Rules for Recovery: Impact of Indexed Disaster Funds on Shock Coping in Mexico

American Economic Journal (2020)

- Alejandro del Valle
- Alain de Janvry
- Elisabeth Sadoulet

Presentador:

Silvio Mauricio Jurado Zenteno

ÍNDICE :

INTRO / MOTIVACIÓN

PROBLEMA :

- Los impactos de los desastres naturales son costosos $$$

- Constreñimientos de países en desarrollo para enfrentarlos:
  1. Falta de fondos disponibles → brechas de liquidez
  2. Falta de reglas

FONDEN

Presupuesto anual e instrumentos de transferencia de riesgo para financiar pérdidas

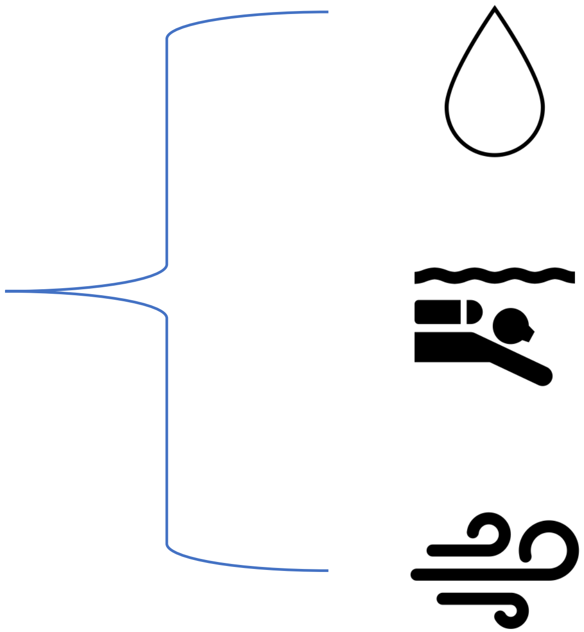
Reglas para el desembolso

Pregunta de investigación :

FONDEN → Reducción de disrupciones económicas (luces nocturnas como proxy) VS. Esfuerzos discrecionales locales

Método : Regresión discontinua borrosa (*fuzzy*)

Criterios de elegibilidad



Detalles institucionales:
EL FONDEN

Objetivo: Asegurar infraestructura y vivienda a población de bajos recursos de municipios afectados

Plan financiero:

Del presupuesto → pérdidas recurrentes, reaseguro de exceso de pérdidas y emisión de bonos.

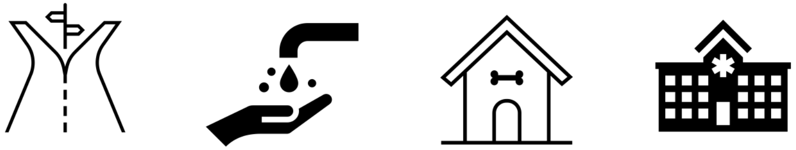
De los instrumentos → pérdidas grandes (menos recurrentes)

Del Fondo Mexicano del Petróleo → pérdidas que excedan las anteriores

Detalles institucionales:
EL FONDEN

Dos conjuntos de reglas:

- **Activos y desastres**



- **Procedimiento para verificación y pago de daños**
  - I. Verificación
    - CONAGUA
      - I. > percentil 90 del registro histórico para ese mes
      - II. > 80 km/h
      - III. Zonas normalmente no sumergidas
    - SEGOB
  - II. Evaluación de daños → 75 días promedio
  - III. Desembolso, reconstrucción y auditoría → 3 meses para reembolso; 150 días de reconstrucción

Detalles institucionales: RESPUESTAS LOCALES

1. Prácticamente **no provienen de transferencias federales.**

2. **Reasignaciones** del gasto estatal y municipal: construcción y mantenimiento de infraestructura.

3. Una buena parte de los proyectos de reconstrucción tienen que ser ejecutados mediante el proceso más largo de **licitaciones públicas.**

LOS DATOS:
Luces nocturnas

- **Proxy de actividad económica → Alumbramiento como bien normal; rastreo de pérdidas y recuperación tras desastres**

- **Programa de Satélites Meteorológicos de Defensa de la Fuerza Aérea de Estados Unidos (DMSP)**

- **168 imágenes compuestas (agregación de días a mes):**
  - **2.5 millones de pixeles – res. $1\ km^2$**
  - **Escala de intensidad de luz DN (0 a 63)**
  - **Promedio a nivel municipal**

- **Variable de interés:**

  diferencia log de promedio 12 meses antes y 12 meses después de desastre

LOS DATOS:
Elegibilidad y verificación

- Elegibilidad →

- Replicación de verificación →

- Otros datos municipales:

Gasto FONDEN y estados, tiempo de desembolso, tiempo de reconstrucción →

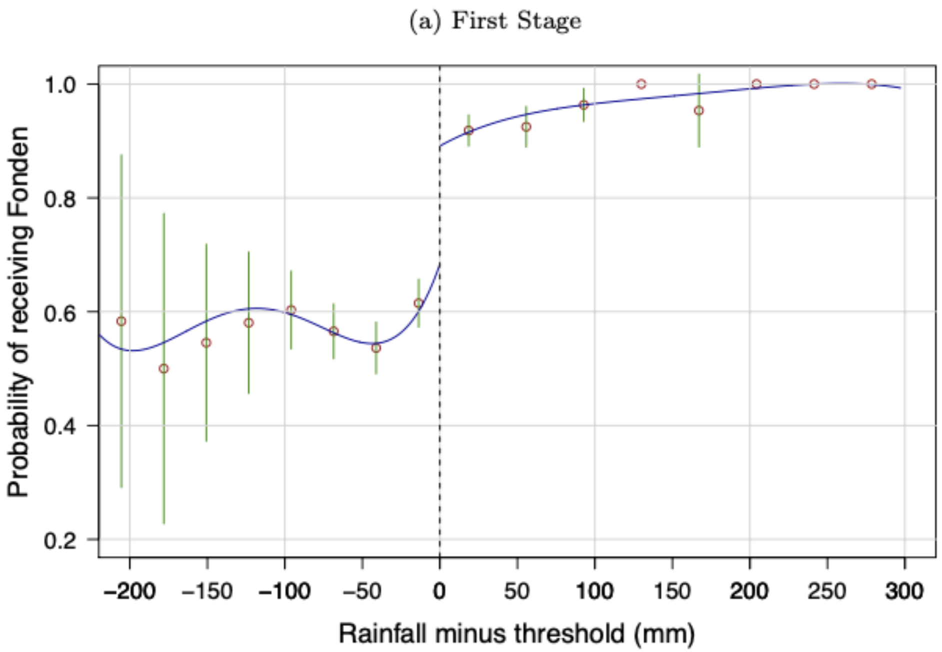
Table 1—Summary statistics

	Mean	Std. Dev.	Min	Max
Log difference night lights	-0.04	0.19	-1.57	1.91
Rainfall (mm)	81.64	80.40	0	391
Fonden threshold (mm)	89.53	44.10	2	237
Rainfall minus threshold (mm)	-7.89	76.23	-219	297
Above threshold=1	0.36	0.48	0	1
Fonden=1	0.71	0.45	0	1

Note: The sample is composed of municipalities that requested Fonden between 2004 and 2012. There are 2708 municipal-year observations in the sample. The log difference night lights is calculated by taking the difference in the logarithm of the average of the municipal night lights over the 12 months before and after the disaster. Above threshold is an indicator variable equal to one when the rainfall is equal or above the threshold. The Fonden variable is equal to one when the Federal Register reports that a municipality is eligible for Fonden resources.
Source: Boudreau (2015); Conagua (2015*a*,*b*,*c*); NOAA (2015)

RESULTADOS (I)

Análisis visual con polinomios globales (4to orden)



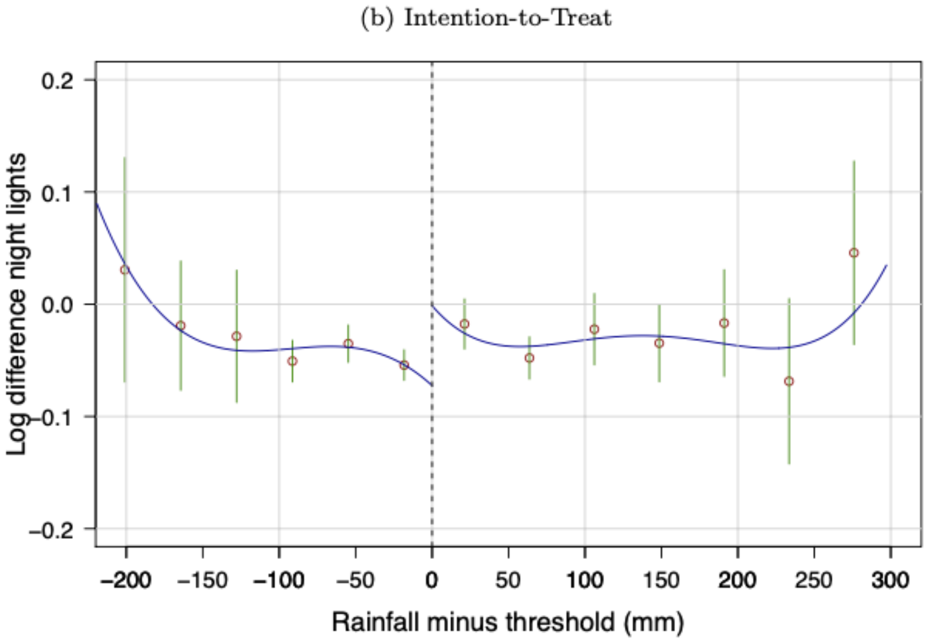


Figure 1. : First stage and Intention-to-Treat

Note: Each graph plots the outcome (probability of receiving Fonden or log difference in night lights between the 12 months before and the 12 months after a disaster) as a function of the running variable (rainfall minus threshold). In each graph, the support of the running variable has been partitioned into disjoint bins. The number of bins is selected to minimize the integrated mean square error of the underlying regression function, as described in Calonico, Cattaneo and Titiunik (2015). The circles plot the local mean of the outcome at the mid-point of each bin. The error bars are the 95% confidence intervals for the local means. The solid lines are fourth-order global polynomials fits (estimated separately on each side of the threshold). Observations to the right of the vertical dashed line are eligible for Fonden

RESULTADOS (I)

Estimación con kernel local lineal

(1) $$F_{mt} = \alpha_0 + \alpha_1 ABOVE_{mt} + g(R_{mt}) + v_{mt},$$

(2) $$Y_{mt} = \beta_0 + \beta_1 ABOVE_{mt} + g(R_{mt}) + \varepsilon_{mt},$$

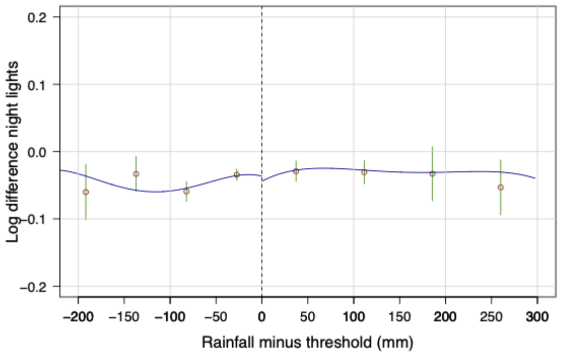
Table 2—Impact of Fonden on night lights

	(1)	(2)
Panel A. *First Stage* (α_1)	0.227	0.230
p-value	< 0.001	< 0.001
CI 95 percent	[0.12,0.28]	[0.13,0.31]
Panel B. *Intention-to-Treat* (β_1)	0.059	0.072
p-value	0.010	0.006
CI 95 percent	[0.02,0.12]	[0.02,0.13]
Panel C. *LATE* (τ_{FRD})	0.260	0.313
p-value	0.009	0.011
CI 95 percent	[0.08,0.56]	[0.08,0.61]
Bandwidth (mm)	57.9	40.0
Obs (left|right)	1038|525	741|410

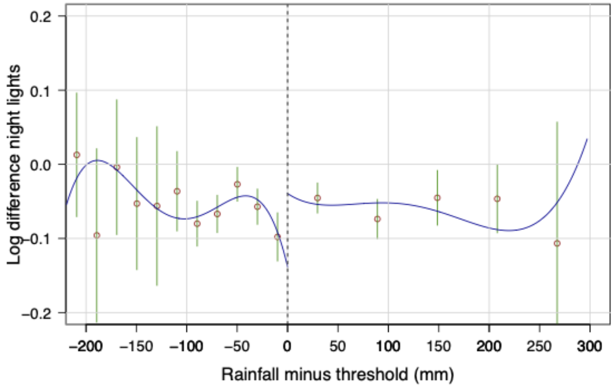
Note: Panel A presents estimates of equation 1, where the dependent variable is eligibility for Fonden resources. Panel B presents estimates of equation 2, where the dependent variable is the log difference in night lights between the 12 months before and after a disaster. Panel C reports the LATE estimate of eligibility for Fonden resources on night lights computed as the ratio of the ITT estimate to the first stage coefficient. Estimates in panel A and B are derived using a triangular kernel and local linear polynomial. The bandwidth selection algorithm used in column 1 is optimal for point estimation; the selection algorithm in column 2 is optimal for inference of confidence intervals. The p-values and 95 percent confidence intervals reported are constructed using robust bias correction and clustering at the municipal level.

RESULTADOS (II)
Impacto dinámico de FONDEN (ITT)

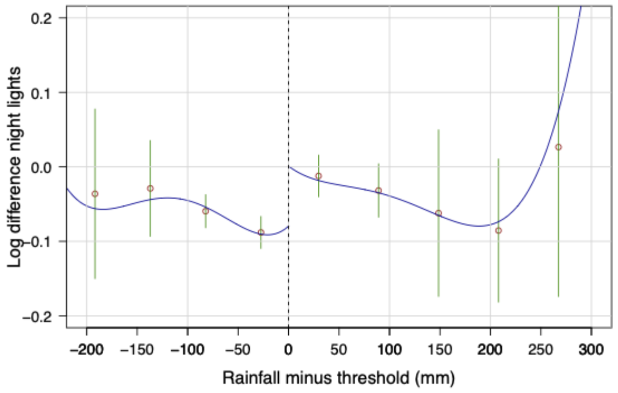
(a) 2 months after
(just before fund disbursement)



(b) 4 months after
(first observed Fonden impact)



(c) 12 months after



(d) 18 months after

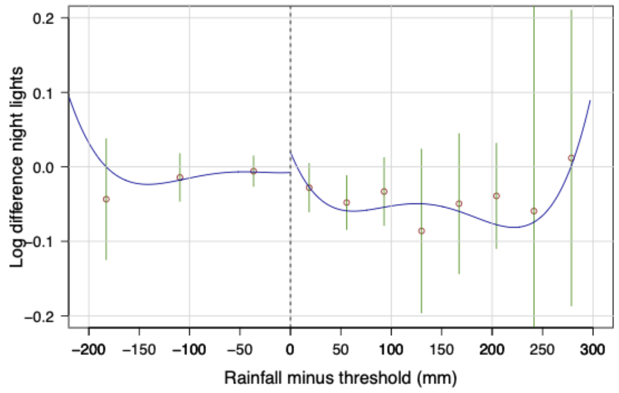


Figure 2. : Dynamics: Intention-to-Treat in various post-disaster months.

Note: The figures plot the log difference in night lights, at four post-disaster periods, as a function of the running variable (rainfall minus threshold). The outcomes are constructed by taking the log difference in night lights between 12 months before the disaster (same baseline as in figure 1b, months -12 to -1), and in months 2, 4, 12, and 18 after the disaster. In each graph, the support of the running variable has been partitioned into disjoint bins. The number of bins is selected to minimize the integrated mean square error of the underlying regression function, as described in Calonico, Cattaneo and Titiunik (2015). The circles plot the local mean of the outcome at the mid-point of each bin. The error bars are the 95% confidence intervals for the local means. The solid lines are fourth-order global polynomials fits (estimated separately on each side of the threshold). Observations to the right of the vertical dashed line are eligible for Fonden under the heavy rainfall criteria.

RESULTADOS (II) Impacto dinámico de FONDEN (LATE)

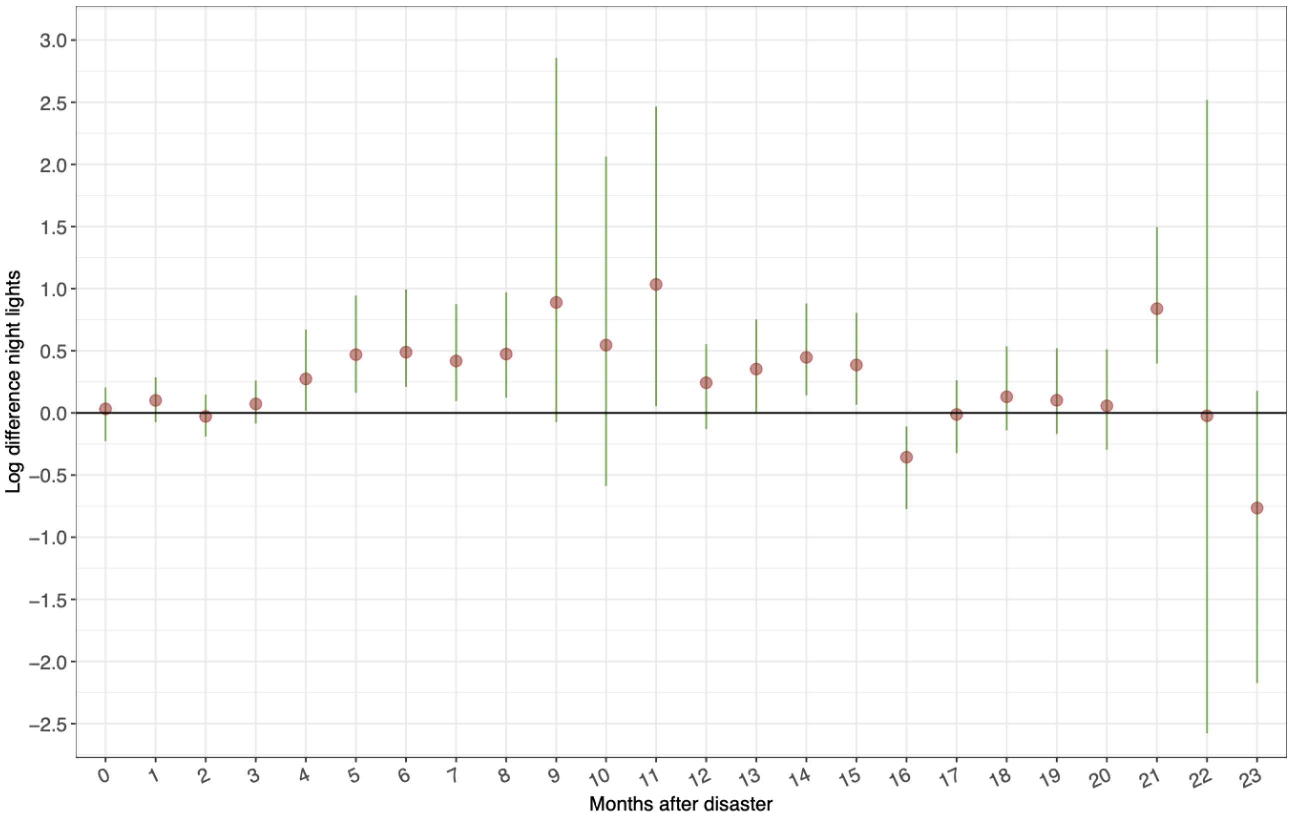


Figure 3. : Month by month impact of Fonden after a disaster

Note: This figure plots coefficients and robust 95% confidence intervals of Fonden LATE. The 24 outcome variables are the log difference in night lights between the 12 months before a disaster (same baseline as in figure 1b, months -12 to -1) and each month in the two years after a disaster. Each plotted coefficient is estimated independently using a triangular kernel, a local linear polynomial, and the average h_{MSE} bandwidth.

RESULTADOS (III)

Efectos de derrame (*spillover*)

Table 3—Spillover effects

		Spillover Effects	
	Baseline (1)	0 to 20 km (2)	20 to 40 km (3)
LATE (τ_{FRD})	0.260	0.234	0.064
p-value	0.009	0.009	0.694
CI 95 percent	[0.08,0.56]	[0.05,0.38]	[-0.09,0.13]
Bandwidth (mm)	57.9	57.9	57.9
Obs (left|right)	1038|525	1038|525	1038|525

Note: The dependent variable is the log difference in night lights between the 12 months before and after a disaster. Column 1 presents estimates of Fonden's LATE from our baseline specification (table 2 column 1, panel C). In columns 2 and 3, the outcome is calculated using only information on pixels that are within the distance to the municipal boundary indicated in the column title. All estimates are derived using a triangular kernel, a local linear polynomial, and a h_{MSE} optimal bandwidth. The p-values and 95 percent confidence intervals reported are constructed using robust bias correction and clustering at the municipal level.

RESULTADOS (IV)
Multiplicador fiscal FONDEN

Table 4—Implied fiscal multiplier

(1)	Events	1383	-	-
(2)	Effect of Fonden on night lights	0.260	(0.105)	-
(3)	Inverse elasticity of lights with respect to GDP	0.095	(0.038)	-
(4)	Implied effect on GDP growth	0.025	(0.015)	-
(5)	Mean municipal GDP in 2003 (millions $)	180.160	(7.480)	-
(6)	Gain per municipality (millions $)	4.430	(2.650)	-
(7)	Total gain (millions)	6127.290	(3660.710)	-
(8)	Gain cost ratio	0.959	(0.573)	[0.017,1.901]

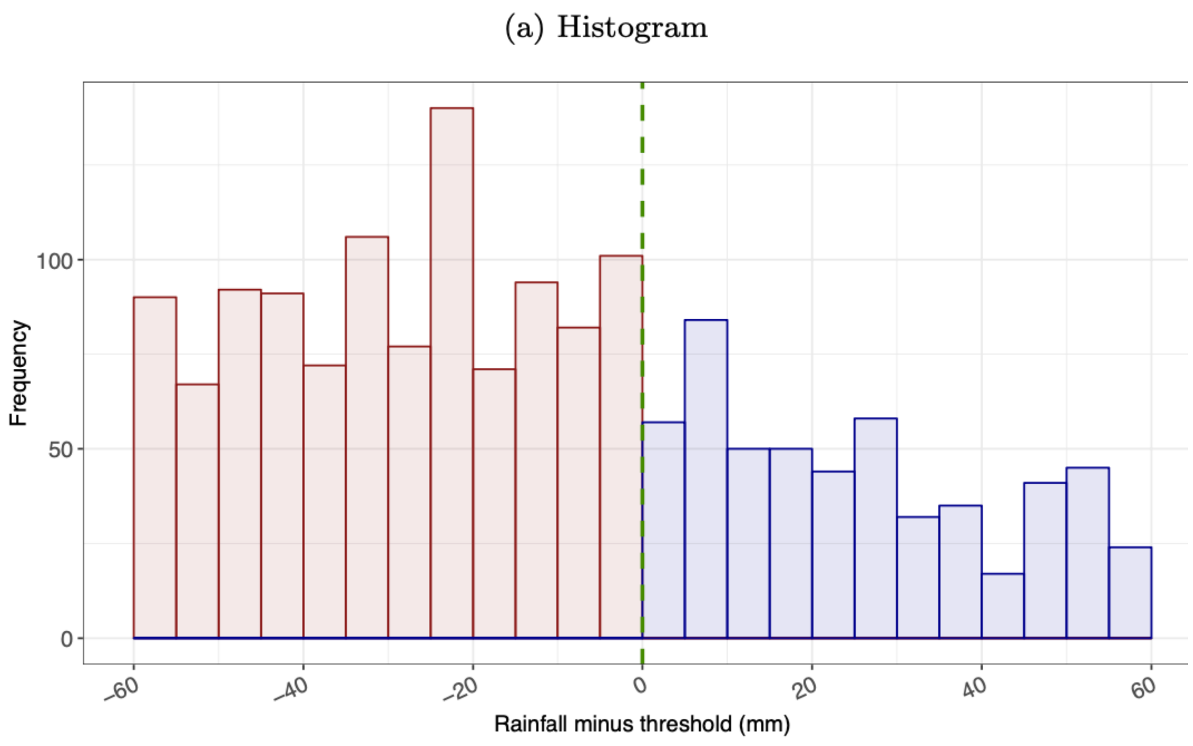
Note: Row 2 reports estimates from table 2 column 1, panel C. Row 3 reports estimates from table A1 column 2. Row 4 is calculated as $(\delta_2 \times \delta_3)$, where δ_j represents the parameter reported in row j of column 1. Because municipal GDP has a heavy-tailed distribution, in row 5, we report the geometric mean. All monetary values are in millions of constant 2010 international dollars. Fonden expenditures in these events totaled \$6391.69. The point estimate in row 8 is calculated as: $\delta_1(\delta_2 \times \delta_3 \times \delta_5)/Cost$. Assuming that covariance and co-skewness are equal to zero its standard error is given by: $\delta_1\sqrt{(\delta_2^2 + se_2^2) \times (\delta_3^2 + se_3^2) \times (\delta_5^2 + se_5^2) - \delta_2^2 \times \delta_3^2 \times \delta_5^2}/Cost$. Standard errors are in parentheses, 90 percent confidence intervals are in brackets.

VALIDACIÓN
Manipulación de la variable de asignación

¿Por qué no es creíble?

1. Falta de procesos formales para apelar decisiones de CONAGUA
2. Las estaciones metereológicas fungen distintas labores civiles y militares
3. Los registros de las estaciones son desconocidas fuera de CONAGUA
4. Poco tiempo para la colusión

VALIDACIÓN
Manipulación de la variable de asignación



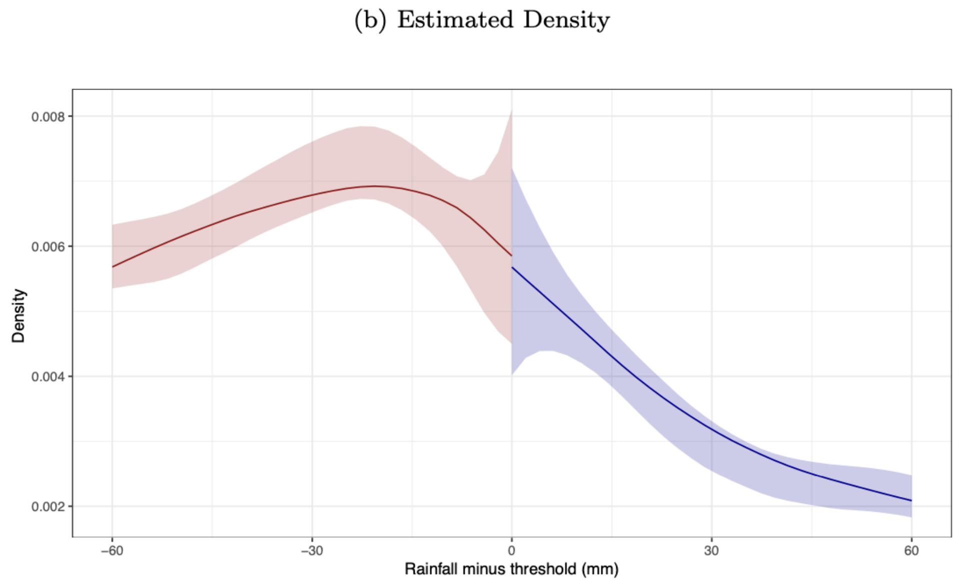


Figure 4. : Histogram and estimated density of rainfall minus threshold

Note: Panels A and B plot the histogram and empirical density of the running variable (rainfall minus threshold) within the bandwidth used for estimation. Analogous graphs for the entire support of the running variable can be found in figures A7a and A7b in the appendix. The p-value for the null hypothesis that the density of the running variable is continuous at the threshold is 0.594 under unrestricted testing and 0.529 under restricted testing. See section IV and Cattaneo, Jansson and Ma (2018) for further details on these tests.

VALIDACIÓN

Manipulación de la variable de asignación

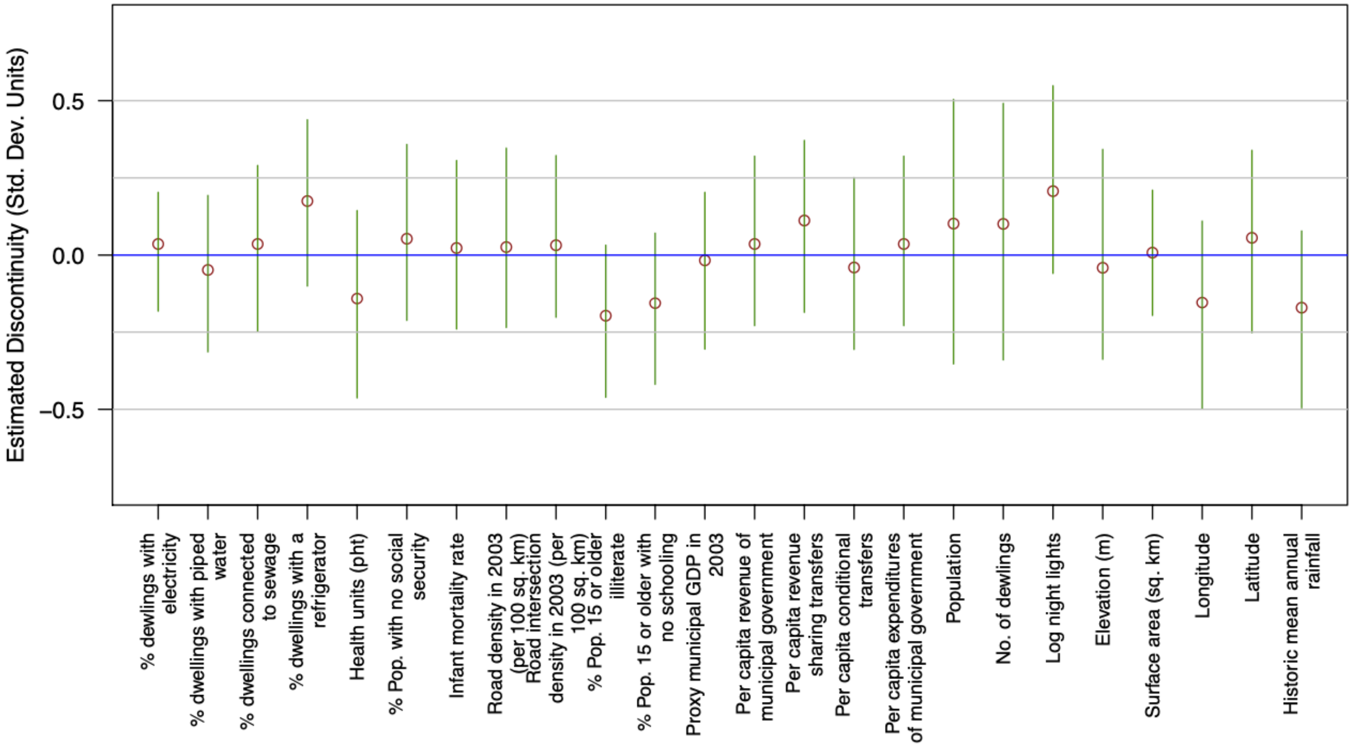


Figure 5. : Balance of municipal characteristics before a hydro-meteorological event

Note: This figure plots estimates of equation 2 using as outcome each of the variables listed. Unless otherwise stated in the label, all variables are measured in the most recent year available that predates a natural disaster used to request Fonden verification. Variables are standardized to facilitate comparison. The circles represent point estimates constructed using a triangular kernel, a local linear polynomial, and a h_{MSE} optimal bandwidth. The error bars represent robust 95% confidence intervals.
Sources: INEGI (2000, 2005, 2010, 2013*a*,*b*, 2014); DGIS (2001); USGS (2003); Conapo (2005); Conagua (2015*a*); NOAA (2015)

VALIDACIÓN
Asignación de otros recursos tras desastre

Table 6—Other resource allocation

Dep. Variable:	Total transfers (1)	Revenue sharing (2)	Conditional (3)
Intention to Treat (β_1)	0.011	-0.023	0.008
Robust p-value	0.980	0.448	0.888
Robust 95 percent CI	[-0.08,0.08]	[-0.12,0.05]	[-0.17,0.14]
Bandwidth (mm)	43.5	46.6	45.0
Obs (left|right)	590|320	636|337	604|326
Mean dep. variable	0.125	0.110	0.141

Note: The table presents estimates of equation 2. The dependent variable is the growth in per-capita transfers between the calendar years before and after a disaster. The type of transfer is listed in the column title. Revenue sharing transfers (primarily branch 28 of the federal budget) are awarded using a rule and can be used for any purpose. Conditional transfers (primarily branch 33 of the federal budget) are awarded using both rules and discretion and can only be used for their earmarked purpose. Estimates are derived using a triangular kernel, local linear polynomial, and a h_{MSE} optimal bandwidth. The p-values and 95 percent confidence intervals reported are constructed using robust bias correction and clustering at the municipal level.

FALSIFICACIÓN

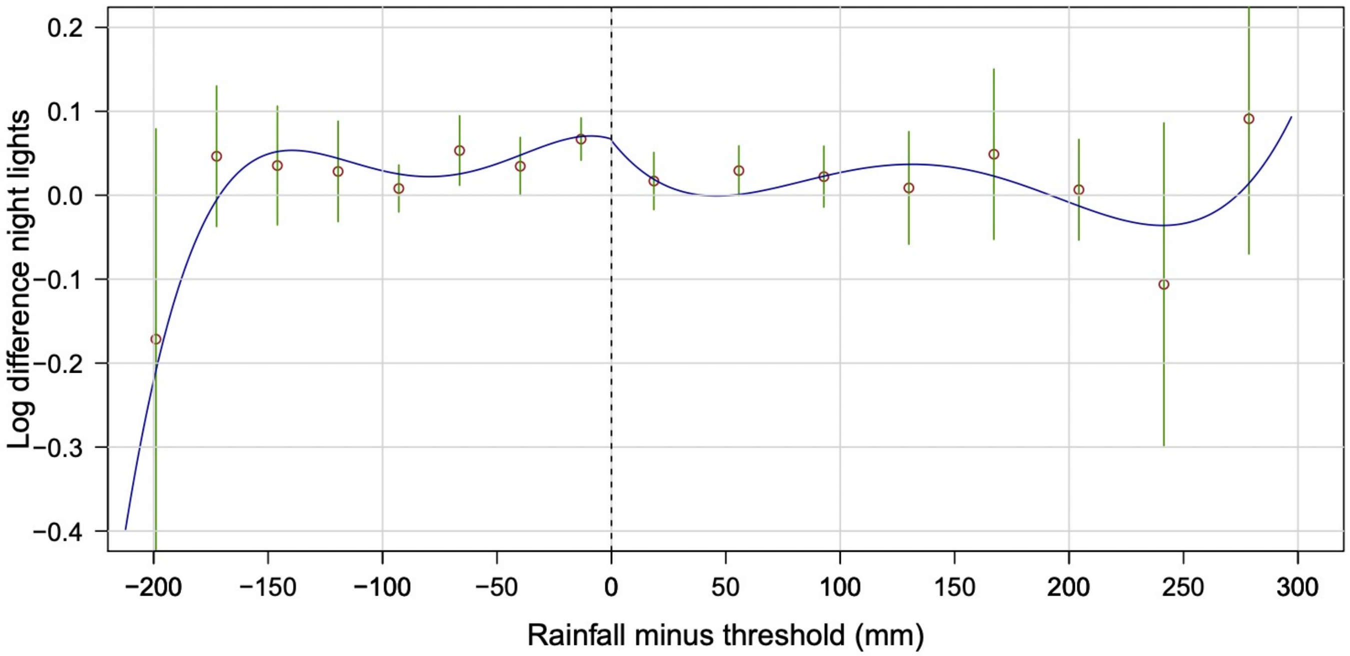


Figure A12: Intention-to-treat (placebo)

Note: The figure plots the log difference night lights, between two years before an event (months -24 to -13) and the year before (months -12 to -1), as a function of the running variable (rainfall minus threshold). The support of the running variable has been partitioned into disjoint bins. The number of bins is selected to minimize the integrated mean square error of the underlying regression function, as described in Calonico, Cattaneo and Titiunik (2015). The circles plot the local mean of the outcome at the mid-point of each bin. The error bars are the 95% confidence intervals for the local means. The solid lines are fourth-order global polynomials fits (estimated separately on each side of the threshold). Observations to the right of the vertical dashed line are eligible for Fonden under the heavy rainfall criteria.

PRUEBAS DE ROBUSTEZ

Table A5: Impact of Fonden on night lights, robustness (tuning parameters)

	Local Polynomial Degree		Kernel		Alternative bandwidths		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LATE (τ_{FRD})	0.312	0.337	0.218	0.252	0.274	0.258	0.292
p-value	0.051	0.024	0.002	0.011	0.020	0.014	0.024
CI 95%	[-0.00,0.64]	[0.04,0.63]	[0.10,0.41]	[0.07,0.55]	[0.05,0.57]	[0.06,0.49]	[0.04,0.56]
Bandwidth (left|right) (mm)	74.3|74.3	48.7|48.7	62.1|62.1	54.3|54.3	50.1|50.1	42.0|71.3	29.0|49.2
Obs (left|right)	1287|605	894|460	1113|549	979|509	926|478	780|599	547|466
Bandwidth selection	$\hat{h}_{MSE}$	$\hat{h}_{CER}$	$\hat{h}_{MSE}$	$\hat{h}_{MSE}$	ITT $\hat{h}_{MSE}$	$\hat{h}_{MSE2}$	$\hat{h}_{CER2}$
Local Polynomial Degree	2	2	1	1	1	1	1

Note: The dependent variable is the log difference night lights between the 12 months before and after a disaster. Estimates are derived using a triangular kernel with the exception of columns 3 (epanechnikov) and 4 (uniform). The local polynomial degree, and optimal bandwidth selection algorithm is indicated in each column. The $\hat{h}_{MSE}$ bandwidth selection algorithm is optimal for point estimation; the $\hat{h}_{CER}$ selection algorithm is optimal for inference of confidence intervals. The subscript 2 in the description of the bandwidth selection algorithm denotes that different bandwidth lengths have been selected in each side of the threshold. The p-values and 95% confidence intervals reported are constructed using robust bias correction and clustering at the municipal level.

Conclusiones

1. FONDEN reduce de manera importante el efecto en luces nocturnas. Efecto sostenido por un año.

2. Ganancias al menos tan grandes como costos.

3. Los esfuerzos basados en reglas pueden mejorar la capacidad de respuesta ante desastres.

4. Las estimaciones posiblemente están subestimadas:
   I. Spillovers
   II. Reducir carga fiscal de los gobiernos

5. Lugares con más desventajas se benefician de manera desproporcionadamente mayor.

COMERCIAL

LA ELIMINACIÓN DEL FONDEN: EL FIN DE UN ESCUDO

Daniela Balbino
Investigadora

26 Octubre, 2023

MPARTIR:

¡GRACIAS!

RESULTADOS (VI)
Efectos heterogéneos

Table 5—Heterogeneous effects of Fonden

Sample split:	Baseline	Primary Fonden expenditure		Road intersection density		Storm drain coverage	
		Roads	Non-roads	Below Median	Above Median	Below Median	Above Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LATE (τ_{FRD})	0.260	0.479	0.173	0.366	0.179	0.553	0.041
p-value	0.009	0.016	0.250	0.053	0.064	0.042	0.622
CI 95 percent	[0.08,0.56]	[0.11,1.10]	[-0.12,0.48]	[-0.01,0.97]	[-0.01,0.46]	[0.02,1.11]	[-0.19,0.31]
Bandwidth (mm)	57.9	46.8	45.2	61.3	70.4	40.7	48.2
Obs (left|right)	1038|525	569|217	425|131	548|289	623|293	381|193	430|242

Note: The dependent variable is the log difference night lights between the 12 months before and the 12 months after a disaster. Column 1 presents estimates of Fonden's LATE from our baseline specification (table 2 column 1). Road intersection density is defined as the number of road intersections per 100 square km in 2003; its median value is 6.34. To proxy storm drain coverage, we use the percentage of dwellings connected to sewage, as measured in the most recent census that predates the natural disaster; its median value is 0.71. Only the estimates for the subsample above and below median storm drain coverage are statistically different from each other (p-value 0.1). All estimates are derived using a triangular kernel, a local linear polynomial, and a h_{MSE} optimal bandwidth. The p-values and 95 percent confidence intervals reported are constructed using robust bias correction and clustering at the municipal level.

RESULTADOS (IV)

Validez externa

Table A2: Complier probability derivative and treatment effect derivative

	(1)	(2)
Complier Probability Derivative	0.0020	0.0002
p-value	0.640	0.983
Treatment Effect Derivative	0.0028	0.0028
p-value	0.802	0.882
Bandwidth (mm)	74.3	48.7
Obs (left|right)	1287|605	894|460

Note: This table provides estimates of the complier probability derivate as described in Cerulli et al. (2017), and of the treatment effect derivative as described in Dong and Lewbel (2015). All specifications use a triangular kernel and a local quadratic polynomial. The bandwidth selection algorithm used in column 1 is optimal for point estimation; the selection algorithm in column 2 is optimal for inference of confidence intervals.