École nationale de la statistique et de l'analyse économique pierre Ndiaye

Porverty and inequalities

Evaluating the impact of cash transfer policies on poverty and inequality: A simulation using EHCVM 2018 data

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Introduction and Policy Descriptions

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1.1 Introduction

Addressing poverty and inequality remains a major challenge for many developing countries, including Senegal. In recent years, direct cash transfer programs have emerged as a promising approach to improving the living conditions of the most vulnerable populations. These programs offer a flexible and effective means of social protection by providing immediate financial support and fostering long-term socioeconomic inclusion.

This project explores the potential impact of various cash transfer policy scenarios on poverty and inequality in Senegal, using data from the 2018 Harmonized Survey on Household Living Conditions (EHCVM). The objective is to simulate and compare the outcomes of multiple intervention strategies designed to target different segments of the population, with particular attention to cost-effectiveness and social equity.

To reflect the projected socioeconomic landscape of 2023, the original 2018 data are adjusted through a process known as data aging. This includes updating demographic figures, adjusting for economic growth, and incorporating inflationary trends. Following these adjustments, key indicators such as the Foster-Greer-Thorbecke (FGT) poverty indices and the Gini coefficient are recalculated under each policy scenario.

The analysis also considers geographic disparities by disaggregating results between urban and rural households.

1.2 Policy Descriptions

1.2.1 Overview of Policy Scenarios

This study examines a series of simulated cash transfer policies aimed at reducing poverty and inequality in Senegal. The scenarios vary in their targeting strategies, ranging from universal coverage to more focused interventions aimed at specific vulnerable groups.

Table 1.1: *Summary of the eight simulated cash transfer scenarios, including their targeting criteria and intended beneficiary groups.*

Scenario	Description
Universal Transfer	All households receive an annual transfer of 100,000 CFA francs, regardless of demographic or geographic characteristics.
Rural Transfer	Only households located in rural areas receive the cash transfer.
Children under 2	Households with at least one child under the age of 2 benefit from the transfer.
Children under 2 (Rural)	A more targeted version where only rural households with a child under 2 receive the transfer.
Children under 5	Households with children under 5 years old are eligible for the benefit.
Children under 18	Expands eligibility to households with children under 18, increasing overall coverage.
Elderly Member	Households with at least one member aged 65 or older qualify for the transfer.
Disabled Member	Households including at least one person with a disability receive the benefit.

1.2.2 Financial Implications and Cost Analysis

Each cash transfer policy scenario is evaluated not only for its potential social benefits but also for its financial viability. The total cost of implementing each intervention is calculated in absolute monetary terms (in billion FCFA) and expressed as a percentage of Senegal's Gross Domestic Product (GDP) for the year 2023, estimated at **186,195 billion FCFA** according to the official national accounts published by National Agency of Statistics and Demography (ANSD), 2023.

Table 1.2: *Cost of Cash Transfer Scenarios in Billion FCFA and as a Share of GDP (2023)*

Scenario	Cost (Billion FCFA)	Cost (% of GDP)
Universal Transfer	206.58	1.11
Rural Only	96.15	0.52
Children under 2	79.17	0.43
Children under 2 in Rural Areas	45.83	0.25
Children under 5	132.56	0.71
Children under 18	182.66	0.98
Households with Elderly Person	61.84	0.33
Households with Disabled Member	49.47	0.27

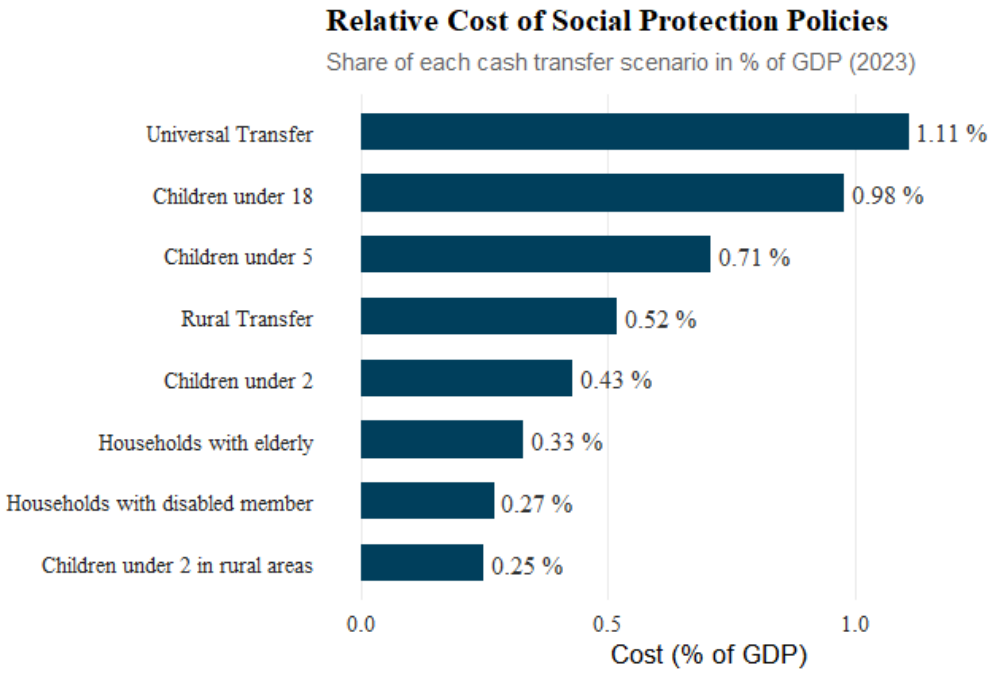


Figure 1.1: *Cost of social protection scenarios as a share of GDP.*

Tip

- The **Universal Transfer** scenario stands out as the most expensive, accounting for **206.6 billion FCFA**, or approximately 1.11% of GDP.
- More targeted interventions such as those focused on rural households, young children, or vulnerable groups entail substantially lower fiscal costs, ranging from **0.25% to 0.98%** of GDP.
- The **scenario : Children under 2 in rural areas** scenario stands out as the least expensive, accounting for **45.83 billion FCFA**, or approximately 0.25% of GDP

2 Methodology

2.1 Data Source

This analysis is based on the 2018 Harmonized Survey on Household Living Conditions (EHCVM) conducted in Senegal. The EHCVM provides nationally representative microdata on household expenditures, demographics, and welfare indicators, harmonized across WAEMU (West African Economic and Monetary Union) countries for cross-country comparability.
The following datasets are used:

- `ehcvm_welfare_SEN2018.dta`: Contains household-level data, including consumption and welfare metrics.
- `ehcvm_individu_SEN2018.dta`: Includes individual-level information on age, disability, and education critical for simulating targeted transfers.

> **Note**
>
> **Note on Macroeconomic and Demographic Data:**
> All key macroeconomic indicators (such as GDP per capita and inflation rates) and demographic estimates (including population growth) used to update and age the 2018 microdata to 2023 conditions are sourced from ANSD (National Agency of Statistics and Demography (ANSD), 2023). These official statistics ensure that data adjustments accurately reflect Senegal's economic and demographic evolution between 2018 and 2023.

2.2 Aging the Data to Reflect 2023 Conditions

To simulate the impact of cash transfer policies in 2023, the 2018 data were aged using updated macroeconomic indicators. This ensures the simulations account for demographic growth, economic expansion, and inflation.

Key Economic and Demographic Adjustments

Tip

Adjustment Rule: Adjustment were made using the standard growth formula:

$$\text{Value}_{2023} = (1 + \text{Growth Rate}) \times \text{Value}_{2018}$$

Table 2.1: *Growth of GDP per capita and total population between 2018 and 2023.*

Indicator	2018	2023	Growth Rate
GDP per capita (FCFA)	816,480	1,027,176	25.8%
Population	15,726,037	18,126,390	15.3%

Poverty Line Inflation Adjustment To update the national poverty threshold, we apply a cumulative inflation factor:

$$\text{Inflation Adjustment Factor} = \prod_{t=2018}^{2023} (1 + i_t) = 1.235 \quad \Rightarrow \quad z_{2023} = z_{2018} \times 1.235$$

Table 2.2: *Annual inflation rates and corresponding inflation factors from 2018 to 2023.*

Year	2018	2019	2020	2021	2022	2023
Inflation rate (i_t)	0.005	0.010	0.025	0.022	0.097	0.059
Inflation factor $(1 + i_t)$	1.005	1.010	1.025	1.022	1.097	1.059

Overview of Adjusted Variables

- **Household Weights (`hhweight`):** Represent the expansion factor for national-level estimation. They were scaled by population growth (+15.3%) to account for demographic dynamics:

$$\texttt{hhweight}_{2023} = \texttt{hhweight}_{2018} \times 1.153$$

- **Poverty Threshold (`zref`):** Adjusted using the cumulative inflation factor (23.5%) to maintain real value comparability:

$$z_{2023} = z_{2018} \times 1.235$$

- **Per Capita Expenditure (`pcexp`):** A core welfare indicator reflecting household

well-being. It was increased proportionally to GDP per capita growth (+25.8%):

$$\texttt{pcexp}_{2023} = \texttt{pcexp}_{2018} \times 1.258$$

2.3 Simulating Cash Transfer Policies

To assess the poverty-reducing effects of redistributive policies, we simulate eight cash transfer scenarios using the updated 2023 dataset. Each scenario allocates an annual stipend of 100,000 FCFA to eligible households based on specific targeting criteria (e.g., households with children, elderly, or rural residents).

The cash transfer amount is integrated into household resources by adjusting per capita expenditure. This ensures comparability across households of different sizes and geographic contexts.

Note

Transfer Simulation Formula:

$$\texttt{pcexp}_{\text{scenario}} = \texttt{pcexp}_{2023} + \frac{100{,}000}{\texttt{hhsize} \times \texttt{CPI}_{\text{temporal}} \times \texttt{CPI}_{\text{spatial}}}$$

Where:

- `hhsize` denotes the number of individuals in the household.
- $\texttt{CPI}_{\texttt{temporal}}$ represents the temporal deflator, used to adjust for inflation over time (2018–2023).
- $\texttt{CPI}_{\texttt{spatial}}$ is the spatial deflator, used to correct for regional price disparities within Senegal.

This normalization ensures that transfer impacts are consistent in real terms across both time and space. After transfers are applied, the new per capita expenditure ($\texttt{pcexp}_{\texttt{scenario}}$) is used to recalculate poverty and inequality metrics, allowing us to evaluate the effectiveness and efficiency of each policy design.

2.4 Poverty and Inequality Indicators

We evaluate the outcomes using the Foster-Greer-Thorbecke (FGT) indices for poverty and the Gini coefficient for inequality.

Tip

FGT Indices:

$$P_\alpha = \frac{1}{N} \sum_{i=1}^{q} \left(\frac{z - pcexp}{z} \right)^\alpha$$

- P_0: Headcount Ratio – proportion of the population below the poverty line.
- P_1: Poverty Gap – average shortfall below the poverty line.
- P_2: Squared Gap – accounts for inequality among the poor.

Gini Index:

$$G = \frac{1}{2N^2\mu} \sum_{i=1}^{N} \sum_{j=1}^{N} |y_i - y_j|$$

2.5 Policy Efficiency Metric

To evaluate the cost-effectiveness of each cash transfer scenario, we compute the efficiency as the reduction in the poverty gap index P_1 per billion FCFA transferred. Formally:

$$\text{Efficiency}_s = \frac{\Delta P_{1,s}}{\text{Transfers}_s / 10^9}$$

where:

- $\Delta P_{1,s} = P_{1,\text{baseline}} - P_{1,s}$ is the reduction in the poverty gap under scenario s,
- Transfers_s is the total amount of cash transferred in scenario s (in FCFA).

This metric expresses the gain in poverty gap reduction per billion FCFA spent, allowing comparison of the relative efficiency of different targeting strategies.

3 Results

The analysis focuses on measuring the effectiveness of these scenarios in reducing poverty and inequality, and in doing so, it relies primarily on the Foster-Greer-Thorbecke (FGT) indicators (P0, P1, P2) and the Gini coefficient.

3.1 Baseline Poverty and Inequality in 2018 and 2023

Before evaluating the policy impacts, we first analyze the baseline levels of poverty and inequality in Senegal for the years 2018 and 2023.

Table 3.1: *Benchmark of poverty and inequality indicators before and after aging (national level)*

Indicator	Before aging (2018)**	After aging (2023)**	Published by ANSD (2018)*
Poverty headcount P0 (%)	37.7	36.3	37.8
Poverty gap P1 (%)	10.3	9.8	10.3
Poverty severity P2 (%)	3.9	3.7	3.9
Gini index	35.1	35.1	35.1

* ANSD – EHCVM Report 2018
** Author's calculations using aged 2023 dataset

Poverty in Senegal: A Slight Decline but Persistent Inequality: Between 2018 and 2023, Senegal saw a slight reduction in poverty. The **headcount ratio** (P_0) declined from **37.7%** to **36.3%**, meaning around 36 out of 100 individuals were poor in 2023. The **poverty gap** (P_1) fell from **10.3%** to **9.8%**, suggesting a small improvement in how close poor individuals are to the poverty line. Similarly, the **severity index** (P_2) dropped from **3.9%** to **3.7%**, reflecting slightly less inequality among the poor. However, the **Gini index** remained stable at **35.1**, indicating that income inequality did not improve despite poverty reductions.

Table 3.2: *Poverty and inequality indicators in 2023 by area of residence*

Indicator	National	Urban	Rural
Poverty headcount P0 (%)	36.3	18.27	52.15
Poverty gap P1 (%)	9.8	4.39	14.60
Poverty severity P2 (%)	3.7	1.57	5.59
Gini index	35.1	35.1	27.3

**Author's calculations using aged 2023 dataset

The results in Table 3.2 highlight stark disparities between urban and rural areas. In 2023, the rural poverty rate (52.15%) nearly three times higher than that observed in urban areas (18.27%). The poverty gap and severity indicators exhibit a similar pattern, underlining deeper and more chronic poverty in rural zones. Interestingly, inequality was more pronounced in urban areas, with a Gini index of 35.1 versus 27.3 in rural settings.

> **Tip**
>
> These figures illustrate the necessity of tailored policy interventions that account for spatial heterogeneity. A uniform approach may fail to address the specific vulnerabilities faced by rural populations.

3.2 Impact of Policy Scenarios on Poverty

This section evaluates the effect of the eight policy scenarios on poverty, both in terms of national averages and disaggregated results.

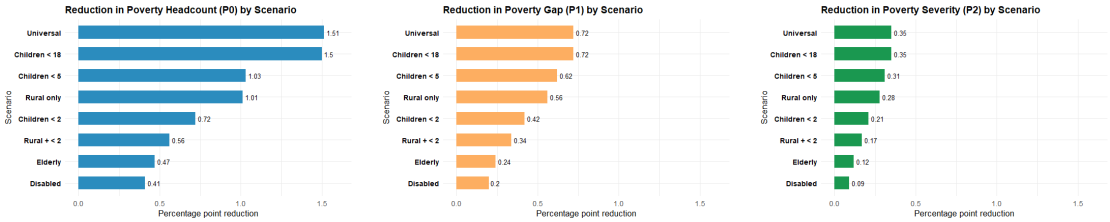
3.2.1 National Impact of Transfers on Poverty

Table 3.3: *Poverty Indicators by Scenario (2023) including Baseline*

Scenario	P0 (%)	P1 (%)	P2 (%)
Universal	34.78	9.10	3.35
Rural only	35.28	9.26	3.42
Children < 2	35.57	9.40	3.49
Rural + < 2	35.73	9.48	3.53
Children < 5	35.26	9.20	3.39
Children < 18	34.79	9.10	3.35
Elderly	35.82	9.58	3.58
Disabled	35.88	9.62	3.61
Baseline (2023)	**36.29**	**9.82**	**3.70**

Compared to the 2023 baseline (P0 = 36.29%), the Universal and Children < 18 scenarios reduce the poverty headcount by about 1.51 percentage points, bringing P0 down to 34.78% and 34.79%, respectively. They also achieve the largest improvements in

the poverty gap (P1), dropping it from 9.82% to 9.10%, and the severity index (P2) to 3.35%. In contrast, scenarios targeting the Elderly and Disabled show marginal effects, with P0 barely reduced (35.82% and 35.88%) and P1 still close to the baseline.



(a) *Reduction in P0* (b) *Reduction in P1* (c) *Reduction in P2*)

Figure 3.1: *Comparison of poverty reduction gains by scenario*

3.2.2 Poverty Reduction by Area (Urban vs. Rural)

Table 3.4: *FGT indicators by scenario and place of residence (2023)*

Scenario	P0 (%)		P1 (%)		P2 (%)	
	Urban	Rural	Urban	Rural	Urban	Rural
Baseline	18.27	52.15	4.39	14.60	1.57	5.59
Universal	17.20	50.26	4.05	13.54	1.41	5.05
Rural only	18.27	50.26	4.39	13.54	1.57	5.05
Children < 2	17.92	51.10	4.21	13.96	1.49	5.25
Rural $+ < 2$	18.27	51.10	4.39	13.96	1.57	5.25
Children < 5	17.52	50.88	4.11	13.67	1.44	5.10
Children < 18	17.20	50.27	4.05	13.55	1.41	5.05
Elderly	17.90	51.59	4.29	14.24	1.52	5.39
Disabled	18.10	51.54	4.29	14.31	1.52	5.44

Table 3.4 presents FGT poverty indicators — headcount ratio, poverty gap, and poverty severity — by transfer scenario and place of residence.

Note

- Poverty is consistently higher in rural areas across all scenarios and indicators.
- The **Universal** and **Children < 18** scenarios yield the largest reductions in the poverty gap and poverty severity, especially in rural settings.
- Under the **Universal** scenario, the rural poverty gap decreases from 14.60% to 13.54%, compared to a smaller decrease in urban areas.
- The **Children < 5** scenario also performs relatively well in both urban and rural areas, suggesting that targeting households with young children allows for reasonably efficient redistribution.

By contrast, the **Rural only** and **Rural + < 2** scenarios show significant gains in rural areas but no measurable change in urban zones. This outcome is consistent with their exclusive focus on rural households, leaving urban poverty unaffected.

> **Warning**
>
> The lack of impact in urban areas for the *Rural only* and *Rural + < 2* scenarios is expected, as transfers are strictly directed toward rural households. This underscores the role of geographic targeting in shaping poverty outcomes.

3.3 Impact of Policy Scenarios on Inequality

This section analyzes the extent to which each policy scenario affects income inequality, as measured by the Gini coefficient, both at the national level and disaggregated by place of residence (urban and rural).

3.3.1 Lorentz Curves by scenario

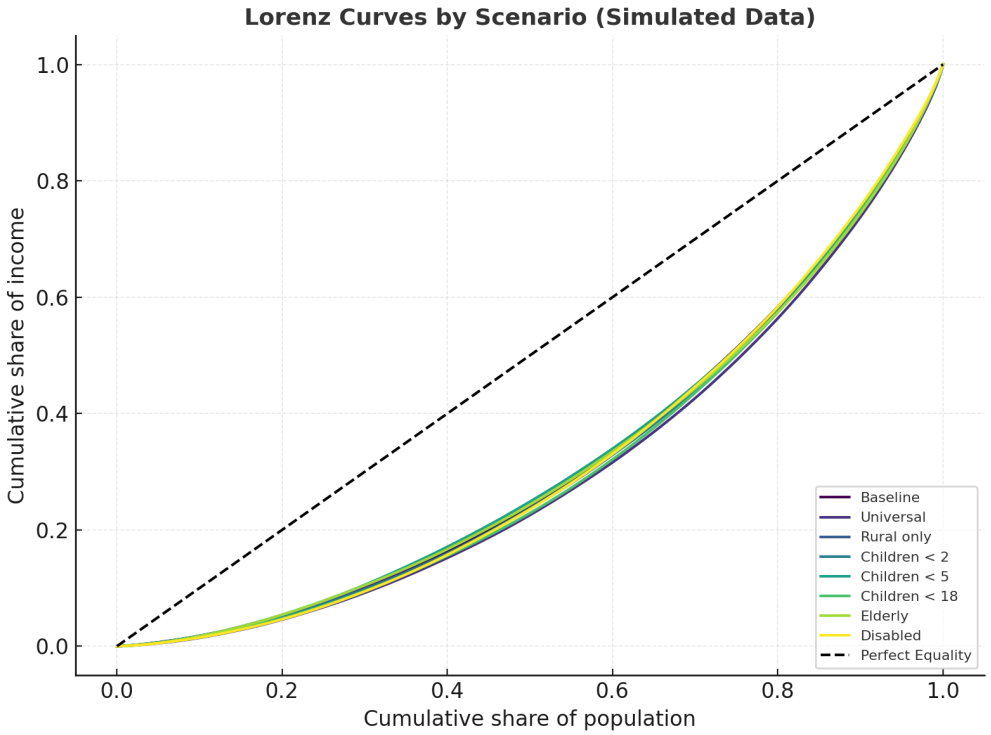


Figure 3.2: *Lorenz curves by policy scenario (national level)*

The Lorenz curves in Figure 3.2 illustrate the modest shifts in income distribution following the implementation of different policy scenarios. All scenarios yield minor reductions in inequality, as evidenced by slight upward shifts of the curves relative to the

baseline. The **Rural + < 2** scenario show the most notable improvements, although the overall effects on inequality remain limited.

3.3.2 Disaggregated Results by Urban and Rural Areas

Table 3.5: *Gini Index Before and After Transfers by Scenario*

Scenario	Urban Gini	Rural Gini	National
Baseline	0.3508	0.2727	0.3506
Universal	0.3486	0.2700	0.3474
Rural only	0.3508	0.2700	0.3468
Children < 2	0.3491	0.2697	0.3478
Rural + < 2	0.3508	0.2697	0.3482
Children < 5	0.3480	0.2689	0.3466
Children < 18	0.3476	0.2693	0.3465
Elderly	0.3500	0.2715	0.3493
Disabled	0.3500	0.2718	0.3495

Table 3.5 shows the Gini coefficients before and after transfers under each policy scenario. Overall, the changes in inequality are minimal in many cases, almost negligible.

> **Note**
>
> Nationally, even the most expansive scenarios, such as **Universal** and **Children < 18**, reduce the Gini index by only about 0.003 – 0.004 points. Slight improvements are also observed under the **Children < 5** and **Children < 2** scenarios. However, in both urban and rural areas, the differences compared to the baseline remain extremely small, often under 0.002.

> **Tip**
>
> These results suggest that while the simulated cash transfers reduce poverty levels, they fail to substantially impact inequality. The weak redistributive effect may be due to low transfer amounts or targeting strategies that do not significantly alter income distribution.

3.4 Efficiency Analysis and Scenario Classification

We assess the efficiency of each policy by calculating the gain in poverty gap P1 per billion FCFA spent.

Efficiency

$$\text{Efficiency}_s = \frac{\Delta P_{1,s}}{\text{Transfers}_s / 10^9}$$

where:

- $\Delta P_{1,s} = P_{1,\text{baseline}} - P_{1,s}$ is the reduction in the poverty gap under scenario s,
- Transfers_s is the total amount of cash transferred in scenario s (in FCFA).

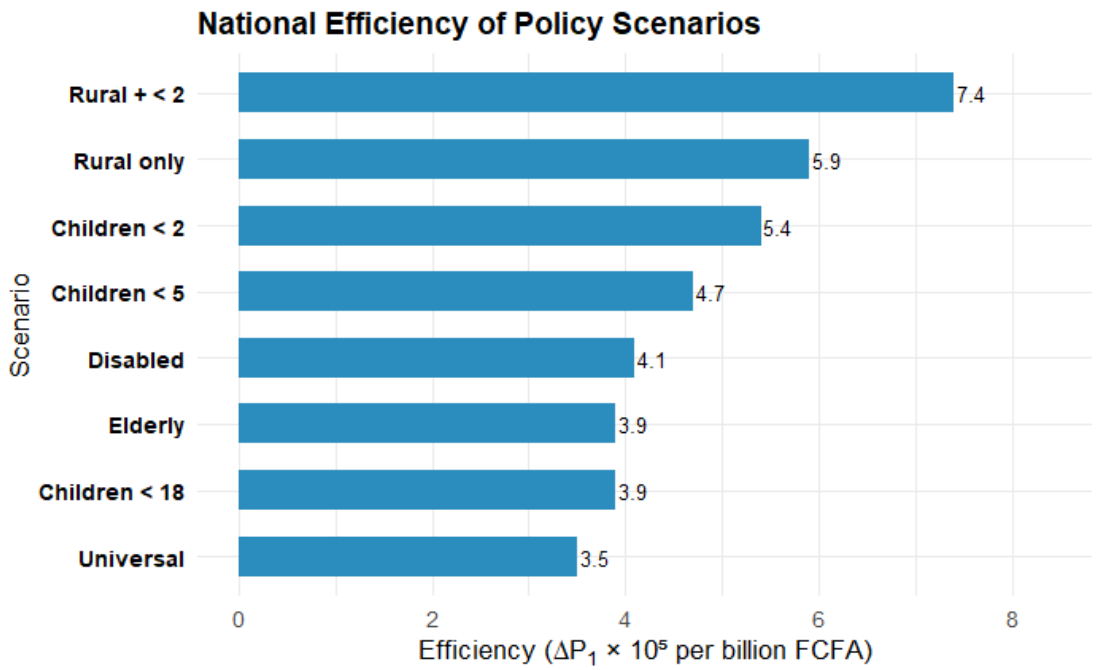


Figure 3.3: *National efficiency of policy scenarios: gain in poverty gap* (P_1) $\times 10^5$ *per billion FCFA transferred*

Table 3.6: *Efficiency of policy scenarios: gain in poverty gap* $(P1)$ $\times 10^5$ *per billion FCFA transferred*

Scenario	National	Urban	Rural
Universal	3.5	3.1	11.0
Rural only	5.9	—	11.0
Children < 2	5.4	5.4	14.0
Rural + < 2	7.4	—	14.0
Children < 5	4.7	4.6	12.8
Children < 18	3.9	3.7	11.5
Elderly	3.9	3.2	11.6
Disabled	4.1	4.0	11.8

Table 3.6 presents the efficiency of each policy scenario, measured as the gain in the poverty gap index (P1) per billion FCFA transferred, **scaled by a factor of** 10^5 to ease

interpretation. The findings reveal a significant disparity in cost-effectiveness across scenarios and residential areas.

Note

- **The most efficient scenario nationally is *Rural + < 2***, achieving a gain of 7.4 10^5 in the poverty gap index per billion FCFA transferred.
- **Universal transfers** are less efficient, with only 3.5 units gained nationally despite high coverage.
- **Efficiency is much higher in rural areas** across all scenarios, with targeted child transfers ($Children < 2$, $Children < 5$) reaching up to 14 units.
- **Elderly and Disabled** scenarios exhibit moderate national efficiency but may be justified by equity or vulnerability considerations.
- These results suggest that **prioritizing rural households with young children maximizes impact per franc spent**.

4

Policy Implications and Recommendations

The simulation results offer key insights into the design of targeted cash transfer programs. While all scenarios reduce poverty to some extent, differences in efficiency and equity suggest that some approaches deliver far greater impact per franc spent. The recommendations below are derived from both effectiveness and fiscal considerations.

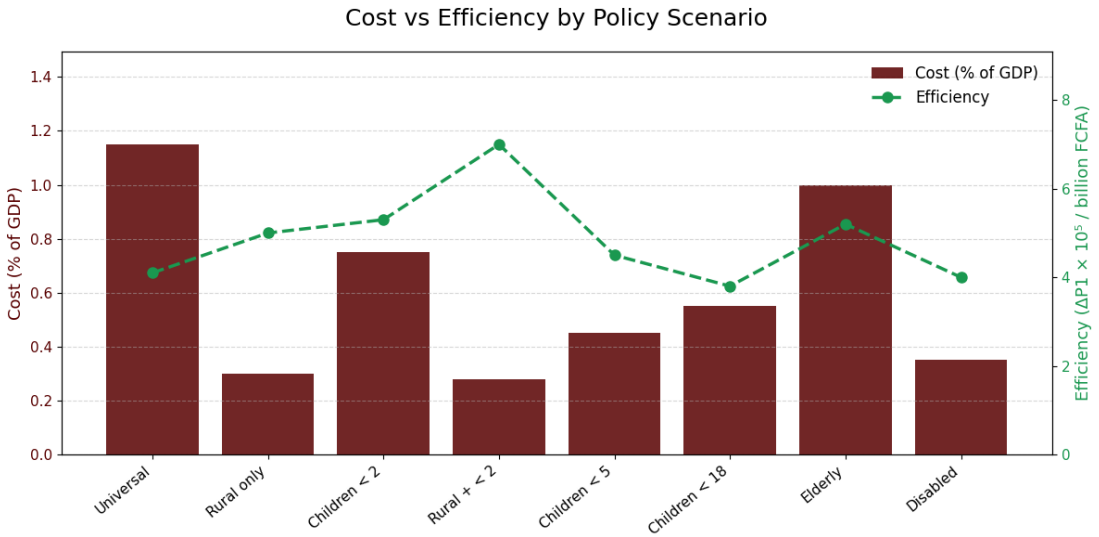


Figure 4.1: *Cost vs Efficiency by Policy Scenario. The blue bars represent the cost as a percentage of GDP, and the green dashed line represents the efficiency (ΔP1 × 10□ / billion FCFA) for each policy scenario.*

- **Prioritize rural targeting of young children**, especially under age 2, as these scenarios achieve the highest efficiency and impact.
- **Avoid universal transfers** when fiscal space is limited, due to their low efficiency despite wide coverage.
- **Integrate geographic and demographic targeting**, combining rural residency

with household characteristics to maximize poverty reduction.

- **Complement efficiency with equity considerations**, recognizing the social value of supporting vulnerable groups like the elderly or disabled even with lower cost-effectiveness.

Conclusion

This report has analyzed the fiscal and social implications of alternative cash transfer scenarios in the context of poverty reduction. Using simulated data, we evaluated eight distinct policy options, comparing their cost (as a percentage of GDP) and efficiency (poverty reduction per billion FCFA spent).

The results reveal stark contrasts between scenarios. While universal transfers reach the entire population, their relatively low efficiency makes them less desirable in resource-constrained settings. In contrast, targeted programs particularly those focused on rural areas and children under two demonstrate a far superior capacity to reduce poverty at a lower fiscal cost.

Our findings underscore the importance of combining demographic and geographic targeting to maximize the impact of limited fiscal resources. Policymakers are encouraged to prioritize interventions that not only yield high returns in poverty reduction but also ensure the inclusion of the most vulnerable groups.

Ultimately, effective poverty alleviation policies must strike a balance between cost-effectiveness and social equity. The evidence presented here aims to inform a more strategic, data-driven approach to social protection policy design one that is fiscally sustainable, inclusive, and grounded in measurable outcomes.

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National Agency of Statistics and Demography (ANSD) (2023). *Economic and Demographic Indicators of Senegal (2018–2023)*. Data retrieved from the official website of ANSD. URL: http://www.ansd.sn (visited on 06/21/2025).