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EUROSYSTÈME

DECOMPOSING THE INFLATION RESPONSE TO NATURAL DISASTERS

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INTRODUCTION

(Acute) **Physical risks of climate change**: droughts, floods, extreme precipitations, wildfires

- Important dimension of climate change (vs. **transition risks**)
- Growing body of literature to understand economic consequences (growth, investment, inflation, …).
- Consensus: a natural disaster has elements of a **supply and demand shock**

This paper:

1. What are the effects of natural disasters on ***sectoral*** **prices**?
2. Which sectors are dominated by deterioration of **supply conditions**, which sectors more by **demand** effects?
3. What are the implications for **inflation inequality**?

WHAT WE DO

Methodology and data

1. **Empirical analysis** : panel local projection model using monthly data from 1999m1 – 2018m12 on French oversea territories (DCOMs)
2. **Combination of several data sources in a novel way**:
   - *Administrative* and *meteorological* data on natural disasters (wind and precipitations)
   - Sectoral price indices for four French Oversea Territories (La Réunion, Martinique, Guadeloupe, Guyane)
   - Consumption baskets per income quantiles, products can be matched with price data
   - Other economic data (employment, tourism, firm creation/destruction)

WHAT WE DO

Main results

1. **Natural disasters have a mild positive, insignificant and transitory effect on inflation** (+0.5 p.p.)
2. **Aggregation hides strong sectoral effects**:
   – Strong rise in fresh food products (+12 p.p./*supply effect*)
   – Decline in all other products (-0.2 to -0.7 p.p./*demand effect*)
3. **Sectoral response implies rise in inflation inequality**:
   – Lowest income quintile: +0.65 p.p.
   – Highest income quintile: +0.4 p.p.

Contribution

1. **IV approach** to address attenuation and reporting biases in natural disasters data (Felbermayer & Groeschl 2014, Grislain-Letrémy 2018, Schumacher & Strobl 2011, Bertinelli & Strobl 2013)
2. **Focus on the compositional effect on inflation:** full decomposition of CPI reaction, not available in existing papers (Parker (2018), Heinen et al. (2019), Kabundi et al., 2023)
3. **Estimate the consequences for inflation inequality**

DATA. NATURAL DISASTERS

A. Climate data	data collection mode	phenomen		frequency	variable used	other variables
Cross-Calibrated Multi-Platform, CCMP (NOAA)	satellite (remote sensing)	wind	0.25 degree (lat/lon)	6h (intraday)	u,v	
Climate Prediction Center, CPC (NOAA)	satellite (remote sensing)	precipitation	0,5 degrees (lat/lon)	daily	precip	
Global Surface Summary of the Day, GSOD (NOAA)	weather stations	wind		daily	GUST	MXSPD
Global Surface Summary of the Day , GSOD (NOAA)	weather stations	precipitation		daily	PRCP	

+ Météo France data on 33 specific events.

B. Administrative natural disaster databases	provider	first obs	geographic entity	classification		economic damage
EMDAT	CRED/UC Louvain	1900	by country	earthquakes, floods, storms etc.		yes
GASPAR (*Base national de gestion assistée des procédures administratives relatives aux risques*)	French Ministry of ecological transition	1982	by community	earthquakes, floods, storms etc.		no

[Location of weather stations]

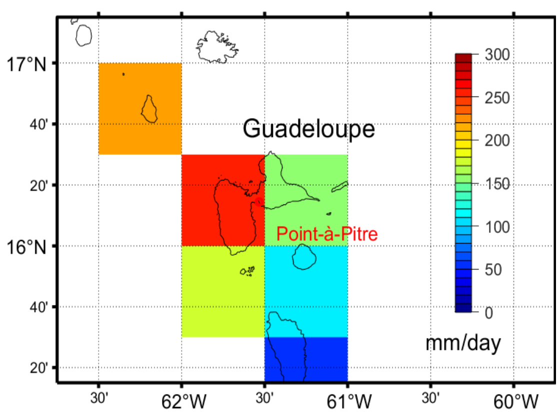
DATA. NATURAL DISASTERS

Table. Administrative measures of shocks

		Number (%) in		Number (%) in			
	N	**GASPAR**	**EM-DAT**	**Guadeloupe**	**Guyane**	**La Réunion**	**Martinique**
GASPAR	68	-	11 (16.2)	21 (30.9)	5 (7.3)	22 (32.3)	20 (29.4)
EM-DAT	12	11 (91.7)	-	3 (25)	0 (0)	5 (41.7)	4 (33.3)
All admin.*	**69**	-	-	**21 (30.4)**	**5 (7.2%)**	**23 (33.3)**	**20 (30)**

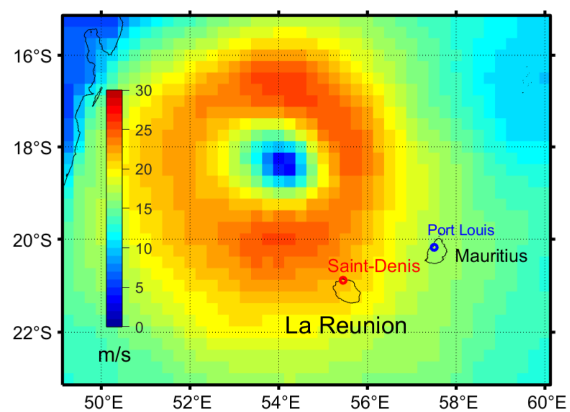
*** GASPAR or EM-DAT**

Figure. Precipitation (CPC)



Note. Precipitation via remote sensing is taken from the NOAA Climate Prediction Center (CPC), measured on a 0.5-degree grid in millimeters per day. The panel shows the maximum daily precipitation on Guadeloupe in the sample, which amounts to 252.59 mm on 19.11.1999.

Figure. Wind speed (CCMP)



Note. Wind speed via remote sensing from the NCAR Cross-Calibrated Multi-Platform (CCMP), measured on a 0.25-degree grid in meters per second on a range from 0 to 30. The panel shows the maximum average wind speed in a 6h interval on La Réunion in the sample, which amounts to 27.76 m/s on 2007-Feb-25 (12AM) when cyclone Gamede passed the island.

Aggregation of data into monthly time series: $x_{it} = \max[x_{i1}, x_{i2}, \dots, x_{iN}]$

Well-known weaknesses in data quality

- **Contra administrative data:** ***Attenuation and reporting biases*** in natural disaster databases (Felbermayer & Groeschl 2014, Grislain-Letrémy 2018)
- **Contra climate data:** ***Attenuation bias.*** Weather intensity only a ***proxy*** for economic damages. Many other determinants like risk exposition (Schumacher & Strobl 2011) slope of the continental shelf and the shape of the coastline (Bertinelli & Strobl 2013)

→ **This project:** combine various data sources to *overcome these biases simultaneously*

[Comparison with weather stations]
[Météo France shocks]
[Summary statistics]

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INFLATION DATA IN FRENCH OVERSEA TERRITORIES

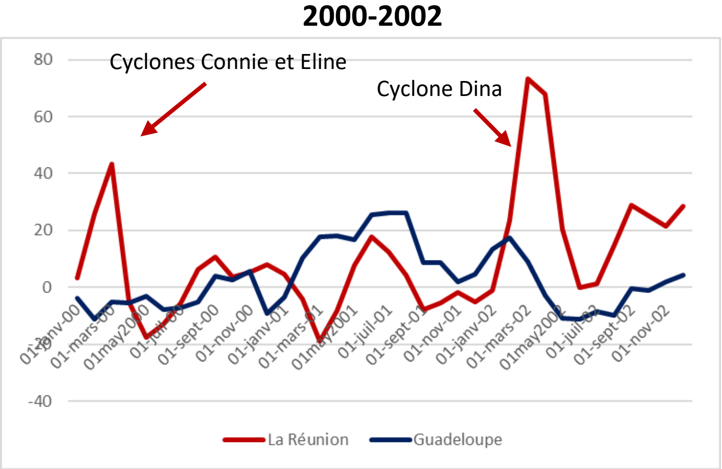
Inflation data (INSEE)

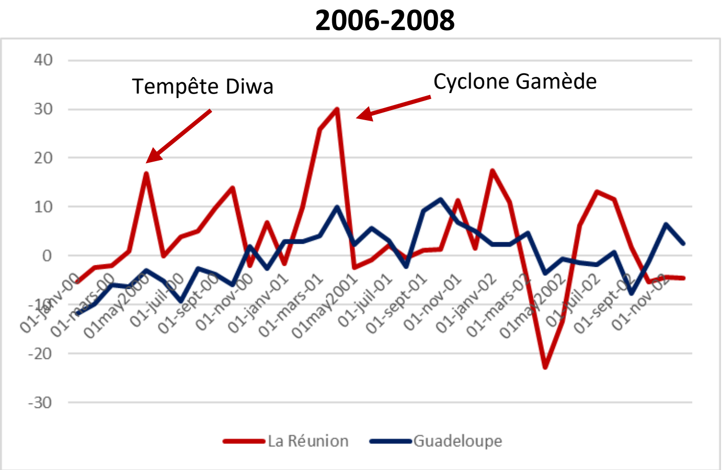
- 1967m1: Guadeloupe, Martinique, Réunion
- 1969m1: Guyane
- Only regions (département) for which regional inflation data is available
- Harmonized methodology
- Complete set of 12 sub-components (**compositional effect**)
- Mapping with consumption baskets (**inflation inequality**)
- Fresh products: low weight but strong volatility [Appendix]

Discussion: Implications for identification

- Small size of territories allows to closely associate natural disasters and changes in inflation
- Overseas territories spread across the globe (avoiding spillovers)

Figure. CPI fresh-food products





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[Stylized facts on prices in DCOM]

IDENTIFICATION (IV APPROACH)

Challenge: measurement errors in administrative data, unobserved true economic damage of climate shocks

In the literature, most papers use either:

- **Only meteorological data** (Heinen et al., 2019) : risks of attenuation biases and misspecification of damage function
- **Only administrative (EMDAT) data** (Parker, 2018; Kabundi et al., 2023): risks of attenuation and reporting biases
- **Our proposal**: combine two sources of natural disaster data in order to construct an instrument.

First stage:

$$\boldsymbol{\omega_{i,t,m} = \alpha + \beta X_{i,t,m} + \gamma_i + \delta_t + \theta_m + \theta_m \times R_i + \varepsilon_{i,t,m}}$$

where γ_i is a DCOM fixed effect, δ_t is a year fixed effect, θ_m is a calendar month fixed effect and $R_i$is a dummy indicating whether DCOM i is La Réunion.

→ The vector $X_{i,t,m}$ contains meteorological data explaining administrative (=significant) disaster events $\omega_{i,t,m}$.

Second stage:

Take (linear) predicted probability of a significant natural disaster $\widehat{\omega}_{it}$ and put it into the second stage model.

$$\boldsymbol{log\left(\frac{P_{i,t,m+h}}{P_{i,t,m-1}}\right) = \tau_h + \theta_h \widehat{\omega}_{i,t,m} + \gamma_{i,h} + \delta_{t,h} + \theta_{m,h} + \theta_{m,h} \times R_{i,h} + \varepsilon_{i,t,m,h}}$$

with $P_{i,t+h}$ denoting the price index of region *i* at month *t+h*, $\widehat{\omega}_{i,t,m}$ is the predicted probability of a natural disaster during month *m* of *year t* in DCOM *i* according to administrative datasets. Year fixed effects are denoted by $\delta_{t,h}$, calendar months fixed effects are denoted by $\theta_{m,h}$and local fixed effects by $\gamma_{i,h}$, while $\varepsilon_{i,m,t,h}$ is an i.i.d residual.

- **Estimation period:** 1999m1-2018m12
- The coefficient θ_h corresponds to the **cumulated effect on prices** of the natural disaster shock after *h* months.

[Admin vs meteo. shocks]
[Seasonality of shocks]

FIRST STAGE: PREDICTING ADMINISTRATIVE REPORTS OF AN EXTREME CLIMATE EVENT WITH METEOROLOGICAL DATA

Table. First stage : regressing administrative disasters on meterological data

	Remote sensing data				Weather stations data			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wind	**0.026*****	-0.016	-0.136	-0.033	0.022	0.070	-0.062	-0.080
	(3.53)	(0.52)	(1.27)	(1.01)	(1.47)	(1.12)	(0.24)	(1.01)
Rain	**0.002*****	0.001	0.002	0.001*	0.001***	0.000	0.000	0.000*
	(4.28)	(1.58)	(1.44)	(1.71)	(4.34)	(0.70)	(1.05)	(1.95)
$Wind^2$		0.002	0.010	0.003**		-0.008	0.038	-0.006
		(1.28)	(1.31)	(2.22)		(0.80)	(0.45)	(0.46)
$Rain^2$		0.000	-0.000	0.000*		0.000**	-0.000	0.000
		(1.13)	(0.29)	(1.90)		(2.10)	(0.36)	(2.49)**
$Wind^3$			-0.000				-0.005	
			(1.10)				(0.56)	
$Rain^3$			0.000				0.000	
			(0.64)				(0.83)	
MF	**0.411*****	0.387***	0.388***		0.476***	0.474***	0.482***	
	(4.71)	(4.26)	(4.05)		(5.52)	(5.49)	(5.42)	
A.R^2	**0.31**	0.32	0.32	0.26	0.29	0.29	0.29	0.20
N	**928**	928	928	928	928	928	928	928
F-Stat	**39.66**	22.42	20.54	21.70	29.57	19.32	8.70	21.09

- Strong link between meteorological data and administrative databases of natural disasters.
- Satellite data can predict natural disasters better then weather stations.
- Non-linear models perform better, reflecting well-known physical relationships between weather and economic damages.

FIRST STAGE FITTED VALUES

Figure. First stage fitted values: predicted probability conditional on the occurrence of GASPAR shocks

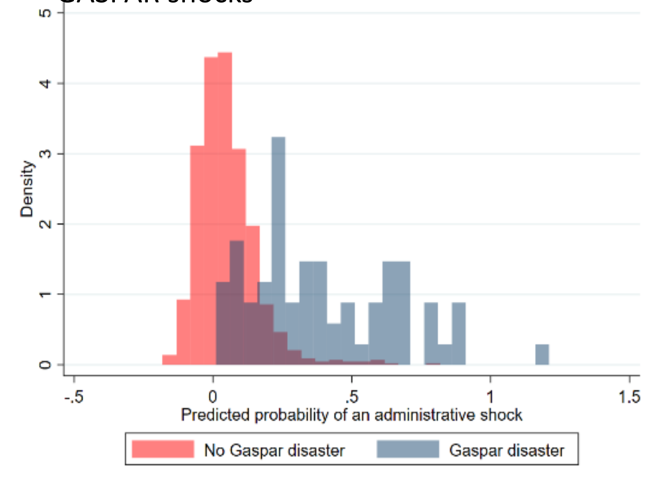


Figure. First stage fitted values: predicted probability conditional on the occurrence of EM-DAT shocks

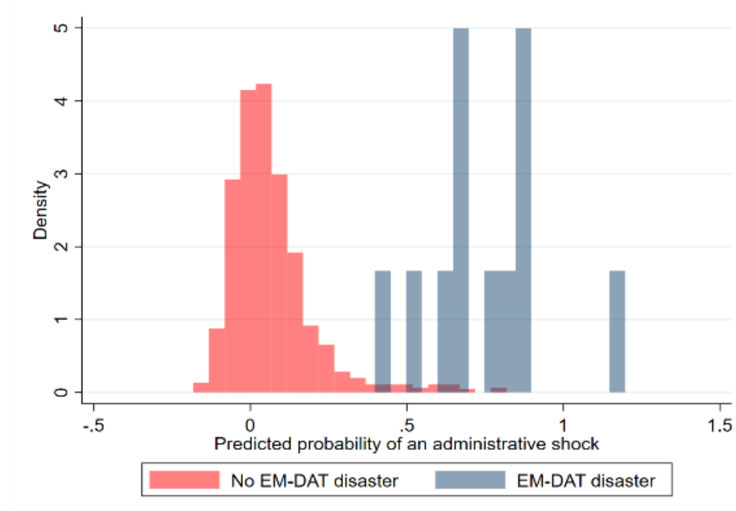
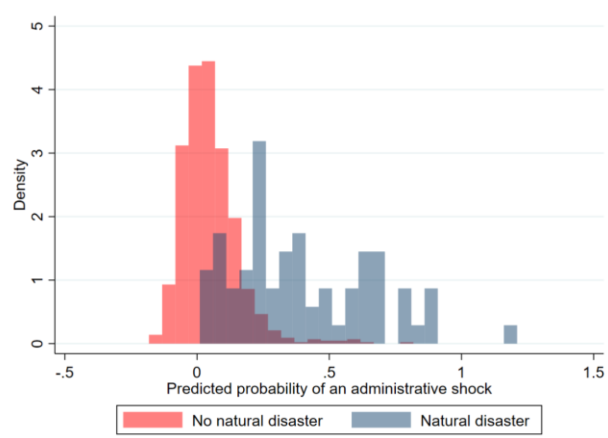


Figure. First stage fitted values: predicted probability conditional on the occurrence of administrative shocks



[Total distribution]

MAIN RESULTS

Figure. Total CPI

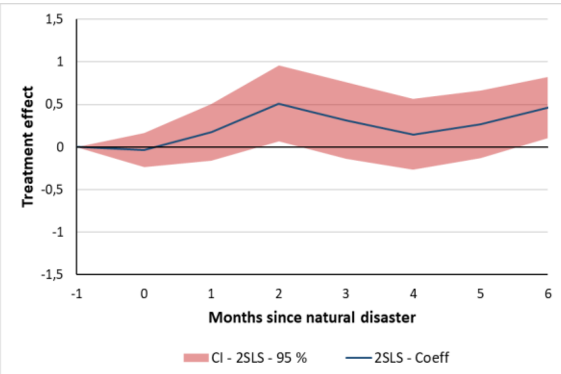


Figure. Fresh food products

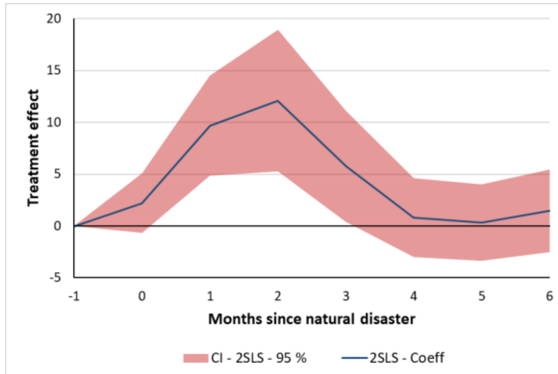


Figure. Total CPI, net of fresh food

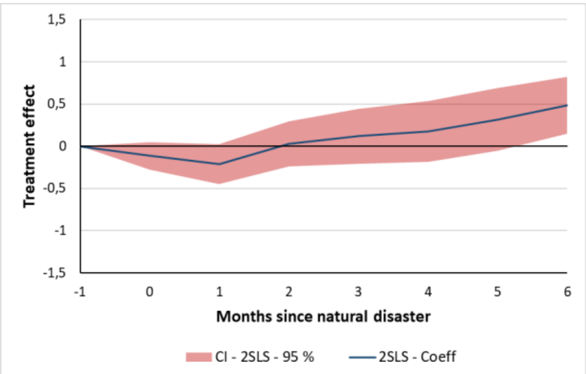


Figure. Services

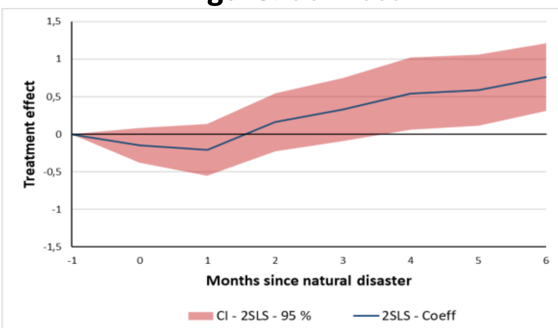


Figure. Manufactured products

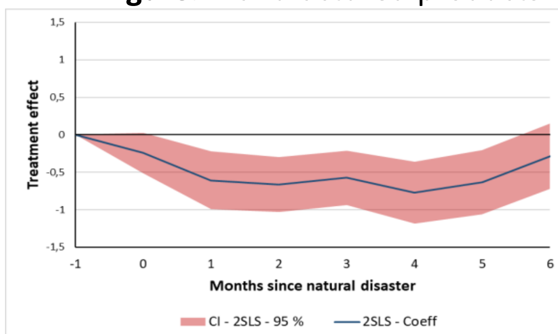
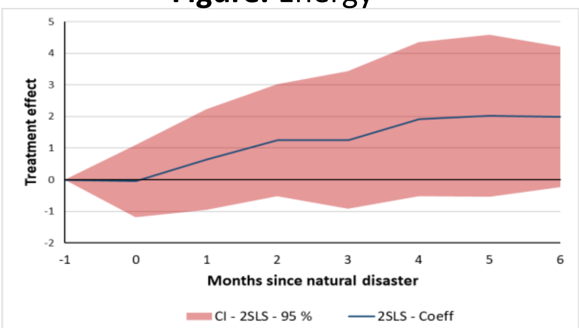


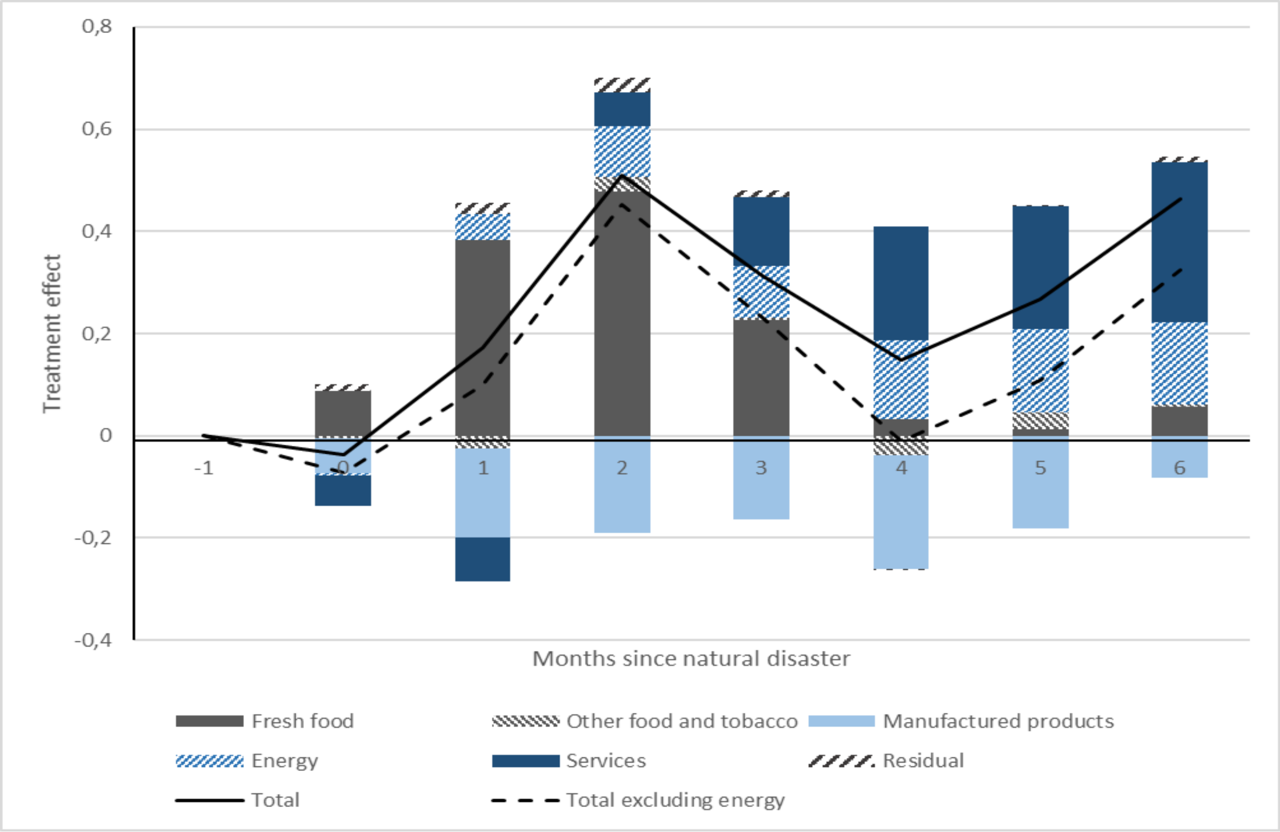
Figure. Energy



- 2SLS results on fresh products are about 3 times higher than simple OLS results [Appendix]
- The effect on headline inflation depends on the weight of fresh food products [Appendix]
- Our estimation indirectly captures intensity effects [Appendix]
- Results are robust to several alternative specifications [Appendix]
- Placebo shocks do not yield significant results [Appendix]
- Different reactions before and after the implementation of an aggregate price cap (« Bouclier Qualité Prix ») [Appendix]

FULL DECOMPOSITION

Figure. Decomposition of the reaction of total inflation in the baseline specification



Note: Decomposition of the cumulative impulse response of headline CPI to a natural disaster in the baseline IV local projection. The contribution of each component is computed as the cumulative response of the CPI of this component times its average weight in the consumer baskets of the four DCOMs between 1999 and 2018. Treatment effects are expressed in percent.

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WHAT IS THE NATURE OF THE SHOCK? SUPPLY VERSUS DEMAND

Figure. Employment in agricultural sector

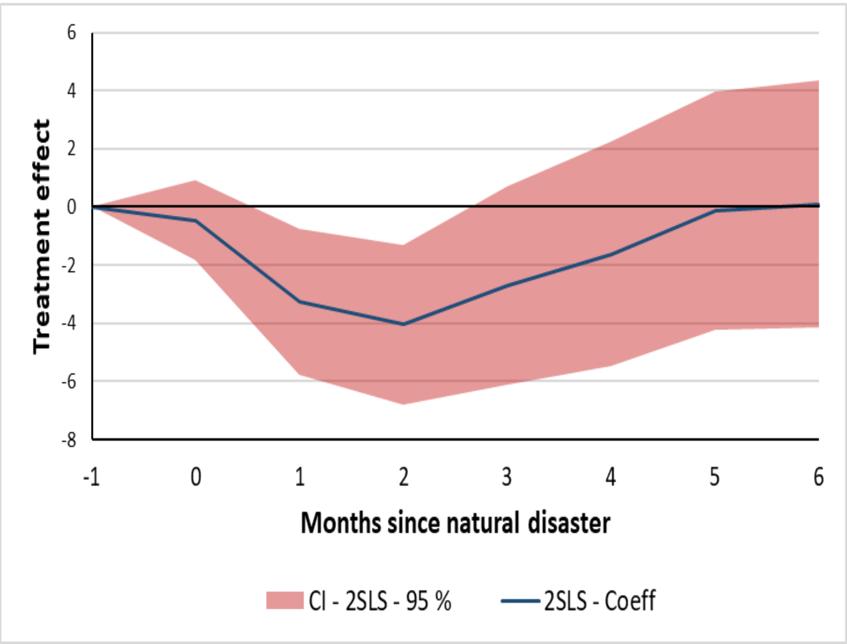
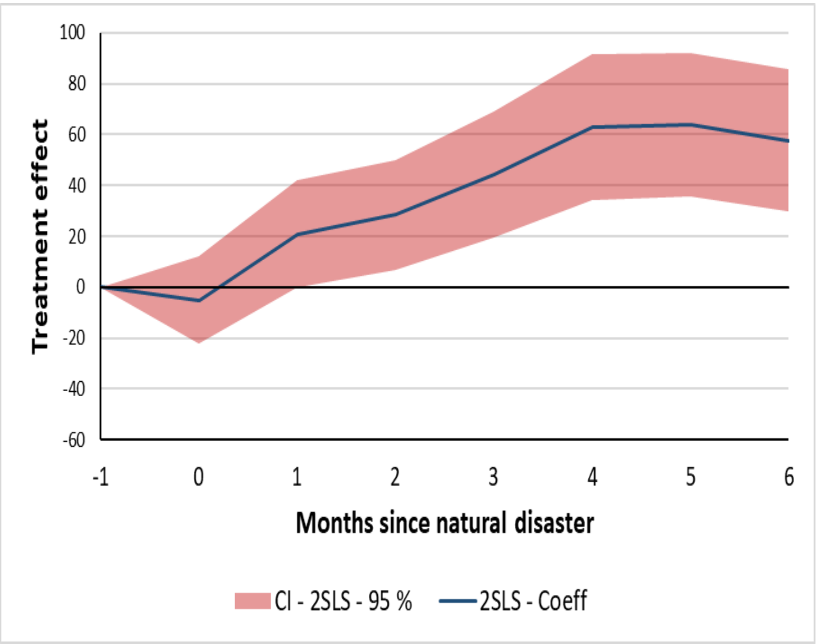


Figure. Hotel overnight stays



Our interpretation:

- response of fresh-food supply driven
- response of remaining products demand driven

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INFLATION INEQUALITY

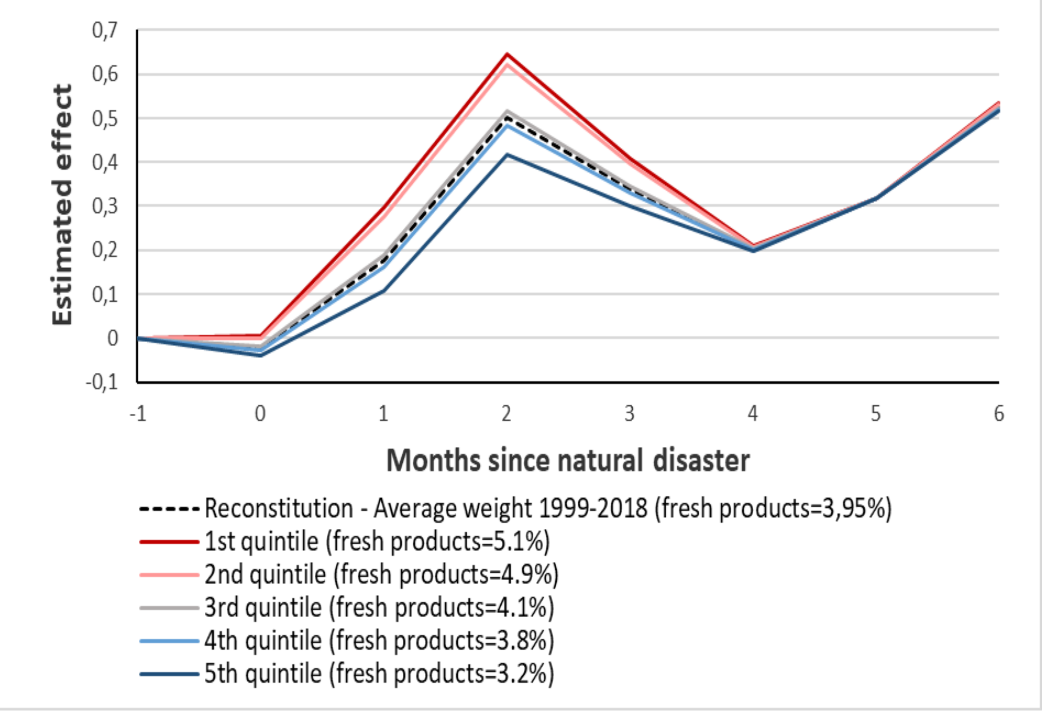
- **Result**: Inflation in the lowest income quintile is almost **twice as large** as inflation in the upper quintile (0,65% vs 0,4% after 2 months)

Table. Weights of fresh food by quintile in French oversea territories

	Moyenne
Poids alimentation	16.2
1er quintile	21.1
2e quintile	20.2
3e quintile	16.6
4e quintile	15.5
5e quintile	13.3

Source: Enquête « Budget de famille »

Figure. Cumulative effect on consumer prices of natural disaster by income quintile



Note: Comparison of the reconstitution of effect on headline CPI using a linear combination of estimated effects on fresh products and total excluding fresh products using average weights between 1999 and 2018 (solid dotted line), with reconstitutions using estimated weights of fresh products for the 5 quintiles of income (blue, red and grey lines). Treatment effects are expressed in percent.

CONCLUSION

1. **Moderate and transitory effect of natural disasters** on CPI inflation in French overseas territories, but **strong compositional effects:**
   - Strong positive effect on fresh food prices (*supply effect*)
   - Negative effect on CPI without fresh food (*demand effect*)

2. **Results broadly consistent with the existing literature**:
   - Contributing full decomposition of the effect
   - Improving the measurement of natural disasters, combining administrative and meteorological datasets

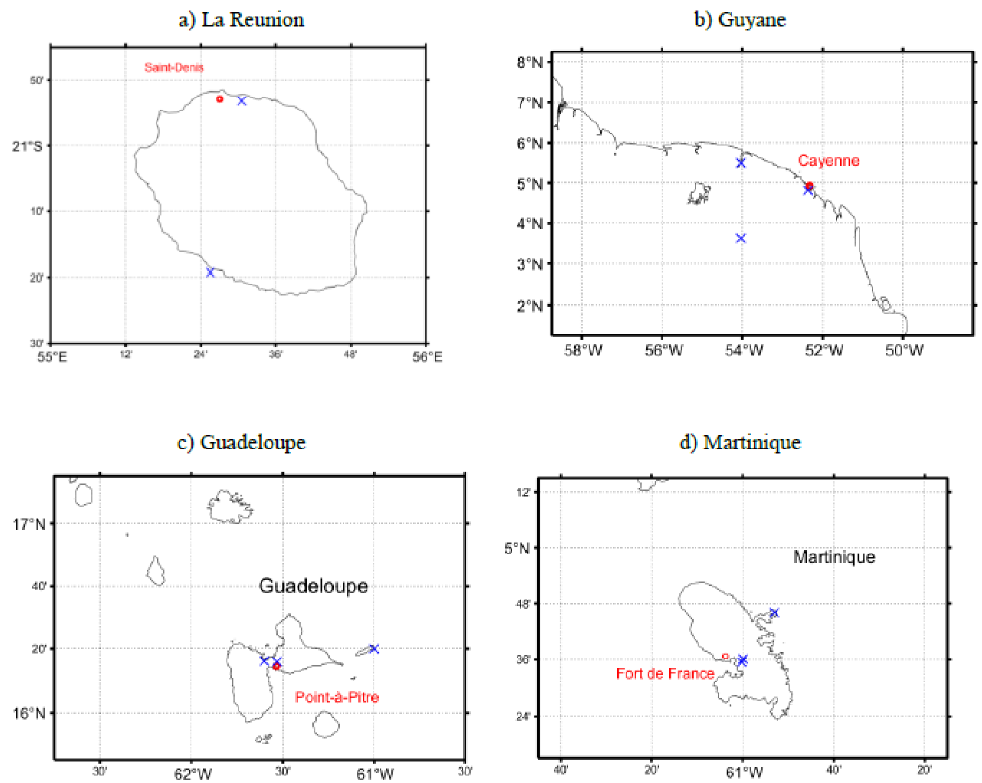
3. **Natural disasters have transitory effects on inflation inequality:** poorer households are affected more negatively

Thanks!

APPENDIX

LOCATION OF WEATHER STATIONS

Table. Location of weather stations

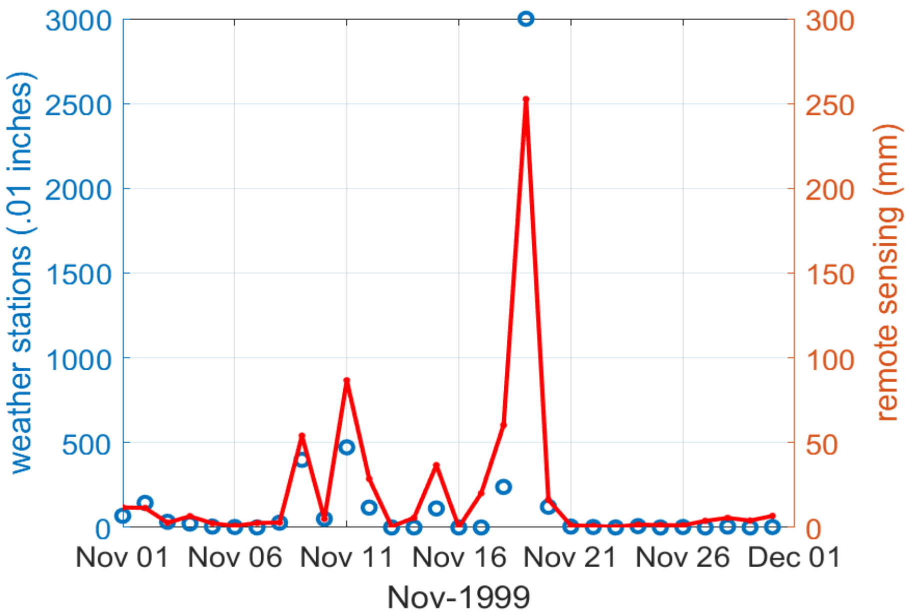


Note: Weather stations from the Global Summary of the Day (GSOD) database on La Reunion (*St Denis Gillot, St Pierre Pierrefonds*), Martinique (*La Lamentin, Martinique Aime Césaire International Airport, Trinité Caravelle*), Guadeloupe (*La Desirade, Le Raizet, Point-à-Pitre International Airport*), and Guyane (*Maripasoula, Rochambeau, St Laurent du Maron*).

[Retour]

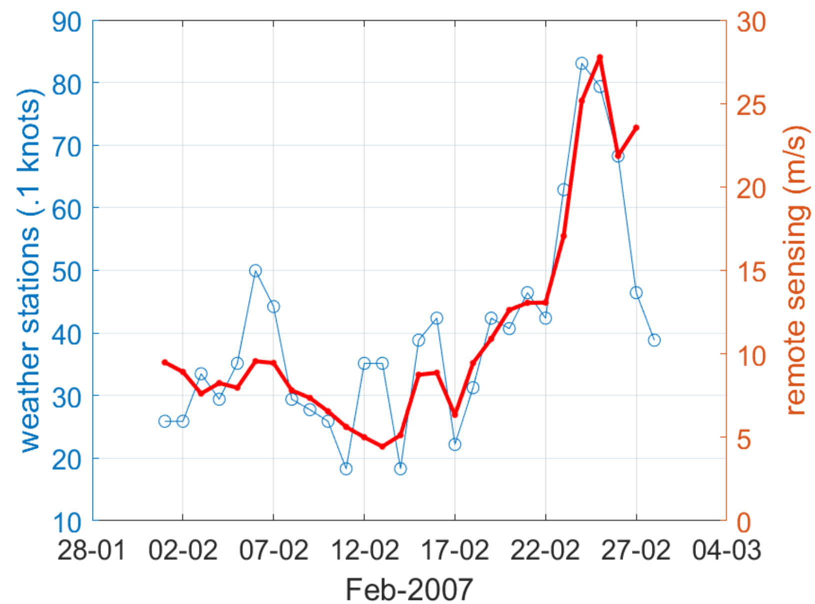
DATA: COMPARING WEATHER STATIONS WITH REMOTE SENSING

Figure. Precipitation (Guadeloupe)



Note. Precipitation records from remote sensing are plotted alongside precipitation from weather stations as documented in GSOD in .01 inches.

Figure. Wind speed (La Reunion)



Note. Wind speed records from remote sensing are plotted alongside maximum for 1 minute sustained wind speed from weather stations as documented in the Global Surface Summary of the Day (GSOD) database in .1 knots.

[Retour]

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MÉTÉO-FRANCE DATA

Table. Météo-France events

Region	Date	Event name	Event type
La Réunion	24-Feb-2007	Gamede	cyclone
La Réunion	3-Mar-2006	Diwa	cyclone
La Réunion	21-Jan-2002	Dina	cyclone
La Réunion	3-Jan-2018	Ava	cyclone
La Réunion	9-Mar-1999	Davina	cyclone
La Réunion	4-Mar-2018	Dumazile	cyclone
La Réunion	1-Jan-2014	Bejisa	cyclone
La Réunion	7-Mar-2015	Haliba	cyclone
Guyane	15-May-2013	-	extreme rain
Guyane	24-Jan-2010	-	extreme rain
Guyane	1-Jun-2008	-	extreme rain
Guyane	8-May-2006	-	extreme rain
Guyane	30-Apr-2000	-	extreme rain
Guyane	17-May-2000	-	extreme rain
Guadeloupe	10-Nov-2018	-	extreme rain
Guadeloupe	18-Sep-2017	Maria	hurricane
Guadeloupe	12-Oct-2012	Rafael	hurricane
Guadeloupe	3-Jan-2011	-	extreme rain
Guadeloupe	30-Aug-2010	Earl	hurricane
Guadeloupe	17-Aug-2007	Dean	hurricane
Guadeloupe	18-Nov-1999	Lenny	hurricane
Guadeloupe	21-Oct-1999	Jose	hurricane
Martinique	16-Apr-2018	-	extreme rain
Martinique	31-Dec-2017	-	extreme rain
Martinique	28-Sep-2016	Matthew	hurricane
Martinique	6-Nov-2015	-	extreme rain
Martinique	12-Oct-2012	Rafael	hurricane
Martinique	1-Aug-2011	Emily	hurricane
Martinique	30-Oct-2010	Tomas	hurricane
Martinique	4-May-2009	-	extreme rain
Martinique	17-Aug-2007	Dean	hurricane
Martinique	18-Nov-1999	Lenny	hurricane

[Retour]

SUMMARY STATISTICS OF METEOROLOGICAL DATA

Table. Summary statistics of meteorological data

	Precipitation				Wind speed			
	Remote sensing (CPC)		Weather stations (GSOD)		Remote sensing (CCMP)		Weather stations (GSOD)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
La Reunion	43.25	45.92	110.08	122.48	13.12	2.55	2.75	0.46
Guyane	69.82	30.97	142.67	86.21	10.06	1.31	1.62	0.35
Guadeloupe	36.67	25.10	89.03	92.81	11.61	1.58	1.99	0.58
Martinique	40.36	23.98	97.32	79.19	11.17	1.26	2.45	0.70
Unweighted average	47.53	31.49	109.78	95.17	11.49	1.68	2.20	0.52

Note: All data was harmonized for comparability. Precipitation is measured in cumulative millimeters per day (conversion: .01 inches = 0.254 mm). Wind speed is measured in meters/second (conversion: .1 knots = 0.0514444 m/s).

[Retour]

DESCRIPTIVE STATISTICS: WEIGHT OF MAIN AGGREGATES IN CPI

Table. Weight of the main aggregates of Consumer Price Index

	Guadeloupe		Guyane		La Réunion		Martinique		DCOMs		France	
Aggregate	Weight 2018	Weight 1999-2018	Weight 2018	Weight 1999-2018	Weight 2018	Weight 1999-2018	Weigh 2018	Weight 1999-2018	Weight 2018	Weight 1999-2018	Weight 2018	Weight 1999-2018
Food	1709	2226	1757	2359	1812	2181	1897	2140	1794	2226	1820**	1849**
Fresh products	179	453	162	402	121	263	180	463	160	395	243	218
Other food	1441	1698	1434	1847	1523	1748	1601	1623	1500	1729	1384	1460
Tobacco	89	75	161	110	168	172	116	55	133	103	193	193
Manufactured products	3344	3025	2930	2535	2748	3058	2871	2850	2973	2867	2594	2949
Footwear and garment	482	626	663	616	506	641	483	676	533	640	416	477
Other manuf. products	2290	2101	1850	1705	1932	2208	1924	1925	1999	1985	1753	2029
Pharmaceutical products	572	298	417	214	360	209	464	249	453	242	425	443
Energy	694	903	789	733	642	748	791	858	729	810	777	776
Petroleum products	498	691	572	507	464	532	592	645	531	594	408	454
Services	4253	3847	4524	4372	4748	4013	4441	4152	4491	4096	4809	4404
Transportation*	223	428	304	440	256	426	163	236	236	382	282	246
Communication*	409	287	390	387	374	445	425	351	399	367	223	257
Health	714	367	566	236	968	387	657	348	726	334	617	534
Rents	774	820	1239	1618	907	988	904	1014	956	1110	764	750
Other services	2132	2063	2025	1878	2243	1970	2292	2258	2173	2042	2923	2617

* Data available only since 2010 for all DCOMs.

Note: The table shows the weight of the main components of CPI in the 4DCOMs, and in France, for 2018 and for the period 1999-2018. The average for the 4 DCOMs is an unweighted mean.

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DESCRIPTIVE STATISTICS: INFLATION

Figure. m-o-m variations and standard deviation of CPI in the 4 DCOMs

	Guadeloupe		Guyane		La Réunion		Martinique		DROMs		France	
Component	m-o-m	sd	m-o-m	sd	m-o-m	sd	m-o-m	sd	m-o-m	sd	m-o-m	sd
Headline	0.12	0.47	0.11	0.31	0.12	0.60	0.12	0.36	0.12	0,43	0.12	0.31
Headline excluding fresh products	0.11	0.46	0.11	0.29	0.12	0.53	0.11	0.34	0.11	0.4	0.12	0.31
Food	0.18	0.87	0.17	0.72	0.22	1.47	0.19	0.72	0,19	0,94	0.17	0.47
Fresh products	0.22	3.45	0.30	3.41	0.71	9.21	0.26	2.92	0,37	4,75	0.25	3.49
Manufactured products	0.04	0.93	-0.03	0.26	0.04	0.89	0.02	0.66	0.02	0.68	0.01	1.04
Energy	0.21	1.94	0.24	2.12	0.22	1.81	0.23	1.91	0,22	1,94	0.30	1.66
Services	0.13	0.59	0.14	0.50	0.13	0.80	0.13	0.46	0.13	0,59	0.15	0.41

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CORRELATION BETWEEN CPI DCOM ET CPI FRANCE

Table. Correlations between main CPI in DCOMs and in France (1999m01-2018m04)

Component	Guadeloupe	Guyane	La Réunion	Martinique	DCOMs
Headline	0.22	0.12	-0.04	0.12	0.14
	[0.001]	[0.06]	[0.51]	[0.06]	[0.04]
Headline excluding fresh products	0.28	0.16	-0.05	0.24	0.19
	[0.000]	[0.02]	[0.43]	[0.000]	[0.003]
Food	0.10	0.09	0.08	-0.07	0.11
	[0.12]	[0.16]	[0.22]	[0.26]	[0.11]
Fresh products	0.05	0.02	0.02	-0.12	0.00
	[0.46]	[0.76]	[0.76]	[0.06]	[0.95]
Manufactured products	0.31	0.38	-0.21	0.36	0.23
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]
Energy	0.31	0.28	0.21	0.37	0.35
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]
Services	0.41	0.59	0.58	0.44	0.70
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Note: p-values between brackets

Stylized facts of inflation in DROM (Insee 2010, Chauvin and Hugounenq 2006)

- Consumption structure close to mainland France, prices more elevated, in particular for food
- Significant – but incomplete – correlation of inflation with mainland :
  - **Correlating factors**: common legislation on wages, rents,; imports (manufactured goods, transformed food)
  - **Un-correlating factors:** local taxation, regulated local prices, locally produced goods (services, fresh food), climatic seasonality

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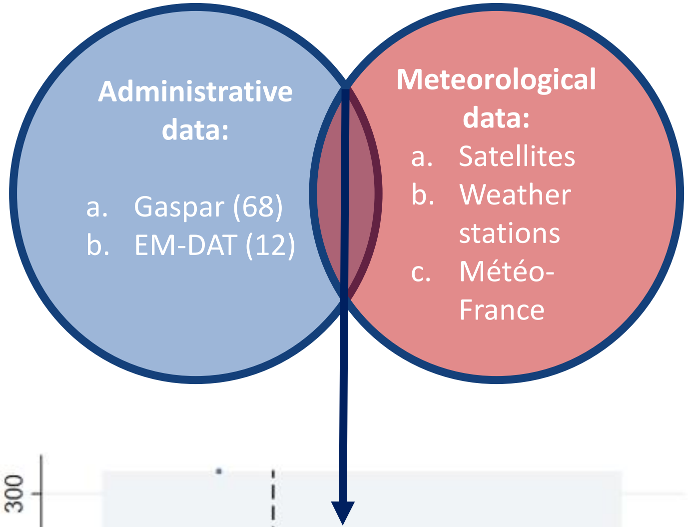
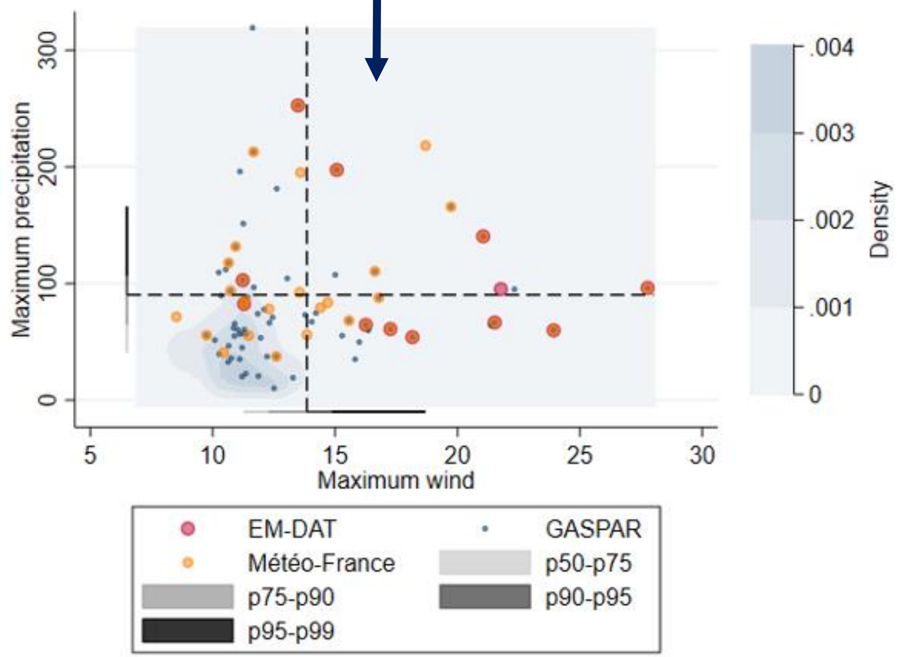
COMBINING ADMINISTRATIVE AND CLIMATE DATA





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Note. Distribution of monthly wind speed and precipitation data in 4 French oversea territories, and reported natural disasters in GASPAR/EMDAT/Météo France.

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IMPORTANT ISSUE: SEASONALITY OF SHOCKS

Table. Share of total administrative shocks occurring in each month

Month	La Réunion	Guadeloupe – Martinique – Guyane
1	26,09	6,52
2	34,78	0
3	8,7	2,17
4	21,74	6,52
5	4,35	17,39
6	0	2,17
7	0	2,17
8	0	6,52
9	0	17,39
10	0	15,22
11	0	15,22
12	4,35	8,7

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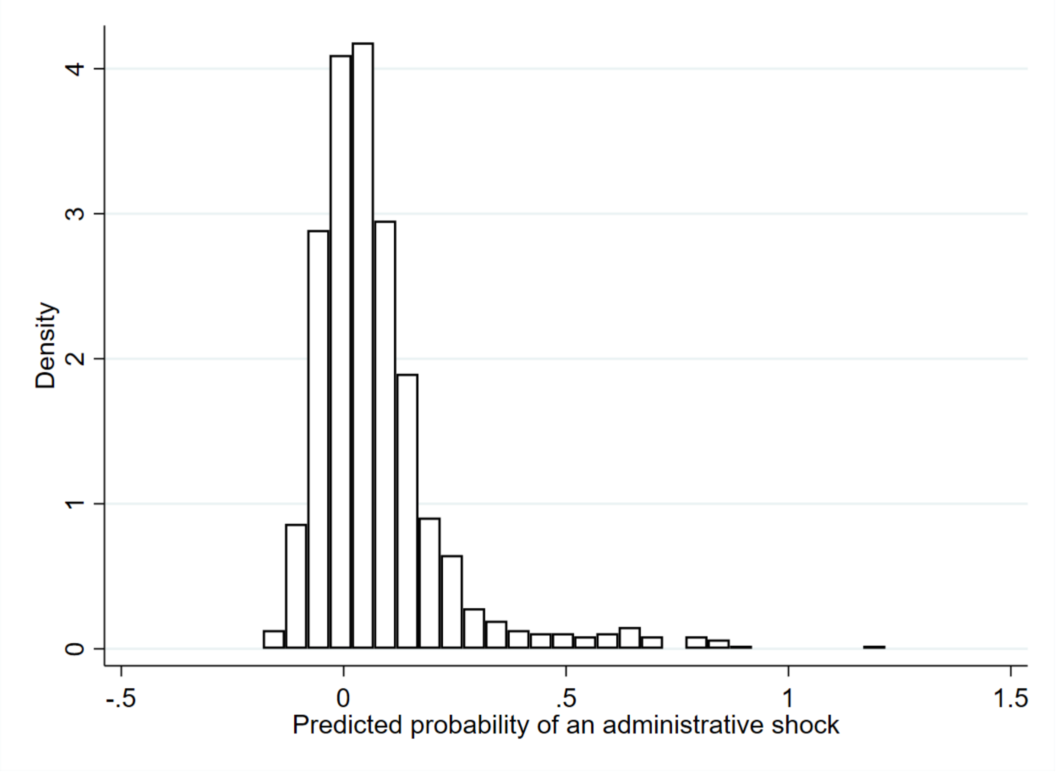
FIRST STAGE FITTED VALUES

Figure. First stage fitted values: predicted probability of significant disaster



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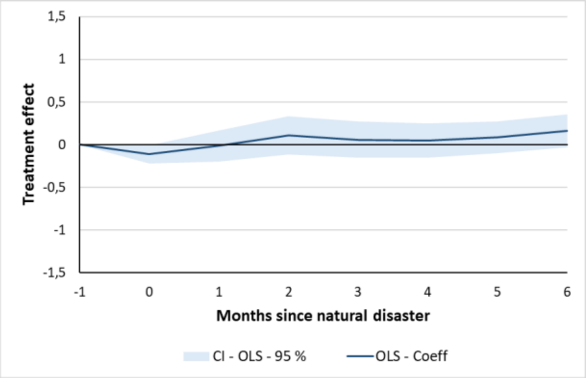
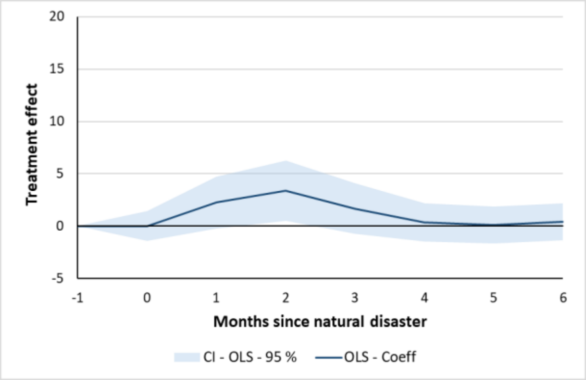
MAIN RESULTS - OLS

Figure. Cumulated effects of natural disasters on CPI

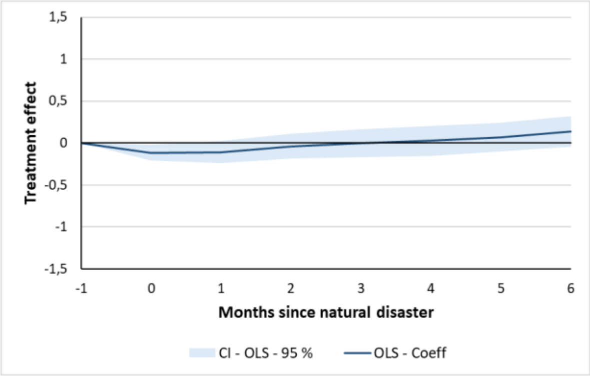
Headline



Fresh food



Overall excluding fresh food



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ROBUSTNESS

- **Results are robust to**:
  - Including lags of the shock
  - Using weather station data
  - Excluding La Réunion
  - Excluding shocks occurring less than 6 months before
  - Not controlling for seasonality

Table. Robustness analysis

	T=0	T=1	T=2	T=4	T=6
(A) Total					
2SLS - Baseline	-0.000	0.002	0.005**	0.001	0.005**
2SLS – Year x Month FE	0.000	0.002	0.005**	0.002	0.002
2SLS – Baseline, 3 lags shock	-0.001	0.001	0.003	0.001	0.003*
2SLS – Baseline, Weather station data	-0.001	0.001	0.004*	0.002	0.005***
2SLS – Baseline – no Réunion	0.000	0.002	0.003*	0.003	0.006***
2SLS – Baseline excl. shock < 6months	-0.000	0.002	0.007**	0.002	0.006**
OLS	-0.001**	-0.000	0.001	0.000	0.002
Jan – Feb – La Réunion	-0.001	-0.002	0.002	0.001	0.002
(B) Fresh products					
2SLS - Baseline	0.022	0.097***	0.121***	0.008	0.015
2SLS – Year x Month FE	0.077***	0.183***	0.209***	0.036	-0.025
2SLS – Baseline, 3 lags shock	-0.001	0.047*	0.064*	-0.024	-0.018
2SLS – Baseline, Weather station data	0.013	0.082***	0.112***	0.024	0.025
2SLS – Baseline – no Réunion	0.022**	0.055***	0.061***	0.010	0.001
2SLS – Baseline excl. shock < 6months	0.030	0.127***	0.158***	0.012	0.022
OLS	0.000	0.023*	0.034**	0.004	0.004
Jan – Feb – La Réunion	0.098***	0.205***	0.268***	0.168***	0.065***
(C) Total excl. fresh products					
2SLS - Baseline	-0.001	-0.002	0.000	0.002	0.005***
2SLS – Year x Month FE	-0.003***	-0.005***	-0.003***	0.001	0.003**
2SLS – Baseline, 3 lags shock	-0.001	-0.001	0.001	0.003*	0.005***
2SLS – Baseline, Weather station data	-0.001	-0.002*	-0.000	0.002	0.005***
2SLS – Baseline – no Réunion	-0.001	-0.002	-0.000	0.003	0.007***
2SLS – Baseline excl. shock < 6months	-0.001	-0.003*	0.000	0.002	0.006***
OLS	-0.001**	-0.001	-0.000	0.000	0.001
Jan – Feb – La Réunion	-0.004***	-0.010***	-0.009***	-0.005***	-0.001

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PLACEBO

- **Placebo 1**: randomly drawn values of climate data
  - Randomly draw rain and wind from Gumbel distributions
  - Randomly draw Météo-France shocks from uniform distribution
- **Placebo 2**: randomly drawn administrative shocks
  - Randomly draw rain and wind from Gumbel distributions
  - Randomly draw Météo-France shocks from uniform distribution

In both cases, T-stat placebo distribution of maximum effects does not go over 1,9 in absolute values (vs 3,47 in our baseline)

Figure. Randomization of instrumental variables

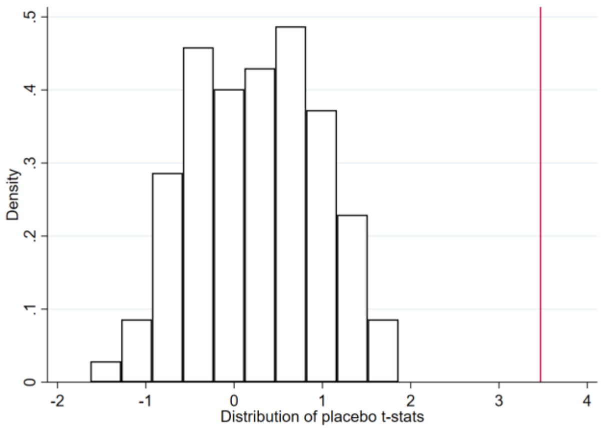
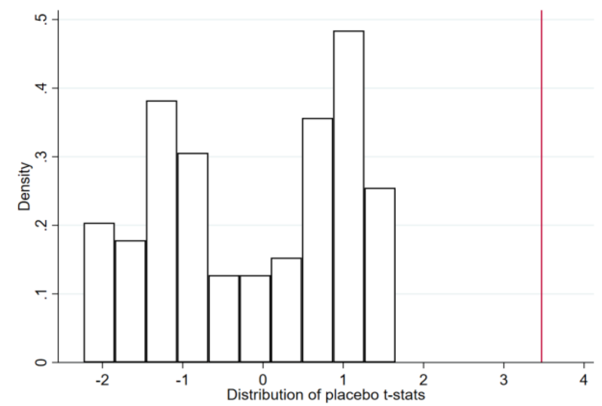


Figure. Randomization of treatment variable



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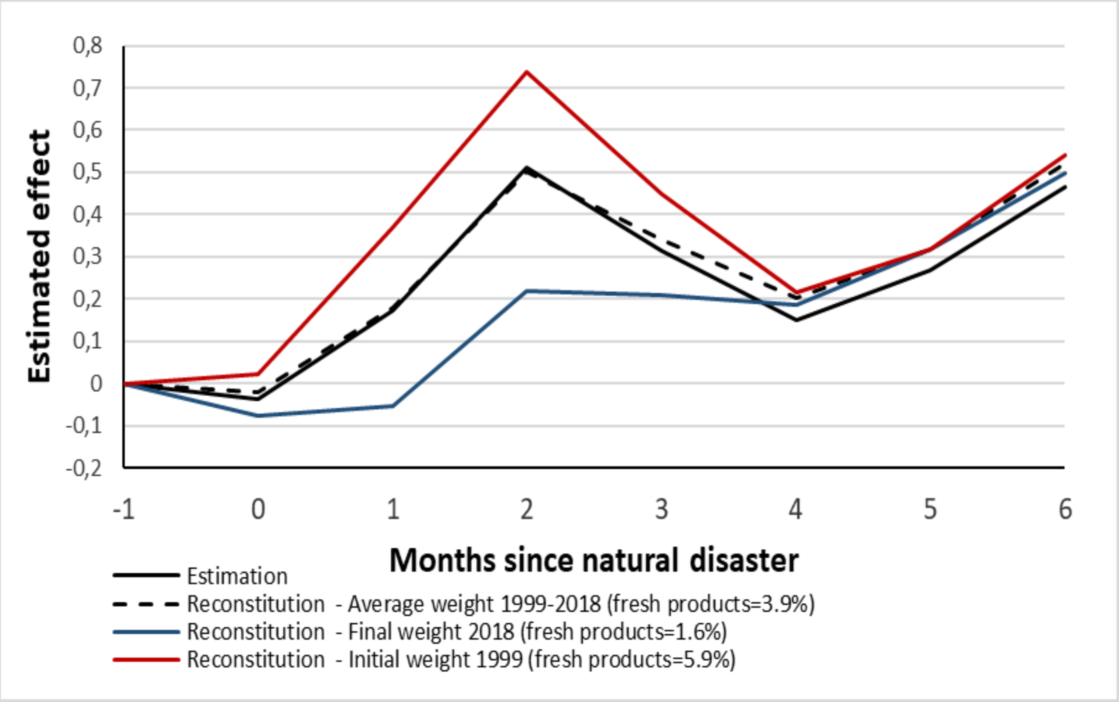
EFFECT OF THE WEIGHT OF FRESH PRODUCTS

Figure. Cumulated effect on CPI of a natural disaster, depending on hypothesized weight of « fresh products »



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ARE WE CAPTURING INTENSITY EFFECTS ?

- We compare our baseline 2SLS effect with OLS effects based on dummy shocks defined on alternative threshold probabilities between 0 and 1

→ For a given threshold $s \in [0,1]$, we assume that a DCOM *i*, during calendar month *m* of year *t* is hit by a shock if $\widehat{\omega}_{i,t,m} > s$

→ We run a local projection of fresh food CPI on $\mathbb{1}\,(\widehat{\omega}_{i,t,m} > s)$ for different values of *s*

- Our baseline 2SLS estimate is in the top 5% of OLS estimates using this methodology

- It is more than twice higher than an OLS estimate with an « optimal » shock selected based on ROC criterion (minimizing false positive rate and maximizing true positive rate)
- However, different interpretations of the results:
  - 2SLS : effect of a probability going from 0 to 1 of facing an average EMDAT/GASPAR disaster
  - OLS: effect of being above the threshold probability of average EM-DAT/GASPAR disaster

Figure. OLS estimates of discrete shocks based on different threshold probabilities

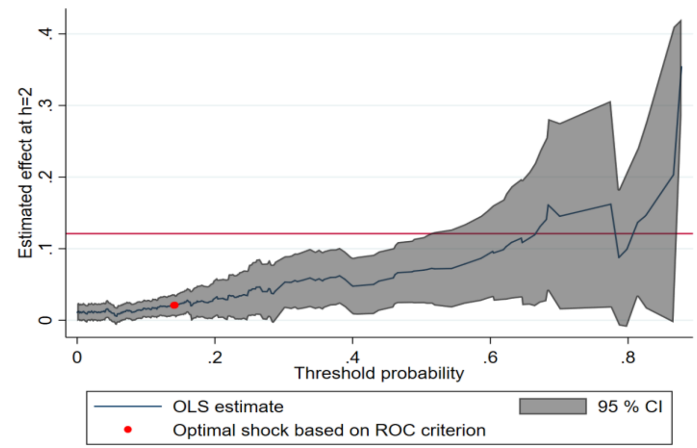
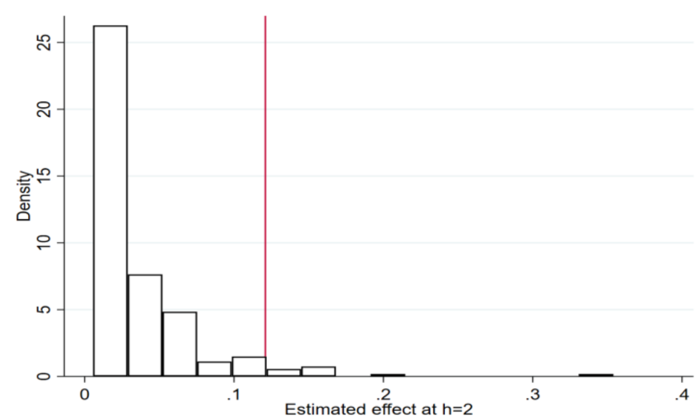


Figure. Distribution of OLS estimates based on different threshold probabilities



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ROC CURVE AND « OPTIMAL SHOCK »

- For each threshold *s*, we construct a discrete shock $\mathbb{1}(\widehat{\omega}_{i,t,m} > s)$
- We then compare this shock with actual observed shocks (confusion matrix), and build :
  - The false positive rates (1-specificity): $\frac{FP}{FP+TN}$
  - The true positive rates (sensitivity): $\frac{TP}{TP+FN}$
- The optimal shock maximizes TPR and minimizes FPR

Figure. ROC curve of discrete shocks based on estimated probability of shocks

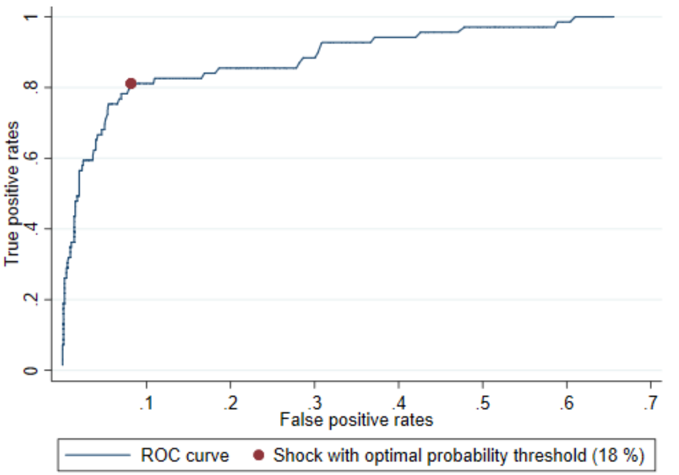

Figure. Confusion matrix for optimal shock

	Pred. shock=0	Pred. Shock=1
True shock=0	789	70
True shock=1	13	56

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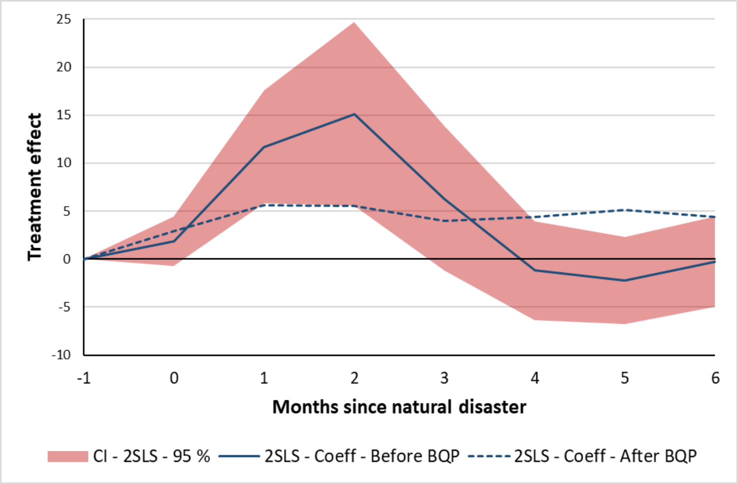
BOUCLIER QUALITÉ PRIX

- In 2013 the French government introduced a « Bouclier Qualité-Prix » (BQP): overall price cap for a selection of products (food and hygene)

- Lower immediate effect, but more sustained

Figure. Effect before and after BQP



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