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

A microsimulation approach

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ABSTRACT

In Rwanda, as in other countries, different types of households will experience the economic effects of the COVID-19 pandemic differently. We use a microsimulation approach to highlight the importance of these differences and to draw attention to the diversified livelihood strategies of Rwandan households in order to fully understand COVID-19's impacts on their income and poverty status. Our approach complements macro-level assessments of COVID-19's economic impacts, focusing on the contribution of the income sources, asset holdings, and location (urban/rural) of households to understanding these differential effects.

Our analysis was conducted in mid-2020 at a point early on in the COVID-19 pandemic for Rwanda. The main results from our simulations suggest the following.

- Nationally, during the six-week lockdown period between March and May 2020, household incomes declined by an estimated 33 percent on average. The urban population experienced the largest declines in incomes, averaging 40 percent during this period.
- Unlike other economic shocks, the middle-income segment of the population 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* category 2) households (27 percent); however, the absolute number of individuals in poverty during the lockdown was concentrated in rural areas in the lower- and middle-income *Ubudehe* categories.
- 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; however, relative to their poverty severity prior to COVID-19, those in the lowest expenditure quintile experienced the smallest impact.
- 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.

The microsimulation results suggest that targeting should be a central component of the design and implementation of social protection programs and economic recovery policies to address the needs of the individuals and households most adversely affected by COVID-19 in Rwanda. Different approaches for post-COVID recovery will be needed to meet the respective needs of poorer farming households, rural nonagricultural households, the urban poor, and households in the middle expenditure quintiles.

INTRODUCTION

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 detailed 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 when necessary to meet critical needs. Specifically, shops and markets were closed except for those selling food and essential items; entertainment and tourist activities were prohibited; motorcycle taxis could not carry passengers, though they could provide delivery services; restaurants, bars, and cafes were only permitted to provide take-away services; and most industrial operations were suspended, apart from agro-processing and the production of beverage, medical and hygiene supplies, and raw materials. Notably, most agricultural and farming activities were exempted from these policy restrictions, although administrative permissions were required for the movement and transport of agricultural goods and services.

After the lockdown period ended, services and industries were gradually reopened in compliance with a range of public health guidelines. Restrictions were occasionally re-introduced in specific localities where COVID-19 outbreaks were identified, but a national lockdown was not re-introduced in 2020. Restrictions continued to ease throughout the year and economic activities picked up, which likely contributed to an annual change in Rwanda's real gross domestic product (GDP) of −0.2 percent. This is a much better economic performance than that seen across sub-Saharan Africa (−1.9 percent) and globally (−3.3 percent) (IMF 2021a) in 2020.

Despite this, it is important to take stock of the economic consequences of the COVID-19 pandemic as it unfolds. According to figures from the Government of Rwanda, GDP in the second quarter of 2020 – the first full quarter of the COVID-19 pandemic and the quarter in which the policy restrictions were most severe – decreased by 12.4 percent (NISR 2020a). The agriculture sector's exemption from the policy restrictions during this period resulted in a smaller decrease in agricultural sector GDP of just 2 percent, while GDP for the industrial and services sectors decreased by 19 and 16 percent, respectively. For the entire year, total GDP contracted by 3.4 percent compared to 2019, with agriculture sector growth hovering at a positive 1 percent, while the industry and services sectors contracted by 4 and 6 percent, respectively (NISR 2021).

These figures indicate that, 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. This implies that the effects of the pandemic are unlikely to be distributed equally across households that derive their incomes from the different sectors. 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 service and industrial 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 within Rwanda's economy means that COVID-19 policy restrictions reverberated throughout the economy and affected all households.

In this paper, we use microsimulations to explore the effects of the COVID-19 pandemic on household incomes and the poverty status of individuals in Rwanda. Our approach highlights the importance of understanding the diversified livelihood strategies of Rwandan households to fully understand COVID-19's impacts on their incomes. The approach complements macro- and country-level assessments of COVID-19's impacts (Aragie et al. 2021; IMF 2021b; World Bank 2021; UN 2020), and highlights the contribution of the income sources, asset holdings, and

location (rural/urban) of households to understanding the COVID-19 pandemic and the shaping of social protection programs and economic recovery policies.[1]

The analysis presented here was conducted in mid-2020 at a time early on in the COVID-19 pandemic for Rwanda. Between then and the publication of this paper in mid-2021, the Government of Rwanda introduced additional measures to contain the spread of COVID-19, including multiple district-level lockdowns and one national three-week lockdown beginning in January 2021. While it is difficult to provide a continuous series of simulations to assess the economic impacts of each event, our analysis aims to provide novel insights into the nuanced differential micro-level impacts of the COVID-19 pandemic in Rwanda.

HOUSEHOLD INCOMES AND INCOMES SOURCES IN RWANDA

The differences in the recent performance of Rwanda's economic sectors during the COVID-19 pandemic suggest that Rwandan households similarly experienced the economic shocks of COVID-19 in different ways, with a household's location (rural vs. urban), income-earning activities (agriculture, wage employment, or other activities), and asset holdings (particularly any relatively liquid savings) partly determining their experience. We examine each of these below.

The majority of Rwanda's population is rural. As such, agriculture is the main occupation for most households. In the first quarter of 2020, 43 percent of the formally employed population worked in agriculture, while 40 percent worked in services, and only 17 percent worked in industry (NISR 2020b). Additionally, of those not formally employed, 50 percent of the unemployed population and 54 percent of those not in the labor force, nonetheless, engaged in some subsistence agriculture (NISR 2020b).

Despite this, the majority of household income in Rwanda is derived from off-farm household businesses, with income from agriculture accounting for less than 20 percent of income across all household categories (Figure 1).[2] Household businesses, primarily trade enterprises in the services sector, account for the largest share of household incomes nationally (35 percent) and vary little between urban, rural nonfarm, and farm household types.

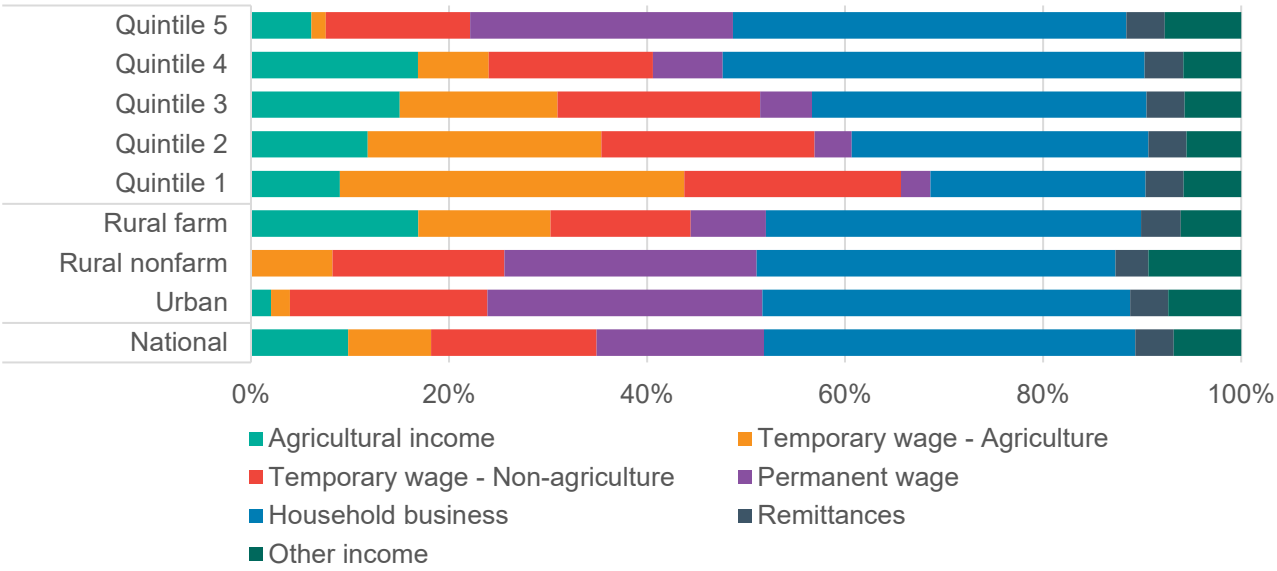
However, among poorer households, the importance of household businesses is less pronounced. Specifically, household businesses account for between 22 and 30 percent of income among households in the lowest two expenditure quintiles, while temporary agriculture wages account for between 24 and 35 percent. Permanent wages – which we assume are not as vulnerable to economic shocks – constitute just 2 to 3 percent of household income in the lowest two quintiles.[3]

[1] For an equally informative microsimulation exercise for Rwanda, see Wylde (2021).

[2] The relatively small importance of agriculture as an income source partially masks its overall importance in the household. On average, 17.6 percent of total household expenditures nationally (22.9 percent for rural farm households) is own consumption of food produced at home (authors' calculations using EICV5).

[3] Expenditure quintiles comprise five categories with equal numbers of households in each, with quintile 1 including households whose expenditure per adult equivalent is in the 0-20th percentile nationally, quintile 2 including households whose expenditure per adult equivalent is in the 20-40th percentile nationally, and so on.

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.

Several implications follow from this description of income sources in Rwanda. First, all types of households are likely to have been affected by the economic shock resulting from the COVID-19 pandemic and the associated policy measures because they depend on diversified livelihood portfolios, especially from nonfarm income sources. The average number of income sources for households in Rwanda is 4.2, with little variation between expenditure quintiles – households in the wealthiest quintile 5 average 3.8 income sources, while those in poorest quintile 1 average 4.5 income sources. For households in expenditure quintile 1, nonagricultural temporary wage and household business incomes together account on average for 44 percent of their income. The shares of income from these sources are even higher for urban and rural nonfarm households and for households in higher income quintiles (Figure 1). Because households have many income streams, there is likely to be significant variability in income shocks across households.

Second, because agricultural income only comprises one of many income sources for rural farm households, the majority of these households are unlikely to be sufficiently well-cushioned by their farm income in the event of a shock. Among such households, nonagricultural temporary wage and household business incomes combined account for 52 percent of their income on average.[4] Agricultural incomes were least important for households in wealthiest quintile 5 – accounting for only 6 percent of income for this group – because these households are more likely to be urban and to have formal sector employment.

Third, the many households that derive income from non-agricultural wage work and off-farm household businesses are particularly vulnerable to policy measures that limit their movement and mobility. Temporary non-agriculture wage work is important for households in all income quintiles, while household business income accounts for a large share of income in higher quintiles. This suggests greater exposure to COVID-19 related shocks in the higher income quintiles. Additionally, it is worth noting that relatively shock-resilient permanent wages are only an important income

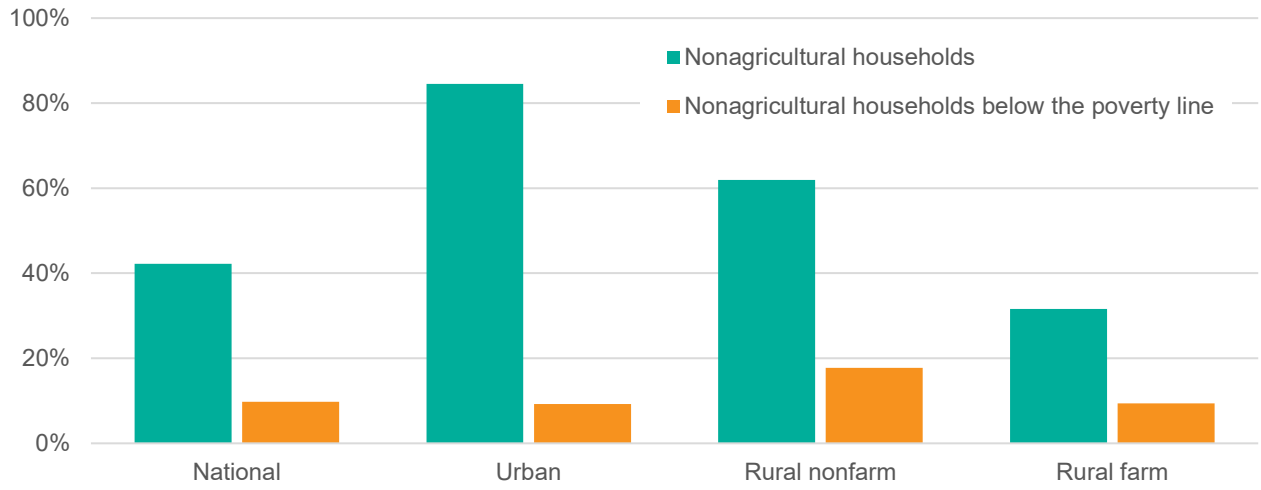
[4] Interestingly, agricultural income was most important for households in expenditure quintile 4 (accounting for 17percent of income) than for quintile 1 (9 percent). This suggests that high-income households have larger, more productive, or more profitable investments in farming. However, the precise nature of this income stream across household categories is a topic for further exploration.

source for households in quintile 5, for which this source provides 27 percent of their income, compared to less than 10 percent in all other expenditure quintile groups.

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 in which the poorest households are placed in *Ubudehe 1* and the richest in *Ubudehe 4* (LODA 2018).[5] 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.[6]

To obtain a better understanding of the contribution of nonagricultural income to household welfare, we examine the poverty rate[7] among a subset of households that we classify as "primarily nonagricultural", i.e., households that derive more than 30 percent of their income from nonagricultural sources.[8] Not surprisingly, 85 percent of the urban population of Rwanda are members of households in this category (Figure 2). But the share of rural individuals in primarily nonagricultural households is also high: 62 percent of rural nonfarm and 32 percent of rural farm individuals. Prior to the COVID-19 pandemic, the poverty rate among these primarily nonagricultural individuals in the rural nonfarm category was 18 percent, significantly higher than the poverty rate among rural farm and urban individuals in primarily nonagricultural households, both at 9 percent. Thus, we expect that rural nonfarm individuals are potentially more vulnerable to the economic shocks resulting from the COVID-19 pandemic than are other types of individuals.

Figure 2: Individuals in primarily nonagricultural households, by type and poverty status



Source: Authors, calculated using data from the NISR Integrated Household Living Conditions Survey 2016–17 (EICV 5).
Note: "Primarily nonagricultural" is defined as a household deriving more than 30 percent of their income from non-agricultural related sources. 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.

[5] The *Ubudehe* categorization that was in effect from 2016-2020 is as follows, according to Ezeanya-Esiobu who cited the Government of Rwanda and Ministry of Local Government (both of which are no longer available online since the *Ubudehe* category classifications were updated in 2020):

- 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.

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

[7] Rwanda's national poverty line is RWF 159,375 (USD 178) per adult equivalent per month in constant January 2014 prices. For details on the calculation of adult equivalents, see NISR (2018b).

[8] Specifically, an agricultural source was defined as any farm income, any wage income in agriculture, and any household business in agriculture.

We also consider household savings levels prior to the COVID-19 pandemic as a potential coping mechanism to mitigate or at least to manage the full effect of the shock. Given that it may have been difficult to liquidate certain types of fixed assets during the lockdown, we only consider liquid (cash) savings as a coping strategy in the microsimulations. Nationally, 47 percent of households have savings, and among those households, their liquid savings before the shock averaged RWF 33,020 per adult equivalent.[9] The prevalence and level of savings is lower in the poorer expenditure quintiles – only 30 percent of households in quintile 1 have savings, which average just 1,050 RWF per adult equivalent – compared to the top quintiles – 67 percent of households in quintile 5 have savings, averaging RWF 82,070 RWF per adult equivalent. The heterogenous nature of household savings patterns suggests this might not be a consistent or reliable coping mechanism, especially for a prolonged shock such as the COVID-19 pandemic.

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 on household incomes and poverty status of the COVID-19 pandemic (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 the construction sector by 80 percent. This is done regardless of the income type, i.e., both wage income and household business income from construction are reduced by 80 percent. 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.[10]

It is important to note that the SAM multiplier model captures economywide linkages that allow us to estimate COVID-19 impacts on agriculture, despite the sector's exemption from many of the policy measures taken to contain the spread of the virus. The SAM multiplier model suggests that demand for agricultural products declined due to the limited capacity of hotels, restaurants, bars and cafes, and due to reduced regional and international trade. This demand shock resulted in a reduction in agriculture sector output that directly affected incomes dependent on agricultural production.

The microsimulation approach allows for more refined estimations than a SAM multiplier by using additional household data, including the variation in household income sources, occupations, and business types. In the simulations, we assume that workers employed in higher skilled positions, including management, professional, and skilled positions; in certain sectors, such as the public sector and international organizations; or with a permanent worker contract will not experience a shock to that specific income source (see Annex 1). This results in the model simulations allowing certain household income streams to be shocked according to the SAM multiplier model estimates (e.g., temporary wage in agriculture), while leaving other income streams intact (e.g. permanent public sector employment).

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[9] At the time when this analysis was conducted in July 2020, the exchange rate was approximately $1 USD=915.75 RWF.

[10] 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.

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. Important to note is that we exclude own-consumption of farm output from our calculation of the expenditure shock. We base this assumption on the fact that farming was not affected by the COVID-19 associated restrictions, further assuming that own-consumption patterns also did not shift significantly.

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 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. Necessarily, some of these assumptions may be subject to further refinement.

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.

Within these scenarios, this micro-level approach allows us to categorize households in different ways to identify the characteristics of the most vulnerable households. Specifically, we analyze households at the national level and by expenditure quintiles as defined by the National Institute of Statistics of Rwanda (NISR). We also categorize households as urban, rural nonfarm, and rural farm, based on the classification set forth in the Fifth Integrated Household Living Conditions Survey (EICV5) conducted in 2016-2017 (NISR 2018a, b). A household is categorized as ‘rural farm’ if they live in a rural area and derive any income from their farm, and conversely as ‘rural nonfarm’ if they live in a rural area and do not derive any income from their own farm. We further categorize households by their *Ubudehe* category, also based on the EICV5 classification and data.

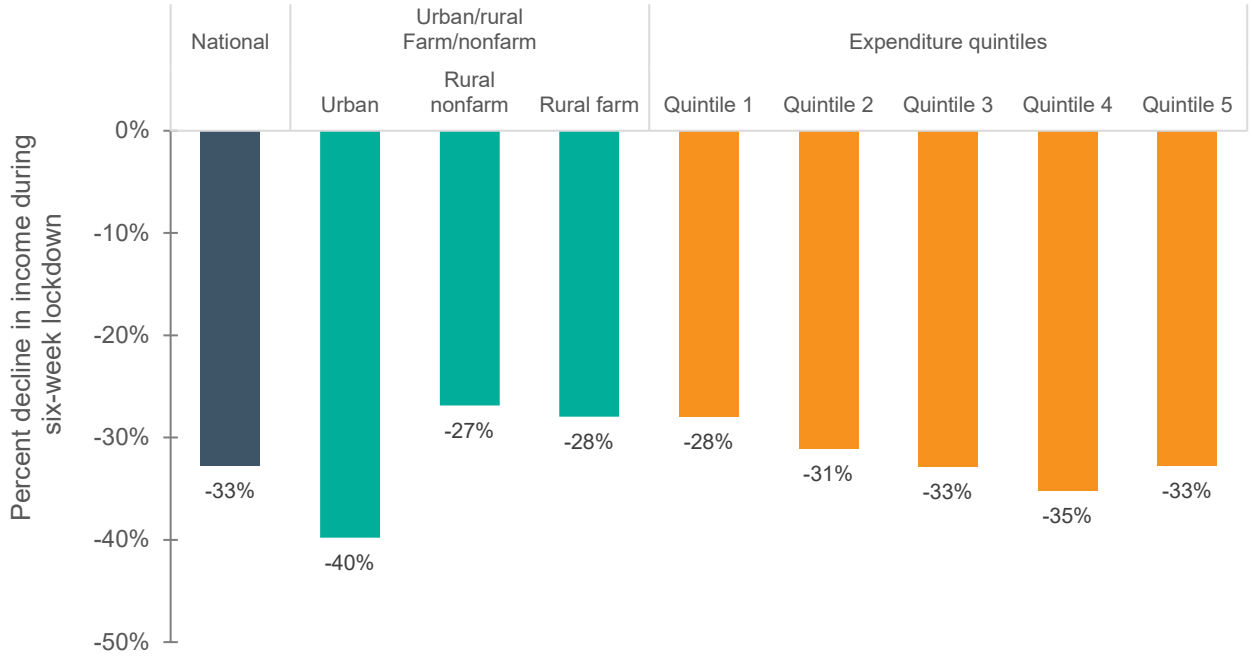
COVID-19 SHOCK RESULTS IN HETEROGENEOUS IMPACTS ON HOUSEHOLD INCOMES

Income declines

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 3). 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 in size, reflecting the importance of nonagricultural incomes affected by the lockdown for households in both of these rural categories.

Figure 3: 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.

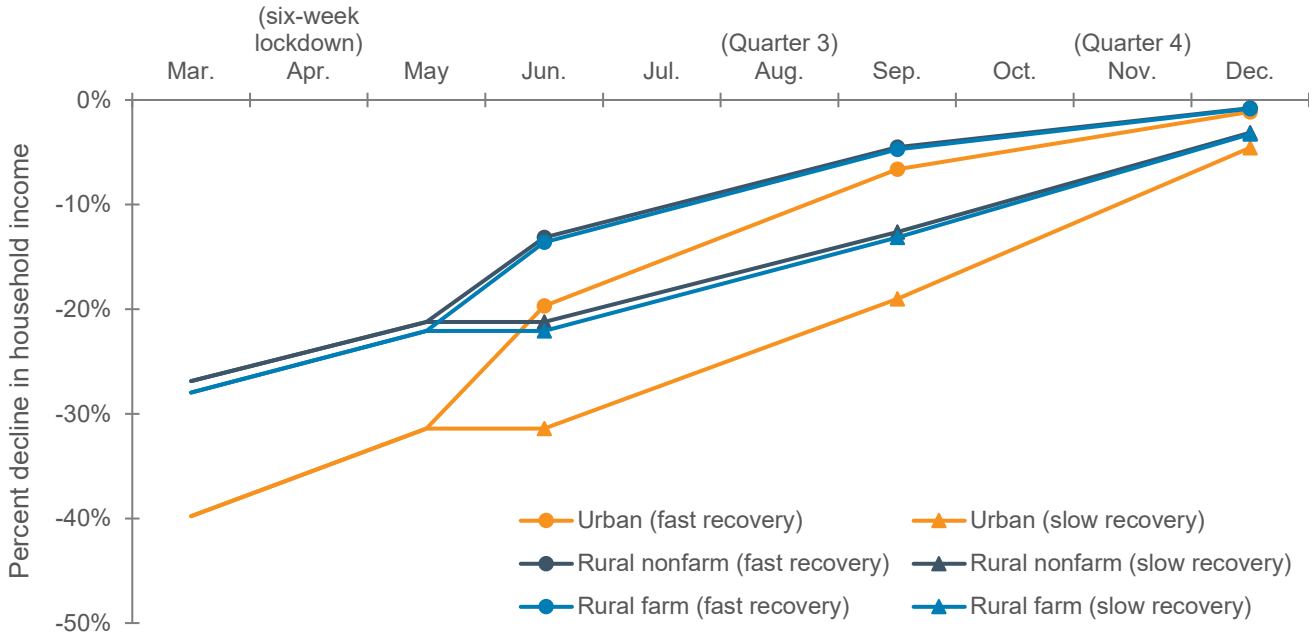
The microsimulation results further suggest that households in the middle and higher expenditure quintiles experienced larger proportional declines in incomes compared to those in the lowest expenditure quintile. Figure 3 shows that households in quintile 4 experienced the largest income declines, while households in the lowest quintile experienced the smallest income declines. Households in expenditure quintile 5 did not experience as much of an income decline as those in quintile 4, likely in part due to these households deriving more of their income from permanent wages and less from temporary nonagricultural wage jobs.

Our comparison of income losses through the rest of 2020 after the lockdown under our two recovery scenarios suggests the following. First, by the 4th quarter of 2020, the majority of households will have almost returned to their pre-income levels under both the fast and slow recovery scenarios described earlier (Figure 4). Second, while large differences in income effects are observed early in the pandemic, by the 4th quarter, the estimated income losses nearly converge, with all households under the fast recovery scenario experiencing only a 1 percent reduction in income relative to a no-COVID baseline simulation and a 3 to 5 percent reduction under the slow recovery scenario. Third, the strong adverse economic impact of COVID-19 on urban households is abundantly clear in Figure 4: In June under the fast recovery scenario, the reduction in income for these households relative to if the COVID-19 shock had not occurred was very similar to the reduction rural households were experiencing under the slow recovery scenario.

However, it is important to keep in mind that, while the recovery of incomes by the 4th quarter of 2020 is encouraging, these results do not account for the potentially enduring effects of temporary income losses and transient poverty during the early stages of the pandemic. The effects of

economic shocks on household income, poverty, and wellbeing over both the short and long term are complex and difficult to incorporate into a microsimulation approach.

Figure 4: Percent reduction in household incomes relative to a no-COVID scenario under fast and slow recovery scenarios over month in 2020, by household type



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.

Combining rural/urban 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 (highest decline was for rural *Ubudehe* 2 households 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.

Among both groups, rural and urban, the microsimulation results indicate that households in *Ubudehe* category 2 were the most affected economically by COVID-19 and associated mitigation measures during the lockdown period, though only marginally in the case of rural households (29 percent declines for *Ubudehe* 2 compared to 28 percent for *Ubudehe* 3). Perhaps surprisingly, households in rural *Ubudehe* 1 – the group that might be expected to be hardest hit by the COVID-19 shock – were the least affected, only experiencing a 24 percent income decline during the lockdown period. Similar to the results in Figure 4, almost all household incomes converge to near-pre-COVID levels by the 4th quarter of the year in both the slow and fast recovery 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).

Income composition

We also find that the composition of income among households changed dramatically during the lockdown period (see Figure 1 for the income composition among households 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. The only exceptions are households in expenditure quintiles 1 through 3 for which temporary nonagricultural wages saw the largest decline as a share of total income.

Table 2: Percentage change in population income derived from various economic activities during six-week 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.

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. Remittances and other sources of income comprised relatively small shares of overall household income pre-COVID, so their shares in total household income did not change notably.

Poverty

Next, we examine the microsimulation results on the share of the population that fell below the poverty line during the lockdown period and over the course of the fast and slow economic recovery scenarios. During the lockdown, our simulation 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 (Table 3). Again, urban individuals and those in the middle expenditure quintiles saw their poverty status change relatively the most when we look at the percent of newly poor individuals – of course, by definition most of those in the lower expenditure quintiles were already below the poverty line. However, because the rural population is significantly larger than the urban population, the number of poor individuals at the end of the lockdown period is much higher in rural farm households than in urban households (4.8 million and 0.76 million, respectively). As most were already poor before the lockdown, the number of poor individuals in the bottom quintile did not change and only increased slightly for the second poorest quintile. Given that their welfare level pre-pandemic was only slightly above the poverty line, the largest absolute number of newly poor individuals resulting from COVID-19 is found in quintile 3 with 0.98 million additional (but possibly temporary) individuals falling into poverty during the six-week lockdown. While incomes are shown in the microsimulation to recover for many of these 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 even as they move out of poverty.

Table 3: Newly poor individuals and the poverty gap of the poor during the six-week 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
Newly poor, percent of all individuals	12	21	17	10	0	3	42	13	5
Newly poor, thousands	1,459	432	90	937	0	70	976	309	113
Total poor, thousands	5,937	762	332	4,843	2,336	2,203	976	309	113
Poverty gap index, at end of COVID-19 lockdown period	37	46	47	35	54	28	23	27	32
Percentage point change in poverty gap index from no-COVID-19 scenario to end of COVID-19 lockdown period	6	17	11	5	7	14	23	27	32

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. 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.

The poverty gap index shown in Table 3 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. The larger the poverty gap index, the farther below the poverty line the household is. Therefore, this measure illustrates the intensity of poverty for different household categories resulting from the COVID-19 pandemic. Nationally, during the six-week lockdown, our simulation results indicate that poor individuals spent 37 percent less than the poverty line, on average (Table 3), a six percentage point change from the poverty gap pre-COVID-19. Individuals in poor urban and rural nonfarm households experienced more severe poverty during the lockdown compared to those in poor rural farm households; however, individuals in quintile 1 prior to the COVID-19 shock remain in the most severe poverty of the whole population, with an average expenditure that is 54 percent below the poverty line. Interestingly, the poverty gap index is larger

in quintile 5 than in quintiles 2, 3, and 4. This is perhaps because of these wealthy households' heavy reliance on nonagricultural wage and household business income (and lack of reliance on agriculture). In consequence, even though not as many individuals in quintile 5 fell below the poverty line, those who did experienced more severe poverty than those in the middle quintiles who fell below the poverty line. However, while the lockdown severely affected urban and rural nonfarm households, the poorest farming households remain the worst off.

Table 4 highlights the same outcome variables as Table 3, but characterizes households by location (urban or rural) and by *Ubudehe* category. This table also includes the quarter 3 results for both the fast and the slow recovery scenarios to show the temporary nature of much of the poverty impacts attributable to the lockdown.

Table 4: 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		Rural			Urban		
	***Ubudehe* category:**	**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 tend to converge by the end of quarter 3 in both the fast and slow recovery scenario. The urban *Ubudehe* categories also experienced the largest percentage point change in the poverty gap index, indicating that the intensity of poverty for the urban poor during COVID-19 was much more than the intensity of poverty for the urban poor pre-COVID-19. However, in the slow recovery scenario, although the poverty gap converges, the table shows that many individuals remain in poverty at the end of the third quarter. This result from the microsimulation suggests 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 the year.

In summary, our microsimulation results suggest that the economic impacts of the six-week lockdown were significant for many household categories, with income losses averaging 33 percent when compared to a no-COVID scenario. The shock was most acute for urban and middle-income households as suggested by income declines of 40 percent among urban households and 35 percent among households in expenditure quintile 4. Heterogeneity is also seen in the rates of newly poor individuals, which were highest among urban households and households in the middle *Ubudehe* categories, with 21 percent of urban individuals, and 16 and 15 percent of individuals in *Ubudehe* categories 2 and 3, respectively, temporarily falling below the poverty line during the six-week lockdown.

However, rural households were also strongly affected, losing on average about 27 percent of their incomes – incomes which, in many cases, were significantly lower pre-COVID than those of their urban counterparts. Although our results indicate that only 10 percent of individuals in rural farming household fell into poverty during the six-week lockdown, compared to 17 percent in rural nonfarm households, this translates into 937,000 individuals temporarily falling below the poverty line. Similarly, the largest absolute number of poor individuals is still found among rural farming households, with 4.8 million poor individuals in that group during the six-week lockdown, compared to 0.76 and 0.33 million among urban and rural nonfarm households, respectively.

In both the slow and fast recovery scenarios, households in all categories returned to near pre-COVID income and poverty levels, although it remains difficult to predict the longer-term effects of the transient poverty experienced by thousands of individuals during this shock.

POLICY RECOMMENDATIONS AND CONCLUDING REMARKS

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 relative to other household types. However, many still experienced substantial negative impacts to their household welfare. Nonfarm households and households in the middle expenditure quintiles – namely, those more likely to derive income from own businesses or with members working as day laborers in non-agriculture sectors – experienced sharp income declines and high increases in poverty rates. The number of individuals falling below the poverty line among rural farm households remained high, and their poverty remains severe.

While social protection programs in Rwanda have traditionally focused on households in *Ubudehe* categories 1 and 2, this analysis suggests that households in category 3 were also affected by the COVID-19 shock. Meanwhile, many of the social protection programs are specifically focused on households with agricultural livelihoods – programs such as *Girinka* ("One Cow per Poor Family") or the agricultural input subsidy programs – may have helped insulate such households from the COVID-19 shock. However, these programs by definition did not serve the thousands of rural nonfarm households who experienced the largest income shocks during the six-

week lockdown. This draws attention to the need for recovery policies and programs that reach rural nonfarm households. It also draws attention to the need for policies and programs that target urban households and those that primarily engage in the industry or services sectors, including any potential informal work that was halted during the lockdown. Efforts to increase the breadth, depth, and reach of the Economic Recovery Fund[11] to micro, small, and medium enterprises beyond current levels may be of particular importance.

It is also important to consider that, even with a rapid recovery, it remains necessary to assist many households who may have fallen into poverty but, due to the complexities of transient poverty dynamics, are unable to return to their pre-COVID levels of income or wellbeing. For both social protection programming and economic recovery policies, this points to an expansion of the targeting of such programs and policies, including greater attention to households that rely on temporary and self-employment. It also suggests the importance of cash transfers over the distribution of food, since many households likely experienced losses affecting a wide range of household expenditures beyond food alone.

Potential solutions to reach the households most impacted by the pandemic in a meaningful way and to prepare social protection program systems to respond as quickly to potential future shocks as possible include focusing more on cash aid rather than food aid to allow greater flexibility depending on household needs; expanding targeting strategies of existing programs, such as the Vision 2020 Umurenge Programme (VUP), which seeks to accelerate poverty eradication, foster rural growth, and provide social protection; and integrating digital solutions into existing programs to allow for more efficient adaptability to combat future shocks. The COVID-19 pandemic came as a shock to many not only in how quickly it spread, but also in terms of who were most affected. For this reason, it is important to consider all households when designing economic recovery plans, and to adapt current structures for increased adaptability in order to be able to respond to the next unforeseen shock to household livelihoods and the Rwandan economy.

[11] For details on the Economic Recovery Fund, including the allocation of available funds, see NBR (2021).

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ANNEX

Due to the nature of the COVID-19 economic restrictions and the structure of the Rwandan economy, not all income streams were shocked according to sector output declines. Wage labor was assumed to be heterogenous – the amount that various jobs were impacted depending on the occupation group, job sector, nature of contract, and industry, as shown in Annex Table A1.

Annex Table A1: Assumptions on shocks experienced by wage labor type

Major occupation groups (ISCO 1-digit classifications)	
Managers	Not shocked
Professionals	Not shocked
Technical and associate professionals	Not shocked
Clerical support workers	Not shocked
Services and sales workers	Shocked
Skilled agricultural, forestry, and fishery	Not shocked
Craft and related trades workers	Shocked
Plant and machine operators, and assembly	Not shocked
Elementary occupations	Shocked
Job sector	
Private nonfarm	Shocked
Private farm	Shocked
Public	Not shocked
Cooperative	Shocked
NGO (local)	Shocked
International org	Not shocked
Household domestic	Shocked
Other	Shocked
Don't know	Shocked
Nature of contract	
Permanent worker	Not shocked
Temporary worker	Shocked
Casual worker	Shocked
Seasonal worker	Shocked
Daily worker	Shocked
Other	Shocked
Industry (ISIC 1-digit classifications)	
A: Agriculture, Forestry, and Fishing	Shocked according to sector GDP declines
B: Mining and Quarrying	Shocked according to sector GDP declines
C: Manufacturing	Shocked according to sector GDP declines
D: Electricity; Gas, Steam, and Air Conditioning Supply	Shocked according to sector GDP declines
E: Water Supply; Sewerage, and Waste Management	Shocked according to sector GDP declines
F: Construction	Shocked according to sector GDP declines
G: Wholesale and Retail Trade	Shocked according to sector GDP declines
H: Transportation and Storage	Shocked according to sector GDP declines
I: Accommodation and Food Services	Shocked according to sector GDP declines
J: Information and Communication	Shocked according to sector GDP declines
K: Financial and Insurance Activities	Shocked according to sector GDP declines
L: Real Estate Activities	Shocked according to sector GDP declines
M: Professional, Scientific, and Technical	Shocked according to sector GDP declines
N: Administrative and Support Services	Shocked according to sector GDP declines
O: Public Administration and Defense	Not shocked
P: Education	Not shocked
Q: Health and Social Work	Not shocked
R: Arts, Entertainment, and Recreation	Shocked according to sector GDP declines

S: Other Services	Shocked according to sector GDP declines
T: Activities of Household as Employer	Shocked according to sector GDP declines
U: Activities of Extraterritorial Organizations	Shocked according to sector GDP declines

Source: Compiled by authors.
Note: ISIC = International Standard Industrial Classification of All Economic Activities; ISCO = International Standard Classification of Occupations. Both the ISIC and the ISCO standardized typology schemes are maintained by the International Labour Organization.

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