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The impact of toxic chemical releases and their management on financial performance

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The impact of toxic chemical releases and their management on financial performance

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Abstract

This paper examines the extent to which environmental performance affects firm profitability, where environmental performance is measured by toxic chemical releases per sales dollar and toxic chemical management (treat, recycle, or recovery) per sales dollar. Conclusions are drawn based on a sample of U.S.-based publicly-traded companies that reported to the Environmental Protection Agency's Toxics Release Inventory (TRI) program between 2001 and 2017. The results show that publicly-traded companies that reduce emissions see an increase in their Tobin's q. In addition, the effects of reducing emissions, treating toxic chemicals to minimize their environmental impact, or combusting toxic chemicals for energy, are more significant for companies that consistently fall under the mandatory reporting requirements of the TRI program. However, recycling toxic chemicals is associated with negative financial consequences for these companies.

Outline of Presentation



Research questions

Link between environmental & financial performance

Hypothesis

Research approaches

Empirical results

Conclusions

Research Questions

Transforming Data into Action



- Can *good* environmental performance *improve* the financial performance of businesses?
- What is the extent of the correlation between environmental performance and firm profitability? Market valuation?
- How can we use TRI data to develop environmental performance indicators?

Channels for Connection

Economic principles provide insight

How does environmental performance affect financial performance? **Why** does it affect financial performance?



Summary of Previous Studies

Relating environmental to financial performance

- Using non-TRI data such as GHG emissions, previous studies show that *good performance pays off*.
 - Cooper et al. (2018), Delmas et al. (2015)
- Using TRI data, studies find a negative correlation between *releases* and:
 - Stock returns (Hamilton, 1995; Khanna et al., 1998),
 - ROA (Morris, 1997; King and Lenox, 2001; Clarkson et al., 2011),
 - Market values (Konar and Cohen, 2001)

Contribution of this study

Use multiple metrics

- Toxic release is just one piece of information
- What about the actions or operations of managing toxic chemical-containing wastes?
- Reveal investment efforts

The Waste Management Hierarchy	
<p>The Waste Management Hierarchy</p> 	<p>The waste management hierarchy established by the PPA guides waste generators toward the best options for managing wastes. The preferred option is to prevent pollution at its source, but for waste that is generated, the preferred management methods are recycling, followed by burning for energy recovery, treatment and, as a last resort, disposing of the waste.</p> <ul style="list-style-type: none">• Source Reduction includes activities that eliminate or reduce the generation of chemical waste.• Recycling includes the recovery of a toxic chemical in waste for reuse.• Energy Recovery includes the combustion of toxic chemicals in waste to generate heat or electricity.• Treatment includes the destruction of a toxic chemical in waste.• Disposal or Other Releases includes toxic chemical quantities entering the environment.

Source: [EPA website](#)

Costs and Benefits of Waste Management

Net impacts affect financial performance

- Incineration facilities are costly
- Additional cost for cleanup and treatment
- Re-useable commodities from recycling
- Energy/heat offset from energy recovery
- Avoid penalty costs by managing wastes
- Avoid permit/disposal costs

Hypothesis

Impact of TRI-based performance



- **Hypothesis 1:** Firms that increase toxic chemical recycling, energy recovery, or treatment can improve their financial performance.
 - *"It pays to be green"*
- **Hypothesis 2:** Core TRI reporters experience a larger improvement in financial performance compared to non-core reporters.

Research Approaches

Selection of appropriate metrics

Environmental performance metrics

- Toxic chemical releases per sales
- Toxic chemical management per sales
 - Recycling
 - Energy Recovery
 - Treatment

Financial performance metric

- Profitability of assets: Return on asset (ROA)
- Market value of assets: Tobin's q

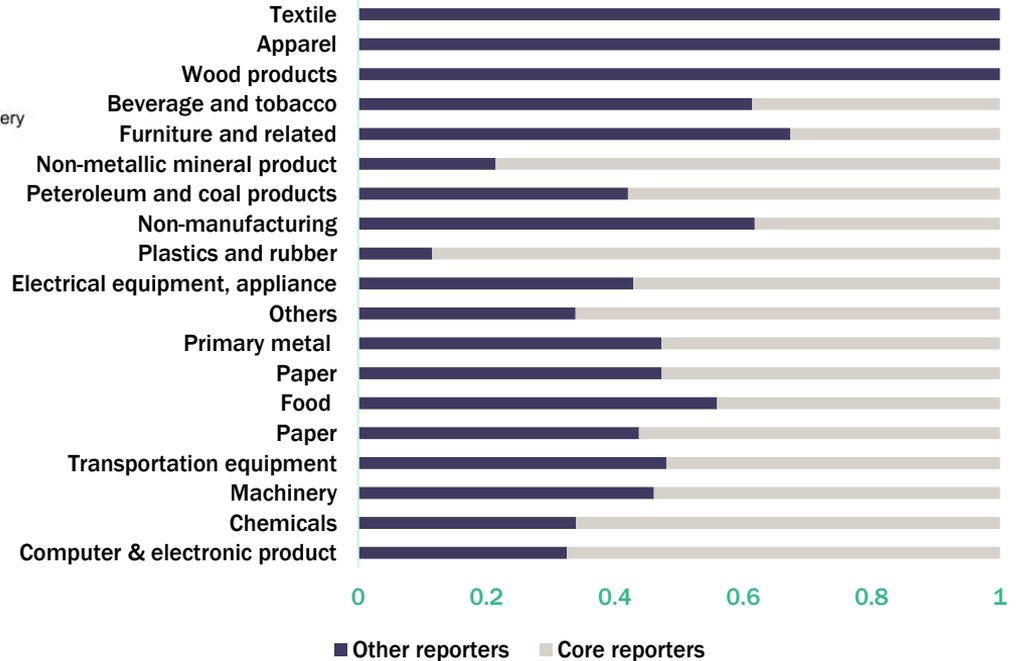
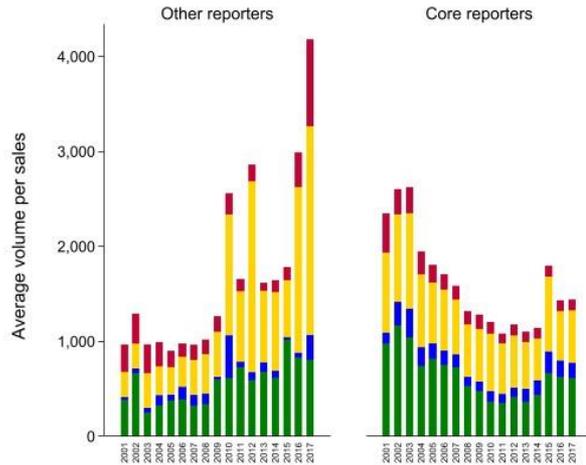
Sample Selection

Our sample has 316 TRI parent companies

- 3,156 publicly traded companies with financial data from relevant sectors(*Compustat*). 2,840 not in the TRI database (non-TRI reporters).
- *Compustat* sample merged with TRI parent data (2001-2017)
- Found 316 matches as our sample
 - We followed TRI reporters over the years
 - Define *core-TRI reporters* (16 years of data), around 59% of the sample
 - 3,509 firm-year observations

Core Reporters

Reported data for 16 or more years



Statistical Approaches

Difference model versus fixed effects model

$$\Delta FIN_PERF_{i,t+1} = \beta_0 + \beta_1 \Delta RELEASE_{i,t} + \beta_2 \Delta RECYCLE_{i,t} + \beta_3 \Delta TREAT_{i,t} + \beta_4 \Delta RECOVER_{i,t} + \beta_5 \Delta RDIN_{i,t} + \beta_6 \Delta CAPIN_{i,t} + \beta_7 \Delta NEW_{i,t} + \beta_8 \Delta \ln TA_{i,t} + \beta_9 RECESSION_{i,t} + \beta_{10} \Delta FINPERF_{i,t} + e_{i,t}$$

$$FIN_PERF_{i,t+1} = \alpha_{0,i} + \alpha_1 RELEASE_{i,t} + \alpha_2 RECYCLE_{i,t} + \alpha_3 TREAT_{i,t} + \alpha_4 RECOVER_{i,t} + \alpha_5 RDIN_{i,t} + \alpha_6 CAPIN_{i,t} + \alpha_7 NEW_{i,t} + \alpha_8 \ln TA_{i,t} + \alpha_9 RECESSION_{i,t} + \alpha_{10} FINPERF_{i,t} + \epsilon_{i,t}$$

Regression Results

Impact on ROA

Table 4
Effect of environmental performance on ΔROA_{t+1}

Panel A: Linear regressions - Effect of environmental performance on ΔROA_{t+1} .							
	Expected sign	All firms			Core reporters		
		Coefficient	Robust standard error	P-value	Coefficient	Robust standard error	P-value
ΔTCR	-	-0.009	0.000	0.238	-0.036**	0.000	0.021
$\Delta RECYCLE$	+	-0.002	0.000	0.278	-0.003**	0.000	0.023
$\Delta TREAT$	+	0.000	0.000	0.642	0.002***	0.000	0.002
$\Delta RECOVER$	+	0.003	0.000	0.248	0.002	0.000	0.401
$\Delta RDIN$		-0.246	0.254	0.333	-0.127	0.296	0.669
$\Delta CAPIN$		0.076	0.105	0.466	0.015	0.142	0.913
ΔNEW		-0.180**	0.071	0.011	-0.157**	0.071	0.028
$\Delta \ln TA$		-0.061***	0.017	0.001	-0.070***	0.019	0.000
RECESSION		-0.039***	0.005	0.000	-0.036***	0.007	0.000
ΔROA		-0.351***	0.055	0.000	-0.390***	0.052	0.000
Constant		0.006***	0.002	0.001	0.010***	0.001	0.000
Industry dummy variables		Yes			Yes		
Number of observations		2493			1676		
Number of firms		262			122		
R squared		0.1709			0.2214		

Regression Results

Impact on Tobin's q

Table 5
Linear regressions - Effect of environmental performance on Δ Tobin's q_{t+1} .

	Expected sign	All firms			Core reporters		
		Coefficient	Robust standard error	P-value	Coefficient	Robust standard error	P-value
Δ TCR	-	-0.210***	0.000	0.002	-0.260***	0.000	0.000
Δ RECYCLE	+	0.003	0.000	0.593	-0.004	0.000	0.321
Δ TREAT	+	0.000	0.000	0.787	0.002	0.000	0.756
Δ RECOVER	+	0.013*	0.000	0.095	0.043***	0.000	0.007
Δ RDIN		0.628	1.110	0.572	1.773	1.151	0.126
Δ CAPIN		-1.572**	0.637	0.014	-1.845***	0.655	0.006
Δ NEW		0.113	0.194	0.561	0.093	0.209	0.658
Δ lnTA		-0.403***	0.063	0.000	-0.395***	0.079	0.000
RECESSION		-0.296***	0.029	0.000	-0.326***	0.033	0.000
Δ Tobin's q		-0.195***	0.043	0.000	-0.250***	0.036	0.000
Constant		0.054***	0.008	0.000	0.181***	0.010	0.000
Industry dummy variables		Yes			Yes		
Number of observations		2704			1794		
Number of firms		277			122		
R squared		0.120			0.166		

Summary of Findings

- TRI performance affects medium to long-term financial performance.
 - Change in **releases** is negatively associated with changes in Tobin's q
 - Change in **energy recovery** is positively associated with changes in Tobin's q
- For core reporters, TRI performance affects short-term profitability.
 - Change in **releases** is negatively associated with change in ROA
 - Change in **treatment** is positively associated with change in ROA
 - Change in **recycling** is negatively associated with ROA (*net cost*)

Conclusions

- Environmental managers should pay attention to sustainable ways of managing waste containing toxic chemicals
- Building a tangible/measurable reputation for good environmental performance can help gain market value
- TRI tools provide meaningful metrics of environmental performance



Thank You!

For questions or comments please contact:

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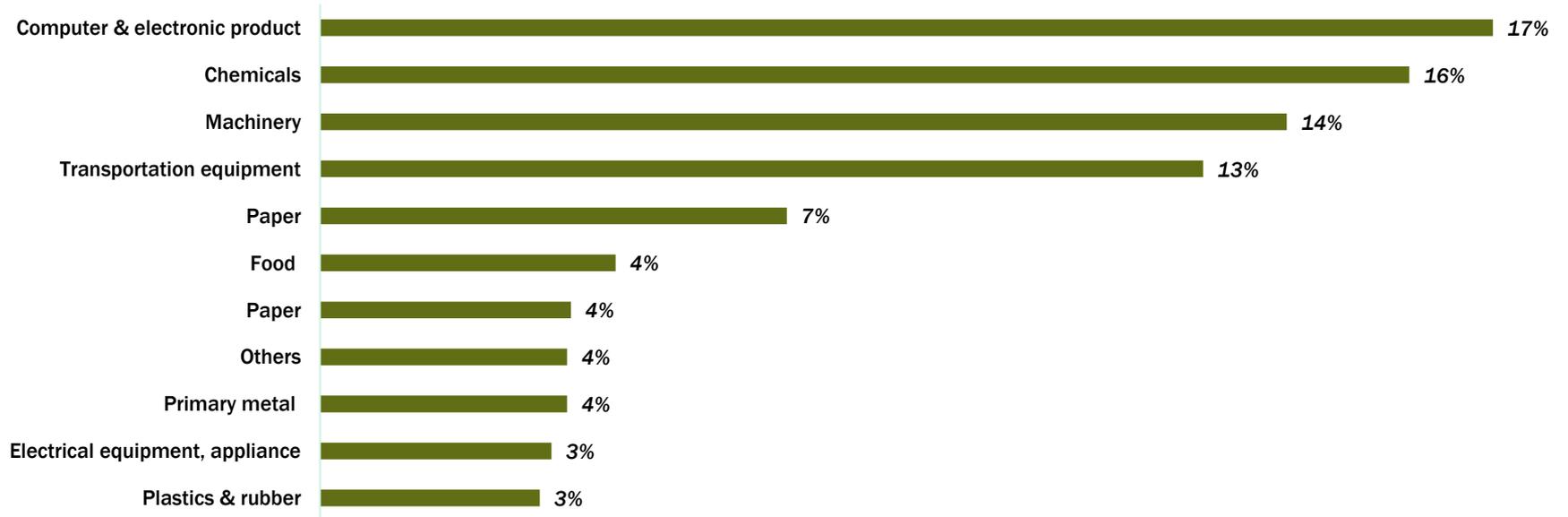
The following are supplementary materials.

Abstract

- Despite studies showing the environmental benefits of reducing toxic chemical releases, there are fewer studies that examine the impact of toxic chemical releases and their management on financial performance and firm valuation. The study examines the extent to which environmental performance affects firm profitability, where environmental performance is measured by toxic chemical releases per sales dollar and toxic chemical management (treat, recycle, or recovery) per sales dollar. Conclusions are drawn based on a sample of US based publicly traded companies that reported to the Environmental Protection Agency's Toxics Release Inventory (TRI) program between 2001 and 2017. Results suggest that publicly traded companies that reduce toxic chemical emissions see an increase in their Tobin's q. In addition, the effects of reducing emissions, treating toxic chemicals to minimize their environmental impact, or combusting toxic chemicals for energy, are more significant for companies that consistently fall under the mandatory reporting requirements of the TRI program. However, recycling toxic chemicals is associated with negative financial consequences for these companies.

Sample Characteristics

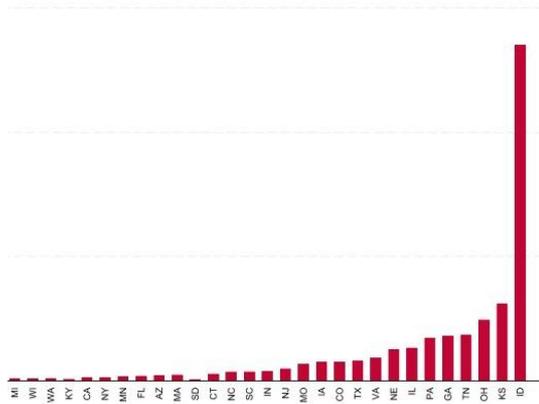
Most companies are manufacturers



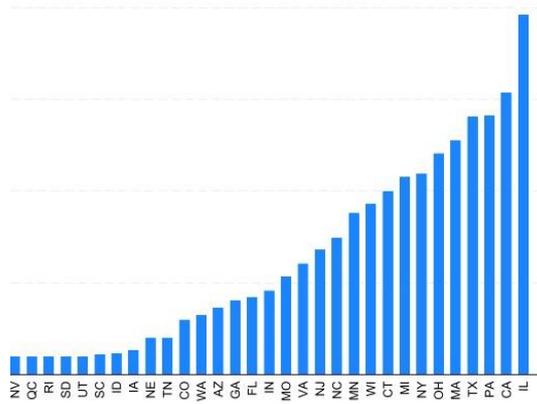
Sample Characteristics

Performance varies by location and metrics

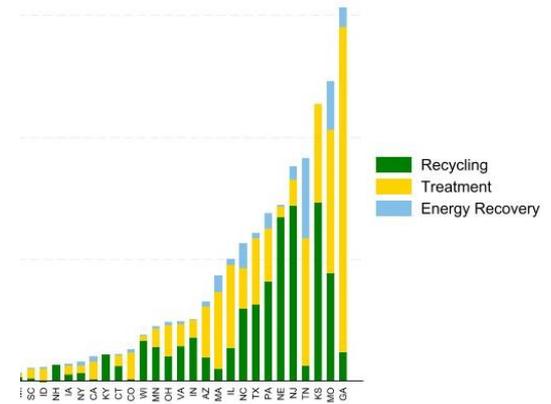
Toxic chemical release (2001-2017)



Number of TRI reporters per year

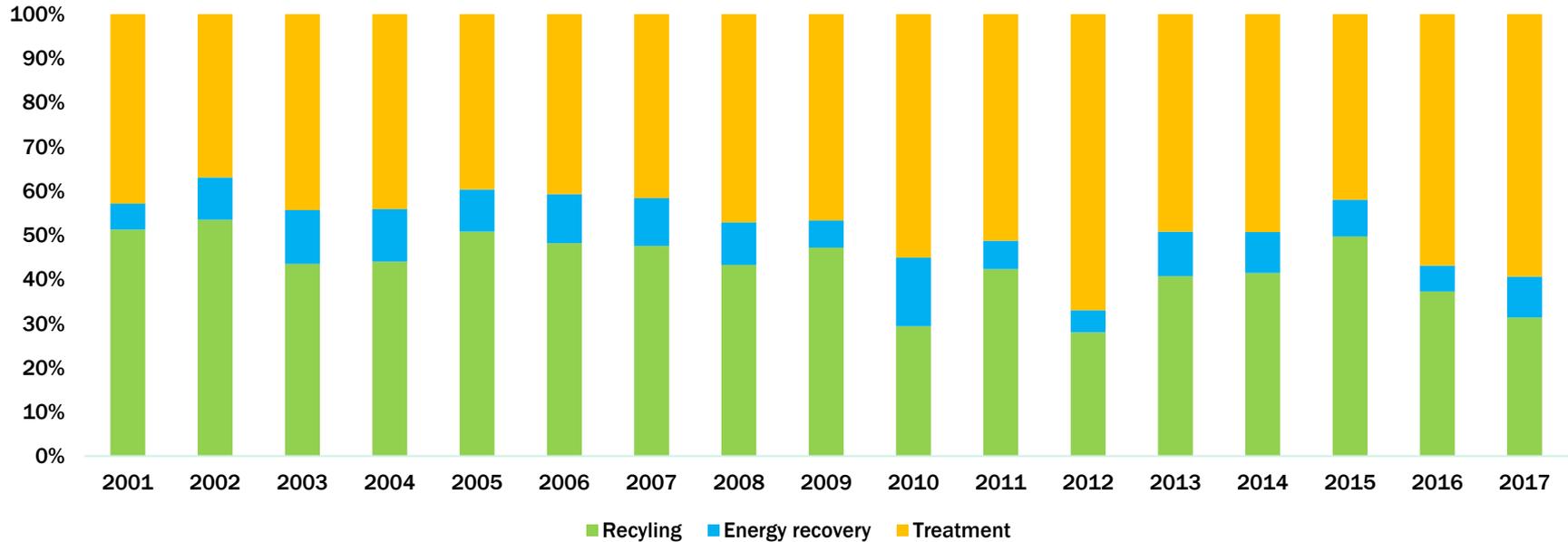


Toxic chemical management per year



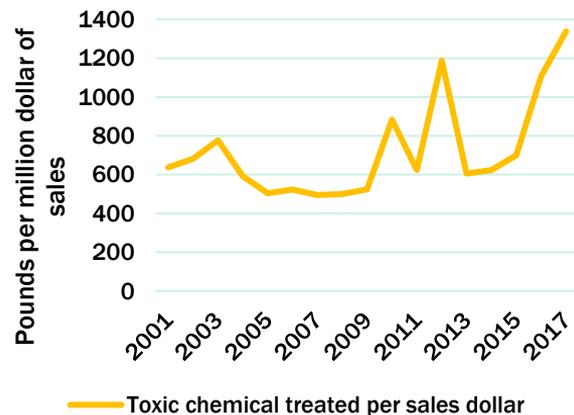
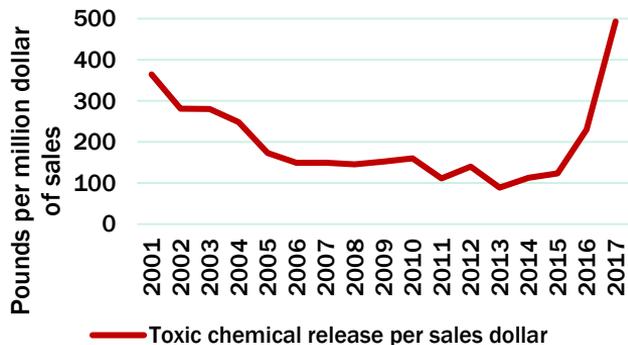
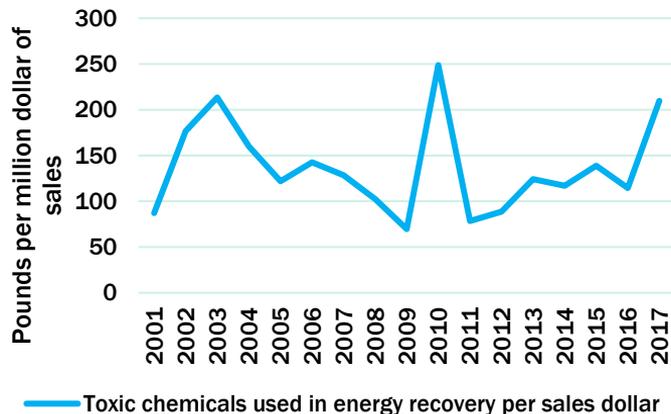
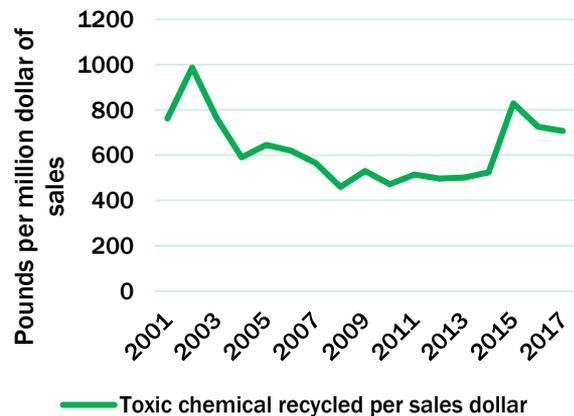
Shares of Different Waste Management Activities

Over time treatment replaced recycling



TRI Statistics for our Sample

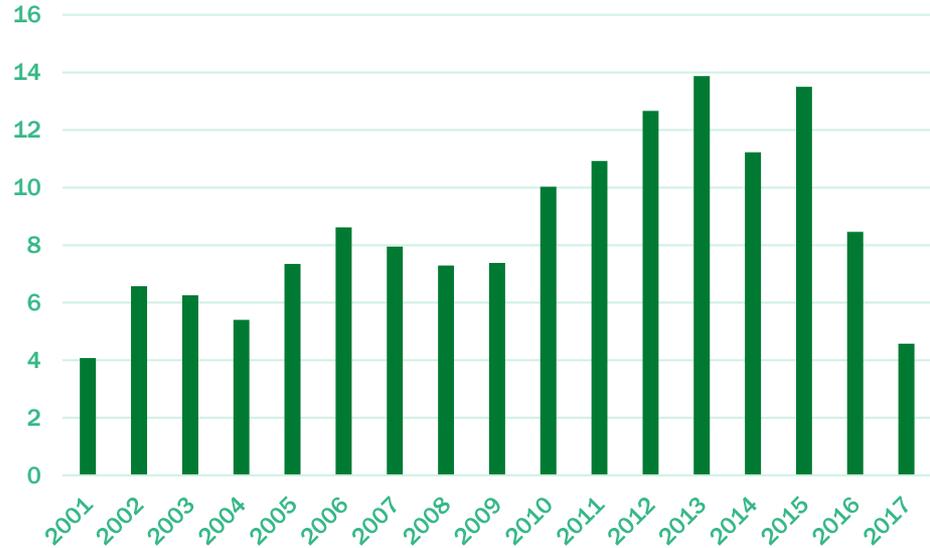
Changes over time



TRI Statistics for our sample

Firms manage more than they release

The ratio of the volume of wastes managed to total releases is on average 8.



Correlation Analysis

Results from Spearman's Rank Correlation

	ROA	Tobin's q	TRI Recycling	TRI Treatment	TRI Recovery	TRI Releases
ROA	1					
Tobin's q	0.6115*	1				
TRI Recycling	0.0149	-0.0633*	1			
TRI Treatment	0.0476*	0.0176	0.1299*	1		
TRI Recovery	0.0233	0.0297	0.0869*	0.4550*	1	
TRI Releases	-0.1010*	-0.1315*	0.3334*	0.4682*	0.3730*	1