# Welfare Effect of Catastrophic Out-of-pocket Health Spending in Nigeria:
## Do Remittances Play a Moderating Role?
### Evidence from the Nigeria General Household Survey – Panel (Wave 5)

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[1]Disclaimer

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# The Problem & Motivation

- Health shocks are a major driver of poverty and vulnerability in Nigeria.
  - 56% in extreme poverty (World Bank, 2024)
  - 90% employment in the informal sector

- **Catastrophic Out-of-Pocket (OOP) Spending:**
  - Health expenditures $> 40\%$ of non-food consumption.
  - Forces households to sacrifice essentials (food, education), creating poverty traps.

- **The Research Gap:**
  - Can informal safety nets, like **remittances**, buffer these shocks?
  - Most studies focus only on international remittances, overlooking domestic flows.

- **This Study Asks:** Do domestic and international remittances moderate the poverty impact of catastrophic health spending?

# What is Catastrophic Health Spending?
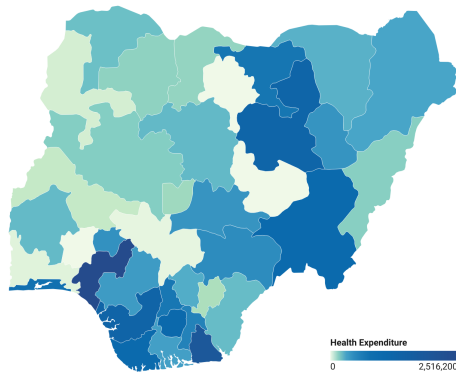
## Definition

OOP health spending that exceeds a substantial share of a household's capacity to pay.

**Common Thresholds:**

- $\geq 10\%$ of **total** household consumption
- $\geq 20\%$ of **total** household consumption
- $\geq 40\%$ of **non**-food household consumption

  **(Threshold used in this study)**



**Health Expenditure in Nigeria**

Health Expenditure
0 — 2,516,200

Source: Nigeria General Household Survey-Panel (GHS-Panel), Wave 5 (2023/2024) • Created with Datawrapper

## Research Objectives

This study seeks to:

1. Estimate the incidence of catastrophic OOP health spending in Nigeria.

2. Analyse its welfare effect (proxied by the probability of falling into poverty).

3. Determine if **domestic remittances** (monetary and in-kind) moderate this adverse effect.

4. Determine if **international remittances** (monetary and in-kind) moderate this adverse effect.

# Setup of the Problem

This study models household behaviour under the dual influence of:

- Catastrophic out-of-pocket (OOP) spending shocks
- Remittance inflows

Households are assumed to maximise their expected intertemporal utility from consumption while facing:

- Income shocks
- Accessing informal risk-sharing mechanisms (remittances)

$$\text{Catastrophic OOP} = \begin{cases} 1, & \text{if } \dfrac{\text{OOP}}{E_{nf}} > \tau \text{ or } \dfrac{\text{OOP}}{E_{tot}} > \tau \\ 0, & \text{otherwise} \end{cases}$$

$\text{OOP} = \text{Out-of-Pocket health expenditure}$

where:
$E_{nf} = \text{Non-food expenditure}$

$E_{tot} = \text{Total expenditure}$

$\tau \in \{0.10, 0.20, 0.40\} = \text{threshold proportion}$

## Utility Function

We assume a standard CRRA utility function:

$$U(C_t) = \frac{C_t^{1-\sigma}}{1-\sigma}, \quad \sigma \neq 1$$

- $C_t$ is household consumption at time $t$
- $\sigma$ is the coefficient of relative risk aversion

At each time $t$, the household faces
Budget Constraint:

$$C_t + S_t = Y_t + R_t + A_t$$

where:

- $C_t$: consumption
- $S_t$: catastrophic OOP shock
- $Y_t$: labour income or earnings
- $R_t$: remittance inflow
- $A_t$: asset drawdown or borrowing

Assume no capital accumulation, so $A_t$ is fixed or exogenous.

## Static Optimization

The household chooses $\{C_t\}_{t=0}^{T}$ to maximize:

$$\sum_{t=0}^{T} \beta^t \frac{C_t^{1-\sigma}}{1-\sigma}$$

subject to:

$$C_t = Y_t + R_t + A_t - S_t$$

Recursively, substituting the constraint into the objective function yields:

$$\sum_{t=0}^{T} \beta^t \frac{(Y_t + R_t + A_t - S_t)^{1-\sigma}}{1-\sigma}$$

## First-Order Conditions

If we're looking at a static case (i.e., one period), the FOC is:

Recall that $C_t = Y_t + R_t + A_t - S_t$

$$\frac{\partial U}{\partial C_t} = C_t^{-\sigma}$$

$$\frac{\partial U}{\partial S_t} = -(Y_t + R_t + A_t - S_t)^{-\sigma}$$

$$\frac{\partial U}{\partial S_t} = \frac{\partial U}{\partial C_t} \cdot \frac{\partial C_t}{\partial S_t} = -C_t^{-\sigma}$$

$$\frac{\partial U}{\partial R_t} = \frac{\partial U}{\partial C_t} \cdot \frac{\partial C_t}{\partial R_t} = C_t^{-\sigma} > 0$$

# Marginal Effects

**Marginal effect of OOP shocks:**

$$\frac{\partial U}{\partial S_t} = -C_t^{-\sigma}$$

- A rise in out-of-pocket spending lowers utility
- The effect is stronger when consumption is already low

**Marginal effect of remittances:**

$$\frac{\partial U}{\partial R_t} = C_t^{-\sigma} > 0$$

- An increase in remittances raises utility
- Acts as a buffer against welfare loss

# Inter temporal Problem

If savings are allowed, households maximize:

$$\sum_{t=0}^{T} \beta^t \frac{C_t^{1-\sigma}}{1-\sigma}$$

subject to:

$$A_{t+1} = (1+r)(A_t + Y_t + R_t - S_t - C_t)$$

Assets tomorrow depend on today's net income (including remittances $R_t$, out-of-pocket shocks $S_t$, current income $Y_t$), and saving or borrowing.

The Euler equation:

$$C_t^{-\sigma} = \beta(1+r)E_t[C_{t+1}^{-\sigma}]$$

**Implication:** Remittances serve as a consumption buffer against shocks.

# Intertemporal Budget Constraint

Households save/borrow via a one-period bond:

$$A_{t+1} = (1+r)(A_t + Y_t + R_t - S_t - C_t)$$

or equivalently:

$$C_t + A_{t+1} = (1+r)(A_t + Y_t + R_t - S_t)$$

Lagrangian:

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[ \frac{C_t^{1-\sigma}}{1-\sigma} + \lambda_t \left( (1+r)(A_t + Y_t + R_t - S_t) - C_t - A_{t+1} \right) \right]$$

# Deriving the Euler Equation

$$\text{FOC w.r.t } C_t: \quad \beta^t C_t^{-\sigma} - \lambda_t = 0 \Rightarrow \lambda_t = \beta^t C_t^{-\sigma}$$

$$\text{FOC w.r.t } A_{t+1}: \quad -\lambda_t + \lambda_{t+1}(1+r) = 0 \Rightarrow \lambda_t = \lambda_{t+1}(1+r)$$

Combining FOCs:

$$\beta^t C_t^{-\sigma} = (1+r)\beta^{t+1} C_{t+1}^{-\sigma}$$

Dividing by $\beta^t$:

$$C_t^{-\sigma} = \beta(1+r) C_{t+1}^{-\sigma}$$

Euler Equation:

$$\frac{C_{t+1}}{C_t} = [\beta(1+r)]^{1/\sigma}$$

# Interpretation of the Euler Equation

$$\frac{C_{t+1}}{C_t} = [\beta(1+r)]^{1/\sigma}$$

- If $\beta(1+r) > 1$: Future consumption preferred $\Rightarrow C_{t+1} > C_t$
- If $\beta(1+r) < 1$: Current consumption preferred $\Rightarrow C_{t+1} < C_t$
- Sensitivity depends on $\sigma$: higher $\sigma$ means greater reluctance to shift consumption over time

## Key Insight

Remittances help smooth consumption over time, reducing the welfare impact of catastrophic health expenditures.

# Optimization Summary

- Households face trade-offs between consumption, shocks, and remittances
- CRRA utility captures risk aversion behavior
- Remittances act as insurance against health shocks
- Euler equation shows how households allocate consumption over time
- Policy implications: Remittances can enhance household resilience to health shocks

# Data & Methodology at a Glance

## Data Source

Nigeria General Household Survey (GHS)-Panel 2023/2024 (Wave 5)

- **Sample:** $\approx$ 4,715 households
- **Representative:** Nationally representative

## Empirical Strategy

- **Dependent Variable:** *Poverty Status* (1 if below poverty line, 0 otherwise)
- **Core Variables:**
  - Catastrophic Spending Dummy (40% threshold)
  - Remittance Dummies (Domestic/International; Cash/In-Kind)
  - Interaction Terms (Remittances $\times$ Catastrophic Spending)
- **Models: Logit and Probit** (Average Marginal Effects reported)

## Table 1: Intensity of Catastrophic Out-of-pocket spending using multiple thresholds

| | 10% threshold (for total household expenditure) | | 20% threshold (for total household expenditure) | | 40% threshold (for non-food expenditure) | |
|---|---|---|---|---|---|---|
| | Headcount | Percent of sample | Headcount | Percent of sample | Headcount | Percent of sample |
| Exposed | 27 | 0.6 | 10 | 0.2 | 167 | 3.7 |
| Not exposed | 3,803 | 99.4 | 4,758 | 99.8 | 4,329 | 96.3 |

## Table 2: Cross-tabulation of Poverty Status, Catastrophic OOP Health Spending, and Remittances

| Key Indicators | | Poor | Non-poor | Total |
|---|---|---|---|---|
| Catastrophic OOP health spending | Exposed | 99 | 68 | 167 |
| | Not exposed | 3,003 | 1,325 | 4,328 |
| International Remittances (Monetary) | Recipient | 60 | 114 | 174 |
| | Non-recipient | 2,709 | 1,147 | 3,856 |
| International Remittances (In-kind) | Recipient | 20 | 29 | 49 |
| | Non-recipient | 2,749 | 1,232 | 3,981 |
| Domestic Remittances (Monetary) | Recipient | 634 | 392 | 1,026 |
| | Non-recipient | 2,135 | 869 | 3,004 |
| Domestic Remittances (In-kind) | Recipient | 355 | 239 | 594 |
| | Non-recipient | 2,414 | 1,022 | 3,436 |

Source: Author's compilation from Nigeria's GHS 2023/2024

# Empirical Results

## Regression Result

Table: Logit and Probit Models for the Impact of Catastrophic OOP Health Spending and Remittances on Poverty (Average Marginal Estimates)

| | Logit | | | | Probit | | | |
|---|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| **VARIABLES** | poor | | | | | | | |
| urban_dummy | -0.189*** (0.014) | -0.195*** (0.014) | -0.195*** (0.014) | -0.196*** (0.014) | -0.193*** (0.014) | -0.198*** (0.014) | -0.198*** (0.014) | -0.199*** (0.014) |
| south_east | -0.020 (0.022) | -0.017 (0.022) | -0.016 (0.022) | -0.015 (0.022) | -0.021 (0.023) | -0.017 (0.023) | -0.016 (0.023) | -0.015 (0.023) |
| north_east | 0.115*** (0.027) | 0.126*** (0.028) | 0.126*** (0.028) | 0.128*** (0.028) | 0.104*** (0.026) | 0.116*** (0.026) | 0.115*** (0.026) | 0.117*** (0.026) |
| south_south | -0.124*** (0.022) | -0.120*** (0.022) | -0.120*** (0.022) | -0.119*** (0.022) | -0.127*** (0.022) | -0.123*** (0.022) | -0.122*** (0.022) | -0.122*** (0.022) |
| north_central | -0.041* (0.022) | -0.034 (0.022) | -0.036 (0.022) | -0.033 (0.022) | -0.041* (0.022) | -0.034 (0.022) | -0.036 (0.022) | -0.034 (0.022) |
| north_west | 0.033 (0.025) | 0.044* (0.025) | 0.043* (0.025) | 0.046* (0.025) | 0.029 (0.025) | 0.040 (0.025) | 0.039 (0.025) | 0.042* (0.025) |
| lhhsize | 0.199*** (0.009) | 0.199*** (0.010) | 0.200*** (0.010) | 0.198*** (0.010) | 0.199*** (0.010) | 0.199*** (0.010) | 0.201*** (0.010) | 0.198*** (0.010) |
| Cf_hs | 0.044 (0.305) | 0.210 (0.133) | -0.036 (0.449) | 0.061 (0.158) | 0.027 (0.325) | 0.200 (0.134) | -0.072 (0.456) | 0.059 (0.156) |
| Cf_size | -0.069 (0.049) | -0.050 (0.052) | -0.071 (0.050) | -0.072 (0.052) | -0.065 (0.049) | -0.048 (0.052) | -0.067 (0.049) | -0.068 (0.051) |
| rem_m_ab | 0.144*** (0.029) | | | | 0.148*** (0.030) | | | |
| m_ab_cf | -0.002 (0.154) | | | | 0.004 (0.165) | | | |
| rem_k_ab | | 0.139* (0.060) | | | | 0.135** (0.061) | | |
| m_k_cf | | 0.039 (0.226) | | | | 0.056 (0.230) | | |
| rem_m_dm | | | 0.021 (0.016) | | | | 0.022 (0.016) | |
| m_dm_cf | | | -0.115 (0.078) | | | | -0.111 (0.078) | |
| rem_k_dm | | | | 0.036* (0.020) | | | | 0.036* (0.019) |
| k_dm_cf | | | | -0.009 (0.089) | | | | -0.011 (0.087) |

*Note:* Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Different remittance proxies used: international monetary remittances (Models 1,5), international in-kind (Models 2,6), domestic monetary (Models 3,7), and domestic in-kind (Models 4,8). South West is the reference category. Source: Authors' computation.

# Summary from Regression Analysis

- Urban residence consistently reduces poverty across all models
- Regional effects vary significantly:
  - North East has higher poverty rates
  - South South has lower poverty rates
- Larger household size increases poverty probability
- Remittances show mixed effects:
  - International monetary remittances increase poverty (counterintuitive)
  - International in-kind and domestic remittances have smaller effects
- Catastrophic health spending variables (Cf_hs, Cf_size) are generally not statistically significant

# Key Finding 1: Poverty is Widespread and Rising

## Our Estimate

National Poverty Headcount Ratio: **69.6%**

- A significant increase from 40.1% (NLSS 2018/2019).

## Spatial Disparities are Stark

|  | Poverty Rate (%) |
| --- | --- |
| **National** | 69.6 |
| **By Settlement** | |
|   - Urban | 38.6 |
|   - Rural | 69.3 |
| **By Zone** | |
|   - North Central (Highest) | 71.8 |
|   - South West (Lowest) | 67.1 |

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[2]The GHS-Panel ($\approx$ 4,750 households) has a smaller sample and a shorter consumption module, The NLSS ($\approx$ 22,000 households) is the nationally representative survey used for Nigeria's official poverty estimates (40.1% in 2018/19).

# Key Finding 2: Catastrophic Spending is Less Prevalent but Severe

### Incidence of Catastrophic OOP Health Spending

| Threshold | Headcount | Percent of Sample |
|---|---|---|
| $\geq$ 10% of total expenditure | 27 | 0.6% |
| $\geq$ 20% of total expenditure | 10 | 0.2% |
| $\geq$ 40% of non-food expenditure | 167 | **3.7%** |

While less prevalent than some past estimates (e.g., 5.1% in 2018/19), for the **3.7%** of households affected, the financial burden is extreme and potentially crippling.

# Key Finding 3: The Remittance-Poverty Paradox (Descriptive)

**Cross-tabulation Insights:**

- Households with catastrophic spending are **more likely to be poor**.
- Remittance-receiving households have **lower poverty rates** than non-recipients.
- **BUT:** A significant number of remittance recipients are *still* poor and experience catastrophic spending.

### Interpretation

Remittances are **targeted at poorer households** (they need it), but are **not sufficient** to fully insure them against major health shocks. They are a symptom of vulnerability, not a cure.

**What significantly drives poverty?**

- ✓ **Larger Household Size:** Strong, significant positive effect.
- ✓ **Rural Location:** Strong, significant negative effect on welfare.
- ✓ **Region:** Significant disparities (e.g., N. East worse off than S. West).

**What doesn't?**

- ✗ **Catastrophic Spending Alone:** Not statistically significant *after controlling for other factors*.
- ✗ **Most Remittance Interactions:** Not statistically significant.

## The Paradox Confirmed

The positive sign on remittance variables confirms they are **received by poorer households**, not that they cause poverty. They correlate with vulnerability.

# Key Finding 5: The Nuance - Domestic vs. International

Despite statistical insignificance, the **direction** of interaction effects tells a story.

### Domestic Remittances

- Show a **negative** interaction effect.
- Suggests a potential buffering effect.

### International Remittances

- Show a **positive or near-zero** interaction effect.
- Suggests no buffering effect.

**Why?** Proximity, frequency, cultural obligations, and timeliness likely make domestic transfers a more responsive, though still limited, cushion against shocks.

# Policy Implications

**Remittances don't eliminate poverty, but they cushion households from falling deeper into it when health crises strike!**

- Urbanization may help reduce poverty, but careful planning needed
- Regional targeting of poverty programs is essential
- Household size management through family planning could help
- Remittance channels matter - need to understand why some increase poverty
- Health shock mitigation requires more than just remittances
- Social safety nets needed to complement remittances
- Remittances act more as an **ex-post symptom of vulnerability** than an **ex-ante insurance mechanism** against health-shock-induced poverty.
- Their power is limited by: Usage for basic consumption, not investment/insurance.

# Informal safety nets are insufficient.
# Formal mechanisms are critical!

1. **Expand Health Insurance Coverage:** Drastically scale up programs like NHIA to reduce OOP spending at the point of care.

2. **Targeted Social Protection:** Design cash transfer programs for households vulnerable to health shocks.

3. **Leverage Remittances:** Policies could reduce transfer costs and encourage channeling remittances into health insurance premiums or health savings accounts.

**This is essential for achieving SDG 1 (Poverty) and SDG 3.8 (UHC).**

# Thank You!

Questions?