When Paper Losses Get Physical: Domestic Violence and Stock Returns

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Prevalence of domestic violence

- Nearly a third of women and more than a quarter of men in the U.S. experience physical violence by an intimate partner in their lifetime (Centers for Disease Control and Prevention, 2011)
- Annual cost of domestic violence against women alone is more than $5.8 bn in the U.S. (Centers for Disease Control and Prevention, 2003)
  - $4.1 bn for direct medical and mental health care
  - $0.9 bn in lost productivity
  - $0.9 bn in lifetime earnings lost by victims of domestic violence homicide

Money as a source of stress in relationships

- "Stress in America" survey conducted by American Psychological Association (APA) (2017):
  62% of respondents report money as a source of stress
- SunTrust Bank survey in 2015:
  Finances are the most common cause of stress in relationships, cited by 35% of respondents

Economic literature on domestic violence

- Source of gratification and an instrument for controlling behavior, linked to bargaining power and outside options
  - Tauchen, Witte, and Long (1991, IER)
  - Aizer (2010, AER) (wage gap)
  - Anderberg, Rainer, Wadsworth, and Wilson (2016, EJ) (unemployment by gender)
- An argument escalates out of control due to emotional cues
  - Card and Dahl (2011, QJE) (football-induced stress)
  - Beland and Brent (2018, JPubE) (extreme traffic congestion)

Stock market as a source of stress

- Hospital admissions for mental conditions in California (Engelberg and Parsons, 2016, JF)
  and in Taiwan
  (Lin, Chen, and Liu, 2015, Health Policy and Planning)
- Cardiovascular mortality in Guangdong
  (Lin, Zhang, Xu, Liu, Xiao, Luo, Xu, He, and Ma, 2013, PLoS ONE)
- Incidence of stroke in Taiwan
  (Chen, Chen, Liu, and Lin, 2012, Social Science & Medicine)
- Death due to coronary heart disease at Shanghai
  (Ma, Chen, Jiang, Song, and Kan, 2011, European Heart Journal)

Research question

- Do emotional cues caused by negative stock returns increase the incidence of domestic violence?

Illustrative loss-of-control model

- Following the approach in Card and Dahl (2011, QJE)
- Likelihood of an argument escalating to violence:

$$h_t = h^0 - \mu(R_t - E_{t-1}[R_t]) \tag{1}$$

- Assuming μ is piecewise linear:

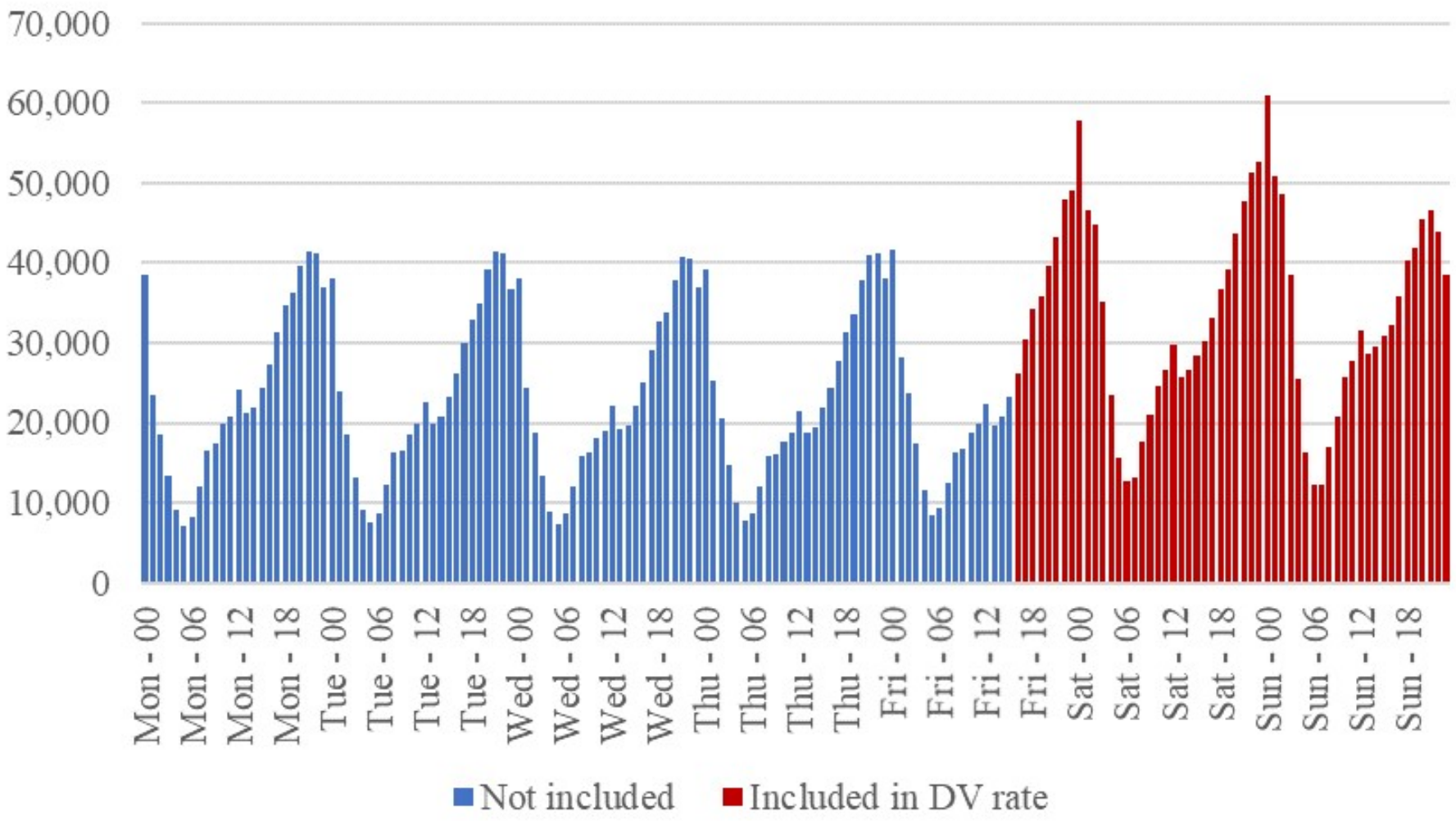
$$\begin{aligned} h^L(R_t) &= h^0 - \alpha(R_t - E_{t-1}[R_t]), \quad R_t - E_{t-1}[R_t] < 0 \\ h^G(R_t) &= h^0 - \beta(R_t - E_{t-1}[R_t]), \quad R_t - E_{t-1}[R_t] > 0. \end{aligned} \tag{2}$$

- Loss aversion implies that $\alpha > \beta$

Data & methodology

- Domestic violence data from National Incident Based Reporting System (NIBRS)
  - Incidents reported at the police agency level
- Domestic violence: Reported incident of assault, aggravated assault, or intimidation by a spouse, partner, or boyfriend/girlfriend (Card and Dahl, 2011, QJE)
- Local stock market return for each state based on all stocks listed on NYSE, NASDAQ, and AMEX, with company location data from Compustat and 10-K reports

Number of incidents by weekday and hour



Number of police agencies

Year	Population covered	Number of agencies	Average population	Number of states
1996	11,233,438	360	31,204	8
1997	17,214,875	504	34,156	12
1998	20,815,169	602	34,577	16
1999	26,012,759	753	34,545	16
2001	39,038,231	1,005	38,844	20
2002	42,316,107	1,066	39,696	21
2003	45,700,878	1,173	38,961	23
2004	50,203,468	1,254	40,035	25
2005	55,875,711	1,354	41,267	28
2006	59,243,478	1,401	42,287	32
2007	61,376,689	1,449	42,358	33
2008	64,198,753	1,524	42,125	33
2009	68,153,097	1,645	41,430	34
2010	70,098,939	1,661	42,203	34
2011	72,220,825	1,729	41,770	34
2012	75,658,735	1,807	41,870	34
2013	77,773,582	1,834	42,407	34
2014	79,546,541	1,865	42,652	35
2015	80,671,537	1,889	42,706	34

Summary statistics - weekly observations

	Mean	Std	Min	p10	p50	p90	Max
Offense rates							
DV rate	2.64	4.25	0.00	0.00	0.00	8.13	92.12
Assault rate	0.64	1.89	0.00	0.00	0.00	2.40	104.68
Murder rate	0.02	0.29	0.00	0.00	0.00	0.00	19.88
Sex offense rate	0.40	1.40	0.00	0.00	0.00	1.13	144.16
Robbery rate	0.36	1.33	0.00	0.00	0.00	0.88	48.01
Drug offense rate	2.95	5.07	0.00	0.00	0.00	8.71	468.51
Agency variables							
Population ('000)	40.90	66.69	10.00	11.61	22.88	77.20	1106.07
PI/capita ('000)	36.45	12.23	12.38	23.96	34.26	51.13	128.18
IU rate (%)	2.38	1.14	0.23	1.12	2.19	3.94	11.52
N	1,296,275						

Summary statistics - weekly observations (cont'd)

	Mean	Std	Min	p10	p50	p90	Max
Raw stock return							
Return	0.002	0.030	-0.428	-0.031	0.003	0.033	0.361
Positive	0.554	0.497	0.000	0.000	1.000	1.000	1.000
Drop 5%	0.040	0.196	0.000	0.000	0.000	0.000	1.000
Drop 7%	0.018	0.133	0.000	0.000	0.000	0.000	1.000
Drop 9%	0.009	0.093	0.000	0.000	0.000	0.000	1.000
Drop 11%	0.004	0.065	0.000	0.000	0.000	0.000	1.000
Drop 13%	0.002	0.050	0.000	0.000	0.000	0.000	1.000
Relative to 4-w avg							
Δ Return	-0.000	0.034	-0.434	-0.035	-0.001	0.036	0.349
Positive	0.481	0.500	0.000	0.000	0.000	1.000	1.000
Drop 5%	0.050	0.218	0.000	0.000	0.000	0.000	1.000
Drop 7%	0.020	0.139	0.000	0.000	0.000	0.000	1.000
Drop 9%	0.009	0.092	0.000	0.000	0.000	0.000	1.000
Drop 11%	0.005	0.067	0.000	0.000	0.000	0.000	1.000
Drop 13%	0.003	0.053	0.000	0.000	0.000	0.000	1.000

Domestic violence and state-level stock returns

Raw state-level stock market return

$$ln(1 + DV\ rate)_{i,s,t} = \alpha_0 + \alpha_1 \times Return_{s,t} + \beta \times X_{i,s,t} + \epsilon_{i,t}$$

	(1)	(2)	(3)	(4)
Return	−0.1073***	−0.0678***	−0.0677***	−0.0535**
	(0.0000)	(0.0048)	(0.0059)	(0.0445)
Weekly IU control	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No
Agency FE	Yes	No	No	No
Agency-Year FE	No	Yes	No	No
Agency-Quarter FE	No	No	Yes	No
Agency-Month FE	No	No	No	Yes
Week of Year FE	No	Yes	Yes	Yes
Holidays FE	No	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275	1,296,275
R^2	0.291	0.338	0.384	0.489

Domestic violence and state-level stock returns

Relative to 4-week-average return

$$ln(1 + DV\ rate)_{i,s,t} = \alpha_0 + \alpha_1 \times \Delta Return_{s,t} + \beta \times X_{i,s,t} + \epsilon_{i,t}$$

	(1)	(2)	(3)	(4)
Δ Return	−0.0460**	−0.0507**	−0.0474**	−0.0495**
	(0.0234)	(0.0148)	(0.0238)	(0.0280)
Weekly IU control	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No
Agency FE	Yes	No	No	No
Agency-Year FE	No	Yes	No	No
Agency-Quarter FE	No	No	Yes	No
Agency-Month FE	No	No	No	Yes
Week of Year FE	No	Yes	Yes	Yes
Holidays FE	No	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275	1,296,275
R^2	0.291	0.338	0.384	0.489

Potential endogeneity concerns

- Bad economic conditions may be correlated with both low stock returns and high DV rates
- Mitigated by the extensive set of fixed effects we include
- To further address this concern, we perform the same regressions with lagged and forward returns – only the contemporaneous return should affect DV

Domestic violence vs. lagged and forward stock returns

Raw state-level stock market return

	(1)	(2)	(3)
Return	−0.0535**	−0.0629**	−0.0645**
	(0.0445)	(0.0234)	(0.0250)
Return (t-1)		−0.0360	−0.0369
		(0.2018)	(0.1971)
Return (t+1)			−0.0058
			(0.8350)
Weekly IU control	Yes	Yes	Yes
Agency-Month FE	Yes	Yes	Yes
Week of Year FE	Yes	Yes	Yes
Holidays FE	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275
R^2	0.489	0.489	0.489

Domestic violence vs. lagged and forward stock returns

Relative to 4-week-average return

	(1)	(2)	(3)
Δ Return	−0.0495**	−0.0558**	−0.0529**
	(0.0280)	(0.0155)	(0.0246)
Δ Return (t-1)		−0.0333	−0.0315
		(0.1557)	(0.1836)
Δ Return (t+1)			0.0139
			(0.5552)
Weekly IU control	Yes	Yes	Yes
Agency-Month FE	Yes	Yes	Yes
Week of Year FE	Yes	Yes	Yes
Holidays FE	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275
R^2	0.489	0.489	0.489

Domestic violence and directional state-level stock returns

	Raw stock market return		Relative to 4-week average	
	(1)	(2)	(3)	(4)
Return x Positive	−0.0522	−0.0603		
	(0.2395)	(0.1931)		
Return x Negative	−0.0826*	−0.0752		
	(0.0564)	(0.1094)		
Δ Return x Positive			0.0075	0.0140
			(0.8353)	(0.7163)
Δ Return x Negative			−0.1217***	−0.1216***
			(0.0030)	(0.0054)
Weekly IU control	Yes	Yes	Yes	Yes
Agency-Year FE	Yes	No	Yes	No
Agency-Quarter FE	No	Yes	No	Yes
Week of Year FE	Yes	Yes	Yes	Yes
Holidays FE	Yes	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275	1,296,275
R^2	0.338	0.384	0.338	0.384

Domestic violence and weekly drops in stock market

Raw state-level stock market return

	(1)	(2)	(3)	(4)	(5)
Drop 5%	−0.0014				
	(0.7407)				
Drop 7%		0.0112*			
		(0.0848)			
Drop 9%			0.0175*		
			(0.0561)		
Drop 11%				0.0347***	
				(0.0079)	
Drop 13%					0.0441**
					(0.0111)
Weekly IU control	Yes	Yes	Yes	Yes	Yes
Agency-Month FE	Yes	Yes	Yes	Yes	Yes
Week of Year FE	Yes	Yes	Yes	Yes	Yes
Holidays FE	Yes	Yes	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275	1,296,275	1,296,275
R^2	0.489	0.489	0.489	0.489	0.489

Domestic violence and weekly drops in stock market

Relative to 4-week-average return

	(1)	(2)	(3)	(4)	(5)
Drop 5%	0.0087**				
	(0.0206)				
Drop 7%		0.0142**			
		(0.0151)			
Drop 9%			0.0191**		
			(0.0336)		
Drop 11%				0.0218*	
				(0.0682)	
Drop 13%					0.0308**
					(0.0484)
Weekly IU control	Yes	Yes	Yes	Yes	Yes
Agency-Month FE	Yes	Yes	Yes	Yes	Yes
Week of Year FE	Yes	Yes	Yes	Yes	Yes
Holidays FE	Yes	Yes	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275	1,296,275	1,296,275
R^2	0.489	0.489	0.489	0.489	0.489

Additional results summary

- The negative relationship between domestic violence and stock returns is strongest in the middle tertile of counties based on PI/capita
- Using Google search volume for "domestic violence" as an alternative proxy for the incidence of domestic violence yields similar results as using reported incidents
- The results are robust to using state-level stock index excluding companies based in the counties that the agency covers
- We find no significant relationship between stock returns and other crime rates

Economic significance

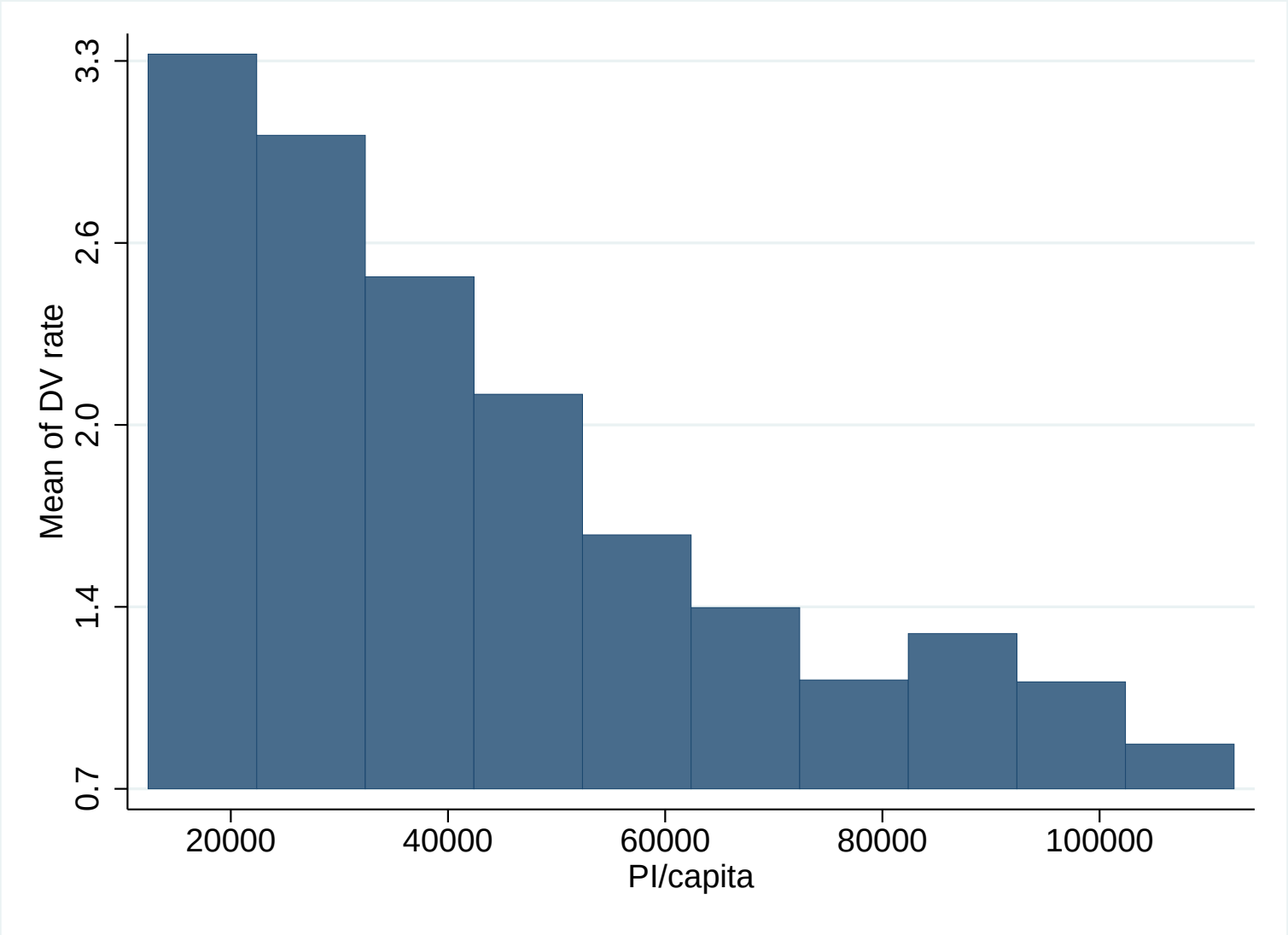
- A 13 %-point decrease in stock return relative to four-week average results in:
  - 0.9% increase in domestic violence, based on baseline estimates (non-directional)
  - 2.2% increase in domestic violence, based on directional estimates
  - 4.3% increase in domestic violence, based on drop dummy estimates
  - 14.7% increase in domestic violence, based on Google search volume analysis
- For comparison:
  - Upset losses in professional football by the home team lead to a roughly 10% increase in at-home male-on-female domestic violence on Sundays during the season (Card and Dahl, 2011)
  - Increase of more than 5% in hospital admissions associated with the Black Monday stock market fall of almost 25% (Engelberg and Parsons, 2016)

Conclusion

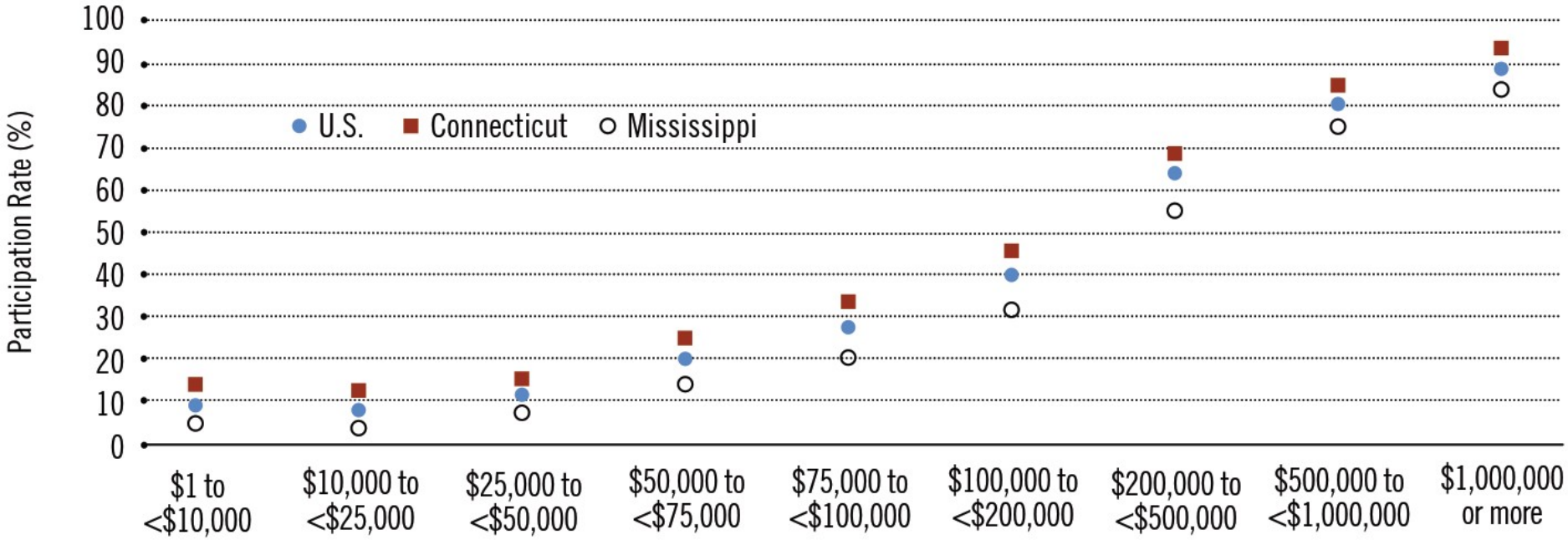
- We find a significant negative relationship between stock returns and the incidence of domestic violence
- The effect only exists for the contemporaneous week returns, supporting a causal interpretation
- The effect is strongest in the middle part of the county income distribution
- A similar result can be found using Google search volume for "domestic violence" at the state level

Appendix

Average domestic violence rate vs. PI per capita



Stock market participation by income (Chien and Morris, 2017)



Domestic violence and stock returns vs. wealth level

Raw state-level stock market return

	(1)	(2)
High PI/capita x Return	−0.0307	−0.0455
	(0.4480)	(0.2708)
Medium PI/capita x Return	−0.0850**	−0.0830**
	(0.0344)	(0.0434)
Low PI/capita x Return	−0.0656	−0.0526
	(0.1350)	(0.2414)
Weekly IU control	Yes	Yes
Agency-Year FE	Yes	No
Agency-Quarter FE	No	Yes
Week of Year FE	Yes	Yes
Holidays FE	Yes	Yes
N	1,244,573	1,244,573
R^2	0.334	0.381

Domestic violence and stock returns vs. wealth level

Relative to 4-week-average return

	(1)	(2)
High PI/capita x Δ Return	−0.0238	−0.0240
	(0.4960)	(0.4954)
Medium PI/capita x Δ Return	−0.0688**	−0.0652*
	(0.0475)	(0.0627)
Low PI/capita x Δ Return	−0.0468	−0.0386
	(0.2220)	(0.3158)
Weekly IU control	Yes	Yes
Agency-Year FE	Yes	No
Agency-Quarter FE	No	Yes
Week of Year FE	Yes	Yes
Holidays FE	Yes	Yes
N	1,244,573	1,244,573
R^2	0.334	0.381

Google search volume for "domestic violence" by state

Raw state-level stock market return

	(1)	(2)	(3)	(4)
Return	−0.9885**	−1.0161**	−0.9475**	−1.1984**
	(0.0218)	(0.0201)	(0.0340)	(0.0175)
Weekly IU control	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No
State FE	Yes	No	No	No
State-Year FE	No	Yes	No	No
State-Quarter FE	No	No	Yes	No
State-Month FE	No	No	No	Yes
Week of Year FE	No	Yes	Yes	Yes
Holidays FE	No	Yes	Yes	Yes
N	24,024	23,977	23,977	23,974
R^2	0.165	0.225	0.271	0.387

Google search volume for "domestic violence" by state

Relative to 4-week-average return

	(1)	(2)	(3)	(4)
Δ Return	−0.8277**	−0.8307**	−0.8234**	−1.0485**
	(0.0324)	(0.0351)	(0.0345)	(0.0152)
Weekly IU control	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No
State FE	Yes	No	No	No
State-Year FE	No	Yes	No	No
State-Quarter FE	No	No	Yes	No
State-Month FE	No	No	No	Yes
Week of Year FE	No	Yes	Yes	Yes
Holidays FE	No	Yes	Yes	Yes
N	24,024	23,977	23,977	23,974
R^2	0.165	0.225	0.271	0.387

State returns excluding agency counties

	(1)	(2)	(3)	(4)
Return (exc. county)	−0.1133***	−0.0695***	−0.0727***	−0.0600**
	(0.0000)	(0.0037)	(0.0031)	(0.0246)
Weekly IU control	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No
Agency FE	Yes	No	No	No
Agency-Year FE	No	Yes	No	No
Agency-Quarter FE	No	No	Yes	No
Agency-Month FE	No	No	No	Yes
Week of Year FE	No	Yes	Yes	Yes
Holidays FE	No	Yes	Yes	Yes
N	1,284,324	1,284,324	1,284,324	1,284,324
R^2	0.291	0.338	0.385	0.491

Other offense rates vs. stock returns

	(1) Assault	(2) Murder	(3) Sex offense	(4) Robbery	(5) Drug offense
Return	0.0016	0.0023	−0.0196	−0.0006	0.0131
	(0.9257)	(0.4915)	(0.1907)	(0.9610)	(0.6328)
Weekly IU control	Yes	Yes	Yes	Yes	Yes
Agency-Month FE	Yes	Yes	Yes	Yes	Yes
Week of Year FE	Yes	Yes	Yes	Yes	Yes
Holidays FE	Yes	Yes	Yes	Yes	Yes
N	1,296,275	1,296,275	1,296,275	1,296,275	1,296,275
R^2	0.423	0.247	0.301	0.460	0.489