How Do Financial Constraints Affect Product Pricing? Evidence from Weather and Life Insurance Premiums

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Journal of Finance, 2022

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ABSTRACT

ABSTRACT:

- I identify the effects of financial constraints on firms' product pricing decisions, using insurance groups containing both life and property & casualty (P&C) divisions.
- Following P&C divisions' losses, life divisions change prices in a manner that can generate more immediate financial resources: premiums fall (rise) for life policies that immediately increase (decrease) insurers' financial resources.
- Premiums change more in groups that are more constrained.
- Life divisions increase transfers to P&C divisions, suggesting P&C divisions' shocks are transmitted to life divisions.
- Results hold when instrumenting for P&C divisions' losses with exposure to unusual weather
- damages, implying that the effects are causal.

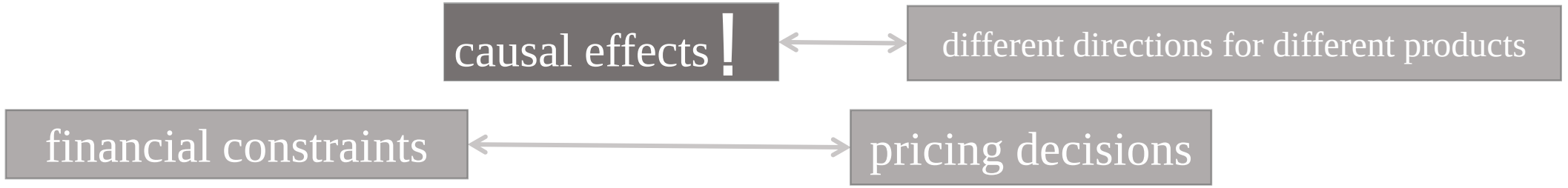
- HOW FRICTIONS IN FINANCIAL MARKETS affect firms' real activities is a fundamentally important question in finance. These frictions can cause firms to be financially constrained.
- I study how financial constraints affect firms' product pricing decisions, which are decisions that all firms face and have significant implications for customers.
- Studying this question is important for under standing how financial shocks transmit to the real economy. Such an investigation can also shed light on one of the channels through which a systemic financial shock, such as the 2008 to 2009 financial crisis, can result in product price movements.

- The prior literature on how financial constraints affect product pricing faces
- two challenges.

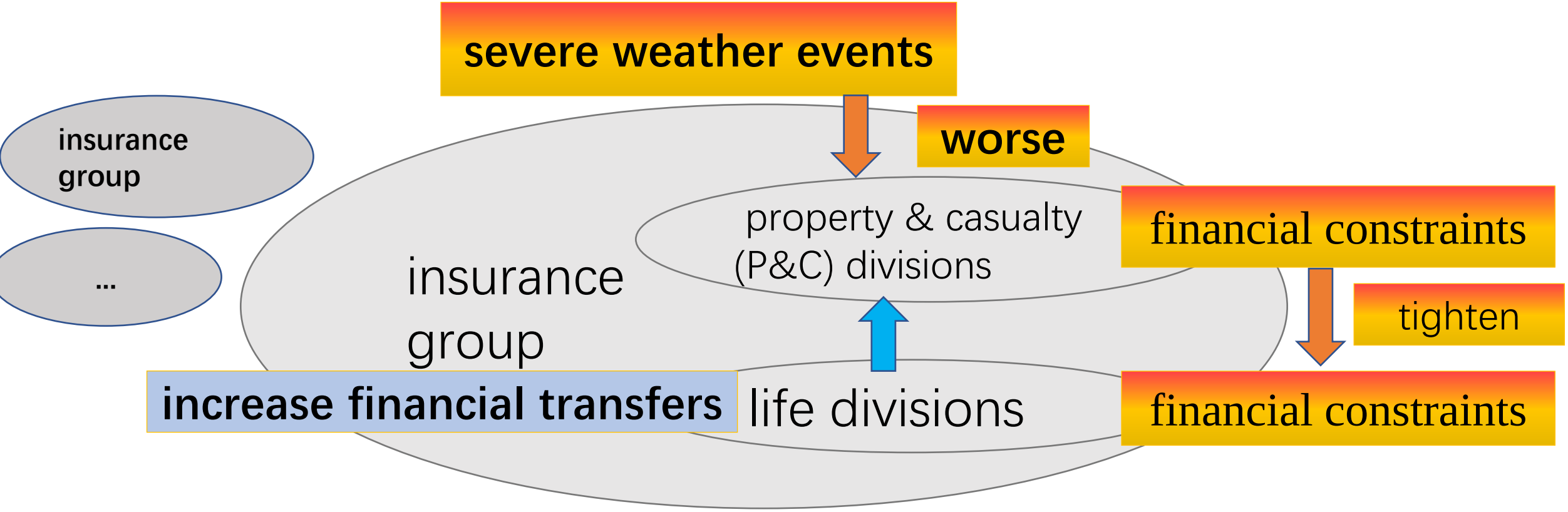
First

Second

this paper



- I use insurance industry as a laboratory:
- plausibly exogenous shocks to life insurers' financial constraints.



- to estimate how life divisions change pricing decisions following losses to P&C divisions of the same insurance group
- I construct a sample of life insurance premium:
- 报价（insurer-month-product level from 216 life insurers from 2002 to 2013）

price changes

product-month fixed effects

insurer-product fixed effects

- **I find that:**
- First, life divisions' premiums for
- a class of permanent life policies decrease with P&C divisions' losses.
- customers pay fixed annual premiums until the insureds die and the insurer pays the death benefits.
- The average annual premiums are high relative to the costs in the early years
- insurers immediately gain financial resources (cash flows, assets, and capital), bring in more immediate financial resources.

- Second, 10-year term policies increase with P&C divisions' losses
- fixed annual premiums+insurer pays death benefits (if the insured dies within the 10-year policy duration)
- The average annual premiums are low relative to the costs in the early years
- insurers initially incur an outflow of financial resources when selling such policies

- endogeneity concern somitted variable　measurement error
- I construct an instrument for P&C losses using P&C divisions' lagged market share in each state, as well as state-quarter-level unusual weather damages relative to the state's historical averages of the same quarter.
- The results on how life divisions change premiums in response to P&C losses hold.

- Finally, I find that when P&C losses are larger, life divisions make more financial transfers to the rest of the group.

- **contribute:**
- First, it contributes to the literature on how firms' financial constraints affect product pricing, in two ways.
- One way is by using plausibly exogenous financial shocks to firms to improve identification and thereby establish a causal effect of financial constraints on product pricing decisions
- Another way is by highlighting that whether firms raise or lower product prices can depend on products' shortterm effects on firms' financial conditions.
- Second, my results relate to the literature on financial intermediation.
- On the one hand, is similar to banks attracting deposits
- On the other hand, is similar to banks making loans
- Third, contributes to the literature on internal capital markets.
- Finally, although this paper aims to shed light on the general question of how
- financial, how financial frictions affect life insurers' pricing, which is an important topic as more than 71% of U.S. households own life policies.

- **Proceeds:**
- Section I: summarizes the institutional background and develops the hypotheses.
- Section II: describes the data.
- Section III: presents results on the effect of P&C divisions' losses on life divisions' pricing decisions.
- Section IV: presents results on how P&C divisions' losses affect internal capital transfers.
- Section V: concludes

I

Institutional Background and Hypotheses

- **A. Financial Resources for Insurers and Hypothesis on Internal Financial Transfers**
- Insurers can further be constrained by assets and capital (assets relative to liabilities), for three reasons.
- the shadow value of cash, capital, and assets in creases at P&C divisions following their losses, assuming frictions in external capital markets.
- Transfers from life to P&C divisions can increase the shadow value of financial resources at life divisions.
- maximize the value of the entire group
- **B. How Selling Life Policies Affects Insurers' Financial Resources and Hypotheses on Price Changes**
- **cash flows,assets=premium-expenses-actuarial costs(each year, ignoring taxes)**
- **expenses= commissions paid to the selling agents, health screening,**
- **analyzing applications, etc.**
- **capital=assets minus liabilities=premium-expenses-actuarial costs-reserves**
- **reserves=present values of expected losses calculated according to statutory rules (recorded under liabilities)**
- **B.1. Permanent Life Policies**
- I hypothesize that life divisions' premiums for such policies fall with P&C divisions' losses
- **B.2. Ten-Year Term Life Policies**
- I hypothesize that life divisions' premiums for such policies rise with P&C losses.

Panel A: Permanent life policy

Year	Inflow	Capital Outflow					
		Asset Outflow					
	Premium	Commission	Other Expense	Actuarial Cost	Reserve	Cumulative Capital Δ	Cumulative Cash Flow or Asset Δ
1	2,103	1,052	604	128	217	103	321
2	2,103	0	44	178	564	1,637	2,201
3	2,103	0	44	220	1,003	3,037	4,040
4	2,103	0	44	258	2,285	3,557	5,840
5	2,103	0	44	308	4,274	3,323	7,590

Panel B: 10-year term life policy

Year	Inflow	Capital Outflow					
		Asset Outflow					
	Premium	Commission	Other Expense	Actuarial Cost	Reserve	Cumulative Capital Δ	Cumulative Cash Flow or Asset Δ
1	394	197	604	128	0	−534	−534
2	394	0	44	178	197	−558	−361
3	394	0	44	220	360	−590	−231
4	394	0	44	258	493	−630	−138
5	394	0	44	308	598	−691	−95

Table I—*Continued*

Panel B: 10-year term life policy							
		Capital Outflow					
	Inflow	Asset Outflow					
Year	Premium	Commi-ssion	Other Expense	Actuarial Cost	Reserve	Cumulative Capital Δ	Cumulative Cash Flow or Asset Δ
1	394	197	604	128	0	−534	−534
2	394	0	44	178	197	−558	−361
3	394	0	44	220	360	−590	−231
4	394	0	44	258	493	−630	−138
5	394	0	44	308	598	−691	−95

II | Data

- **A. Life Insurance Price Data**
- Data on monthly life insurance prices come from CompuLife
- the permanent policies,come from Koijen and Yogo (2015)
- The data on these policies cover products with a death benefit of $250,000 for nonsmoking males and females aged 30, 40, 50, 60, 70, and 80 in the regular health class
- Each combination of age, gender, health status, and death benefit amount (e.g., for a 40-year-old male in regular health with a death benefit of $250,000) defines a product, so there are 12 products.
- This sample contains 27,976 monthly price quotes between January 2005 and July 2011

Table AII
Life Policies' Initial Financial Impact on Insurers

This table reports evidence on how capital and assets are affected by selling each life product in my sample. The calculation for net change in capital and assets is as described in Table I. For permanent policies other than for a 40-year-old male, I adjust the reserves for a male at age 45 by ratios implied by the first two nonzero values of reserves calculated with the software provided by Lombardi (2006) for universal life using CRVM. The reserve values for 10-year term policies are all proxied using those for the regular health category for the corresponding age. Column (1) lists the face amount or death benefits of the policies. Column (2) lists the health category, with "Reg" meaning "Regular," "Pref" meaning "Preferred," and "Pref+" meaning "Preferred Plus." Column (3) lists the age of the insured at issuance, (4) the gender of the insured, (5) the mean of the premium of the policy type, and (6) the median premium. Column (7) reports the net impact on capital at the end of the first year after issuance, and (8) reports that at the end of the first two years. Column (9) reports the cash flows or net change in assets at the end of the first year after issuance, and (10) that at the end of the first two years. Columns (7) to (10) are calculated based on the mean premium. Assuming a commission rate of between 10% and 100% generates similar implications.

Panel A: Permanent life policies

						Cumulative Capital Δ		Cumulative Cash Flow or Assets Δ	
Face Amnt ($000) (1)	Health (2)	Age (3)	Gender (4)	Mean Premium (5)	Median Premium (6)	First Year (7)	First & Second Years (8)	First Year (9)	First & Second Years (10)
250	Reg	30	Female	1,163	1,135	−152	775	−75	976
250	Reg	40	Female	1,705	1,673	32	1,365	169	1,722
250	Reg	50	Female	2,633	2,547	265	2,163	498	2,765
250	Reg	60	Female	4,301	4,143	789	3,779	1,164	4,745
250	Reg	70	Female	7,570	7,276	1,555	6,533	2,174	8,113
250	Reg	80	Female	15,502	15,075	2,418	10,717	3,382	13,099
250	Reg	30	Male	1,398	1,373	−78	1,014	13	1,252
250	Reg	40	Male	2,103	2,039	103	1,637	321	2,201
250	Reg	50	Male	3,250	3,133	457	2,827	749	3,582
250	Reg	60	Male	5,463	5,314	1,116	4,974	1,601	6,218
250	Reg	70	Male	9,914	9,601	2,244	8,571	3,023	10,542
250	Reg	80	Male	19,721	19,359	3,824	14,953	4,937	17,685

- the 10- year term policies, from CompuLife
- I collect prices for nonsmoking males aged 30, 40, 50, 60, 70, and 80 in three health classes (preferred plus, preferred, and regular) with a death benefit of $250,000 or $500,000. Each combination of age, health status, and death benefit amount defines a product, so I have 36 products.
- This sample contains 312,310 insurer-month-product quotes be tween 2002 and 2013.

Table AII—*Continued*

Panel B: 10-year term life policies

Face Amnt ($000) (1)	Health (2)	Age (3)	Gender (4)	Mean Premium (5)	Median Premium (6)	Cumulative Capital Δ First Year (7)	Cumulative Capital Δ First & Second Years (8)	Cumulative Cash Flow or Assets Δ First Year (9)	Cumulative Cash Flow or Assets Δ First & Second Years (10)
250	Pref+	30	Male	166	163	−556	−578	−556	−484
500	Pref+	30	Male	253	245	−547	−626	−547	−438
250	Pref	30	Male	199	198	−554	−560	−554	−466
500	Pref	30	Male	317	310	−545	−595	−545	−407
250	Reg	30	Male	278	270	−547	−522	−547	−428
500	Reg	30	Male	473	460	−532	−521	−532	−333
250	Pref+	40	Male	213	208	−552	−655	−552	−458
500	Pref+	40	Male	339	320	−544	−792	−544	−399
250	Pref	40	Male	263	258	−550	−633	−550	−436
500	Pref	40	Male	439	418	−539	−747	−539	−354
250	Reg	40	Male	394	370	−534	−558	−534	−361
500	Reg	40	Male	691	645	−513	−614	−513	−222
250	Pref+	50	Male	420	401	−511	−776	−511	−313
500	Pref+	50	Male	737	705	−470	−1,059	−470	−133
250	Pref	50	Male	532	516	−500	−695	−500	−233
500	Pref	50	Male	956	915	−451	−906	−451	21
250	Reg	50	Male	818	769	−467	−526	−467	−63
500	Reg	50	Male	1,507	1,440	−395	−599	−395	327
250	Pref+	60	Male	974	938	−341	−1,030	−341	248
500	Pref+	60	Male	1,813	1,735	−147	1,615	−147	942
250	Pref	60	Male	1,219	1,178	−309	−886	−309	392
500	Pref	60	Male	2,288	2,195	−90	−1,349	−90	1,207
250	Reg	60	Male	1,865	1,744	−199	−450	−199	827
500	Reg	60	Male	3,519	3,345	101	−567	101	1,987
250	Pref+	70	Male	2,902	2,760	280	−1,205	280	2,147
500	Pref+	70	Male	5,544	5,219	1,033	−2,154	1,033	4,550
250	Pref	70	Male	3,645	3,458	426	−886	426	2,463
500	Pref	70	Male	6,990	6,625	1,306	−1,575	1,306	5,125
250	Reg	70	Male	5,294	5,120	714	298	714	3,639
500	Reg	70	Male	10,221	9,880	1,847	693	1,847	7,375
250	Pref+	80	Male	10,419	9,804	2,761	585	2,761	10,216
500	Pref+	80	Male	20,261	19,188	5,837	951	5,837	20,217
250	Pref	80	Male	12,219	11,305	2,924	838	2,924	10,446
500	Pref	80	Male	23,816	21,880	6,140	1,389	6,140	20,611
250	Reg	80	Male	16,896	16,345	3,524	3,984	3,524	13,496
500	Reg	80	Male	32,884	32,270	7,198	7,255	7,198	26,292

Panel E: Life policy premiums

# of Quotes	% Affiliatedwith P&C	Mean	Std Dev	25th Pctl	Median	75th Pctl
Permanent Life Policies (Jan. 2005 to Jul.2011)						
		Premiums, $				
27,976	51.34	6,130	5,733	1,875	3,772	8,671
		Premiums, % of Product Average				
		100.00	12.66	91.40	97.21	106.60
10-Year Term Life Policies (Jan. 2002 to Dec. 2013)						
		Premiums, $				
312,424	39.06	2,468	4,545	340	780	2,540
		Premiums, % of Product Average				
		100.00	21.98	84.03	95.40	112.11

- **B. Insurers' Financial Data**
- in my sample correspond to 216 life insurers, of which 103 belong to 50 groups that also have P&C divisions. There are 391 P&C divisions in the sample. Insurers' financial data come from their statutoryreports, obtained from the National Association of Insurance Commissioners(NAIC) and SNL Financial.
- Each of AM Best' s reports gives insurers' most recent ratings, which

can be dated before 2003.

- age, health status, and death benefit amount defines a product.

Panel A: Individual life insurers

	Mean	Std Dev	25th Pctl	Median	75th Pctl
Assets ($ Billion)	16.45	33.23	0.85	3.16	12.88
Rating (Larger Number = Better Rating)	15.34	1.30	15(A)	16(A+)	16(A+)
Asset Growth (%)	8.48	19.09	0.61	5.22	11.40
Capital Adequacy Ratio Minus Guidelines	76.72	138.51	3.00	40.00	97.00
Leverage (%)	85.09	15.79	83.44	91.11	93.97
Current Liquidity	92.40	60.06	64.40	77.40	95.20
Operating ROE (%)	5.70	17.08	1.40	6.85	13.20
Capital (Assets − Liabilities, $ Billion)	1.22	1.89	0.08	0.39	1.52
Net Income (% of Assets)	1.19	2.78	0.14	0.68	1.54
RBC Ratio	10.52	8.64	6.02	7.95	10.81
Unrealized Capital Gain (% of Assets)	0.05	0.96	−0.10	0.00	0.15
Net Transfer Paid Out (% of Capital)	10.40	26.84	−0.03	6.21	22.82

Panel B: Individual P&C insurers

	Mean	Std Dev	25th Pctl	Median	75th Pctl
Assets ($ Billion)	1.67	4.55	0.06	0.20	0.95
Leverage (%)	58.56	17.79	50.74	62.79	70.70
P&C Loss (% of Assets)	2.61	5.23	0.00	0.49	2.85
P&C Unusual Weather Exposure (% of Assets)	0.86	4.09	−0.22	0.00	0.60
Capital (Assets − Liabilities, $ Billion)	0.59	1.70	0.02	0.07	0.32
Net Transfer Received (% of Capital)	−0.06	0.32	−0.09	0.00	0.00
RBC Ratio	15.44	28.09	5.05	7.55	12.80
Net Income (% of Assets)	3.32	5.17	1.14	3.32	5.49
Unrealized Capital Gain (% of Assets)	0.16	1.93	−0.35	0.14	0.91

Panel C: Aggregated at the group level

	Mean	Std Dev	25th Pctl	Median	75th Pctl
P&C Loss (% of Assets)	1.47	2.48	0.00	0.00	2.12
P&C Unusual Weather Exposure (% of Assets)	0.63	2.02	−0.17	0.09	0.68
P&C Assets ($ Billion)	13.91	24.37	0.34	3.03	18.02
Group Assets ($ Billion)	54.19	86.11	2.64	15.91	64.82
Group Leverage (%)	73.28	17.26	64.32	76.34	85.19
Group RBC Ratio	7.20	3.13	5.22	6.46	8.20
Group Net Income (% of Assets)	1.72	2.09	0.57	1.40	2.77
Group Unrealized Capital Gain (% of Assets)	0.04	8.06	−2.52	0.91	3.96

Panel D: (Unusual) weather damages					
	Mean	Std Dev	25th Pctl	Median	75th Pctl
Weather Damages (State-Quarter, $Mil)	75.86	1,068.10	0.18	1.85	10.37
Unusal Weather Damages (State-Quarter, $Mil)	38.33	1,067.00	−16.65	−3.39	−0.10

- B.1. Reported P&C Losses
- P&C insurers report net underwriting gain, which in short is equal to premiums minus losses incurred minus expenses, net of reinsurance

III

Life Insurance Prices and Affiliated P&C Losses

- A. Main Specification

$$Life\ Premium_{i,p,q} = \beta \cdot P\&C\ Loss_{g,(q-4\ to\ q-1)} + \gamma \cdot X_{i,y-2\ \&\ i,q-5} + FE_{i,p} + FE_{p,m} + \epsilon_{i,p,m}. \quad (1)$$

The dependent variable is the dollar annual premium for product p (e.g., a permanent policy for a 40-year-old male, regular health, $250,000 death benefifits) offered by life insurer i in each month of quarter q. Life insurer i belongs to group g. If standalone, i is equivalent to g. I match life insurer-product month premiums in quarter q with losses of P&C divisions of the same group, summed over the four quarters preceding q, P&C Lossg,(q −4 to q−1). For example,a life insurer’ s premiums between April and June 2011 are matched to its P&C affifiliates’ losses over 2010Q2 to 2011Q1. The reason to aggregate P&C losses over four quarters is to smooth out seasonality.

- B. Instrumenting for P&C Losses
- B.1. Motivation for Instrumenting for P&C Losse

state-quarter-level unusual weather damages, as well as P&C divisions' lagged market share in each state.The event types include hurricanes, wildfires, and tornadoes, among others.

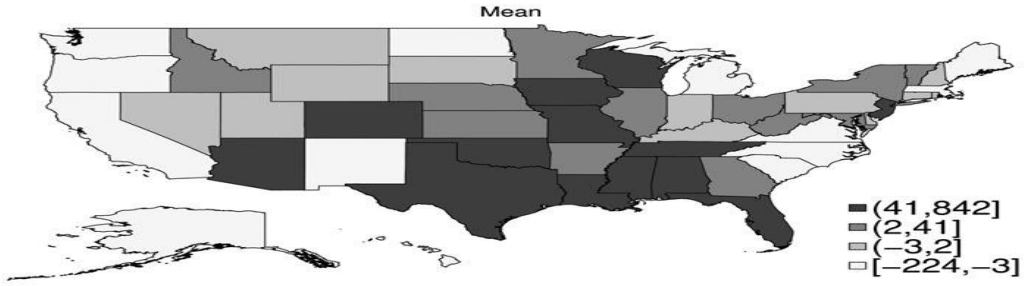
- B.2. The Instrumental Variabl

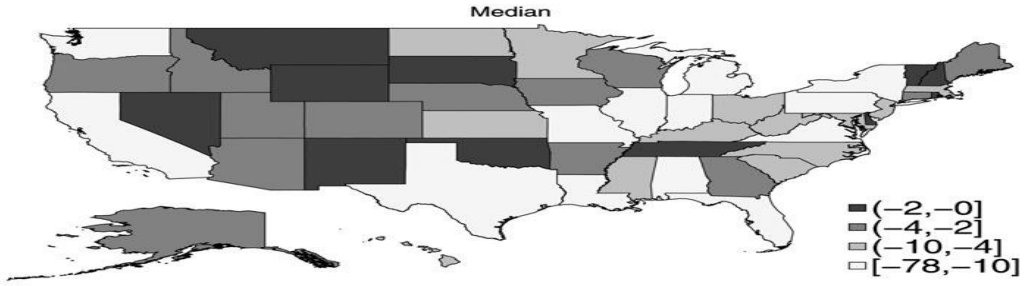
First, I aggregate the dollar amount of weather damages to properties from SHELDUS at the state-quarter level to construct Weather Damage$_{s,q}$, I obtain Unusual Weather Damage$_{s,q}$ by subtracting the state-quarter historical average from Weather Damage$_{s,q}$.

Second, I construct the lagged market share of P&C division j in state s and quarter q as j’ s direct premiums written in state s over the four preceding.

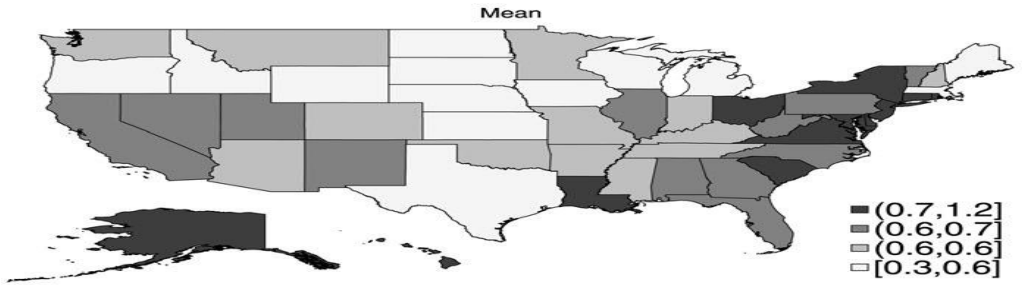
Third,one may be concerned that the instrument reflects P&C divisions’ endogenous choices on their operations and that such endogenous choices correlate with their life affiliates’ pricing decisions.However, it is highly unlikely that insurers’ endogenous choices.all of the regressions use fifixed effects to absorb time-invariant differences across insurers so that such differences do not con found the results.

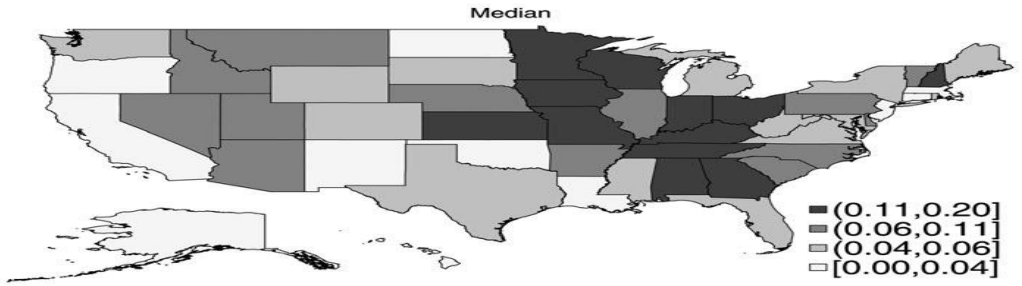
Panel (A) Unusual Weather Damages, $Million



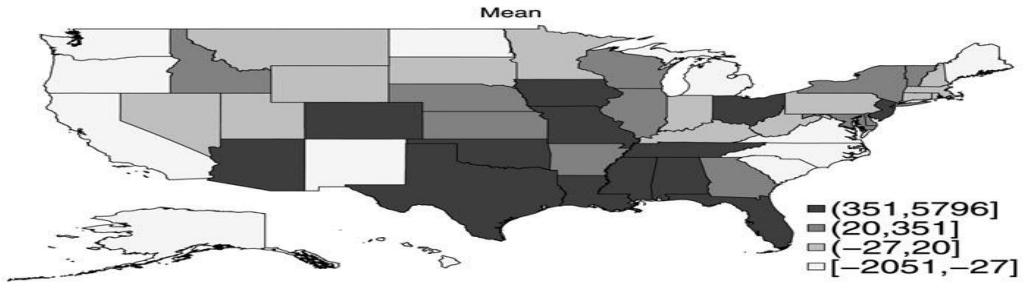


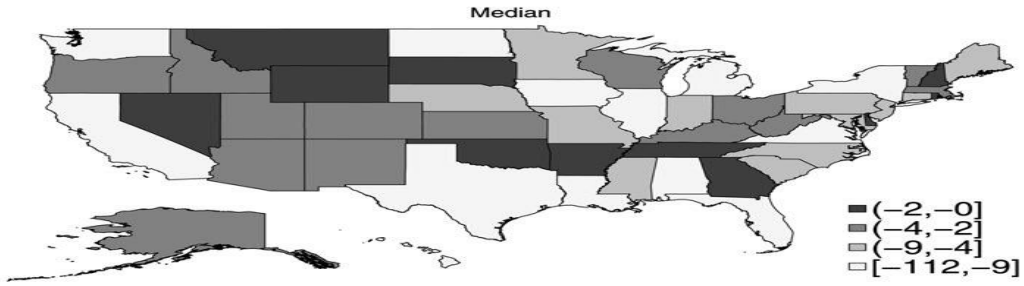
Panel (B) Group-Level P&C Market Share, %





Panel (C) Unusual Weather Damage×Group's Market Share, $000





C. Life Divisions' Policy Premiums andAffiliated P&C Losses

C.1. Permanent Life Policy Premiums and Affiliated P&C Losses

I examine the hypothesis that, after P&C divisions suffer losses, life divisions lower premiums for policies that immediately increase insurers' financial resources, namely, the permanent policies. Intu_x0002_itively, with elastic demand, lower premiums can lead to larger demand and attract more financial resources.

Table III—*Continued*

Panel A: Permanent life policies, OLS estimation

Sample:	All Life Insurers		P&C Affiliated
Dependent Variable:	Life Policy Premium (q)		
	(1)	(2)	(3)
P&C Loss ($q-4$ to $q-1$)	−18.16***	−16.08**	−24.90***
	(−2.94)	(−2.40)	(−3.22)
Controls		Yes	Yes
Insurer-Product FE	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes
N	27,976	26,660	13,144
	t-stat, Cluster SE by Group		
	(−1.56)	(−1.21)	(−1.53)

Panel B: Permanent life policies, instrumental variable estimation

Sample:	All Life Insurers				P&C Affiliated	
	First Stage	Second Stage	First Stage	Second Stage	First Stage	Second Stage
Dependent Variable:	P&C Loss ($q-4$ to $q-1$)	Premium (q)	P&C Loss ($q-4$ to $q-1$)	Premium (q)	P&C Loss ($q-4$ to $q-1$)	Premium (q)
	(1)	(2)	(3)	(4)	(5)	(6)
P&C Unusual Weather Exposure ($q-4$ to $q-1$)	0.51***		0.50***		0.56***	
	(6.09)		(5.68)		(5.38)	
P&C Loss ($q-4$ to $q-1$)		−51.65***		−62.40***		−43.22***
		(−3.17)		(−2.93)		(−2.85)
Controls			Yes	Yes	Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
N	27,976	27,976	26,660	26,660	13,144	13,144
Cragg-Donald F-stat		110.34		90.19		35.65
			t-stat, Cluster SE by Group			
	(7.17)	(−1.96)	(7.27)	(−1.95)	(6.00)	(−2.24)

C.2. Ten-Year Term Policy Premiums and Affiliated P&C Losses

I next examine the hypothesis that for policies that cause an initial outflow of financial resources, the 10-year term policies, premiums should increase with P&C losses. By raising premiums, life insurers will sell fewer such policies and reduce the outflow of financial resources.

In the second-stage results, the coefficients on the instrumented P&C Loss are all positive and statistically significant, suggesting that P&C losses cause prices to increase for the 10-year term policies.

Table III—*Continued*

Panel C: 10-year term life policies, OLS estimation

Sample:	All Life Insurers		P&C Affiliated
Dependent Variable:	Life Policy Premium (q)		
	(1)	(2)	(3)
P&C Loss ($q-4$ to $q-1$)	11.50***	17.79***	20.64***
	(4.32)	(4.13)	(4.80)
Controls		Yes	Yes
Insurer-Product FE	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes
N	312,310	210,495	79,168
	t-stat, Cluster SE by Group		
	(2.45)	(2.64)	(3.77)

Panel D: 10-year term life policies, instrumental variable estimation

Sample:	All Life Insurers				P&C Affiliated	
	First Stage	Second Stage	First Stage	Second Stage	First Stage	Second Stage
Dependent Variable:	P&C Loss ($q-4$ to $q-1$)	Premium (q)	P&C Loss ($q-4$ to $q-1$)	Premium (q)	P&C Loss ($q-4$ to $q-1$)	Premium (q)
	(1)	(2)	(3)	(4)	(5)	(6)
P&C Unusual Weather Exposure ($q-4$ to $q-1$)	0.29***		0.30***		0.29***	
	(3.27)		(2.97)		(2.82)	
P&C Loss ($q-4$ to $q-1$)		41.85***		47.61***		46.66***
		(3.01)		(3.28)		(2.90)
Controls			Yes	Yes	Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
N	283,329	283,329	210,495	210,495	79,168	79,168
Cragg-Donald *F*-stat		54.01		100.65		19.96
			t-stat, Cluster SE by Group			
	(4.58)	(1.28)	(4.42)	(1.85)	(2.89)	(1.54)

C.3. Difference between Permanent and 10-Year Policies

I next test whether the two categories of policies respond to P&C losses statistically significantly differently by estimating the following equation using the joint sample of the two:

$$Premium_{i,p,q} = \beta_1 \cdot P\&C\ Loss_{g,(q-4,q-1)} \times 10\ Year\ Dummy_p + \beta_2 \cdot P\&C\ Loss_{g,(q-4,q-1)} + \gamma \cdot \boldsymbol{X}_{i,y-2\ \&\ i,q-5} + \boldsymbol{FE}_{i,p} + \boldsymbol{FE}_{m,p} + \epsilon_{i,p,m}, \quad (2)$$

Table III—*Continued*

Panel E: Difference between permanent and 10-year policies					
Sample:	All Life Insurers				P&C
	OLS		IV		OLS
Dependent Variable:	Life Policy Premium (q)				
	(1)	(2)	(3)	(4)	(5)
P&C Loss ($q-4$ to $q-1$) × 10-Year Dummy	29.74***	33.13***	94.23***	102.84***	47.97***
	(6.40)	(5.58)	(5.83)	(6.17)	(7.20)
P&C Loss ($q-4$ to $q-1$)	−18.24***	−15.73***	−52.37***	−54.69***	−28.32***
	(−4.74)	(−3.84)	(−5.72)	(−5.51)	(−5.75)
Controls		Yes		Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes
N	340,286	237,155	311,305	237,155	92,312
	t-stat, Cluster SE by Group				
P&C Loss (q-4 to q-1) × 10-Year Dummy	(3.05)	(3.57)	(3.26)	(4.10)	(3.21)
P&C Loss ($q-4$ to $q-1$)	(−1.58)	(−1.32)	(−2.02)	(−2.00)	(−1.74)

Panel F: Univariate average premium comparisons							
	Reported P&C Loss				Instrumented P&C Loss		
	High	Low	High− Low	p-value	High	Low	High−Lov
Permanent Premiums	−92.98	23.21	−116.19	0.000	−85.89	21.47	−107.36
10-Yr Premiums	28.56	−7.14	35.70	0.000	26.87	−6.72	33.59

C.4. Difference between OLS and Instrumental Variable Estimates

First,P&C insurers can manipulate reported losses, making reported losses noisy proxies for true losses. Thus, the OLS estimates of the coefficients on P&C Loss can be biased toward zero, understating the true effect of P&C Loss on life policy premiums.

Second,P&C divisions' reported losses can sometimes be negatively correlated with their need for financial resources.

Its estimated coeffificient in OLS will mask the true effect of fifinancial constraints on pricing.

C.5. Univariate and Other Robustness Tests

It is useful to see if the results hold in a coarser univariate sense to verify that the results are not driven by the full model specification structure.

Accordingly, I compare average life premiums between subsamples with high versus low affiliated P&C losses.

I demean life policy premiums, as well as their P&C affiliates' reported and instrumented P&C Loss, by subtracting insurer-product and product-month averages.

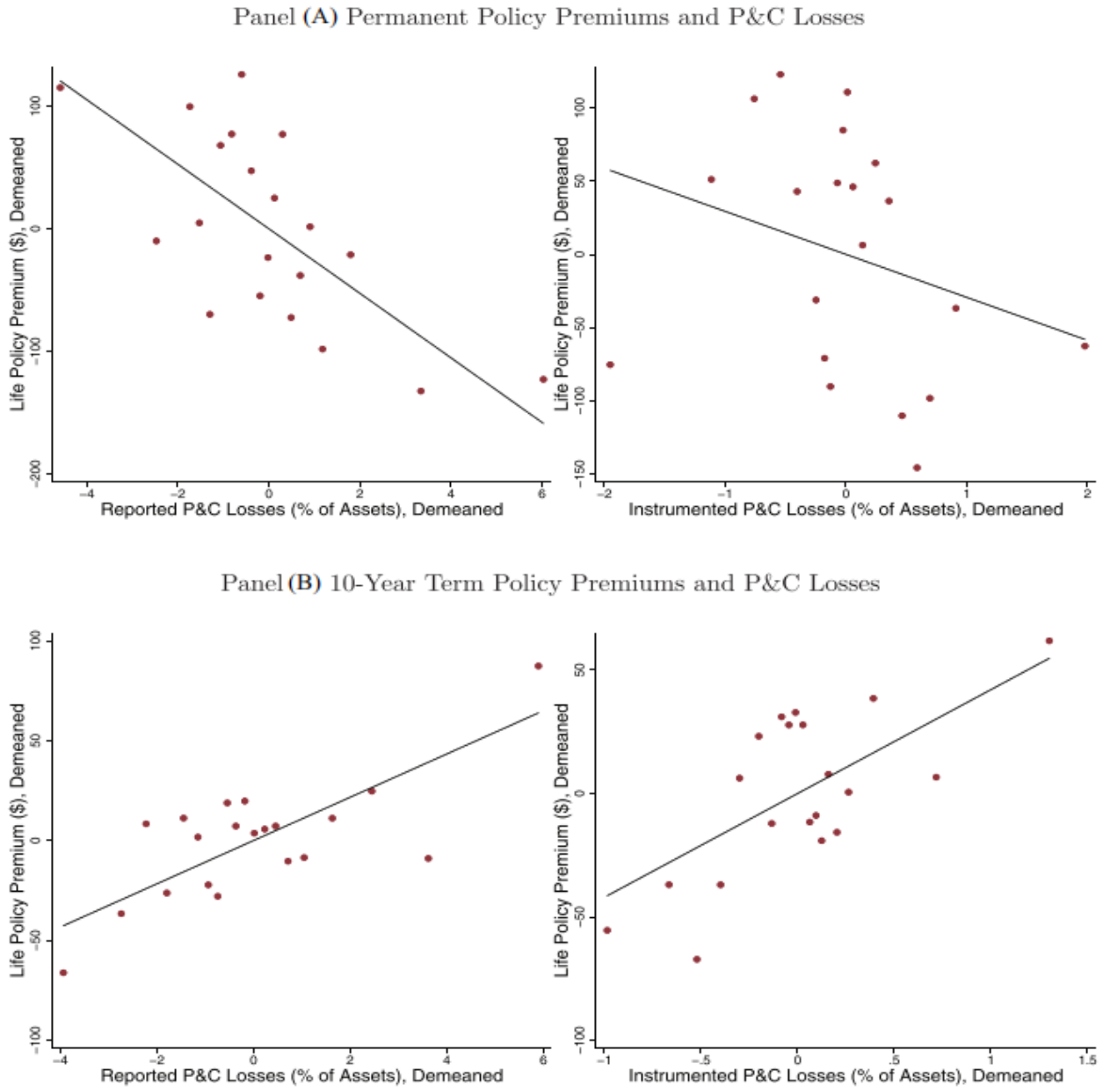


Figure 2. Life insurance premiums and affiliated P&C losses. These figures present binned scatter plots of demeaned life insurance premiums against demeaned affiliated P&C losses, us_x0002_ing life insurers with P&C affiliates. Life insurer-product-month-level premiums in quarter q are matched to losses by the P&C divisions within the same group in q − 4 to q − 1. I demean life divisions' policy premiums and their P&C affiliates' reported and instrumented P&C Loss by sub tracting insurer-product and product-month averages. Instrumented losses are predicted P&C losses from the first stage of the instrumental variable regression, corresponding to column (1) in Table III, Panels B and D. The horizontal axis is the demeaned reported P&C losses in the figures on the left and the demeaned instrumented P&C losses on the right. Panel A corresponds to permanent life policies. Panel B corresponds to 10-year term policies.

C.6. Pretrends in Life Policy Premiums

Life divisions may have changed policy premiums before P&C divisions' losses.To test whether such pretrends exist, I first test whether life insurance prices are related to future P&C affiliates' losses in the following regression:

$$Life\ Premium_{i,p,q} = \beta \cdot P\&C\ Loss_{g,(q+1\ to\ q+4)} + \gamma \cdot X_{i,y-2\ \&\ i,q-5} + FE_{i,p} + FE_{p,m} + \epsilon_{i,p,m}.$$

Tests for Pretrends in Life Divisions' Policy Premiums

Panel A: Permanent life policies

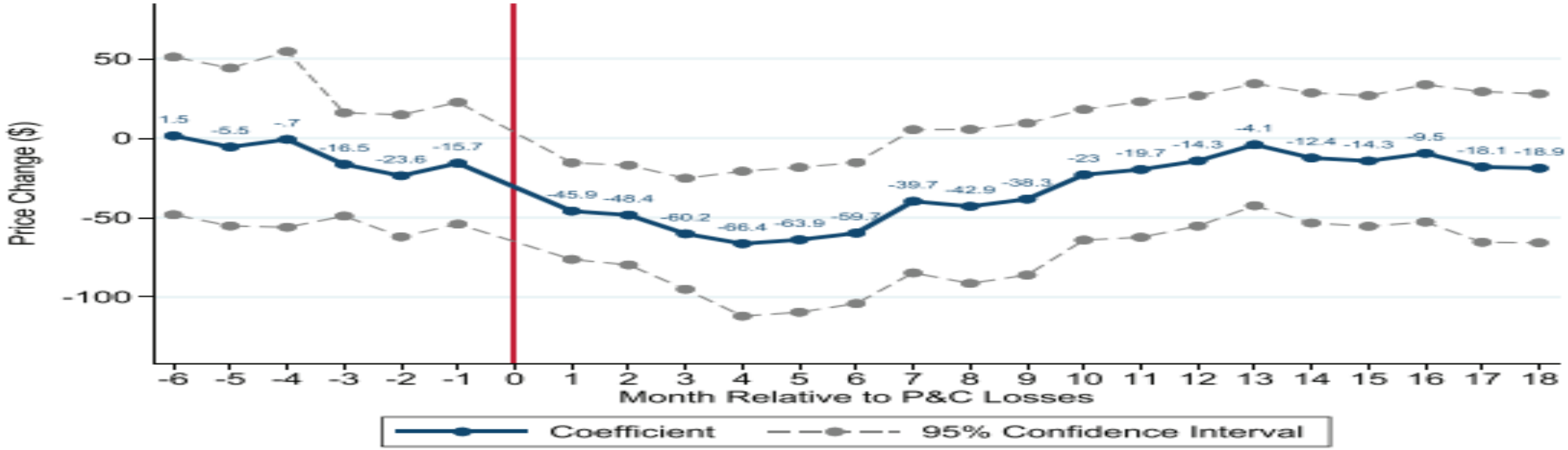
	OLS		IV			IV		
			First Stage	Second Stage		First Stage	Second Stage	
	Premium (q)		P&C Loss(q+1 to q+4)	Premium (q)		P&C Loss(q+1 to q+4)	Premium (q)	
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
P&C Unusual Weather Exposure (q−4 to q−1)			0.45*** (4.86)					
P&C Unusual Weather Exposure (q+1 to q+4)						0.52*** (4.33)		
P&C Loss (q+1 to q+4)	−6.53 (−1.26)	−6.77 (−1.33)		−58.68*** (−2.93)	−63.95*** (−2.73)		−18.73 (−1.06)	−21.87 (−1.05)
Controls (y−2 & q−5)		Yes			Yes			Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	27,976	26,660	27,976	27,976	26,660	27,976	27,976	26,660

(Continued)

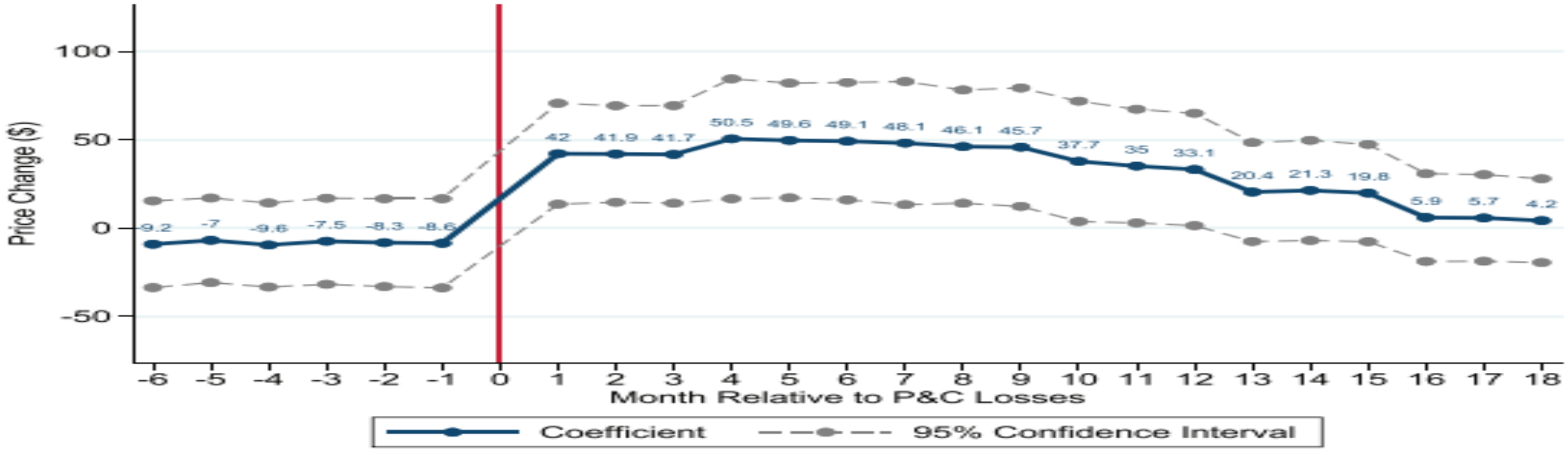
Table IV—*Continued*

Panel B: 10-year term life policies								
	OLS		IV			IV		
			First Stage	Second Stage		First Stage	Second Stage	
	Premium (q)		P&C Loss(q+1 to q+4)	Premium (q)		P&C Loss(q+1 to q+4)	Premium (q)	
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
P&C Unusual Weather Exposure (q−4 to q−1)			0.24***					
			(3.79)					
P&C Unusual Weather Exposure (q+1 to q+4)						0.25***		
						(3.47)		
P&C Loss (q+1 to q+4)	11.64***	25.85***		50.72***	48.23***		−10.14	−6.47
	(4.05)	(6.36)		(4.83)	(5.49)		(−0.65)	(−0.21)
Controls (y−2 & q−5)		Yes			Yes			Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	312,310	210,495	283,329	283,329	210,495	312,310	312,310	210,495

Panel (A) Permanent Policy Premiums Before/After Instrumented P&C Losses



Panel (B) 10-Year Policy Premiums Before/After Instrumented P&C Losses



D. Premium Changes and Ex Ante Financial Constraints

Intuitively, if an insurance group has ample financial slack, it can mitigate adverse shocks to P&C divisions without changing life divisions' activities.Therefore, affiliated P&C losses should have a larger impact on life policy premiums for more constrained groups.

$$\begin{aligned} Premium_{i,p,q} = {} & \beta_1 \cdot P\&C\ Loss_{g,(q-4,q-1)} \times Constrained_{g,y-2} \\ & + \beta_2 \cdot P\&C\ Loss_{g,(q-4,q-1)} + \gamma_1 \cdot Constrained_{g,y-2} \\ & + \gamma_2 \cdot X_{i,y-2\ \&\ i,q-5} + FE_{i,p} + FE_{m,p} + \epsilon_{i,p,m}, \end{aligned}$$

Table V—*Continued*

Panel A: Permanent policies, no interaction between controls & Constrained dummy							
Dependent Variable:	Life Policy Premium (q)						
	OLS						IV
Constrained based on:	Assets (1)	RBC Ratio (2)	Capital (3)	Rating (4)	Private (5)	Composite (6)	Composite (7)
β_1: P&C Loss (q−4 to q−1)	−47.74***	−6.35	−50.76*	−37.09	−59.53*	−71.01*	−110.84
× Constrained (y−2)	(−3.05)	(−0.46)	(−1.79)	(−1.08)	(−1.94)	(−1.87)	(−1.42)
β_2: P&C Loss (q−4 to q−1)	−0.94	4.91	24.18	8.41	42.52	58.27	74.03
	(−0.10)	(0.44)	(0.89)	(0.25)	(1.42)	(1.62)	(1.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13,144	12,632	13,144	13,060	13,144	12,632	12,632
$\beta_1 + \beta_2$ (effect of P&C Loss in more constrained subsample)	−48.69***	−1.45	−26.58***	−28.68***	−17.01**	−12.74	−36.81
	(−5.13)	(−0.15)	(−3.06)	(−3.65)	(−1.98)	(−1.32)	(−1.59)

Panel B: Permanent policies, with interaction between controls & Constrained dummy							
Dependent Variable:	Life Policy Premium (q)						
	OLS						IV
Constrained based on:	Assets (1)	RBC Ratio (2)	Capital (3)	Rating (4)	Private (5)	Composite (6)	Composite (7)
β_1: P&C Loss (q-4 to q-1)	-50.10***	−2.72	−28.04	−59.76	−45.54	−61.89	−122.64
× Constrained (y−2)	(−3.33)	(−0.18)	(−0.95)	(−1.63)	(−1.08)	(−1.47)	(−1.53)
β_2: P&C Loss (q-4 to q-1)	−1.10	6.62	1.82	30.56	25.24	44.07	76.39
	(−0.12)	(0.53)	(0.06)	(0.85)	(0.61)	(1.09)	(1.13)
Controls × Constrained(y−2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13,144	12,632	13,144	13,060	13,144	12,632	12,632
$\beta_1 + \beta_2$ (effect of P&C Loss in more constrained subsample)	−51.20***	3.89	−26.22***	−29.20***	−20.30**	−17.82*	−46.25*
	(−5.42)	(0.42)	(−2.90)	(−3.65)	(−2.40)	(−1.82)	(−1.89)

(*Continued*)

Table V—*Continued*

Panel C: 10-year term policies, no interaction between controls & Constrained dummy

Dependent Variable:	Life Policy Premium (q)						
	OLS						IV
Constrained based on:	Assets (1)	RBC Ratio (2)	Capital (3)	Rating (4)	Private (5)	Composite (6)	Composite (7)
β_1: P&C Loss (q-4 to q-1)	0.25	17.64***	5.70	−0.79	0.91	13.18**	53.88**
× Constrained ($y-2$)	(0.03)	(2.91)	(0.74)	(−0.12)	(0.10)	(2.28)	(2.33)
β_2: P&C Loss (q-4 to q-1)	20.29***	2.45	15.79**	16.41***	19.80**	4.56	7.41
	(4.23)	(0.40)	(2.23)	(2.77)	(2.27)	(0.81)	(0.33)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	77,449	75,853	77,449	75,973	79,168	75,613	75,613
$\beta_1 + \beta_2$ (effect of P&C Loss in more constrained subsample)	20.54***	20.09***	21.48***	15.61***	20.71***	17.74***	61.29***
	(2.72)	(5.09)	(4.56)	(3.49)	(4.70)	(4.17)	(3.29)

Panel D: 10-year term policies, with interaction between controls & Constrained dummy

Dependent Variable:	Life Policy Premium (q)						
	OLS						IV
Constrained based on:	Assets (1)	RBC Ratio (2)	Capital (3)	Rating (4)	Private (5)	Composite (6)	Composite (7)
β_1: P&C Loss (q-4 to q-1)	1.86	12.19**	11.04*	−3.43	21.69***	9.88*	41.13*
× Constrained ($y-2$)	(0.27)	(2.14)	(1.77)	(−0.49)	(2.84)	(1.76)	(1.78)
β_2: P&C Loss (q-4 to q-1)	16.97***	7.14	6.75	17.30***	−1.38	7.43	16.63
	(3.81)	(1.26)	(1.20)	(2.86)	(−0.20)	(1.40)	(0.63)
Controls × Constrained($y-2$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Insurer-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YYMM-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	77,449	75,853	77,449	75,973	79,168	75,613	75,613
$\beta_1 + \beta_2$ (effect of P&C Loss in more constrained subsample)	18.83***	19.33***	17.79***	13.87***	20.30***	17.31***	57.76***
	(3.22)	(4.95)	(4.12)	(3.22)	(4.61)	(4.11)	(3.26)

E. The Life Insurance Marketplace

When life divisions affected by affiliated P&C losses change prices, the effectiveness of the price changes in securing more immediate financial resources depends on demand elasticity.Thus, customers may shop around more, possibly leading to a higher elasticity than 2.2. Life policy premium comparison websites also help raise elasticity. On average, 214 life insurers sell ordinary policies in each of the continental U.S.states each year between 2002 and 2014. Life insurers generally sell policies in many states, with the 25th percentile being 49 states.

A life insurer can use additional strategies to affect customer demand, even if elasticity could be limited due to customers' heterogeneous utility associated with a certain insurer (e.g., their familiarity with the brand).

F. Impact on Financial Resources

How much financial resources do the documented price changes bring? Insurers do not report the number of permanent policies sold but do report the total number of term policies sold (although without a breakdown across different policy durations).

The total changes to financial resources may be larger than presented here as life divisions can generate additional financial resources by changing prices on other products as well, including the permanent policies studied in this paper.

G. Alternative Explanations for Premium Changes

One of my main results is that life insurers reduce prices for permanent life policies following losses to P&C affiliates.A potential alternative explanation is that when life insurers make transfers to P&C affiliates, life insurers' financial strength weakens. Similarly, one may be concerned that P&C Loss is associated with losses or lower sales for life divisions, which can weaken life divisions' financial strength directly.

IV

Internal Financial Transfers and P&C Losses

To test whether transfers from life divisions to the rest of the group increase with P&C affiliates' losses, I estimate the following specification in Table VI:

$$Net\ Transfer\ from\ Life_{i,y} = \beta \cdot P\&C\ Loss_{g,y-1} + \gamma \cdot X_{i,y-2\ \&\ g,y-2} + FE_i + FE_y + \epsilon_{i,y}, \quad (5)$$

where i indexes life divisions, g indexes groups, and y indexes years. Because insurers report the net inflows they receive, I take the negative of reported net inflows to obtain net transfers from life divisions to the rest of the group. The dependent variable is net transfers in year y as a percentage of the life division's capital (assets minus liabilities) from y − 2.24 The main independent variable is P&C affiliates' losses in y − 1 scaled by P&C assets from y − 2. X is a vector of controls based on Niehaus (2014). I include insurer and year fixed effects. The regression uses life divisions that appear in my pricing sample

Transfers from Life Divisions and Affiliated P&C Losses

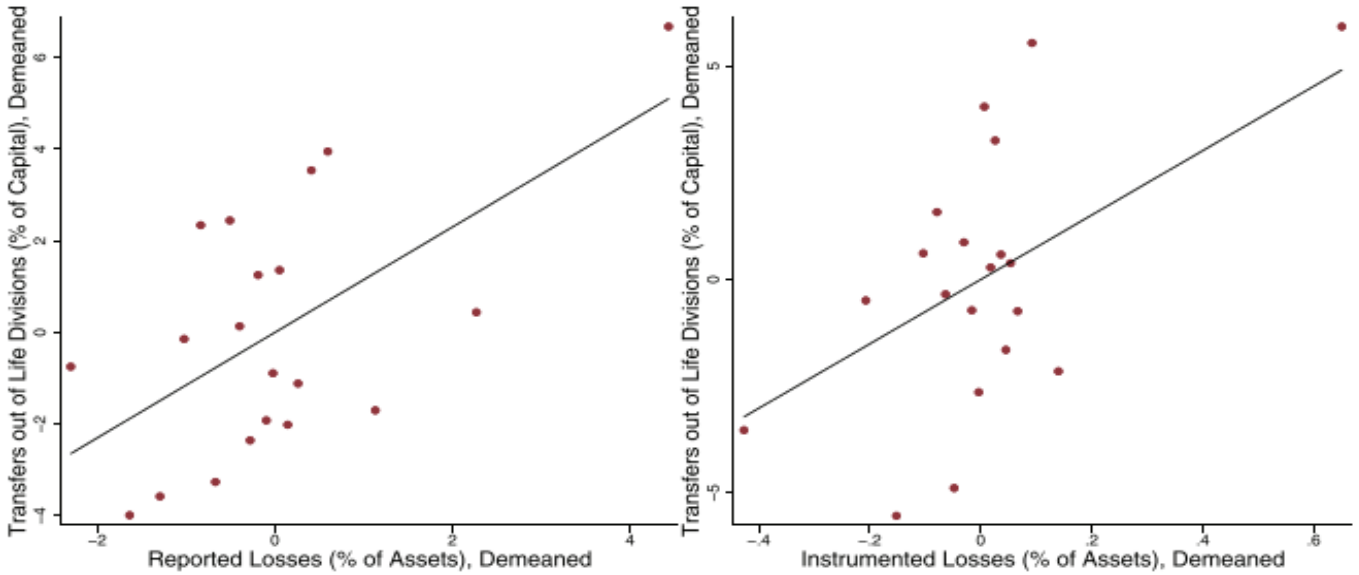
Panel A: Regression results

	OLS		IV		IV	
			First Stage	Second Stage	First Stage	Second Stage
Dependent Variable:	Transfers out of Life (y)		P&C Loss (y-1)	Transfers out of Life (y)	P&C Loss (y-1)	Transfers out of Life (y)
	(1)	(2)	(3)	(4)	(5)	(6)
P&C Unusual Weather Exposure ($y-1$)			0.14***		0.15**	
			(2.68)		(2.60)	
P&C Loss ($y-1$)	1.10**	1.21**		7.54***		8.04***
	(2.39)	(2.60)		(2.70)		(2.82)
Controls		Yes			Yes	Yes
Insurer FE, Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1,570	1,288	1,570	1,570	1,288	1,288
Cragg-Donald F-stat				13.73		13.68

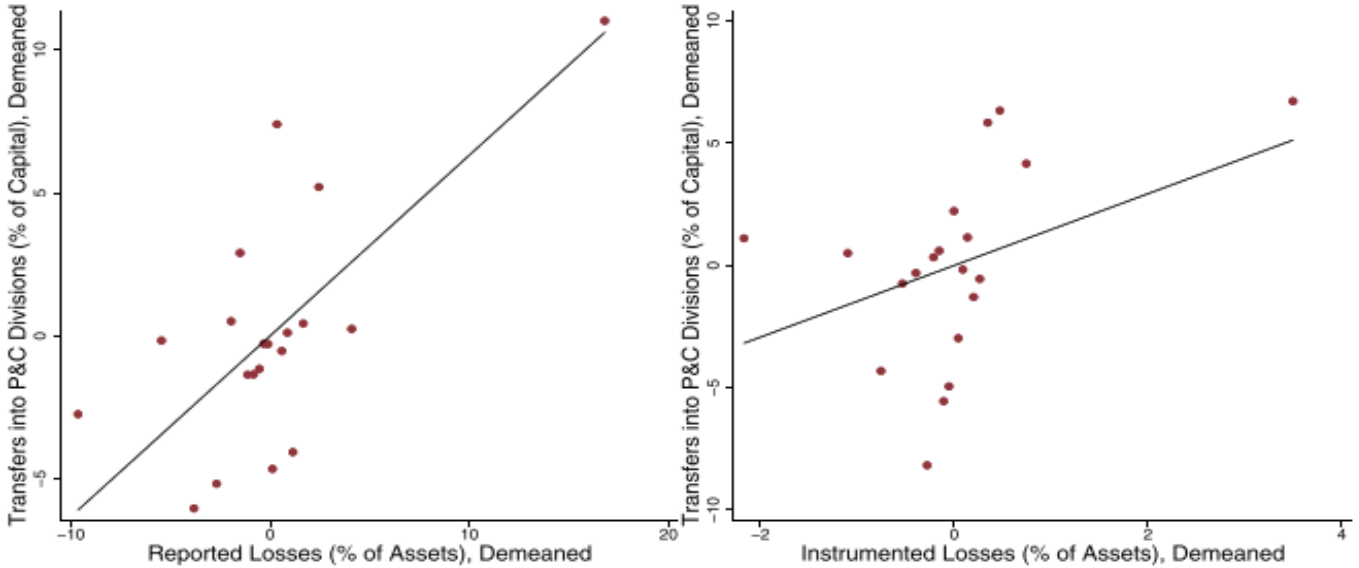
Panel B: Univariate mean comparisons

	Reported P&C Loss				Instrumented P&C Loss			
	High	Low	High–Low	p-value	High	Low	High–Low	p-value
Transfers	2.34	−0.58	2.92	0.033	2.15	−0.54	2.68	0.050

Panel (A) Transfers from Life Divisions to Rest of Group and P&C Losses



Panel (B) Transfers to P&C Divisions from Rest of Group and P&C Losses



V

Conclusion

One of the channels through which fifirms′ financial constraints can affect the real economy is through fifirms′ product pricing decisions.

I find that following P&C losses, life insurers change prices in different directions for different policies.

First, for permanent life policies, which initially increase insurers′ financial resources, premiums decline with affiliated P&C losses.

In contrast, for 10-year policies, which initially reduce insurers′ financial resources, premiums rise with affiliated P&C losses.

Evidence also suggests that life insurers in more constrained groups change prices to a greater extent. Moreover, following larger P&C losses, life divisions increase financial transfers to the rest of the group.

This study has three main implications, most of which could generalize across industries.

First, this paper contributes to the literature by showing that financial constraints can have a causal effect on product pricing decisions.

Second, this paper contributes to our understanding of firms' internal capital markets.

Third, this study contributes to the broad literature on financial intermediation, as insurers are significant players in this market.

2022

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- 2022-12-28

Variable Definitions

Variable	Definition (Unit)
P&C Loss	Set to zero if the net underwriting gain is positive. Equal to the negative of the net underwriting gain, as a percentage of lagged assets, if the net underwriting gain is negative. The net underwriting gain is available on the Statement of Income in the statutory filings, Line 8 Column 1 in the 2014 filing. To break it down, P&C Loss = (losses incurred + loss expenses incurred + other underwriting expenses incurred + aggregate write-ins for underwriting deductions) − (premiums earned + net income of protected cells). It is set to zero if the first bracket is smaller than the second bracket. Losses incurred = losses paid less salvage from direct business and reinsurance assumed − reinsurance recovered + net losses unpaid current year − net losses unpaid prior year. Life insurers unaffiliated with P&C insurers are assigned a P&C Loss equal to zero. The measure is aggregated across all P&C divisions at the group level in all tables other than in regressions on transfers received by individual P&C divisions, where the measure is at the individual P&C division level. (%)

(*Continued*)

Variable	Definition (Unit)
P&C Unusual Weather Exposure	Instrumental variable for P&C Loss. See Section III.B.2 for the construction of the variable. The measure is aggregated across all P&C divisions at the group level in all tables other than in regressions on transfers received by individual P&C divisions, where the measure is at the individual P&C division level. (%)
Life Assets	The admitted assets of the life insurer. ($000)
Life Asset Growth	The admitted assets of the life insurer minus that in the previous year, scaled by the latter. (%)
Life Operating ROE	AM Best's measure of after-tax insurance earnings in relation to the mean of the company's current- and prior-year policyholders' and shareholders' surplus base. (%)
Life Leverage	Total liabilities over total assets of the life insurance company. (%)
Life Capital Ratio Minus Guidelines	AM Best's Capital Adequacy Ratio of the life insurer minus the ratio corresponding to insurers' AM Best rating according to AM Best's rating guideline.
Life Current Liquidity	AM Best's Current Liquidity measure of the life insurer, which measures the proportion of liabilities (excluding AVR, conditional reserves, and separate account liabilities) covered by cash and unaffiliated holdings, excluding mortgages and real estate.
Life Rating Category Dummies	A vector of dummy variables representing each rating category: A++, A+, and so on.
Transfer from Life	I take the negative of the reported net inflow to obtain the net outflow of the life insurers. Net total transfers from the life division to the rest of the group as a percentage of the life division's capital from year $y-2$, with the absolute value capped at one. (%)
Life RBC Ratio	Life insurers' risk-based capital ratio, which is total adjusted capital divided by authorized control-level capital.
Life Net Income	Life insurers' net income scaled by assets. (%)
Life Unrealized Capital Gain	Life insurers' unrealized capital gain scaled by assets. (%)
Group Assets	The sum of admitted assets of all insurers within a group. ($000) Note the caveat that this aggregation does not take into account one division's ownership of another within a group.
Group Leverage	The sum of liabilities of all insurers within a group, divided by group assets. (%) Note a similar caveat as the one above applies.
Group RBC Ratio	Risk-based capital ratio at the group level, defined as the sum of total adjusted capital divided by the sum of authorized

Variable	Definition (Unit)
Group Net Income	Net income scaled by assets, both summed over all insurers in the group. (%)
Group Unrealized Capital Gain	Unrealized capital gain scaled by assets, both summed over all insurers in the group. (%)
Transfer to P&C	Net total transfers received by an individual P&C division as a percentage of its capital from year $y-2$, with the absolute value capped at one. (%)
Insurers' Rating	Cardinal numbers to index the AM Best ratings: 17 for A++, 16 for A+, 15 for A, 14 for A−, 13 for B++, 12 for B+, 11 for B, 10 for B−, 9 for C++, 8 for C+, 7 for C, 6 for C−, 5 for D, 4 for E, 3 for F, 2 for S, and 1 for Insufficient Size and/or Operating Experience. A higher number indicates a better rating.