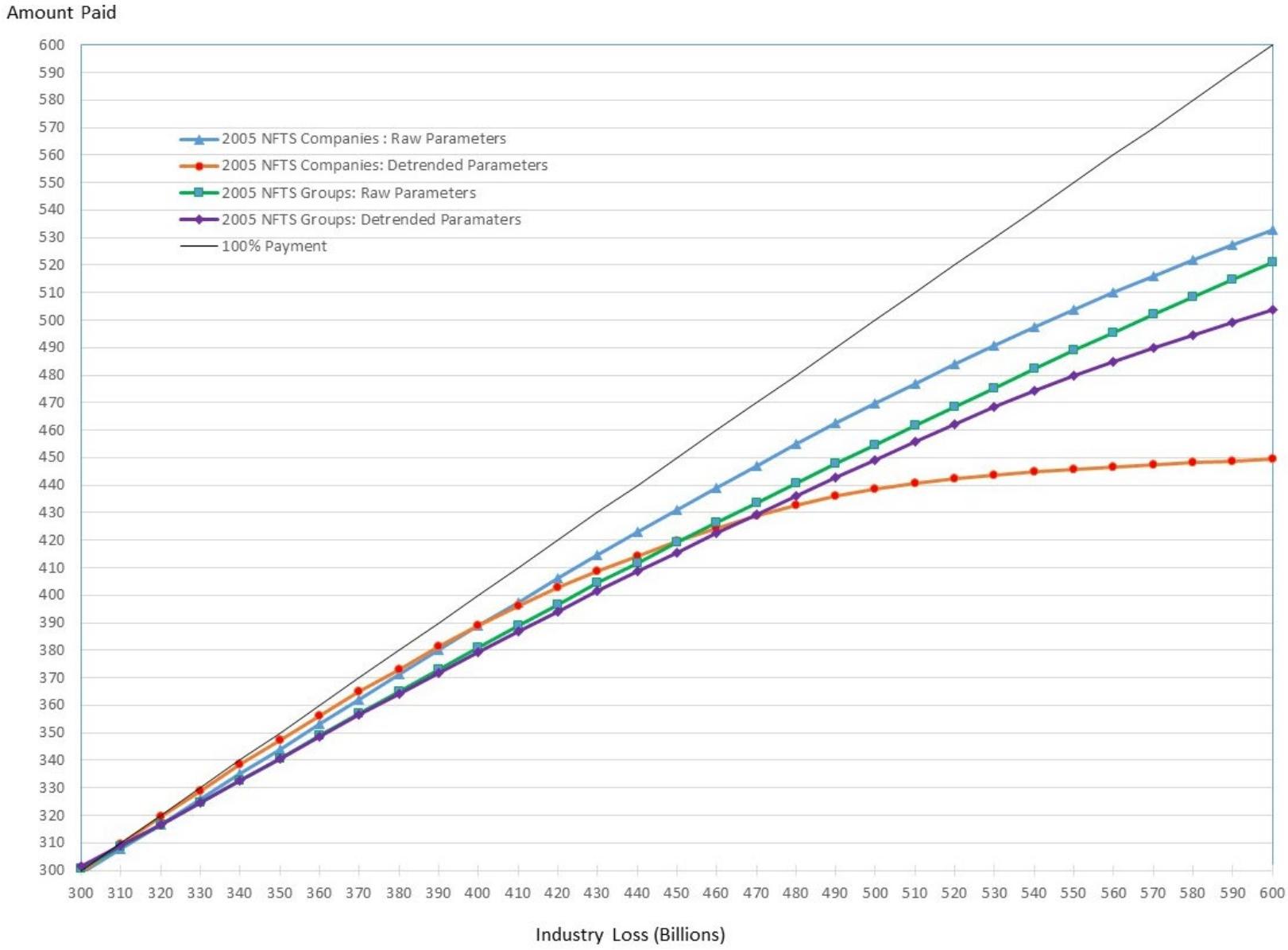

Figure OA2.5: Response functions national net loss, 2005 (NFTS)

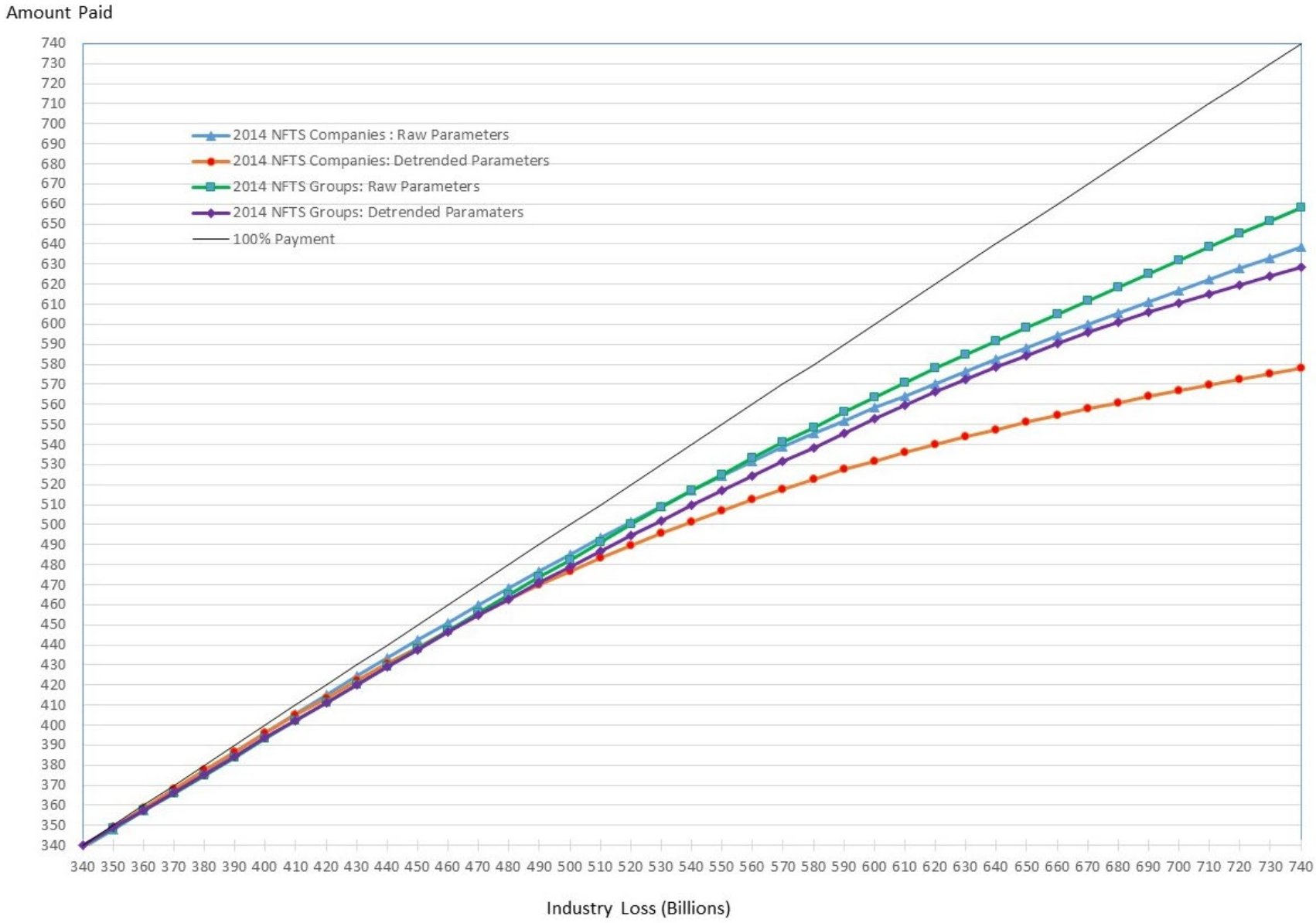

Figure OA2.6: Response functions national net loss, 2014 (NFTS)

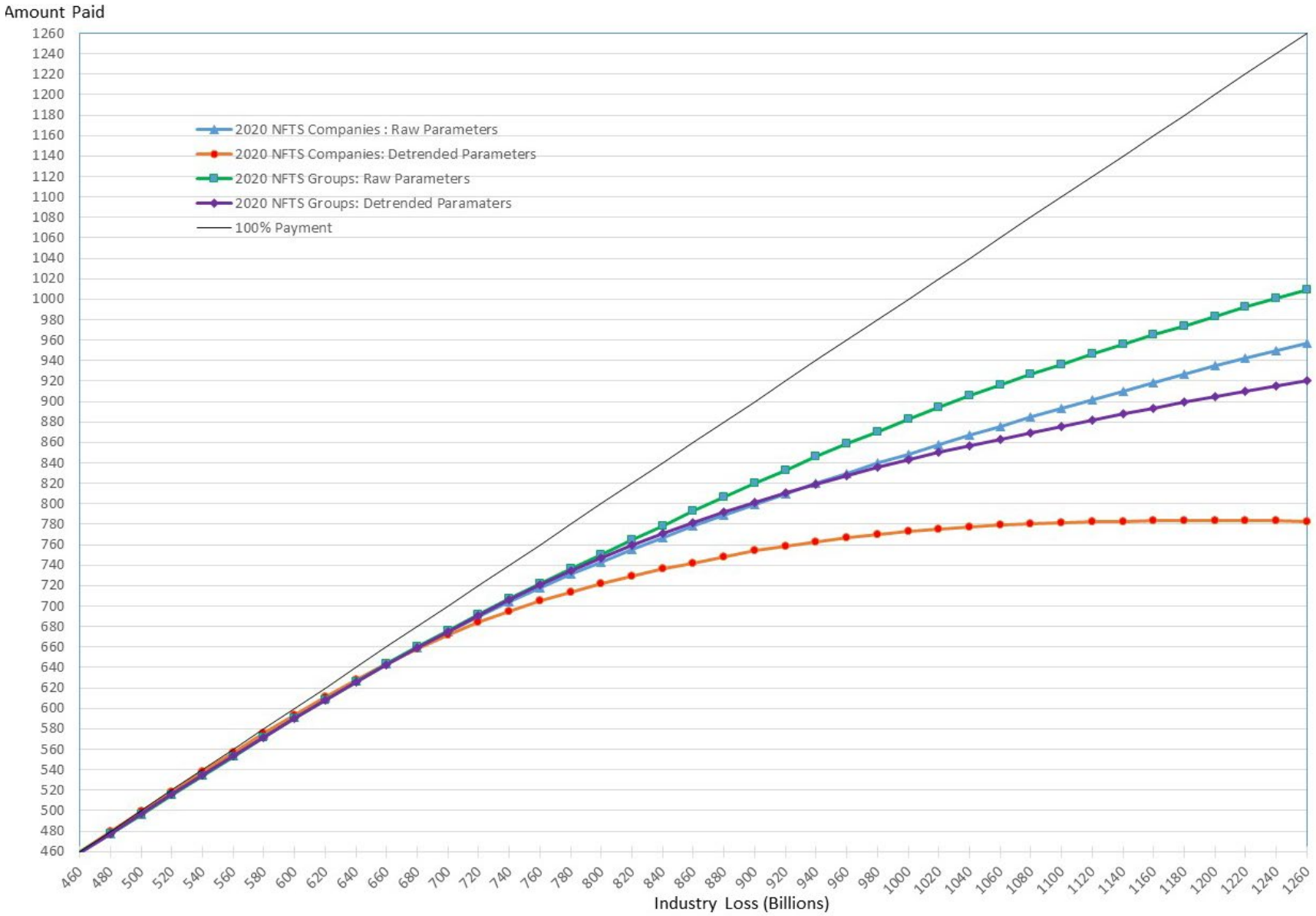

Figure OA2.7: Response functions national net loss, 2020 (NFTS)

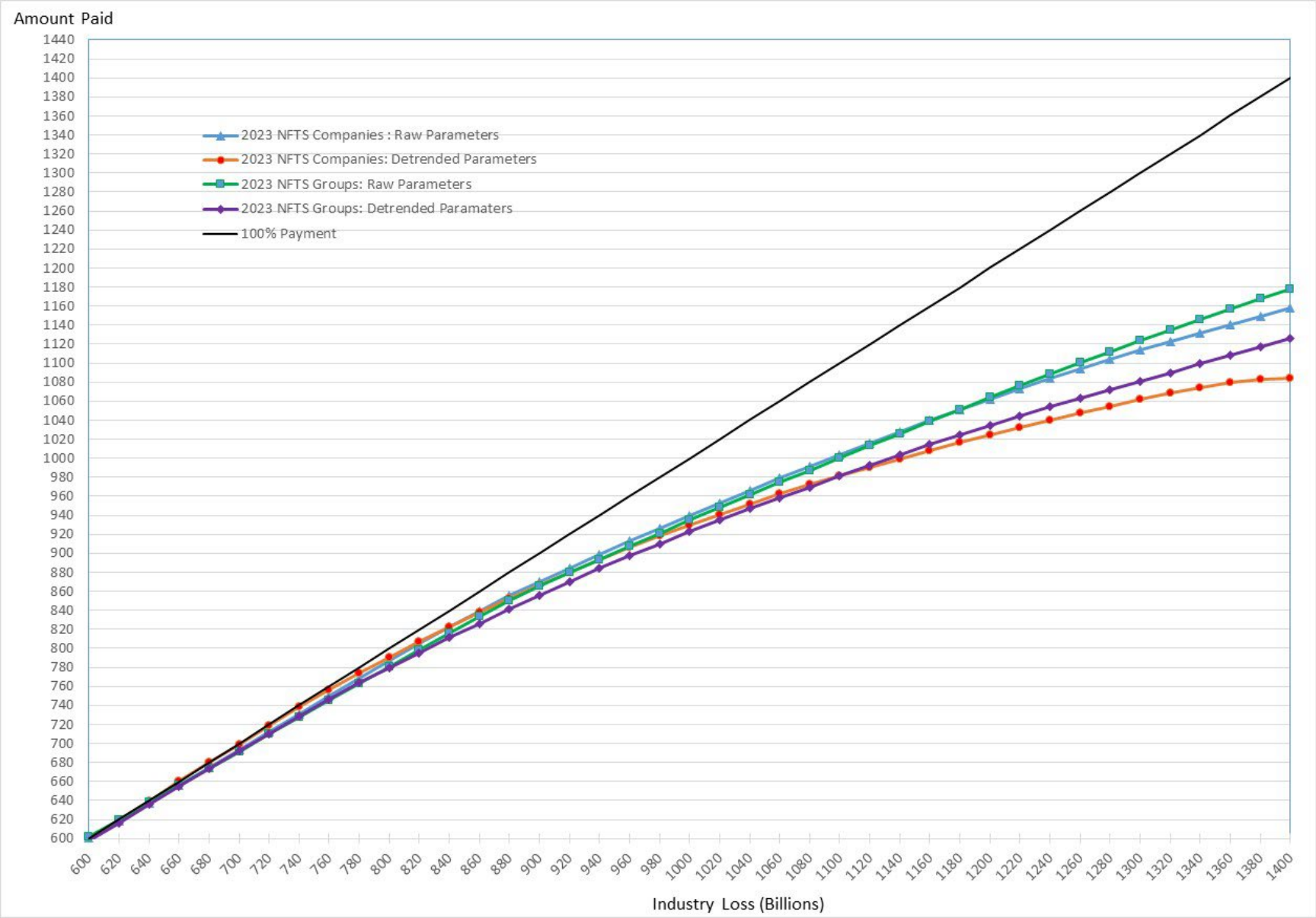

Figure OA2.8: Response functions national net loss, 2023 (NFTS)

Online appendix OA3 – Sample 3

Table OA3.1 reports net losses and equity capital from the FTS Sample 3 data across various years, disaggregated by all companies, and groups and unaffiliated companies. As shown in the table, the ratio of net losses to equity capital has generally declined over time.

In 2005, net losses amounted to $287 billion across 1,314 insurance companies. This figure rose to $448 billion in 2020 for 1,407 insurers, and further to $622billion in 2023 for 1,420 companies. Despite this increase in total net losses, the ratio of net losses to equity capital decreased from 61% in 2005 to 42% in 2020, before rising slightly to 52% in 2023.

Table OA3.1: FTS Sample 3
Summary statistics: Losses and equity capital
($000 omitted)

	Insurance industry FTS		Number of firms
Sample	Net losses incurred	Equity capital	
2005			
Groups & unaffiliated companies	287,487,717	472,358,567	747
All companies	287,487,717	472,358,567	1,314
2014			
Groups & unaffiliated companies	335,638,810	768,051,416	726
All companies	335,638,810	768,051,416	1,385
2020			
Groups & unaffiliated companies	448,309,430	1,069,230,397	784
All companies	448,309,430	1,069,230,397	1,407
2023			
Groups & unaffiliated companies	622,484,177	1,194,453,428	795
All companies	622,484,177	1,194,453,428	1,420

Samples 1 and 2 provide 10 annual observations per insurer, while Sample 3 offers 15 annual observations per insurer. The number of companies or groups included in Sample 3 is consistently lower than in samples 1 and 2, though the gap narrows over time. In 2005, FTS Sample 3 includes 264 fewer companies than Sample 1 and 310 fewer than Sample 2. By 2014, these differences decrease to 189 and 220, respectively. In 2020, the gaps further narrow to 102 (vs. Sample 1) and

163 (vs. Sample 2), and by 2023, the differences are only 25 and 107, respectively. This trend indicates a convergence in sample sizes over time.

For groups and unaffiliated companies, the number of entities in Sample 3 is also lower compared to Sample 1—by 106 in 2005, 118 in 2014, 57 in 2020, and just 8 in 2023. Compared to Sample 2, the reductions are 119, 141, 93, and 53, respectively.

To estimate the industry observed response function, we need, for each company *i*, to calculate the standard deviation of the net losses ($\hat{\sigma}_i$) and the correlation coefficient between company *i*'s losses and the industry losses ($\hat{\rho}_i$).

By inserting the financial characteristics of the NFTS firms into the estimated equations, we obtain fitted parameters of the standard deviation and correlation coefficient and used these values for company not in the FTS sample, called NFTS estimates. On average, the detrented standard deviation for all companies are lower than those from FTS sample.

As expected, detrending reduces the magnitudes of loss standard deviations and the correlations between companies and industry losses. Because detrending leads to larger reductions in correlations than the standard deviations, we expect the estimated loss payments to be lower for the detrended parameter estimates than for the raw estimates.

The average value of the raw and detrended parameter estimates for all companies and groups and unaffiliated companies are presented in Table OA3.2 for FTS and NFTS samples from Sample 3. The detrended standard deviations and correlations are higher in 2023.

On average, the detrended standard deviation increases over time across all samples. In 2023, Sample 3 exhibits the highest values, followed by Sample 1 (for group and unaffiliated companies), while Sample 2 (for all companies) shows the lowest values. This indicates that relative variability is most pronounced in Sample 3 and least in Sample 2.

On average, for Sample 1, the detrended correlation increases over time, except for 1997, where it is higher than in 2005. After 2005, the upward trend resumes, continuing through 2014, 2020, and 2023. For samples 2 and 3, the detrended correlation in 2005 is higher than in 2014, but lower than in 2023, indicating a U-shaped pattern over the period.

When comparing detrended correlation coefficients across samples in 2023, Sample 1 shows the highest values, followed by Sample 3, with Sample 2 generally showing the lowest values. An exception is observed for all NFTS companies: in this case, Sample 3 shows a lower correlation value than Sample 2.

Table OA3.2: Detrended and raw parameter estimates:
Property-liability insurance industry with values from Sample 3

	Average				
Case	Detrended sigma × 10^8	Detrended correlation	Raw Sigma × 10^8	Raw Correlation	Number of firms
2005					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.3573	0.2186	0.7330	0.5283	747
All companies	0.2765	0.2013	0.5103	0.4599	1,314
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.4173	0.2412	0.8479	0.5042	1,201
All companies	0.1689	0.1594	0.5637	0.4555	2,152
2014					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.5018	0.1411	0.8730	0.4476	867
All companies	0.3663	0.1481	0.5761	0.3991	1,605
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.5454	0.1597	0.9520	0.4233	1,064
All companies	0.2638	0.1078	0.5970	0.3931	1,922
2020					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.5223	0.1883	1.0606	0.3762	784
All companies	0.3862	0.2023	0.6929	0.3833	1,407
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.5523	0.2011	1.2135	0.3738	992
All companies	0.3041	0.1621	0.7731	0.3802	1,787
2023					
Insurance industry (FTS)					
Groups & unaffiliated companies	0.6910	0.2923	1.5274	0.4502	795
All companies	0.4671	0.3043	0.9344	0.4746	1,420
Insurance industry (NFTS)					
Groups & unaffiliated companies	0.7889	0.2880	1.8057	0.4310	986
All companies	0.3785	0.2618	1.0487	0.4560	1,753

Note: FTS: Full-time samples. NFTS: Non-full-time sample.

The response functions are calculated for various values of *L*, the total industry net loss. The response functions for the insurance industry Sample 3 are shown in figures OA3.1 to OA3.4 respectively for 2005, 2014, 2020 and 2023. This sample is composed of firms that have FTS. The horizontal axis measures possible values for aggregate insurance industry net losses. The vertical axis measures the expected payout of all firms considered.

The figures show the estimated amounts that would be paid for the industry losses, spanning from the actual expected losses adding unexpected losses for a given year: spanning from $300 billion to $600 billion in 2005; from $340 billion to $740 billion in 2014; from $460 billion to $1,260 billion in 2020 and from $600 billion to $1,460 billion in 2023. These limits were chosen because total losses and loss expenses for the US property-liability insurance industry and the total equity capital. Four response curves are shown in the figure based on raw and detrended parameters for group and company sample. Our main interpretation will be for detrended parameters for all companies.

Figure OA3.1 shows that in 2005 the response curve with detrended FTS data from Sample 3 begins to diverge from the 45° line approximately at $350 billion and that the 2020 response curve begins to diverge from the 45° line approximately at $620 billion (same amount as in Sample 1) and that the 2023 response curve begins to diverge from the 45° line approximately at $ billion .

The corresponding numbers for realized capacity are presented in Table OA3.3. Realized capacity is obtained as the ratio, at the chosen loss level, of the value of the response curve E(L)Z to the value of the maximum curve E(L)C.

In FTS Sample 3, all companies were able to cover 96.4% of a $100 billion loss in 2005, but only 85.2% of a $200 billion loss. In 2020, these percentages increased to 99.3% and 96.2%, respectively. That year, industry also appeared capable of covering 84.2% of a $400 billion event (85.2% in the NFTS sample). In 2023, the industry seemed able to cover 90.5% of a $400 billion loss (91.0% NFTS) and 79.8% of a $700 billion loss (80.3% NFTS).

Table OA3.3: Capacity from Sample 3 with detrended values

	%			
2005	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	98.3	91.5	82.2	73.3
All companies	96.4	85.2	72.6	61.2
Insurance industry (NFTS)				
Groups & unaffiliated companies	94.6	88.1	83.8	78.1
All companies	98.0	88.3	76.6	65.0

	%			
2014	100 billion	200 billion	300 billion	400 billion
Insurance industry (FTS)				
Groups & unaffiliated companies	98.1	92.5	85.6	79.1
All companies	96.6	89.4	81.0	72.3
Insurance industry (NFTS)				
Groups & unaffiliated companies	95.6	90.9	84.7	79.1
All companies	97.4	90.7	82.6	73.9

	%					
2020	100 billion	200 billion	300 billion	400 billion	500 billion	600 billion
Insurance industry (FTS)						
Groups & unaffiliated companies	99.7	97.8	97.1	89.6	85.2	80.8
All companies	99.3	96.2	90.4	84.2	78.6	73.4
Insurance industry (NFTS)						
Groups & unaffiliated companies	98.3	96.4	93.1	89.6	85.3	81.6
All companies	99.5	96.9	91.4	85.2	79.6	74.4

	%					
2023	100 billion	200 billion	300 billion	400 billion	500 billion	600 billion
Insurance industry (FTS)						
Groups & unaffiliated companies	99.7	98.0	95.6	92.8	89.8	86.7
All companies	99.5	97.3	94.1	90.5	86.6	82.8
Insurance industry (NFTS)						
Groups & unaffiliated companies	98.2	96.1	93.5	90.4	89.4	83.1
All companies	99.6	97.4	94.4	90.8	86.7	84.4

Tables OA3.4 report net losses and capital for all years of our data (2004-2023). Summary statistics on equity capital, the other determinant for computing industry capacity, are presented in tables OA3.5 for the same period.

Table OA3.4: FTS Sample 3
Summary statistics: Net losses and loss expense incurred by year (2004–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Max	CV
2004	1,237	264,503,191	213,826	1,052,472	27,059,473	4.9221
2005	1,314	287,487,717	218,788	1,152,654	29,846,734	5.2684
2006	1,367	274,902,657	201,099	995,308	25,459,006	4.9493
2007	1,382	289,964,171	209,815	1,032,292	26,371,754	4.9200
2008	1,426	335,444,768	235,235	1,135,859	28,142,990	4.8286
2009	1,439	306,754,410	213,172	1,086,599	28,701,847	5.0973
2010	1,443	307,905,021	213,378	1,107,813	29,717,899	5.1918
2011	1,438	342,188,269	237,961	1,192,243	30,474,865	5.0102
2012	1,440	335,233,522	232,801	1,157,314	30,204,525	4.9713
2013	1,415	321,412,915	227,147	1,166,891	31,447,613	5.1372
2014	1,385	335,638,810	242,338	1,264,738	32,970,073	5.2189
2015	1,411	349,653,387	247,805	1,306,360	34,203,391	5.2717
2016	1,399	374,753,733	267,873	1,451,008	38,768,776	5.4168
2017	1,401	410,793,280	293,214	1,524,343	38,816,047	5.1987
2018	1,408	429,370,329	304,951	1,495,464	36,187,577	4.9039
2019	1,406	441,127,949	313,747	1,535,221	36,311,052	4.8932
2020	1,407	448,309,430	318,628	1,480,309	31,865,776	4.6459
2021	1,425	496,775,532	348614	1,727,779	39,398,537	4.9561
2022	1,433	564,371,241	393839	2,031,822	47,965,604	5.1590
2023	1,420	622,484,177	438369	2,343,010	570,03,028	5.3448

Note: FTS: Full-time samples.

Table OA3.5: FTS Sample 3

Summary statistics: Equity capital by year (2004–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Min	Max	CV
2004	1,237	424,505,481	343,173	1,806,940	1	46,144,211	5.2654
2005	1,314	472,358,567	359,481	1,888,726	107	50,187,253	5.2540
2006	1,367	547,659,699	400,629	2,182,941	246	58,034,268	5.4488
2007	1,382	589,061,477	426,238	2,329,006	346	63,577,269	5.4641
2008	1,426	534,548,107	374,858	1,935,882	66	53,273,952	5.1643
2009	1,439	597,343,315	415,110	2,204,569	168	58,180,271	5.3108
2010	1,443	647,522,802	448,734	2,722,582	266	68,437,054	6.0673
2011	1,438	636,826,755	442,856	2,738,029	68	70,155,428	6.1827
2012	1,440	68,2782,249	474,154	3,007,913	37	78,861,515	6.3437
2013	1,415	746,776,490	527,757	3,574,915	3	97,226,052	6.7738
2014	1,385	768,051,416	554,550	3,645,278	2	93,997,652	6.5734
2015	1,411	778,215,499	551,535	3,582,339	5	89,828,619	6.4952
2016	1,399	813,843,448	581,732	3,906,138	401	101,285,906	6.7147
2017	1,401	870,517,591	621,354	4,604,487	413	128,562,566	7.4104
2018	1,408	863,508,966	613,288	4,531,000	348	122,471,087	7.3880
2019	1,406	994,499,796	707,326	5,757,755	256	167,718,679	8.1402
2020	1,407	1,069,230,397	759,936	6,355,109	167	187,762,294	8.3627
2021	1,425	1,211,976,278	850,510	7,719,833	107	239,470,233	9.0767
2022	1,433	1,124,374,606	784,630	6,788,244	182	207,276,468	8.6515
2023	1,420	1,194,453,428	84,1164	7,368,001	67	225,582,882	8.7593

Note: FTS: Full-time samples.

Table OA3.6: FTS Sample 3
($000 omitted)

Year	L_{t-14}	L_{t-13}	L_{t-12}	…	L_{t-2}	L_{t-1}	L_t	$\bar{L}$	$\hat{\sigma}$
2004	148,999,366	154,443,808	167,877,353	…	237,886,545	253,204,795	264,503,191	195,402,444	36,987,950.05
2005	153,889,337	166,332,196	158,834,720	…	254,938,814	266,709,049	287,487,717	204,727,347	42,196,403.19
2006	165,372,484	158,494,474	174,285,852	…	267,852,091	289,331,774	274,902,657	213,312,118	43,891,065.35
2007	157,975,308	173,886,885	172,189,022	…	291,072,432	276,921,632	289,964,171	221,596,466	46,557,074.71
2008	175,188,896	173,470,666	183,846,948	…	279,359,332	294,283,112	335,444,768	234,786,830	51,713,511.82
2009	173,484,842	183,888,602	181,454,633	…	293,507,470	335,502,036	306,754,410	243,782,036	52,083,795.56
2010	180,224,307	178,439,625	187,494,458	…	336,332,946	308,471,486	307,905,021	251,463,314	52,180,663.75
2011	176,626,139	185,788,643	193,898,815	…	306,936,444	307,397,321	342,188,269	261,080,128	53,334,746.80
2012	184,928,009	194,582,973	209,392,567	…	309,386,531	343,771,374	335,233,522	272,719,823	51,499,470.59
2013	189,973,582	204,840,387	231,333,881	…	337,611,159	329,020,262	321,412,915	276,980,850	46,745,636.79
2014	203,221,052	229,481,349	231,217,844	…	326,453,493	320,060,325	335,638,810	283,848,956	41,738,532.01
2015	229,701,945	231,521,439	248,460,174		322,047,383	338,663,859	349,653,387	295,273,855	39,249,136.99
2016	229,039,328	247,511,596	262,497,337		335,523,538	347,973,049	374,753,733	301,329,709	39,642,434.96
2017	245,717,383	260,574,010	281,903,102		347,276,505	373,677,808	410,793,280	312,712,219	43,967,598.18
2018	256,588,234	278,276,664	265,704,223		372,002,895	409,340,179	429,370,329	322,428,956	50,218,141.87
2019	277,151,229	264,786,847	276,614,729		408,051,610	427,812,742	441,127,949	333,931,261	55,348,580.17
2020	263,247,674	274,680,698	307,462,312		426,522,710	440,303,925	448,309,430	343,358,251	60,785,234.50
2021	274,971,413	307,172,919	290,028,320		439,496,053	447,591,491	496,775,532	359,253,098	67,694,718.98
2022	303,378,903	286,381,453	286,655,789		441,890,499	492,395,164	564,371,241	373,521,049	82,817,801.86
2023	280,075,642	282,795,267	321,218,005		483,015,958	554,836,003	622,484,177	389,082,270	101,540,767.65

Note: Sum of the observed losses of company *i* were incurred in year *t-14 up to t* ($L_{t-14,}$ … L_t). Mean of $\bar{L}$ and $\hat{\sigma}$ of losses for the industry by year (2004–2023).

Table OA3.7: ($\hat{\sigma}_i$) FTS Sample 3
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
2004	1,237	49,780.35	170,609.61	5.73	3,618,578.85	3.4272
2005	1,314	51,030.08	179,498.04	6.11	3,845,429.32	3.5175
2006	1,367	50,683.90	174,596.61	6.30	3,526,813.30	3.4448
2007	1,382	52,374.29	175,355.10	6.27	3,290,493.04	3.3481
2008	1,426	56,933.81	186,650.03	6.19	3,158,760.30	3.2784
2009	1,439	57,331.26	188,734.21	5.92	3,222,894.32	3.2920
2010	1,443	57,162.85	188,345.83	5.80	3,264,642.47	3.2949
2011	1,438	58,612.28	194,561.10	5.14	3,272,819.44	3.3195
2012	1,440	58,739.45	190,982.45	4.32	3,040,593.75	3.2513
2013	1,415	58,033.82	187,577.01	0.77	2,798,325.46	3.2322
2014	1,385	57,608.06	193,004.85	3.95	3,054,550.34	3.3503
2015	1,411	57,612.30	205,161.11	3.98	4,107,800.61	3.5611
2016	1,399	57,268.90	223,205.33	2.85	5,013,368.92	3.8975
2017	1,401	61,055.71	253,356.54	2.85	6,108,732.75	4.1496
2018	1,408	63,677.70	272,299.87	2.46	6,909,486.53	4.2762
2019	1,406	66,961.47	289,748.09	2.40	7,621,411.37	4.3271
2020	1,407	69,294.22	304,492.55	2.20	8,190,674.39	4.3942
2021	1,425	73,294.27	325,929.06	2.60	8,867,351.08	4.4469
2022	1,433	80,790.31	370,764.67	3.32	9,623,961.62	4.5892
2023	1,420	93,443.42	442,281.04	0.56	9,975,996.18	4.7331

Note: Summary statistics: Standard deviation of the net losses and loss expense incurred for a company by year (2004–2023).

Table OA3.8: ($\hat{\rho}_i$) FTS Sample 3

Year	N	Mean	Std	Min	Max	CV
2004	1,237	0.4637	0.5651	-0.9653	0.9932	1.2187
2005	1,314	0.4599	0.5678	-0.9501	0.9959	1.2346
2006	1,367	0.4504	0.5734	-0.9498	0.9949	1.2731
2007	1,382	0.4481	0.5726	-0.9551	0.9921	1.2778
2008	1,426	0.4454	0.5694	-0.9513	0.9935	1.2784
2009	1,439	0.4478	0.5669	-0.9596	0.9865	1.2660
2010	1,443	0.4530	0.5593	-0.9498	0.9867	1.2347
2011	1,438	0.4614	0.5402	-0.9494	0.9889	1.1708
2012	1,440	0.4517	0.5354	-0.9452	0.9858	1.1853
2013	1,415	0.4184	0.5419	-0.9357	0.9848	1.2952
2014	1,385	0.3991	0.5424	-0.9507	0.9808	1.3591
2015	1,411	0.3661	0.5543	-0.9381	0.9886	1.5141
2016	1,399	0.3546	0.5548	-0.9366	0.9856	1.5646
2017	1,401	0.3476	0.5657	-0.9491	0.9869	1.6274
2018	1,408	0.3659	0.5634	-0.9467	0.9886	1.5398
2019	1,406	0.3767	0.5774	-0.9603	0.9900	1.5328
2020	1,407	0.3833	0.5834	-0.9668	0.9928	1.5220
2021	1,425	0.3988	0.5847	-0.9483	0.9896	1.4661
2022	1,433	0.4344	0.5716	-0.9358	0.9930	1.3158
2023	1,420	0.4746	0.5583	-0.9268	0.9955	1.1764

Note: Summary statistics: Correlation coefficient between company *i*'s losses and the industry losses by year (2004–2023).

Table OA3.9: ($det\ \hat{\sigma}_i$) FTS Sample 3
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
2004	1,237	27,296.67	84,659.14	4.58	125,6612.94	3.1014
2005	1,314	27,654.68	88,411.14	4.11	131,4722.85	3.1970
2006	1,367	27,464.23	91,451.69	4.03	159,3122.96	3.3298
2007	1,382	28,065.64	91,156.46	4.64	171,0220.57	3.2480
2008	1,426	31,270.40	103,169.81	5.75	171,5076.42	3.2993
2009	1,439	31,569.23	102,086.40	5.39	167,7031.61	3.2337
2010	1,443	32,293.24	104,187.90	5.66	166,6887.22	3.2263
2011	1,438	33,054.99	105,981.68	4.98	166,6155.71	3.2062
2012	1,440	34,110.42	107,462.51	4.29	164,3885.09	3.1504
2013	1,415	35,339.67	112,125.56	0.76	155,0253.11	3.1728
2014	1,385	36,632.79	122,138.51	3.95	203,4562.94	3.3341
2015	1,411	37,484.41	135,247.07	3.97	258,7674.99	3.6081
2016	1,399	35,671.85	136,162.30	2.72	288,7470.78	3.8171
2017	1,401	37,390.42	146,980.15	2.74	3,245,279.14	3.9310
2018	1,408	38,405.34	148,507.40	2.44	3,257,791.60	3.8668
2019	1,406	39,387.62	148,807.16	2.30	3,147,193.52	3.7780
2020	1,407	38,625.19	142,499.26	2.13	2,672,567.99	3.6893
2021	1,425	39,073.88	142,669.72	2.21	2,482,472.85	3.6513
2022	1,433	41,355.32	160,011.10	3.32	3,012,906.03	3.8692
2023	1,420	46,721.09	206,930.95	0.49	45,47,936.09	4.4291

Note: Summary statistics: Detrended Standard deviation of the net losses and loss expense incurred group and unaffiliated company by year (2004–2023).

Table OA3.10: ($det\ \hat{\rho}_i$) FTS Sample 3

Year	N	Mean	Std	Min	Max	CV
2004	1,237	0.1956	0.5021	-0.9158	0.9402	2.5670
2005	1,314	0.2013	0.5116	-0.9232	0.9599	2.5415
2006	1,367	0.1774	0.4474	-0.8212	0.9339	2.5220
2007	1,382	0.1653	0.4032	-0.8120	0.9478	2.4392
2008	1,426	0.1668	0.3640	-0.7770	0.9312	2.1823
2009	1,439	0.1512	0.2845	-0.7525	0.8486	1.8816
2010	1,443	0.1450	0.3399	-0.7774	0.8317	2.3441
2011	1,438	0.1303	0.3356	-0.7512	0.8034	2.5756
2012	1,440	0.1419	0.3667	-0.7382	0.8238	2.5842
2013	1,415	0.1581	0.3926	-0.7553	0.8611	2.4832
2014	1,385	0.1481	0.3813	-0.7278	0.8547	2.5746
2015	1,411	0.1209	0.3558	-0.6587	0.9072	2.9429
2016	1,399	0.1343	0.2890	-0.6867	0.8263	2.1519
2017	1,401	0.1635	0.3332	-0.8204	0.8794	2.0379
2018	1,408	0.1962	0.4020	-0.8897	0.9306	2.0489
2019	1,406	0.2125	0.4344	-0.8940	0.9497	2.0442
2020	1,407	0.2023	0.4456	-0.8961	0.9598	2.2027
2021	1,425	0.2238	0.4690	-0.8348	0.9356	2.0956
2022	1,433	0.2729	0.4908	-0.9087	0.9585	1.7985
2023	1,420	0.3043	0.5130	-0.9316	0.9792	1.6858

Note: Summary statistics: Detrended Correlation coefficient between group and unaffiliated company *i*'s losses and the industry losses by year (2004–2023).

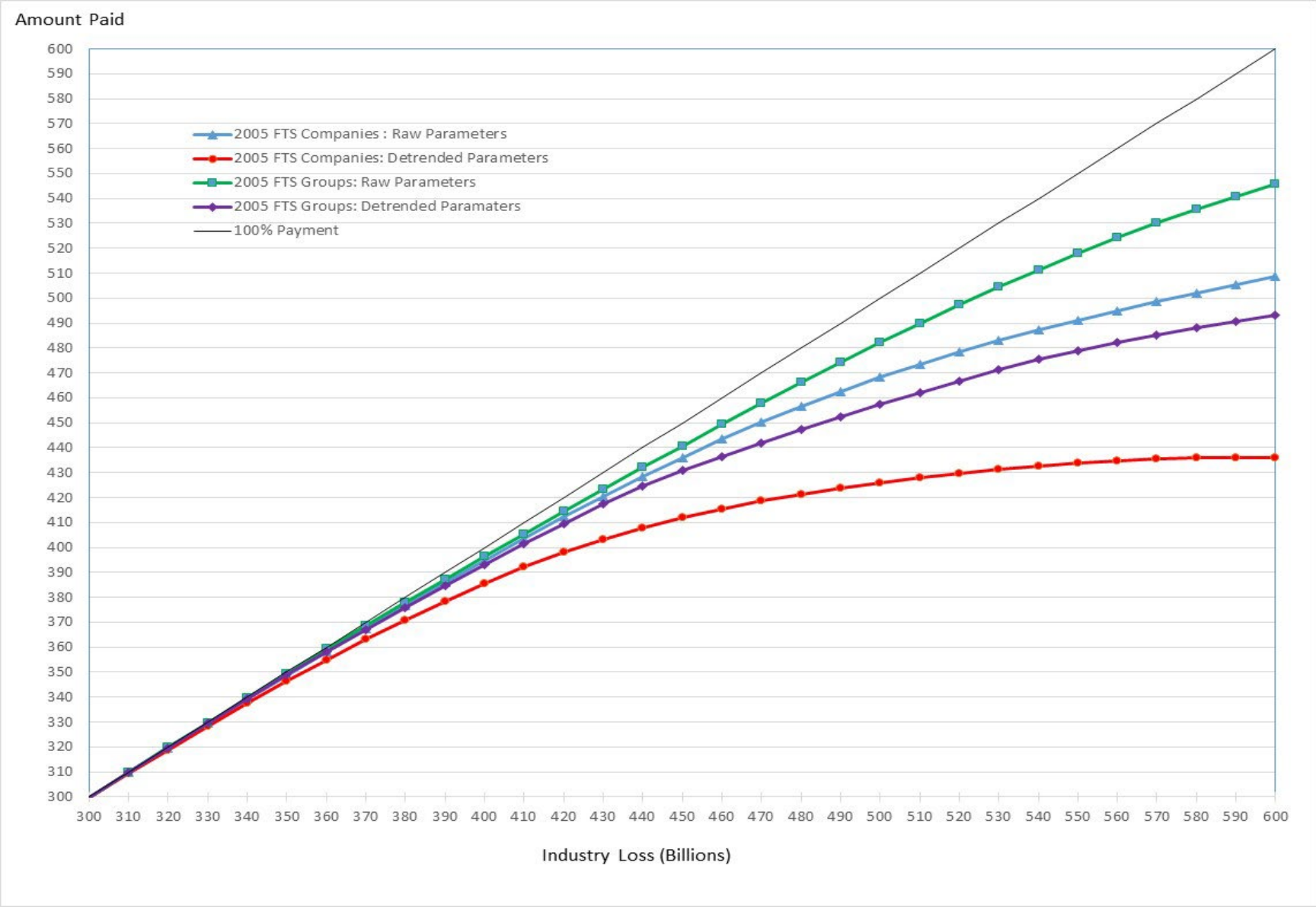

Figure OA3.1: Response functions national net loss, 2005 (FTS Sample 3)

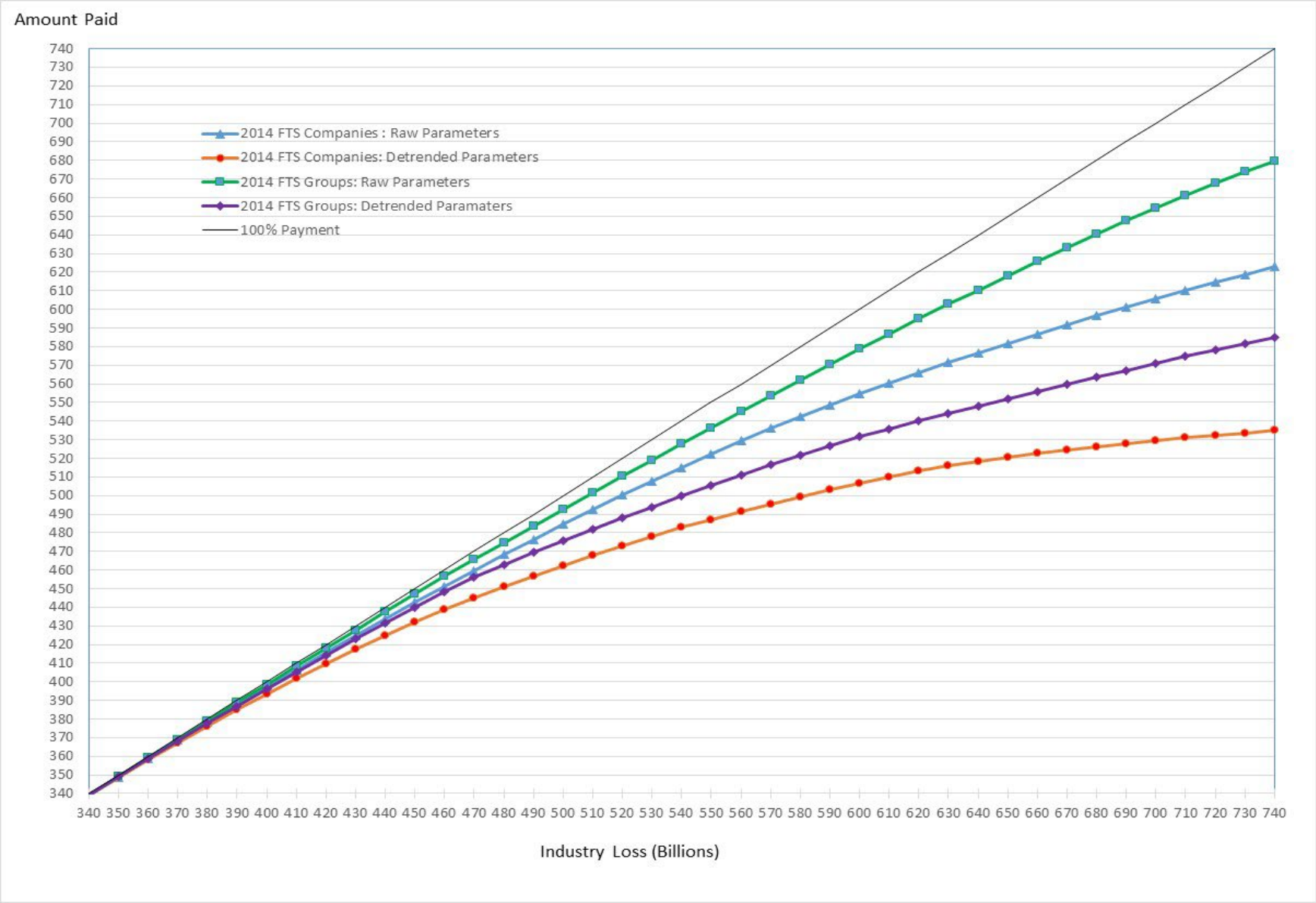

Figure OA3.2: Response functions national net loss, 2014 (FTS Sample 3)

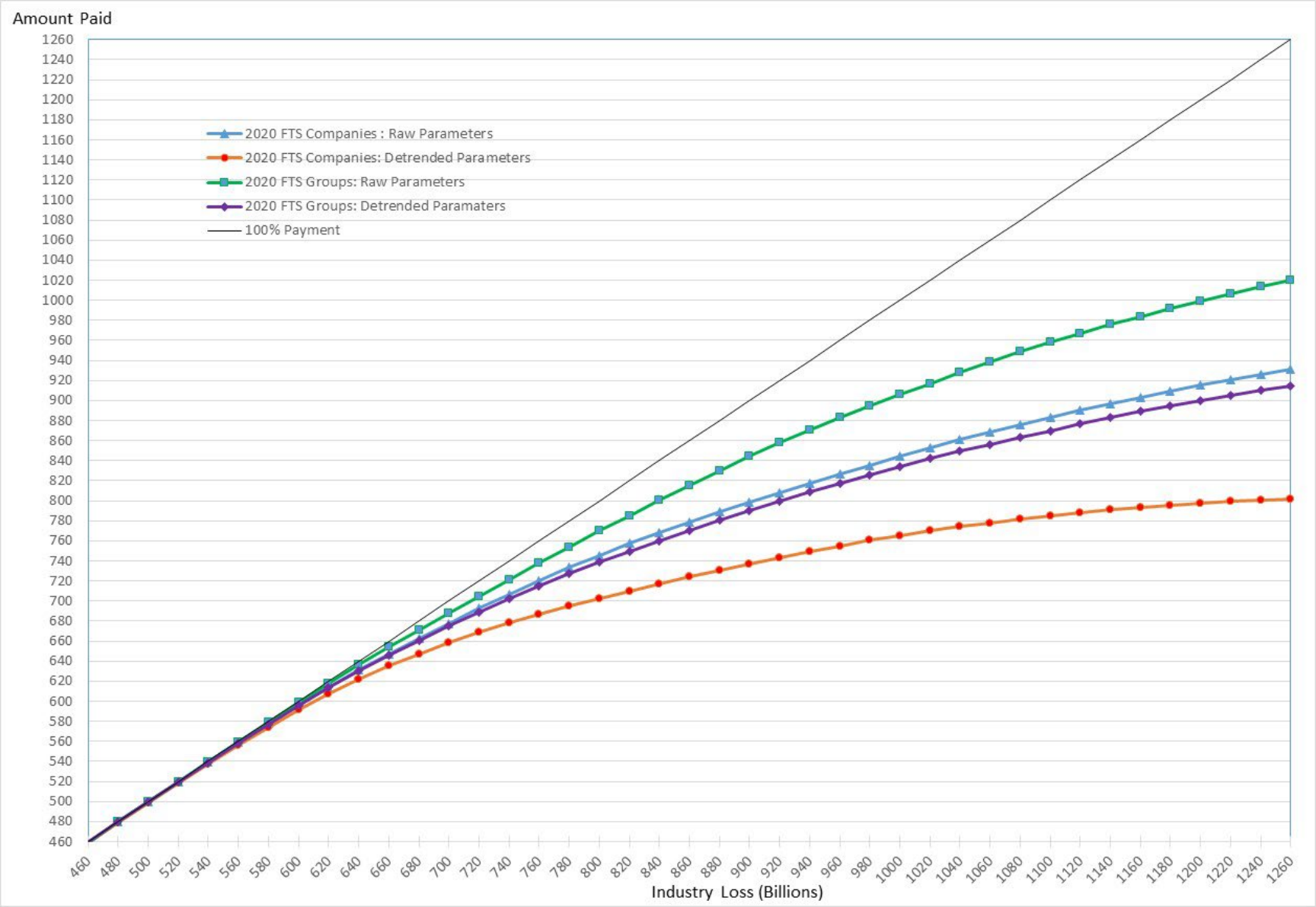

Figure OA3.3: Response functions national net loss, 2020 (FTS Sample 3)

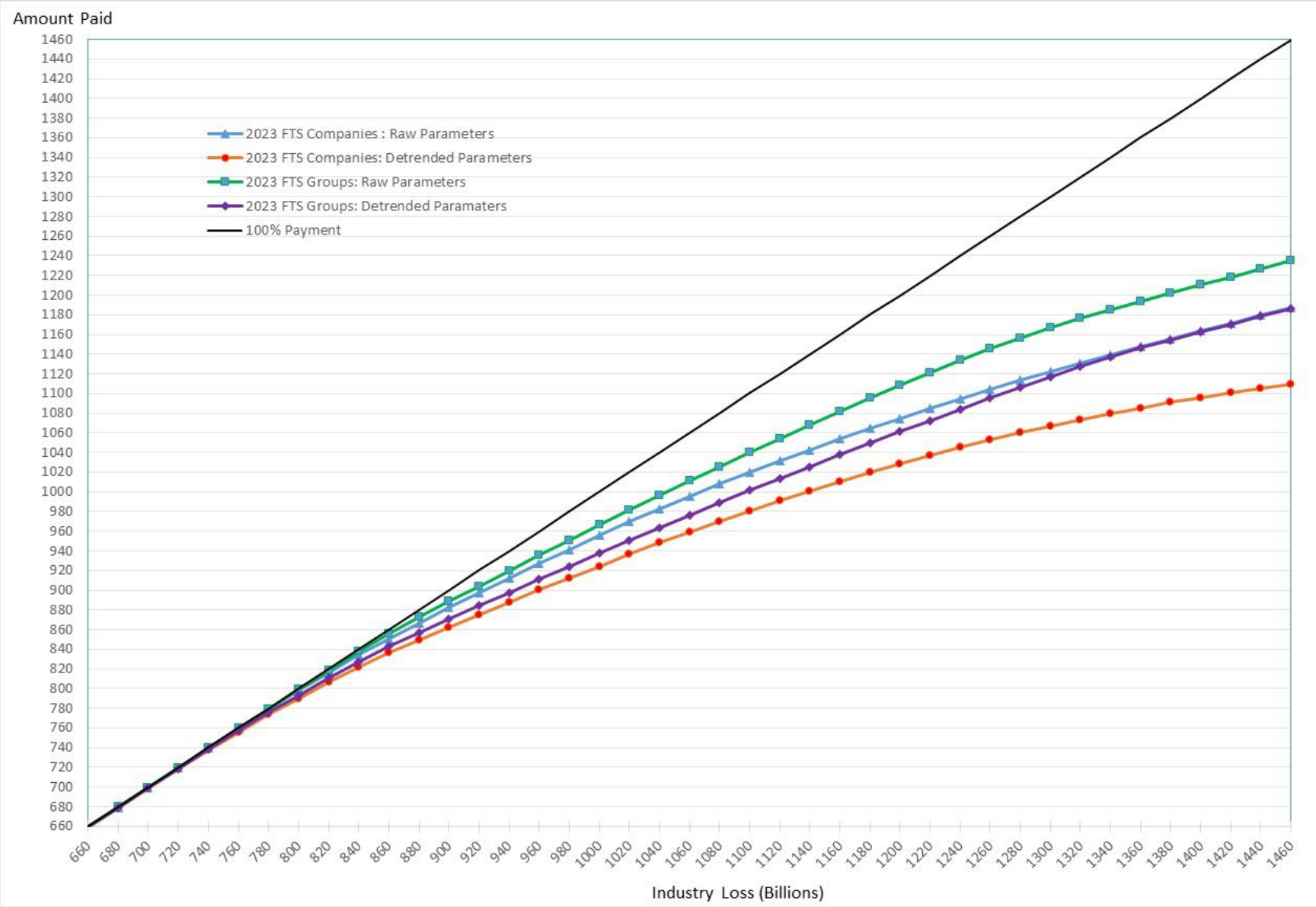

Figure OA3.4: Response functions national net loss, 2023 (FTS Sample 3)

Regression models for parameters estimations

Table OA3.11a: Sample 3
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2005

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.2355 8.61	-0.4021 -14.75	0.3842 5.40	0.1919 5.43
Ln(equity capital)	0.0463 11.69	0.0260 13.50	0.0745 7.79	0.0359 7.55
Ln(net losses incurred)	0.0042 1.38	-0.0002 -0.12	0.0035 0.45	0.0004 0.11
Short / Asset	0.1298 4.66	0.0599 4.43	0.2617 4.13	0.1147 3.64
Liquid asset / Asset	-0.0505 -1.53	-0.0420 -2.61	-0.1206 -1.40	-0.0701 -1.64
Sigma	0.1308 51.26	0.0749 51.26	0.2795 38.65	0.1389 38.65
Log likelihood	591	1,540	-108	414
AIC	-1,170	-3,068	228	-817
No. of observation	1,314	1,314	747	747

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.11b: Sample 3
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2014

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.2301	-0.5540	0.3725	0.2047
	8.51	-15.64	4.87	4.79
Ln(equity capital)	0.0504	0.0327	0.0749	0.0412
	12.77	12.93	7.16	7.06
Ln(net losses incurred)	0.0050	0.0014	0.0080	0.0030
	1.56	0.70	0.88	0.59
Short / Asset	0.1650	0.1005	0.2784	0.1403
	5.27	5.02	3.81	3.44
Liquid asset / Asset	-0.0426	-0.0278	-0.1046	-0.0590
	-1.29	-1.31	-1.11	-1.12
Sigma	0.1653	0.1057	0.3092	0.1726
	52.63	52.63	38.10	38.10
Log likelihood	528	1,147	-178	245
AIC	-1,044	-2,283	368	-478
No. of observation	1,385	1,385	726	726

Short = Cash, cash equivalent and short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.11c: Sample 3
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2020

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.2999 7.17	-0.6587 -15.62	0.4508 4.13	0.2097 5.32
Ln(equity capital)	0.0724 10.77	0.0399 13.05	0.1223 7.53	0.0548 9.35
Ln(net losses incurred)	0.0009 0.18	-0.0013 -0.54	-0.0025 -0.19	-0.0020 -0.42
Short / Asset	0.1776 3.49	0.1035 4.48	0.3894 3.32	0.1597 3.77
Liquid asset / Asset	-0.0802 -1.57	-0.0338 -1.46	-0.1045 -0.78	-0.0520 -1.07
Sigma	0.2733 53.05	0.1241 53.04	0.4785 39.60	0.1727 39.60
Log likelihood	-171	939	-535	264
AIC	355	-1,866	1,081	-517
No. of observation	1,407	1,407	784	784

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.11d: Sample 3
Tobit censored (lb=0) model
Standard deviations: Net losses incurred 2023

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.3373 6.27	-0.7695 -13.11	0.5053 3.20	0.2435 3.86
Ln(equity capital)	0.0854 8.77	0.0420 9.25	0.1662 6.24	0.0713 6.70
Ln(net losses incurred)	0.0134 1.72	0.0048 1.33	0.0105 0.47	0.0024 0.27
Short / Asset	0.1690 2.54	0.0840 2.70	0.5034 2.90	0.1864 2.69
Liquid asset / Asset	-0.0026 -0.04	-0.0115 -0.36	0.0710 0.35	-0.0024 -0.03
Sigma	0.3997 53.29	0.1866 53.29	0.7652 39.87	0.3062 39.87
Log likelihood	-713	369	-915	-187
AIC	1,437	-726	1,843	386
No. of observation	1,420	1,420	795	795

Note: Short = Cash + cash equivalent + short-term investment; Liquid asset = bond + stock + short. Lb is for lower bond. The dependent variable is the standard deviation of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.12a: Sample 3
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2005

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.4947 4.06	-0.1803 -0.87	0.7865 4.95	0.4492 2.74
Ln(equity capital)	-0.1392 -10.15	-0.0369 -2.68	-0.1449 -8.51	-0.0611 -3.47
Ln(net losses incurred)	0.1937 16.17	0.0844 7.01	0.1929 12.29	0.0998 6.15
Short / Asset	0.0978 1.11	0.1113 1.26	-0.1823 -1.80	0.0708 0.68
Total liability / Asset	-0.0638 -0.67	0.0276 0.29	-0.2067 -1.70	-0.0607 -0.48
Liquid asset / Asset	0.4157 3.90	0.2158 2.01	0.2457 1.73	0.0047 0.03
Sigma	0.4844 51.26	0.4868 51.26	0.4468 38.65	0.4617 38.65
Log likelihood	-912	-919	-458	-483
AIC	1,838	1,851	930	979
No. of observation	1,314	1,314	747	747

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.12b: Sample 3
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2014

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.3820 2.93	-0.7114 -4.56	0.8849 4.92	0.1093 0.76
Ln(equity capital)	-0.0773 -5.96	0.0436 4.39	-0.1043 -5.77	0.0377 2.60
Ln(net losses incurred)	0.1255 10.59	-0.0069 -0.76	0.1541 8.77	-0.0067 -0.47
Short / Asset	-0.1961 -2.12	-0.0112 -0.16	-0.2646 -2.44	-0.0529 -0.61
Total liability / Asset	0.1646 1.57	0.0531 0.66	-0.3080 -2.13	-0.0714 -0.62
Liquid asset / Asset	0.2734 2.55	0.1422 1.73	0.0656 0.43	0.1859 1.53
Sigma	0.4881 52.63	0.3738 52.63	0.4600 38.10	0.3688 38.10
Log likelihood	-972	-602	-466	-306
AIC	1,958	1,218	947	626
No. of observation	1,385	1,385	726	726

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.12c: Sample 3
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2020

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.6771 5.24	-0.4917 -2.69	0.8928 5.02	0.2661 1.75
Ln(equity capital)	-0.0923 -6.48	0.0106 0.88	-0.1185 -6.23	0.0019 0.12
Ln(net losses incurred)	0.1553 12.54	0.0406 3.92	0.1832 10.71	0.0457 3.13
Short / Asset	-0.0252 -0.27	0.1524 1.92	-0.0228 -0.19	0.2054 1.96
Total liability / Asset	0.0783 0.75	0.1204 1.37	-0.1862 -1.35	0.1058 0.90
Liquid asset / Asset	0.0081 0.08	0.0107 0.12	-0.0372 -0.24	0.0251 0.19
Sigma	0.5098 53.03	0.4272 53.03	0.5004 39.60	0.4270 39.60
Log likelihood	-1,048	-799	-570	-445
AIC	2,109	1,612	1,153	904
No. of observation	1,407	1,407	784	784

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.12d: Sample 3
Tobit censored (lb=-1 ub=1) model
Correlation coefficient: Net losses incurred 2023

Variable	Companies Raw	Companies Detrended	Group Raw	Group Detrended
Intercept	0.7568 6.79	0.3384 1.66	0.7589 4.74	0.6440 4.20
Ln(equity capital)	-0.0969 -7.22	-0.0514 -3.70	-0.1207 -6.29	-0.0432 -2.35
Ln(net losses incurred)	0.1714 14.23	0.1120 8.99	0.1857 10.65	0.1043 6.24
Short / Asset	-0.1688 -2.20	-0.0754 -0.95	-0.2213 -2.04	-0.0194 -0.19
Total liability / Asset	0.0440 0.46	-0.2836 -2.84	-0.0172 -0.13	-0.2005 -1.63
Liquid asset / Asset	0.0859 0.99	-0.1119 -1.25	0.1067 0.78	0.0273 0.21
Sigma	0.4608 53.29	0.4768 53.29	0.4785 39.87	0.4587 39.87
Log likelihood	-915	-963	-542	-508
AIC	1,844	1,940	1,098	1,031
No. of observation	1,420	1,420	795	795

Note: Short = Cash + cash equivalent + short-term investment. Liquid asset = bond + stock + short. Lb and Ub are for lower bond and upper bond. The dependent variable is the correlation coefficient of net losses incurred. For each variable, we report the regression coefficient and the *t*-ratio.

Table OA3.13: ($\hat{\sigma}_i$) NFTS Sample 3
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
2004	2,140	54,912.05	131,965.81	5.7346067	3,618,578.85	2.4032
2005	2,152	56,370.15	1424,87.67	6.1116594	3,845,429.32	2.5277
2006	2,192	54,239.36	139,774.67	6.2958792	3,526,813.30	2.5770
2007	2,222	55,252.02	140,329.75	6.2663120	3,290,493.04	2.5398
2008	2,246	58,897.49	150,684.23	6.1898534	3,158,760.30	2.5584
2009	2,206	59,805.05	154,348.11	5.9217115	3,222,894.32	2.5809
2010	2,163	58,371.60	155,517.20	5.8047600	3,264,642.47	2.6643
2011	2,119	60,107.11	162,032.63	5.1390197	3,272,819.44	2.6957
2012	2,069	60,201.05	161,012.97	4.3171860	3,040,593.75	2.6746
2013	2,015	60,065.13	158,956.42	0.7745967	2,798,325.46	2.6464
2014	1,922	59,699.83	165,311.88	3.9460649	3,054,550.34	2.7691
2015	1,952	61,147.39	175,949.10	3.9797104	4,107,800.61	2.8775
2016	1,911	62,239.48	192,536.31	2.8452132	5,013,368.92	3.0935
2017	1,867	67,773.17	221,215.81	2.8452132	6,108,732.75	3.2641
2018	1,825	71,645.89	240,948.91	2.4553149	6,909,486.53	3.3631
2019	1,805	75,514.55	257,547.21	2.4043611	7,621,411.37	3.4106
2020	1,787	77,310.78	271,966.11	2.1995671	8,190,674.39	3.5178
2021	1,787	81,238.37	292,801.75	2.5967012	886,7351.08	3.6042
2022	1,778	90,156.92	334,882.67	3.3209293	962,3961.62	3.7144
2023	1,753	104,870.36	400,278.62	0.5606119	997,5996.18	3.8169

Note: Summary statistics: Raw Standard deviation of the net losses and loss expense incurred for a company by year (2004–2023).

Table OA1.14: ($\hat{\rho}_i$) NFTS Sample 3

Year	N	Mean	Std	Min	Max	CV
2004	2,140	0.4546902	0.4483530	-0.9653261	0.9931815	0.9861
2005	2,152	0.4554556	0.4599050	-0.9501159	0.9959215	1.0098
2006	2,192	0.4404254	0.4674160	-0.9497824	0.9949277	1.0613
2007	2,222	0.4413788	0.4645582	-0.9550969	0.9921070	1.0525
2008	2,246	0.4369082	0.4659165	-0.9512583	0.9935037	1.0664
2009	2,206	0.4340436	0.4691747	-0.9596023	0.9865277	1.0809
2010	2,163	0.4414353	0.4657871	-0.9497653	0.9866759	1.0552
2011	2,119	0.4417431	0.4553533	-0.9493755	0.9889317	1.0308
2012	2,069	0.4309645	0.4566733	-0.9451991	0.9857888	1.0597
2013	2,015	0.4070722	0.4622474	-0.9357250	0.9848420	1.1355
2014	1,922	0.3930505	0.4677156	-0.9506626	0.9808095	1.1900
2015	1,952	0.3632888	0.4781657	-0.9381279	0.9886014	1.3162
2016	1,911	0.3558370	0.4816997	-0.9366294	0.9856268	1.3537
2017	1,867	0.3495733	0.4973389	-0.9490993	0.9868746	1.4227
2018	1,825	0.3662300	0.5013329	-0.9467046	0.9885501	1.3689
2019	1,805	0.3729897	0.5157657	-0.9603331	0.9899884	1.3828
2020	1,787	0.3802477	0.5239949	-0.9668353	0.9927877	1.3780
2021	1,787	0.3924308	0.5291444	-0.9482907	0.9896228	1.3484
2022	1,778	0.4212417	0.5208776	-0.9358040	0.9929816	1.2365
2023	1,753	0.4559542	0.5111805	-0.9267677	0.9955184	1.1211

Note: Summary statistics: Raw Correlation coefficient between company *i*'s losses and the industry losses by year (2004–2023).

Table OA3.15: ($det\ \hat{\sigma}_i$) NFTS Sample 3
($000 omitted)

Year	N	Mean	Std	Min	Max	CV
2004	2,142	15,756.40	65,708.42	1.752335E-14	1,256,612.94	4.1703
2005	2,152	16,885.80	70,379.28	4.873742E-15	1,314,722.85	4.1680
2006	2,193	17,119.75	73,410.12	4.72956E-13	1,593,122.96	4.2880
2007	2,223	17,440.07	73,126.78	1.520423E-19	1,710,220.57	4.1930
2008	2,246	19,853.78	83,564.25	5.53935E-16	1,715,076.42	4.2090
2009	2,207	20,583.66	83,783.39	8.468785E-13	1,677,031.61	4.0704
2010	2,163	21,543.75	86,439.49	1.999368E-17	1,666,887.22	4.0123
2011	2,119	22,431.84	88,651.37	5.315075E-13	1,666,155.71	3.9520
2012	2,070	23,740.45	91,005.58	9.021962E-17	1,643,885.09	3.8334
2013	2,015	24,804.38	95,308.91	1.520287E-15	1,550,253.11	3.8424
2014	1,922	26,383.99	104,941.00	6.058584E-19	2,034,562.94	3.9774
2015	1,952	27,081.67	116,166.58	2.282383E-16	2,587,674.99	4.2895
2016	1,911	26,114.56	117,558.31	1.901331E-11	2,887,470.78	4.5016
2017	1,867	28,057.84	128,336.10	2.603822E-10	3,245,279.14	4.5740
2018	1,825	29,629.99	131,425.07	2.658046E-10	3,257,791.60	4.4355
2019	1,805	30,680.88	132,337.61	4.761655E-10	3,147,193.52	4.3134
2020	1,787	30,411.66	127,418.73	1.909038E-10	2,672,567.99	4.1898
2021	1,787	31,158.52	128,358.02	5.001992E-11	2,482,472.85	4.1195
2022	1,778	33,330.81	144,569.36	2.738563E-8	3,012,906.03	4.3374
2023	1,753	37,845.96	187,130.13	0.000019814	4,547,936.09	4.9445

Note: Summary statistics: Detrented Standard deviation of the net losses and loss expense incurred by year (2004–2023).

Table OA3.16: ($det\ \hat{\rho}_i$) NFTS Sample 3

Year	N	Mean	Std	Min	Max	CV
2004	2,142	0.1425072	0.3869326	-0.9158120	0.9402143	2.7152
2005	2,152	0.1593908	0.4038973	-0.9232071	0.9599483	2.5340
2006	2,193	0.1204652	0.3608090	-0.8211668	0.9338548	2.9951
2007	2,223	0.1128676	0.3249031	-0.8120274	0.9478374	2.8786
2008	2,246	0.1323754	0.2938887	-0.7770202	0.9311778	2.2201
2009	2,207	0.0995025	0.2403785	-0.7524584	0.8486031	2.4158
2010	2,163	0.0968379	0.2858369	-0.7774213	0.8317238	2.9517
2011	2,119	0.0885429	0.2829762	-0.7512425	0.8033726	3.1959
2012	2,070	0.0996039	0.3125511	-0.7382291	0.8238025	3.1379
2013	2,015	0.1132078	0.3360464	-0.7552936	0.8610978	2.9684
2014	1,922	0.1077814	0.3299337	-0.7278313	0.8547064	3.0611
2015	1,952	0.0890173	0.3067299	-0.6587340	0.9072374	3.4457
2016	1,911	0.0990703	0.2540422	-0.6866608	0.8262655	2.5643
2017	1,867	0.1263858	0.2956990	-0.8204181	0.8794083	2.3397
2018	1,825	0.1531442	0.3618562	-0.8896513	0.9305552	2.3628
2019	1,805	0.1669542	0.3927812	-0.8939908	0.9497062	2.3526
2020	1,787	0.1621351	0.4028787	-0.8961040	0.9597800	2.4848
2021	1,787	0.1835356	0.4263924	-0.8347921	0.9356064	2.3232
2022	1,778	0.2238175	0.4518442	-0.9087044	0.9585497	2.0188
2023	1,753	0.2617709	0.4703497	-0.9315695	0.9792196	1.7968

Note: Summary statistics: Detrented Correlation coefficient between company *i*'s losses and the industry losses by year (2004–2023).

Table OA3.17: FTS Groups and unaffiliated companies Sample 3
Summary statistics: Net losses and loss expense incurred by year (2004–2023)
($000 omitted)

Year	N	Sum	Mean	Std	Min	Max
2004	707	264,503,191	374,120	1,909,696	1	33,389,144
2005	747	287,487,717	384,856	2,073,403	2	37,365,769
2006	748	274,902,657	367,517	1,944,225	2	34,552,444
2007	774	289,964,171	374,631	2,006,970	1	35,738,878
2008	775	335,444,768	432,832	2,330,970	1	41,893,664
2009	758	306,754,410	404,689	2,180,565	1	41,358,771
2010	762	307,905,021	404,075	2,182,795	2	42,547,231
2011	747	342,188,269	458,083	2,439,435	1	45,996,798
2012	754	335,233,522	444,607	2,403,693	2	44,829,975
2013	746	321,412,915	430,848	2,324,994	1	44,975,965
2014	726	335,638,810	462,312	2,484,678	1	47,090,286
2015	735	349,653,387	475,719	2,574,159	1	47,884,283
2016	738	374,753,733	507,796	2,827,072	2	53,294,126
2017	752	410,793,280	546,268	3,079,383	1	57,033,235
2018	768	429,370,329	559,076	3,036,684	1	52,921,588
2019	772	441,127,949	571,409	3,113,601	1	52,235,775
2020	784	448,309,430	571,823	3,098,951	1	52,557,754
2021	788	496,775,532	630,426	3,553,161	2	58,681,190
2022	797	564,371,241	708,119	4,154,760	2	68,832,963
2023	795	622,484,177	782,999	4,658,710	2	83,277,428

Table OA3.18: ($\hat{\sigma}_i$) FTS Groups and unaffiliated companies Sample 3
($000 omitted)

Year	N	Mean	Std	Min	Max
2004	707	69,998.14	293,593.17	5.7346067	3,984,748.92
2005	747	73,301.55	321,473.54	6.1116594	4,554,633.14
2006	748	75,099.50	335,768.67	6.2958792	5,201,357.60
2007	774	76,861.29	350,787.45	6.2663120	5,801,584.49
2008	775	86,351.93	385,248.37	6.1898534	6,508,073.36
2009	758	89,096.17	394,146.75	5.9217115	6,484,363.18
2010	762	88,049.76	379,733.48	5.8047600	5,744,263.05
2011	747	92,531.39	395,867.20	5.1390197	5,591,051.80
2012	754	90,705.83	390,405.55	4.3171860	5,5082,46.07
2013	746	89,413.17	375,186.63	0.7745967	5,136,123.44
2014	726	87,296.96	355,163.19	3.9460649	4,594,951.45
2015	735	86,365.90	356,699.91	3.9797104	4,663,551.84
2016	738	85,036.35	373,753.29	4.0473389	5,525,926.90
2017	752	90,682.46	428,435.31	4.0473389	6,905,884.21
2018	768	95,590.82	468,865.89	4.0473389	7,843,598.55
2019	772	102,878.06	506,952.58	3.8815804	8,764,195.99
2020	784	106,062.26	537,481.74	2.5317037	9,644,261.96
2021	788	114,329.21	596,159.91	2.5967012	10,768,907.02
2022	797	128,943.81	708,944.78	3.3209293	12,724,902.73
2023	795	152,738.20	849,197.60	0.5606119	13,535,330.52

Note: Summary statistics: Raw Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (2004–2023).

Table OA3.19: ($\hat{\rho}_i$) FTS Groups and unaffiliated companies Sample 3

Year	N	Mean	Std	Min	Max
2004	707	0.5325560	0.5303933	-0.9144850	0.9931815
2005	747	0.5282986	0.5303474	-0.9252321	0.9919107
2006	748	0.5114766	0.5411513	-0.9447594	0.9925776
2007	774	0.5007070	0.5466377	-0.9465556	0.9922203
2008	775	0.4879513	0.5562132	-0.9410837	0.9885393
2009	758	0.5033153	0.5444802	-0.9403212	0.9861364
2010	762	0.4992231	0.5388207	-0.9099596	0.9866757
2011	747	0.5132308	0.5182778	-0.9090587	0.9853968
2012	754	0.4930469	0.5183105	-0.9133251	0.9857888
2013	746	0.4610009	0.5208911	-0.8917605	0.9836246
2014	726	0.4475972	0.5165039	-0.9033075	0.9794053
2015	735	0.4167320	0.5248604	-0.9324193	0.9771787
2016	738	0.3813812	0.5392871	-0.9169411	0.9788871
2017	752	0.3666968	0.5481428	-0.9281775	0.9856858
2018	768	0.3671902	0.5518608	-0.9467046	0.9885501
2019	772	0.3733982	0.5680036	-0.9603331	0.9899884
2020	784	0.3762418	0.5775739	-0.9793097	0.9927877
2021	788	0.3832699	0.5865288	-0.9659781	0.9923459
2022	797	0.4127094	0.5839461	-0.9358040	0.9936519
2023	795	0.4501708	0.5723365	-0.9267677	0.9950874

Note: Summary statistics: Raw Correlation coefficient between groups and unaffiliated company *i*'s losses and the industry losses by year (2004–2023).

Table OA3.20: ($det\ \hat{\sigma}_i$) FTS Groups and unaffiliated companies Sample 3
($000 omitted)

Year	N	Mean	Std	Min	Max
2004	707	34,675.51	147,056.20	4.5807940	2,317,992.45
2005	747	35,729.83	157,542.94	4.1135767	2,695,393.98
2006	748	35,884.31	160,294.35	4.0270873	2,741,404.69
2007	774	35,496.47	154,082.83	4.6354153	2,692,700.60
2008	775	41,000.29	169,289.03	5.7455469	2,686,466.82
2009	758	42,658.78	168,556.75	5.3852911	2,579,350.62
2010	762	43,760.94	173,757.42	5.6623833	2,799,556.58
2011	747	45,862.35	182,253.61	4.9776371	2,981,793.30
2012	754	46,649.35	188,435.58	4.2922668	3,206,557.14
2013	746	50,656.56	209,392.20	0.7611417	3,751,001.82
2014	726	50,184.62	196,312.07	3.9457740	3,378,223.68
2015	735	50,850.98	198,953.24	3.9704371	3,210,357.32
2016	738	46,983.07	175,827.87	4.0062876	2,140,919.54
2017	752	49,939.00	194,261.36	3.9283225	2,460,985.08
2018	768	51,540.77	202,862.62	3.8071272	2,593,569.46
2019	772	54,772.26	216,178.78	3.7488887	2,684,411.72
2020	784	52,227.73	203,814.41	2.2039698	2,500,709.88
2021	788	53,931.82	221,358.00	2.2135367	2,705,468.66
2022	797	59,527.27	271,481.14	3.3170863	3,462,578.72
2023	795	69,096.00	343,057.62	0.4904704	5,969,366.67

Note: Summary statistics: Detrented Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (2004–2023).

Table OA3.21: ($det\ \hat{\rho}_i$) FTS Groups and unaffiliated companies Sample 3

Year	N	Mean	Std	Min	Max
2004	707	0.2098112	0.4749432	-0.8861377	0.9402143
2005	747	0.2186490	0.4892162	-0.8865774	0.9350721
2006	748	0.1922154	0.4304525	-0.8211668	0.9044509
2007	774	0.1831258	0.3925028	-0.8120274	0.8505072
2008	775	0.1876948	0.3505970	-0.7770202	0.8502230
2009	758	0.1558743	0.2769927	-0.7309067	0.7985907
2010	762	0.1406547	0.3366185	-0.7774213	0.8441944
2011	747	0.1228034	0.3288244	-0.7211016	0.7955030
2012	754	0.1362618	0.3645110	-0.6793852	0.8420546
2013	746	0.1555715	0.3932400	-0.7552936	0.8838279
2014	726	0.1410741	0.3772353	-0.7090649	0.8843901
2015	735	0.1128660	0.3427623	-0.6247970	0.8326764
2016	738	0.1208521	0.2917294	-0.6795642	0.8034595
2017	752	0.1423927	0.3423896	-0.7884246	0.8697421
2018	768	0.1690276	0.4135594	-0.8896513	0.9069556
2019	772	0.1936776	0.4386565	-0.8939908	0.9206346
2020	784	0.1883354	0.4467571	-0.8943447	0.9287161
2021	788	0.2005491	0.4724463	-0.8347921	0.9460335
2022	797	0.2501626	0.4870088	-0.9087044	0.9638963
2023	795	0.2922908	0.4960592	-0.9008271	0.9736285

Note: Summary statistics: Detrented Correlation coefficient between groups and unaffiliated company i's losses and the industry losses by year (2004–2023).

Table OA3.22: ($\hat{\sigma}_i$) NFTS Groups and unaffiliated companies Sample 3 ($000 omitted)

Year	N	Mean	Std	Min	Max
2004	1,178	80,785.48	230,334.34	5.7346067	3,984,748.92
2005	1,201	84,437.36	256,080.06	6.1116594	4,554,633.14
2006	1,225	87,911.60	265,181.03	6.2958792	5,201,357.60
2007	1,272	91,109.30	276,589.09	6.2663120	5,801,584.49
2008	1,269	100,611.51	303,916.61	6.1898534	6,508,073.36
2009	1,231	103,549.06	311,977.92	5.9217115	6,484,363.18
2010	1,203	99,374.67	304,519.75	5.8047600	5,744,263.05
2011	1,171	103,468.47	318,703.46	5.1390197	5,591,051.80
2012	1,132	101,510.47	321,032.60	4.3171860	5,508,246.07
2013	1,116	98,949.63	308,891.48	0.7745967	5,136,123.44
2014	1,064	95,201.55	295,502.38	3.9460649	4,594,951.45
2015	1,070	95,091.71	297,555.03	3.9797104	4,663,551.84
2016	1,054	95,403.33	314,915.57	4.0473389	5,525,926.90
2017	1,022	102,897.35	369,601.23	4.0473389	6,905,884.21
2018	1,010	111,064.76	411,457.09	4.0473389	7,843,598.55
2019	995	119,604.24	449,196.00	3.8815804	8,764,195.99
2020	992	121,351.31	480,432.90	2.5317037	9,644,261.96
2021	992	132,247.42	534,289.50	2.5967012	10,768,907.02
2022	993	15,1861.51	639,035.72	3.3209293	12,724,902.73
2023	986	180,565.86	767,439.36	0.5606119	13,53,5330.52

Note: Summary statistics: Raw Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (2004–2023).

Table OA3.23: ($\hat{\rho}_i$) NFTS Groups and unaffiliated companies Sample 3

Year	N	Mean	Std	Min	Max
2004	1,178	0.5043031	0.4312634	-0.9144850	0.9941051
2005	1,201	0.5042536	0.4350460	-0.9252321	0.9919107
2006	1,225	0.4834190	0.4414171	-0.9447594	0.9925776
2007	1,272	0.4800209	0.4405383	-0.9465556	0.9922203
2008	1,269	0.4667171	0.4491396	-0.9410837	0.9885393
2009	1,231	0.4705963	0.4415355	-0.9403212	0.9861364
2010	1,203	0.4699574	0.4399464	-0.9099596	0.9866757
2011	1,171	0.4715669	0.4279179	-0.9090587	0.9853968
2012	1,132	0.4570446	0.4344772	-0.9133251	0.9857888
2013	1,116	0.4321402	0.4348066	-0.8917605	0.9836246
2014	1,064	0.4233035	0.4354410	-0.9033075	0.9794053
2015	1,070	0.3979941	0.4429702	-0.9324193	0.9771787
2016	1,054	0.3722486	0.4581339	-0.9169411	0.9788871
2017	1,022	0.3593699	0.4769245	-0.9281775	0.9856858
2018	1,010	0.3667521	0.4878540	-0.9467046	0.9885501
2019	995	0.3690360	0.5060789	-0.9603331	0.9899884
2020	992	0.3737589	0.5185133	-0.9793097	0.9927877
2021	992	0.3771200	0.5293496	-0.9659781	0.9923459
2022	993	0.4022331	0.5307261	-0.9358040	0.9936519
2023	986	0.4310428	0.5216353	-0.9267677	0.9950874

Note: Summary statistics: Raw Correlation coefficient between groups and unaffiliated company *i*'s losses and the industry losses by year (2004–2023).

Table OA3.24: ($det\ \hat{\sigma}_i$) NFTS Groups and unaffiliated companies Sample 3 ($000 omitted)

Year	N	Mean	Std	Min	Max
2004	1,178	40,671.69	115,310.64	4.5807940	2,317,992.45
2005	1,201	41,733.62	125,440.99	4.1135767	2,695,393.98
2006	1,226	42,435.24	126,546.35	4.0270873	2,741,404.69
2007	1,272	41,121.70	121,499.12	4.6354153	2,692,700.60
2008	1,269	46,489.28	133,653.82	5.7455469	2,686,466.82
2009	1,232	47,226.60	133,433.93	5.3852911	2,579,350.62
2010	1,203	47,886.05	139,366.20	5.6623833	2,799,556.58
2011	1,171	50,177.51	146,756.40	4.9776371	2,981,793.30
2012	1,132	51,439.14	154,932.88	4.2922668	3,206,557.14
2013	1,116	56,526.23	172,367.70	0.7611417	3,751,001.82
2014	1,064	54,540.53	163,269.97	3.9457740	3,378,223.68
2015	1,070	55,362.01	165,937.70	3.9704371	3,210,357.32
2016	1,054	49,587.67	148,223.32	4.0062876	2,140,919.54
2017	1,024	52,733.47	167,460.45	3.9283225	2,460,985.08
2018	1,010	55,904.44	178,107.03	3.8071272	2,593,569.46
2019	995	59,917.30	191,681.71	3.7488887	2,684,411.72
2020	992	55,230.41	182,208.56	2.2039698	2,500,709.88
2021	992	58,451.13	198,409.42	2.2135367	2,705,468.66
2022	993	66,092.93	244,648.43	3.3170863	3,462,578.72
2023	986	78,887.90	309,909.57	0.4904704	5,969,366.67

Note: Summary statistics: Detrented Standard deviation of the net losses and loss expense incurred for group and unaffiliated company by year (2004–2023).

Table OA3.25: ($det\ \hat{\rho}_i$) NFTS Groups and unaffiliated companies Sample 3

Year	N	Mean	Std	Min	Max
2004	1,178	0.2240838	0.3720539	-0.8861377	0.9402143
2005	1,201	0.2411647	0.3898572	-0.8865774	0.9350721
2006	1,226	0.2088115	0.3391858	-0.8211668	0.9044509
2007	1,272	0.1995182	0.3080185	-0.8120274	0.8505072
2008	1,269	0.1983514	0.2758620	-0.7770202	0.8502230
2009	1,232	0.1564213	0.2183175	-0.7309067	0.7985907
2010	1,203	0.1468312	0.2691551	-0.7774213	0.8441944
2011	1,171	0.1327555	0.2639515	-0.7211016	0.7955030
2012	1,132	0.1501382	0.2990693	-0.6793852	0.8420546
2013	1,116	0.1687363	0.3231594	-0.7552936	0.8838279
2014	1,064	0.1546782	0.3131414	-0.7090649	0.8843901
2015	1,070	0.1266885	0.2857418	-0.6247970	0.8326764
2016	1,054	0.1276205	0.2451718	-0.6795642	0.8034595
2017	1,024	0.1523983	0.2952560	-0.7884246	0.8697421
2018	1,010	0.1842045	0.3636537	-0.8896513	0.9069556
2019	995	0.2041673	0.3884053	-0.8939908	0.9206346
2020	992	0.2010538	0.3990923	-0.8943447	0.9287161
2021	992	0.2110478	0.4233838	-0.8347921	0.9460335
2022	993	0.2517143	0.4383454	-0.9087044	0.9638963
2023	986	0.2879923	0.4476675	-0.9008271	0.9736285

Note: Summary statistics: Detrended Correlation coefficient between group and unaffiliated company *i*'s losses and the industry losses by year (2004–2023).

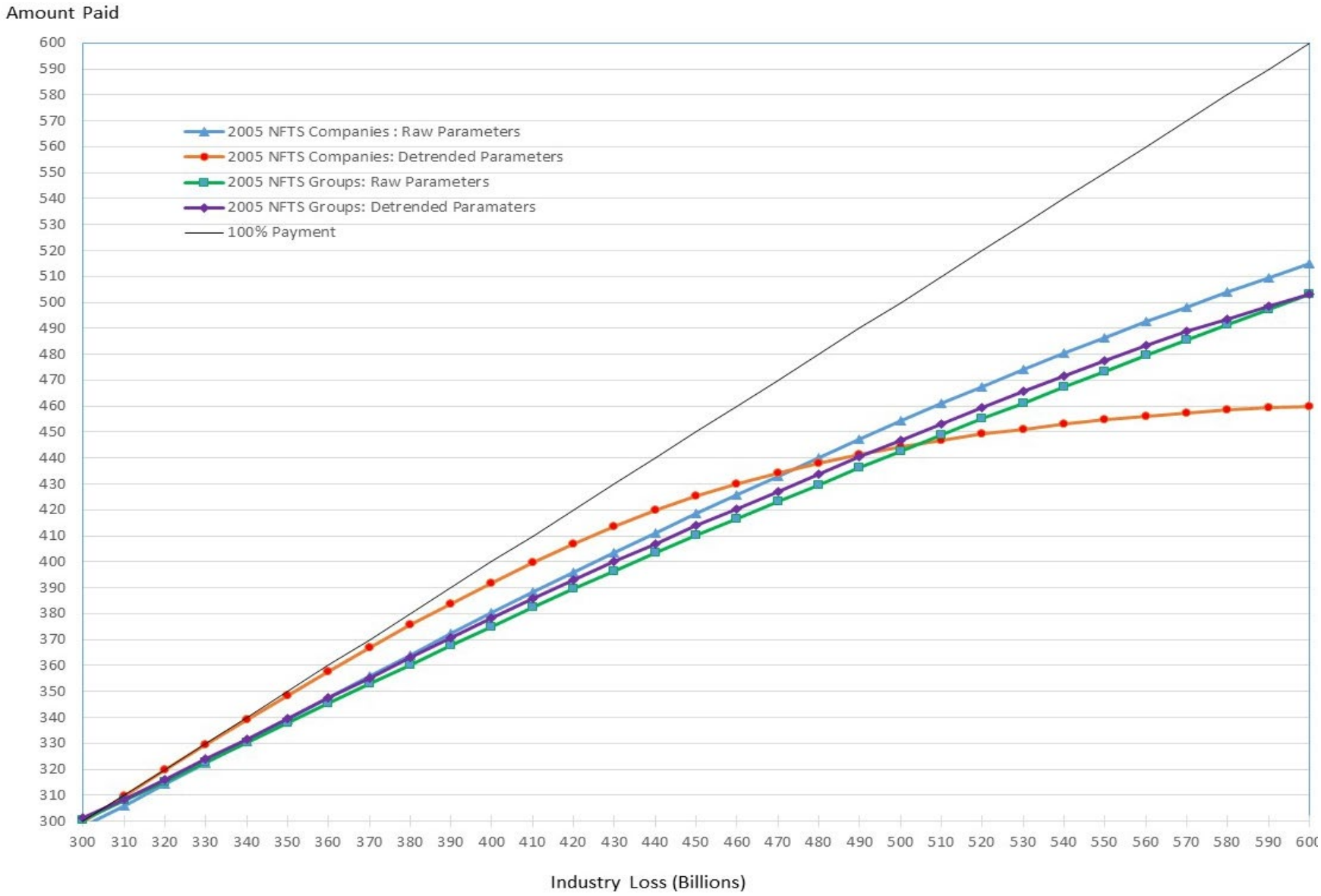

Figure OA3.5: Response functions national net loss, 2005 (NFTS Sample 3)

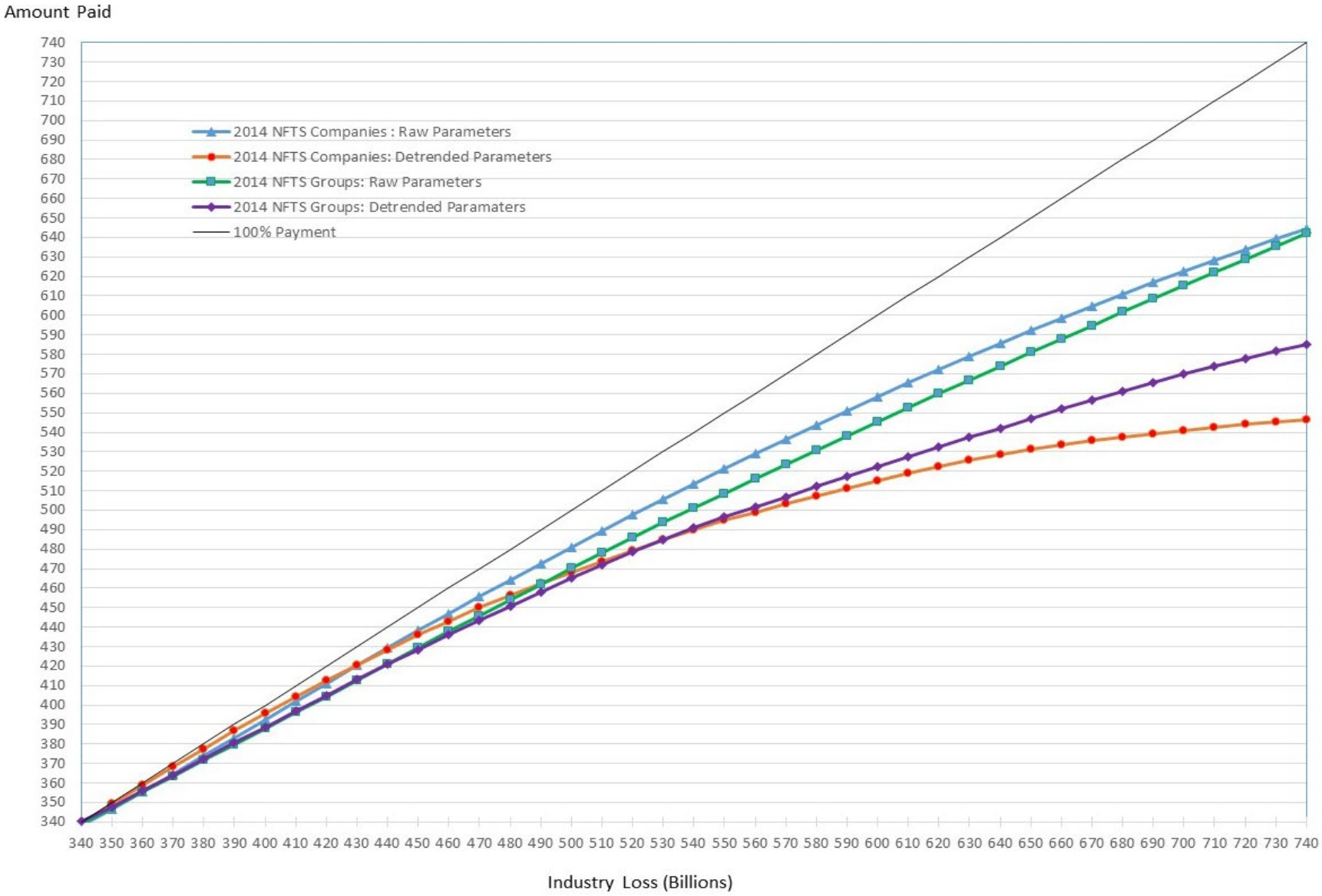

Figure OA3.6: Response functions national net loss, 2014 (NFTS Sample 3)

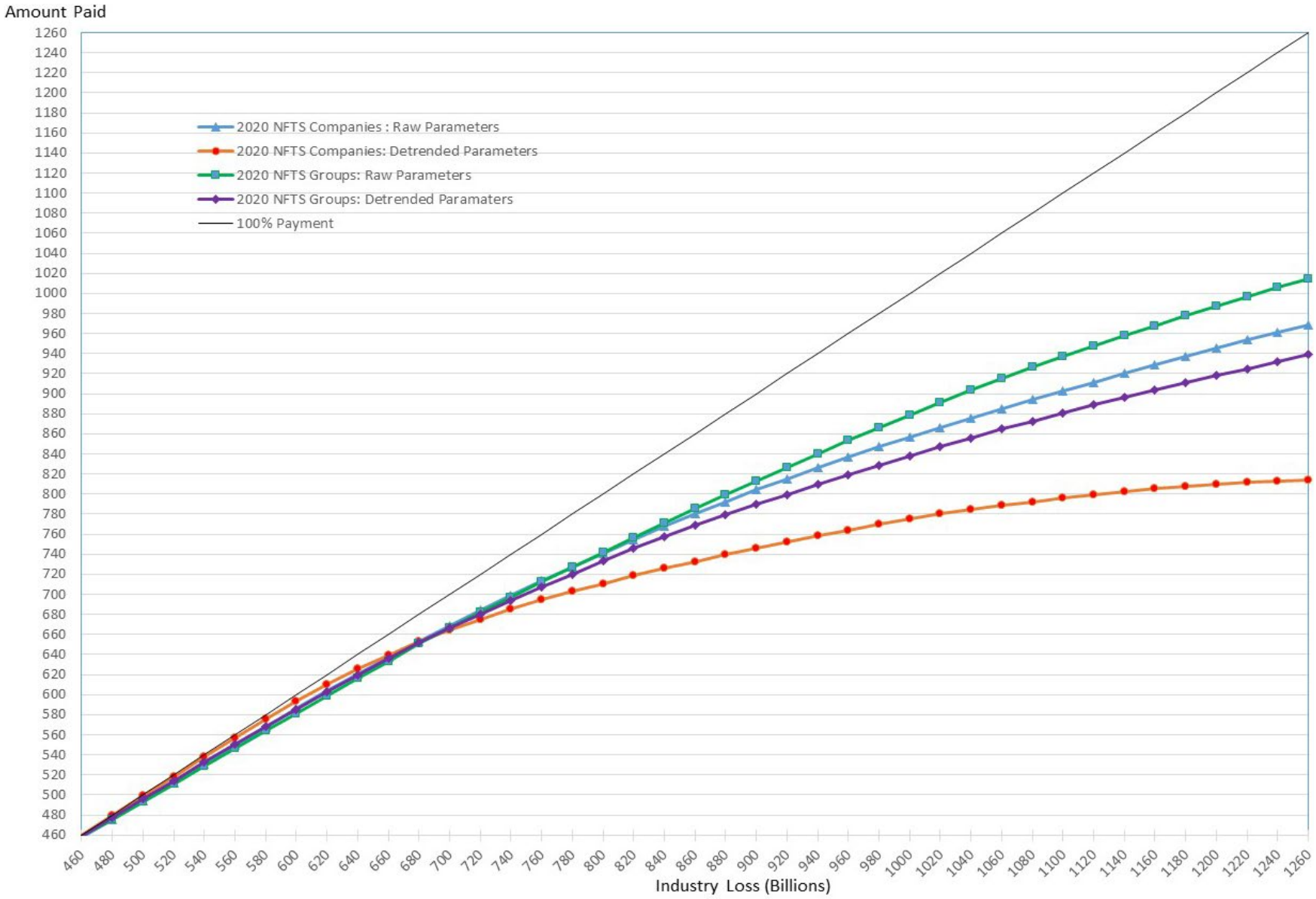

Figure OA3.7: Response functions national net loss, 2020 (NFTS Sample 3)

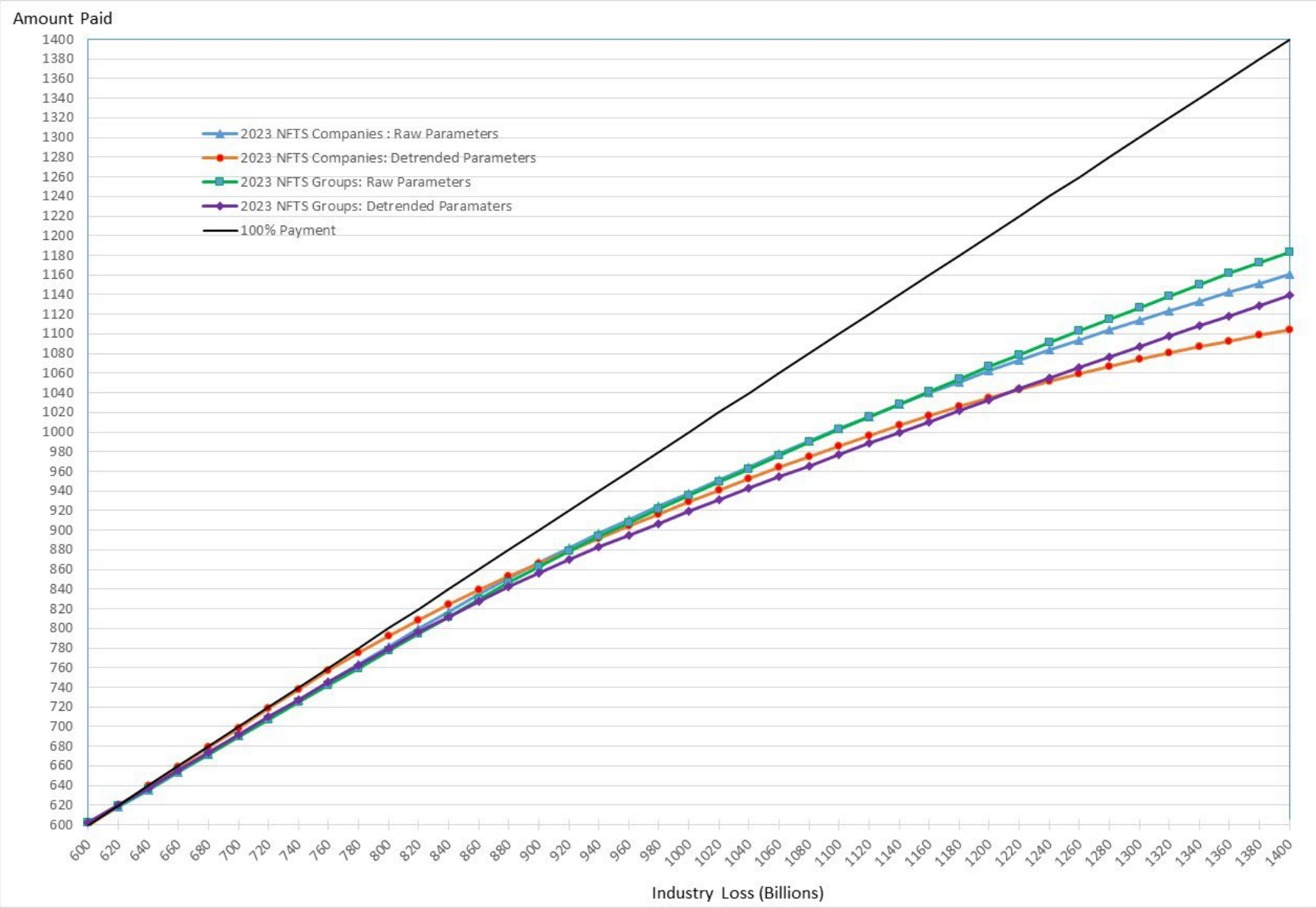

Figure OA3.8: Response functions national net loss, 2023 (NFTS Sample 3)