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IMPORTANCE U.S. property-liability insurers rely on salvage and subrogation recovery to reduce the overall size of claims. The decisions made by insurers with respect to these two processes could materially impact their operations as well as consumers.

OBJECTIVES In this study we conduct an empirical analysis to identify firm-specific characteristics associated with the speed of salvage and subrogation recovery. Among the unique contributions of this study, we focus on both property *and* liability lines of business which allows us to indirectly account for salvage and subrogation independently from one another. Additionally, we consider commercial as well as personal auto lines of business, which provides for settings where key differences exist.

EVIDENCE The financial impact associated with the ability to recover a portion of paid losses cannot be overstated. In 2021, insurers recovered nearly $51.6 billion for the auto physical damage, commercial auto liability, and personal auto liability lines of business combined.[1] It was also recently estimated that missed subrogation opportunities cost the insurance industry $15 billion annually (Harman, 2021).[2]

FINDINGS With respect to auto physical damage coverage, we observe that firm size, age, leverage, profitability, accrual decisions, and the importance of the auto physical damage line to the insurer are positively related to the speed of recovery. We also find that the recovery rate tends to be slower for members of an insurance group. The results for personal and commercial auto liability lines are mixed. In particular, we find that factors such as leverage, diversification, and the importance of the commercial auto liability line on an insurer's portfolio of business impact recovery speed for the commercial auto lability line, whereas profitability, leverage, firm size, and age each affect recovery speed for the personal auto liability line.

CONCLUSION AND RELEVANCE Insurers may look to salvage and subrogation recoveries as a way to keep claim costs down. Furthermore, an understanding of recovery efforts may impact the decision-making process for managers and allow them to more efficiently oversee the collection of salvage and subrogation. Policyholders are concerned with reimbursement of out-of-pocket expenses associated with losses as well as the premiums they are charged, both of which are impacted by salvage and subrogation recovery and the speed that recovery takes place. Finally, regulators, whose job it is to ensure the solvency of insurers and who also oversee the rates

1. Authors' calculations based on values reported in the 2021 NAIC annual statements.

2. Harman, P.L., 2021, Insurers are Overlooking Subrogation Options When Paying Claims, *Property & Casualty 360*, Sept. 17, 2021.

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ABSTRACT

Insurers have significant flexibility in the management of the claims process and the degree to which they prioritize the collection of salvage and subrogation. These deci-

Insurers frequently attempt to recoup a portion of the amounts paid for property and liability claims either through the process of salvage or subrogation. With respect to first-party property losses, insurers will often settle the loss by agreeing with the insured as to the amount of payment for the property, and following the settlement, the insurer takes ownership of the damaged property and has the right to sell it. The payment received is referred to as salvage, and this amount can offset the total amount paid for the claim. Additionally, insurers can also use subrogation as a form of recovery. In this case, the insurer, upon paying a claim for a loss covered under the policy, acquires the right to recover from a tortfeasor the full or proportionate amount of the benefits paid to the insured (Trefz, 2013). The amount of subrogation is limited to the amount of the loss payment made to the insured (Skurnick, 1973), such that the insurer cannot profit through subrogation. The insurers' rights of both salvage and subrogation are established in the issued policies, and both are at the discretion of the insurer upon the payment of a claim.[1]

The financial impact associated with an insurer's ability to recover a portion of paid losses cannot be overstated. In 2021 alone, insurers were able to recover nearly $51.6 billion for the auto physical damage, commercial auto liability, and personal auto liability lines of business combined.[2] It was also recently estimated that missed subrogation opportunities cost the insurance industry $15 billion annually (Harman, 2021). Although the claims department is not intended to be a revenue-generating area (Colquitt & Dumm, 2000), it would seem prudent for insurers to pursue all reasonable avenues for recovery, including through salvage and/or subrogation. However, there are many companies that do not maximize their opportunities in the pursuit of salvage and subrogation (Colquitt & Dumm, 2000). The reasons why firms may not pursue recovery are varied. Some insurers may establish benchmarks for recovery (Carris & Bartlett, 1995) and, upon reaching those benchmarks, limit additional recovery efforts. Other companies may simply act irrationally by not pursuing the recovery available through salvage and subrogation (Carris & Bartlett, 1995). Wickert and Nelson (1995) argue that some firms may either take a "defensive mindset" rather than using subrogation more proactively while others "are shoddy in their investigation of a case's subrogation potential." Another reason for the variation may be the fact that insurance, especially personal auto insurance, has more recently been viewed by many consumers as a commodity (O'Brien, 2012; Burand, 2015).[3] This view has driven insurance companies to reduce premiums (O'Brien, 2012), which, in turn, leads insurers to further attempt to manage costs, including those associated with the collection of

1. It should be noted that endorsements exist, which can place restrictions on the ability to subrogate against a negligent third party. For example, the "Waiver of Our Rights to Recover from Others Endorsement" (Form WC 00 03 13) to the Workers' Compensation and Employers' Liability Insurance Policy allows the insured to eliminate the insurer's right of recovery against specifically listed individuals and organizations. With regards to auto insurance, a similar endorsement exists for commercial auto liability. More specifically, an (Insurance Services Office (ISO) endorsement (Form CA 04 44 10 13) entitled "Waiver of Transfer of Rights of Recovery Against Others to Us (Waiver of Subrogation)" may be used to modify the Business Auto Coverage Form, Motor Carrier Coverage Form, and Auto Dealers Coverage Form.

2. Authors' calculations based on values reported in the 2021 NAIC annual statements.

3. Although personal auto insurance is often considered a commodity by consumers, other lines of insurance are also affected by this mentality (O'Brien, 2012).

salvage and subrogation. Although both internal and external factors may impede insurer salvage and subrogation recovery efforts, the advancement of technology and proliferation of available data have almost certainly created opportunities for insurers to improve their level of recovery and to do so at a lower cost than what may have been possible in the past.

The issue of salvage and subrogation has largely been overlooked in the academic literature, even as the degree to which insurers rely on both continues to vary considerably across firms. This is of particular importance because salvage and subrogation can potentially impact both insurers as well as insureds, as salvage and subrogation may allow insurers to keep rates lower than they would otherwise be

liability (long-tail) lines of business may be attributed to unobservable external factors which insurers may have little control over.

This research should be of interest to insurers, policyholders, and regulators. In an effort to stay competitive and/or to increase market share, insurers may look to salvage and subrogation recoveries as a way to keep claim costs down, allowing them to keep rates lower than they would otherwise be. Furthermore, an understanding of recovery efforts by insurers may impact the decision-making process for managers and allow them to more efficiently oversee the collection of salvage and subrogation. Policyholders, on the other hand, are concerned with reimbursement of out-of-pocket expenses associated with losses as well as the premiums they are charged, both of

which are most reflective of salvage recovery (Colquitt & Dumm, 2000),[9] we also look at recoveries associated with private passenger auto and commercial/truck auto liability and medical payments, which are more reflective of subrogation recovery. This distinction is important as, while they effectively achieve similar objectives of recovery following the payment of a claim, they are very different processes: One involves the sale of damaged tangible items, while the other frequently requires potentially prolonged negotiation and possible litigation.[10, 11]

Prior to providing a detailed discussion of the empirical approach used to examine salvage and subrogation recovery speed, we first present several trends relevant to this study. To illustrate the variation which exists in the industry, Table 1 presents a summary of firm-level salvage and subrogation recovery activity across all lines of business in the property-liability insurance industry for the period from 1996 to 2021. In Panel A, we report summary statistics for two primary measures of salvage and subrogation: 1) a binary variable equal to one for firms that recover any salvage/subrogation in a given year (*Any Salvage and Subrogation*); and 2) a continuous variable equal to the ratio of salvage and subrogation recovery to net claims payments in a given year (*Salvage and Subrogation to Net Claims Paid*).[12] With regards to the binary variable, we find that over threequarters -of the sample firms recover some amount of salvage and subrogation, suggesting that roughly one out of four property-liability insurers do not make recovery efforts. The continuous variable provides further insight into recovery efforts, and we present the summary statistics for the ratio both for the full sample (including those firms that did not recover salvage and subrogation) and for only the sample of firms with any recovery. Summary statistics indicate that, on average, salvage and subrogation represent 4.5% of net claims paid for the full sample and 6.2% of net claims paid when only considering firms with any positive recovery, with a maximum recovery of nearly 90% of net claims paid.

9. Although we contend that salvage is largely captured in the auto physical damage line of business, it is important to note that auto physical damage property recovery can consist of both salvage and subrogation and that any salvage received is typically a small portion of a totaled vehicle's total value. Additionally, insurers can receive salvage recovery for totaled vehicles that they take possession of, regardless of fault. On the other hand, subrogation value can either be the amount to repair a damaged vehicle or, for a total loss, the remaining loss after salvage recovery, if any. This issue was addressed in a Casualty Actuarial Society (CASACT) seminar (1988) in which the speaker noted, "Although subrogation is a liability concept, you may well find that subrogation actually outweighs salvage even in your company's auto physical damage experience. That's because to speed claim settlement, your company has paid for the physical damage of your not-at-fault insureds and then collected subrogation from the insurance companies of the at-fault drivers." Therefore, while for the purpose of this study, it is assumed that auto physical damage better captures salvage recovery relative to the liability lines of business, we do not argue that it comprises the greater portion of auto physical damage as this is dependent on the amount of subrogation received.

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Tab e : Salvage and Subrogation in the U.S. Property-Liability Insurance Industry

there is a 228% increase in the ratio of recovery to net claims paid from Quintile 1 to Quintile 2, a 77% increase in the ratio from Quintile 2 to 3, a 55% increase in the ratio from Quintile 3 to 4, and a 324% increase in the ratio from Quintile 4 to Quintile 5. Overall, the results in Panels A and B indicate that while the majority of insurers take advantage of salvage and subrogation efforts, almost a quarter of firms elect not to, and there is significant variation in terms of recovery efforts even amongst those firms that do recover salvage and subrogation relative to net claims paid.

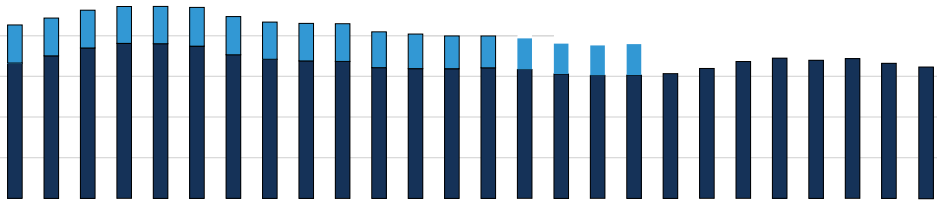
Although Table 1 establishes that there is variation in terms of salvage and subrogation efforts in the industry across all lines of business, it does not directly address the specific lines of business that are the focus of this study, and it is reasonable to believe that differences exist across the different lines. Given our focus on auto physical damage and auto liability lines of business, Figure 1 presents the share of auto insurance premiums relative to those collected for all other lines of property-liability insurance, and it is clear that while the share has fluctuated considerably over the past two and a half decades, it remains an incredibly significant part of the U.S. insurance industry.[13] As illustrated in Figure 1, net premiums written associated with auto physical damage and auto liability lines of business reached a high of nearly 50% of total net premiums written in the industry in 1998, but since that time, there has been a decline of approximately 13.6%, with auto physical damage and liability premiums accounting for 41.8% of total property-liability premiums in the U.S. marketplace in 2021. The steady decline, which has occurred since the late 1990s, may be attributable to the increased role of technology in the industry, the increasing age (and thus declining value) of automobiles on the road, as well as insurers attempting to offer more competitive prices.[14, 15] The trends observed in Figure 1 support our focus on the auto lines of business in this study.

13. The values reported in Figure 1 do not include premiums associated with no-fault coverages.

14. For example, a 2019 report by the U.S. Government Accountability Office (GAO) stated that technology has had the effect of reducing insurer costs associated with consumer communications, underwriting, claims handling, and fraud. Given that auto insurance lends itself to a greater degree of automation than other lines of business (for instance, with regards to underwriting, marketing, and pricing), these reduced costs could presumably result in a decline in the premiums charged to insureds, which could also be responsible for the decline observed in Figure 1.

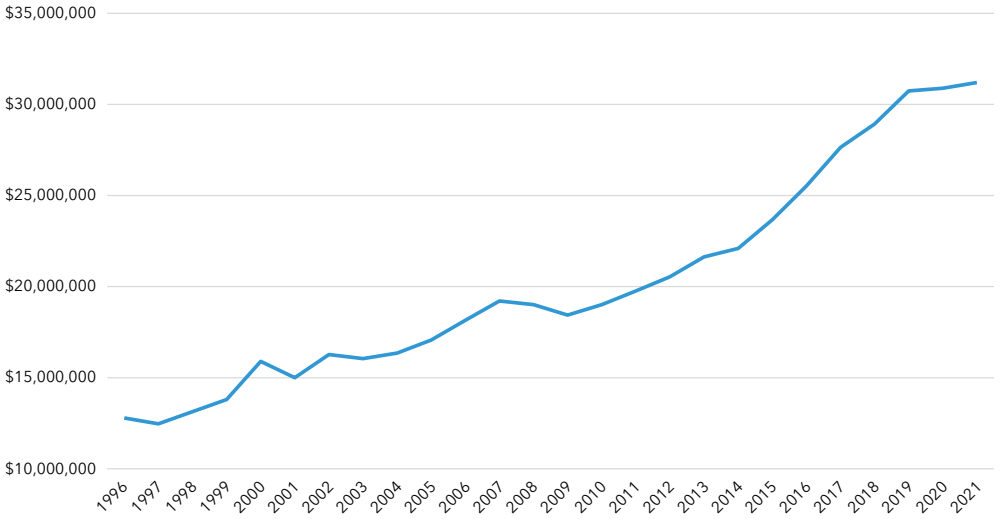
15. The Bureau of Transportation Statistics reports that the average age of "light" vehicles in the U.S. increased by 44% from 1995 to 2021, with an average age of 8.4 years in 1995 to an average age of 12.1 years in 2021 (data available at *https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states*).

F e : Percent of Auto Insurance Premiums to Total Net Premiums Written



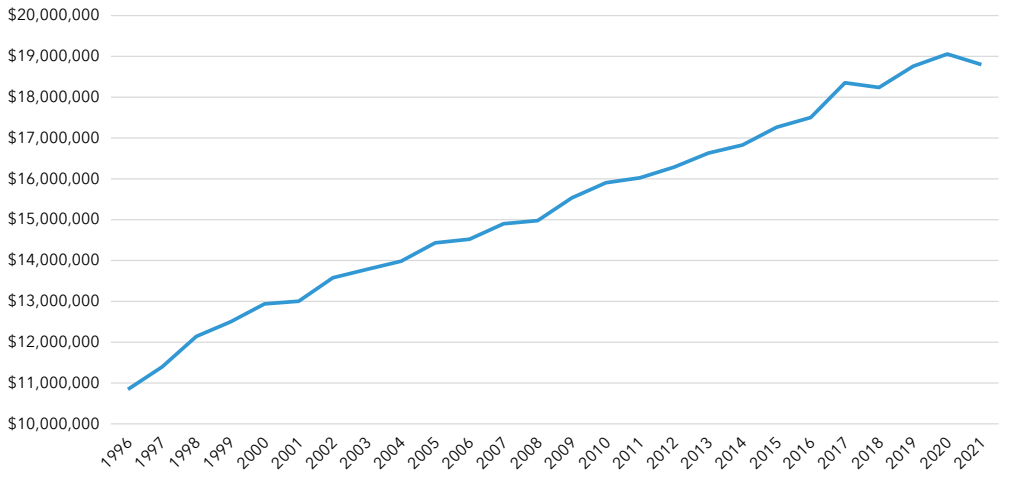
liability lines are attributable to a number of factors, including the problem of social inflation (Lynch & Moore, 2022).[19]

F e : Total Auto Physical Damage Salvage and Subrogation Recovery ($), to 2 2



Authors' calculations based on values reported in NAIC annual statements. Values represent inflation-adjusted industry-level (aggregate) salvage and subrogation recovery in thousands for auto physical damage coverage.

F e : Total Personal Auto Liability Salvage and Subrogation Recovery ($ . .), to 2 2



Authors' calculations based on values reported in NAIC annual statements. Values represent inflation-adjusted industry-level (aggregate) salvage and subrogation recovery in thousands for personal auto liability coverage.

Finally, in Figures 5 and 6, we illustrate the industry-wide impact that salvage and subrogation recovery can have on the insurer's balance sheet. In particular, we examine the ratio of salvage and subrogation recovery relative to total net claims paid, with Figure 5 presenting the trend for the auto physical damage line of business and Figure 6 presenting the trend for both the commercial auto and personal auto liability lines of business.[20] Figure 5 indicates that over the sample period, the industry has exhibited a substantial increase in the ratio of salvage and subrogation recovery to claims paid, with roughly 11% in 1996 to approximately 20% in 2021, representing an increase of over 85%. This implies that, in 2021, for every five dollars paid in claims, one dollar was recouped through the salvage and subrogation recovery process for auto physical damage coverage. Alternatively, an examination of Figure 6 provides clear evidence that, while there has been an increase in the ratio of recovery to claims payments over the sample period for the liability lines of business, the increase is much more muted, and the overall ratio is significantly smaller than that observed for the auto physical damage line. More specifically, we find that the average ratio of recovery to net claims paid over the sample period is 1.1% for commercial auto liability and 2% for the personal auto liability line of business.

20. Data used for the construction of Figure 5 are obtained from Schedule P, Part 1J (Auto Physical Damage). Data used for the construction of Figure 6 are obtained from Schedule P, Parts 1B (Private Passenger Auto Liability / Medical) and 1C (Commercial Auto/Truck Liability/Medical).

F e : Industry-Wide Ratio of Salvage and Subrogation Recovered to Total Net Claims Paid – Auto Physical Damage

Da a, Me d , a d Va ab e

Data

We follow Ames et al. (2019) and control for the decision of the insurer to accrue for anticipated salvage and subrogation using a binary variable equal to one for insurers reporting non-zero values for anticipated salvage and subrogation for a given year.

Percentage of Line-of-Business Premiums. Colquitt and Dumm (2000) hypothesize that insurers may focus more of their resources and attention on those lines of business that are more important to the firm's operations, such that they will more aggressively pursue and manage claims than they would for lines of business that

Diversification. Insurers with more diversified operations can rely less on the performance of any single line of business and can benefit from a coinsurance effect in which the losses of one line of business can be offset by stronger performance in other lines of business, thus reducing overall volatility (Liebenberg & Sommer, 2008). Additionally, greater diversification limits the importance of any single line on the firm's operations, which may reduce the speed of salvage and subrogation recoveries. We control for the potential effect that diversification may have on recovery rates by including measures of product and geographic diversification. We capture line of business diversification (*LOB Div*) by including a variable equal to one minus the line of business Herfindhal-Hisrchman Index (HHI), where the line of business HHI is based on direct premiums written in 23 distinct lines of business.[31] Similarly, we measure geographic diversification (*GEO Div*) as one minus the geographic HHI, which is based on direct premiums written in the 50 U.S. states and the District of Columbia.

Leverage. A primary goal of insurance regulation is to monitor the financial position of insurers and to ensure their continued solvency. One commonly relied upon measure of potential insolvency risk is leverage, where more highly levered firms face a greater risk of insolvency and are less financially stable (e.g., Carson & Hoyt, 1995; Shim, 2017). Following prior literature, we measure leverage (*Leverage*) as the ratio of net premiums written to total policyholders' surplus (e.g., Cummins & Doherty, 2002; Born, Cole, & Nyce, 2021). In general, insurers are expected to maintain a ratio of premiums-to-surplus that is less than 3:1 (Neale, Drake, & Konstantopoulos, 2020). In the event an insurer's ratio of premiums-to-surplus were to approach the 3:1 threshold, they may attempt to manage their balance sheet and reduce the ratio by increasing surplus through the salvage or subrogation recovery process.

Performance. One benefit of better performance is that firms can generate additional cash flow that can be used in ways that further the goals of the firm. Better-performing insurers may be able to use that additional cash flow to invest in their salvage and subrogation efforts and increase the speed of recovery.[32] We control for firm perfor-

auto liability coverage (*Specialty*). This variable is only considered in the models examining salvage and subrogation for the personal auto liability line of business.[33]

Variable definitions are provided in Table 2 and summary statistics are presented in Table 3. Focusing first on the dependent variables, we observe that over 55% of recovery takes place in the first year for the auto physical damage line of business. The high percentage of recovery in this line is likely attributable to the fact that property damage is generally considered a short-tail line of business, which indicates that claims are often settled quickly. In addition, as recovery in this area is most likely associated with salvage, and insurers frequently have a standardized process associated with heavily damaged or totaled vehicles, the physical damage (salvage) recovery process is likely to be limited to a shorter timeframe than that associated with liability lines (subrogation). Alternatively, roughly 35 (28) percent of total recovery takes place in the first year for commercial (personal) auto liability coverages. The lower level of first-year recovery relative to the physical damage coverage is indicative of the fact that auto liability (both commercial and personal) is considered a long-tail line. The liability recovery is likely to be a function of subrogation rather than salvage. While the speed at which recovery takes place between the commercial and personal auto liability lines differs by over 20% in the first year, we find that the cumulative collection of salvage and subrogation is relatively close after three years, with nearly 76% of cumulative recoveries taking place by the end of the third year for both liability lines.

With respect to the independent variables, roughly 79% of the firms in our sample are stock insurers, over 83% are affiliated with a group, the average firm has an ROA of 2.34%, and the measure of leverage (the ratio of premiums-to-surplus) is well below the maximum acceptable ratio of 3:1. The summary statistics also indicate that the percentage of direct premiums written in the auto physical damage, commercial auto liability, and personal auto liability lines of business are 20.18%, 13.44%, and 30.42%, respectively. Finally, we find that the majority of firms accrue for anticipated salvage and subrogation, suggesting that these firms do expect to actively take steps to recover at least some portion of the claims paid.

Tab e : Variable Definitions

Variable	Definition
	Auto Physical Damage
Pct. Recovered Yr1	Percent of auto physical damage salvage / subrogation recovered in the year the loss was incurred
	Commercial Auto Liability
Pct. Recovered Yr1	Percent of commercial auto liability salvage / subrogation recovered in the year the loss was incurred
Pct. Recovered Yr2	Percent of commercial auto liability salvage / subrogation recovered one year after the loss was incurred
Pct. Recovered Yr3	Percent of commercial auto liability salvage / subrogation recovered two years after the loss was incurred
Cumulative Pct. Recovered Yr1	Cumulative percent of commercial auto liability salvage / subrogation recovered in the year the loss was incurred

33. We thank an anonymous reviewer for encouraging the inclusion of this additional variable in our analysis.

Cumulative Pct. Recovered Yr2	Cumulative percent of commercial auto liability salvage / subrogation recovered within the first two years of the incurred loss
Cumulative Pct. Recovered Yr3	Cumulative percent of commercial auto liability salvage / subrogation recovered within the first three years of the incurred loss
	Personal Auto Liability
Pct. Recovered Yr1	Percent of personal auto liability salvage / subrogation recovered in the year the loss was incurred
Pct. Recovered Yr2	Percent of personal auto liability salvage / subrogation recovered one year after the loss was incurred
Pct. Recovered Yr3	Percent of personal auto liability salvage / subrogation recovered two years after the loss was incurred
Cumulative Pct. Recovered Yr1	Cumulative percent of personal auto liability salvage / subrogation recovered in the year the loss ered Yr2 ye21ulative Pct. Recovered Yr[illegible]Cumul0 Tw 10.605 1.2 Ta)10 (tive per)18 (cent of)-24 (commer)18.1 (civer)18 to liability salv within the first two years of the incurred loss
Cumulative Pct. Recovered Yr[illegible]Cumul0 Tw 10.605 1.2 Ta)10 (tive per)18 (cent of)-24 (commer)18.1 (cial autover)18 to liabilvage / subrogation rart.	

Table 3: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Auto Physical Damage				
Pct. Recovered Yr1	0.5577	0.1473	0.0000	1.0000
		Commercial Auto Liability		
Pct. Recovered Yr1	0.3506	0.2391	0.0000	1.0000
Pct. Recovered Yr2	0.2958	0.2023	0.0000	1.0000
Pct. Recovered Yr3	0.1193	0.1472	0.0000	0.8824
Cumulative Pct. Recovered Yr1	0.3506	0.2391	0.0000	1.0000
Cumulative Pct. Recovered Yr2	0.6454	0.2742	0.0000	1.0000
Cumulative Pct. Recovered Yr3	0.7645	0.2546	0.0000	1.0000
		Personal Auto Liability		
Pct. Recovered Yr1	0.2826	0.1810	0.0000	1.0000
Pct. Recovered Yr2	0.3107	0.1321	0.0000	0.8333
Pct. Recovered Yr3	0.1654	0.1141	0.0000	0.6667
Cumulative Pct. Recovered Yr1	0.2826	0.1810	0.0000	1.0000
Cumulative Pct. Recovered Yr2	0.5938	0.2179	0.0000	1.0000
Cumulative Pct. Recovered Yr3	0.7598	0.2008	0.0000	1.0000
		Control Variables		
Accrue Auto Physical Damage	0.6811	0.4661	0.0000	1.0000
Accrue Commercial Auto Liab.	0.6417	0.4796	0.0000	1.0000
Accrue Personal Auto Liab.	0.6916	0.4619	0.0000	1.0000
% DPW Auto Physical Damage	0.2018	0.1578	0.0000	1.0000
% DPW Commercial Auto Liab.	0.1344	0.1702	0.0000	1.0000
% DPW Personal Auto Liab.	0.3042	0.2154	0.0000	1.0000
Size	12.2875	1.7904	6.7334	16.6051
Ln Age	3.6311	0.9104	0.0000	5.1648
Stock	0.7861	0.4101	0.0000	1.0000
Group	0.8329	0.3731	0.0000	1.0000
GEO Div	0.5118	0.3730	0.0000	0.9667
LOB Div	0.4544	0.2812	0.0000	0.8998
Leverage	1.2213	0.7451	0.0034	3.7770
ROA	0.0234	0.0390	-0.1629	0.1826
Specialty	0.0023	0.0476	0.0000	1.0000

All continuous variables are winsorized at the 1st and 99th percentiles. The final dataset consists of 11,559 observations for the auto physical damage models, 4,354 observations for the commercial auto liability models, and 5,286 observations for the personal auto liability models. Variable definitions are provided in Table 2.

Re

Stock	0.0525	-0.0150	-0.0187*	0.0525	0.0872	0.0458
	(0.0558)	(0.0141)	(0.0107)	(0.0558)	(0.0814)	(0.0996)
Group	0.0114	0.0150	-0.0022	0.0114	0.0458	0.0340
	(0.0287)	(0.0153)	(0.0131)	(0.0287)	(0.0385)	(0.0391)
GEO Div	-0.0729	-0.0050	0.0060	-0.0729	-0.0494	-0.0489
	(0.0498)	(0.0161)	(0.0122)	(0.0498)	(0.0554)	(0.0514)
LOB Div	-0.0722	-0.0162	-0.0174	-0.0722	-0.0740	-0.0612
	(0.0449)	(0.0225)	(0.0158)	(0.0449)	(0.0607)	(0.0553)
Leverage	0.0101	-0.0045	0.0016	0.0101	0.0000	0.0056
	(0.0114)	(0.0068)	(0.0050)	(0.0114)	(0.0162)	(0.0157)
ROA	-0.0307	0.2517**	-0.1780**	-0.0307	0.2087	0.0057
	(0.1390)	(0.1163)	(0.0724)	(0.1390)	(0.1462)	(0.1431)
Constant	0.4216*	0.3226***	0.1442***	0.4216*	0.7096**	0.4984
	(0.2343)	(0.0536)	(0.0358)	(0.2343)	(0.3482)	(0.3693)
Observations	4,354	4,354	4,354	4,354	4,354	4,354

*, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. All models include unreported year fixed effects and standard errors (presented beneath coefficients in parentheses) are clustered at the firm-level. All models also include firm fixed effects except for those models which the Hausman test indicates random effects are most appropriate. Columns with a "†" denote the use of random effects rather than fixed effects. The dependent variables in the first three columns are *Pct. Recovered Yr1*, *Pct. Recovered Yr2*, and *Pct. Recovered Yr3* and are equal to the percent of commercial auto liability salvage / subrogation recovered in the year the loss was incurred, one year after the loss was incurred, and two years after the loss was incurred, respectively. The dependent variables in the last three columns are *Cumulative Pct. Recovered Yr1*, *Cumulative Pct. Recovered Yr2*, and *Cumulative Pct. Recovered Yr3* and are equal to the cumulative percent of commercial auto liability salvage/subrogation recovered in the year the loss was incurred, the first two years of the incurred loss, and the first three years of the incurred loss. Variable definitions are provided in Table 2.

In the first set of columns in Table 5, we observe very clear differences across the three years of recovery. For the first year, we find that firms with a greater proportion

proactive in the recovery process. In addition, profitability (*ROA*) is negatively related to recovery speed in the third year. The negative relation may be explained by the positive association found in Year 2, suggesting that more profitable firms are able to recover more quickly and that the less profitable firms take longer to recover salvage and subrogation. Finally, we find marginally significant evidence of a negative relation between the stock organizational form and the percentage of recovery in Year 3.

The final three columns in Table 5 present the results for models that use the cumulative proportion of salvage and subrogation recovered in a given year as the dependent variable. The results for the cumulative recovery in Year 1 are necessarily identical to those for the year-specific proportion recovered in Year 1. Following the first year of recovery, we find that firms writing a greater proportion of premiums in the commercial auto liability line have a greater cumulative recovery in the second year. This result is consistent with the Year 2 percentage recovered shown in the first set of columns. We also observe that firms that accrue subrogation for the commercial auto liability line of business recover a greater proportion of salvage and subrogation by Year 3. Interestingly, while the results previously presented in Table 4 indicate that several non-financial, firm-specific characteristics were associated with the rate of recovery for auto physical damage (i.e., size, organizational form, and diversification), we find little evidence of a relation between these factors and the rate of recovery for commercial auto liability. The relatively limited findings for the commercial auto liability line of business suggest that there are many unobservable factors (such as negotiating ability, differences in legal environment, internal policies, etc.) influencing commercial auto liability-specific recovery. Additionally, the increasing reliance on alternative dispute resolution (ADR) techniques as a substitute for potentially time-consuming litigation may influence the speed of recovery.

Personal Auto Liability Salvage and Subrogation Recovery

In Table 6, we present the results for salvage and subrogation recovery for the personal auto liability line of business. As with Table 5, we report results for the percentage recovered by year in the first three columns. First, we find that insurers that are more leveraged recover a higher percentage in the year the loss occurs (Year 1) than do other insurers. We also find that specialty insurers that may focus more of their business on higher-risk drivers recover a greater proportion in the first year. Finally, we observe a negative and marginally significant relation between firm age and Year 1 recovery. Unlike commercial auto liability, we do not observe a statistically significant relationship between the proportion of premiums written in the personal auto liability line of business and salvage and subrogation recovery in the first year. Considering the proportion of recovery in Year 2, we see that specialty insurers recover a lower proportion of salvage and subrogation in the second year. We also find marginal evidence that older firms recover a lower percentage in the second year relative to younger firms and that insurers with weaker performance (*ROA*) recover a greater

than mutual insurers in Year 3. This may indicate that stock insurers are persistent in their recovery later in the claim settlement process.

While we do find several similarities between the personal and commercial auto liability lines in the first three columns, as mentioned previously, it is noteworthy that the proportion of premiums written in the personal auto liability line of business is not significantly related to recovery. One plausible explanation for this difference is that subrogation may be more easily accomplished for personal lines relative to commercial lines, which likely involve larger dollar value claims, higher policy limits, and thus greater negotiation and possible litigation. The degree of complexity associated with subrogation for commercial auto liability may result in a situation where insurers with a specialization in that line can more effectively navigate the subrogation process, whereas such a degree of specialization is not as necessary for the less complex personal auto liability line of business.

In the remaining three columns of Table 6, we consider the cumulative recovery of salvage and subrogation for personal auto liability insurance. The most consistent finding suggests that more highly-leveraged firms collect a greater percentage of salvage and subrogation in the first three years following a loss. Once again, this is in line with the expectation that insurers that are more highly leveraged may attempt to reduce their leverage by increasing their surplus position through more aggressive recovery in the early years. In addition to the *Leverage* variable, the coefficient on the *Ln Age* variable is negative and significant across the three years, implying that older firms collect a lower cumulative percent in the first three years relative to younger firms. We also find that firm size is positively associated with cumulative recovery in Years 2 and 3 (albeit at the 10% level of significance), while insurers that may specialize in higher-risk drivers (*Specialty*) may recover a lower cumulative percent in the second year. Interestingly, while firm size appears to be related to cumulative recoveries for personal auto liability coverage, it is unrelated to recovery for commercial auto liability coverage. It is also noteworthy that while relatively few factors accounted for in our models were statistically associated with the cumulative speed of recovery for the commercial auto liability line of business, far more were related to cumulative recovery for the personal auto line. This may be attributed to personal auto liability claims being less complex and resulting in lower dollar value losses than what is frequently seen with commercial auto liability, such that fewer unobservable factors influence

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