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Synopsis: Assessing the impacts of COVID-19 on household incomes and poverty in Rwanda

A microsimulation approach

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In Rwanda, as elsewhere, different types of households experienced the economic effects of COVID-19 differently. We use a microsimulation approach to show the importance of these differences to better understand COVID-19's impacts on their income and poverty status.

Main results

- Nationally, during the lockdown period between March and May 2020, the simulation results estimate declines in household income by 33 percent on average. The urban population experienced the largest declines, averaging 40 percent during this period.
- Unlike patterns seen with other shocks, middle-income households experienced the sharpest declines in income during the lockdown of an estimated 33 to 35 percent.
- The share of individuals falling into poverty was highest among those in urban, middle-income (*Ubudehe* 2) households (27 percent). However, the greatest absolute number of individuals in poverty remained concentrated in rural areas during the lockdown.
- Poor individuals in the lowest expenditure quintile remain in the most severe poverty, with average expenditures during the lockdown estimated at 54 percent below the poverty line.
- Under both the fast and slow post-COVID economic recovery scenarios used in the simulations, household incomes nearly return to pre-COVID levels for all household categories by the end of 2020. However, these results do not capture the potential long-term impacts of the substantial shocks of the pandemic to incomes, assets, and individual wellbeing.

These modeling results suggest that targeting should be a central component of the design and implementation of social protection programs and economic recovery policies to support a diverse set of beneficiaries. These beneficiaries include rural farming households and poor households, as well as nonagricultural household, and households in the middle expenditure quintiles.

Background and context

In order to contain the spread of COVID-19, Rwanda was quick to introduce a series of policy measures early in the public health crisis. The most significant set of measures was the introduction of restrictions at the national level for a six-week period that began in March 2020—what is commonly referred to as the first lockdown. During this lockdown, all non-essential businesses were closed and the population was asked to remain at home except for essential needs. Most agricultural and farming activities were exempted from these policy restrictions. After these restrictions were removed, services and industries were gradually reopened in compliance with a range of public health guidelines.

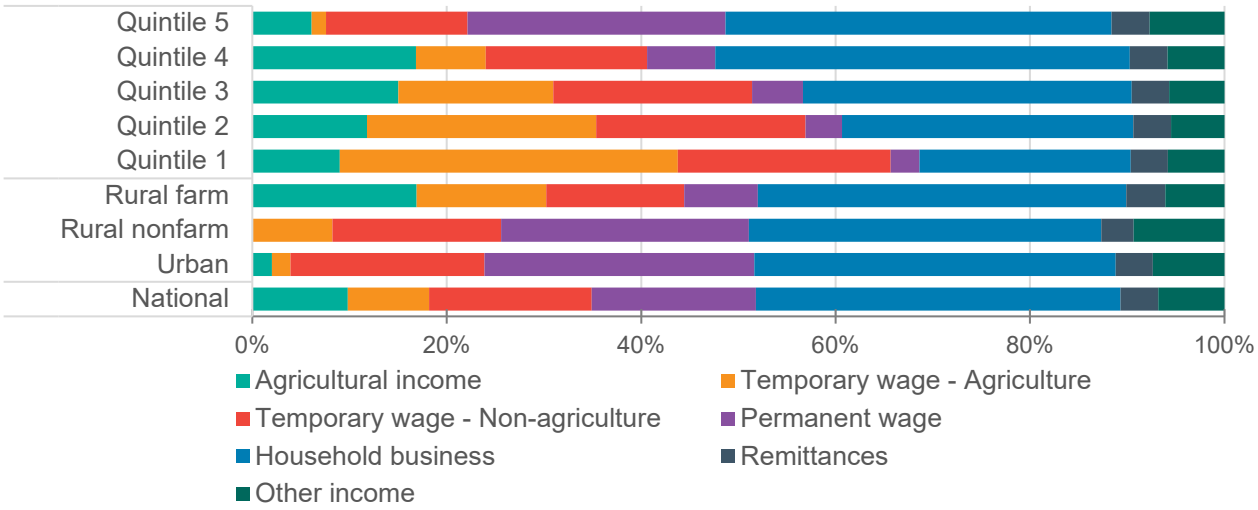
While the economic effects of the COVID-19 pandemic are significant for the country as a whole, the effects are not distributed equally across sectors, and therefore are unlikely to be distributed equally across households. For example, it is possible that the immediate effects of the lockdown were most significant for households whose incomes were derived from non-essential businesses, small-scale enterprises, and wages from nonagricultural activities, particularly in urban areas where these activities are concentrated. But this does not imply that other types of households remained unaffected: the nature of multiplier effects means that COVID-19 policy restrictions reverberated throughout the economy.

In this brief, we use microsimulations to explore the effects of the COVID-19 pandemic on household incomes and poverty in Rwanda. Our approach highlights the importance of understanding the diversified livelihood strategies of Rwandan households to fully understand COVID-19's impacts.

Household incomes and income sources in Rwanda

Differences in the recent performance of Rwanda's economic sectors during the COVID-19 pandemic suggest that households experience the economic shocks of COVID-19 in different ways, with a household's location (rural vs. urban), income-earning activities (agriculture, wage employment, and other activities), and asset holdings (their relatively liquid savings) partly determining their experience.

Figure 1: Share of income derived from various economic activities by households in Rwanda, by household expenditure quintile and type



Source: Authors, calculated using data from the NISR Integrated Household Living Conditions Survey 2016–17 (EICV 5).
Note: A household is classified as "rural farm" if it derives any income from its own farming activities, while a "rural nonfarm" household is classified as such if it does not earn any own-farm income – 19 percent of all households are urban, 6 percent are rural nonfarm, and 74 percent are rural farm.

The majority of the population is rural (81.6 percent) and primarily engaged in agriculture (69 percent). However, as shown in Figure 1, agriculture, including own farm income and temporary wage work in agriculture, only accounts for 18 percent of national income (NISR 2018). Because agricultural income only comprises one of many income sources for rural farm households, many of these households are unlikely to be sufficiently well-cushioned by their farm income in the event of a shock. The majority of income derived nationally is from household businesses and nonagricultural wages, both of which were particularly vulnerable to policy measures that limit movement and mobility, although the importance of the various income sources differs across the household categories.

Finally, we note that these patterns in income sources are similar across *Ubudehe* categories, which is a system of mutual assistance based on Rwandan cultural practice that ties closely to the country's social protection system. Poorest households are placed in *Ubudehe 1* category and the richest in *Ubudehe 4* (LODA 2018).[1] Though not shown in Figure 1, *Ubudehe* categories 1 and 2 report having more agriculture income and less household business and nonagricultural income than does *Ubudehe* category 3.[2]

Microsimulation approach

In the absence of real-time or high-frequency income data that tracks the impacts of the COVID-19 pandemic, we use a microsimulation approach to predict the estimated impacts of the COVID-19 pandemic on household incomes and poverty status (e.g., Sumner et al. (2020) for a global example).

The first step in this approach is to draw on macro-level estimates of COVID-19 impacts generated using a social accounting matrix (SAM) multiplier model (Aragie et al. 2021). We extract sector-level estimates from the SAM multiplier model to "shock" household incomes from each sector. For example, during the six-week lockdown period, the SAM multiplier model suggests that construction sector output declined by 80 percent, so we "shock" any household income derived from this sector by 80 percent regardless of the income type (e.g. household business and/or wages). Since households derive income from multiple sectors, their income stream from each sector is "shocked" according to the corresponding sectoral output from the SAM model.[3]

Next, in order to estimate the poverty impacts of the shock, we assume that estimated decreases in total household incomes using the approach described above are proportionally equivalent to decreases in total household expenditures. This enables us to predict whether a household falls below the poverty line in our simulations, since poverty is determined by expenditure per adult equivalent rather than income. Once we have simulated the changes in household expenditures resulting from the economic shock, we next assume that households unable to make ends meet – those who are below or temporarily fall below the poverty line due to an economic shock – will supplement their necessary household spending by liquidating their

[1] The *Ubudehe* categorization that was in effect from 2016-2020 is as follows (Ezeanya-Esiobu 2017):
- Category 1 households are very poor and vulnerable citizens who are homeless and unable to feed themselves without assistance.
- Category 2 households are citizens who are able to afford some form of rented or low class owned accommodation, but who are not gainfully employed and can only afford to eat once or twice a day.
- Category 3 households are citizens who are gainfully employed or are even employers of labour. Within this category are small farmers who have moved beyond subsistence farming, or owners of small and medium scale enterprises.
- Category 4 households are citizens who manage relatively large businesses, employees who have full-time employment with organizations, industries, or companies, government employees, owners of lockdown shops or markets and owners of commercial transport or trucks.

[2] *Ubudehe* category 4 is not included in this analysis because of the small sample of households in this category in EICV5 (N=31).

[3] The 2020 GDP figures published by NISR report a smaller decrease in GDP as a result of the COVID-19 shock compared to those estimates from the SAM multiplier model. However, the distribution of shocks across sectors is similar between the SAM analysis and the NISR estimates. For this reason, the impact estimates discussed in this paper may be considered "upper-bounds" for the actual impacts experienced, while the comparison across household groups due to how their income profiles differ remains a useful contribution to more fully understanding the impact of COVID-19 on Rwanda's economy and on the welfare of its citizens.

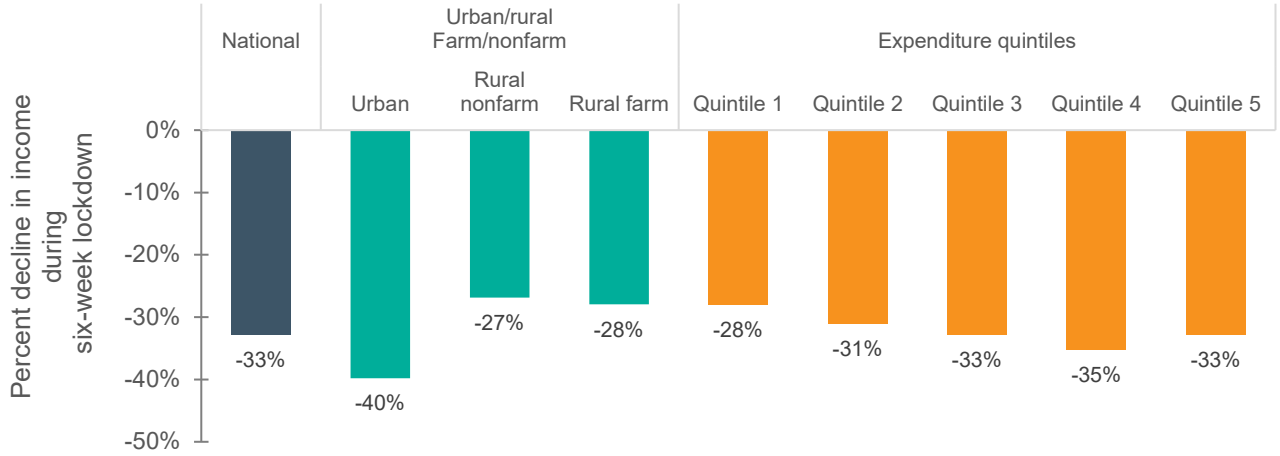
savings up to the amount that they are able to make ends meet (i.e., up to the poverty line), or until they have used all of their savings. For this reason, discussions on poverty generally refer to estimates of per adult equivalent expenditures (supplemented by savings), as opposed to income. Finally, because poverty rates are estimated as the percent of individuals below the poverty line rather than the percent of households, we predict the number of individuals, rather than households, that fall into poverty.

In our simulations, we consider three scenarios that were also analyzed using the SAM multiplier model for Rwanda: (1) the six-week national lockdown that was introduced between March and May 2020; (2) a fast recovery scenario post-lockdown, characterized by a strong economic rebound in the third quarter of 2020 and a return to near-normal (pre-COVID) economic activity in the fourth quarter of 2020; and (3) a slow recovery scenario characterized by a modest rebound in the third quarter of 2020 with economic activity remaining at below pre-COVID levels in the fourth quarter. The two recovery scenarios may be interpreted as upper- and lower-bound estimates for the household income and poverty effects of the COVID-19 pandemic in our simulations.

COVID-19 shock results in heterogeneous impacts on household incomes

Our microsimulation results show that on average households lost 33 percent of their income during the six-week lockdown period relative to the income they would have made during that period (Figure 2). Urban households experienced the largest income declines: a loss of 40 percent relative to their projected income in a no-COVID scenario. Results further show that rural farm and nonfarm households experienced income losses of 28 and 27 percent, respectively. While this likely reflects the agriculture sector's exemption from key restrictions, the income losses are still substantial, reflecting the importance of nonagricultural incomes in both of these rural categories.

Figure 2: Percent decline in household incomes during six-week lockdown period, by household type and expenditure quintile



Source: Authors' calculations using data from the Integrated Household Living Conditions Survey 2016–17 (EICV 5).
Note: Income declines are relative to a 'no-COVID' baseline scenario for each time period. A household is classified as "rural farm" if it derives any income from its own farming activities, while a "rural nonfarm" household is classified as such if it does not earn any own-farm income. Quintile categorizations were taken from the NISR poverty file of the EICV5 dataset.

The microsimulation results further suggest that households in the middle and higher expenditure quintiles experienced larger proportional declines in incomes compared to those in the lowest expenditure quintile. Figure 2 shows that households in quintile 4 experienced the largest income declines, while households in the lowest quintile experienced the smallest income declines.

Combining the rural/urban distinctions with welfare status (*Ubudehe* categories) provides a better illustration of which households in our simulations are most impacted by the COVID-19 shock (Table 1). Households in *Ubudehe* categories 1 and 2 living in urban areas were most impacted by the shock, with estimated income declines of 48 and 51 percent, respectively, during the six-week lockdown period compared to a no-COVID scenario. Even households in *Ubudehe* category 3 in urban areas experienced greater income declines of 39 percent on average than all rural *Ubudehe* household categories – the *Ubudehe* category with the highest income decline for rural households was for those in the *Ubudehe* 2 category of 29 percent.

Table 1: Percent reduction in household incomes relative to a no-COVID scenario in 2020 under fast and slow recovery scenarios, by location and *Ubudehe* household category

Location	*Ubudehe* category	Recovery scenario	Lockdown	May	June	Third quarter	Fourth quarter
Rural	*Ubudehe* 1	Fast	-24	-19	-12	-4	-1
		Slow			-19	-11	-3
	Ubudehe 2	Fast	-29	-23	-14	-5	-1
		Slow			-23	-13	-3
	Ubudehe 3	Fast	-28	-22	-14	-5	-1
		Slow			-22	-13	-3
Urban	*Ubudehe* 1	Fast	-48	-38	-23	-8	-1
		Slow			-38	-22	-5
	Ubudehe 2	Fast	-51	-40	-25	-8	-1
		Slow			-40	-24	-6
	Ubudehe 3	Fast	-39	-31	-20	-7	-1
		Slow			-31	-19	-5

Source: Authors' calculations using data from the Integrated Household Living Conditions Survey 2016–17 (EICV 5).
Note: Income declines are relative to a 'no-COVID' baseline scenario for each time period.

Our comparison of incomes losses through the rest of 2020 after the lockdown under our two recovery scenarios suggests that by the fourth quarter of 2020, the majority of households will have almost returned to their pre-COVID income levels under both the fast and slow scenarios, with the largest persistent declines in incomes found among urban households in all *Ubudehe* categories (5 to 6 percent decreases in the slow recovery scenario for the 4th quarter).

Table 2: Percentage change in population income derived from various economic activities during COVID-19 lockdown period, by household type and expenditure quintile

	National	Household types			Expenditure quintiles				
		Urban	Rural nonfarm	Rural farm	1	2	3	4	5
Agricultural income	4	1	0	6	3	5	7	8	3
Temporary wage – Agriculture	4	1	3	5	12	10	7	4	1
Temporary wage – Non-agriculture	-5	-1	-7	-7	-12	-11	-11	-7	-1
Permanent wage	8	18	9	3	1	2	3	4	13
Household business	-16	-27	-9	-10	-7	-9	-9	-13	-20
Remittances	1	2	1	1	1	1	1	1	1
Other income	3	5	3	2	2	2	3	3	4

Source: Authors, calculated using data from the NISR Integrated Household Living Conditions Survey 2016–17 (EICV 5).
Note: A household is classified as "rural farm" if it derives any income from its own farming activities, while a "rural nonfarm" household is classified as such if it does not earn any own-farm income. Column sums equal zero since table shows changes in composition of all sources of income.

We also find that the composition of income among households changed dramatically during the lockdown period (see Figure 1 for income compositions pre-COVID). Table 2 shows how the composition of incomes for households in different population groups changed over the six-week

lockdown period. For example, the share of average national household income from household businesses was 16 percentage points less at the end of the lockdown compared to pre-COVID – household businesses accounted for 38 percent of national income pre-COVID and 22 percent at the end of the lockdown. Income from household businesses was the income source showing the largest decline as a share of household incomes across almost all household groups (with the only exceptions are households in expenditure quintiles 1 through 3).

Table 2 also shows the sources of household incomes that increased in importance during the lockdown period. Nationally on average, for urban and rural nonfarm households, and for those in expenditure quintile 5, the share of total income from permanent wage work grew more than any other income source. For rural farm households and those in expenditure quintiles 1 through 4, the shares of income derived from agriculture and from temporary agriculture wage work increased the most. These results are consistent with our expectation that permanent wage and agriculture-based incomes were impacted the least during the lockdown period. These types of income would help cushion the impact of the economic shock due to COVID-19 for specific types of households.

Next, we examine the microsimulation results on the share of the population that fell below the poverty line during the lockdown and recovery periods. During the lockdown, our results show that nationally 12 percent of the population, approximately 1.5 million individuals, temporarily fell below the poverty line, even after supplementing their income losses with savings. While incomes are shown in the microsimulation to recover for many households and individuals later in 2020 under both the fast and slow recovery scenarios, it is important to recognize that the complexity of poverty dynamics may result in longer term adverse impacts to the wellbeing of these individuals. Table 3 highlights the poverty impacts in terms of percent and number of newly poor individuals, total number of poor individuals, and the poverty gap index which is the difference between the poverty line and the average household expenditure per adult equivalent of poor households, expressed as a percentage of the poverty line.

Table 3: Newly poor individuals and the poverty gap during the six-week lockdown and over quarter 3 of 2020 under the two recovery scenarios, by location and *Ubudehe* category

Time period and scenario	*Ubudehe* category:	Rural			Urban		
		1	2	3	1	2	3
Six-week lockdown	Newly poor, percent of all individuals	8	11	11	25	27	17
	Newly poor, thousands	127	362	449	31	164	175
	Total poor, thousands	1,016	1,987	1,872	75	287	288
	Poverty gap index	39	36	33	53	43	46
	Percentage point change in poverty gap index compared to no-COVID-19	4	5	5	18	12	22
Quarter 3, 2020 Fast recovery scenario	Newly poor, percent of all individuals	2	2	2	3	3	2
	Newly poor, thousands	26	67	66	4	20	20
	Total poor, thousands	914	1,692	1,489	48	143	133
	Poverty gap index	35	31	29	36	31	25
	Percentage point change in poverty gap index compared to no-COVID-19	1	1	1	1	0	1
Quarter 3, 2020 Slow recovery scenario	Newly poor, percent of all individuals	4	5	5	14	12	7
	Newly poor, thousands	61	172	213	17	76	68
	Total poor, thousands	949	1797	1636	61	199	182
	Poverty gap index	37	33	30	37	30	28
	Percentage point change in poverty gap index compared to no-COVID-19	2	2	2	2	0	4

Source: Authors' calculations using data from the Integrated Household Living Conditions Survey 2016–17 (EICV 5).
Note: The poverty gap index is the average expenditure per adult equivalent shortfall relative to the poverty line for all poor households expressed as a percentage of the poverty line.

While the number of newly poor individuals during the lockdown is highest in the rural *Ubudehe* categories, the percentages of newly poor individuals are highest in the urban categories. The poverty gap index is also most severe for those in urban households in all *Ubudehe* categories compared to those in rural households during the lockdown, although the indexes nearly converge by the end of quarter 3 in both recovery scenarios. The urban *Ubudehe* categories also experienced the largest percentage point change in the poverty gap index indicating that the intensity of poverty for the poor during COVID-19 is much more than the intensity of the poor in those categories pre-COVID-19.

However, in the slow recovery scenario, although the poverty gap converges, Table 3 shows that many individuals remain in poverty at the end of the third quarter, suggesting that, while many people remain below the poverty line under a slower recovery, their poverty is still not as severe as it was during the lockdown, i.e., their welfare is improving under the recovery period. Conversely under the fast recovery scenario, for those individuals who became poor during the six-week lockdown in all household categories, more than 75 percent recover and rise back above the poverty line by the end of the third quarter, suggesting a broad and strong economic recovery even before the last quarter of 2020.

Policy recommendations

This microsimulation approach to estimating income and poverty shocks of COVID-19 on Rwandan households provides a detailed analysis that complements other macro-level analysis of its effects on the economy. The approach highlights the role of a household's income sources, asset holdings, and location in its experience with the effects of COVID-19. Our findings indicate that the rural poor in Rwanda were somewhat isolated from COVID-19 related shocks but still experienced substantial negative impacts to their household welfare. Nonfarm and middle-income households experienced sharp income declines and high increases in poverty rates. This analysis suggests that social protection programs and economic recovery policies would benefit from an expansion of the targeting of such programs and policies, including greater attention to households that rely on temporary and self-employment.

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