

Appendix for Online Publication: Addressing Environmental Justice Through In-Kind Court Settlements

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A1 Examples of In-Kind Settlements

Table A1: Examples of In-Kind Settlements by Category

Category	Frequency	Average Cost	Example
Emergency Planning and Preparedness	529 (20.80%)	\$44,212	Purchase and donate equipment to the local fire department/emergency management agency/local emergency planning committee.
Pollution Prevention	525 (20.64%)	\$246,273	Retrofit of 4 heaters on-site with next generation-ultra low NOx burners.
Pollution Reduction	401 (15.77%)	\$316,149	Conceptual design and installation of an exhaust fan and carbon filter for the outer extruder area.
Environmental Restoration and Protection	300 (11.80%)	\$405,166	Purchase and protection of 36 acres of Wetlands, in perpetuity.
Multiple Categories	243 (9.56%)	\$698,463	[1] Install Novo Bioreef system [2] Install on-site wastewater treatment system.
Other Program Specific SEP	226 (8.89%)	\$229,105	Develop a green chemistry curriculum for implementation throughout local public schools.
Public Health	217 (8.53%)	\$170,766	Form a Health Care Project to establish a program to pay for medical care for asbestos-related illnesses.
Environmental Compliance Promotion	55 (2.16%)	\$96,241	Develop and deliver training for the roofing industry on proper handling of hazardous wastes.
Assessments and Audits	47 (1.85%)	\$122,109	Perform certified lead-based paint inspection.

Notes: Categories are defined by the EPA; we aggregated Pollution Prevention, which is broken into seven subcategories (Energy Efficiency-Conservation / Equipment-Technology Modification / Improved Housekeeping, O&M, Training, Inventory Control / In-Process Recycling / Process-Procedure Modification / Product Reformulation, Redesign / Raw Materials Substitution).

Table A2: Examples of In-Kind Settlements by Law Violated

Statute	Example in-kind project
Clean Water Act	Preservation of an 11.54 acre Wetland parcel and construction of nature trails.
Clean Air Act	Installation of a new roof ventilation hood to collect fumes.
Safe Drinking Water Act	Properly plug and abandon orphan wells.
Resource Conservation and Recovery Act	Replacement of 6 refrigeration units for units that will use non-ozone depleting substances.
Federal Insecticide, Fungicide and Rodenticide Act	Perform a pesticide safety and compliance training program.
Comprehensive Environmental Response, Compensation and Liability Act	Provide equipment for local emergency planning committee & funding for local emergency planning committee conference.
Toxic Substances Control Act	Replacement of 40 windows to reduce lead-based paint and lead-based paint dust hazards.
Emergency Planning and Community Right-to-Know Act	Purchase and donate equipment to the local fire department/emergency management agency/local emergency planning committee.
Marine Protection, Research and Sanctuaries Act	Placement of artificial reef materials within a authorized artificial reef site.

Notes: Examples of Supplemental Environmental Projects assigned by the federal statute that was violated.

A2 Additional Summary Statistics

Table A3: Summary Statistics of Environmental Enforcement Actions, No Selection

	Full sample		Cases with stock-market information	
	Mean	(Std. Dev.)	Mean	(Std. Dev.)
I(Cash settlement)	.565	(.496)	.468	(.499)
I(In-kind settlement)	.024	(.154)	.046	(.210)
I(Other \$ amount)	.367	(.482)	.642	(.479)
Cash \$ amount, when present	57,421	(1,052,360)	408,951	(2,018,492)
In-kind \$ amount, when present	336,596	(1,387,486)	593,514	(1,429,135)
Other \$ amount, when present	3,336,266	(63,989,207)	14,333,459	(105,923,320)
Observations	104,981		2,684	

Notes: Summary statistics of enforcement cases, 1997–2017. The left panel includes any case in the Federal Enforcement and Compliance dataset. The right panel includes information for cases where we find stock-market information for at least one of the respective defendants.

A3 Additional Information About Survey Design and Results

We posted a Qualtrics survey on Prolific on October 14th, 2020. The description stated that we would pay £0.60 for an estimated time of three minutes, which is a £12.00/h wage. We also informed participants that they were contributing to a research project. Respondents could take up to 23 minutes to answer the survey.

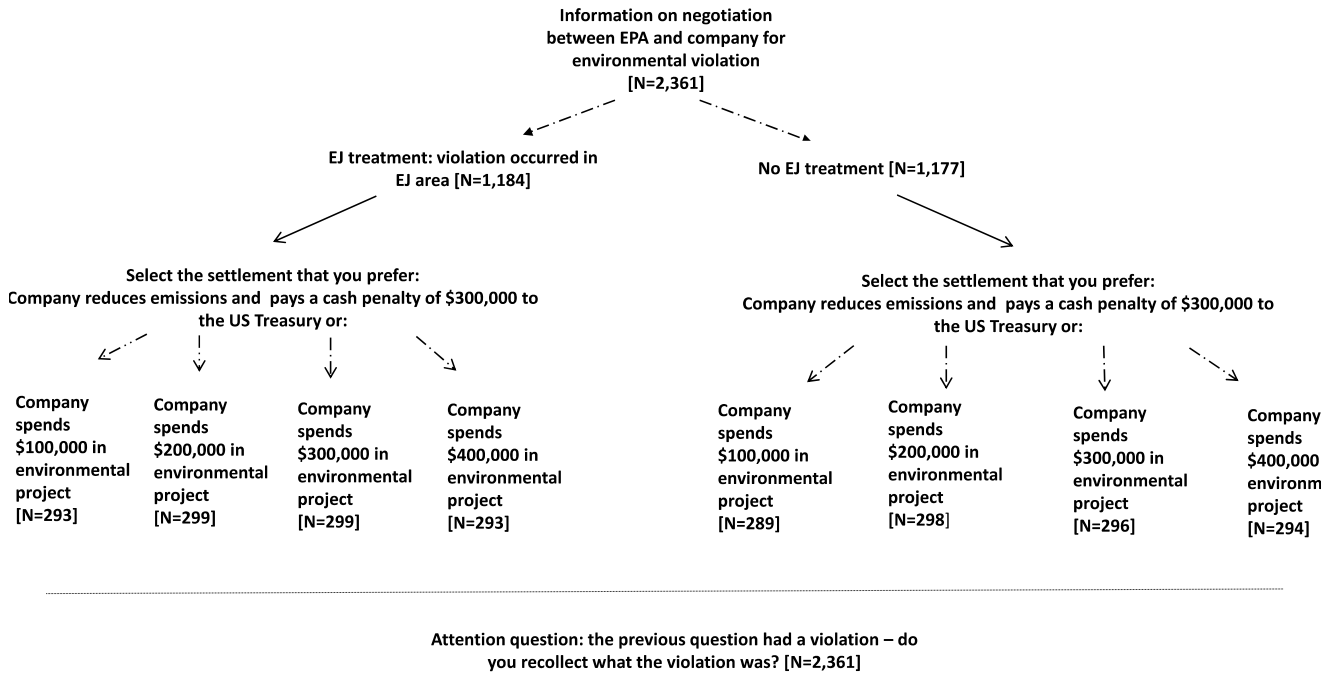
The initial sample that we received from Prolific had 2,434 respondent with a unique ID. Of these, 39 withdrew their survey answers (i.e., completed the survey but withdrew the authorization to use it), 21 timed out, and 13 did not have a match in the Qualtrics sample, likely because of typos when the respondents inserted their unique ID. As a result, the attrition rate is of 2.5 percent.

The sample is broadly representative of the US population on a number of relevant characteristics, based on a comparison with the most recent estimates from the US Census Bureau.⁶⁷ It has some relatively small differences in terms of median age (42 against population median age of 38 in 2018) and percentage of foreign born (7 percent versus population percentage of 13.5 percent in 2019). For other characteristics, the representativeness is higher: 52 percent of the respondents are women (compared to the population share of 51 percent), 65 percent of those of working age are employed (compared to the OECD’s estimate of the population employment rate in the third quarter of 2020 being 66 percent), and the percentage of White, Black, and Asian people is respectively 78, 11, and 6 percent (compared to 76, 13, and 6 percent in the population.)

In Figure A1, we show the flow of the survey. We randomized the order of appearance of Part A and Part B, to address the concern that the content of the first part of the study would affect responses to the second. The figure also outlines what part of the survey we randomized and the size of our samples. In Figure A3, we show screenshots of example questions.

⁶⁷See <https://www.census.gov/quickfacts/fact/table/US/PST045219>.

(a) Part A: Choice Experiment and an Attention Question



(b) Part B: Randomized Survey

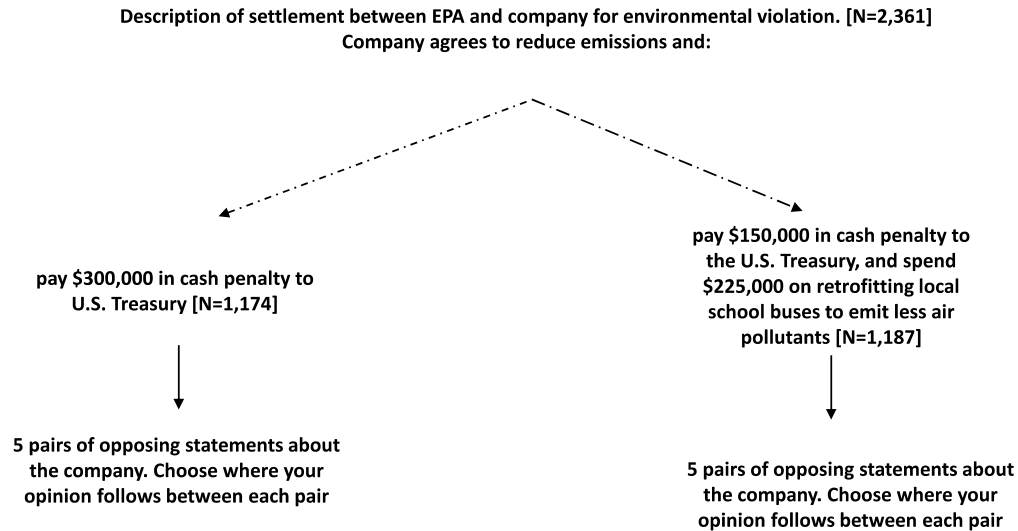



Figure A1: The Structure of the Survey Experiments

Notes: Figure summarizes the survey design. Dashed arrows indicate random assignment of the treatment. The order in which participants answered Part A and Part B is also randomized across participants, and in Part B, the order in which the five pairs of statements are shown is also randomized. N is number of subjects that answered each question. Example screenshots from the survey are found in Appendix Figures A2–A4.



We are researchers at the University of Calgary and Stockholm School of Economics. Our goal is to provide information on the public's preferences for different types of environmental enforcement actions made by the US Environmental Protection Agency.

This survey consists of **only three questions**. No matter what your views are, by completing this survey you are contributing to our knowledge as a society.

If you would like to participate, please enter your unique Prolific ID and continue.

Figure A2: Screenshot of Survey Start Page

(a) Survey Part A

The U.S. Environmental Protection Agency is negotiating a settlement with a company for exceeding regulatory limits on harmful air pollution emissions. The company's facility is located in a community vulnerable to Environmental Justice concerns, namely a community with a high share of low-income populations and minorities, that are both more prone and more susceptible to pollution. Select the settlement you prefer.

The company agrees to reduce emissions below regulatory limits and...

the company pays a cash penalty of \$300,000 to the U.S. Treasury.

the company spends \$100,000 on an environmental project in the community (e.g., retrofitting local school buses, implementing an environmental training program, or installing pollution-reduction equipment at their own plant).

(b) Survey Part B

Consider the following situation: the U.S. Environmental Protection Agency has announced a settlement with a company to resolve alleged Clean Air Act violations resulting from exceedances of emission limits. As a result of the settlement, the company agrees to reduce emissions and pay \$300,000 in a cash penalty to the U.S. Treasury.

Please choose where your opinion about the company would fall within the following opposing statements:

I feel negatively toward the company.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	I feel positively toward the company.
The company will have a hard time getting community approval to expand operations in the area.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	The company will have an easy time getting community approval to expand operations in the area.
The company will have a hard time hiring workers.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	The company will have an easy time hiring workers.
An investment in the company would be a bad investment.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	An investment in the company would be a good investment.
The company is unlikely to comply with environmental regulations in the future.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	The company is likely to comply with environmental regulations in the future.

Figure A3: Screenshot of the Survey

Notes: The figures are screenshots of one version of the survey as seen by respondents. Order of appearance of Part A or Part B is randomized across respondents. In Part A, we randomize (a) whether environmental justice concerns are mentioned and (b) the size of the proposed environmental project in dollar amounts. In Part B, we randomize (a) whether the settlement description includes an in-kind project and (b) the order in which we list the pairs of opposing statements.



(This question will help us assess how much attention was paid in answering)
The previous question had a violation--do you recollect what the violation was?

Exceeding regulatory limits on harmful air pollution emissions.

Discharging hazardous waste into a source of drinking water.

Figure A4: Attention Question After Part A

A4 Additional Stock-Market Analysis

A4.1 Selection Criteria for the Stock-Market Analysis

We match stock-market information for nearly 2,700 cases (≈ 2.5 percent of the total), involving 781 firms. When the same company is cited as a defendant in multiple consecutive cases, we check that these cases are at least 31 days apart, to avoid confounding the effects of different settlements. When the cases are less than 31 days apart, we drop them. Additionally, throughout the analysis, we always drop the BP Deep Horizon case, because it is an outlier in terms of size of the assessed monetary payments and type of violations involved (the violations were also prosecuted criminally). We also follow [Dube et al. \(2011\)](#) and drop companies that during the sample period have at least one of the following events: (a) company name change, (b) change in stock-market price larger than 50 percent, and (c) change in outstanding share by more than 5 percent. We are thus left with 2,165 cases, out of which 1,204 result in no monetary penalty, 867 result in a cash penalty only, and 94 result in an in-kind penalty. Our goal is to compare cash versus in-kind decisions, and so we restrict the sample to those 961 cases with some financial penalty. We drop 54 cases with multiple defendants, as the information on penalties is available at the case level rather than the defendant level.⁶⁸ We also drop 206 cases where we find evidence of information about the settlement being released before the lodge/issue date, or of other newsworthy events involving the same firm occurring at around the same time as the settlement. The final sample consists of 678 cases.

A4.2 Robustness Checks

A4.2.1 Identification

Concluding that the opposite stock-market response to in-kind and cash settlements is due to the settlement type requires assuming that the two settlements are similar in characteristics that influence share prices upon the settlement announcement. In this section, we consider a number of potential violations of this assumption.

Previous stages of the enforcement action A concern is that the share price of defendants involved in in-kind settlements drops more in previous stages of the enforcement action; if so,

⁶⁸In a few cases, the EPA data show more than one defendant even though these are subsidiaries of the same parent company or plants owned by the same parent company. In these cases, we proceeded as though they had one defendant.

the more positive evaluations are only revisions upon the settlement announcement. However, in roughly 70 percent of the cases that we study, the complaint that officially starts an enforcement action was filed on the same day as the settlement announcement, implying that in most of the cases, we actually likely capture the entire stock-market response to the enforcement action.

Differences in firm- and settlement-level characteristics by settlement type Firms volunteering in-kind settlements might be systematically different in ways that make the stock market response to their wrongdoing different. For instance, they might also be better at spinning the settlement to the public and could have observed a positive response even in absence of an in-kind project. However, Table 3 shows no evidence of significant differences between cases resulting in in-kind versus cash punishment, or between their respective defendants, based on a few observable measures.

Since some of the differences in Table 3 are large, albeit not statistically significant (see the variable *Other*), below we perform two additional tests, to address remaining concerns of differences in characteristics: we use a control-based strategy and estimate the intensive margin for the treatment.

For the control-based strategy, we consider the sample of large cases and estimate variations of Equation (1) where we control for $\mathbf{1}[t \in \mathbf{W}] \cdot x$, where x stands for each of the control variables in Table 3. Figure A5 shows that the observed difference in stock-market response is not explained by any of the case-level and defendant-level characteristics that we consider, although in some specifications, the estimates are less precise, likely due to the lower number of observations.⁶⁹

⁶⁹The defendant-level control variables are missing for a number of cases.

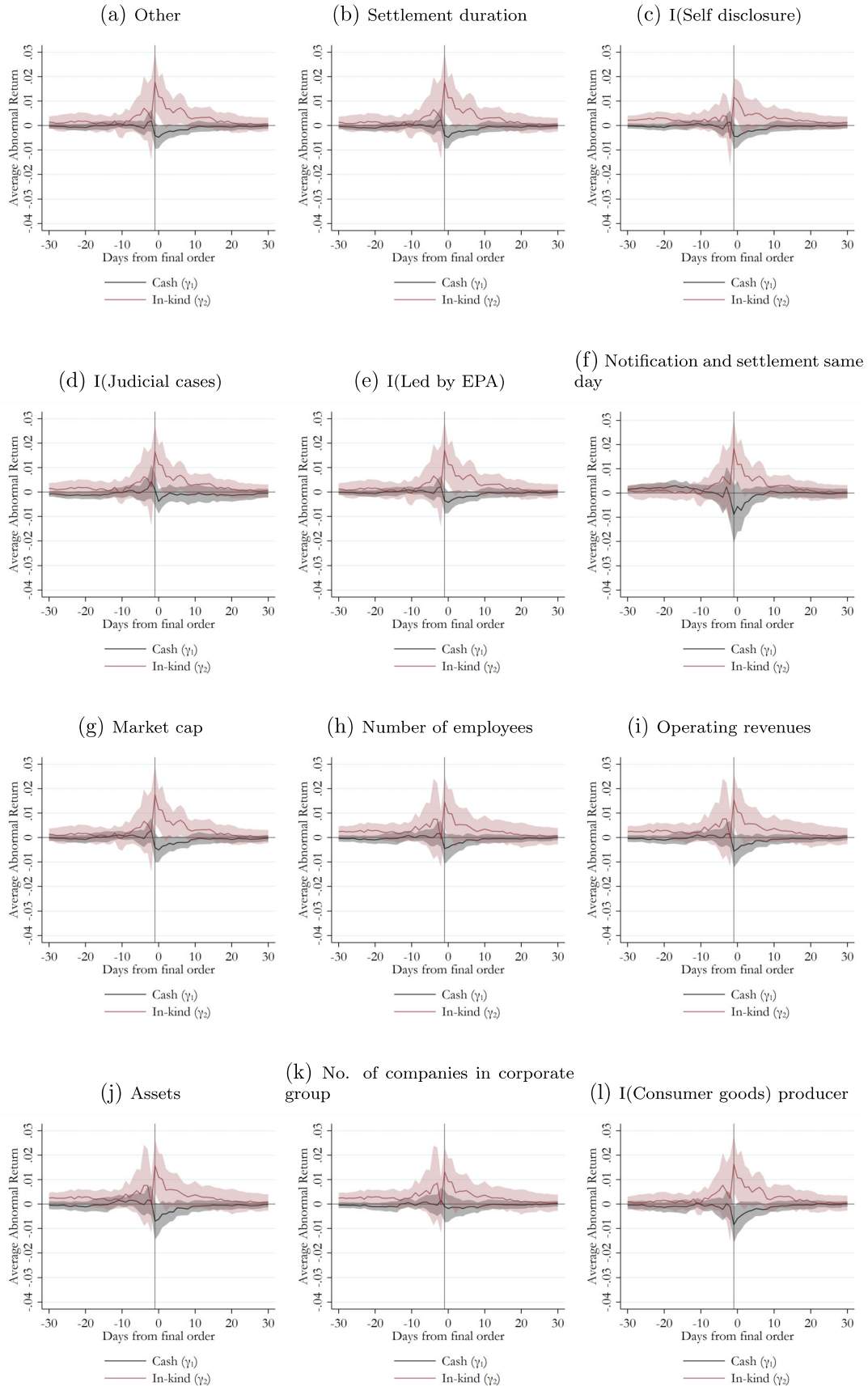


Figure A5: Robustness including interaction terms

Notes: We replicate the analysis in Figure 4d but also account for an interaction between $\mathbf{1}[t \in \mathbf{W}]$ and each of the characteristics listed in the subtitles (see Equation 1). Figure I(Led by EPA) shows Δ_{112} from replicating the analysis in Figure 4d after excluding those cash settlements where the case was led by a state; this is because all in-kind settlements in our relevant sample are led by the EPA.

When we estimate the intensive margin of the treatment (e.g., cash and in-kind amount), we focus only on in-kind settlements. The advantage of this approach is twofold: first, we limit the comparison to a more homogeneous sample of cases, that is, those that result in in-kind settlements, and second, we let the stock-market response to the settlement announcement depend on cash and in-kind amounts, as suggested by the evidence in Section 6.2.⁷⁰ The estimated equation is:

$$R_{fjt} = \phi_j \cdot R_{mt} + \theta_1 \text{cash}_{fj} \cdot \mathbf{1}[t \in \mathbf{W}] + \theta_2 \text{in-kind}_{fj} \cdot \mathbf{1}[t \in \mathbf{W}] + \varepsilon_{fjt} \quad (2)$$

The variables in-kind_{fjt} and cash_{fjt} represent the estimated cost of the in-kind project and the cash penalty, respectively. We set in-kind_{fjt} and cash_{fjt} to their respective dollar amount for all days in the window \mathbf{W} and to 0 for all days before the settlement.

As shown in Figure A6, the larger the cash settlement, the more negative is the stock-market response; the converse is true for in-kind settlements. Notice that this specification allows estimating the impact of a larger in-kind settlement while accounting for the size of the cash penalty and vice versa. In sum, studying the intensive margin of the treatment on the sample of cases with in-kind settlements confirms the conclusion from the main analysis: the stock-market views a cash settlement as bad news for the company, whereas the in-kind settlement is treated as good news.

Defendants volunteer to perform in-kind projects because they benefit from them A threat to identification related to the discussion above is that defendants volunteer to perform an in-kind project when they expect a strong negative stock-market response to the punishment announcement. If this were the case, our estimate of the difference in abnormal stock-market returns would be a lower bound of the positive stock-market response to in-kind settlements.

Alternatively, a hypothesis is that the defendants that volunteer to perform an in-kind project are those that expect larger benefits from settling in-kind, such as because their investors and stakeholders are particularly sensitive to green advertisement; such treatment-effect heterogeneity has implications for the interpretation of our findings but not for identification, as long as cash settlements provide a useful counterfactual for investors' response in absence of the in-kind project. In other words, one possibility is that in-kind projects benefit those defendants that volunteer to perform them, but were other defendants induced to do so, the benefits to them would not be necessarily the same.

⁷⁰Despite the advantages of studying the intensive margin of the treatment, we emphasize the extensive margin specification as our main analysis because (a) the point estimates are easier to interpret and to compare with the existing literature, and (b) identification of θ_1 and θ_2 is less straightforward given that cash amount and in-kind amount are jointly determined and thus endogenous to each other.

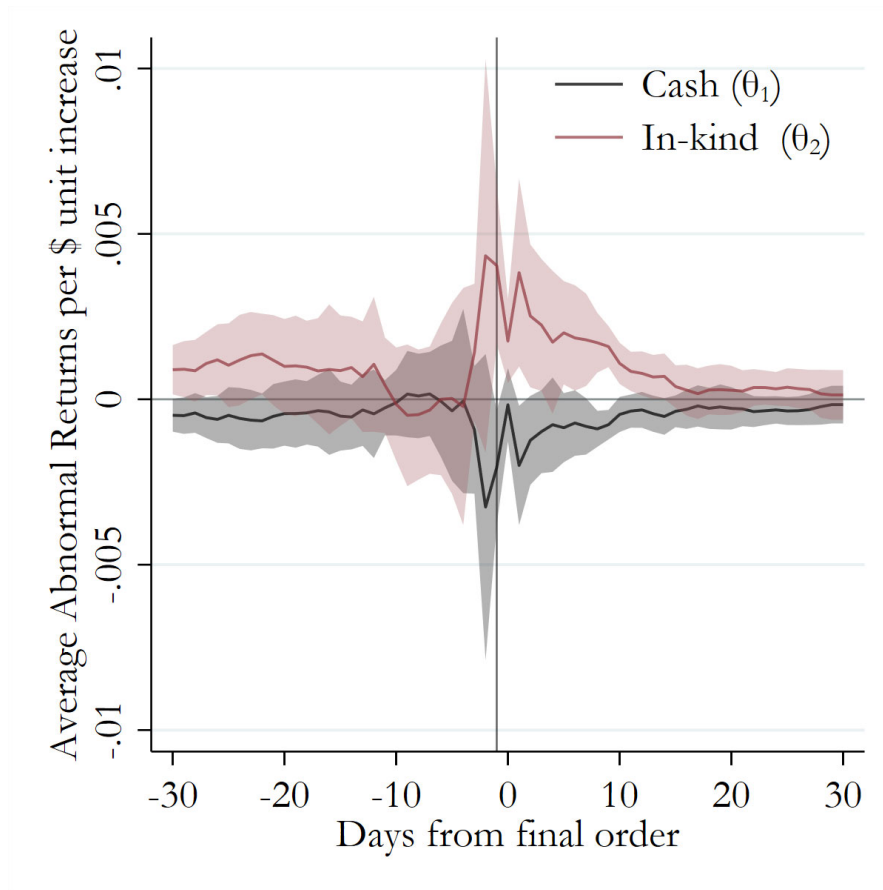


Figure A6: Average Abnormal Returns per Unit Increase in Settlement Amount

Notes: We replicate the analysis for Figure 4d but instead examine the intensive margin of the treatment, namely, the stock-market impact of the dollar amount for cash and in-kind settlements. This corresponds to estimating to θ_1 and θ_2 in Equation (2).

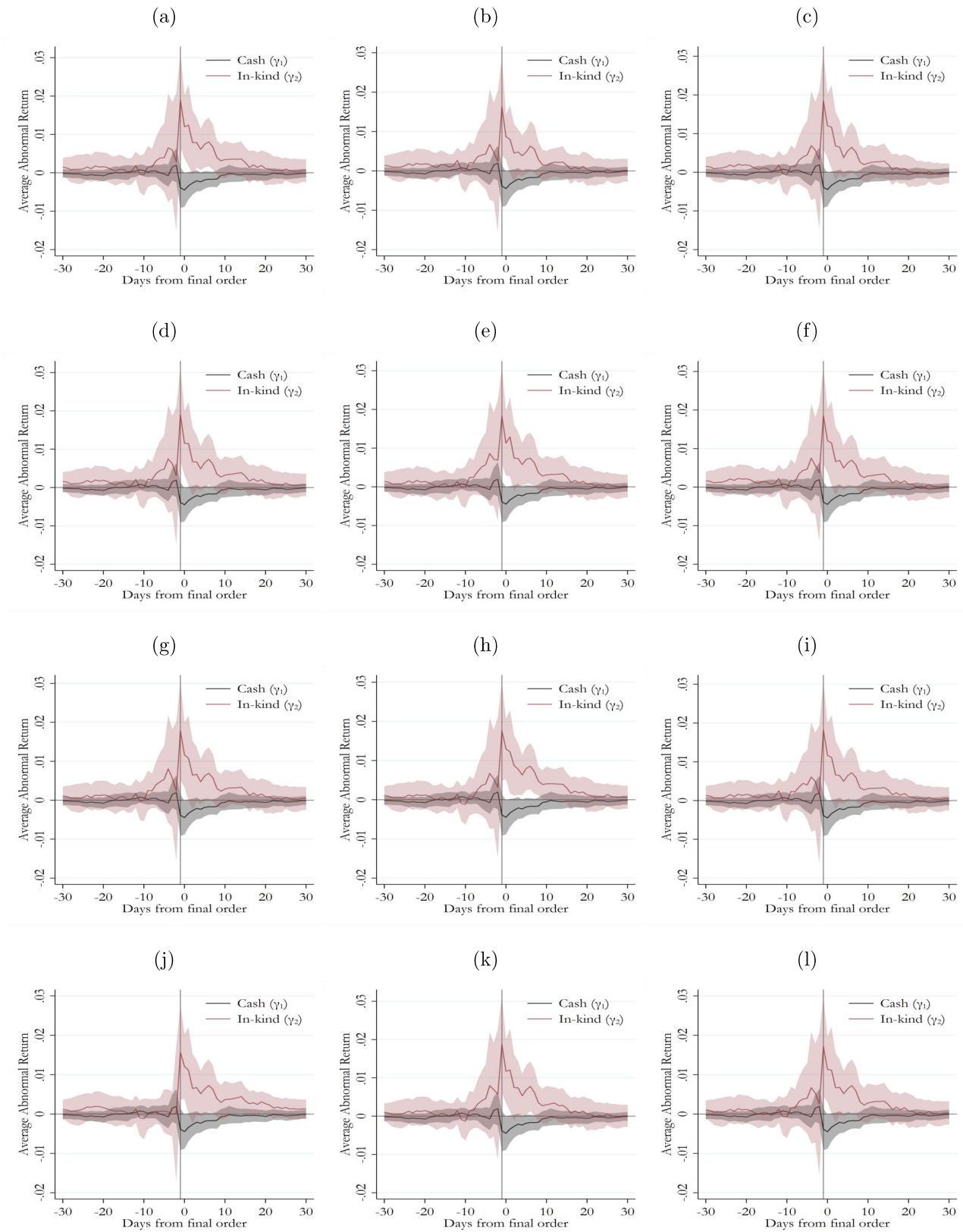
A4.2.2 Alternative Samples of the Large-Settlement Cases

Given that the 90th percentile sample includes relatively few in-kind settlements (13), a concern might be that the results are driven by a limited number of settlements. We thus re-estimate Equation (1) in 13 alternative samples, each of which excludes one of the in-kind settlements at time, whereas the number of cash settlements remains the same (55). As shown in Figure A7, the conclusions from the analysis are unaffected.

A4.3 Media Coverage of Large Settlements

Although we find no stock-market response to settlement announcement when we consider all the cases in our stock-market sample, in a related study, [Karpoff et al. \(2005\)](#) find a significant negative stock-market impact of press announcements disclosing environmental violations in the United States between 1980 and 2000, nearly half of which are settlement announcements. We conjecture that the discrepancy is due to their focus on news in the press, which likely cover only the largest settlements.

To corroborate this conjecture, we conducted a manual search of the media coverage of the 68 largest settlements and show that coverage is relatively large and increases with the settlement size. Specifically, we proceeded through the following steps. First, we simplified the name of the defendant (e.g., E.I. DU PONT DE NEMOURS AND CO. was modified to DUPONT). Second, we searched hits for the name of the defendant and the word *EPA* 11 days around the event date (from day -1 to +10) in *Newslibrary* (as in [Campa \(2018\)](#)) and *Proquest* (as in [Beattie \(2020\)](#)); Newslibrary archives publications from around 7,000 US newspapers and other news sources, and Proquest is one of the largest databases available for researchers and includes newspapers articles. Third, we counted all the hits among the returned results that explicitly mentioned a settlement between the defendant and the EPA in the title or abstract. Our search returned media coverage, defined as at least one hit in Newslibrary or ProQuest, for more than half (54 percent) of the cases. For the cases with media coverage, we found an average of 11 hits from Newslibrary and 5 from ProQuest (a correlation of 0.70 across the two sources). The correlation between the total punishment (cash + in-kind) and media coverage is quite high, at 0.31, confirming that larger cases tend to receive more media coverage.



(m)

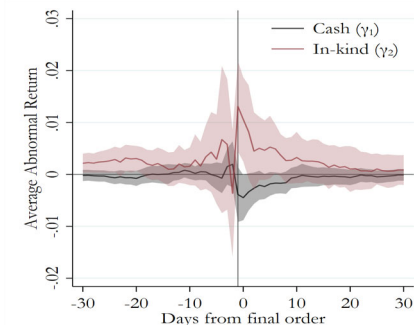


Figure A7: Average Abnormal Returns in Alternative Samples

Notes: Given the small sample of cases in the 90th percentile of penalty amount, we replicate the analysis for Figure 4d but omit one case each time. Our results remain whether or not individual cases are included in the analysis.

A5 Details on the Analysis on Environmental Quality

A5.1 Toxic Concentration Data

The Risk-Screening Environmental Indicators (RSEI) of the EPA provide a screening measure of risks to human health associated with chemical releases. We focus on an environmental-quality indicator, which does not consider population exposure, given our focus on detecting the occurrence of environmental violations. Such a measure is based on facility-level releases of toxic chemicals as self-reported by individual facilities to the Toxic Release Inventory (TRI).⁷¹ The EPA calculates air concentrations resulting from these chemical releases using a dispersion model that considers weather conditions, facility stack parameters, and chemical-specific air decay rate and destruction and removal efficiency (for off-site incinerators).⁷² Each chemical is weighted by an inhalation toxicity index based on human health effects associated with long-term exposure to chemicals.⁷³ For each chemical reported by a facility, RSEI estimates a toxicity-weighted concentration for each 810-meter grid cell around the facility for 49 kilometers, and then the information is aggregated at the zip-code level and summed over all chemicals impacting the zip code.

Figure A8 shows the distribution of the toxic concentration in our sample (left panel) and of its log transformation (right panel).

⁷¹Under this program, US facilities in different industries that release, process, or otherwise use an above-threshold amount of as many as 770 chemicals have to report yearly the amount of each of these chemicals that they release to the air, water and land. The chemicals are monitored because they are generally known or suspected to have health and environmental effects.

⁷²For a more detailed description of how the data are converted in geographic concentrations, see <https://www.epa.gov/rsei/modeling-air-releases-rsei>.

⁷³See <https://www.epa.gov/rsei/rsei-toxicity-weights>

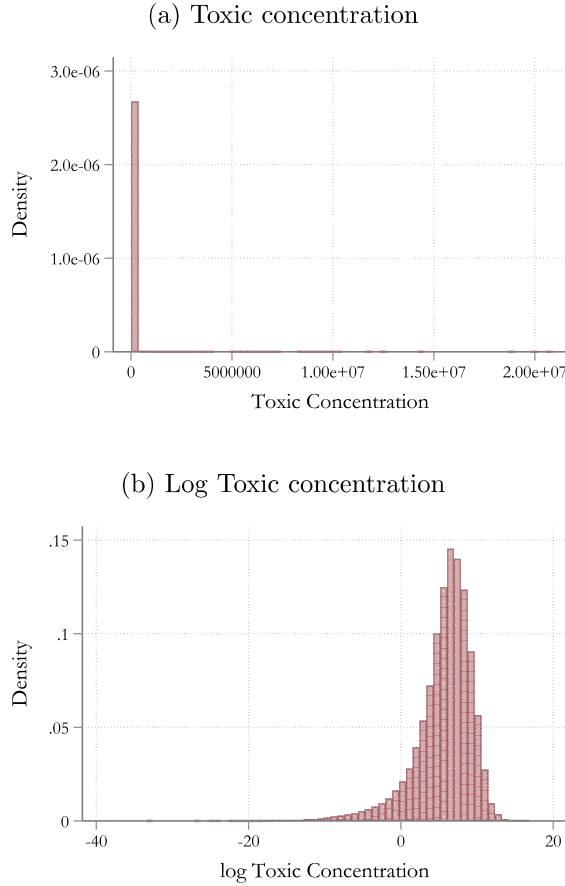


Figure A8: Distribution of Toxic Concentration Across Zip Codes (1997–2017)

A5.2 Difference-in-Differences Estimator

Following [De Chaisemartin and D’Haultfoeuille \(2022\)](#), let F_z be the time that zip code z is first involved in at least one cash or in-kind settlement. Then, let $\delta_{z,l}$, be the expected difference between zip code z ’s environmental quality at time $F_z + l$ and the counterfactual environmental quality had its treatment status remained unchanged (i.e., no treatment) from the beginning of the panel to period $F_z + l$. The $DID_{z,l}$ estimator for $\delta_{z,l}$ proposed by [De Chaisemartin and D’Haultfoeuille \(2022\)](#) compares the evolution of the toxicity index at zip code z from the year before its first settlement to year $F_z + l$ with the evolution of the index at zip codes that during the same years have not yet had a first settlement. Then, the $DID_{z,l}$ estimators are aggregated across facilities and years to deliver a DID_l estimator for each posttreatment period l .

In [Figure 5](#), we also show placebo coefficients that are based on the DID_l^{pl} estimator proposed by [De Chaisemartin and D’Haultfoeuille \(2022\)](#). The DID_l^{pl} estimator mimics the DID_l estimator. It is an average across units and years of $DID_{z,l}^{pl}$ estimators, where $DID_{z,l}^{pl}$ compares the evolution of the toxic concentration at zip code z from $F_z - l - 2$ to the year before treatment, $F_z - 1$,

and the comparison group is the same as for the corresponding DID_l estimator, namely, those zip codes with no settlement from the beginning of the panel to period $F_z + l$. Practically speaking, DID^{pl} assesses whether first-time treated and their corresponding control group are on parallel trends when untreated, for $l + 1$ periods, the number of periods over which parallel trends have to hold for DID_l to be unbiased.

A5.3 Standard Event-Study Design

We employ a standard event-study design to estimate the effect of the first settlement on local toxic concentration in a zip code up to five years after the settlement. To be consistent with the main analysis, our treatment of interest is only the first time the zip code has a facility with a cash (or in-kind) settlement. We also test the parallel trend assumption up to six years before the settlement to be consistent with the number of placebos in the main analysis.⁷⁴ Moreover, to be consistent with the main analysis, we examine one treatment at a time, examining cash in a separate regression from in kind. Using the sample of ever-treated zip codes (e.g., ever had a cash settlement in the regression examining cash) we regress:

$$T_{z,t} = \phi_z + \lambda_t + \sum_{j=\underline{j}}^{\bar{j}} \beta_j D_{zt}^j + \varepsilon_{zt} \quad (3)$$

where $\underline{j} = -6$, $\bar{j} = 5$, and D_{zt}^j are indicators taking the value of 1 if zip code z is treated at time $t + j$.⁷⁵ The coefficient β_{-1} is normalized to 0, so that all the coefficients are to be interpreted in relation to one year before the treatment. The indicators at the endpoints, i.e. the last lag and lead, are “binned”: treatment turns on if in any past year or future year the zip code is treated, to take into account all observable past (future) events going beyond the effect window.

We estimate Model (3) twice, once each for cash and in-kind settlements. The design accounts for zip-code-specific time-invariant characteristics that affect the toxic concentration (e.g., industrial mix) and economywide shocks in toxic concentration (e.g., business cycle-induced changes in output).⁷⁶ We show the estimated coefficients in Figure A9.

When we consider punishment of any size, the evidence would suggest that cash settlements

⁷⁴For the outcome variable, we consider our entire sample period from 1997 to 2017; however, because for each zip-code-by-year, we estimate six leads and five lags of the treatment variable, we can only consider settlements that occurred between $1997 + 5$ and $2017 - 6$.

⁷⁵For instance, if zip code z is treated in 2000, the indicator D^j for zip code z takes value of 1 in year 2002.

⁷⁶Notice that our use of bins implies an implicit assumption that the effect of a settlement stabilizes from the fifth period after its occurrence.

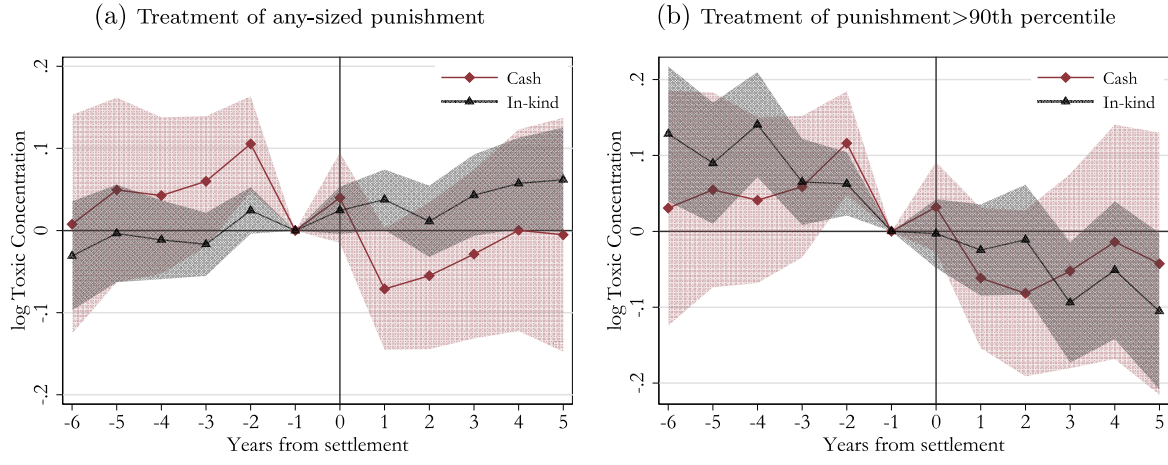


Figure A9: Toxic Concentration

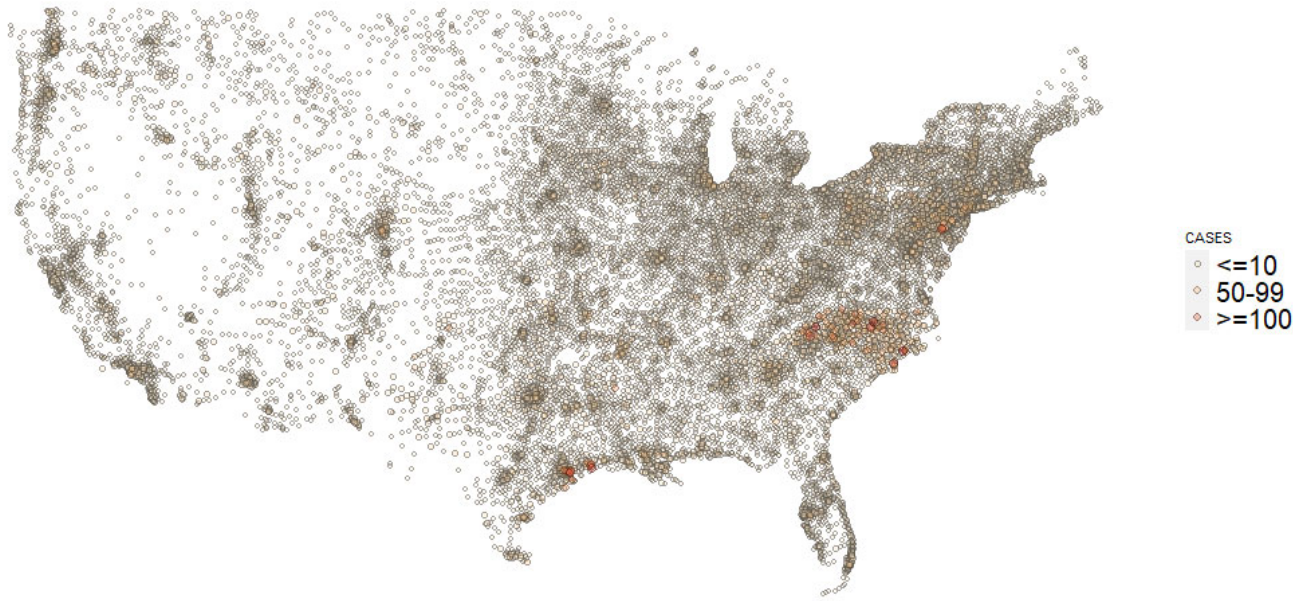
Notes: To the right of 0, the figure shows event-study estimates of the effect of the lag of a first settlement with penalty (cash or in kind) on the logarithm of toxic concentration. To the left of 0, the figure shows the placebo estimates based on leads of the treatment variable. At $x = -1$, the coefficient is normalized to 0. In-kind and cash settlements are analyzed separately but plotted on the same figure. The shaded areas depict 95 percent confidence intervals. Standard errors are clustered at the zip-code level.

are associated with worse environmental quality postsettlement, whereas the opposite is true for in-kind settlements, although for the latter, none of posttreatment coefficients is statistically significant at the conventional levels. These results differ from the evidence in 7.3; the conclusions from the analysis on large punishments are instead more consistent with those in Section 7.3, although the analysis of large cases presents even more caveats than in Section 7.3 because of pretrends and more noisy estimates in the regression for cash settlements.

A6 Location of Cases

Figure A10 depicts the location of cases and, in a different scale, the location of in-kind settlements.

(a) Cases



(b) In-kind settlements



Figure A10: Location of Cases and In-Kind Settlements (1997–2017)

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