Does Water Management Improve Corporate Value ?

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Chaire Finance Durable et Investissement Responsable

Why Should We Care ?

Water is not just used to irrigate crops. The U.S. economy is directly or indirectly dependent of water

"The nation's water supplies are connected to nearly all economic activity through the energy-water-food nexus."(EPA, 2013)

Water risks are rapidly materializing for businesses

- Because of growing population, economic activity and climate change
- Water cycle is directly related to the carbon cycle and thus to climate change (IPCC 2012)
- Increase of water risk disclosures in the SEC filings (Adrio, 2012)

Water is a social and environmental concern

- UN Sustainable Development Goals [6]) ;
- Related to the Corporate Social Responsibility
- *Poor environmental performance is an indicator of a firm's operational inefficiency, which leads to competitive disadvantages* ; Guenster et al. (2011) ;

Research Question

I investigate the empirical significance of water management on firm value.

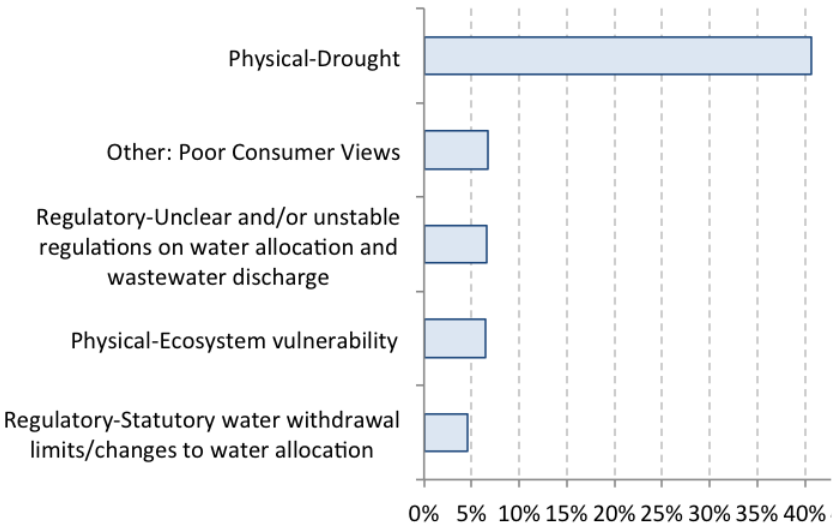
In particular I examine :

- Whether and by how much investors value water management ;
- Why do investors value water management ?

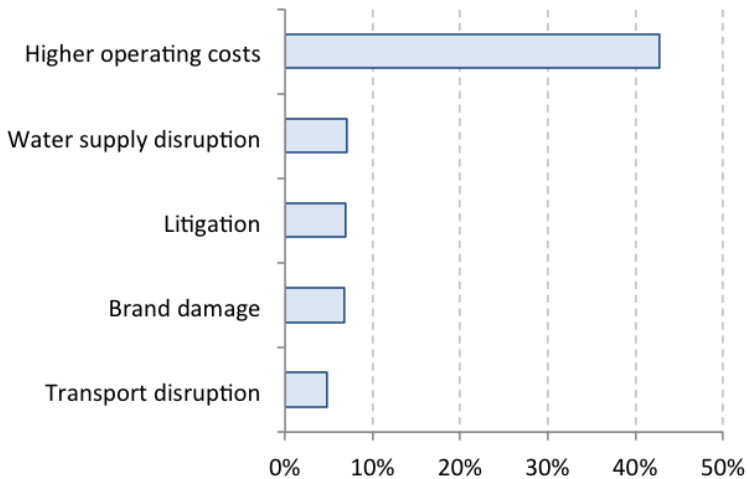
Do Investors Value Water Management ?

Taking Cues from the CDP survey Data (N= 1'261)

"Please describe the detrimental water-related impacts experienced by your organization ?"



IMPACT INDICATOR



IMPACT AT THE FIRM LEVEL

Identification Strategy

- Because water management and corporate performance are likely to be endogenously determined, **I use the occurrence of heat shocks as a source of exogenous variation**.
- Heat shocks are exogenous and thus are likely to create **water supply frictions**.
- If corporate water management improved operating efficiency $\rightarrow$ this positive effect should be particularly identifiable and pronounced in periods of water stress.

Companies with good corporate water management should exhibit higher operating performances during times of water stress.

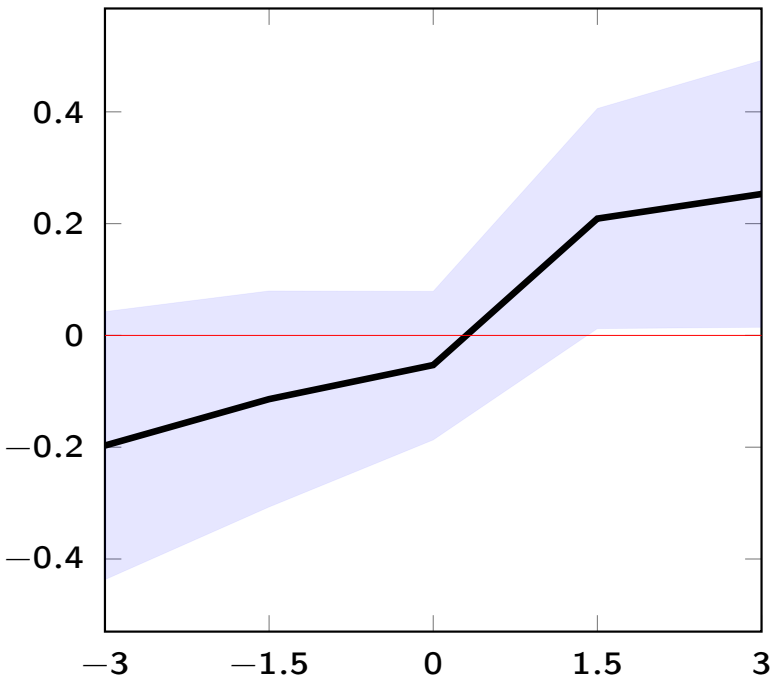
This paper

- Examines how water supply frictions could affect the firm performance and value using heat shocks

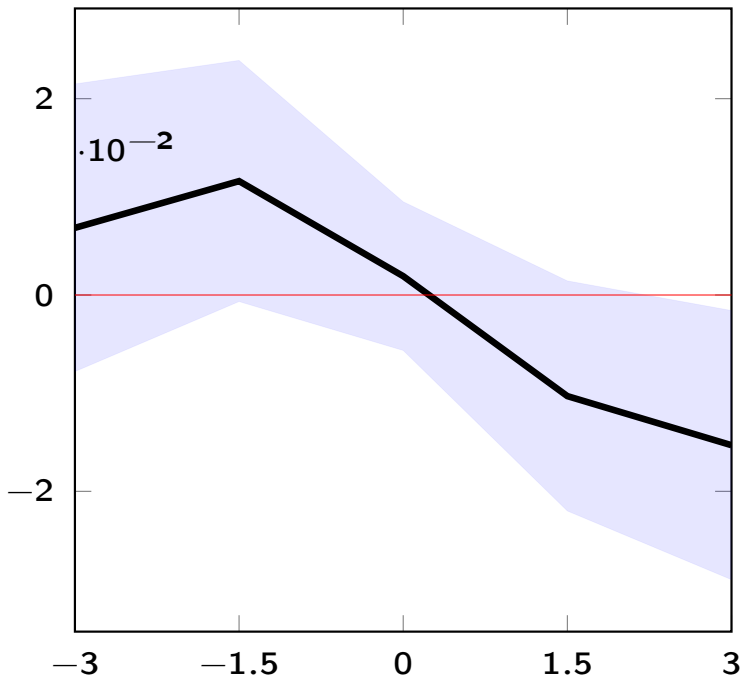
- Based on publicly available information
  - US. Manufacturing Industry from 2013 to 2016 - 139 firms
  - MSCI water management scores
  - Drought data from NOAA

My Paper in One Picture

Firm Value, Operating Expenses and Drought Severity



Tobin's Q



$(\text{OPEX/Sales})_{q+1}$

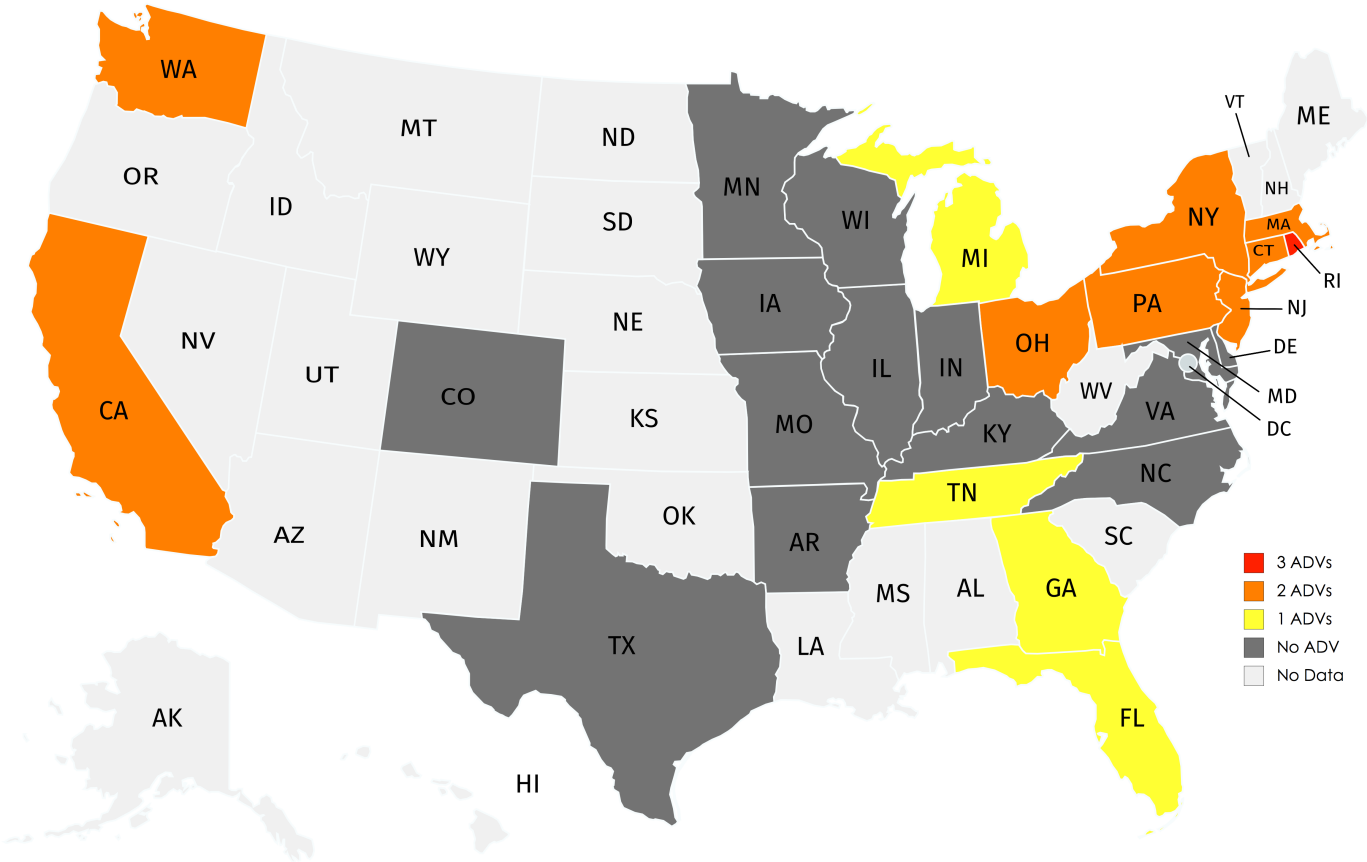
Main Results

- **Investors value positively water management :**
  The differential in value between good and poor water management firms increases by **8%** during heat shocks
- **This increase in valuation is explained by lower operating expenses :**
  - The relative decrease in operating expenses for good water management firms is **1.5%** ($\sim$ \$ 80 million)
  - Relative increase in operating expenses for poor water management firms is **1.6%**
  - A *good* water management provides a **competitive advantage** for firms and acts as an **hedging strategy**
  - The increase in value and the decrease in operating costs only occur during heat shocks, no during wet conditions

How to Identify a Heat Shock

- I use the Palmer Drought Severity Index from (NCEI/NOAA) (Dai and Zhao, 2017)
  - One of the most used in U.S climate studies (Hong et al., 2016) ;
  - Standardized from -10 (dry) to +10 (wet).
- **Sizeable heat shocks in each U.S state are defined in terms of the deviation in the yearly changes in the PDSI from its average level over the period 2000-2016.**
- Formally : *Abnormal Drought Variations* (ADV) occur in an state-year when the negative PDSI change is 3 times larger than the state's average ;
- Match state-level abnormal drought variations with locations of firm headquarters.

Annual Abnormal Drougth Variations *ADV*



Water Management Scores

- Individual company water management scores come from MSCI
- MSCI's analysts assess water management according to quantitative and qualitative criteria :
  1. **Governance and Strategy** : *Is there a specific executive body in charge of the company's water management strategy, ...*
  2. **Targets** : *existence of specific targets, track records, reduction in water consumption, aggressiveness of the company's reduction target,...*
  3. **Performance** : *Water consumption, Water withdrawals,...*
  4. **Water conflicts controversies** : *ecological damage resulting from water withdrawals, depletion of water resources for other users,...*
- MSCI water management = weighted average of the criteria minus the controversy deduction.
- **Water management scores range from 0 to 10 and are industry-adjusted. Best water management firms have higher scores.**

Did Water Management Increase Firm Value ?

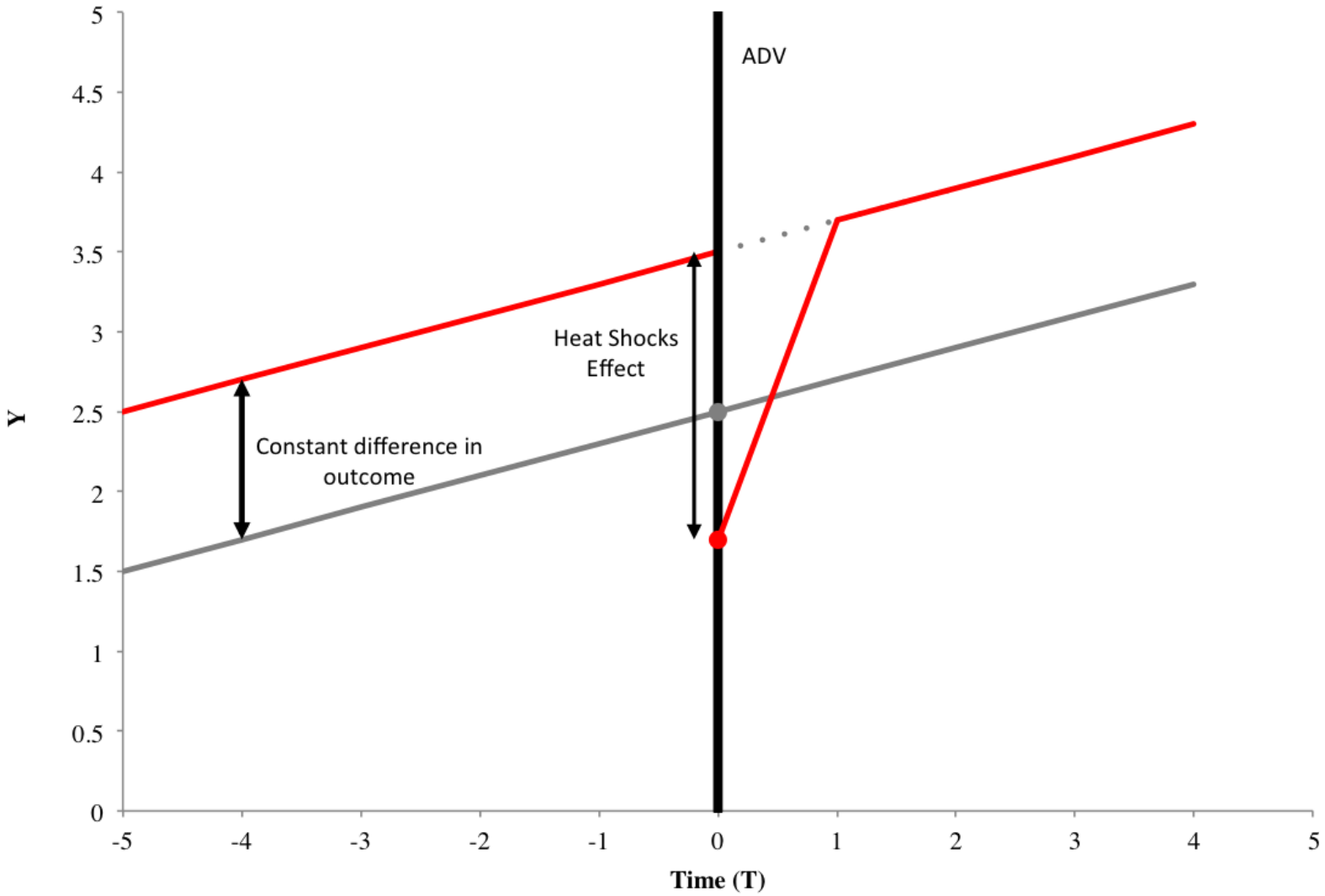
Use a (generalized) triple differences setting to identify the value investors assign to water management, in particular how firms with good water management react relative to firms with poor water management :

$$\begin{aligned} Y_{ijsbt} = \beta_1 \times ADV_{it} + \beta_2 \times \left\{ADV_{ijt} \times BEST_{it}\right\} \\ + Controls_{it} + \gamma_i + \delta_{bt} + \varphi_{jt} + \varphi_{st} + \varepsilon_{ijsbt}, \end{aligned} \quad (1)$$

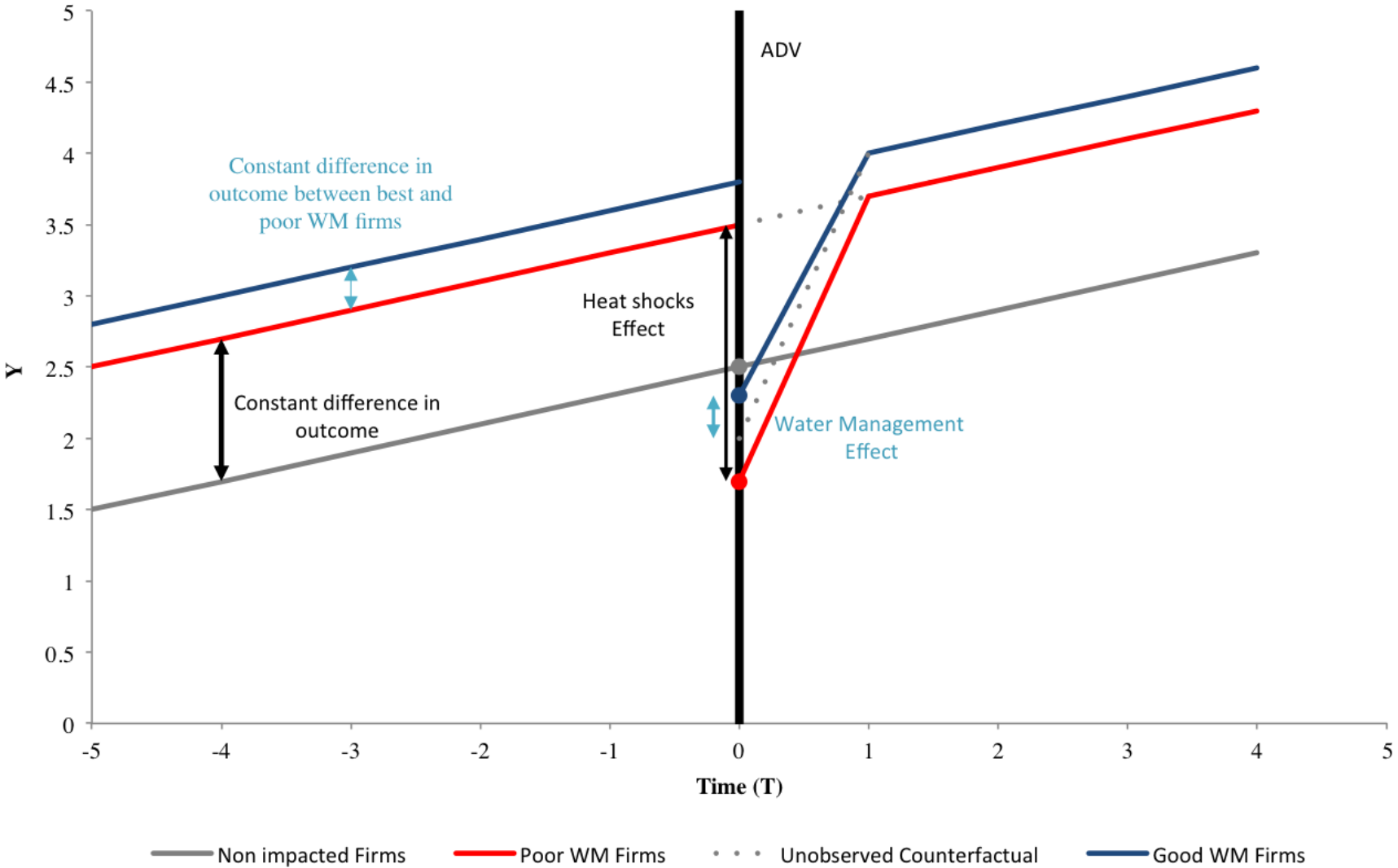
where Y is :

- either the value of the firm (Tobin's Q) : a forward-looking measure that allows to capture the value investors assign to water management ;
- or a variable related to the operating performance of the firm (*e.g. Operating expenses, ROA,...*)

Difference-in-Difference Estimation, Graphical Explanation



Difference-in-Difference Estimation, Graphical Explanation (cont.)



Impact on Value

- Improvement of $\sim$ **8 %** in value for the impacted *Best* firms relative to the average *Tobin's Q* of the sample
- Only partial evidence of a decrease in value for the impacted *poor* firms

	1	2	3	4	5
ADV	-0.0498	-0.137**	-0.0644	-0.132*	-0.130*
	(0.0542)	(0.0585)	(0.0680)	(0.0742)	(0.0671)
ADV×BEST		0.195***		0.208**	0.198**
		(0.0738)		(0.0872)	(0.0853)
ADV×BEST$_{t-1}$			0.148		
			(0.110)		
ln(Assets)				-0.629***	-0.640***
				(0.127)	(0.140)
Q_{t-1}				0.346***	0.343***
				(0.125)	(0.124)
N	480	480	355	466	466
R^2	-0.000	0.007	-0.000	0.239	0.237
Year-BEST FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
State FE	N	N	N	N	Y
Governance	N	N	N	N	Y

Summary and Additional Results

1. **Investors value water stewardship during heat shocks.**
   Firms with good water management scores exhibit higher values.

2. **Similar results when I control for :**
   - Time variant heterogeneity across industries :
     i.e. some industries perform better during drought periods,...
   - Time variant heterogeneity accross states :
     i.e. macro-economic or climate conditions, state water policies, ...
   - Trend in size, governance and cash.

→ **Why do investors value water management ?**

Why do investor value water management ?

Impact on Operating Performance : Demand vs. Supply Effects

- While the relative decrease in operating expenses between *best* and *poor* firms is **1.5%** ($\sim$ \$ 80 million)
- *Poor* firms exhibit a relative increase in operating expenses of **1.65%**
- In particular, implies lower SG&A.

	ROA_{q+1}	$\left(\frac{OPEX}{Sales}\right)_{q+1}$	$\left(\frac{COGS}{Sales}\right)_{q+1}$	$\left(\frac{SG\&A}{Sales}\right)_{q+1}$	SOA_{q+1}
ADV	-0.00175**	0.0132***	0.00158	0.0105***	0.000515
	(0.000827)	(0.00344)	(0.00230)	(0.00328)	(0.00254)
ADV×BEST	0.00195**	-0.0121***	-0.00194	-0.00983***	0.00356
	(0.000980)	(0.00425)	(0.00270)	(0.00331)	(0.00292)
ln(Assets)	-0.00346**	-0.0230**	-0.00265	-0.0187***	0.00614
	(0.00174)	(0.0103)	(0.00679)	(0.00669)	(0.00696)
$dep._{t-1}$	0.0875*	0.209***	0.228***	0.228***	0.688***
	(0.0451)	(0.0408)	(0.0735)	(0.0718)	(0.0493)
N	1812	1796	1810	1798	1812
R^2 Within	0.012	0.070	0.066	0.083	0.480

Terciles Analysis : Monotonic Relationship

	T1 Good	T2 Medium	T3 Poor		
	ADV×T1	ADV×T2	ADV×T3	N	$\overline{R^2 \text{ Within}}$
Q_q	0.257***	0.0751	-0.285***	1575	0.122
	(0.0925)	(0.0768)	(0.0918)		
ROA_{q+1}	0.00228*	0.00188	-0.00487***	1943	0.008
	(0.00133)	(0.00146)	(0.00182)		
$\left(\frac{OPEX}{Sales}\right)_{q+1}$	-0.0275***	0.00680	0.0255**	1927	0.005
	(0.00851)	0.00680	(0.0124)		
$\left(\frac{COGS}{Sales}\right)_{q+1}$	-0.0172***	0.0181**	-0.000915	1942	0.006
	(0.00586)	(0.00737)	(0.00711)		
$\left(\frac{SG\&A}{Sales}\right)_{q+1}$	-0.00932	-0.0117**	0.0259***	1928	0.024
	(0.00597)	(0.00546)	(0.00716)		
SOA_{q+1}	-0.00893	0.00604	-0.000385	1943	0.032
	(0.00640)	(0.00631)	(0.00746)		

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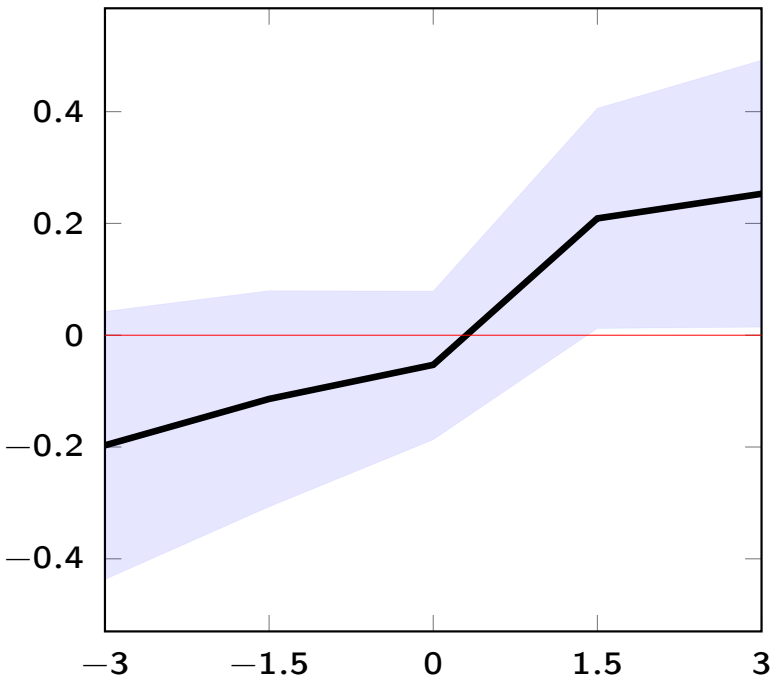
Terciles Analysis : Monotonic Relationship

- **COGS** : reflects the direct costs and overhead costs associated with the product.
- **SG&A** corresponds to the expenses not directly related to the acquisition or production of the goods
- **U.S Generally Accepted Accounting Principles (GAAP)** only provide accounting guidelines such that the same COGS and SG&A **may be reported differently between companies**

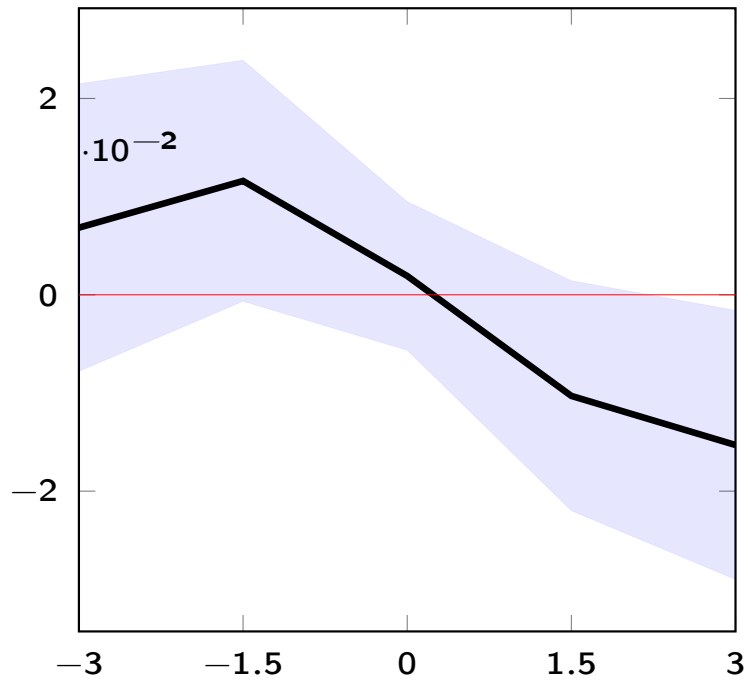
The results suggest that the benefits from a good water management are reported in COGS, while the costs due to a poor management are reported in SG&A.

Wet shocks and *ADV* Severity

Firm Value, Operating Expenses and Drought Severity



Tobin's Q



$(\text{OPEX/Sales})_{q+1}$

- Good water management acts as an hedging strategy
- The increase in value and the decrease in operating costs only occur during heat shocks, no during *wet/normal* conditions

Summary

1. **Corporate water management acts as a competitive advantage during heat shocks.**
   This outperformance occurs with a lagged effect.
   Firms with poor management are negatively affected.
2. **Heat shocks impact is monotonically decreasing in water management**
   Water management acts as an insurance against drought shocks
3. **The manager's willingness to manage water is associated to the accounting cost categories**
   - Firms with good water management seem to report water-related costs in **COGS** → Water is deemed as a "critical" resource
   - Firms with poor water management seem to report water-related costs in **SG&A** → Manager' incentives to manage water are low.

Robustness Checks

- **Water supply frictions affect mainly the U.S manufacturing industry.**
  if water supply frictions really affect firms, then the non-manufacturing firms should be less or non impacted.

- **Is ADV/heat shock really an exogenous shock ?**
  Parallel trend assumption Figure

- **What explain the water management MSCI water management score ?**
  Cross-validation using alternative datasets (ASSET4, CDP Survey Data)

Conclusion

- Heat shocks reveal water management benefits ;
- Suggest a causal impact ;
- At the investor level : improves valuation ;
- At the operating level water management
  - increases efficiency ;
  - acts as an hedging strategy
  - provides a competitive advantage to the firms
- Not explained by size, governance, environmental and social scores, seasonal effects, industry shocks, state macro trends or year or quarter trends.

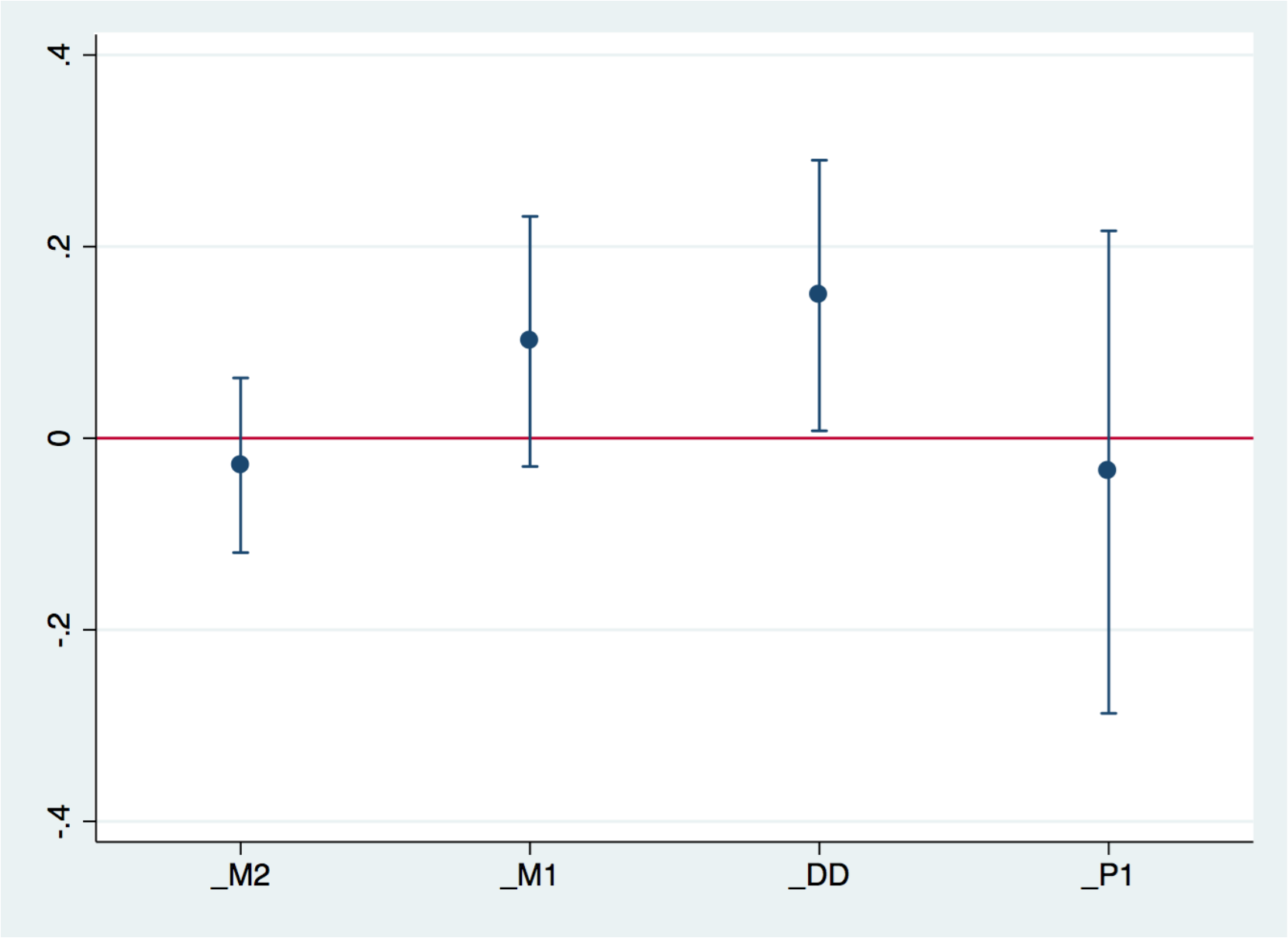
→ Caring about water management is a value enhancing strategy for firms and investors

Conclusion (cont.)

- *Material* nature of water information even in a developed country ;
- Give managers and investors incentives to consider water stewardship ;
- Additional evidence that financial performance may be achieved by implementing an environmental and social strategy.

BACKUP SLIDES

Parallel Trends Assumption



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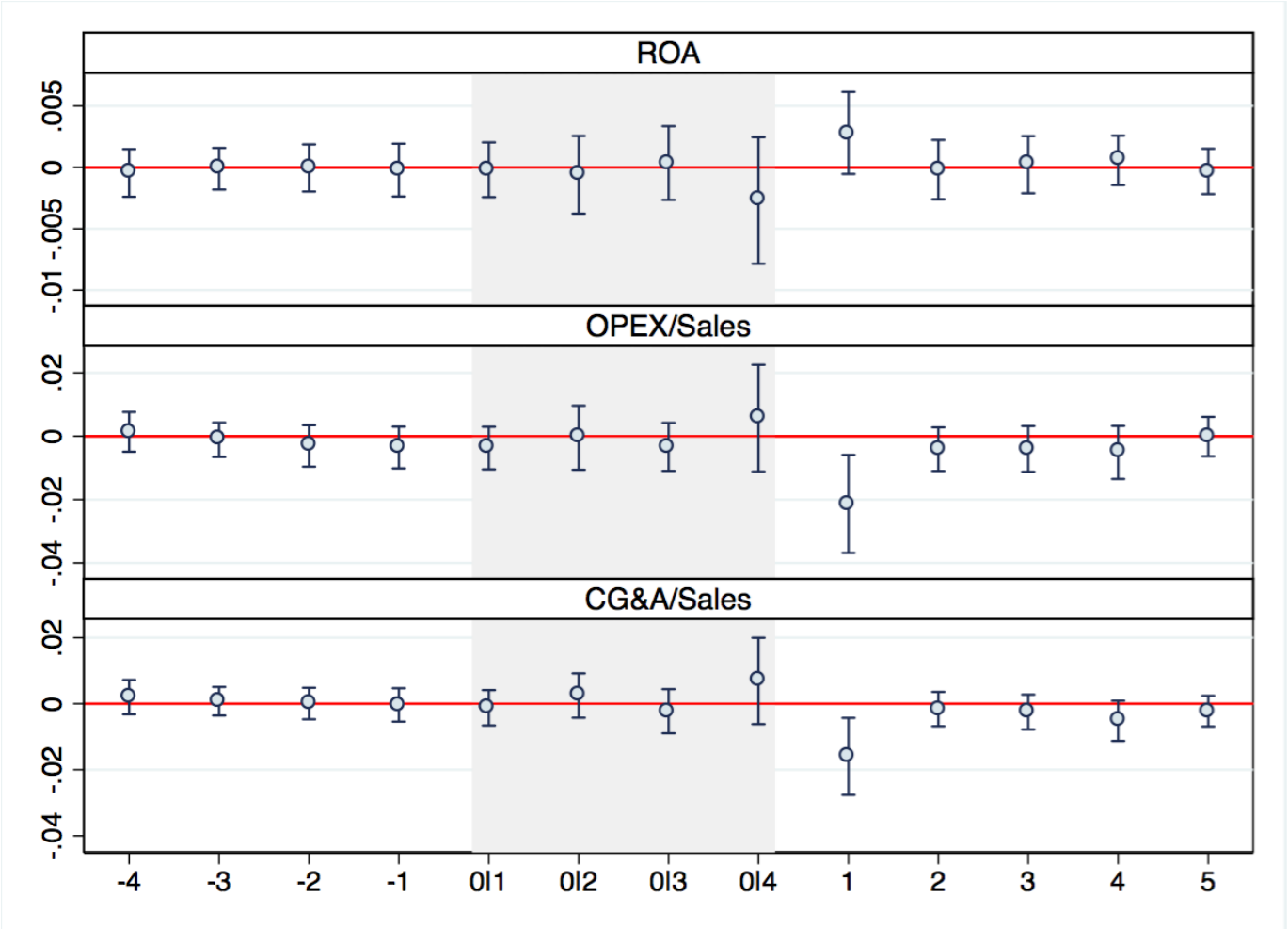

Return