Floods, Food, and Fighting

Testing relations with graphs for three or more variables

An example study on disasters, food prices, and conflict

Dr Elisa D'Amico
School of Politics and International Relations, University College Dublin

POL10170 Foundations in Political Research 23 October 2026

Today

1. The research question, and how the paper is built
2. Reading figures that show three or more variables
3. A follow-up paper that zooms in on one step
4. Making a three-variable graph yourself

The one idea to take away

Every variable in a graph needs its own visual **job**. Position, colour, size, shape, and panels are the jobs on offer.

01
The example study

The question

Do floods and storms lead to more violent conflict?

And does that depend on El Niño and La Niña?

- Floods and storms destroy harvests and disrupt supply chains
- That can drive up food prices
- Food price shocks have been linked to unrest and fighting
- El Niño and La Niña shift where and how disasters hit

> D'Amico (2026). The price of instability. *Humanities and Social Sciences Communications*.

How the paper is built

1 Introduction
The puzzle, and why it matters for policy

2 Literature review
What we know about climate, food, and conflict

3 Theory
Disaster → food prices → conflict

4 Data and methods
Subnational regions, month by month, 2000 to 2021

5 Results
The figures carry the main findings

6 Conclusion
What it means, and what we still do not know

Today we spend most of our time on step 5.

Where the data come from

What	Source	Unit
Disasters	EM-DAT International Disaster Database	Event
Conflict	UCDP Georeferenced Event Dataset	Battle event
Food prices	World Food Programme (VAM)	Market price
El Niño / La Niña	NOAA Oceanic Niño Index	Month

All four are matched to the same subnational regions and months. That merge is most of the work in a project like this.

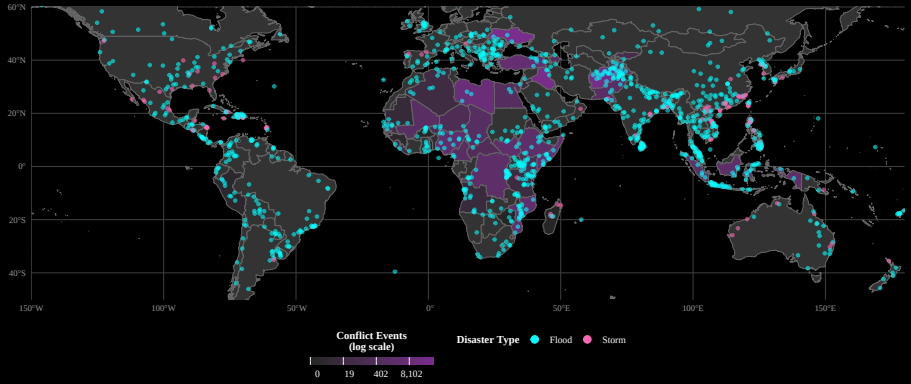
02
Reading the figures

Ways to show a variable

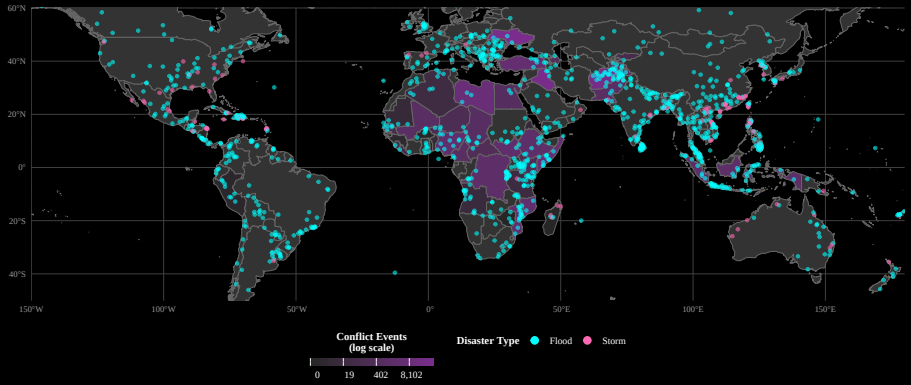
Visual job	Good for	Example
Position on x or y	Numbers, time	Months since a flood
Colour	Groups	El Niño vs. La Niña
Size	A second number	Number of storms
Filled or open	Yes / no	Statistically significant or not
Panels	One more group	One panel per disaster type

For each figure that follows, ask **what are the variables, and what job does each one have?**

Where disasters and conflict overlap

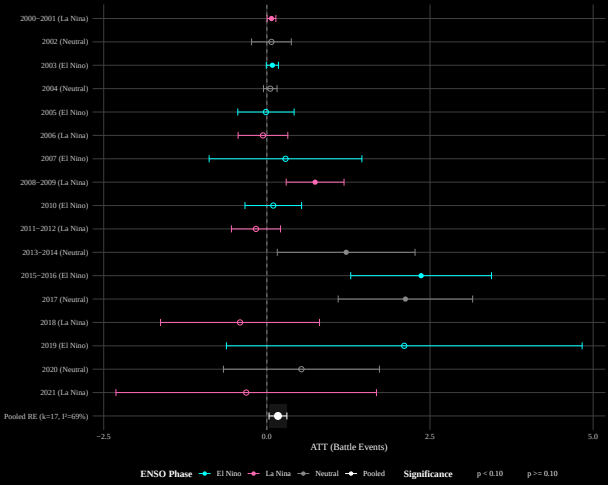


Where disasters and conflict overlap

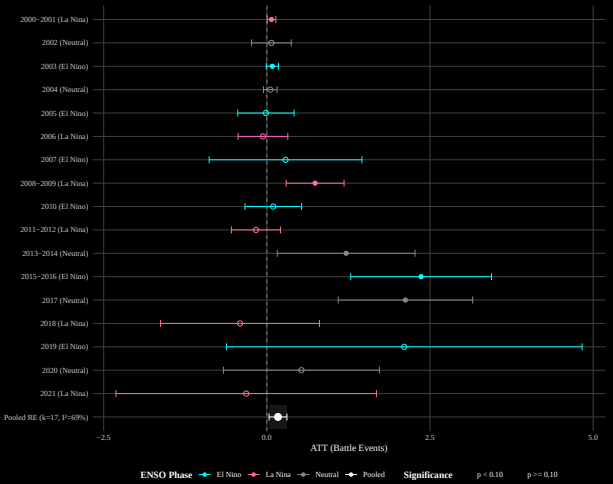


Location **map position** Disaster type **point colour** Conflict **country shading**

Floods increase battle events



Floods increase battle events



- **Rows** one El Niño or La Niña episode each
- **Dot** the estimated effect
- **Line** uncertainty around it
- **Colour** El Niño, La Niña, Neutral
- **Filled vs. open** significant or not

The white dot at the bottom combines all 17 episodes.

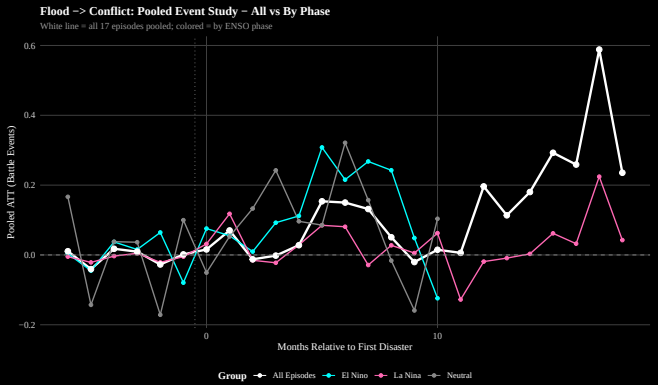
Conflict peaks five to six months later



- **x** months before and after the disaster
- **y** effect on battle events
- Flat before the disaster, then a slow build

A delay like this fits a food price story better than people fleeing straight away.

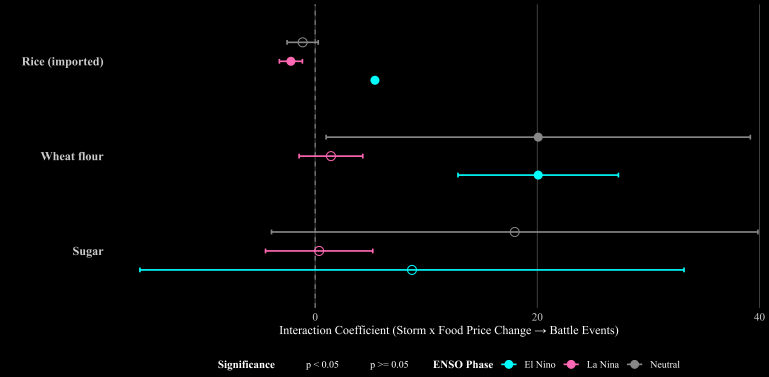
The same figure, split by El Niño and La Niña



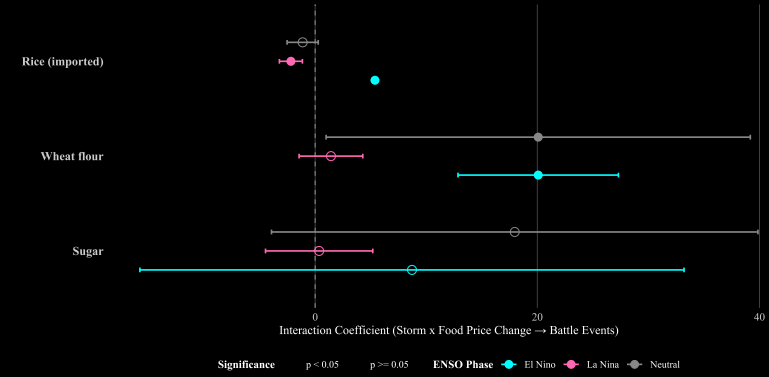
- **White** all 17 episodes, as on the last slide
- **Colour** one line per phase: El Niño, La Niña, Neutral

Adding colour as a third variable asks a new question. Does the delay show up in every phase?

Four variables in one figure



Four variables in one figure



Food type **rows** Effect **position** ENSO phase **colour** Significance **filled vs. open**

03
A follow-up paper

Zooming in on one step

Disaster → **food prices** → conflict

A second paper looks only at the middle step.

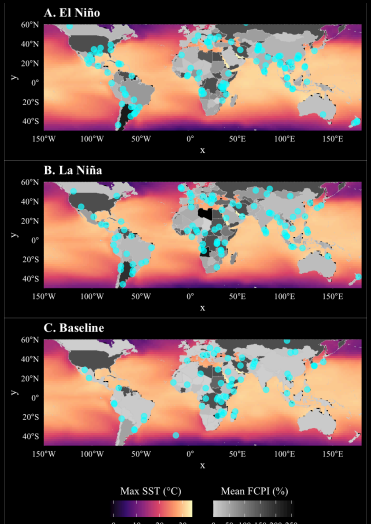
- Monthly wheat-flour prices in 129 regions of 19 countries
- Does the same disaster move prices the same way everywhere?
- Or does it depend on whether a region is in a **drier** or **wetter** spell?

D'Amico (2026). Regional El Niño patterns shape wheat-flour price responses to climate disasters. *Environmental Research Letters*.

El Niño, La Niña, and the oceans

- **Panels** El Niño (2015 to 2016), La Niña (2017 to 2018), and a baseline (2019 to 2021)
- **Ocean colour** hottest sea surface temperature
- **Land shading** food price inflation
- **Cyan points** floods, storms, and droughts

> Four variables across three panels. This map sets the scene. It shows what changes between phases, but it does not test the effect.



Same flood, opposite effects



- **x** months since the flood
- **y** change in wheat-flour price
- **Colour** drier vs. wetter regions
- **Band** uncertainty

Prices rise in drier regions and fall slightly in wetter ones.

04
Make it yourself

Start with a table

Disaster	Drier	Wetter
Flood	12.21	−4.43
Drought	2.92	12.11
Extreme temperature	3.46	2.55
Storm	−4.70	14.98

Average change in wheat-flour prices in the 13 months after each disaster

Start with a table

Disaster	Drier	Wetter
Flood	12.21	−4.43
Drought	2.92	12.11
Extreme temperature	3.46	2.55
Storm	−4.70	14.98

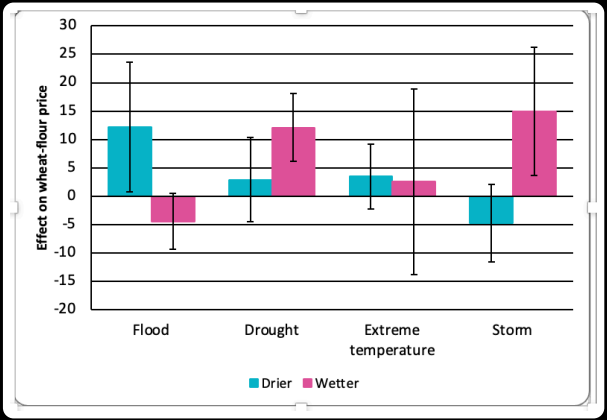
Average change in wheat-flour prices in the 13 months after each disaster

Three variables: disaster type rows regional climate columns price effect the numbers

In Excel

1. Select the table
2. **Insert → Clustered Column**
3. Click a bar, then **Add Chart Element → Error Bars**
4. Add axis titles

> Rows become groups on the x-axis. Columns become colours.

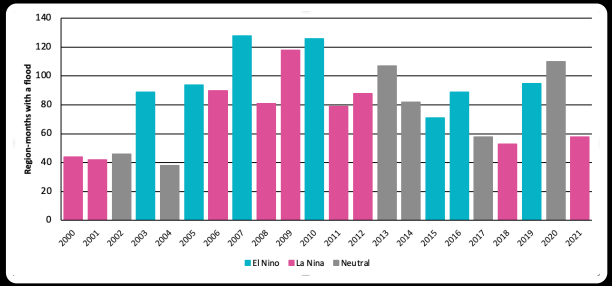


Another one: trends over time

- **x** year, 2000 to 2021
- **Bar height** region-months with a flood
- **Colour** El Niño, La Niña, Neutral

The trick: put each year's number in the column for its phase. Excel then colours the bars for you.

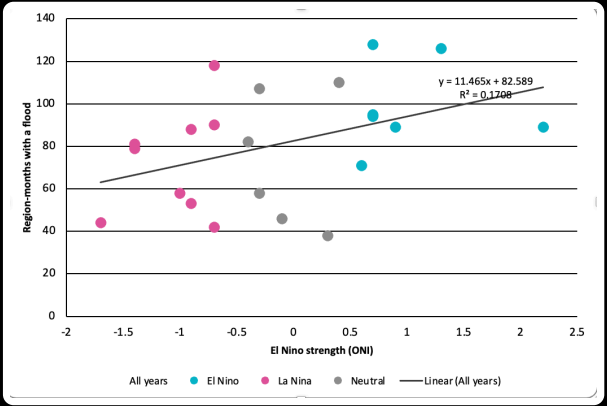
Do El Niño years have more floods? Is that enough to say El Niño *causes* them?



A scatter plot with a fitted line

- **x** how strong El Niño was that year
- **y** region-months with a flood
- **Colour** El Niño, La Niña, Neutral
- **Line** the best straight-line fit

The line slopes up, but the points are spread widely and there are only 22 years. How would you describe this in one honest sentence?



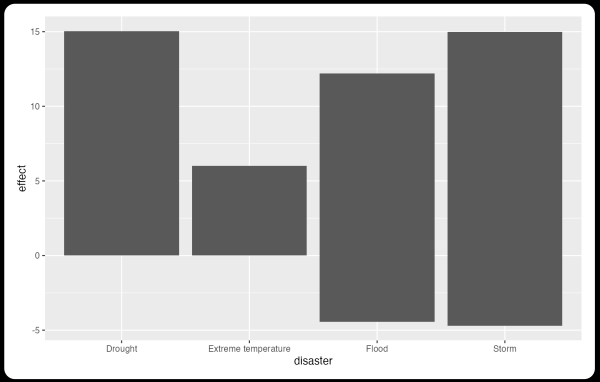
The same chart in R

stage 1

```
d <- read.csv("pooled_effects.csv")

ggplot(d, aes(x = disaster,
              y = effect)) +
  geom_col()
```

Two variables only. Drier and wetter are piled on top of each other, so this chart is **wrong**.

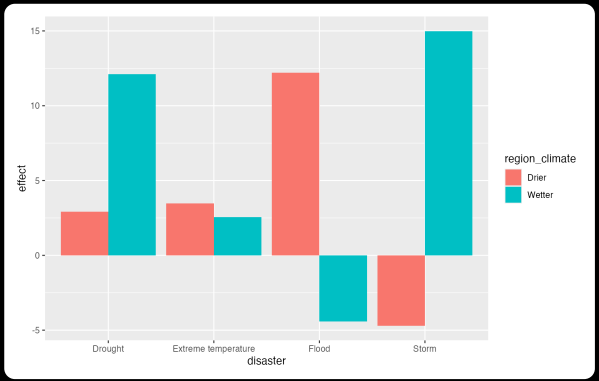


The same chart in R

stage 2

```
ggplot(d, aes(x = disaster,
              y = effect,
              # NEW: third variable
              fill = region_climate)) +
  # NEW: side by side
  geom_col(position = "dodge")
```

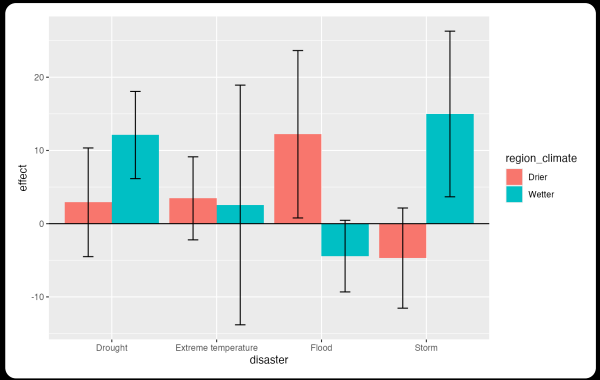
Colour gives the third variable its own job.



The same chart in R

stage 3

```
ggplot(d, aes(x = disaster,
              y = effect,
              fill = region_climate)) +
  geom_col(position = "dodge") +
  # NEW: uncertainty
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(0.9),
    width = 0.2) +
  geom_hline(yintercept = 0)
```

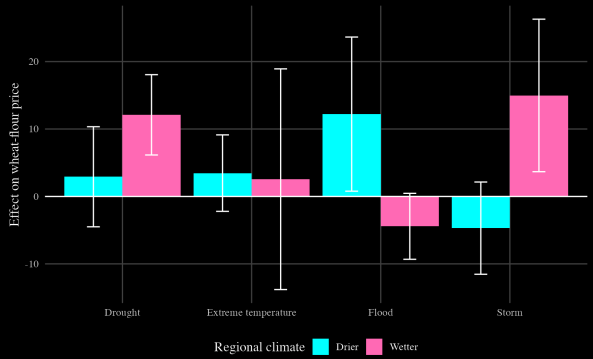


If an error bar crosses zero, we cannot rule out "no effect".

The same chart in R

stage 4

```
... +
# NEW: colours and labels
scale_fill_manual(values = c(
  "Drier"  = "#00FFFF",
  "Wetter" = "#FF69B4")) +
labs(x = NULL,
     y = "Effect on wheat-flour price",
     fill = "Regional climate") +
# NEW: the dark look
theme_minimal() +
theme(plot.background =
        element_rect(fill = "black"),
      text =
        element_text(colour = "white"))
```



A checklist for your own graphs

- Can you name every variable, and the job each one has?
- Does each variable have **one** job?
- Are the axes labelled in plain words, with units?
- Does the graph show uncertainty where there is some?
- Does the caption tell the reader what to look for?

Start from the table

If you can lay your data out as rows, columns, and numbers, you already have a three-variable chart.

Play with an interactive visualization



Bridging the Distance

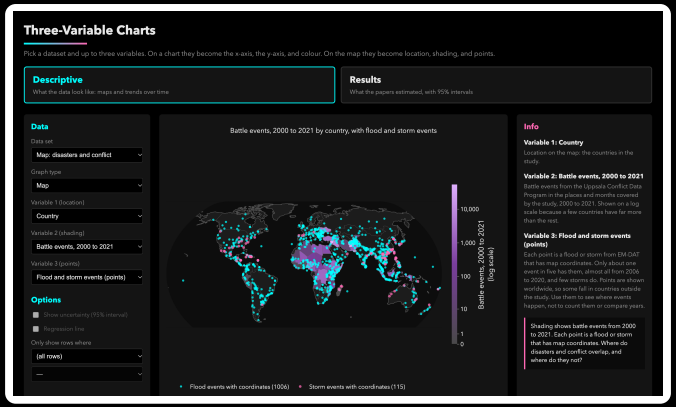
New insights on geography in conflict mediation

- A different study, on where peace talks happen
- The same research told as an interactive web page
- Click a country to explore the data

tvancisin.github.io/elisa_damico

Web and visualizations by Tomas Vancisin

Build your own three-variable chart



- **Descriptive** maps and trends over time
- **Results** estimates with 95% intervals
- Pick Variables 1 to 3. Combinations that make no sense are greyed out.

elisadamico.net/graphs-three-variables

Want to try it on your own?

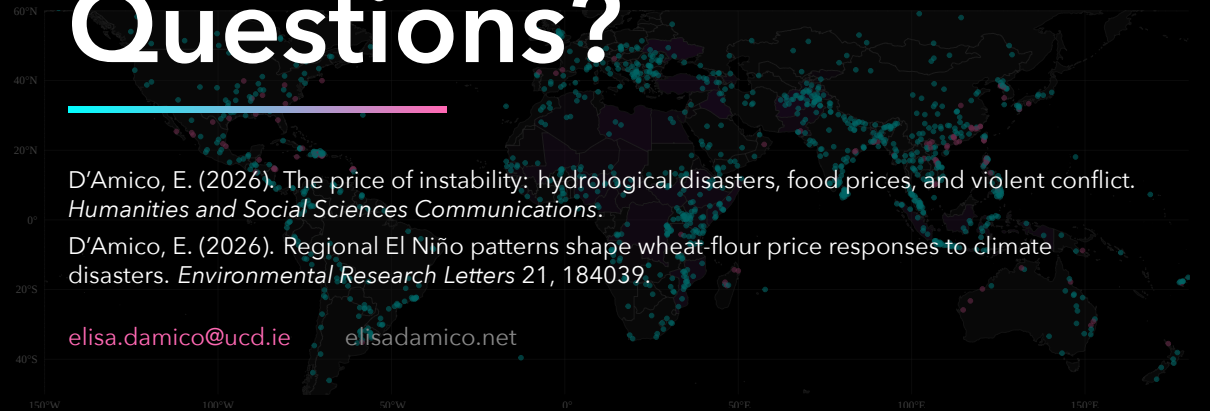
- Today's table on disasters and food prices
- Floods per year and El Niño, 2000 to 2021
- Excel steps for three charts
- Today's R code, runs in your browser
- A chart builder with a map, in your browser

`github.com/elisadamico/graphs-three-variables`

`elisadamico.net/graphs-three-variables`



Questions?



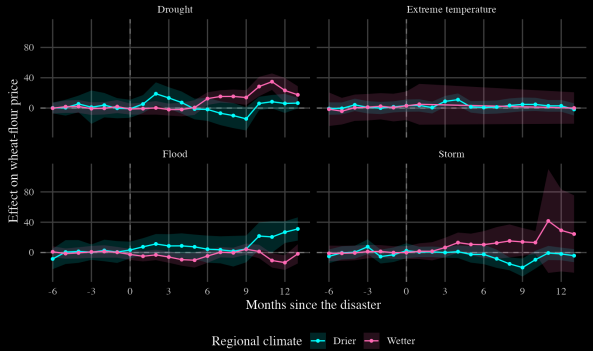
D'Amico, E. (2026). The price of instability: hydrological disasters, food prices, and violent conflict. *Humanities and Social Sciences Communications*.

D'Amico, E. (2026). Regional El Niño patterns shape wheat-flour price responses to climate disasters. *Environmental Research Letters* 21, 184039.

elisa.damico@ucd.ie elisadamico.net

Appendix A a fourth variable with panels

```
ggplot(es, aes(x = month,
               y = effect,
               colour = region_climate,
               fill = region_climate)) +
  geom_ribbon(aes(ymin = lower,
                  ymax = upper),
              alpha = 0.15,
              colour = NA) +
  geom_line() +
  # NEW: fourth variable
  facet_wrap(~ disaster)
```



Appendix B storms increase battle events too

