

Codebook for ifo GAME

Natural Hazard and Disaster Data

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Version 0.1; November 2015

Description ifo GAME Data

We construct three datasets:

- **Event-based monthly ifo GAME-Data.** Unit of analysis is the country-month-year resolution. This file reports the ifo GAME data physical disaster intensity measures and, if available, corresponding material and human damage reported in EM-DAT.
- **Country-year ifo GAME-Data: disaster_magnitude.** Unit of analysis is the country-year resolution. The file reports GAME physical disaster intensity measures and EM-DAT disaster indices. The data is collapsed to country and year from original monthly data.
- **Country-year ifo GAME-Data used in JDE: balanced_panel.** Unit of analysis is the country-year resolution. The file reports ifo GAME physical disaster intensity measures, EM-DAT disaster indices and further macroeconomic control variables and interaction terms with ifo GAME variables used in the regression analysis of the “naturally negative” paper. The data is collapsed to country and year from original monthly data. Small countries are already dropped.

Virtually all earthquakes, volcanic eruptions, storms, floods, droughts, and extreme temperature events reported by EM-DAT can be also found in ifo GAME too, but the opposite is not true: Out of 10,448 earthquakes with strength at least 5 on the Richter scale, EM-DAT reports only 6.2%. That rate is highest for the strongest earthquakes (40.9%), but falls quickly with decreasing earthquake intensity. Volcano eruptions are better covered, with 14.7% of all events with VEI measure higher than 2 being included into EM-DAT and half of all events stronger than VEI 4 covered.

Citation

When using the monthly or yearly ifo GAME data, please cite:

Felbermayr, Gabriel and Gröschl, Jasmin, 2014. “Naturally Negative: The Growth Effects of Natural Disasters”, *Journal of Development Economics* 111, 92–106.

Primary Data Sources

This dataset builds on various datasets assembled by primary sources.¹ If you are fully convinced you discovered an error and have checked this against the original sources, please contact us at groeschl@ifo.de for the aggregated monthly or yearly data. What follows is a list of sources used to assemble the datasets.

¹ We thankfully acknowledge David Bolvin from NASA Goddard Space Flight Center for graciously providing us with ASCII data on weather station data.

Earthquakes. Our data on seismic activity stem from the *Incorporated Institute for Seismology* (IRIS), which lists the strength (Richter scale) of every earthquake on the planet by latitude and longitude of the epicenter. We map the data to countries using Flinn-Engdahl codes¹ and geographic information system (GIS) software². We consider earthquakes on land and those happening right off the coastline of a specific country (150 km range). We use the maximum realization within a single earthquake event as the measure of physical disaster intensity of that earthquake. The highest value on the Richter scale recorded in our data is 8.8 and was measured on the Philippines in February 2006.

Volcanic Eruptions. The *Global Volcanism Program of the Smithsonian Institution* measures volcanic eruptions and specifies the magnitude by the Volcanic Explosivity Index (VEI).³ The Global Volcanism Program documents the eruption start date and stop date of all volcanic eruptions. The listed VEI is the highest VEI reached during the entire eruptive episode. We use latitude and longitude information to locate the volcano within a country. The highest reported VEI in our dataset is 6, which was recorded for an outbreak by the Pinatubo on the Philippines in 1991. We use the maximum VEI as our measure of the intensity of volcanic eruptions.

Storms. We use two primary data sources for wind speed: the *International Best Track Archive for Climate Stewardship* (IBTrACS) and the *Global Surface Summary of Day* (GSOD) data. The IBTrACS data (version v03r03) is provided by the *National Climatic Data Center of the National Oceanic and Atmospheric Administration* (NOAA) which records data of individual hurricane events, positions (latitude and longitude) of hurricane centers at 6-hourly intervals, combined with intensity information (wind speed in knots and barometric pressure). The data incorporate information from a variety of sources, such as reconnaissance aircraft, ships, and satellites.⁴ The raw 'best track' data give no indication on affected countries. We use geographic information system (GIS) software to map hurricane position data to affected countries. Not only do we consider positions (latitude and longitude) on land, but we also consider positions off the coastline of a country.⁵ To capture tornadoes, and winter and summer storms (not captured

¹ The Flinn-Engdahl seismic and geographical categorization of regions breaks the world into regions based on geographic and political boundaries, where each region is assigned a unique number. Regional boundaries are defined at one-degree intervals and may thus differ from national boundaries.

² GIS uses geographical location as the key index variable to relate information to specific countries, or regions. Any variable that can be located spatially can be referenced using GIS software. Information, such as precipitation in a certain region, storm or epicenter location anywhere on the globe may be mapped to countries using information on their geographical occurrence, such as longitude and latitude, respectively.

³ The Volcanic Explosivity Index is coded on a logarithmic scale and is defined over the interval 0 to 8. The VEI combines the volume of tephra ejected and the height of the eruption cloud.

⁴ Since the 1960s most of the data stem from satellites (Chu et al., 2002; Yang, 2008).

⁵ As tropical storms and hurricanes can be relatively wide, tropical storm-force and hurricane-force winds may cause destruction even though they did not make landfall (National Hurricane Center, 1999).

by the IBTrACS data), the hurricane track data is matched to daily data of the GSOD data (version 7) on maximum wind speed and wind gust. This dataset includes records of wind speed from over 9000 worldwide stations and is produced by the *National Climatic Data Center* (NCDC). GSOD uses daily summaries of hourly observations contained in the *Integrated Surface Data* (ISD). We collapse daily extremes on wind speed and wind gust over all stations on a country basis. Combining both datasets, we obtain a measure that brings together wind speed from the hurricane track data and wind speed from GSOD. We use the maximum total wind speed in knots on a country basis as our disaster intensity measure for storms.

Floods and Droughts. Precipitation data are recorded by the *Goddard Space Flight Center* of the *National Aeronautics and Space Administration* (NASA) in the *Global Precipitation Climatology Project* (GPCP). The GPCP combines weather station rainfall gauge measures and satellite information. Total monthly precipitation data are provided in millimeters (mm) for 2.5 latitude and longitude degree grid nodes. Following Miguel et al. (2004) and Brückner and Ciccone (2011), we bring the data to the country level by matching rainfall estimates per node to the corresponding country using GIS software and we average rainfall across nodes to produce an estimate of total monthly rainfall per country. If no degree node fell within the national boundaries of a country, we assigned the rainfall measures from the nearest node(s) to their borders. Our principal measure of weather variation is the difference in monthly rainfall in mm, which we define as the proportional deviation of total monthly rainfall from average monthly rainfall of the entire available time period (1979-2010); $(R_{i,t} - R_{i;1979-2010})/R_{i;1979-2010}$. We distinguish two disaster types, floods and droughts. We measure flooding events by the positive difference in total monthly precipitation. Droughts are, however, different in the sense that a single dry month usually does not cause a drought, but several months in a row or within a year might do so. For this reason, we create an indicator variable for droughts, which takes the value of unity if at least three subsequent months have rainfall below 50% of the long-run average monthly mean, or if at least five months within a year have rainfall below 50% of the long-run monthly mean, and zero otherwise.

Extreme temperature events. Temperature data also stem from (GSOD, version 7) which includes records of temperature from over 9000 worldwide stations and is produced by the *National Climatic Data Center* (NCDC). Data are converted from degrees Fahrenheit into degrees Celsius using the common formula $(^{\circ}\text{F}-32)*5/9$. The GSOD dataset uses daily summaries of hourly observations contained in the *Integrated Surface Data* (ISD). We collapse daily temperature extremes over all stations on a country basis. Our disaster intensity measure for temperature extremes is the percentage difference between the maximum temperatures in one month from the corresponding long-run (1979-2010) monthly mean; $(T_{i,t} - T_{i;1979-2010})/T_{i;1979-2010}$. Strong positive deviations are interpreted as heat waves, strong negative ones as cold waves.

Other Data

To assess the quality of our novel comprehensive ifo GAME-Data, we take data on people killed, affected, or monetary damage from EM-DAT provided by the *Centre for Research on the Epidemiology of Disasters* (CRED). We construct a disaster variable counting all disasters reported in EM-DAT, and a large disaster variable by deploying the decision rule based on the convention of 'great natural disasters' by Munich Re (2006). Disasters are defined as large if events (i) killed 1,000 or more persons; (ii) affected 100,000 or more persons; or (iii) caused a monetary damage of 1 billion or more US dollars. To compare damage over time, we convert dollar values into constant 2000 US dollars using the US GDP deflator from the World Development Indicators (WDI). We count the number of all/large disasters in EM-DAT and scale them by land area.

To estimate the disaster impact on economic activity, we use real income per capita in purchasing power parities, population, and trade openness from the *Penn World Tables* (PWT, 7.1). Further controls include the Polity index from the *Polity IV Project*. The polity index is rescaled and normalized between 0 and 1, with 0 being the most autocratic state and 1 being the most democratic nation. As a measure of international financial openness, we use the updated Chinn-Ito index, which measures the degree of capital account openness of a country. For a more detailed description on the index see Chinn and Ito (2008). Alternative to trade openness, we use the index of trade policy openness constructed by Sachs and Warner (1995) and extended by Wacziarg and Welch (2008). We use surface area in squared kilometers from *CEPII*. Data on the United Nations General Assembly voting stem from Erik Voeten's homepage (Voeten, 2013). We use the correlation in UN assembly roll-call votes with G8 countries. Domestic policy variables comprise consumer price inflation, domestic credit in the banking sector as a share of GDP, gross capital formation as a share of growth, and the current account balance as a share of GDP. External factors are foreign direct investment as a share of GDP and real interest rates. These variables are taken from the World Development Indicator Database (WDI) of the World Bank.

Event-based monthly ifo GAME-Data

STATA file: EMDAT_GAME.dta

- monthly data on earthquakes/Richter scale; volcanoes/Volcanic Explosivity Index; storms and hurricanes/wind speed; extreme temperatures/difference in temperature; difference in precipitation by event

The variable layout for this version of the data is detailed below.

year	year of disaster
month	month of disaster
iso	3-digit iso country code
killed_pop_eq	killed over total population, earthquake (EM-DAT)
affected_pop_eq	affected over total population, earthquake (EM-DAT)
damage_gdp_eq	monetary damage over GDP, earthquake (EM-DAT)
large_eq	1 if large disaster, great natural catastrophe MunichRe (2006) earthquake (EM-DAT)
type_eq	type of disaster, earthquake (EM-DAT)
mag	maximum richter scale experienced (GAME)
killed_pop_vol	killed over total population, volcano (EM-DAT)
affected_pop_vol	affected over total population, volcano (EM-DAT)
damage_gdp_vol	monetary damage over GDP, volcano (EM-DAT)
large_vol	1 if large disaster, great natural catastrophe MunichRe (2006) volcano (EM-DAT)
type_vol	type of disaster, volcano (EM-DAT)
maxvei	maximum VEI experienced (GAME)
killed_pop_str	killed over total population, storm (EM-DAT)
affected_pop_str	affected over total population, storm (EM-DAT)
damage_gdp_str	monetary damage over GDP, storm (EM-DAT)
large_str	1 if large disaster, great natural catastrophe MunichRe (2006) storm (EM-DAT)
type_str	type of disaster, storm (EM-DAT)
combi	maximum wind speed experienced (GAME)
killed_pop_temp	killed over total population, temperature (EM-DAT)

affected_pop_temp	affected over total population, temperature (EM-DAT)
damage_gdp_temp	monetary damage over GDP, temperature (EM-DAT)
large_temp	1 if large disaster, great natural catastrophe MunichRe (2006) temperature (EM-DAT)
type_temp	type of disaster, temperature (EM-DAT)
meantemp	long-run monthly mean, 1979-2010 (GAME)
dif_temp	difference in monthly mean temperature from long-run monthly mean, 1979-2010 (GAME)
killed_pop_fld	killed over total population, flood (EM-DAT)
affected_pop_fld	affected over total population, flood (EM-DAT)
damage_gdp_fld	monetary damage over GDP, flood (EM-DAT)
large_fld	1 if large disaster, great natural catastrophe MunichRe (2006) flood (EM-DAT)
type_fld	type of disaster, flood (EM-DAT)
prec_mm	total monthly rainfall in mm – from daily averages (GAME)
meanprec	mean monthly rainfall in mm – from daily averages (GAME)
difmonth	difference in monthly rainfall in mm from the mean – from daily averages (GAME)
killed_pop_drg	killed over total population, drought (EM-DAT)
affected_pop_drg	affected over total population, drought (EM-DAT)
damage_gdp_drg	monetary damage over GDP, drought (EM-DAT)
large_drg	1 if large disaster, great natural catastrophe MunichRe (2006) drought (EM-DAT)
type_drg	type of disaster, drought (EM-DAT)
lpop	log population (PWT)
polity	polity index between 0 and 1 (Polity IV)
nkaopen	Chinn-Ito financial openness index between 0 and 1 (Chinn and Ito, 2008)
open_ww	adjusted Openness Dummy acc. Sachs-Warner crit., 1 if open (1990 -1999) (Sachs & Warner, 1995; Wacziarg & Welch, 2008)
vote_corr	UN vote correlation with G8 countries, yes/abstain/no (Voeten, 2013)

Country-year ifo GAME-Data

STATA file: disaster_magnitude.dta

- collapsed to country and year from original monthly data

The variable layout for this version of the data is detailed below.

year	year of disaster
country	country name
iso	3-digit iso country code
disaster	large disasters in EM-DAT, great natural disasters - Munich Re (2006) (EM-DAT)
sdisaster	all disasters in EM-DAT, count (EM-DAT)
damage_cor	monetary damage (sum) recorded EM-DAT, millions of US dollar (EM-DAT)
quake	count of earthquakes in EM-DAT (EM-DAT)
storm	count of storms and hurricanes in EM-DAT (EM-DAT)
mag	maximum Richter scale for earthquakes (GAME)
maxvei	maximum Volcanic Explosivity Index for volcanoes (GAME)
combi	maximum wind speed in knots for storms and hurricanes, combined measure (GAME)
difmonth	difference of monthly precipitation over mean – from daily averages, 1979-2010 (GAME)
abs_diff	absolute difference of monthly precipitation over mean – from daily averages, 1979-2010 (GAME)
drought	1 if 3 month in row below 50% of long run mean, or 5 months within year, 0 other (GAME)
dif_temp	difference of monthly temperature over mean, 1979-2010 (GAME)

STATA file: balanced_panel.dta

- collapsed to country and year from original monthly data
- includes all sorts of controls, interaction terms etc.
- data used for regression analysis
- small countries etc. already dropped

The variable layout for this version of the data is detailed below.

year	year
id	group(iso)
country	country name
iso	3-digit iso country code
region	world region (World Bank)
income_group	World Bank income group (World Bank)
lcmdp	log gdp per capita PPP (PWT)
lpop	log population in thousands (PWT)
polity	polity index between 0 and 1 (Polity IV)
open	trade openness (imports+exports/GDP) (PWT)
interest	real interest rate (%) (WDI)
credit	domestic credit provided by banking sector (% of GDP) (WDI)
gross	gross capital formation (annual % growth) (WDI)
fdi	foreign direct investment, net inflows (% of GDP) (WDI)
cpi	inflation, consumer prices (annual %) (WDI)
balance	current account balance (% of GDP) (WDI)
open_ww	adjusted openness dummy acc. Sachs-Warner crit., 1 if open (1990 -1999) (Sachs and Warner, 1995; Wacziarg and Welch, 2008)
kaopen	Chinn-Ito financial openness index between 0 and 1 (Chinn and Ito, 2008)
oecd	1 if OECD member state, 0 otherwise
noil	1 if Mankiw-Romer-Weil (MRW) sample, 0 otherwise
safrica	1 if Sub-Saharan African country, 0 otherwise (World Bank)
low	1 if low income country, 0 otherwise (World Bank)
middle	1 if middle income country, 0 otherwise (World Bank)
high	1 if high income country, 0 otherwise (World Bank)
quake	count of earthquakes in EM-DAT (EM-DAT)
storm	count of storms and hurricanes in EM-DAT (EM-DAT)
sdisaster	all disasters in EM-DAT, count (EM-DAT)

disaster	large disaster in EM-DAT, great natural disasters weighted (EM-DAT)
damage_cor	monetary damage (sum) recorded EM-DAT, millions of US dollar (EM-DAT)
damage_gdp	sum of monetary damage over GDP (EM-DAT)
disasterla	large disaster in EM-DAT, great natural disasters weighted by land area (EM-DAT)
sdisasterla	all disaster in EM-DAT, count weighted by land area (EM-DAT)
mag	maximum Richter scale for earthquakes (GAME)
maxvei	maximum Volcanic Explosivity Index for volcanoes (GAME)
combi	maximum wind speed in knots for storms and hurricanes, combined measure (GAME)
difmonth	difference of monthly precipitation over mean– from daily averages, 1979-2010 (GAME)
abs_diff	absolute difference of monthly precipitation over mean – from daily averages, 1979-2010 (GAME)
dif_temp	difference of monthly temperature over mean, 1979-2010 (GAME)
drought	1 if 3 months in row below 50% of long run mean, or 5 months within year, 0 otherwise (GAME)
flood	positive difference in precipitation over mean – from daily averages, 1979-2010 (GAME)
magla	maximum Richter scale for earthquakes weighted by land area (GAME)
maxveila	maximum Volcanic Explosivity Index for volcanoes weighted by land area (GAME)
combila	maximum wind speed in knots for storms and hurricanes, combined measure weighted by land area (GAME)
difmonthla	difference of monthly precipitation over mean – from daily averages, 1979-2010 weighted by land area (GAME)
abs_diffila	absolute difference of monthly precipitation over mean – from daily averages, 1979-2010 weighted by land area (GAME)
dif_templa	difference of monthly temperature over mean, 1979-2010 weighted by land area (GAME)

droughtla	1 if 3 months in row below 50% of long run mean, or 5 months within year, 0 otherwise by land area(GAME)
floodla	positive difference in precipitation over mean, 1979-2010 weighted by land area (GAME)
disindex	disaster index, sum of types weighted by inverse of standard deviation (GAME)
disindexla	disaster index, sum of types weighted by inverse of sd and by land area (GAME)
indexla	disaster index, sum of types weighted by land area (GAME)
dindex	disaster index, sum of types (GAME)
maglaxopen_ww	Richter scale/area times Sachs-Warner trade openness (t-1) (GAME)
maglaxpolity	Richter scale/area times lagged polity index (t-1) (GAME)
maglaxkaopen	Richter scale/area times lagged Chinn-Ito financial openness (t-1) (GAME)
maxveilaxopen_ww	VEI/area times Sachs-Warner trade openness (t-1) (GAME)
maxveilaxpolity	VEI/area times polity index (t-1) (GAME)
maxveilaxkaopen	VEI/area times Chinn-Ito financial openness (t-1) (GAME)
combilaxopen_ww	wind speed/area times Sachs-Warner trade openness (t-1) (GAME)
combilaxpolity	wind speed/area times polity index (t-1) (GAME)
combilaxkaopen	wind speed/area times Chinn-Ito financial openness (t-1) (GAME)
floodlaxopen_ww	pos. diff. in precipitation/area times Sachs-Warner trade openness (t-1) (GAME)
floodlaxpolity	pos. difference in precipitation/area times polity index (t-1) (GAME)
floodlaxkaopen	pos. diff. in precipitation/area times Chinn-Ito financial openness (t-1) (GAME)
droughtlaxopen_ww	drought/area times Sachs-Warner trade openness (t-1) (GAME)
droughtlaxpolity	drought/area times polity index (t-1) (GAME)
droughtlaxkaopen	drought/area times Chinn-Ito financial openness (t-1) (GAME)

dif_templaxopen_ww difference in Temperature/area times Sachs-Warner trade openness (t-1) (GAME)

dif_templaxpolity difference in Temperature/area times polity index (t-1) (GAME)

dif_templaxkaopen difference in Temperature/area times Chinn-Ito financial openness (t-1) (GAME)

indexlaxopen_ww disaster index/area times Sachs-Warner trade openness (t-1) (GAME)

indexlaxpolity disaster index/area times polity index (t-1) (GAME)

indexlaxkaopen disaster index/area times Chinn-Ito financial openness (t-1) (GAME)

disindexlaxopen_ww disaster index weighted/area times Sachs-Warner trade openness (t-1) (GAME)

disindexlaxpolity disaster index weighted/area times polity index (t-1) (GAME)

disindexlaxkaopen disaster index weighted/area times Chinn-Ito financial openness (t-1) (GAME)

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