Impact of Climate Risk on Fiscal Space: Do Political Stability and Financial Development Matter?

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Outline

Research question

Motivation

- How do climate vulnerability risk impact fiscal space?
- Big natural disasters is likely to necessitate large fiscal outlays for relief and recovery efforts
- Climate change-related fiscal expenditures pose a major threat to fiscal space / stainability in the future
- Examine the link between climate risk and fiscal space in a systematic and rigorous way
  - Levels of Vulnerability: Climate risk premium
  - Levels of Political Stability
  - Levels of Financial Development
- More stable political environment is likely to reduce the impact of fiscal cost of climate shocks
- Financial development is also expected to mitigate climate-related fiscal risks
  - Confirmation of the climate risk premium (Beirne et al., 2021; Cevik and Jalles, 2022; Zenios, 2022)
  - **Do Political Stability and Financial Development Matter?**

Research question

Literature overview

- **Climate risks:** economic growth (Oppenheimer et al., 2004; Tol et al., 2004; Mendelson et al., 2006; Diffenbaugh and Burke, 2019; Dasgupta et al., 2023)
- Exacerbates inequality in developing countries (Cappellia et al., 2021; Dasgupta et al., 2023)
- Mitigate the socio-economic impact of climate change and rising temperatures, countries must possess a high adaptive capacity (Tol et al., 2004), a diversified economy (Dissart, 2003), political stability (Dell et al., 2012), and strong institutional leadership (Pike et al., 2010)
- You et al (2014) examine the link between democracy, financial openness, and carbon dioxide emissions

Research question

Preview of the results

- **Contribution 1:** Political stability reduces the adverse spillover effects of climate risks on fiscal space
- **Contribution 2:** Financial development also weakens the link between climate risks and fiscal space
- **Contribution 3:** Asymmetric effects in the sense that the most fiscally constrained economies are subject to the largest climate-related risk premia

Research question

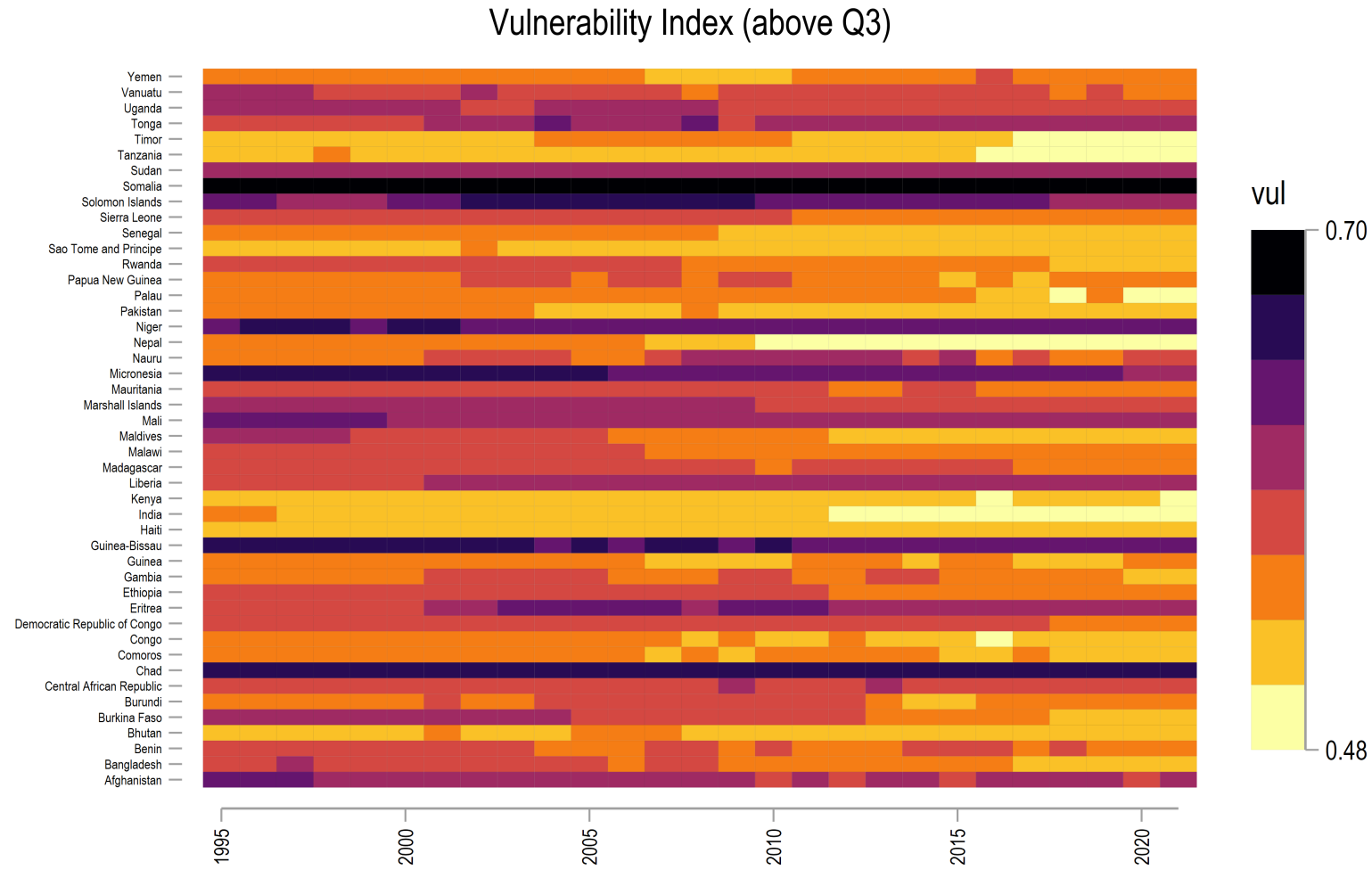
Figure 1. Heat plot for the low vulnerability score

Data source: Notre Dame Global Adaptation Initiative.

Source: authors' calculations.

Research question

Figure 2. Heat plot for the high vulnerability score

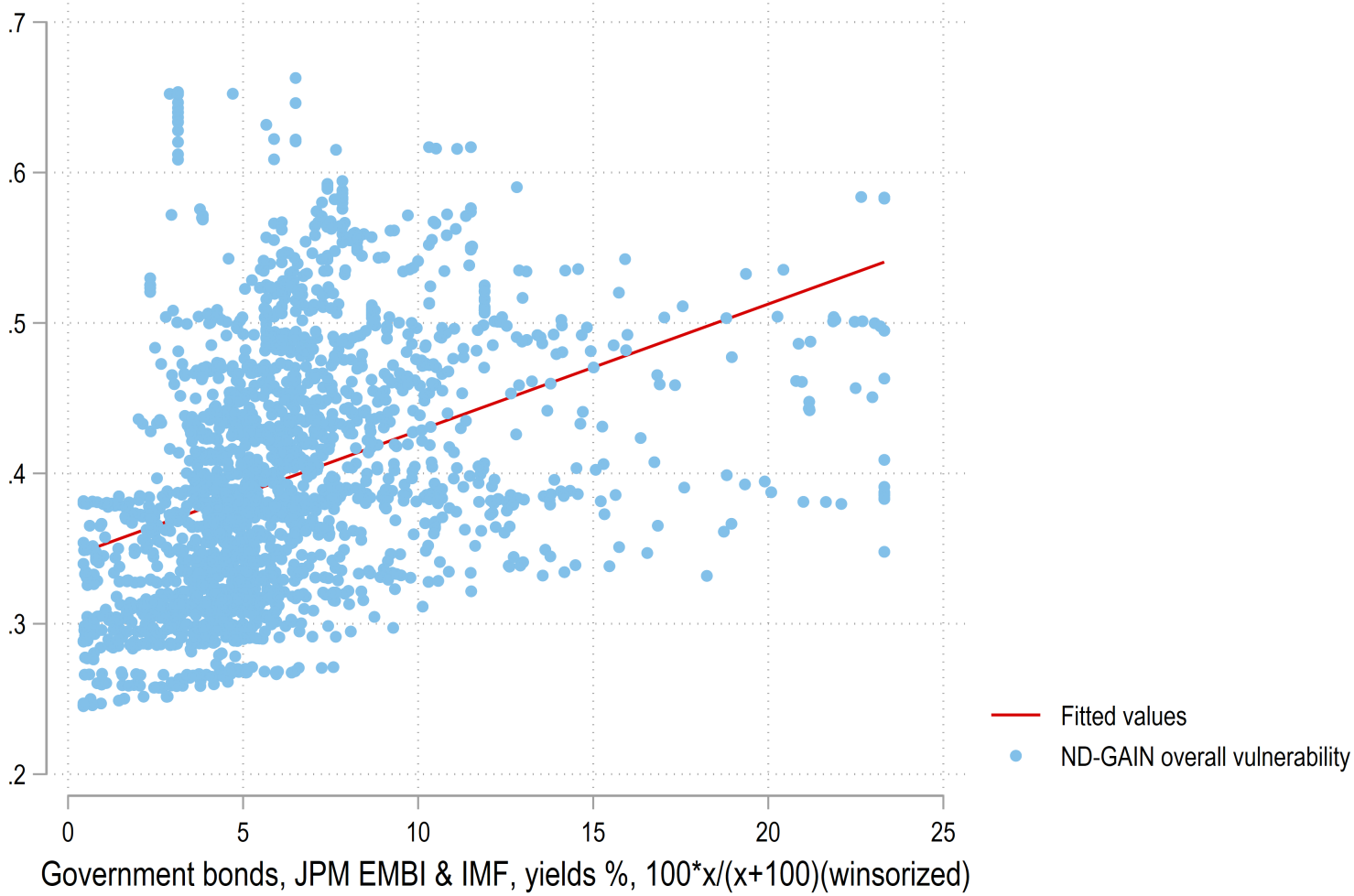


Data source: Notre Dame Global Adaptation Initiative.

Source: authors' calculations.

Research question

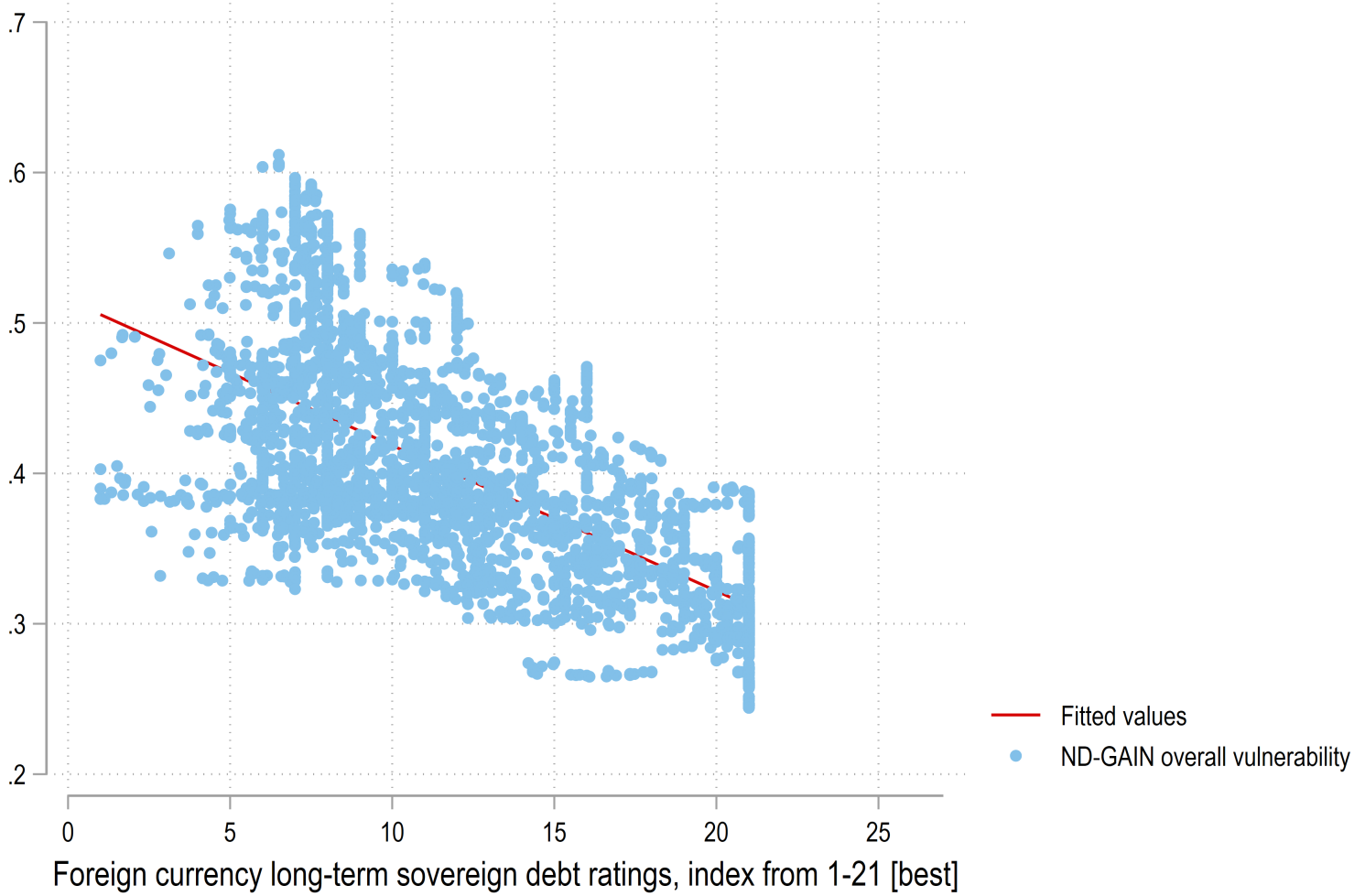
Figure 3. Scatter plot for the vulnerability score and bond yields



Source: authors' calculations.

Research question

Figure 4. Scatter plot for the vulnerability score and sovereign ratings



Source: authors' calculations.

Outline

Empirical approach

- Annual data from 1995 to 2021 for a sample of 199 countries, $n \times T = 199 \times 27 = 5373$ (maximum possible observations).
- Panel local projections, quantile panel local projections
  - Climate variables: ND-GAINS vulnerability scores
  - Fiscal variables: Bonds yields on government bonds and Sovereign ratings on foreign currency long-term sovereign debt
  - Several robustness checks: Financial Development (FDI indexes, Svyridzenka, 2016); Political Stability (ICRG indexes for Political Risks); Variation of the ND-GAINS vulnerability scores
- Baseline specification:

$$y_{i,t+h} = b_h S_{i,t} + \gamma_h y_{i,t-1} + \alpha' z_{i,t-1} + v_{i,t+h}$$
$$\text{IRF}(h) = \hat{b}_h, \quad h = 0, 1, \ldots \tag{1}$$

- Impulse/Treatment variable, S: unit-shock on the vulnerability score; Response variable, y: bond yields or sovereign ratings

Data and Methodology

Table 1. Descriptive statistics for the involved variables

Variables	Count	Mean	Q1	Median	Q3	SD	Min	Max
Climate risk vulnerability variable								
ND-GAIN overall vulnerability	4,784	0.442	0.372	0.43	0.517	0.0955	0.244	0.696
Fiscal space variables								
Government bonds, yields %	2,052	6.078	3.97	5.256	7.351	3.656	0.438	23.31
Sovereign debt ratings, index	3,300	12.36	8	11.87	16.67	5.181	1	21
Domestic controls								
Current Account Balance	4,510	-2.276	-7.167	-2.773	1.739	14.01	-148	311.7
Gov. Net Lending/Borrowing	4,859	-2.02	-4.613	-2.335	0.016	6.551	-59.74	125.1
General Gov. Gross Debt	4,694	55.83	29.48	46.25	69.83	44.59	0	600.1
CPI % year-on-year	3,607	0.501	0.132	0.291	0.592	0.843	-1.223	8.925
Banking crises dummy	4,356	0.012	0	0	0	0.109	0	1
Currency crises dummy	4,356	0.018	0	0	0	0.132	0	1
Debt crises dummy	4,356	0.006	0	0	0	0.079	0	1
Global controls								
MSCI World index	4,440	0.524	0.006	0.89	1.285	1.42	-4.297	3.184
US Government bonds, yields %	4,440	3.686	2.386	3.697	4.675	1.332	1.778	6.048
CBOE Volatility Index: VIX	5,373	20.48	15.48	19.66	25.6	5.903	11.09	32.7

Source: authors' calculations.

Data and Methodology

Table 2. Comparing fundamentals and institutional features for different levels of vulnerability

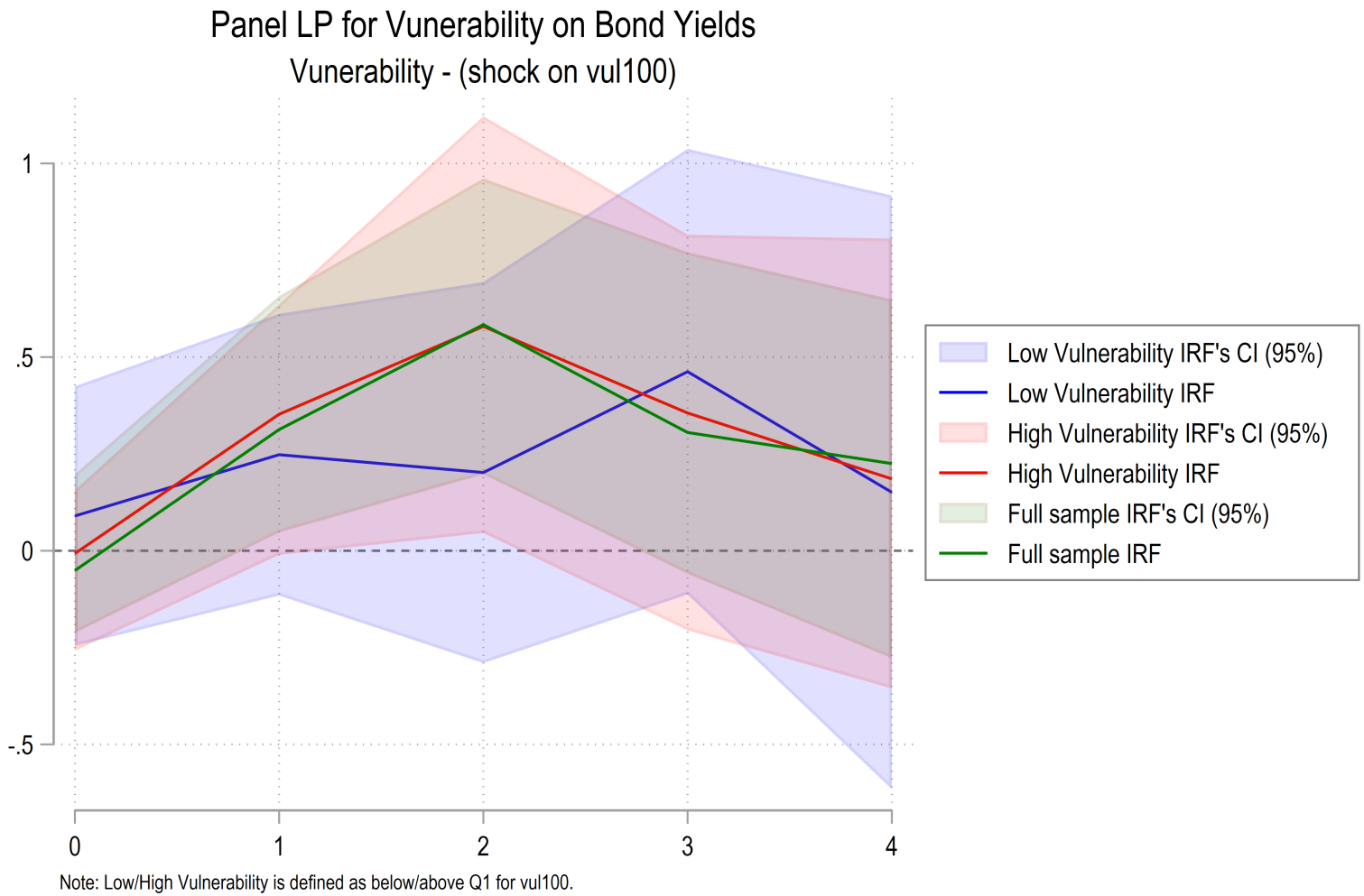
	VUL High (Above Q3 of VUL) 1,196 (25.0%)	**VUL Low (Below Q3 of VUL)** 3,588 (75.0%)	**Total** 4,784 (100.0%)	**Test**
ND-GAIN overall vulnerability	0.57 (0.04) 0.07	0.40 (0.06) 0.16	0.44 (0.10) 0.22	<0.001
ND-GAIN overall readiness	0.31 (0.07) 0.22	0.43 (0.13) 0.31	0.40 (0.13) 0.33	<0.001
Government bonds, yields %	7.67 (3.55) 0.46	5.93 (3.63) 0.61	6.08 (3.66) 0.60	<0.001
Treasury Bills, yields %	9.83 (6.34) 0.65	6.36 (6.03) 0.95	7.01 (6.24) 0.89	<0.001
Foreign currency sovereign debt ratings	7.30 (1.38) 0.19	12.64 (5.14) 0.41	12.23 (5.15) 0.42	<0.001
Current Account Balance in % of GDP	-4.40 (22.94) -5.22	-1.97 (10.03) -5.10	-2.49 (13.92) -5.58	<0.001
CPI inflation, year-on-year %	0.63 (0.70) 1.11	0.47 (0.88) 1.85	0.50 (0.85) 1.68	<0.001
General Gov. Gross Debt in % of GDP	62.53 (63.99) 1.02	54.41 (36.90) 0.68	56.33 (44.94) 0.80	<0.001
Gov. Net Lending/Borrowing in % of GDP	-1.95 (7.83) -4.02	-2.12 (5.77) -2.73	-2.07 (6.33) -3.05	0.44
Laeven-Valencia's dummy: banking crisis	0.00 (0.04) 22.85	0.02 (0.13) 7.66	0.01 (0.11) 8.74	<0.001
Laeven-Valencia's dummy: currency crisis	0.01 (0.10) 9.70	0.02 (0.15) 6.65	0.02 (0.14) 7.16	0.018
Laeven-Valencia's dummy: debt crisis	0.00 (0.03) 32.33	0.01 (0.09) 10.66	0.01 (0.08) 12.17	0.008
Total reserves minus gold (% of GDP)	14.84 (14.53) 0.98	17.91 (18.52) 1.03	17.27 (17.82) 1.03	<0.001
Fuel Export on Total Exports	9.71 (22.81) 2.35	17.89 (27.16) 1.52	16.58 (26.67) 1.61	<0.001
Fuel Import on Total Imports	16.41 (8.77) 0.53	13.54 (8.42) 0.62	14.07 (8.56) 0.61	<0.001
Chinn-Ito index, normalized	0.34 (0.32) 0.94	0.57 (0.37) 0.65	0.52 (0.37) 0.72	<0.001
Exchange Rate Stability Index	0.57 (0.28) 0.48	0.62 (0.31) 0.50	0.61 (0.31) 0.50	<0.001
Financial Institution index	0.18 (0.07) 0.41	0.45 (0.21) 0.48	0.38 (0.22) 0.57	<0.001
Financial Market index	0.03 (0.08) 2.48	0.26 (0.26) 1.03	0.20 (0.25) 1.24	<0.001
ICRG index: External Conflict	9.11 (1.64) 0.18	10.10 (1.32) 0.13	9.92 (1.44) 0.14	<0.001
ICRG index: Corruption	1.95 (0.78) 0.40	2.91 (1.22) 0.42	2.74 (1.21) 0.44	<0.001
ICRG index: Bureaucracy Quality	1.22 (0.81) 0.66	2.44 (1.03) 0.42	2.22 (1.10) 0.49	<0.001
ICRG index: Democratic Accountability	3.19 (1.32) 0.41	4.22 (1.65) 0.39	4.03 (1.64) 0.41	<0.001
ICRG index: Ethnic Tensions	3.08 (1.06) 0.34	4.24 (1.19) 0.28	4.03 (1.25) 0.31	<0.001
ICRG index: Government Stability	8.09 (1.66) 0.21	8.17 (1.58) 0.19	8.16 (1.60) 0.20	0.258
ICRG index: Internal Conflict	7.76 (1.62) 0.21	9.48 (1.64) 0.17	9.17 (1.76) 0.19	<0.001
ICRG index: Law and Order	2.80 (0.98) 0.35	3.98 (1.29) 0.32	3.77 (1.32) 0.35	<0.001
ICRG index: Military in Politics	2.08 (1.32) 0.64	4.24 (1.56) 0.37	3.85 (1.73) 0.45	<0.001
ICRG index: Religious Tensions	3.67 (1.34) 0.36	4.78 (1.21) 0.25	4.58 (1.30) 0.28	<0.001
ICRG index: Socioeconomic Conditions	3.23 (1.38) 0.43	6.22 (2.28) 0.37	5.68 (2.43) 0.43	<0.001
ICRG index: Investment Profile	6.68 (1.77) 0.27	8.65 (2.11) 0.24	8.30 (2.19) 0.26	<0.001
Personal remittances, received (% of GDP)	4.49 (6.09) 1.36	4.03 (6.89) 1.71	4.13 (6.72) 1.63	0.062
Military expenditures (% of GDP)	0.02 (0.03) 1.38	0.02 (0.02) 0.81	0.02 (0.02) 0.95	0.745

Source: authors' calculations.

Outline

Results

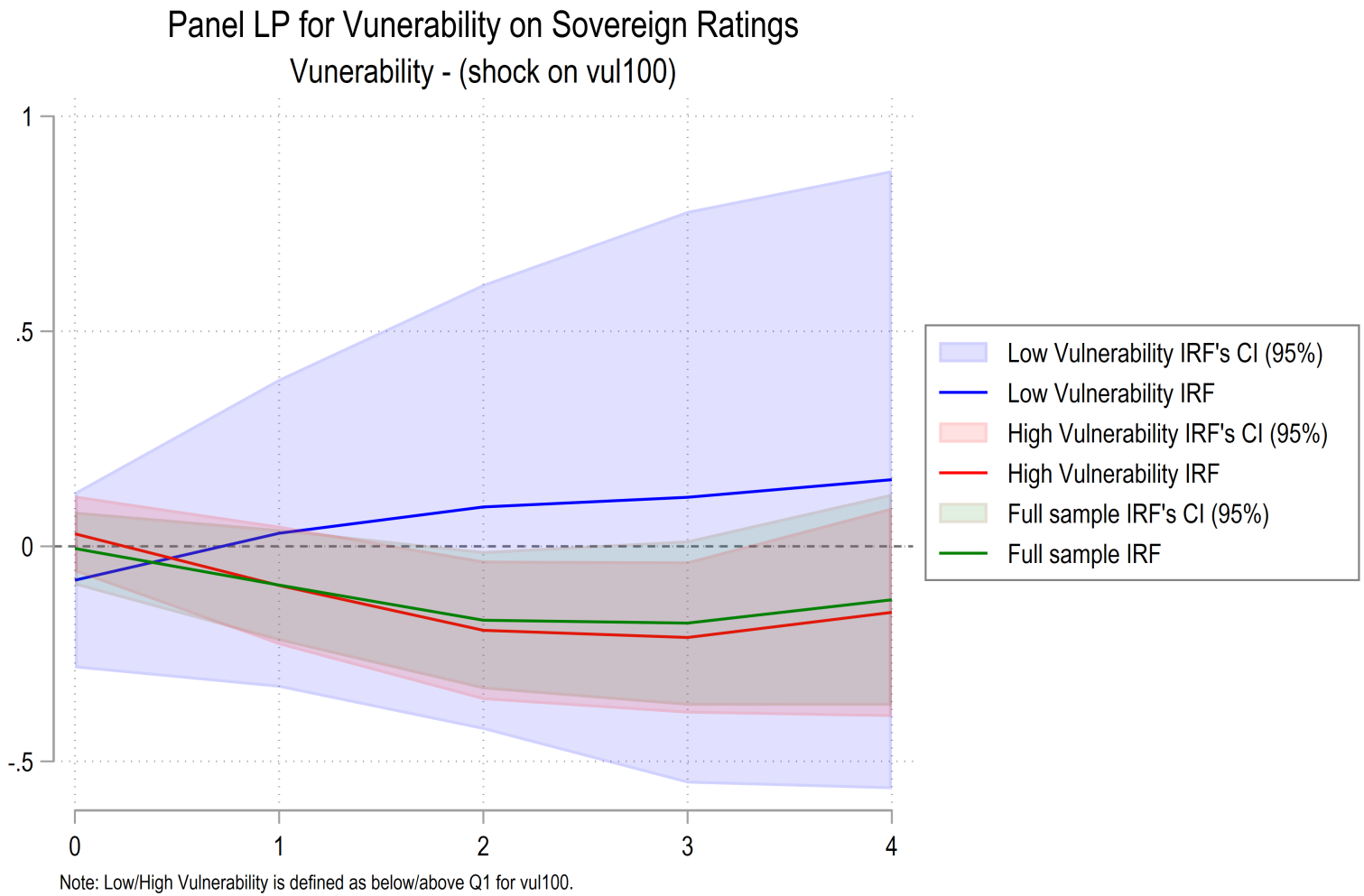
Figure 5. Panel LP for the impact of vulnerability on bond yields



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results

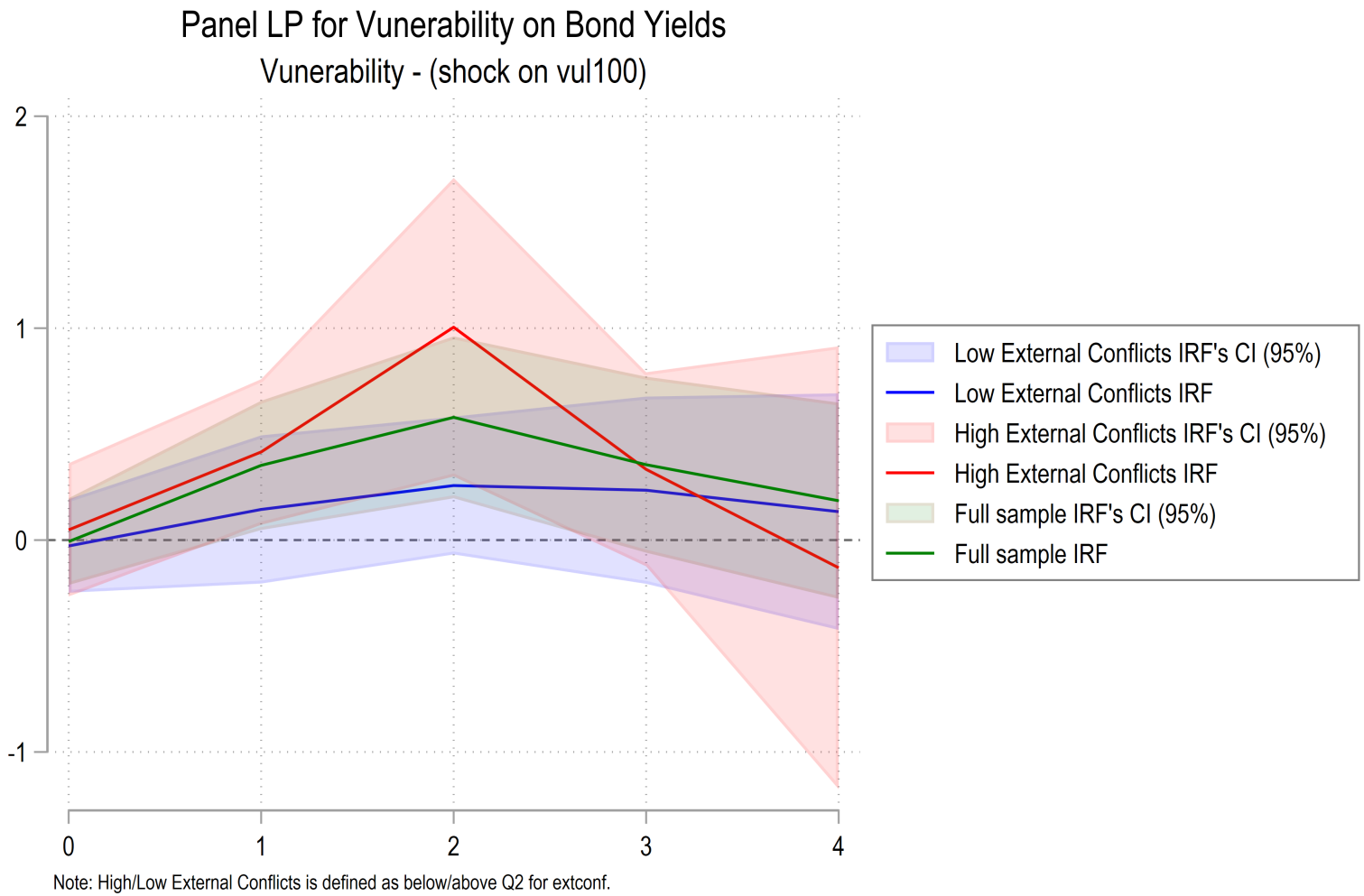
Figure 6. Panel LP for the impact of vulnerability on sovereign ratings



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results

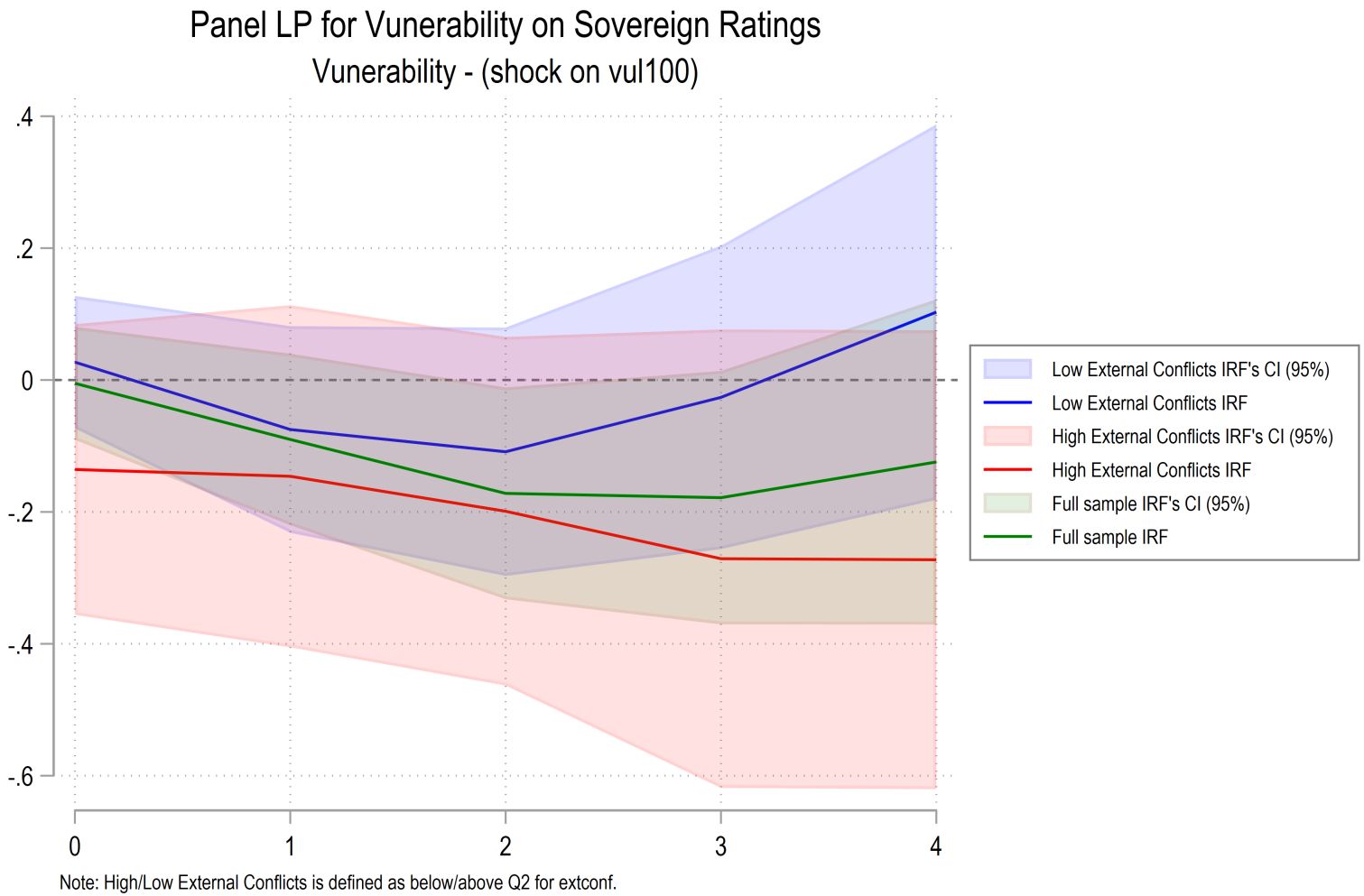
Figure 7. Panel LP for the impact of vulnerability on bond yields (External Conflicts)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results

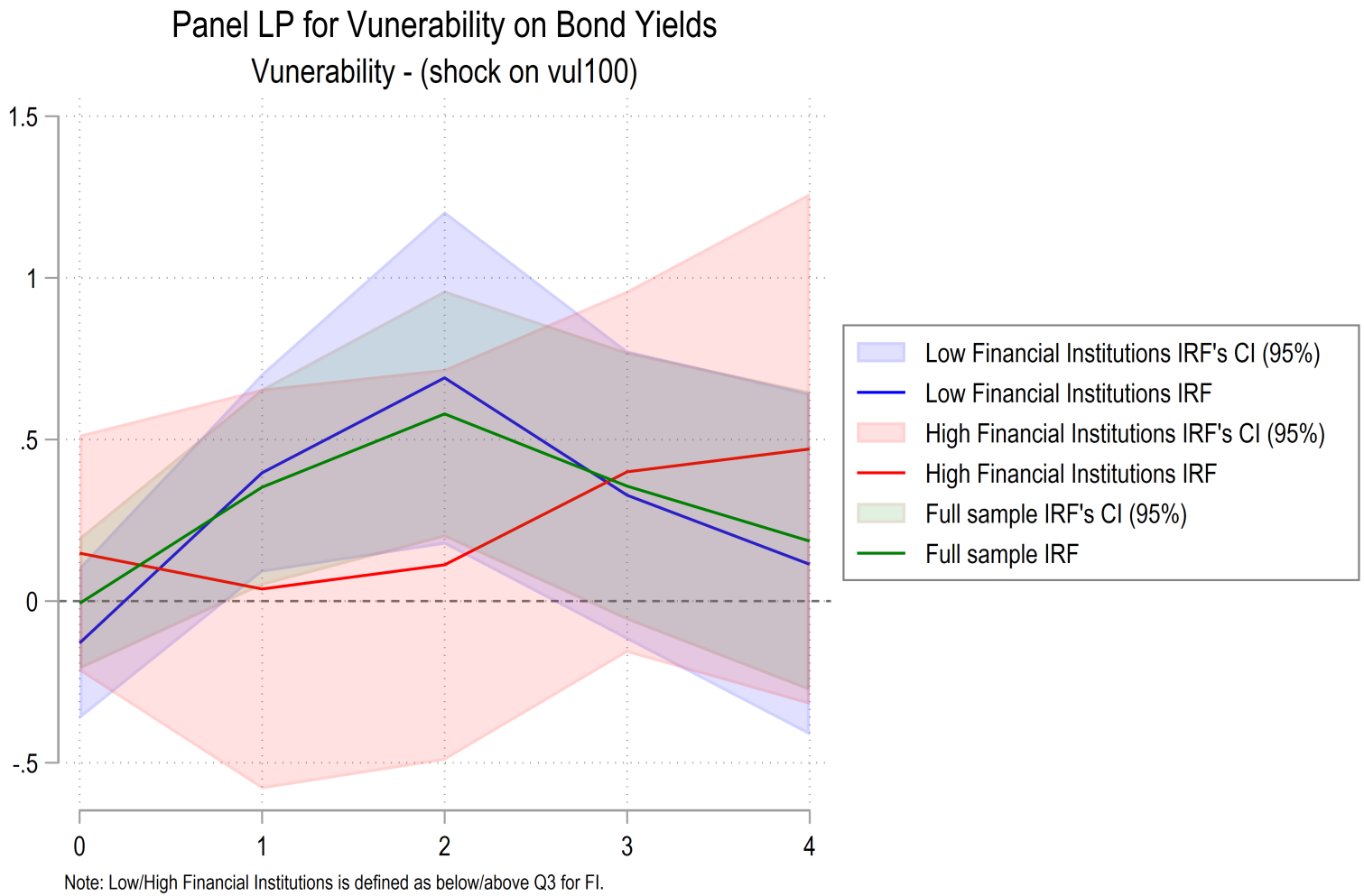
Figure 8. Panel LP for the impact of vulnerability on sovereign ratings (External Conflicts)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results

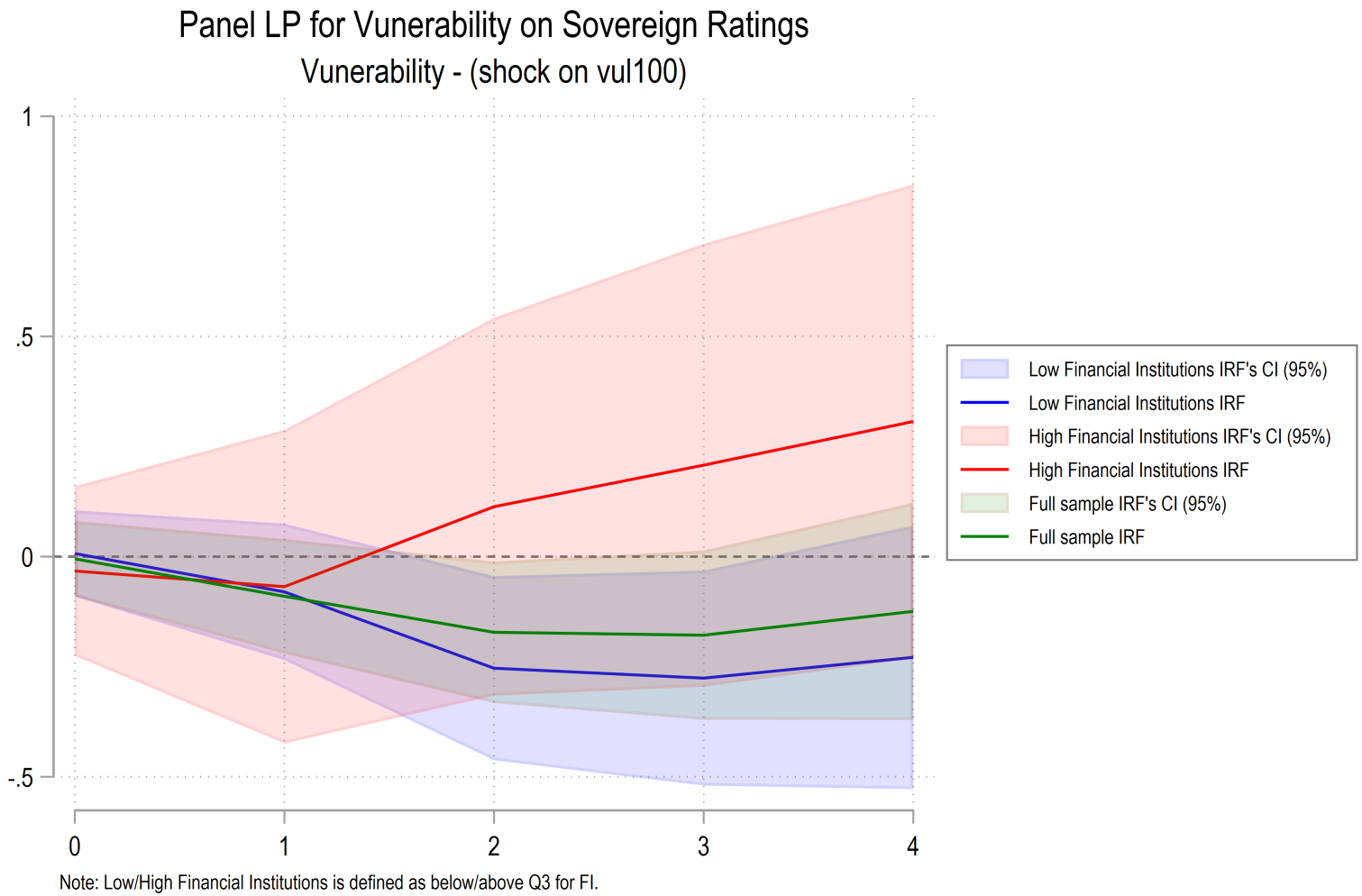
Figure 9. Panel LP for the impact of vulnerability on bond yields (Financial Institutions)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results

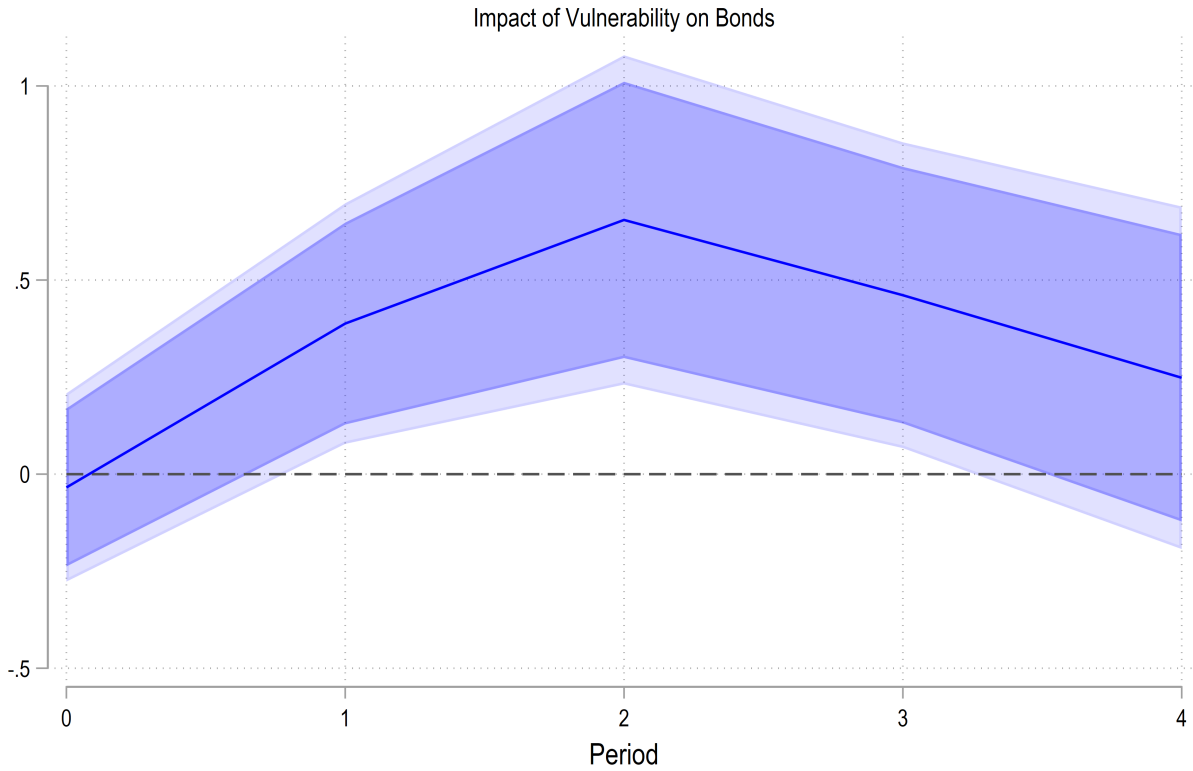
Figure 10. Panel LP for the impact of vulnerability on sovereign ratings (Financial Institutions)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results: Extended set of controls

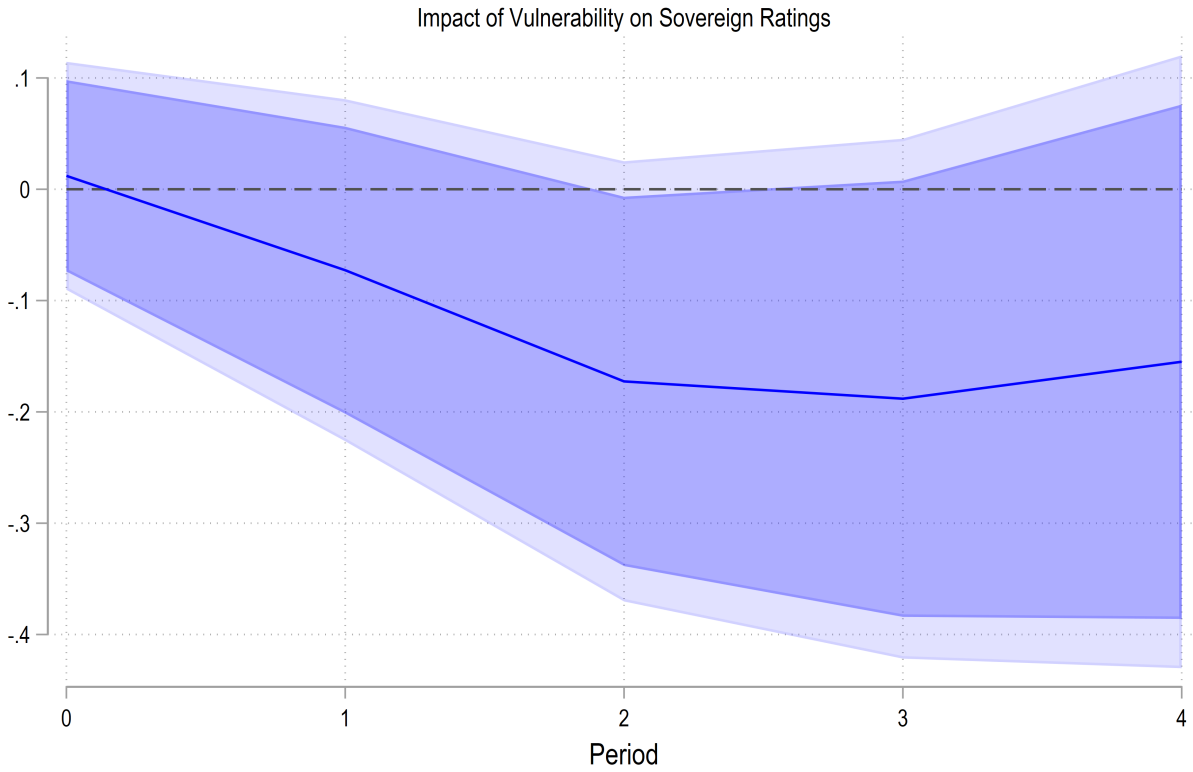
Figure 11. Panel LP for the impact of vulnerability on bond yields (Extensive set of controls)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping. 90%, 95% confidence intervals in dark blue and light blue, respectively. We add to four variables the original set of controls, namely, the capital account openness index, the exchange rate stability index, and the shares in total trade of fuel imports and exports, as described in Section 2.

Results: Extended set of controls

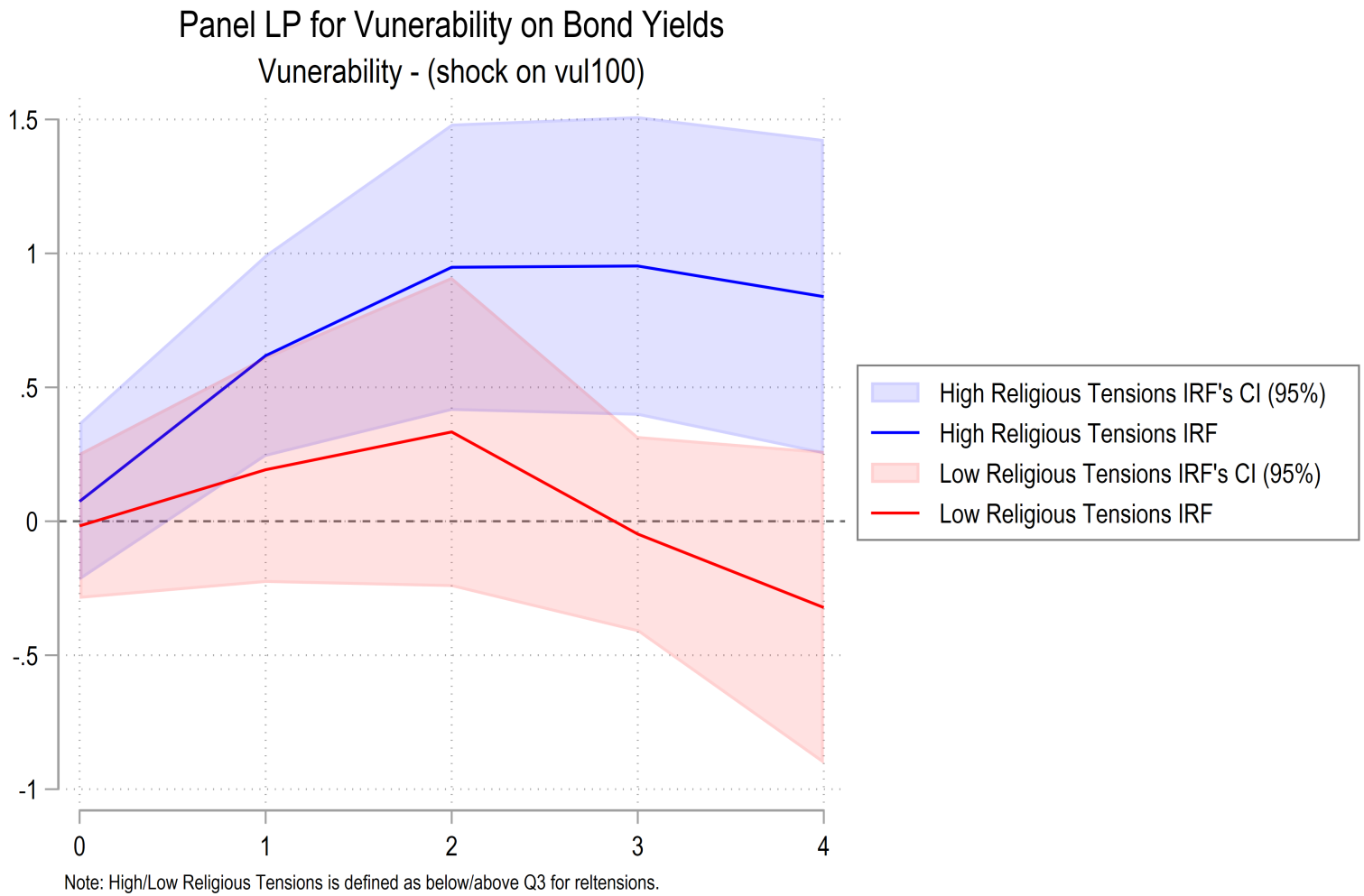
Figure 12. Panel LP for the impact of vulnerability on sovereign ratings (Extensive set of controls)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping. 90%, 95% confidence intervals in dark blue and light blue, respectively. We add to four variables the original set of controls, namely, the capital account openness index, the exchange rate stability index, and the shares in total trade of fuel imports and exports, as described in Section 2.

Results: Robustness

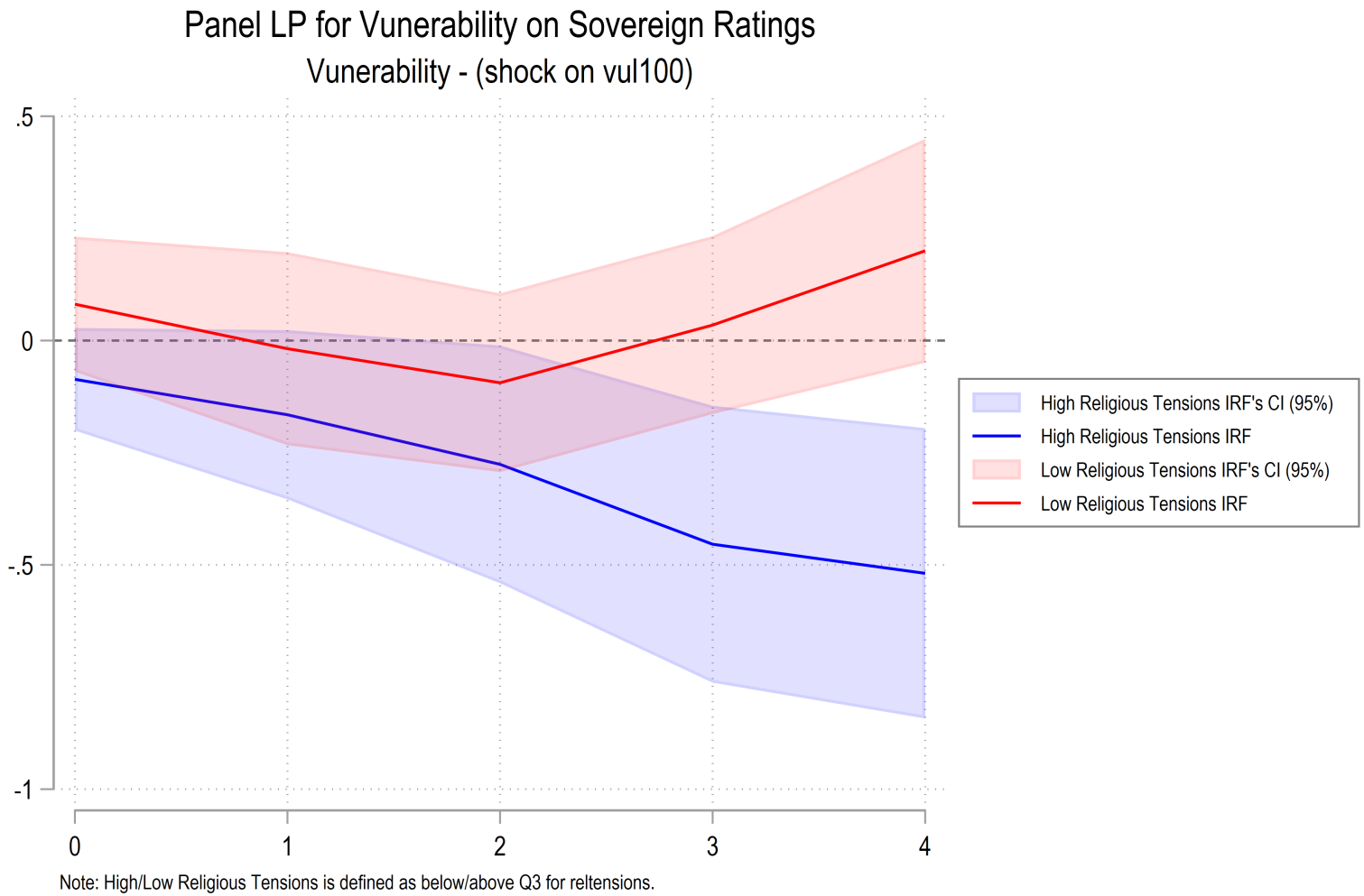
Figure 13. Panel LP for the impact of vulnerability on bond yields (Religious Tensions)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results: Robustness

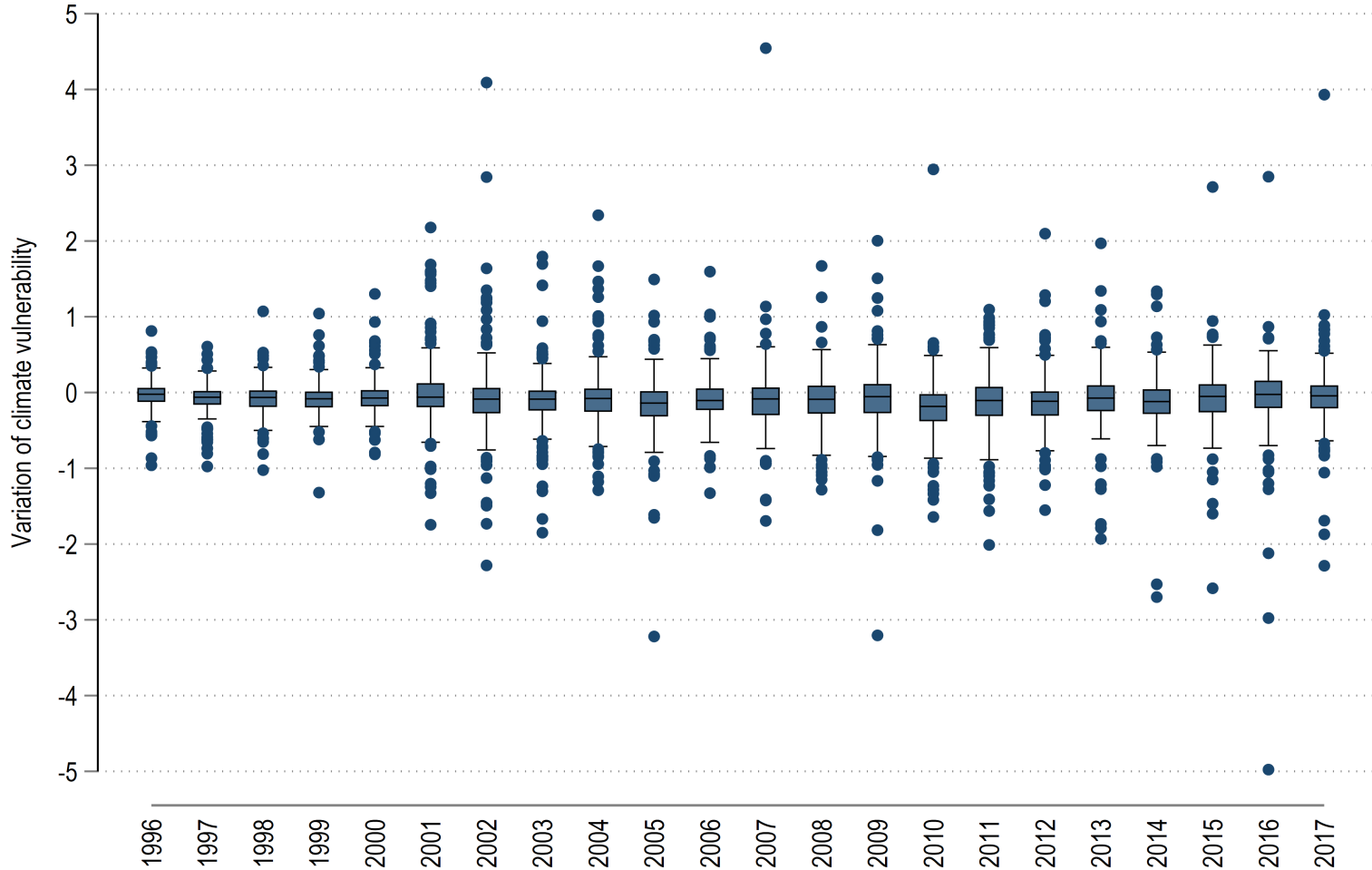
Figure 14. Panel LP for the impact of vulnerability on sovereign rates (Religious Tensions)



Note: authors' calculations. The shock is a unit-shock on the vulnerability variable. Fixed effects are included, and standard errors are obtained through bootstrapping.

Results: Robustness with the variation of the vulnerability scores

Figure 15. Shocks of climate vulnerability



Note: authors' calculations.

Results

Table 3. Contemporaneous-correlation table

Variables	Variation in vulnerability score
Government bonds yields	-0.05
P-values	(0.04)
Nb. Obs.	2052
Foreign currency long-term sovereign debt ratings	0.09
P-values	(0.00)
Nb. Obs.	3007

Source: authors' calculations.

Results

Table 4. Contemporaneous-correlation table

Variables	Variation in vulnerability score
Market cap. of listed domestic companies (% of GDP)	0.05
P-value	(0.06)
Nb. Obs.	1690
Chinn-Ito index	0.00
P-value	(0.97)
Nb. Obs.	4470
Financial Institution index	0.04
P-value	(0.00)
Nb. Obs.	4576
Financial Market index	0.04
P-value	(0.01)
Nb. Obs.	4576
ICRG index - External Conflict	-0.02
P-value	(0.16)
Nb. Obs.	3489
ICRG index - Internal Conflict	0.01
P-value	(0.73)
Nb. Obs.	3489
ICRG index - Government Stability	-0.04
P-value	(0.03)
Nb. Obs.	3489
ICRG index - Law and Order	0.02
P-value	(0.32)
Nb. Obs.	3489
ICRG index - Ethnic Tensions	0.01
P-value	(0.71)
Nb. Obs.	3489
ICRG index - Religious Tensions	0.00
P-value	(0.85)
Nb. Obs.	3489

Source: authors' calculations.

Results: Robustness with the variation of the vulnerability scores

Table 5. Reverse causality: Bond yields

Variables	D.vul100
Bonds	0.01
	(0.34)
L.Bonds	-0.01
	(0.41)
L2.Bonds	0.01
	(0.32)
L3.Bonds	-0.01
	(0.22)
L4.Bonds	0.00
	(0.73)
Constant	-0.09
	(0.13)
Observations	1,670
R-squared	0.02

Note: authors' calculations. P-values in parentheses. Time-FE included.

Results: Robustness with the variation of the vulnerability scores

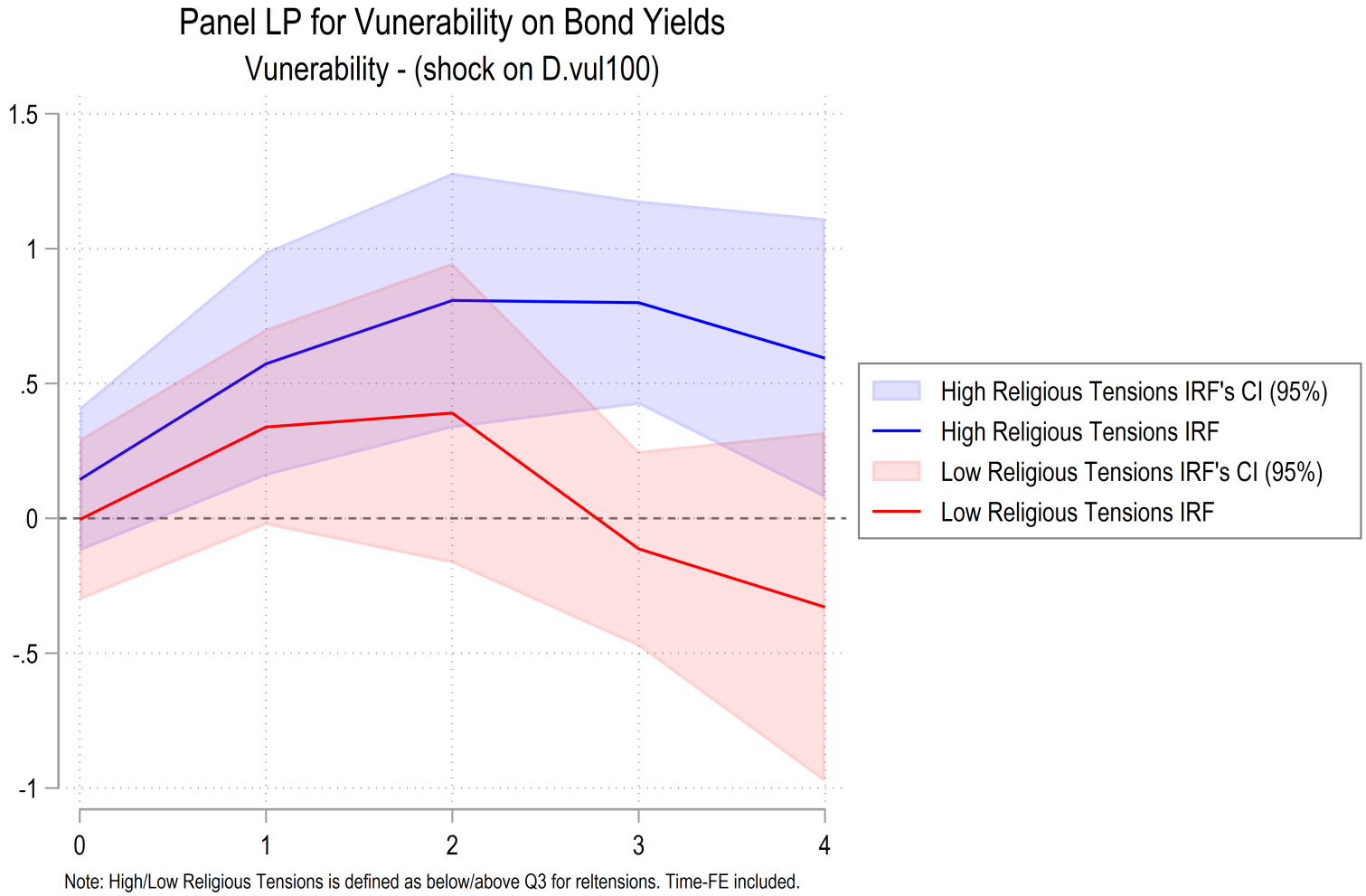
Table 6. Reverse causality: Sovereign ratings

Variables	D.vul100
Sovrate	-0.01
	(0.25)
L.Sovrate	0.01
	(0.51)
L2.Sovrate	-0.01
	(0.72)
L3.Sovrate	0.02
	(0.16)
L4.Sovrate	-0.01
	(0.27)
Constant	-0.11**
	(0.04)
Observations	2,632
R-squared	0.05

Note: authors' calculations. P-values in parentheses. Time-FE included.

Results: Robustness with the variation of the vulnerability scores

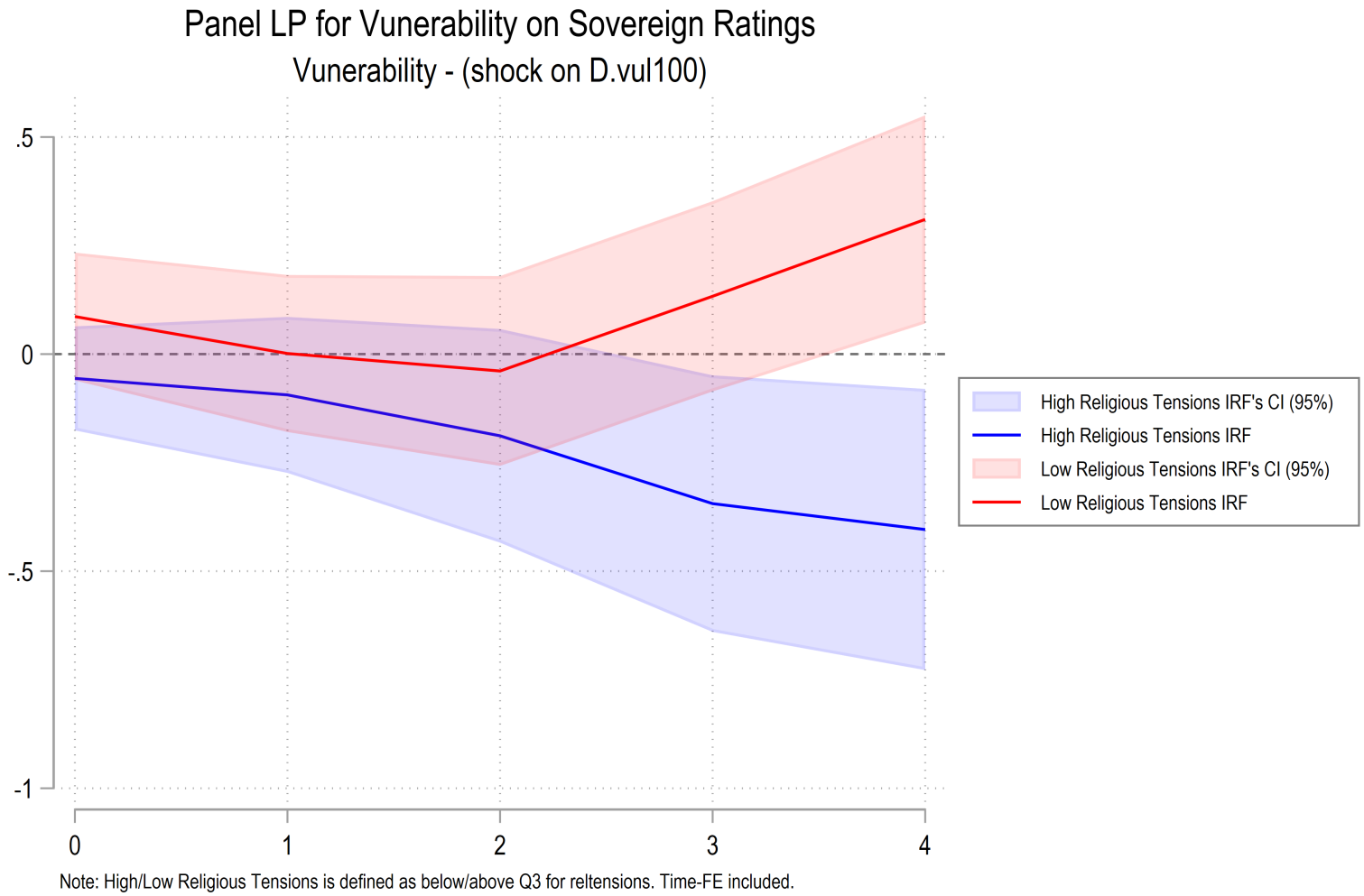
Figure 16. Variation of the vulnerability score (shock on Δ***VUL***)



Note: authors' calculations.

Results: Robustness with the variation of the vulnerability scores

Figure 17. Variation of the vulnerability score (shock on Δ***VUL***)



Note: authors' calculations.

Final thoughts

Key takeaways

- Negative spillovers of exposure to climate change on fiscal space are most pronounced for economies most vulnerable to climate change
- Effects are mitigated in countries with more stable political environments and better developed financial markets
- Religious tensions are the most impactful form of political instability
- While fiscal consolidation is the key to mitigating the adverse effect of climate risks on fiscal space, our results suggest that both political stability and financial development can contribute as well