BACKGROUND NOTE 7

Vulnerability to Climate Risk-induced Poverty in El Salvador June 2024

Abstract

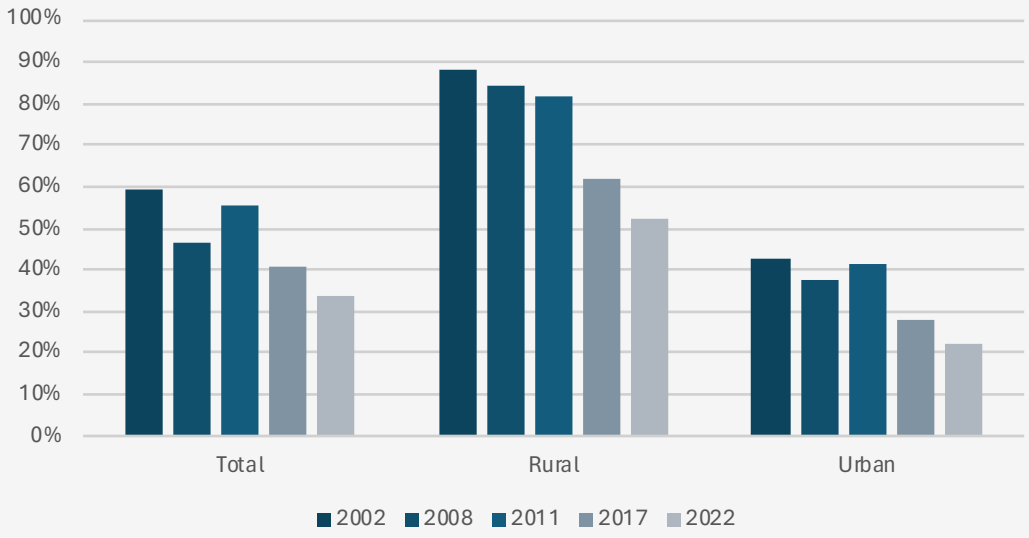
This note measures vulnerability to poverty in El Salvador based on the approach proposed in De l a Fuente and Serio (2024). Results show that around 34 percent of households are vulnerable to poverty, that is, there are not poor, but they are exposed to hazard events that could affect human beings, their livelihoods and assets, and lead them to fall into poverty. The results provide a comprehensive and new perspective on the challenges faced by households in El Salvador, especially those that are more likely to be poor either because of their expected level of income or because of the risks to which they are exposed.

JEL Classification: Q54, I32, D1

Keywords: Vulnerability, Risks, Natural disasters, Poverty

The vulnerability to poverty in El Salvador has declined over the years. In 2002, the rate was 59 percent. In 2022, it was 34 percent, showing that initially, more than half of the households were vulnerable to poverty either by the expected mean—poverty induced (PI)—or by the expected variance—risk induced (RI). This declined to one-third in 2022. The vulnerability is higher in rural areas than in urban areas. In rural areas, more than half of the households are vulnerable to poverty, while in urban areas, 22 percent of households are vulnerable to poverty.

FIGURE 7.1. HOUSEHOLD VULNERABILITY TO POVERTY

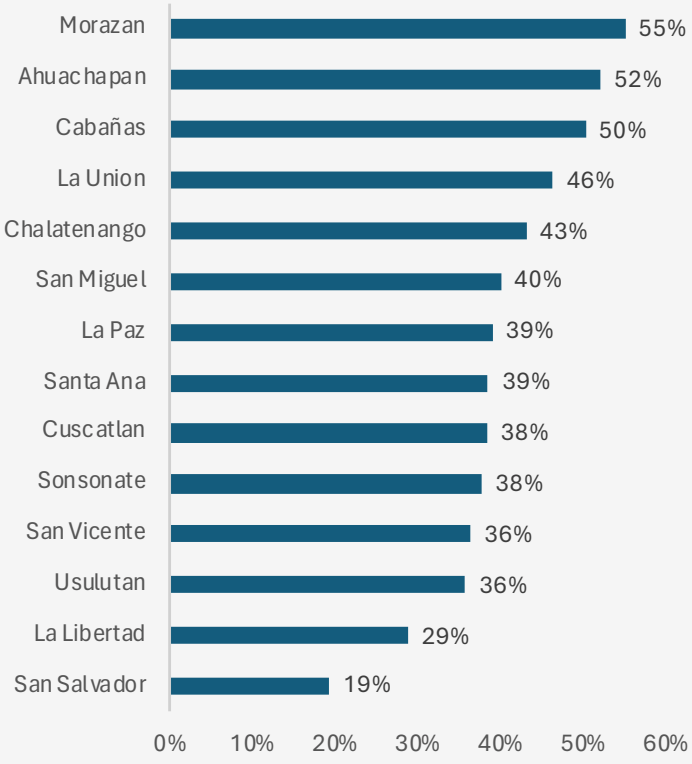


Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

1. Oficina Nacional de Estadística y Censos (ONEC, 2023a).

The vulnerability to poverty varies significantly across departments, as Figure 7.2 displays. Morazan, Ahuachapan, and Cabañas have more than half of their households classified as vulnerable. In contrast, San Salvador has a vulnerability to poverty rate of 19 percent, and La Libertad has a rate of 29 percent. The remaining departments present rates between 36 percent and 46 percent.

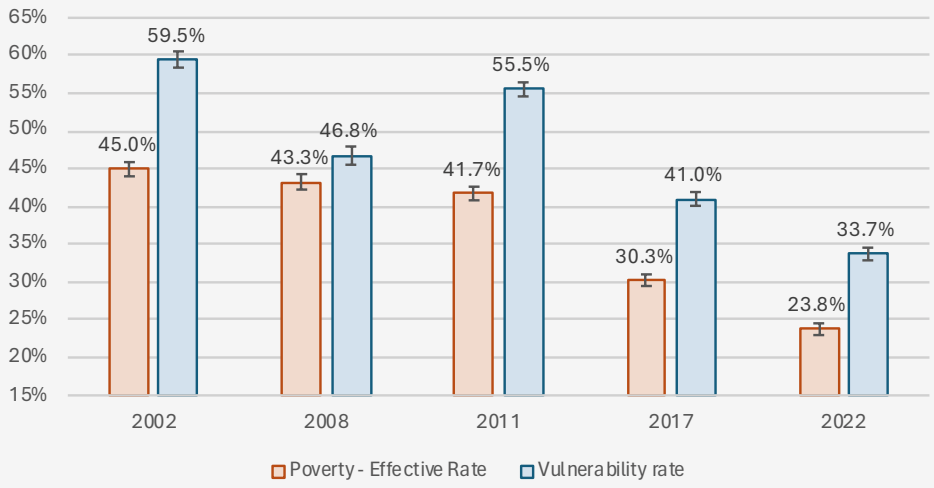
FIGURE 7.2. HOUSEHOLD VULNERABILITY TO POVERTY BY DEPARTMENT FOR 2022



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

Figure 3 illustrates the differences between the incidence of household poverty and vulnerability to poverty under the model. The vulnerability to poverty incidence surpasses the poverty estimates, with 2002 and 2011 exhibiting the most substantial difference, approaching 14 percentage points, followed by 2017 and 2022 with a difference of 10 percentage points. Table 7C.2 presents the estimated poverty rates from the model estimation, which are also lower than the vulnerability to poverty rates. The model is good enough to predict effective poverty. The correlation between the predicted probability of being poor and the effective poverty status is consistent with studies which find a correlation of 0.870 for 104 developing countries, and which estimate a correlation of 0.428 for Latin America and the Caribbean countries, between the predicted probability of being poor and the effective poverty status when income or consumption equations are used.

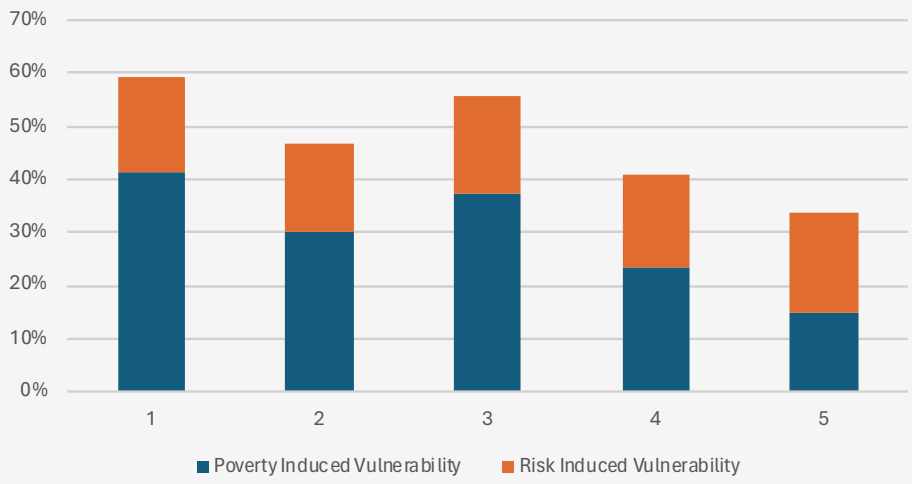
FIGURE 7.3. POVERTY AND VULNERABILITY TO POVERTY RATES



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

When estimating PI and RI household vulnerability, we observe that at the beginning of the period, there was a high percentage of PI households. PI households are mainly pushed into poverty because their expected income is below the poverty line. However, in 2022, the percentage of RI households became higher than that of PI households. Over the past few years, the share of RI households has not declined compared to the share of PI households. These households have an estimated expected income above the poverty line, but the estimated expected variance in their income is so high that it increases their likelihood of falling into poverty.

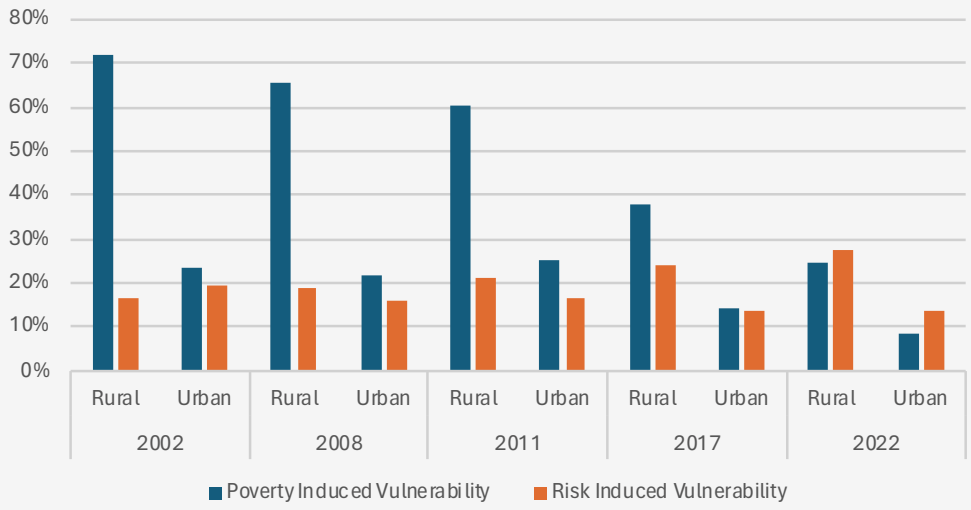
FIGURE 7.4. VULNERABILITY TO POVERTY RISK AND POVERTY INDUCED



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

The RI is an issue especially in rural areas in recent years. It is known that people in rural areas rely heavily on income from agriculture and natural ecosystems. As a result, they are susceptible to diverse idiosyncratic shocks such as job loss or covariate shocks such as natural disasters like floods or droughts which affect crop yields as well as the overall health of ecosystems.

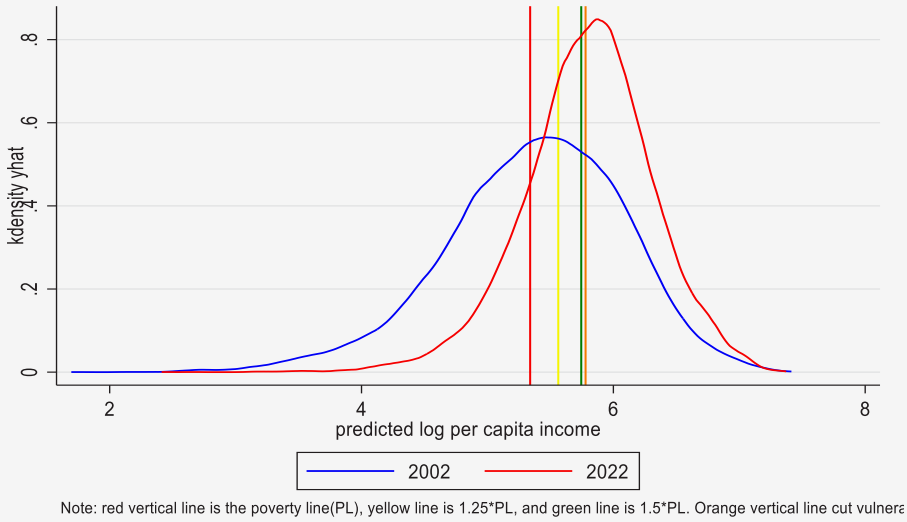
FIGURE 7.5. HOUSEHOLD VULNERABILITY TO POVERTY RISK AND POVERTY INDUCED BY AREA



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

Figure 7.6 shows the changes in the income distribution between 2002 and 2022. The red line indicates the poverty line of US$6.85 per day. Those below this line are PI (their estimated expected mean is lower than the poverty line). We can see that the income density has shrunk in 2022, showing lower PI. Meanwhile, the RI (between red and orange lines) does not show a decreasing pattern. Figure 7C.1 shows the income densities for each year of the period in more detail.

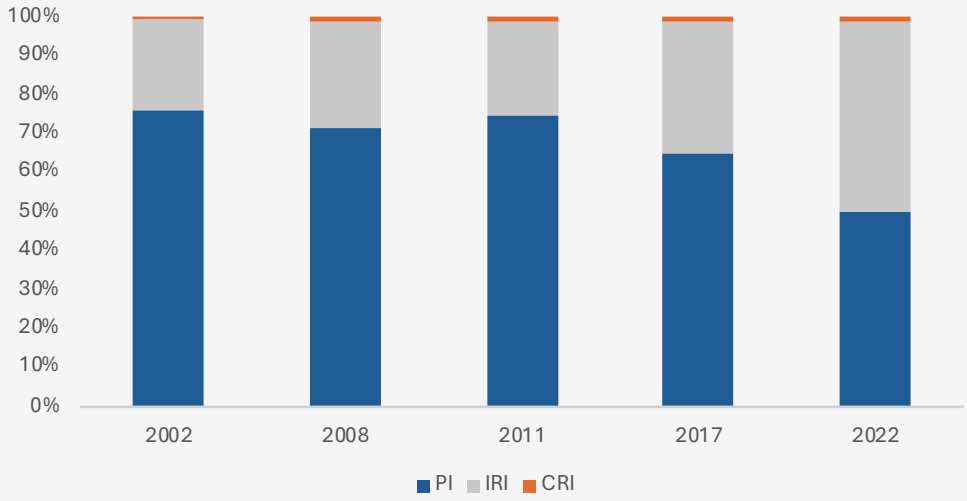
FIGURE 7.6. INCOME DENSITIES IN 2002 AND 2022



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

According to estimates, in 2022 approximately 50 percent of people vulnerable to poverty are PI and 50 percent are RI. However, out of the total RI, almost all are idiosyncratic risk induced (IRI, including covariance effects) and less than 5 percent are covariate risk induced (CRI). These percentages correspond to 1.32 million individuals PI, 1.28 million individuals IRI, and 0.035 million CRI, resulting in a total of 2.64 million vulnerable people.

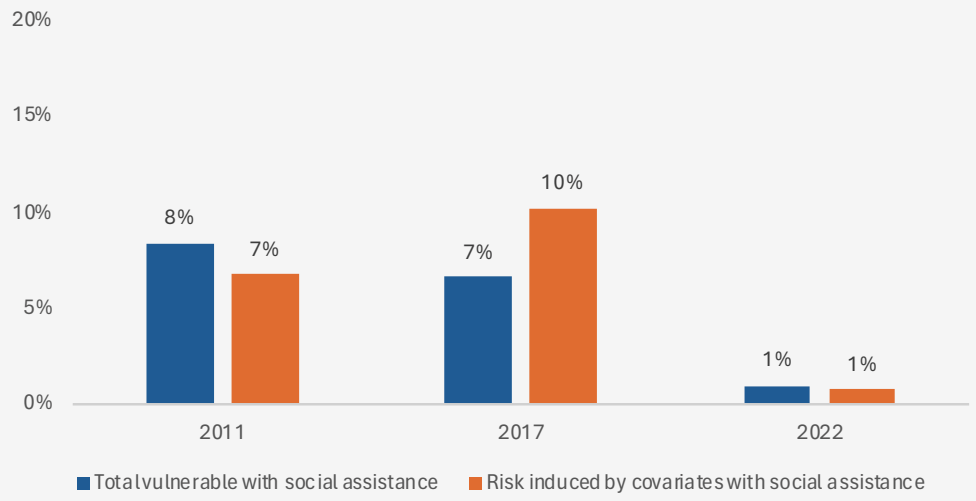
FIGURE 7.7. VULNERABILITY PEOPLE BY SOURCES



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

Social assistance is a crucial policy instrument that can provide a safety net for the most vulnerable. To determine whether social assistance is reaching vulnerable households, it is essential to understand the reach of the policy instruments that are already in place. Figure 7.8 shows that in 2011 around 8–7 percent of total vulnerable people and CRI vulnerable individuals reported at least one member of their household being a beneficiary of a social assistance program. In 2017, these percentages were 7 and 10 percent, respectively. However, in 2022 less than 1 percent of vulnerable people reported having social assistance.

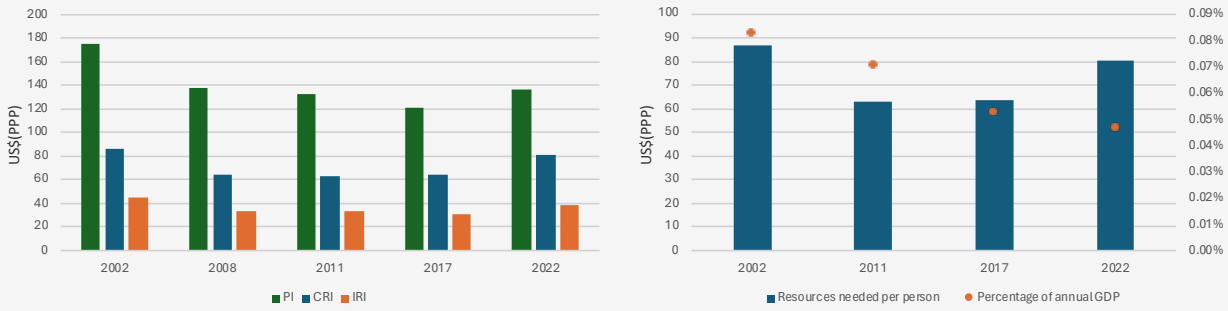
FIGURE 7.8. VULNERABLE PEOPLE WITH SOCIAL ASSISTANCE



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

It is helpful to simulate the minimum resources required to overcome vulnerability to poverty. We can do this by analyzing how much each person's income needs to increase to reduce the probability of vulnerability to less than 0.29, based on the estimated mean and variance of income from the model. The average difference in income needed per person in 2022 is around 137 (PPP constant international $) for those mainly PI, 81 for CRI, and 39 for IRI. Moving out of vulnerability is more difficult for CRI than IRI due to a higher income requirement per person. IRI leads more people to vulnerability to poverty than CRI (see Figure 7.7), but the effort in terms of income is higher among CRI individuals, representing annually 0.05 percent of the country's GDP.

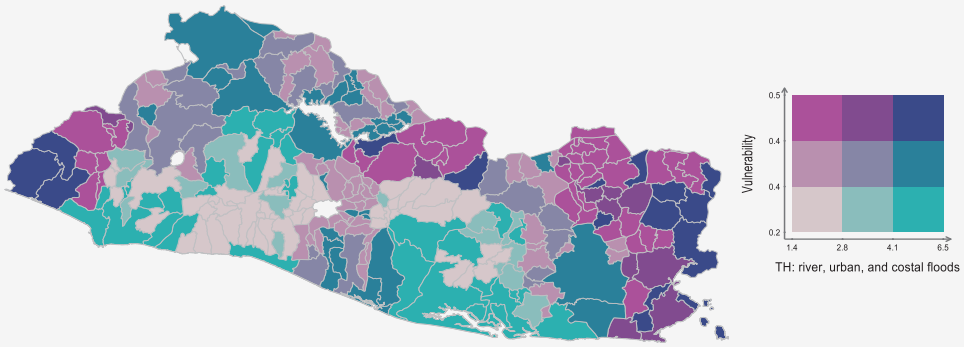
FIGURE 7.9. RESOURCES NEEDED TO NOT BE VULNERABLE



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.
Note: Average difference of income per person needed to reach a probability of 0.29 and not be considered vulnerable. GDP, PPP constant 2021 international $.

More specifically, the data suggest that the potential damages from floods in El Salvador are highly granular, indicating the need for specific assessments for each district (see Figure 7B.2). Figure 7.10 shows that some provinces, such as Ahuachapan and La Union, have a high incidence of vulnerability to poverty, and some of their districts present a high potential damage from floods, while others show less potential damage from the ThinkHazard index.

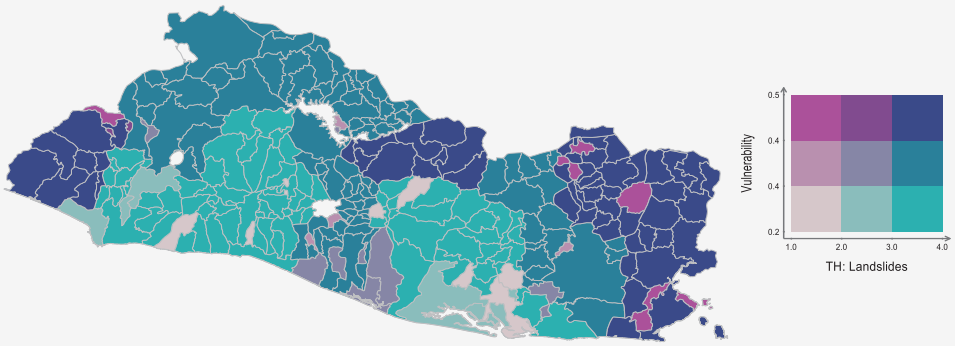
FIGURE 7.10. VULNERABILITY AND FLOOD HAZARD



Source: Based on model estimations and ThinkHazard! index.
Note: Higher values on the y-axis correspond to higher percentage of household vulnerability, and larger values on the x-axis indicate higher potential damage from floods.

In the case of landslides, the north of the country with fewer cultivated areas presents a high potential for damage (Figure 7B.2). The departments of Cabañas, Morazan, and La Union stand out for their high vulnerability to poverty and potential for damage. Additionally, certain districts in the coastal region, particularly in less vulnerable departments like La Libertad, show high potential for damage from landslides.

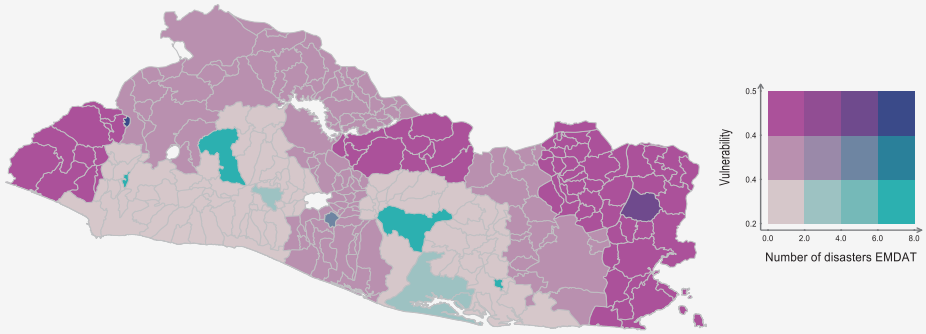
FIGURE 7.11. VULNERABILITY AND LANDSLIDE HAZARD



Source: Based on model estimations and ThinkHazard! index.
Note: Higher values on the y-axis correspond to higher percentage of household vulnerability, and on the x-axis, the value 1 represents very low, 2 low, 3 medium, and 4 high potential damage from landslides.

There is high heterogeneity between vulnerability to poverty and the number of disasters that occurred over the years considered in the model. The district Santa Rosa de Lima in the department of La Union with high department vulnerability indicates five disasters in the EMDAT database. Moreover, the district El Refugio in the department of Ahuachapan indicates seven disasters in the EMDAT database.

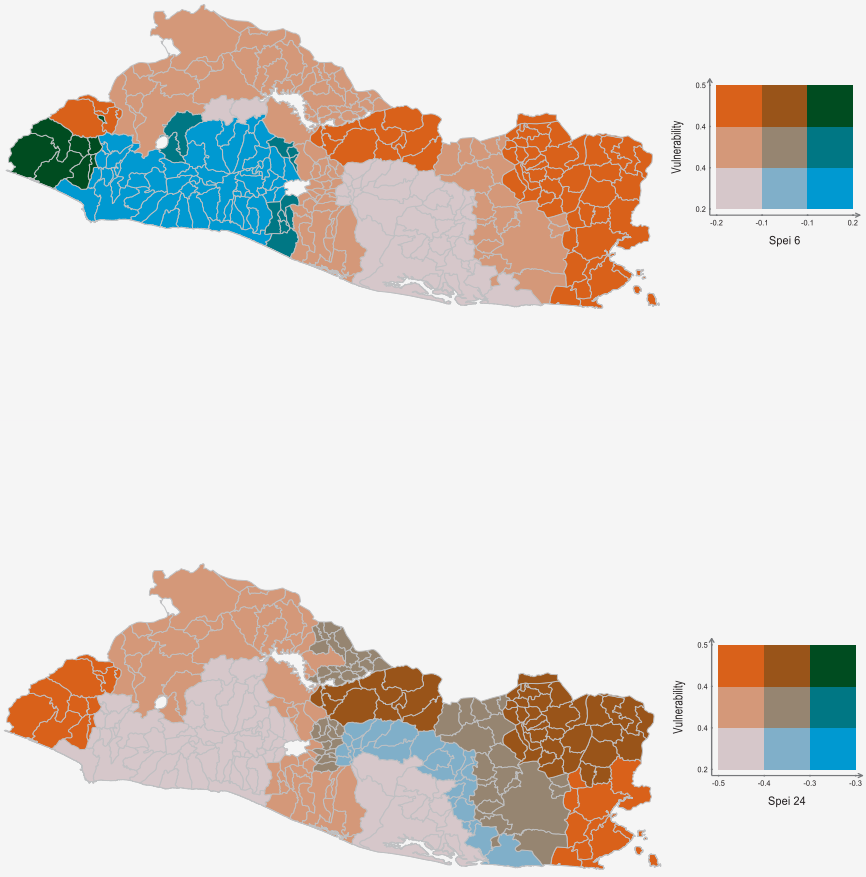
FIGURE 7.12. VULNERABILITY AND NUMBER OF DISASTERS



Source: Based on model estimations and EMDAT disasters reported.

Even though El Salvador does not experience severe or moderate dryness as indicated by the SPEI with negative values below –1, it has shifted from being wetter to experiencing milder drought over the years. With the exception of 2002, when severe drought affected several departments, there was an increase in dry conditions in recent years in 2017 and 2022. The eastern departments of the country are more affected by SPEI dryness on a short scale and have high vulnerability. Meanwhile, the western departments of the country would face greater challenges due to dryness in the longer term associated with variations in reservoir storage and groundwater storage.

FIGURE 7.13. VULNERABILITY AND DROUGHT INDEX



Source: Based on model estimations and SPEI.
Note: orange areas (larger negative values) show more dryness than blue areas.

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Appendix A:

Databases and variables

TABLE 7A.1. DATABASES AND INFORMATION FOR VARIABLES OF MODEL EQUATIONS

Database	Source	Years	Individual-level income equation (X)	Community-level income equation (Z, C)	Community-level risk equation (N)
Household survey - EHPM	SEDLAC	2002, 2008, 2011, 2017, 2022	At household: X	At ADM 1: Z	
Hazards (floods [river, urban, and coastal], landslides, cyclones, wildfires, extreme temperature)	ThinkHazard!	Modeled			At ADM 2: TH index
Disaster occurrences (floods, landslides, droughts, cyclones, wildfires)	EMDAT	2001, 2002, 2007, 2008, 2010, 2011, 2016, 2017, 2021, 2022			At ADM 2: number of occurrences in current survey year, number of occurrences in previous survey year
Drought	SPEI Vicente et al. (2010, 2023)	2001, 2002, 2007, 2008, 2010, 2011, 2016, 2017, 2021, 2023			At ADM 2: SPEI scales 6 and 24 of current survey year and previous year
Climate change	CCKP	Historical		At ADM 1: C which includes temperature trend difference (trend 2000–2020 versus trend 1940–2020), number of extreme aggregated accumulated precipitation in mm events in 1901–2021	

TABLE 7A.2. VARIABLES USED TO ESTIMATE MODEL EQUATIONS

Table 7A.2. Variables used to estimate model equations

Income community-level covariates (Z, C)	1) proportion of HHs engaged in agriculture in the state, 2) state's employment rate, 3) state's unemployment rate, 4) share of self-employed and entrepreneurs in the state, 5) share of the population with at least secondary education in the state, 6) population density (urban dummy), 7) temperature trend index in the state, 8) number of precipitation outlier events (high-low) in the state
Individual and HH characteristics at the HH level (X)	1) HH head salaried, 2) informal employment, 3) dependency, 4) HH principal income from agriculture, 5) dwelling with low-quality materials, 6) dwelling has toilet facilities linked to the sewer, 7) dwelling has access to electricity, 8) dwelling has access to water, 9) overcrowding, 10) HH has a car, 11) HH has a fridge, 12) HH has a computer, 13) HH has a washing machine, 14) number of HH members, 15) HH head age, 16) age squared, 17) HH head sex, 18) HH head years of education completed
Slope variables	1) Individual with a principal income from agriculture, 2) dwelling has toilet facilities linked to the sewer, 3) dwelling has access to electricity, 4) dwelling has access to water
Risk community-level covariates (N)	1) TH floods (river, urban, and coastal weighted index) at ADM 2, 2) TH landslides index at ADM 2, 3) EMDAT floods in the survey year at ADM2, 4) EMDAT cyclones in the survey year at ADM2, 5) EMDAT floods lag one year at ADM2, 6) EMDAT cyclones lag one year at ADM2,7) SPEI-6 at ADM 2 (in the survey year and lag one year), 8) SPEI-6 squared at ADM 2 (in the survey year and lag one year), 9) SPEI-24 at ADM 2 (in the survey year and lag one year), 10) SPEI-24 squared at ADM 2 (in the survey year and lag one year)

Note: HH = Household.

Appendix B:

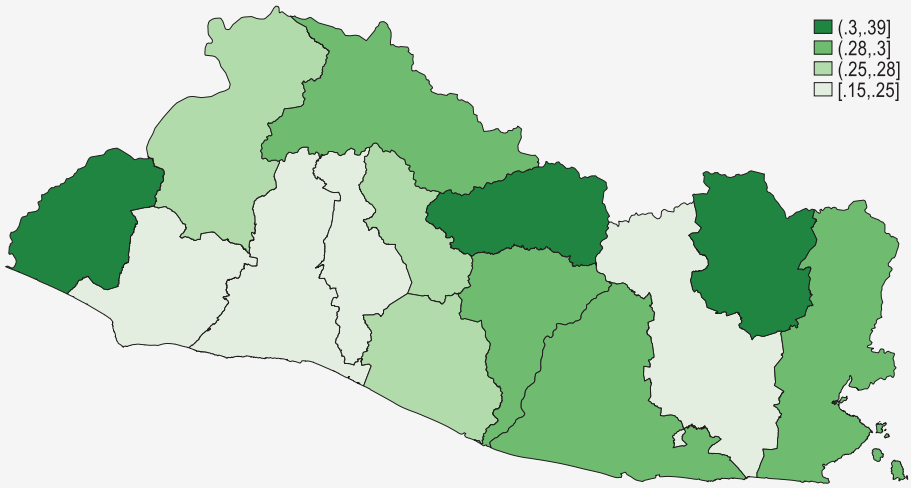
Overview

TABLE 7B.1. MONETARY POVERTY RATES USING A POVERTY LINE OF US$6.85 PER DAY (%)

Poverty rate	2002	2008	2011	2017	2022
Household poverty	45.0	43.3	41.7	30.3	23.8
Individual poverty	52.4	50.9	50.0	36.3	27.5

Source: SEDLAC.

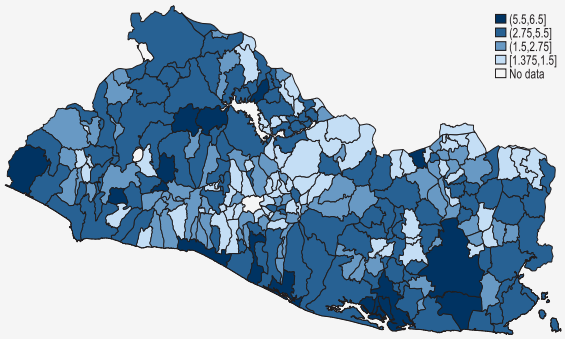
FIGURE 7B.1. MONETARY HOUSEHOLD POVERTY INCIDENCE (US$6.85 PER DAY) IN 2022



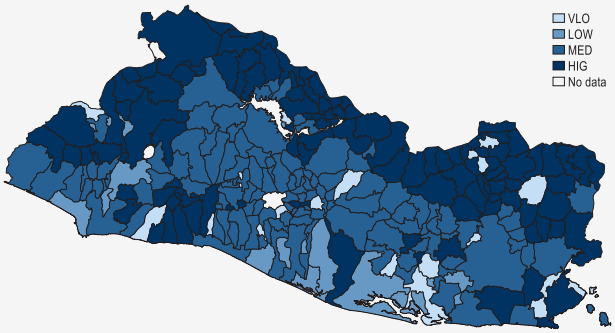
Source: SEDLAC.

FIGURE 7B.2. THINKHAZARD INDEX FOR FLOODS AND LANDSLIDES

(a) TH river, urban and coastal floods

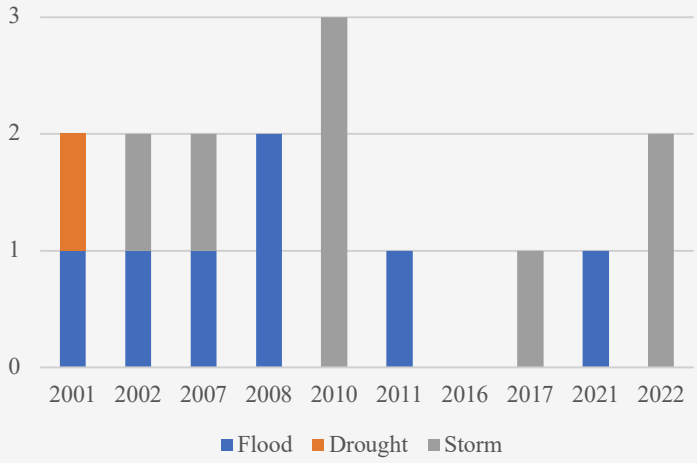


(b) TH landslides



Source: ThinkHazard!

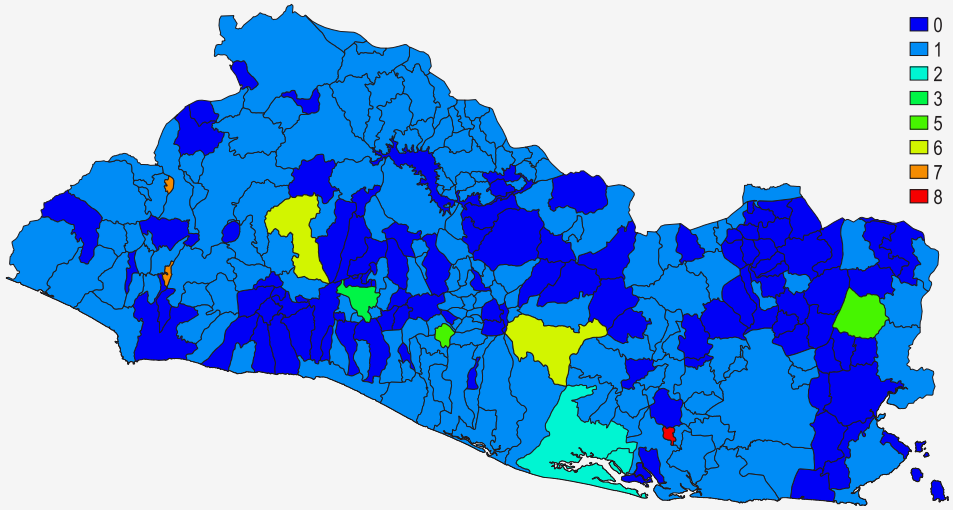
FIGURE 7B.3. NUMBER OF DISASTERS OCCURRED DURING PERIOD



	Flood	Drought	Storm	Total
2001	1	1		2
2002	1		1	2
2007	1		1	2
2008	2			2
2010			3	3
2011	1			1
2016				0
2017			1	1
2021	1			1
2022			2	2
Total	7	1	8	16

Source: EMDAT.
Note: Hurricane in 2002 named Isidore, in 2007 Hurricane Felix, in 2010 Hurricane Agatha, Tropical Storm 'Alex', and Tropical Storm Matthew. In 2017, Hurricane 'Nate' and in 2022 Tropical Storm 'Bonnie' and Hurricane Julia.

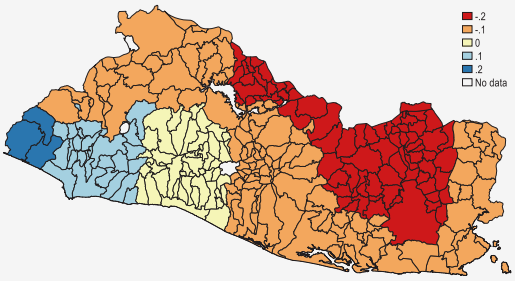
FIGURE 7B.4. NUMBER OF DISASTERS OCCURRED BY DISTRICT OVER TOTAL YEARS



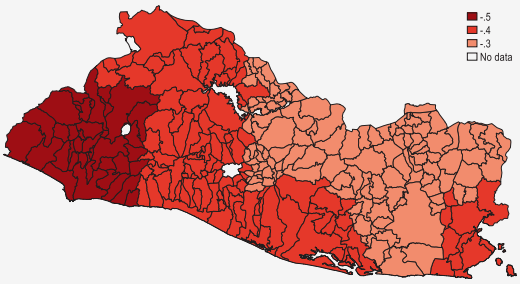
Source: EMDAT.

FIGURE 7B.5. DROUGHT INDEX USING SPEI BY DISTRICTS

(a) Scale 6

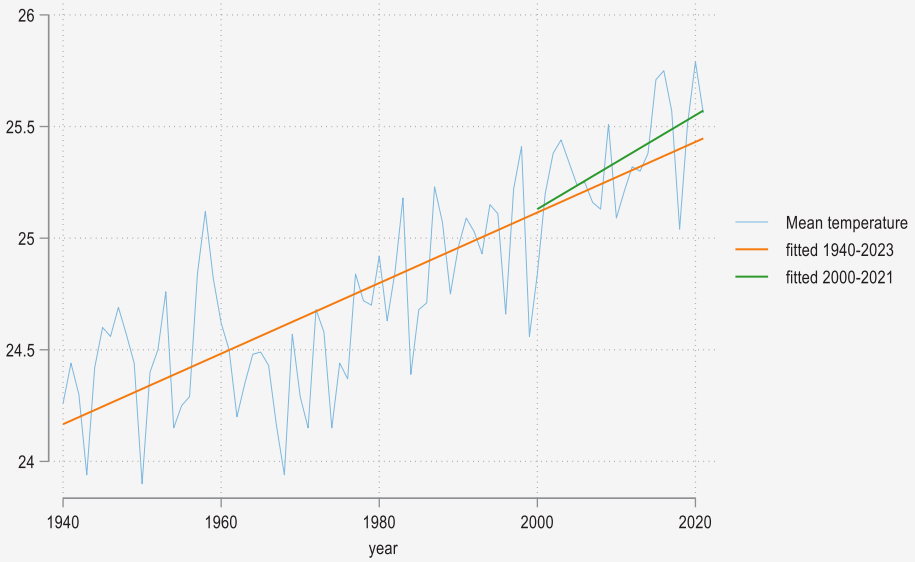


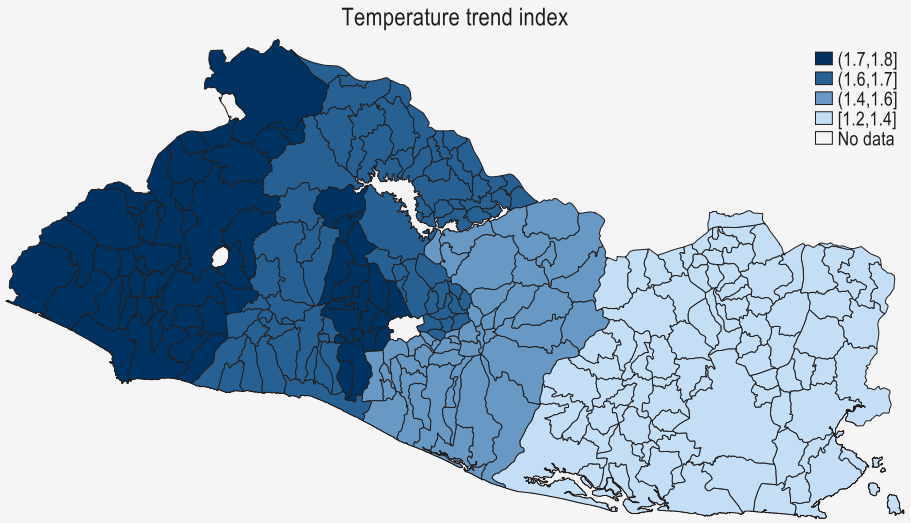
(b) Scale 24



Source: SPEI.
Note: Negative values show dryness and positve wetness.

FIGURE 7B.6. TEMPERATURE TRENDS AND TEMPERATURE TREND INDEX





Source: CCKP.

Appendix C:

Vulnerability to poverty results

TABLE 7C.1. VULNERABILITY TO POVERTY IN EL SALVADOR

Year	Region	Vulnerability to poverty rate (%)	PI vulnerability (%)	RI vulnerability (%)
2002	Total	59	41	17
	Rural	88	72	15
	Urban	43	24	18
	1. Occidental	74	56	17
	2. Central I	73	49	23
	3. Central II	78	59	18
	4. Oriental	76	57	17
	5. Area Metropolitana de San Salvador	31	15	15
2008	Total	47	30	11
	Rural	85	65	8
	Urban	38	22	12
	1. Occidental	62	46	12
	2. Central I	59	36	10
	3. Central II	69	50	8
	4. Oriental	54	37	7
	5. Area Metropolitana de San Salvador	30	15	14
2011	Total	56	37	18
	Rural	82	61	21
	Urban	41	25	16
	1. Occidental	64	46	18
	2. Central I	64	43	21
	3. Central II	68	47	21
	4. Oriental	69	47	21
	5. Area Metropolitana de San Salvador	29	17	13
2017	Total	41	22	17
	Rural	62	36	23
	Urban	28	14	13
	1. Occidental	51	29	21
	2. Central I	46	22	20
	3. Central II	50	27	19
	4. Oriental	51	30	19
	5. Area Metropolitana de San Salvador	19	10	9
2022	Total	34	15	19
	Rural	53	25	28
	Urban	22	9	14
	1. Occidental	42	19	22
	2. Central I	35	14	21
	3. Central II	41	18	23
	4. Oriental	42	20	22
	5. Area Metropolitana de San Salvador	16	6	10

Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

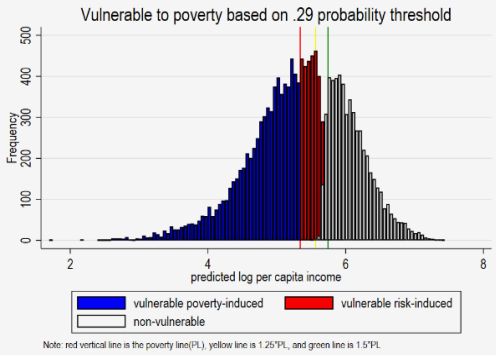
TABLE 7C.2. EFFECTIVE POVERTY, ESTIMATED POVERTY, AND VULNERABILITY TO POVERTY IN EL SALVADOR (%)

Year	Poverty - Effective rate	Lower bound	Upper bound	Poverty - Estimated rate	Lower bound	Upper bound	Vulnerability rate	Lower bound	Upper bound
2002	45.0	44.0	45.9	39.0	38.1	40.0	59.5	58.4	60.6
2008	43.3	42.3	44.3	20.0	19.2	20.8	46.8	45.5	48.0
2011	41.7	40.8	42.6	37.4	36.5	38.2	55.5	54.6	56.5
2017	30.3	29.5	31.0	23.5	22.7	24.2	41.0	40.1	41.9
2022	23.8	23.0	24.5	14.7	14.1	15.3	33.7	32.9	34.6

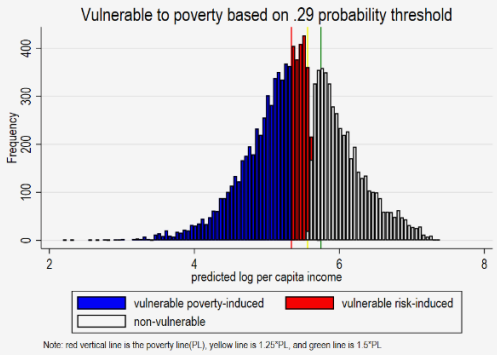
Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

FIGURE 7C.1. INCOME DENSITIES

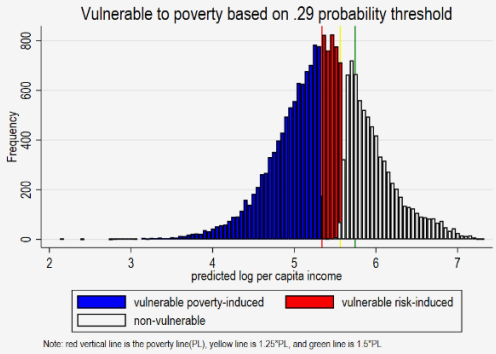
(a) 2002



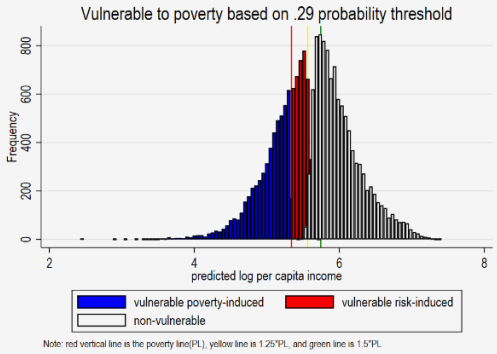
(a) 2008



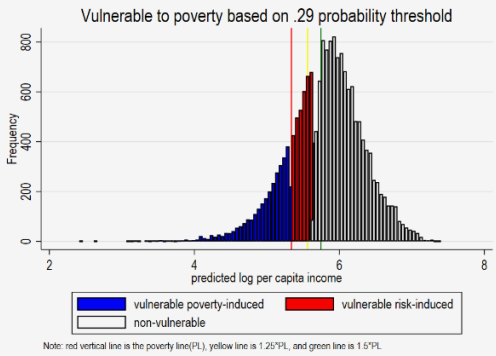
(a) 2011



(a) 2017



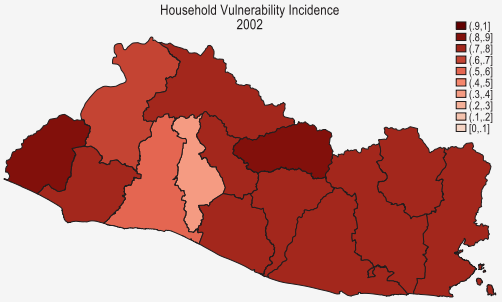
(a) 2022



Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, and CCKP information.

FIGURE 7C.2. HOUSEHOLD VULNERABILITY TO POVERTY IN MAPEL SALVADOR (%)

(a) 2002



(b) 2022

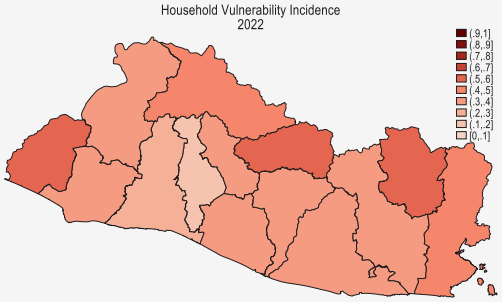


TABLE 7C.3. RESOURCES NEEDED TO LEAVE VULNERABILITY TO POVERTY

Years	CRI	IRI	PI	Total	CRI % of GDP	Total vulnerability % of GDP
	(1)	(2)	(3)	(4)		
2002	87	45	175	135	0.08	15.73
2008	64	34	138	102	n.a.	n.a.
2011	63	33	132	100	0.07	9.54
2017	64	31	121	83	0.05	5.41
2022	81	39	137	83	0.05	4.06

Source: Based on model estimations from SEDLAC, ThinkHazard, EMDAT, SPEI, CCKP, and World Development Indicators (WDI) information.
Note: Average income difference per person to reach a probability equal to 0.29 and not be considered as vulnerable to poverty among the CRI, IRI, PI, all vulnerable (total) population.