Execution Report

Title: **Natural Disasters and Financial Stress: Can Macroprudential Regulation Tame Green Swans?**

Authors: **Pauline Avril, Grégory Levieuge, Camelia Turcu**

Full reference: Avril, Pauline, Levieuge, Grégory, and Turcu, Camelia, " Natural Disasters and Financial Stress: Can Macroprudential Regulation Tame Green Swans?"

The structure and contents of this execution report provided by **cascad** for the certification are similar to those recommended by the AEA Data Editor.

1. DATA DESCRIPTION

This study relies on a wide variety of data:

- The external finance premium data used to support the findings of this study have been deposited in the International Financial Statistics repository of International Monetary Fund.
- The Extensity of macroprudential framework data used to support the findings of this study have been deposited in the iMaPP repository (WPIEA2019066).
- The Prompt corrective action data used to support the findings of this study have been deposited in the Bank Regulation And Supervision Survey repository of the World Bank data catalog (doi/10.1108/17576381311329661).
- The Banking concentration data used to support the findings of this study have been deposited in the Global Financial Development repository of World Bank data catalog (Indicator Id:GFDD.OI.01).
- The bank loans to the private sector data used to support the findings of this study have been deposited in the International Financial Statistics repository of International Monetary Fund.
- The GDP at current price data used to support the findings of this study have been deposited in the World Development Indicators repository of World Bank data catalog (Indicator Id:NY.GDP.MKTP.CD).
- The annual growth of real GDP data used to support the findings of this study have been deposited in the in the World Development Indicators repository of World Bank data catalog (Indicator Id:NY.GDP.MKTP.KD.ZG).

- The GDP per capita data used to support the findings of this study have been deposited in the in the World Development Indicators repository of World Bank data catalog (Indicator Id:NY.GDP.PCAP.CD).

- The inflation data used to support the findings of this study have been deposited in the International Financial Statistics repository of International Monetary Fund.

- The Chinn-Ito index data used to support the findings of this study have been deposited in the website (http://web.pdx.edu/~ito/Chinn-Ito_website.htm).

- The polity2 index data used to support the findings of this study have been deposited in the Center for Systemic Peace website (http://www.systemicpeace.org/polityproject.html).

- The Banking crisis data used to support the findings of this study have been deposited in the IMF Economic Review (https://link.springer.com/article/10.1057/s41308-020-00107-3?wt_mc=Internal.Event.1.SEM.ArticleAuthorOnlineFirst&utm_source=ArticleAuthorOnlineFirst&utm_medium=email&utm_content=AA_en_06082018&ArticleAuthorOnlineFirst_20200131#Sec15).

- The Control of Corruption data used to support the findings of this study have been deposited in the Worldwide Governance Indicators repository of World Bank data catalog.

- The Inflation targeting data used to support the findings of this study have been deposited in the three articles of: Roger (2009) (WP/09/236); Schmidt-Hebbel and Carrasco (2016) (https://doi.org/10.1007/978-81-322-2840-0_18); Adler et al. (2020) (WP/20/69).

- The FX regime data used to support the findings of this study have been deposited in website (available at https://www.ilzetzki.com/irr-data).

- The Financial Markets Depth Index data used to support the findings of this study have been deposited in the Financial Development Index Database in IMF repository.

- The Budget Balance Rule data used to support the findings of this study have been deposited in the Fiscal Rules Dataset in IMF repository.

- The paper uses EM-DTA (Emergency Disasters Database) data from Research on the Epidemiology of Disasters (CRED). To obtain the info you need to register on this website (https://www.emdat.be/)

- The wind speed data used to support the findings of this study have been deposited in the International Best Track Archive for Climate Stewardship in repository the National Climatic Data Center of the National Oceanic and Atmospheric Administration (NOAA) (https://www.ncdc.noaa.gov/ibtracs/) + Global Surface Summary of Day (GSOD) (https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.ncdc:C00516)

- The precipitation data used to support the findings of this study have been deposited in the Global Unified Gauge-Based Analysis of Daily Precipitation in repository NOAA Climate Prediction Center (CPC) (https://climatedataguide.ucar.edu/climate-data/cpc-unified-gauge-based-analysis-global-daily-precipitation#:~:text=A%20gauge%2Dbased%20analysis%20of,over%20the%20global%20lan

d%20areas.&text=The%20daily%20analysis%20is%20constructed,from%201979%20to%20the%20present.)

- The area and maps of region have been deposited in GADM (3.6 version) website (https://gadm.org/)

- The information on population density have been deposited in UN WPP-adjusted population count rasters (Gridded Population of the World - GPW) collection provided by the Center for International Earth Science Information Network (CIESIN) (https://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-density-adjusted-to-2015-unwpp-country-totals-rev11)

For a thorough description of the data, please refer to section 4 of the paper.

2. CODE DESCRIPTION

For the purpose of this certification, we aimed to check the results displayed in Figures 2 to 13 and in Tables 1 and 2.

The Code is written in Stata. The replication materials contain four data files, *Database.dta*, *p_density_region.dta*, *Q_Storm_indicateur_final.dta* and *Q_Flood_indicateur_final.dta*, that are called by the do-file *main_code.do* to generate the results.

3. REPLICATION STEPS

The resources were downloaded from the **cascad** website and run as per readme, using Stata 16.1 on a computer with 64GB RAM, intel® Core™ i9-9900K CPU @3.60-5.00GHz, Nvidia Geforce RTX 2060, and Windows 10 OS.

We encountered no issues during the replication.

4. FINDINGS

We reproduced the figures and tables with perfect accuracy.

4.1. TABLE 1: OUR (A)IGI MEASURES AND EM-DAT VARIABLES: DESCRIPTIVE STATISTICS (1996-2016)

Original:

	Our measures						Costs reported in EM-DAT	
		Mean	Sd	Min	Max	Nb[c]	Killed[d]	Affected[d]	Damages[e]
Storm	Geophysical intensity[a]	109.0	43.8	18.0	305.6				
	IGI	0.8	3.3	0.0	49.4	859	0.0004	0.6392	0.1924
	AIGI	6.8	69.4	0.0	1836.9				
Flood	Geophysical intensity[b]	166.8	174.9	0.2	1541.1				
	IGI	0.8	1.9	0.0	31.5	1262	0.0001	0.5920	0.1109
	AIGI	27.5	250.9	0.0	6769.4				

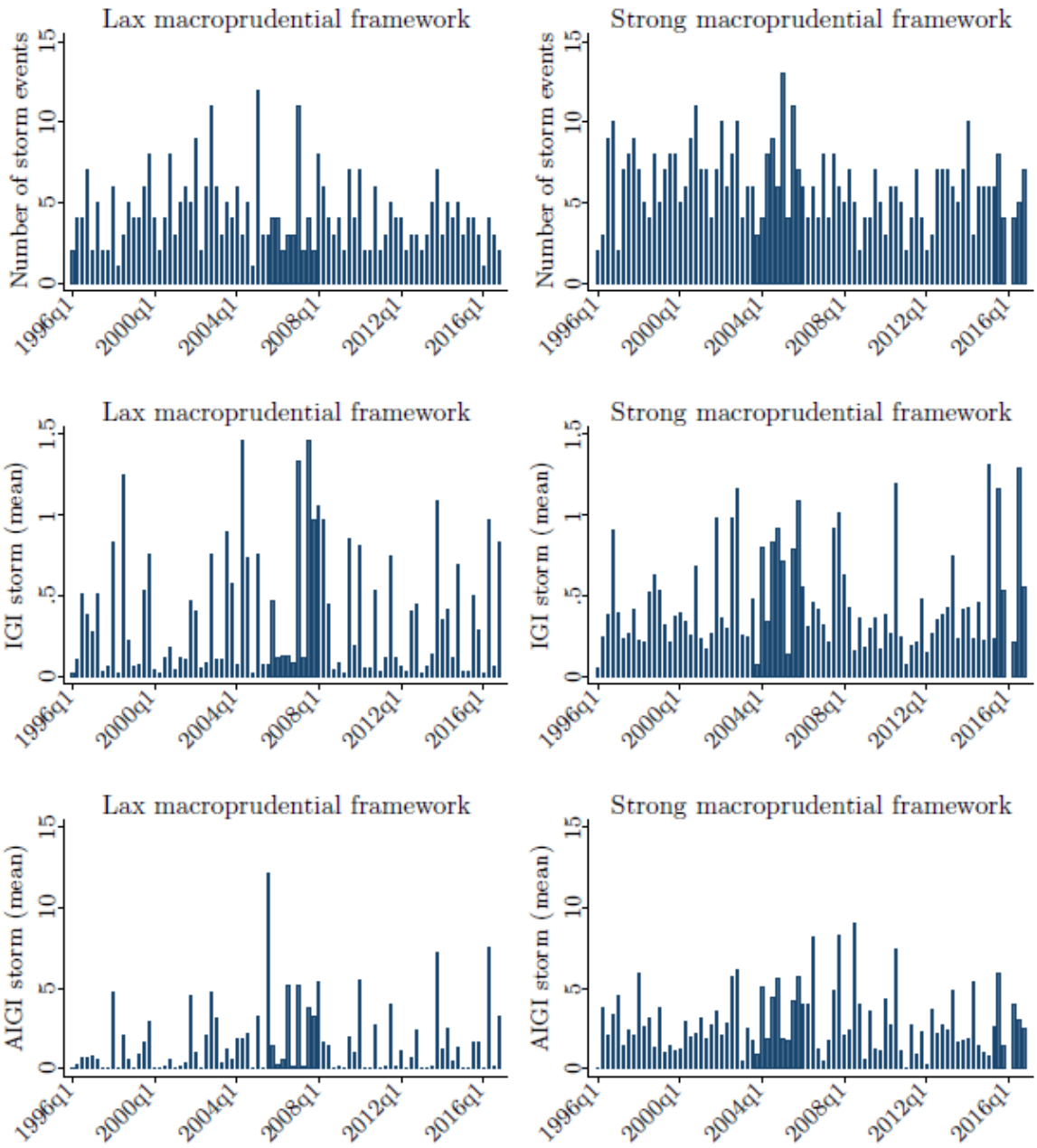
Reproduced:

	S_Physical_magnitude							
	mean	sd	min	max	count	Killed	Affected	Damages
Physical magnitude	109.0	43.8	18.0	305.6	859	.	.	.
em_dat	.	.	.	.	859	0.0	0.6	0.2
IGI	0.8	3.3	0.0	49.4	859	.	.	.
AIGI	6.8	69.4	0.0	1836.9	859	.	.	.

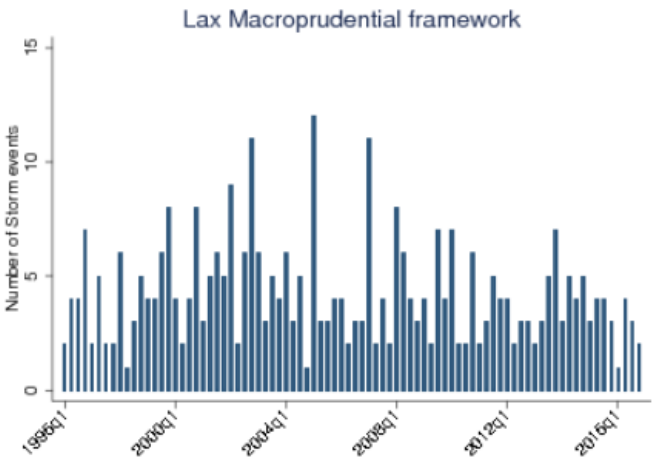
	F_Physical_magnitude							
	mean	sd	min	max	count	Killed	Affected	Damages
Physical magnitude	166.8	174.9	0.2	1541.1	1262	.	.	.
em_dat	.	.	.	.	1262	0.0	0.6	0.1
IGI	0.8	1.9	0.0	31.5	1262	.	.	.
AIGI	27.5	205.9	0.0	6769.4	1262	.	.	.

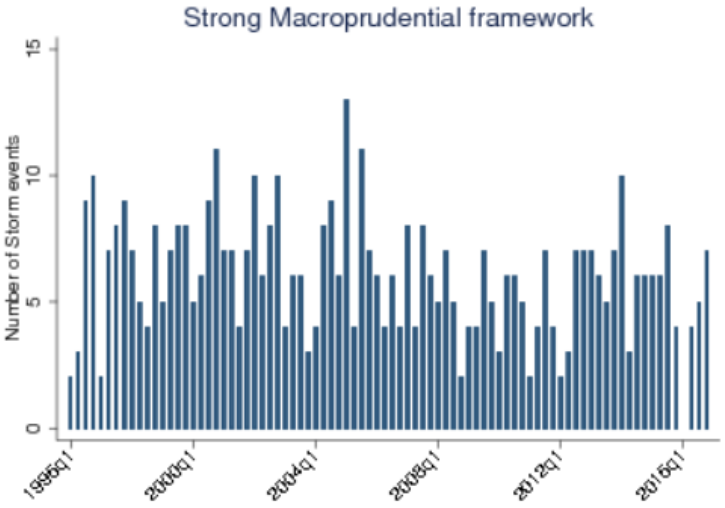
4.2. FIGURE 2: DISTRIBUTION OF STORMS IN COUNTRIES WITH LAX VS STRONG MACROPRUDENTIAL POLICIES

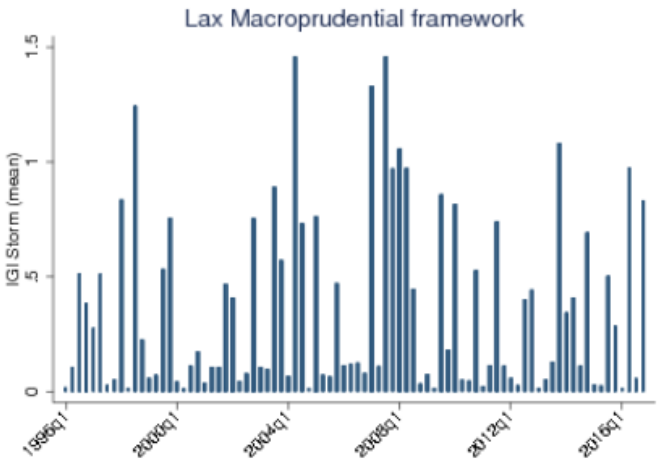
Original:

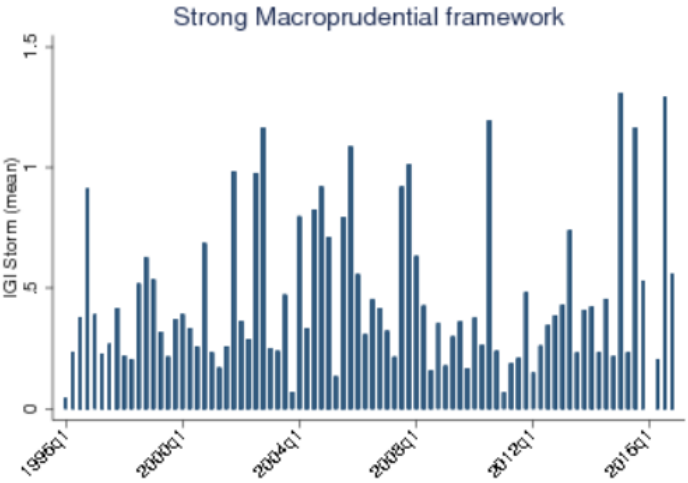


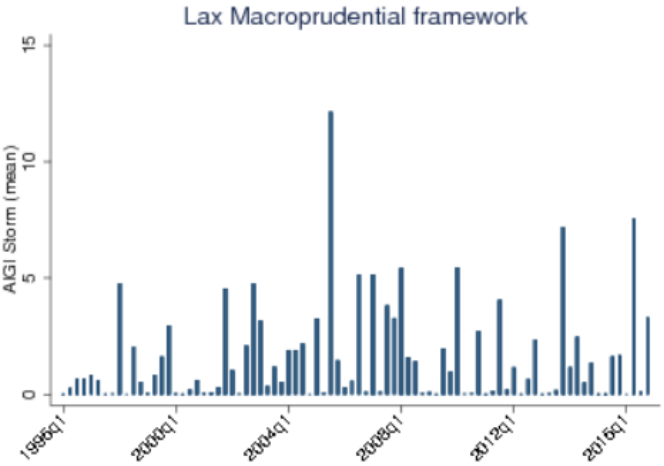
Reproduced:

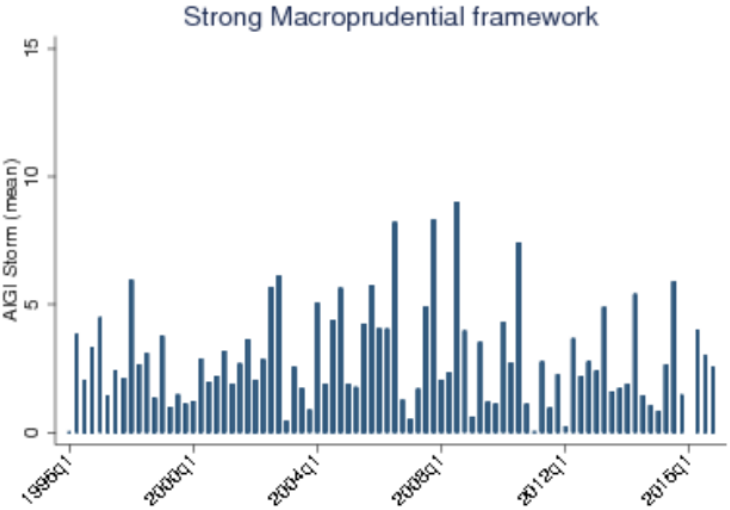

Lax Macroprudential framework
Number of Storm events
0
5
10
15
1995q1
2000q1
2004q1
2008q1
2012q1
2016q1


Strong Macroprudential framework
Number of Storm events
0
5
10
15
1995q1
2000q1
2004q1
2008q1
2012q1
2016q1


Lax Macroprudential framework
IGI Storm (mean)
0
.5
1
1.5
1995q1
2000q1
2004q1
2008q1
2012q1
2016q1

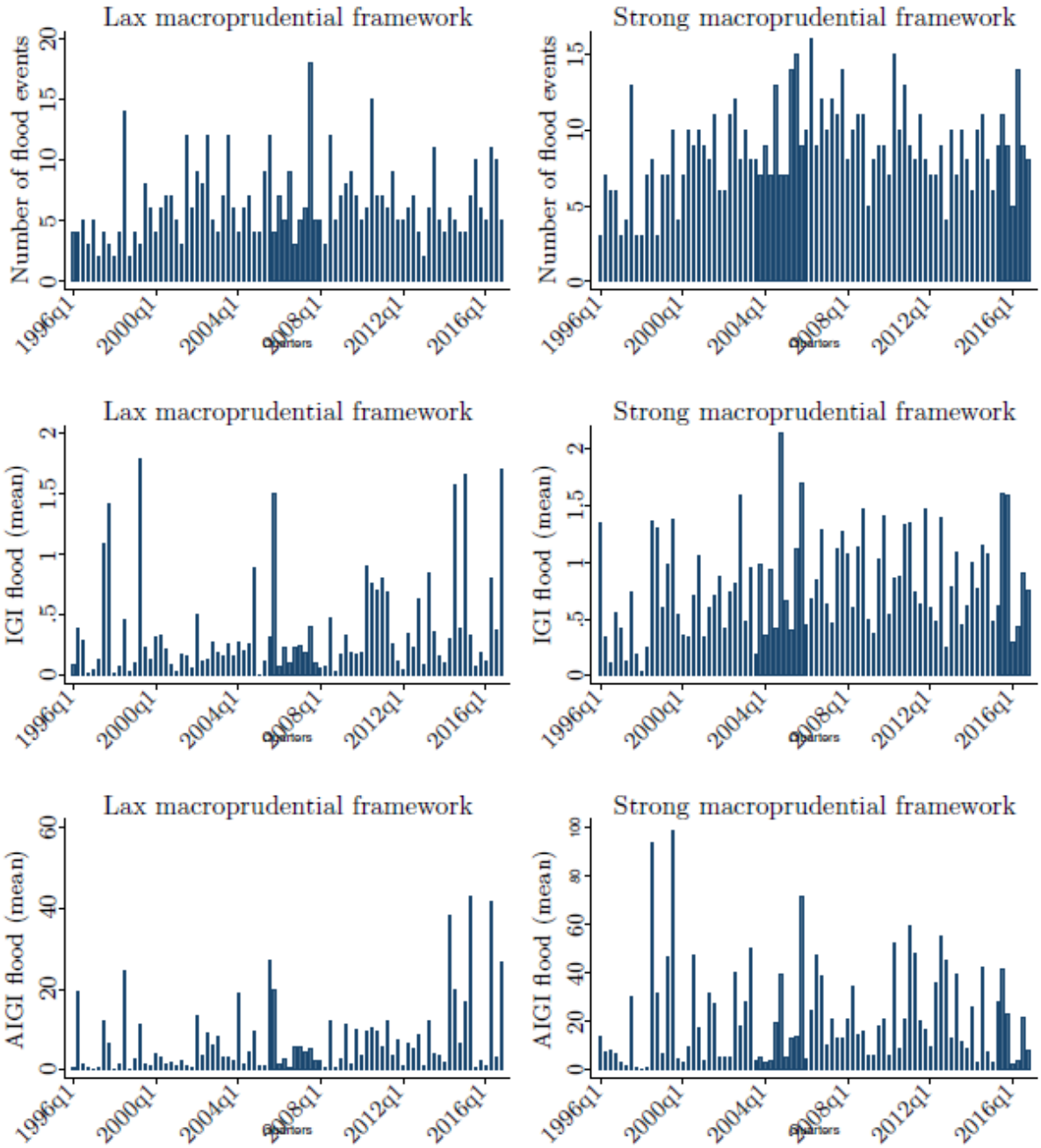

Strong Macroprudential framework
IGI Storm (mean)
0
.5
1
1.5
1995q1
2000q1
2004q1
2008q1
2012q1
2016q1


Lax Macroprudential framework
AIGI Storm (mean)
0
5
10
15
1995q1
2000q1
2004q1
2008q1
2012q1
2016q1

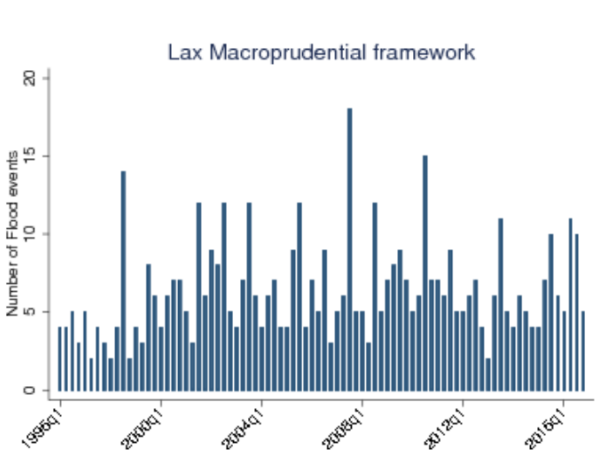

Strong Macroprudential framework
AIGI Storm (mean)
0
5
10
15
1995q1
2000q1
2004q1
2008q1
2012q1
2016q1

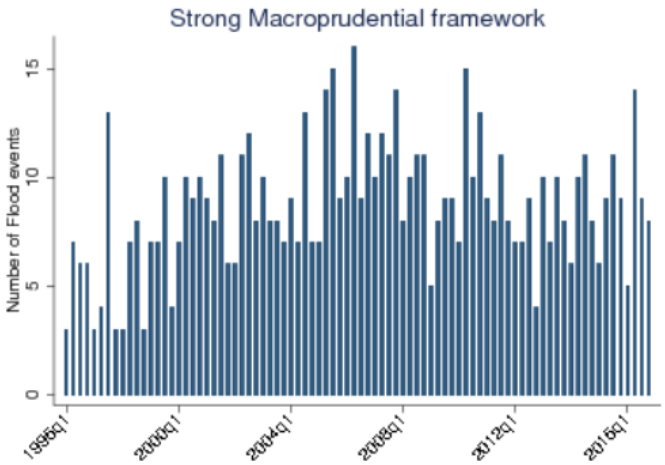
4.3. FIGURE 3: DISTRIBUTION OF FLOODS IN COUNTRIES WITH LAX VS STRONG MACROPRUDENTIAL POLICIES

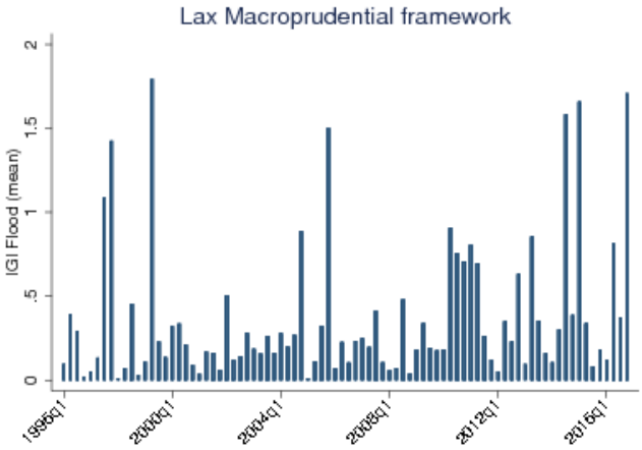
Original:

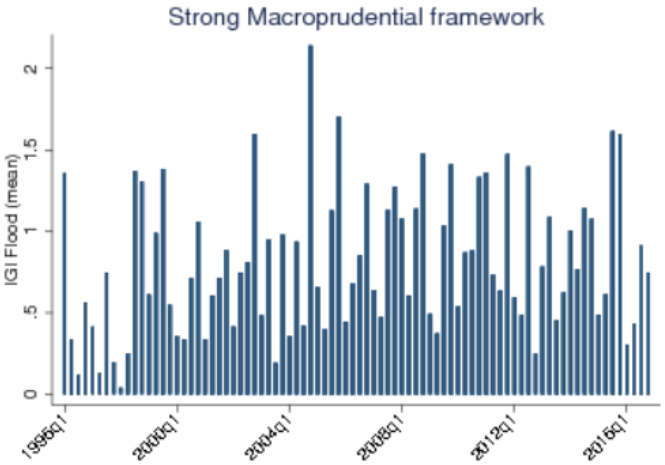


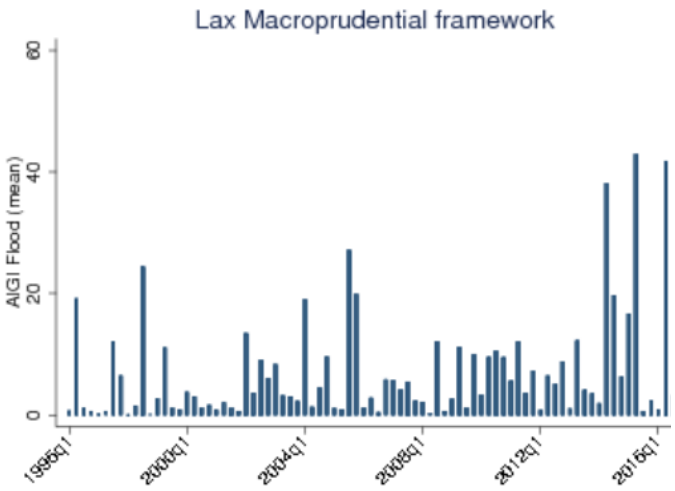
Reproduced:

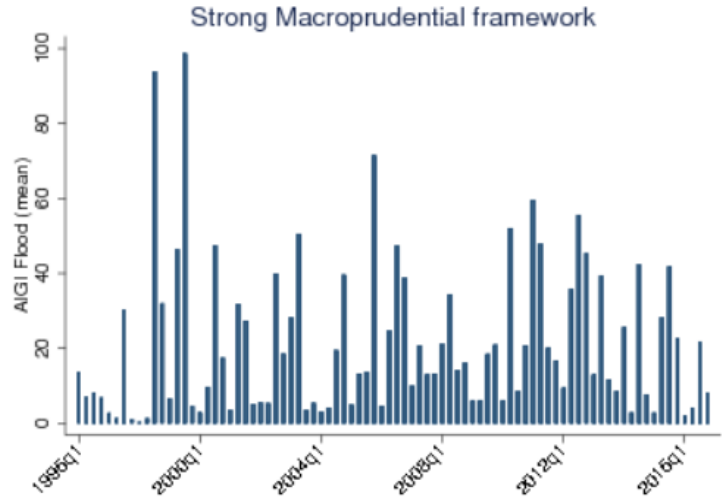

Lax Macroprudential framework
Number of Flood events
0
5
10
15
20
1995q1
2000q1
2004q1
2008q1
2012q1
2015q1


Strong Macroprudential framework
Number of Flood events
0
5
10
15
1995q1
2000q1
2004q1
2008q1
2012q1
2015q1


Lax Macroprudential framework
IGI Flood (mean)
0
.5
1
1.5
2
1995q1
2000q1
2004q1
2008q1
2012q1
2015q1

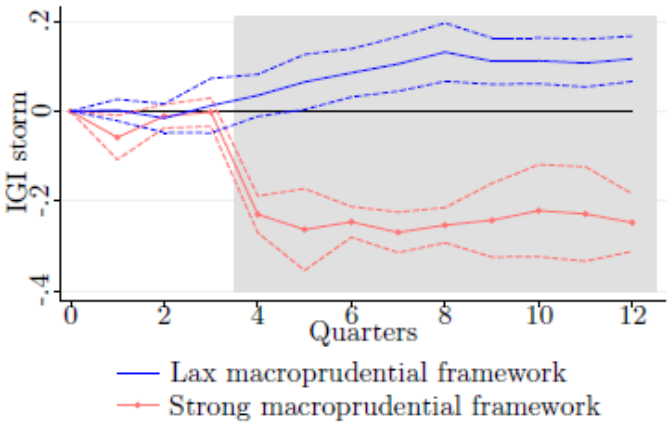

Strong Macroprudential framework
IGI Flood (mean)
0
.5
1
1.5
2
1995q1
2000q1
2004q1
2008q1
2012q1
2015q1

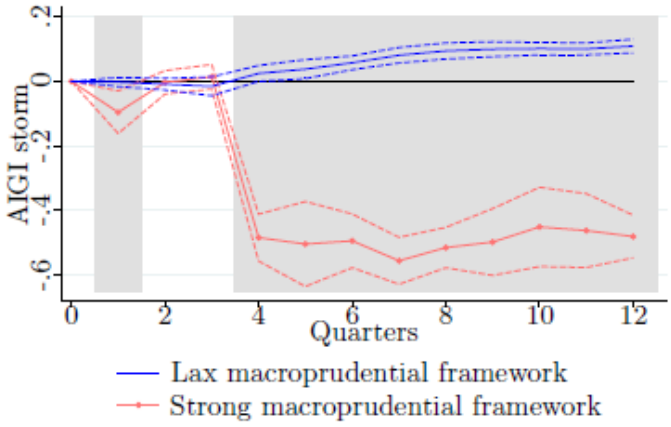

Lax Macroprudential framework
AIGI Flood (mean)
0
20
40
60
1995q1
2000q1
2004q1
2008q1
2012q1
2015q1


Strong Macroprudential framework
AIGI Flood (mean)
0
20
40
60
80
100
1995q1
2000q1
2004q1
2008q1
2012q1
2015q1

4.4. FIGURE 4: RESPONSE OF EFP TO STORMS CONDITIONAL ON THE STRINGENCY OF THE MACROPRUDENTIAL FRAMEWORK

Original:





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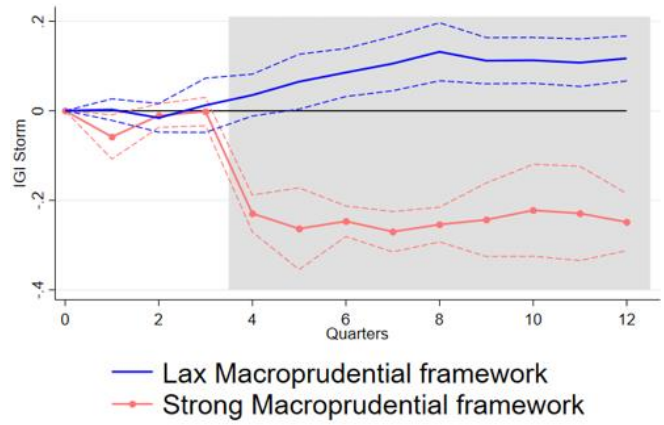
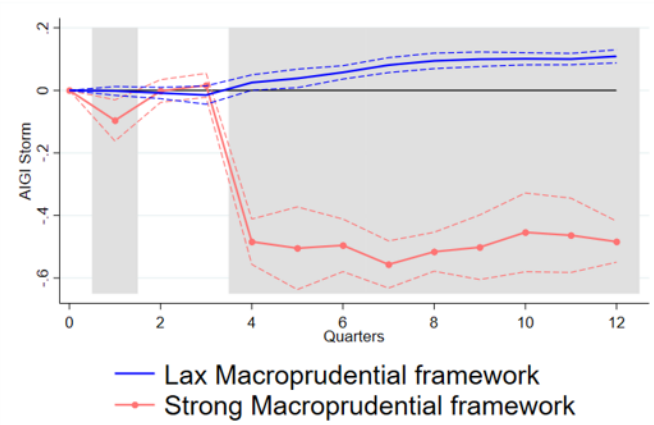
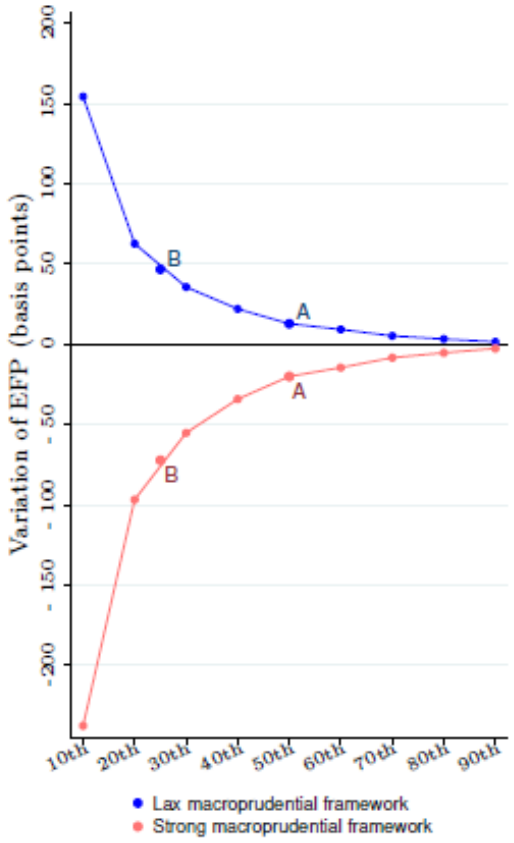




4.5. FIGURE 5: REACTION OF EFP TO IGI-STORMS AS A FUNCTION OF COUNTRY AREA (H=8)

Original:



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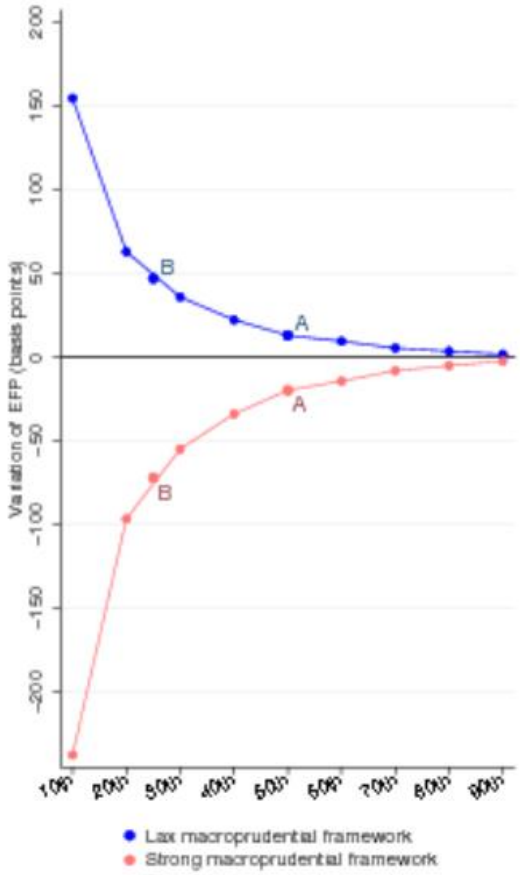
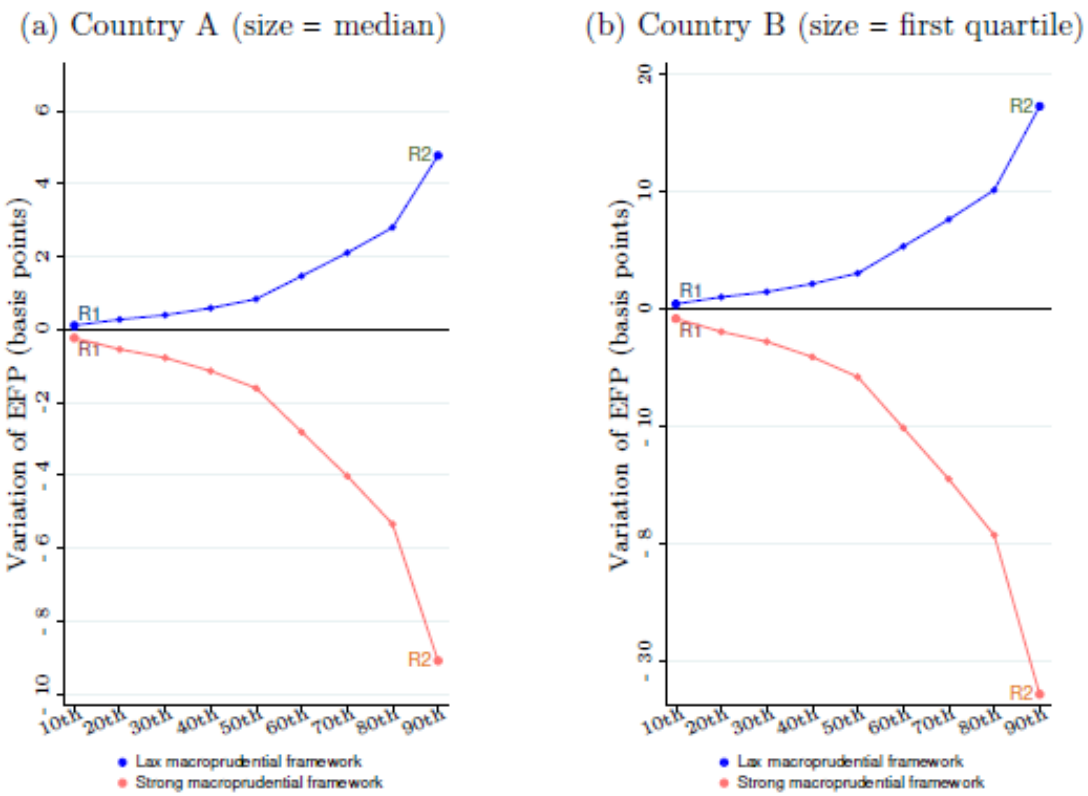
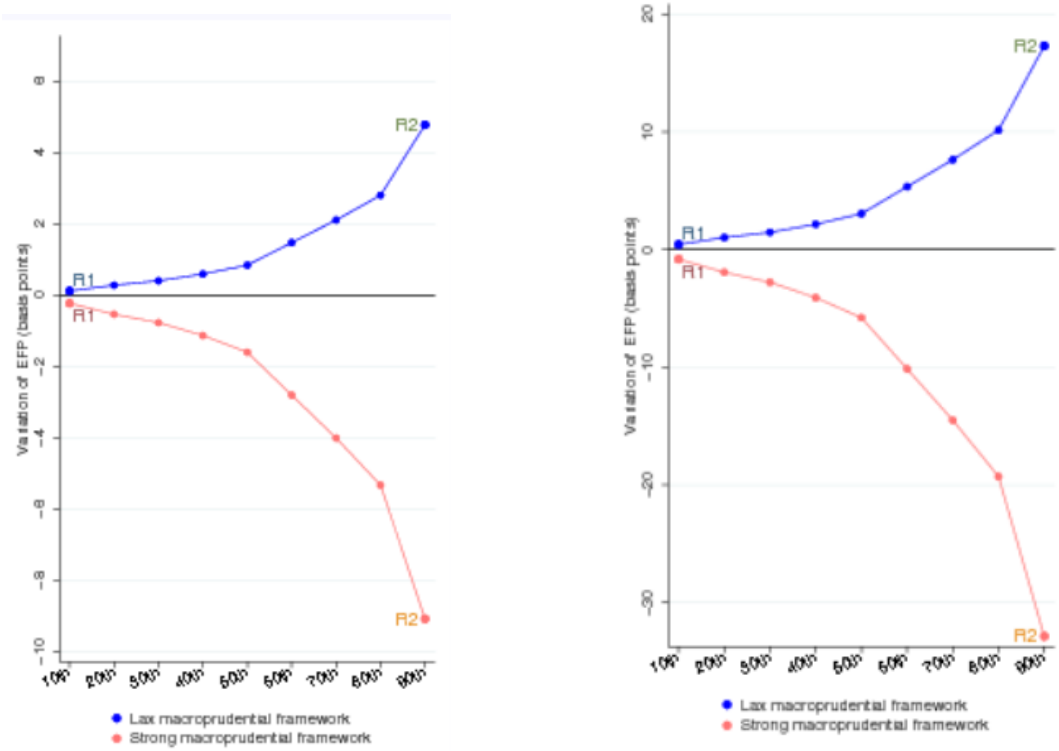


4.6. FIGURE 6: REACTION OF EFP TO AIGI-STORMS AS A FUNCTION OF COUNTRY AREA AND POPULATION DENSITY (H=8)

Original:

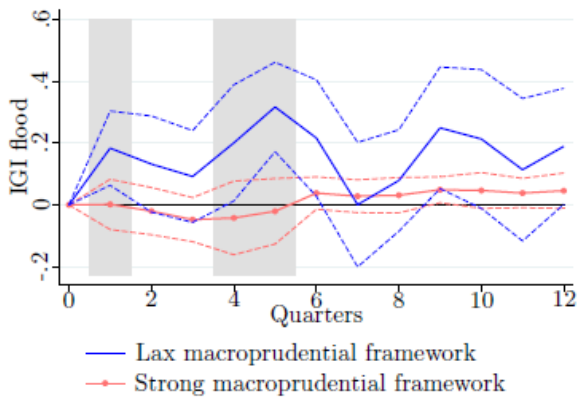


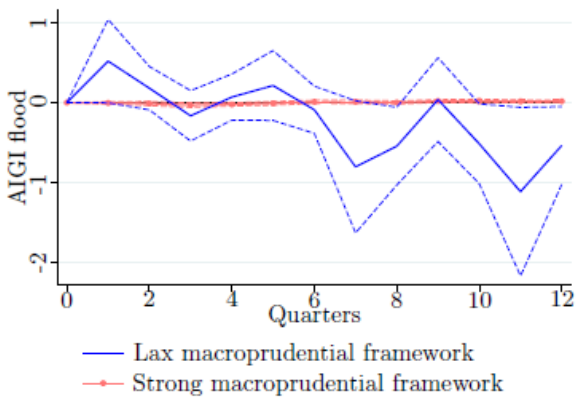
Reproduced



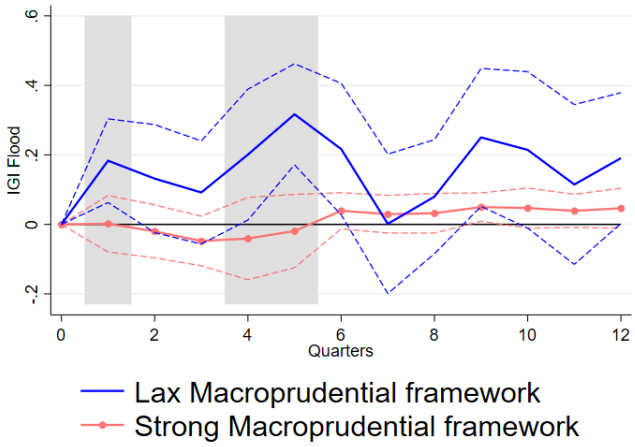
4.7. FIGURE 7: RESPONSE OF EFP TO FLOODS CONDITIONAL ON THE STRINGENCY OF THE MACROPRUDENTIAL FRAMEWORK

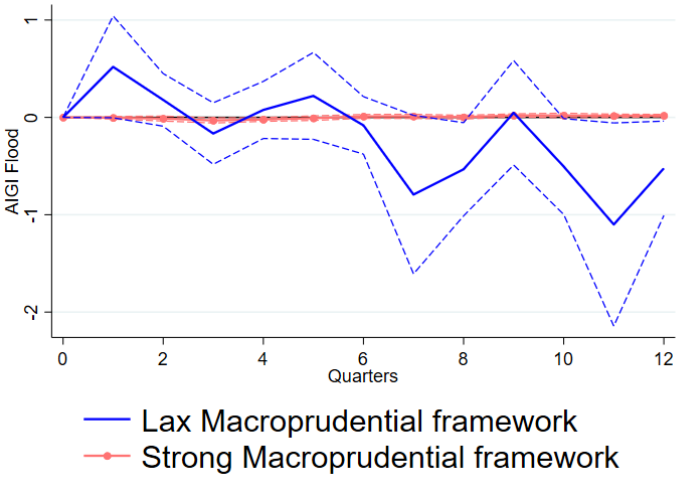
Original:





Reproduced:





4.8. TABLE 2: EFFECTS OF NATURAL DISASTERS CONDITIONAL ON THE NUMBER OF MACROPRUDENTIAL INSTRUMENTS

Original:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
IGI Storm$_t$	-0.00	-0.04	0.00	0.11	0.19*	0.25***	0.36***	0.37***	0.29***	0.28***	0.27**	0.29***
	(0.05)	(0.05)	(0.07)	(0.09)	(0.10)	(0.08)	(0.08)	(0.08)	(0.10)	(0.10)	(0.11)	(0.11)
IGI Storm$_t$ × Number of instrument$_{t-1}$	-0.01	0.02	-0.00	-0.13*	-0.18**	-0.21***	-0.29***	-0.28***	-0.23***	-0.22**	-0.21**	-0.23**
	(0.03)	(0.03)	(0.04)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.08)	(0.09)	(0.10)	(0.09)
AIGI Storm$_t$	0.03	-0.02	-0.07	0.33*	0.37**	0.43**	0.58***	0.55***	0.50**	0.45*	0.49**	0.51***
	(0.06)	(0.04)	(0.05)	(0.17)	(0.17)	(0.17)	(0.15)	(0.15)	(0.21)	(0.23)	(0.20)	(0.18)
AIGI Storm$_t$ × Number of instrument$_{t-1}$	-0.04	0.01	0.05	-0.32*	-0.35**	-0.39**	-0.51***	-0.47***	-0.42**	-0.37*	-0.41**	-0.42**
	(0.06)	(0.03)	(0.04)	(0.16)	(0.16)	(0.16)	(0.15)	(0.14)	(0.20)	(0.21)	(0.19)	(0.17)
IGI Flood$_t$	0.09*	0.03	-0.03	0.06	0.17**	0.15*	0.01	0.04	0.18**	0.14	0.10	0.14*
	(0.05)	(0.05)	(0.07)	(0.08)	(0.08)	(0.09)	(0.09)	(0.07)	(0.09)	(0.10)	(0.10)	(0.08)
IGI Flood$_t$ × Number of instrument$_{t-1}$	-0.02*	-0.01	-0.00	-0.02	-0.05***	-0.03	0.00	0.00	-0.03	-0.02	-0.02	-0.03
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
AIGI Flood$_t$	0.04	-0.01	-0.05	-0.01	0.05	0.01	-0.05	-0.05	0.02	-0.12	-0.16	-0.12
	(0.03)	(0.04)	(0.06)	(0.05)	(0.05)	(0.07)	(0.10)	(0.08)	(0.10)	(0.09)	(0.16)	(0.13)
AIGI Flood$_t$ × Number of instrument$_{t-1}$	-0.02	0.00	0.01	-0.00	-0.02	0.00	0.03	0.02	0.00	0.07	0.09	0.07
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.07)	(0.06)

Reproduced:

Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12
-0.00	-0.04	0.00	0.11	0.19*	0.25***	0.36***	0.37***	0.29***	0.28***	0.27**	0.29***
(0.05)	(0.05)	(0.07)	(0.09)	(0.10)	(0.08)	(0.08)	(0.08)	(0.10)	(0.10)	(0.11)	(0.11)
-0.01	0.02	-0.00	-0.13*	-0.18**	-0.21***	-0.29***	-0.28***	-0.23***	-0.22**	-0.21**	-0.23**
(0.03)	(0.03)	(0.04)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.08)	(0.09)	(0.10)	(0.09)
88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00
5436.00	5345.00	5255.00	5166.00	5077.00	4988.00	4900.00	4813.00	4726.00	4639.00	4552.00	4465.00
0.17	0.15	0.13	0.19	0.24	0.24	0.20	0.22	0.24	0.22	0.22	0.21

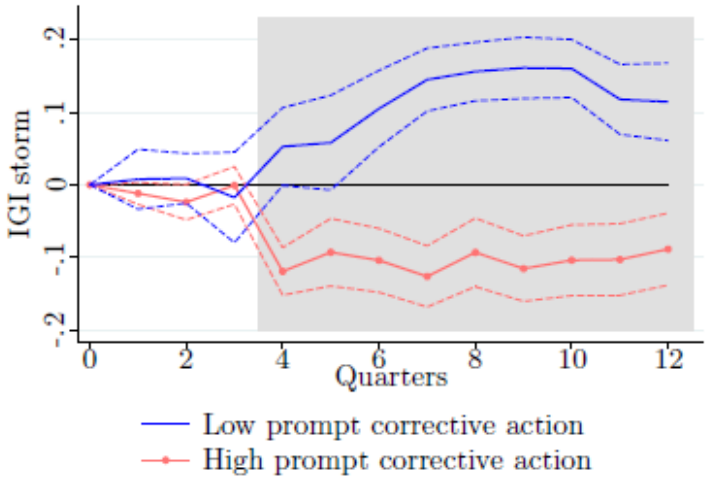
Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12
0.03	-0.02	-0.07	0.33*	0.37**	0.43**	0.58***	0.55***	0.50**	0.45**	0.49**	0.51***
(0.06)	(0.04)	(0.05)	(0.17)	(0.17)	(0.17)	(0.15)	(0.15)	(0.21)	(0.23)	(0.20)	(0.18)
-0.04	0.01	0.05	-0.32*	-0.35**	-0.39**	-0.51***	-0.47***	-0.42**	-0.37*	-0.41**	-0.42**
(0.06)	(0.03)	(0.04)	(0.16)	(0.16)	(0.16)	(0.15)	(0.14)	(0.20)	(0.21)	(0.19)	(0.17)
88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00
5436.00	5345.00	5255.00	5166.00	5077.00	4988.00	4900.00	4813.00	4726.00	4639.00	4552.00	4465.00
0.17	0.15	0.13	0.19	0.24	0.24	0.20	0.22	0.24	0.22	0.22	0.22

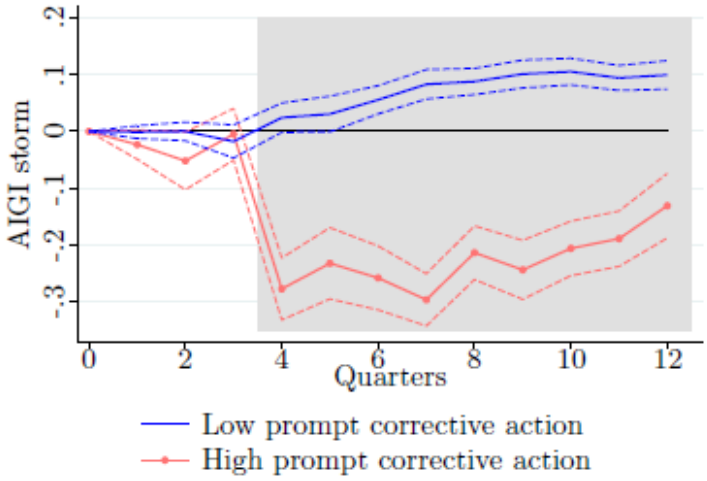
Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12
0.09*	0.03	-0.03	0.06	0.17**	0.15*	0.01	0.04	0.18**	0.14	0.10	0.14*
(0.05)	(0.05)	(0.07)	(0.08)	(0.08)	(0.09)	(0.09)	(0.07)	(0.09)	(0.10)	(0.10)	(0.08)
-0.02*	-0.01	-0.00	-0.02	-0.05***	-0.03	0.00	0.00	-0.03	-0.02	-0.02	-0.03
(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00
5436.00	5345.00	5255.00	5166.00	5077.00	4988.00	4900.00	4813.00	4726.00	4639.00	4552.00	4465.00
0.18	0.15	0.13	0.19	0.24	0.24	0.20	0.22	0.24	0.22	0.22	0.21

Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12
0.04	-0.01	-0.05	-0.01	0.05	0.01	-0.05	-0.05	0.02	-0.12	-0.16	-0.12
(0.03)	(0.04)	(0.06)	(0.05)	(0.05)	(0.07)	(0.10)	(0.08)	(0.10)	(0.09)	(0.16)	(0.13)
-0.02	0.00	0.01	-0.00	-0.02	0.00	0.03	0.02	0.00	0.07	0.09	0.07
(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.07)	(0.06)
88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00
5436.00	5345.00	5255.00	5166.00	5077.00	4988.00	4900.00	4813.00	4726.00	4639.00	4552.00	4465.00
0.17	0.14	0.13	0.19	0.24	0.24	0.20	0.22	0.24	0.22	0.22	0.21

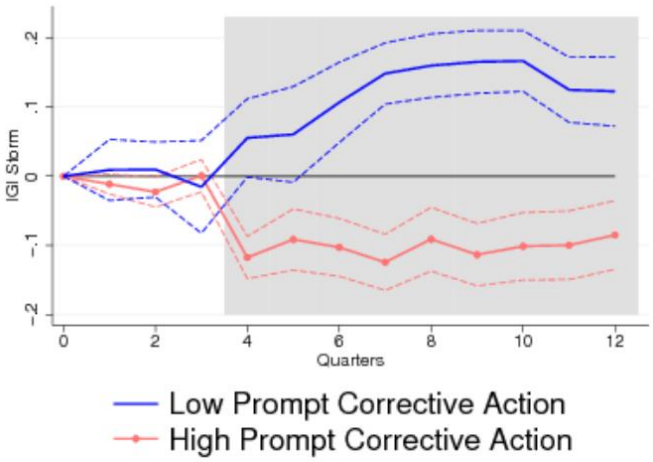
4.9. FIGURE 8: RESPONSE OF EFP TO STORMS CONDITIONAL ON PROMPT CORRECTIVE ACTION

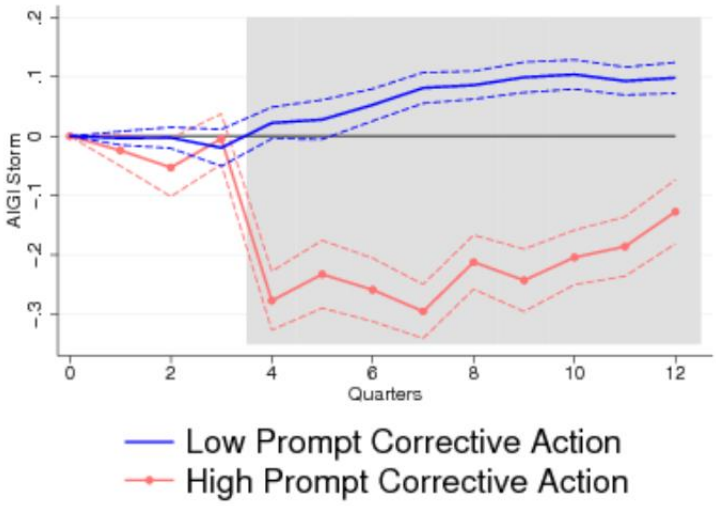
Original:





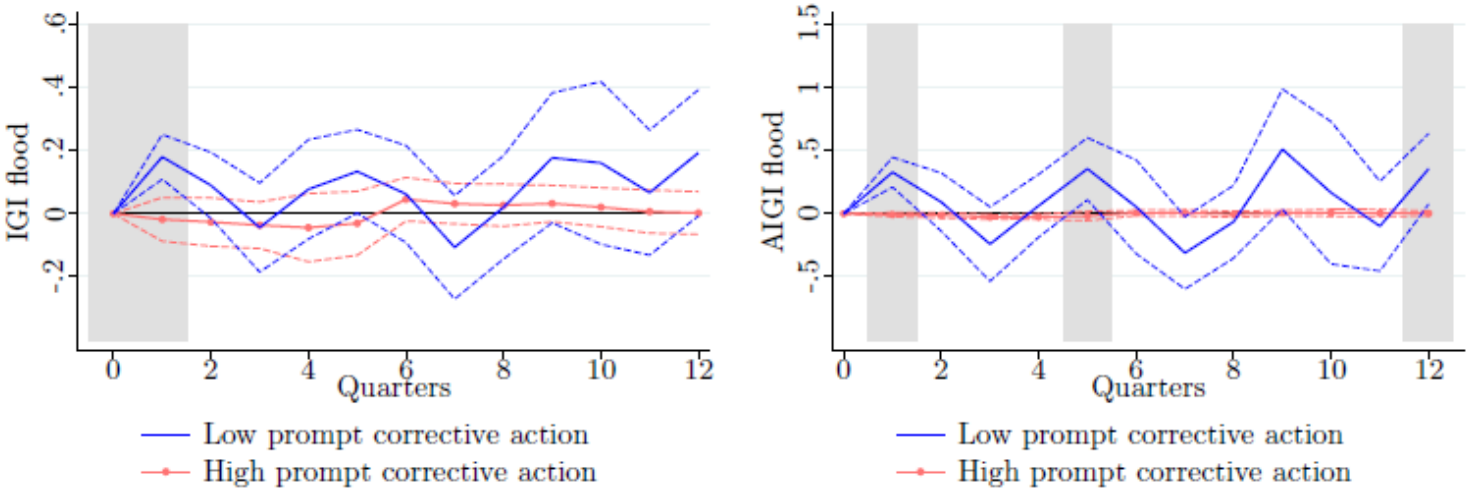
Reproduced:





4.10. FIGURE 9: RESPONSE OF EFP TO FLOODS CONDITIONAL ON PROMPT CORRECTIVE ACTION

Original:



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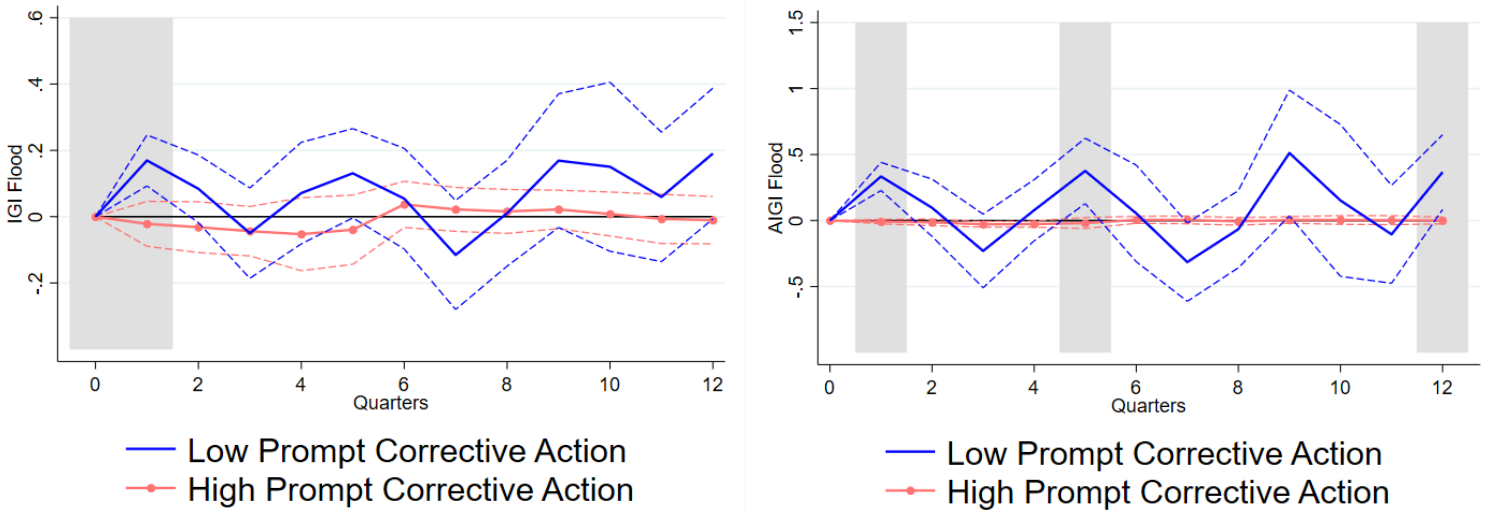
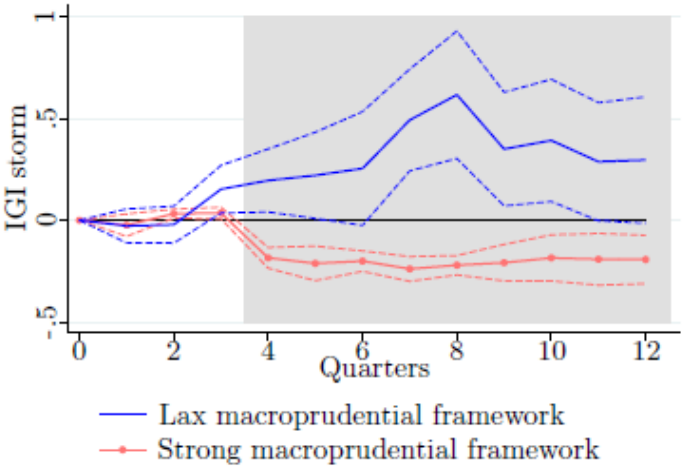
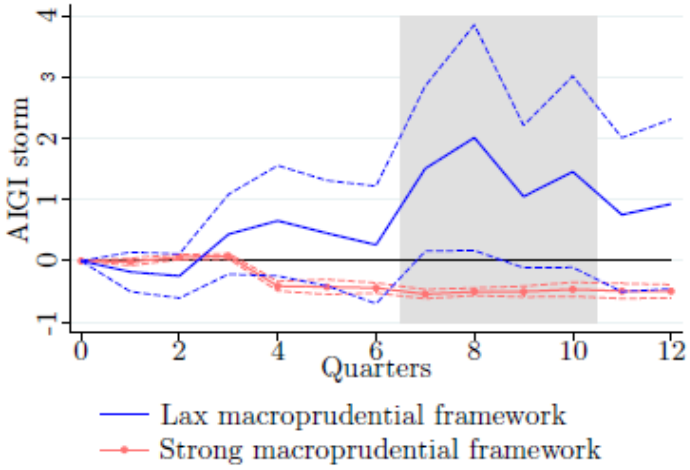


4.11. FIGURE 10: RESPONSE OF EFP TO STORMS - RECENT PERIOD

Original:





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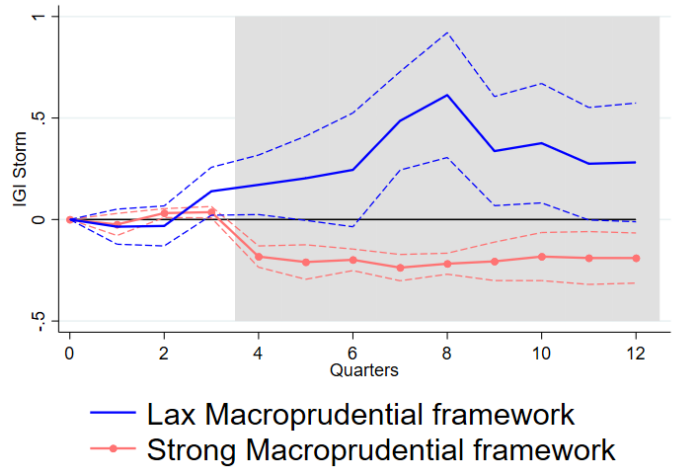
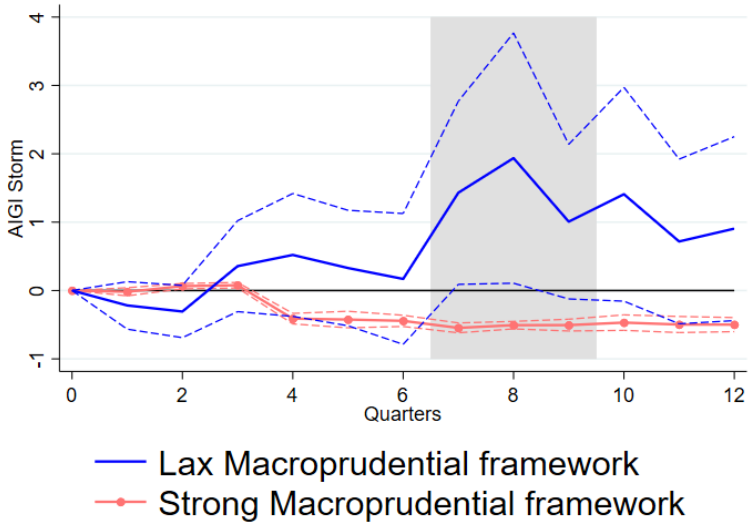
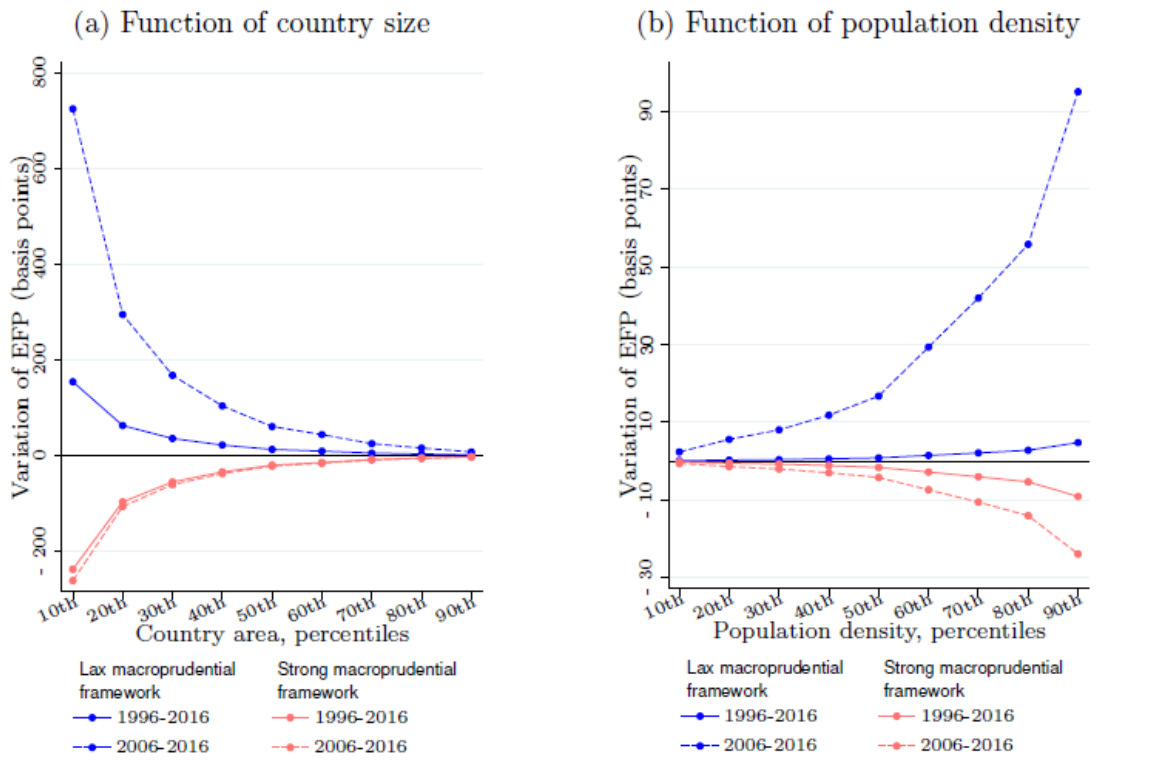


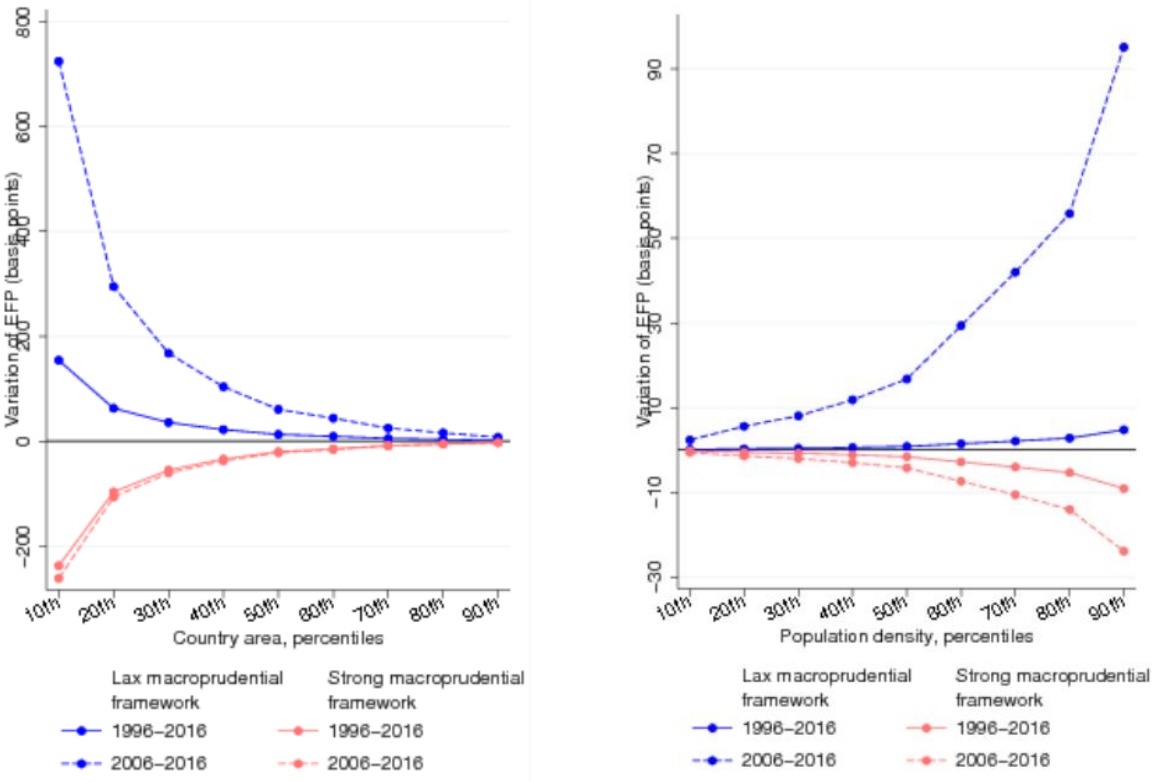


4.12. FIGURE 11: REACTION OF EFP AS A FUNCTION OF COUNTRY AREA, POPULATION DENSITY AND ESTIMATION PERIOD (H=8)

Original:

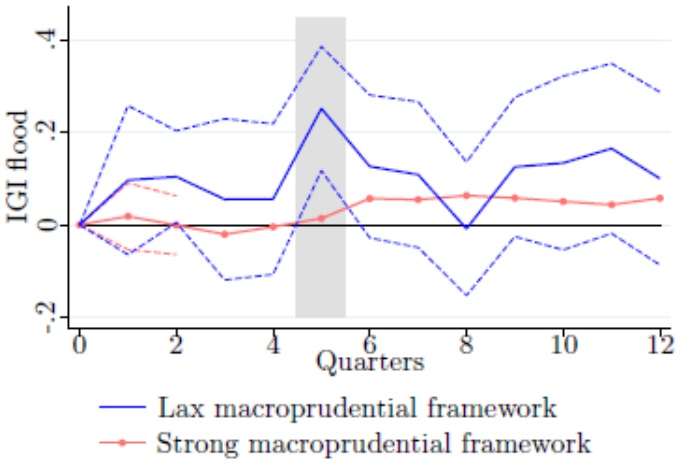


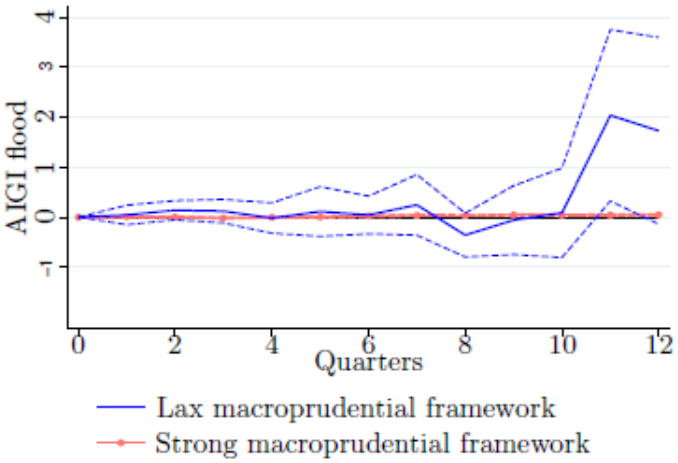
Reproduced



4.13. FIGURE 12: RESPONSE OF EFP TO FLOODS - RECENT PERIOD

Original:





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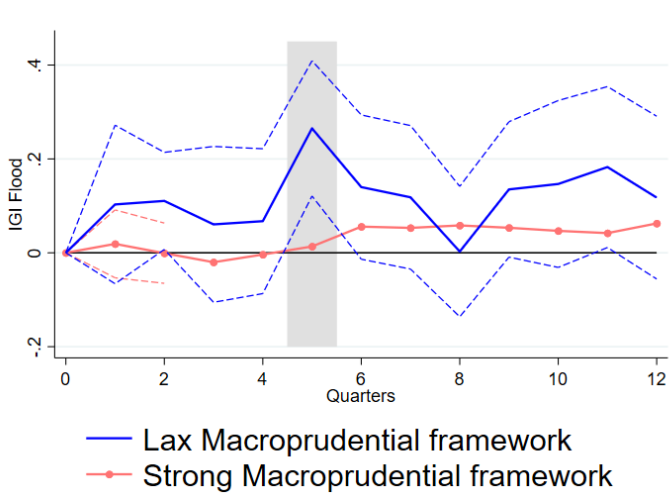
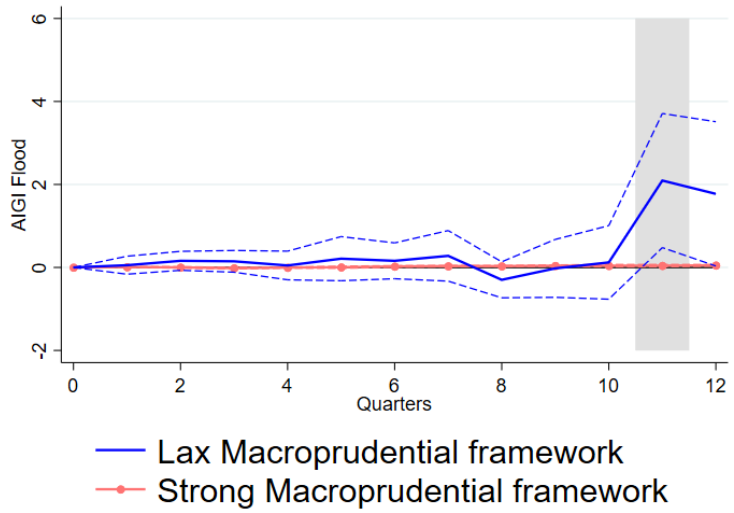
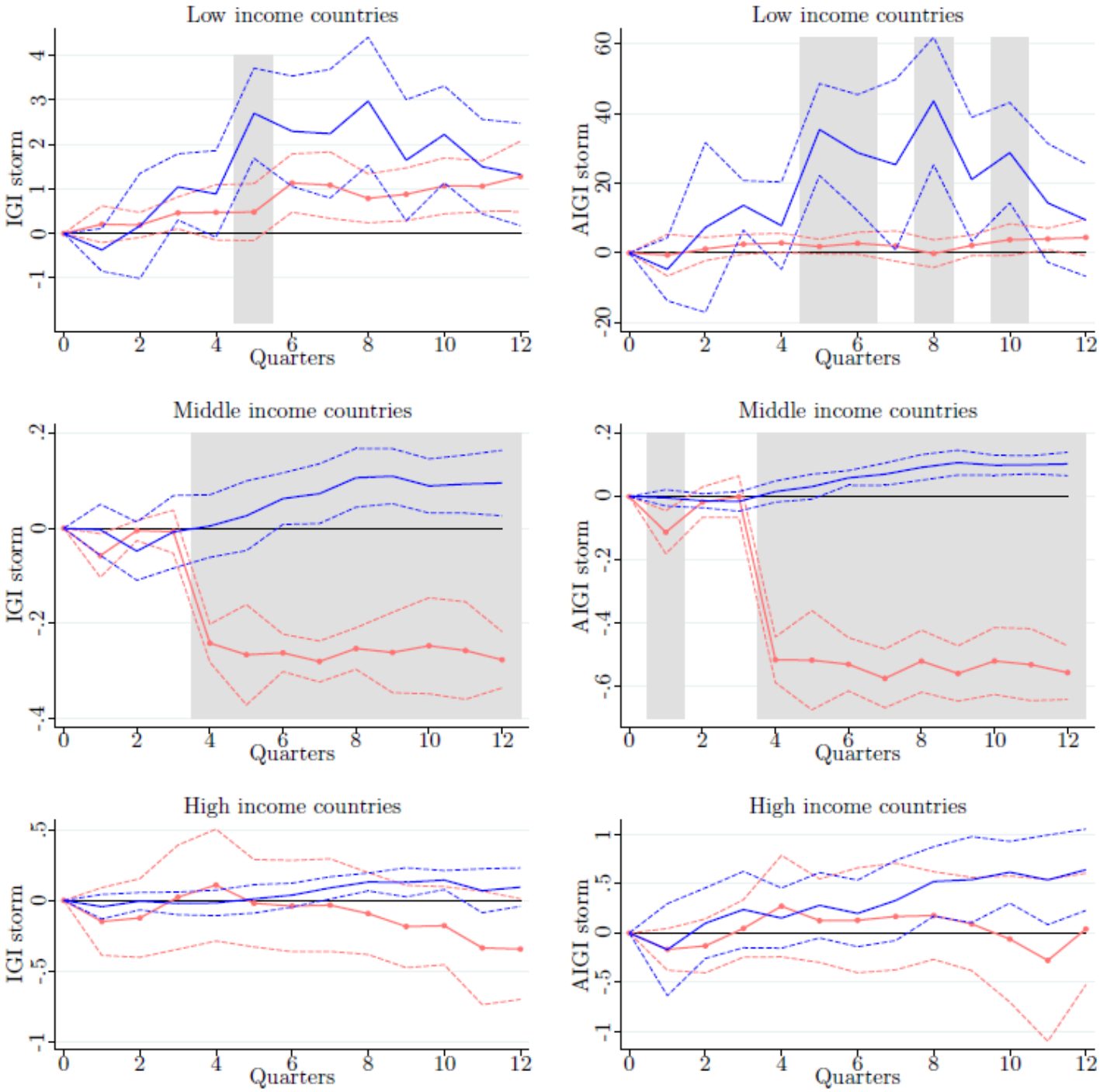




4.13. FIGURE 13: RESPONSE OF EFP TO STORMS DEPENDING ON COUNTRY INCOME LEVEL

Original:



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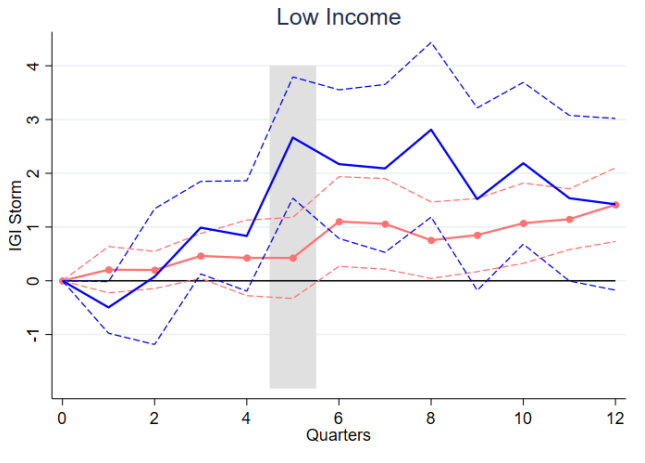
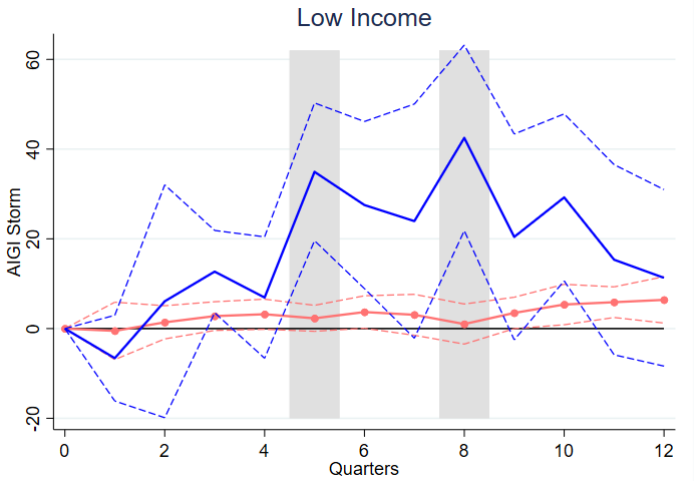
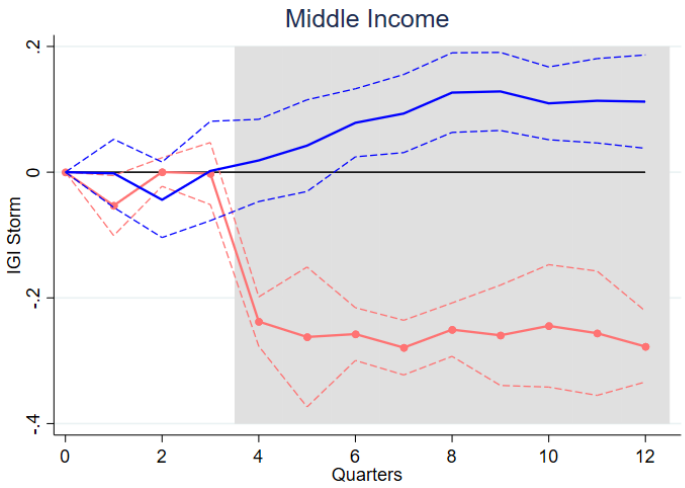
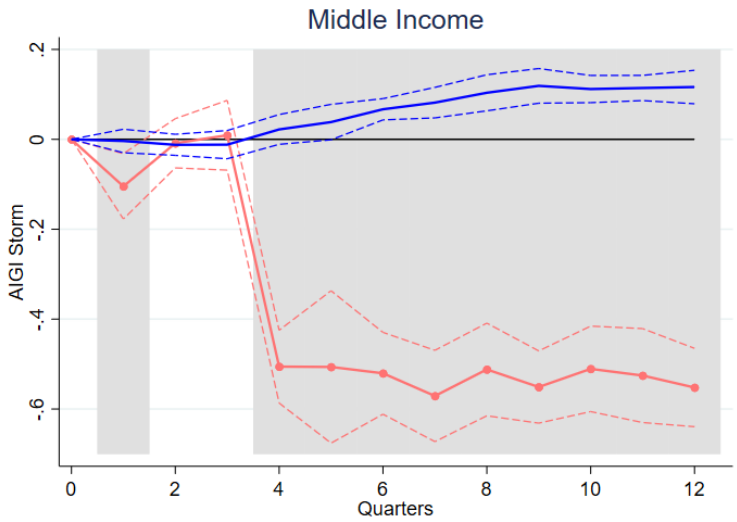
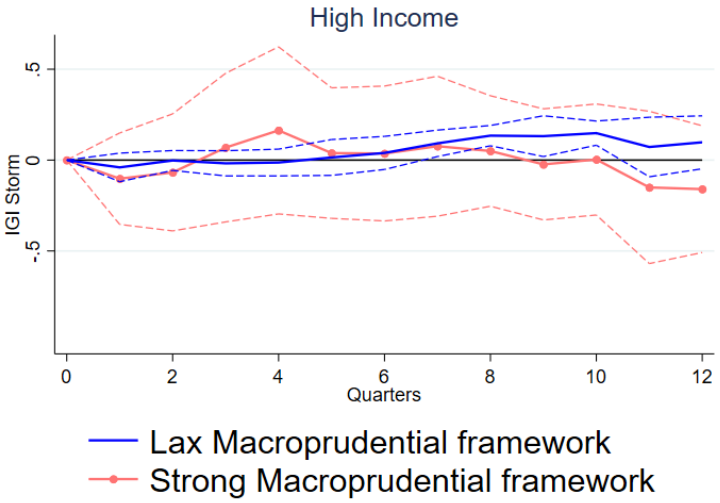
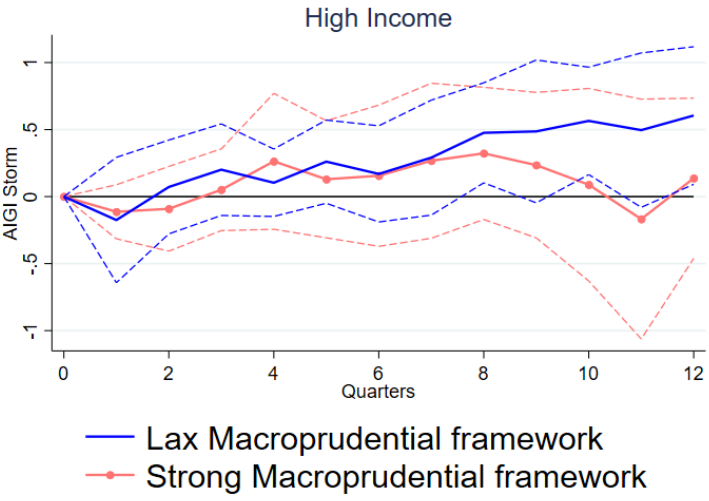

Low Income
IGI Storm
Quarters


Low Income
AIGI Storm
Quarters


Middle Income
IGI Storm
Quarters


Middle Income
AIGI Storm
Quarters


High Income
IGI Storm
Quarters


High Income
AIGI Storm
Quarters

Lax Macroprudential framework
Strong Macroprudential framework

Lax Macroprudential framework
Strong Macroprudential framework