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Understanding poverty dynamics and vulnerability in Tanzania: 2012–2018

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Abstract

We study poverty dynamics and vulnerability in Tanzania between 2012 and 2018 using synthetic panel methods. Under the surface of apparent stability in aggregate poverty rates, and despite robust economic growth, households experienced strong fluctuations in consumption levels during this period: 12.5% of the population remained in persistent poverty, a further 30% experienced transient poverty, and one of five Tanzanians above the poverty line in 2012 was poor 6 years later. Education and employment in the nonfarm sector are particularly effective at shielding households from poverty, while rural and large households with many children are most likely to slip into poverty. Considerable differences exist between less-deprived areas such as Dar es Salaam or Kilimanjaro and regions in the northwest, where persistent poverty is especially high. Looking ahead to the impact of COVID-19, those households least prepared to take preventive measures against the virus suffer from more adverse poverty dynamics, while those involved in the sectors taking the hardest economic hit from the pandemic start from a better pre-pandemic situation. This suggests that novel policies that specifically support this

'new vulnerable' need to be combined with redoubled efforts to address the structural causes of poverty and vulnerability.

1 | INTRODUCTION

Current discourse on global poverty tends to paint a picture of substantial and steady progress toward the eradication of extreme poverty, now suddenly brought to a halt by the outbreak of the COVID-19 pandemic. Global poverty has witnessed a steady and marked decrease over the past three decades, even if at a somewhat slower pace in recent times[1] (World Bank, 2020). However, these positive developments have now been jeopardized, as the pandemic has pushed millions of people in the developing world into poverty,[2] leading to increasing global poverty rates in 2020 for the first time in two decades. Different researchers have recently focused on quantifying the magnitude of this setback (Decerf et al., 2020; Laborde et al., 2020; Summer et al., 2020), often framed in terms of years of foregone growth and poverty reduction, while institutions have attempted to design and implement appropriate policies to address it.

An element that Tanzania's situation shares with this global narrative is that of a recent slowdown in the pace of poverty reduction, as the sustained and substantial economic growth attained by the country over the past few years has not been reflected in rapidly declining poverty rates. Tanzania's annual real economic growth improved significantly from less than 4% in the second half of the 1990s to consistently about 6.5% in the past decade. Nevertheless, the incidence of basic needs poverty decreased only from 28.2% in 2012 to 26.4% in 2018, compared to a decrease of about 1% per year between 2007 and 2012. This modest decrease in the poverty rate, coupled with vigorous population growth, translated into an increase in the number of poor people in Tanzania in absolute terms, from 12.3 million people in 2012 to 14 million people in 2018 (URT, 2019a). Using the international extreme poverty line of US$ PPP 1.9 per day, poverty in Tanzania remains at 49% of the population (26 million people). In addition, poverty vulnerability is substantial, and three Tanzanians fell into poverty for every four who moved out of it between 2008 and 2012 (World Bank, 2019).

Concerns about limited progress in the reduction of poverty and vulnerability are exacerbated by the disruption to the favorable macroeconomic environment caused by the COVID-19 pandemic. However, a feature that might set Tanzania apart from the global narrative is the relatively limited macroeconomic impact of the pandemic. While international institutions estimate real gross domestic product (GDP) growth for 2020 at around 2% (International Monetary Fund, 2020; World Bank, 2021), according to the Bank of Tanzania (2021a) real output grew at 4.8% over 2020, a moderate setback from pre-pandemic expectations. Tanzania opted not to go for a lockdown as a strategy to combat the spread of COVID-19 pandemic, and most economic activities continued, with the exception of some initial short-lived interruptions due to precautionary measures. In spite of the economy's resilience at the macro level, there are concerns about the

ability of microeconomic actors to cope with this shock, particularly households relying on self-employment and informal or microenterprises, as well as those in sectors affected by the impact of COVID-19 elsewhere, such as agriculture related with exports and especially tourism (World Bank, 2021).

Against this background, we undertake the study of poverty dynamics and vulnerability in Tanzania between 2012 and 2018. Our aim is twofold. First, we aim to provide the most up-to-date assessment of poverty and vulnerability to poverty in Tanzania. In doing so, this paper addresses the following questions: Does the sluggishly declining poverty rate reflect stability in household consumption or rather large, roughly equal, mutually offsetting flows of poverty entry and exit? Who among the poor faces the greatest difficulties to escape from poverty? Who among the nonpoor remains vulnerable and faces a high risk of falling back into it? Second, we integrate early insights into the impact of COVID-19 into our analysis to elucidate how recent circumstances may affect (or not) the profile of the poor and vulnerable.

For this purpose, we take advantage of recent methodological innovations, such as the synthetic panel methods developed by Dang et al. (2014) and Dang and Lanjouw (2013, 2017), which enable the analysis of poverty dynamics and vulnerability based on two cross-sectional household surveys. We apply synthetic panel methods to the two most recent waves of the Household Budget Survey (HBS), corresponding to 2011–2012 and 2017–2018, to determine poverty dynamics and the extent of vulnerability in that recent period. We introduce a methodological refinement to the synthetic panel approach by incorporating panel data in the estimation of a key intermediate parameter that has been pointed out as one of the critical and most sensitive steps in the procedure (Garcés-Urzainqui, 2017; Hérault & Jenkins, 2019). We also provide profiles of the persistently and transiently poor and the vulnerable along a number of socioeconomic factors.

The most recent assessment of poverty dynamics in Tanzania to date (World Bank, 2019) consists of a comprehensive analysis of National Panel Survey (NPS) panel data between 2008 and 2012, as well as some synthetic panel results for dynamics over the period 2010–2014, based on the fourth NPS wave. Compared to that recent work on essentially the same subject, this paper contributes to the literature in various ways. First, we provide a more updated scenario of poverty dynamics for the period between 2012 and 2018, thereby focusing on a period of strong economic growth but feeble poverty reduction. Second, we rely on HBS data, which cover a considerably larger sample. More important, substantial differences between the HBS and the NPS have been documented in terms of trends in poverty, inequality, and pro-poor growth (Hassine-Belghith et al., 2018), so that an analysis based on the data used to produce official poverty statistics (HBS) is of utmost interest. In addition, the sampling frame of the HBS, particularly the 2017–2018 round, allows for regional disaggregation, an important aspect for understanding the spatial distribution of poverty and vulnerability and their dynamics. Third, we empirically define a vulnerability line and provide profiles of the vulnerable population, a very relevant issue in an economy characterized by high levels of income variability. Finally, we discuss the characteristics that might be particularly relevant in view of COVID-19.

We find that the Tanzanian economy is characterized by sizable fluctuations around the poverty line, as more than twice as many households experience transient poverty than persistent poverty. An initially poor household is about 10% more likely to be classified as nonpoor than to remain poor in the subsequent period, while one of five initially nonpoor households will fall below the poverty line. This fact indicates very high levels of vulnerability. In line with the sluggish poverty reduction, the numbers of households that transition in and out of poverty are roughly comparable.

Some of the household characteristics that are strongly associated with less vulnerability and persistent poverty are education above the primary level, wage employment, small household sizes and single household heads, low dependency ratios, living in urban areas or certain regions (Dar es Salaam, Pwani, and Kilimanjaro), and high living standards in terms of dwelling characteristics and asset ownership. Finally, households that are less well equipped to take preventive measures against COVID-19 are worse off in terms of their poverty trajectories, while those households more likely to be affected by the first-order economic effects of the pandemic are generally less represented among the poor and the vulnerable.

Section 2 summarizes recent information on growth, poverty, and vulnerability in the country. Section 3 introduces the methodology adopted and the data used in our analysis of poverty dynamics and vulnerability. Section 4 provides details on the estimation procedure and presents results for the whole population of mainland Tanzania. These results are then refined further in Section 5, which discusses poverty and vulnerability profiles. Section 6 reviews available early evidence on the impact of COVID-19 in Tanzania and presents some poverty and vulnerability profiles that might be particularly relevant regarding the pandemic. Section 7 concludes with a discussion of the implications of our findings.

2 | COUNTRY BACKGROUND: RECENT TRENDS IN ECONOMIC GROWTH AND POVERTY

Tanzania has recorded notable economic growth over the past decade, and recently attained lower middle-income economy status, as envisaged in the Tanzania Development Vision 2025 (URT, 2000). According to the National Account Statistics,[3] real GDP growth maintained a rate of around 6.5% over the period 2008–2019, as can be observed in Figure 1.

While GDP growth in Tanzania has been impressive, its effect on poverty reduction has not been equally impressive. The incidence of basic needs poverty reached 26.4% in 2018 according to the 2017–2018 HBS, a slight decrease from 28.2% in the 2011–2012 HBS. This was preceded by a more pronounced decrease from 34.4% in 2007 (see Figure 2), so that there are signs of an increasingly weak response of poverty to economic growth. Food poverty decreased from 11.8% in 2007 to 9.7% in 2011 and further down to 8.0% in 2017–2018 (URT, 2019a).
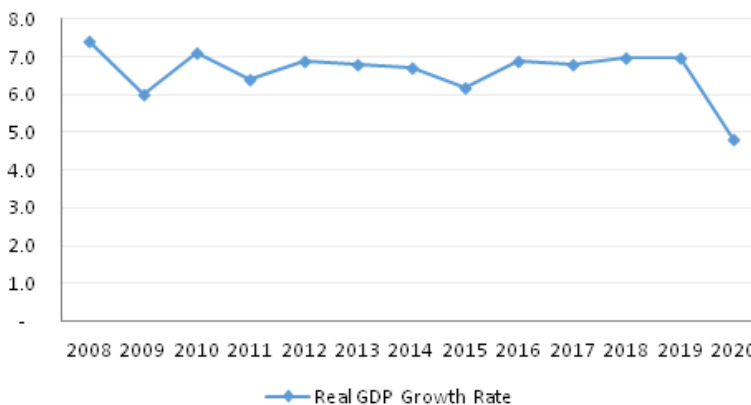

FIGURE 1 Annual gross domestic product (GDP) growth rates at 2015 market prices, mainland Tanzania, 2008–2020. *Source*: Authors' construction based on National Accounts Statistics of mainland Tanzania 2008–2020 [Colour figure can be viewed at wileyonlinelibrary.com]
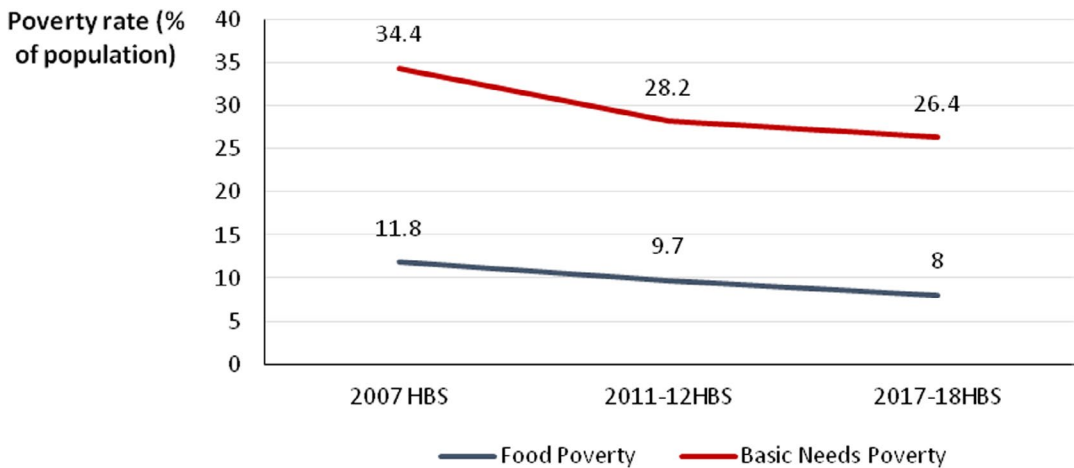
FIGURE 2 Poverty trends in mainland Tanzania, 2007–2018. *Source*: Authors' construction based on 2007, 2011–2012, and 2017–2018 Household Budget Survey Data [Colour figure can be viewed at wileyonlinelibrary. com]

Arndt et al. (2016) study Tanzania's growth elasticity of poverty (GEP) and show that a 10% increase in GDP per capita in Tanzania is expected to reduce poverty by only 8.2%.[4] An even lower GEP has been estimated for the period 2012–2018, so that 10% of GDP growth translates into 4.5 percentage points of poverty reduction (World Bank, 2019). Tanzania's GEP is thus low in international perspective, since in other developing countries a 10% increase in GDP per capita is associated with reductions in the poverty rate over 20% (World Bank, 2019).

The rate of poverty reduction between 2011–2012 and 2017–2018 lies below the rate of population growth for this period, estimated at an annual average of around 3%, which implies that the decrease in poverty rates is not enough to offset the increase in the poor population resulting from those born in poverty. Thus, in absolute terms, poverty increased from 12.3 million people in 2011–2012 to 14 million people in 2017–2018.

Poverty rates show substantial variation across regions (URT, 2019a). The incidence of basic needs poverty is higher in rural areas (31.3%) than in urban areas (15.8%) according to the 2017–2018 HBS. Over 80% of the country's poor reside in rural areas, while only 3.0% reside in Dar es Salaam. Similarly, according to the 2017–2018 HBS, food poverty is higher in rural areas (9.7%) than in urban areas (4.4%). Regarding other socioeconomic characteristics, poverty is positively associated with household size and number of children, and thus concentrated among individuals aged 0–19 years.

3 | METHODOLOGY AND DATA

3.1 | Methodology

This paper studies poverty dynamics in Tanzania using the synthetic panel approach proposed by Dang et al. (2014) and Dang and Lanjouw (2013). Briefly, the synthetic panel approach relies on estimating models for household consumption based on time-invariant household characteristics. These models then make it possible to predict household per-capita consumption for

survey rounds where the household is not observed and, under certain assumptions, to derive bounds and point estimates for poverty dynamics. The methodology is fully explained in Garcés-Urzainqui et al. (2021).

We introduce an innovation to this methodology. To deliver point estimates of mobility, the synthetic panel approach requires a point estimate of the intertemporal correlation of the component of consumption not explained by the prediction models. Dang and Lanjouw (2013) suggest to derive this from the intertemporal correlation of income ρ_y, which they approximate by the correlation of average income for cohorts of individuals born in the same year or group of years. This approximation has been pointed out as one of the most contentious and sensitive steps in the procedure to provide point estimates based on synthetic panels (Garcés-Urzainqui, 2017; Hérault & Jenkins, 2019). Given the availability of relatively recent nationally representative panel data for the period 2008–2012, we thus prefer to directly estimate ρ_y from an actual household panel and extrapolate it to our period of study. The key assumption here is that intertemporal income correlation did not change much over time between 2008 and 2018, which seems realistic as the macroeconomic environment was largely stable.

We use the official national poverty lines set by the National Bureau of Statistics (NBS): 36,482 Tanzania shillings (TZS) per equivalent adult in 2011–2012 and 49,320 TZS in 2017–2018 (URT, 2019a). To define a vulnerability line, we follow the empirical approach suggested in Dang and Lanjouw (2017). In this approach, a conditional probability that vulnerable households slip into poverty in the next period (also called vulnerability index P^2) needs to be specified ex ante, and the vulnerability line is set at the adequate level so that this prespecified target is met for the data at hand.

3.2 | Data

We use data from Tanzania HBS conducted by the NBS in collaboration with the World Bank. To date, there are five rounds of the HBS (1990–1991, 2001, 2007, 2011–2012, and 2017–2018). We apply synthetic panel methods to the two most recent rounds of the HBS, 2011–2012 and 2017–2018. The HBS is the nationally representative cross-sectional survey that is used for official measurement and reporting of poverty in Tanzania. The sample covered is large (10,186 households in 2011–2012 and 9,552 in 2017–2018), and the similarity of survey design and format across the rounds of survey ensures the comparability of data over time. In addition, the 2017–2018 round allows for disaggregated estimates for all regions of mainland Tanzania (URT, 2019a), an important aspect when seeking to understand the spatial distribution of poverty and vulnerability across the country.

As mentioned earlier, we also use panel data from the NPS, a comprehensive panel survey that is equivalent to the World Bank's Living Standards Measurement Survey, with an initial sample of 3,265 households. We use data from waves 1 and 3, corresponding to 2008–2009 and 2012–2013, respectively, to estimate the intertemporal correlation of income at the household level. It should be noted that the latest wave of panel data available at the time of writing (February 2021) that can be fully related to previous data corresponds to 2012–2013. Thus, we resort to applying synthetic panel methods to the most recent rounds of the HBS to provide the most up-to-date perspective possible on the correlates of poverty dynamics and vulnerability.

4 | POVERTY AND VULNERABILITY AT THE AGGREGATE LEVEL

We estimate a linear regression model with the logarithm of consumption expenditure per-adult equivalent per month, adjusted for spatial price differences, as the dependent variable. To obtain reliable predictions for consumption in the period in which the household is not observed, we include as regressors only those covariates that can be confidently assumed to be time invariant: gender, age, education level, and region of birth of the household head. Further, to ensure the stability of the reference population, we focus on households whose heads are aged between 25 and 65 years in survey round 1, and the sample is adjusted accordingly in period 2.[5] Table A1 in the Appendix available online under Supplementary Files provides descriptive statistics for characteristics included in the model, and Table A2 (Available online under Supplementary Files) presents the results from the estimation of these income models.

Table 1 shows lower and upper bounds of transitions in and out of poverty between 2012 and 2018 based on our prediction models. As is often the case, the range of possible poverty transitions delimited by these bounds is rather wide. However, it is obvious that even in the case with the least mobility we would expect 11% of the initially poor households to transition out of poverty, a first indication of the importance of transient poverty. We also see that the ranges of possible values for transitions into and out of poverty overlap almost perfectly, pointing to the slow pace of poverty reduction.

To refine the findings from this exercise, we need to rely on a point estimate of the intertemporal correlation of income ρ_y. We derive it from panel data, in particular from waves 1 and 3 of the NPS. We estimate a value of $\rho_y = 0.49$, which implies that $\rho = 0.35$. To estimate ρ_y, we adjust for the fact that the 6-year period between the two HBS rounds of interest is 50% longer than that between the two NPS waves from which we derive our estimate of the intertemporal correlation of income based on household-level data.[6]

Table 2 presents the resulting estimates of poverty transitions in Tanzania over the 2012–2018 period as joint probabilities, that is, the absolute probability that a household would be in the pair

TABLE 1 Poverty dynamics in Tanzania, 2012–2018: Parametric bounds

	Lower bound	Upper bound
Panel A: Joint probabilities		
Poor, poor	8.71	24.53
Poor, nonpoor	3.16	18.98
Nonpoor, poor	2.51	18.33
Nonpoor, nonpoor	53.98	69.80
Panel B: Conditional probabilities		
Poor to poor	31.45	88.58
Poor to nonpoor	11.42	68.55
Nonpoor to poor	3.47	25.35
Nonpoor to nonpoor	74.65	96.53

Notes: Probabilities expressed as percentages. Household head's age is restricted to be between 25 and 65 years in 2012 and accordingly in 2018. These are synthetic panel estimates, computed using population weights. The estimation sample has 8,602 observations in Household Budget Survey (HBS) 2011–2012 and 7,243 in HBS 2017–2018.

TABLE 2 Point estimates of poverty dynamics in Tanzania, 2012–2018: Joint probabilities

		2018	
		Poor	**Nonpoor**
2012	Poor	12.52	15.18
	Nonpoor	14.52	57.79

Notes: Each cell represents the share of population in the state indicated by the row in 2012 and the column in 2018. Household head's age is restricted to be between 25 and 65 years in 2012 and accordingly in 2018. These are synthetic panel estimates, computed using population weights. The estimation sample has 8,602 observations in Household Budget Survey (HBS) 2011–2012 and 7,243 in HBS 2017–2018.

of states (p_{2012}, p_{2018}), where p ε {poor, nonpoor}—or, in an alternative interpretation, the share of households in that situation. Rows reflect poverty status in 2012, while columns correspond to 2018. The percentage of households that do not experience poverty in any of the two periods is limited to 60% of the Tanzanian population. This is likely to be an underestimate of the actual poverty risk faced by households in Tanzania, as we have measured only their economic well-being at two points in time, and some households may well have experienced poverty spells and recovered from them at some point between 2012 and 2018. Income fluctuations are an important characteristic of the economic life of Tanzanian households, as the percentage of households that experience transient poverty (poor in only one period) is more than double that of households in persistent poverty: 29.7% versus 12.5%. Transitions in and out of poverty are roughly of the same magnitude, which underlines the limited progress made in terms of poverty reduction during these years.

The poverty transitions expressed conditionally on the state of the household in 2012, presented in Table 3, indicate that a household that was poor in 2012 was slightly less likely to stay poor (45.2%) than to have moved out of poverty by 2018 (54.80%). On the other hand, one of five households initially out of poverty experienced downward mobility into it. Taking the population numbers of HBS 2012 as a reference, that is ~6.3 million people.

Our estimates of both joint and conditional poverty transitions are qualitatively very similar to those in World Bank (2019) that result from analyzing NPS data over two different 4-year periods between 2008 and 2014—for instance, we estimate the conditional probability to exit poverty at 54.80%, which is between their panel estimate of 51.9% for 2008–2012 and their synthetic panel estimate of 60.8% for 2010–2014. These are high levels of mobility with respect to the range of possible outcomes as reflected by the bounds, and also in a regional perspective: just 8 of the other 20 countries in sub-Saharan Africa studied by Dang and Dabalen (2019) over different

TABLE 3 Point estimates of poverty dynamics in Tanzania, 2012–2018: Conditional probabilities

		2018	
		Poor	**Nonpoor**
2012	Poor	45.20	54.80
	Nonpoor	20.08	79.92

Notes: Each cell represents the probability (in percentage points) of a household in the state indicated by the row in 2012 transitioning to the state indicated by the column in 2018. Household head's age is restricted to be between 25 and 65 years in 2012 and accordingly in 2018. These are synthetic panel estimates, computed using population weights. The estimation sample has 8,602 observations in Household Budget Survey (HBS) 2011–2012 and 7,243 in HBS 2017–2018.

periods between 1990 and 2012 present a higher incidence of transient poverty than the 29.7% estimated here.

The method in Dang and Lanjouw (2017) allows to define a vulnerability line that matches a pre-specified level of downward mobility risk. We choose a vulnerability index $P^2 = 0.30$, which implies that 30% of the households defined as vulnerable in 2012 fall into poverty in 2018. This is a larger value than usually set in the literature (Dang & Dabalen, 2019), a choice that reflects the high vulnerability to poverty that characterizes the Tanzanian economy.[7] For HBS 2011–2012 we obtain a line of 53,561 TZS per-adult equivalent per month, in nominal terms, which implies scaling up the poverty line by about 146.8%. With the price deflators implied by the poverty lines, this corresponds to a vulnerability line of 72,409 TZS in HBS 2017–2018. With this vulnerability line, 28% (26%) of the population is considered to be vulnerable in 2012 (2018), while around 45% (47%) of Tanzanians enjoy secure consumption levels above the vulnerability line.

We now further disaggregate the patterns observed in Tables 2 and 3, and present results for joint and conditional probabilities of transitions between the three categories defined by the poverty and vulnerability lines (poor, vulnerable, and secure) in Tables 4 and 5. We see in Table 4 that initially vulnerable households spread in similar proportions across the three categories in the second period, although Table 5 clarifies that the probability that an initially vulnerable household will improve its status to secure is about 50% larger than that of slipping into poverty. Some porosity exists between the top and the bottom categories and transitions in one or the other direction account each for about 7.5%–8% of the total population, as detailed in Table 4. This emphasizes again the great consumption variability faced by Tanzanian households: even 'secure' households are susceptible to slipping into poverty, although they are about half as likely to do so as initially vulnerable households (15.3% vs. 30%, see Table 5). On the bright side, we see that the largest cell in Table 4 is that of the nonpoor and nonvulnerable over both periods, 31.76% of the population. Looking at conditional probabilities in Table 5, this translates into a probability close to 65% for initially secure households to stay above the vulnerability line.

5 | IDENTIFYING THE PERSISTENTLY POOR AND VULNERABLE

This section details how various household characteristics are associated with poverty dynamics and vulnerability. First, we focus on variation by region and area of residence. Then, we study the role played by household characteristics, such as education, occupation, demographic

TABLE 4 Point estimates of welfare dynamics in Tanzania, 2012–2018: Joint probabilities

		2018		
		Poor	Vulnerable	Secure
2012	Poor	12.52	7.15	8.03
	Vulnerable	7.02	6.13	10.24
	Secure	7.50	9.65	31.76

Notes: Each cell represents the share of population in the state indicated by the row in 2012 and the column in 2018. The vulnerability line is calculated by taking a vulnerability index of 30%. This results in a vulnerability line of 53,561 TZS per equivalent adult per month in 2012. Household head's age is restricted to be between 25 and 65 years in 2012 and accordingly in 2018. These are synthetic panel estimates, computed using population weights. The estimation sample has 8,602 observations in Household Budget Survey (HBS) 2011–2012 and 7,243 in HBS 2017–2018.

TABLE 5   Point estimates of welfare dynamics in Tanzania, 2012–2018: Conditional probabilities

		2018		
		Poor	**Vulnerable**	**Secure**
2012	Poor	45.20	25.80	29.00
	Vulnerable	30.00	26.22	43.78
	Secure	15.34	19.73	64.93

Notes: Each cell represents the probability (in percentage points) of a household in the state indicated by the row in 2012 to transition to the state indicated by the column in 2018. The vulnerability line is calculated by taking a vulnerability index of 30%. This results in a vulnerability line of 53,561 TZS per equivalent adult per month in 2012. Household head age is restricted to be between 25 and 65 years in 2012 and accordingly in 2018. These are synthetic panel estimates, computed using population weights. The estimation sample has 8,602 observations in Household Budget Survey (HBS) 2011–2012 and 7,243 in HBS 2017–2018.

composition, financial inclusion, and welfare according to alternative indicators. For ease of exposition, we focus on the share of households estimated to be vulnerable and secure in 2018, and in persistent poverty over the period of study, as well as on conditional probabilities of moving into poverty. Unless otherwise indicated, we present results as odds ratios; that is, how much more likely is a household with the given characteristic to be in a particular welfare category as compared to the national average?

It should be noted that these profiles rely on a common consumption model and intertemporal correlation for all types of households. A possible alternative to this homogeneity assumption could involve computing separate intertemporal correlation parameters and estimating specific income models for each particular subsample. We prefer to employ a common model for all characteristics to ensure consistency with our national estimates and enhance comparability across characteristics. In addition, working with a specific model for each characteristic is not feasible or sensible due to sample size issues. Nevertheless, we illustrate the role of the homogeneity assumption for urban and rural areas in Table A3 (Available online under Supplementary Files). We compare the baseline results obtained with one common model for the whole country to the poverty dynamics estimated when the complete estimation procedure is carried out separately for urban and rural areas. Both approaches capture that urban areas have more favorable poverty dynamics. Nevertheless, specific models yield considerably higher conditional probabilities of leaving poverty in urban areas, so that differences in rural areas are accentuated, particularly in terms of persistent poverty. While we have no benchmark to evaluate which approach performs best, this suggests that using a common model may dampen the differences in poverty dynamics associated with particular characteristics and thus lead to conservative estimates of such differences. In any case, it is appropriate to interpret the following profiles with caution.

5.1 | Regional variation

Figure 3 shows poverty transitions by area of residence. Poverty is predominantly a rural phenomenon in Tanzania, as the poverty rate in rural areas (31.3%) approximately doubles that in urban areas (15.8%).[8] This is reflected in our estimates in Figure 3 as rural areas display higher levels of persistent poverty, conditional downward mobility, and vulnerability but a lower share of households above the vulnerability line. It should be noted that the difference between Dar es Salaam and other urban areas is comparable to the gap between the latter and rural areas.
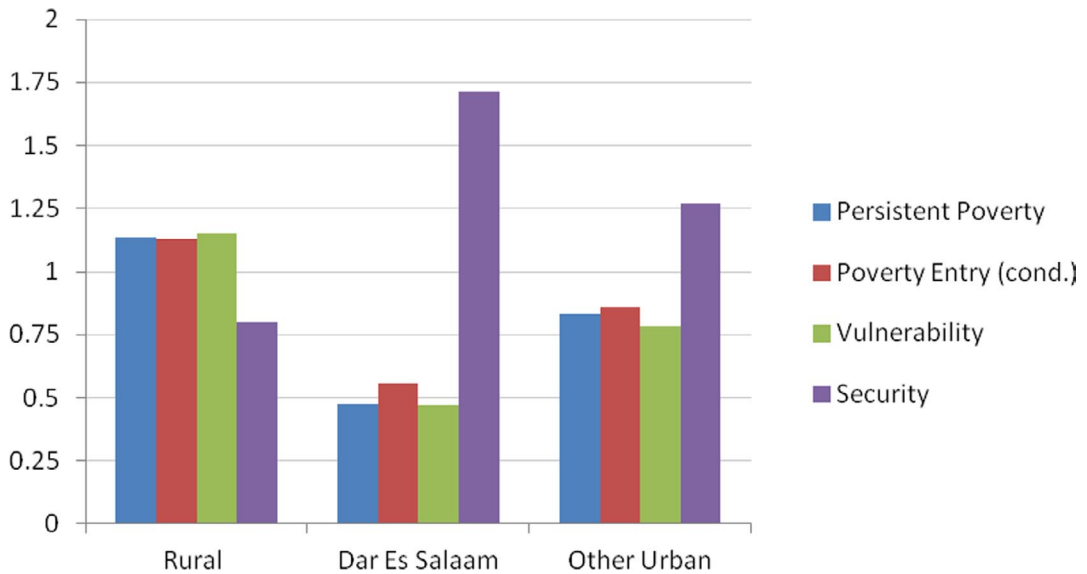
FIGURE 3 Persistent poverty, poverty entry, vulnerability and security by area of residence. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially non-poor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%) [Colour figure can be viewed at wileyonlinelibrary.com]

There is substantial regional variation beyond Dar es Salaam. We visualize regional patterns in persistent poverty, vulnerability, and movements out of poverty with the help of maps.[9] Figure 4 shows the spatial distribution of persistent poverty, which ranges between 4.40% in Kilimanjaro and 23.50% in Kigoma. In general, the situation in the northwest of the country is more dramatic, with persistent poverty consistently above 15%, levels reached only in Singida (center) and Ruvuma (south) outside that area. On the contrary, Dar es Salaam, Pwani, and Morogoro are regions with a more favorable outlook, with persistent poverty rates below 10%.

Figure 5 shows the share of the vulnerable population in 2018 across different regions. Most regions show values around 30%, and northern regions tend to have higher values. Note that regions with very different poverty rates (Njombe at 15% and Geita at almost 40%) can have similar vulnerability levels. Dodoma and Shinyanga exhibit the highest levels of vulnerability (above 36%), while regions on the southern border, Mbeya and especially Dar es Salaam, enjoy the lowest values of vulnerability.

Another mobility quantity that is characterized by a clear regional gradient is poverty exit, the conditional probability of transitioning from poor to nonpoor status. As reflected in Figure 6, the high-poverty exit probabilities in the south and east of the country decline gradually as we move across the center of the country to arrive at their lowest levels in the northern and western regions. It should be noted that high-poverty exit probabilities are found not only in the regions that are, in general, economically stronger, among which Kilimanjaro stands out with an estimate above 70%, but also in some southern regions like Ruvuma, affected by substantial levels of persistent poverty. On the negative side, Rukwa's conditional upward mobility lies at 70% of the national average, while downward mobility is 70% higher than average for the initially nonpoor there (see Table A5 available online under Supplementary Files).
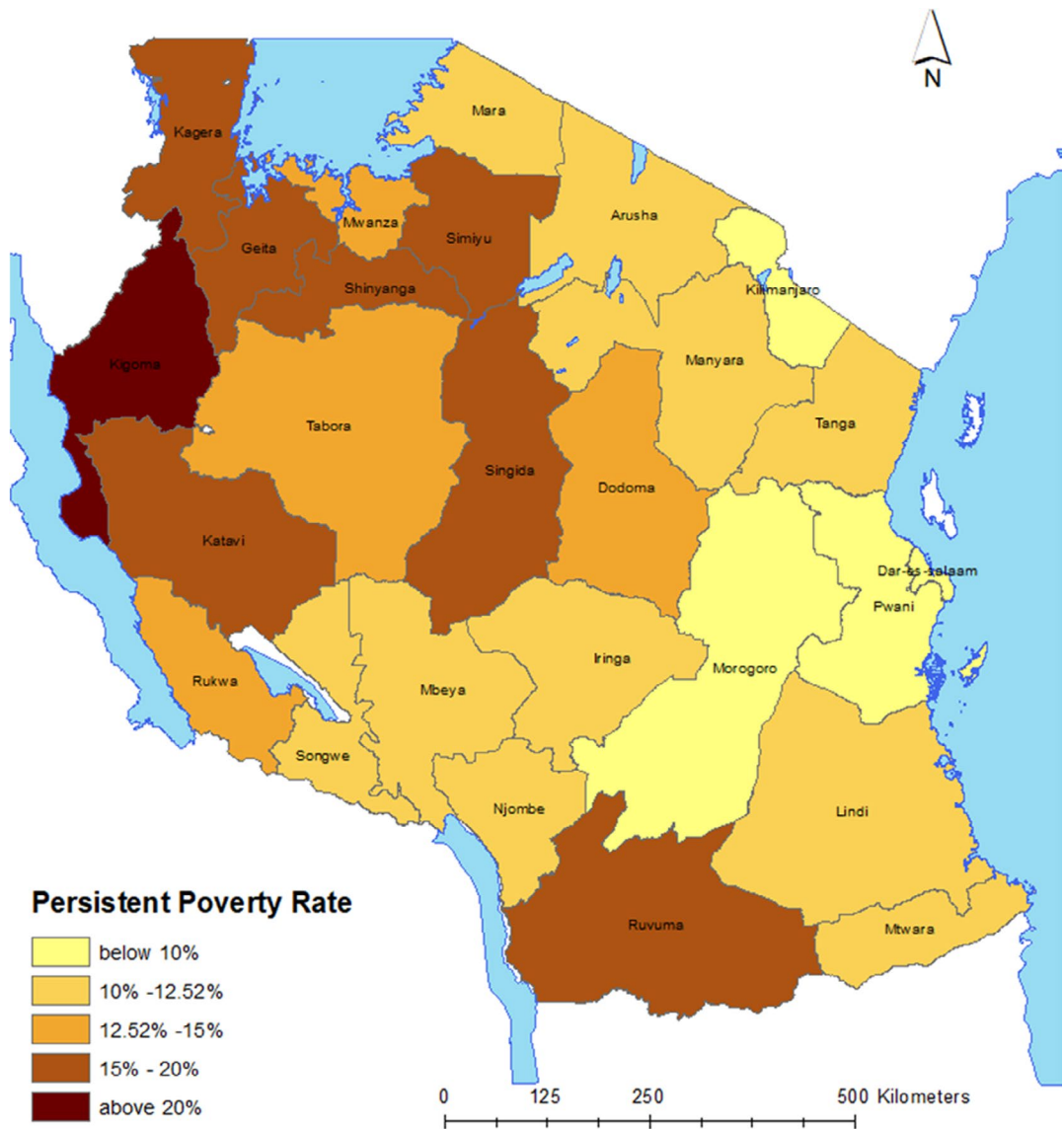
FIGURE 4 Persistent poverty across regions in mainland Tanzania. Estimates show synthetic panel estimates of the absolute probability of being below the poverty line in both 2012 and 2018 [Colour figure can be viewed at wileyonlinelibrary.com]

5.2 | Household characteristics

We now discuss which household characteristics are more strongly associated with positive or negative poverty dynamics. Our results in Figure 7 reflect the determinant role of education for living standards. Households whose head has education beyond the primary level are particularly well shielded from poverty: the share of households whose head has secondary education in persistent poverty is 13% of the national average, while there are virtually no persistently poor households with a head with a diploma or tertiary education. The contribution of education to
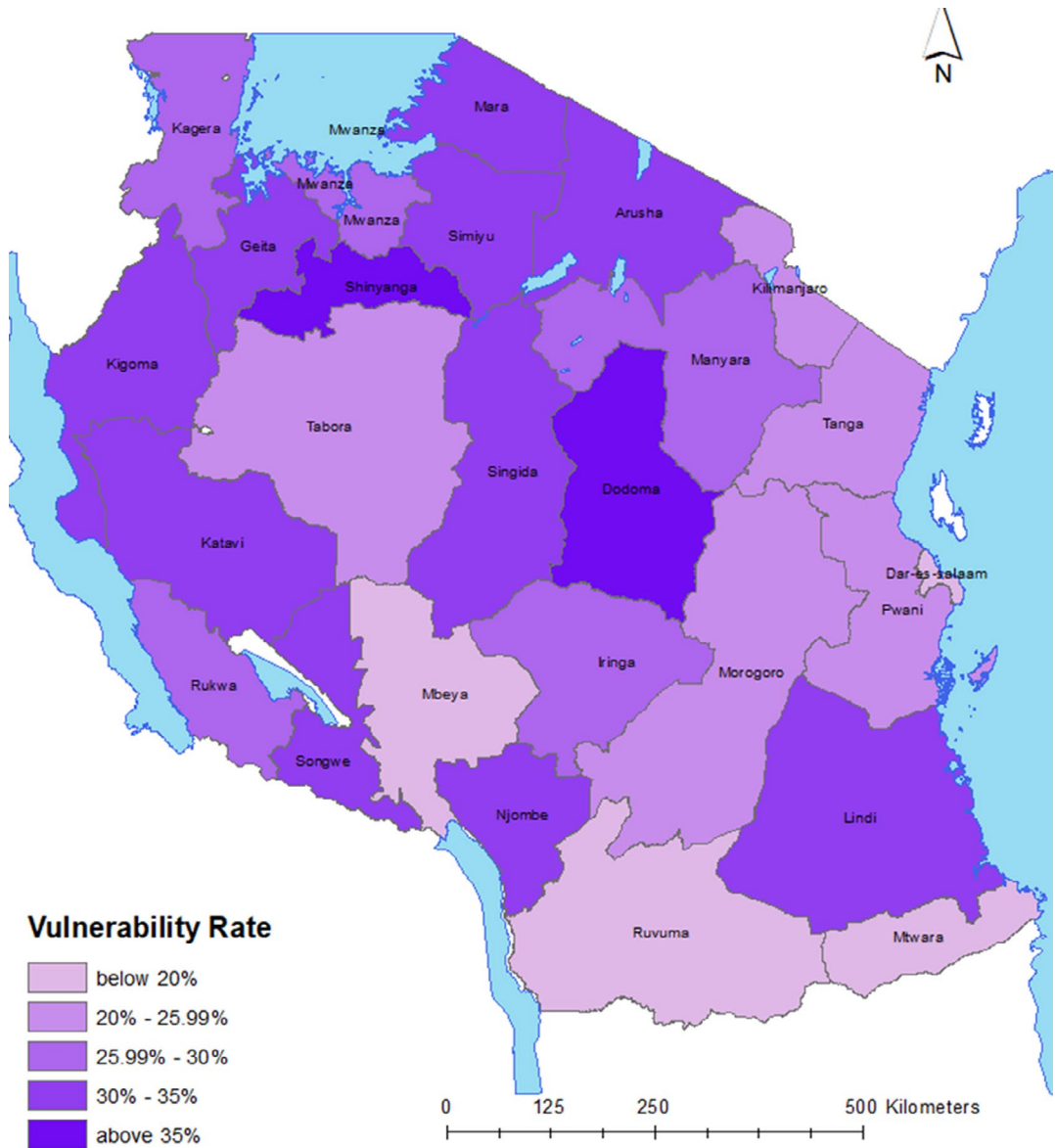
FIGURE 5 Vulnerability across regions in mainland Tanzania. Estimates show the share of the vulnerable population in 2018. The vulnerability line is calculated by taking a vulnerability index of 30%. This results in a vulnerability line of 72,409 TZS per-equivalent adult per month in 2018 [Colour figure can be viewed at wileyonlinelibrary.com]

insurance against poverty can be also observed in the smaller probability of slipping into poverty for the highly educated. On the contrary, households with a head who cannot read or write are in the worst situation, as they are 50% more likely than an average household to suffer from persistent poverty and 40% more likely to slip into poverty. No other characteristic shows such a strong influence on poverty dynamics as education.

In terms of the main activity of the household head,[10] work on the household farm is associated with worse outcomes than average and also than self-employment in nonfarm activities.
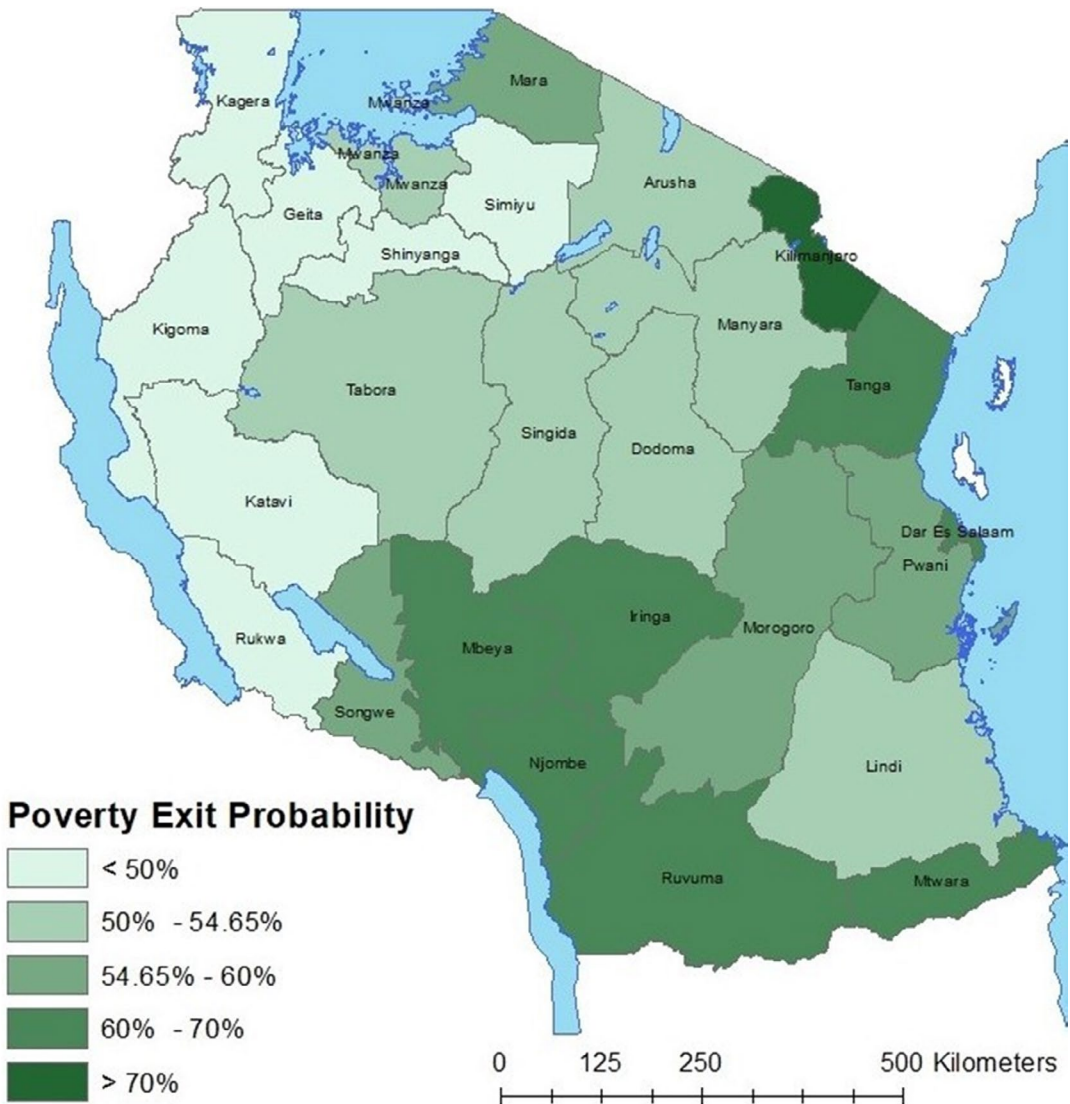
FIGURE 6 Poverty exit across regions in mainland Tanzania. Estimates show synthetic panel estimates of the probability of being above the poverty line in 2018, conditional on being below the poverty line in 2012 [Colour figure can be viewed at wileyonlinelibrary.com]

There is a similar gap between these categories and paid employees, as these suffer from very low persistent poverty and downward mobility rates (about 40%–55% lower than the national average), and many of them are secure above the vulnerability line. The same holds for households that have any member employed in the secondary sector. While those in salaried work are mostly household heads with relatively high levels of education, the secondary-work sector comprises diverse activities suitable for different education levels, which points to an independent role of occupation. Rural households with a head whose main activity is not farm related are somewhat worse off than other nonfarm households but better off in terms of poverty dynamics than the average household and in particular the average rural household. On the contrary, these rural households with a head engaged in nonfarm employment are disproportionately likely to be
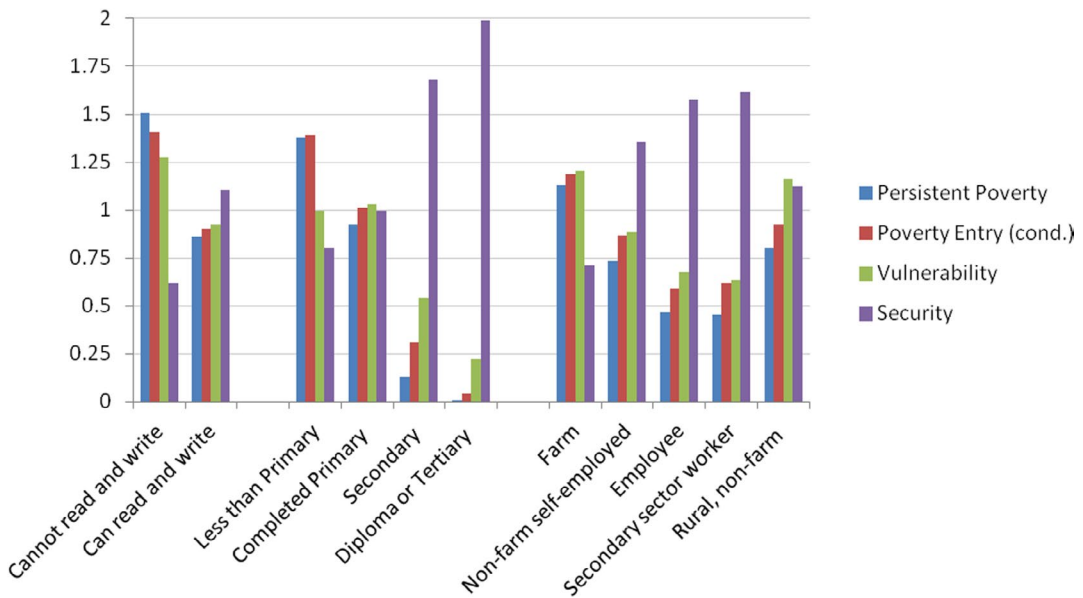
FIGURE 7 Persistent poverty, poverty entry, vulnerability and security by education, and main activity of household head. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially nonpoor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%) [Colour figure can be viewed at wileyonlinelibrary.com]

classified as vulnerable, which shows that many of them are not that far above the poverty line. This points to the role of rural economic diversification as one of the possible ways to alleviate rural poverty (Diao et al., 2018) but also underlines the fragility of the progress attained.

Figure 8 focuses on demographic characteristics of the household. The gender of the household head does not seem to play a major role in poverty dynamics, although female-headed households are around 8% more likely to be persistently poor. On the contrary, persistent poverty and vulnerability are lower among households with a younger head (aged less than 40 years in 2018), although the conditional probability of falling into poverty for this group does not seem markedly different from that of older households. In line with this age gradient, single-household heads seem to be clearly in the best situation in terms of persistent poverty, downward mobility, and especially vulnerability compared to heads with different civil status. On the contrary, households where the head is polygamous are at a somewhat higher risk (17%) than the average households of falling into poverty or being persistently poor.

These findings are consistent with the patterns that can be identified based on household composition. Small households with one to three people, which are likely to include the young and the unmarried, are more than 50% more likely than the average household to be classified as secure, while large households with six or more members are about 20% more likely to be conditionally downwardly mobile and 20% less likely to lie above the vulnerability line. The patterns are quite similar when we split households by their dependency ratio, the share of household members below age 15 or above 65 years, reflecting that large households also tend to have more dependents.

Figure 9 shows how further household characteristics (other welfare indicators, financial integration, access to mobile phone devices, and participation in public programmes) are associated
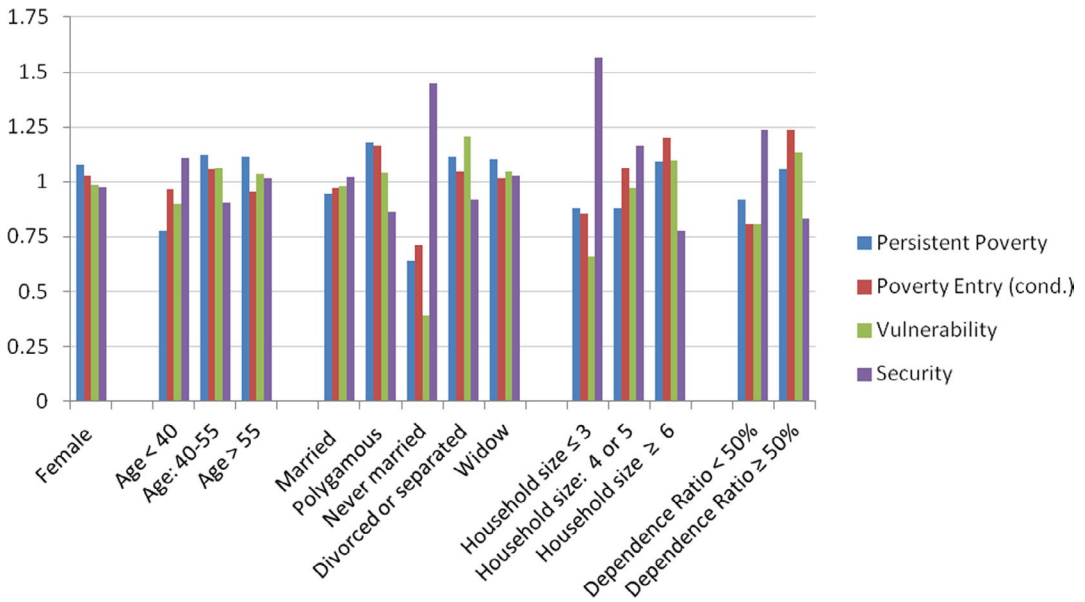
FIGURE 8 Poverty dynamics and vulnerability by demographic characteristics. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially nonpoor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%). The first three blocks (gender, age, and civil status) refer to characteristics of the household head [Colour figure can be viewed at wileyonlinelibrary.com]

with poverty dynamics. We can see that acute food insecurity[11] is related to a small probability of being considered secure from the perspective of our monetary welfare indicator. Persistent poverty and downward mobility are higher for food-insecure households but only slightly so — this small difference shows the ubiquity of severe shocks that lead households to skip meals, not circumscribed to the poor —. Next, we compute the living standard component of the global multidimensional poverty index (MPI), as in Alkire et al. (2020). The component includes six dimensions: sanitation, drinking water, cooking fuel, assets, housing adequacy, and electricity. We split households according to the number of these six dimensions in which they are considered deprived. As could be expected, the MPI Living Standards component is robustly associated with outcomes in terms of monetary poverty dynamics. The least deprived households (zero to two deprivations) are 35%–40% less likely than the average Tanzanian to experience persistent poverty, vulnerability, and downward mobility, while the most deprived households (five or six deprivations) are about 25% more likely to be persistently poor or to slip into poverty. These patterns are consistent with the literature, which has found a stark overlap of monetary and multidimensional poverty in sub-Saharan Africa (World Bank, 2020), and identified low asset ownership as one of the characteristics on which persistently poor households differ most markedly from other households in Tanzania (World Bank, 2019). Figure A1 (Available online under Supplementary Files) shows that, among the MPI components, adequate housing, cooking fuel, and electricity have the most marked association with welfare dynamics.

As for the other characteristics in Figure 9, financial inclusion (having a bank account) is a very strong predictor of income security (83% above the national mean) and reduced risk of downward mobility. It can be argued that this shows that bank accounts are a prerogative of richer segments of the population. However, mobile phone ownership is much more widespread
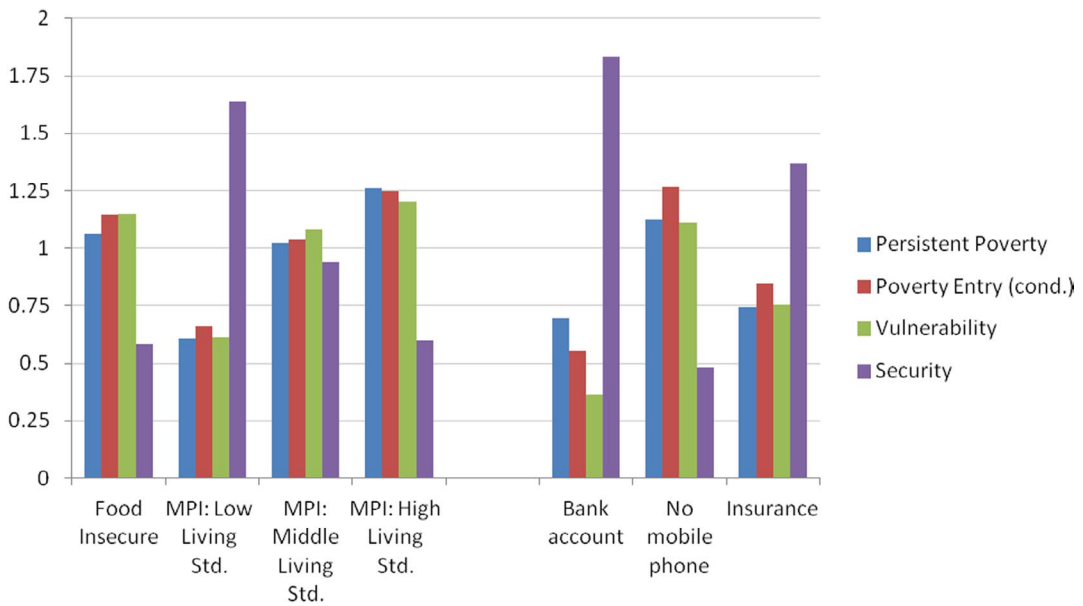
FIGURE 9 Poverty dynamics and vulnerability by other household characteristics. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially nonpoor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%). Some estimates in the first block correspond to different numbers of deprivations in the Living Standard component of the Global Multidimensional Poverty Index, computed as in Alkire et al. (2020). 'Low living standards' means deprivation in zero to two dimensions, 'middle living standards' means deprivation in two to four dimensions, and 'high living standards' means deprivation in four to all six dimensions [Colour figure can be viewed at wileyonlinelibrary.com]

and allows many households to make use of mobile money. Lacking a mobile phone is strongly associated with higher odds of slipping into poverty (27% above the national average) and being below the vulnerability line. Households with insurance are also generally well off, although less so than those that are financially integrated.

6 | VULNERABILITY AND COVID-19

Section 5 sought to investigate the correlates of persistent poverty and vulnerability between 2012 and 2018, 'normal times' characterized by robust economic growth not sufficiently translated into poverty reduction. The immediate question facing policymakers is to what extent these findings should inform their initiatives to reduce poverty and vulnerability in the current panorama, dominated by the impact of COVID-19 and policy responses to the pandemic. This section aim to contribute to this reflection by incorporating insights into the likely impact of COVID-19 into our profiles of vulnerability: Is the pandemic mainly worsening the circumstances of those already in a more frail situation, or does it instead mostly affect a different class of households? For that purpose, we first present an overview of early insights into the impact of COVID-19 in Tanzania, and we then analyze the pre-pandemic poverty and vulnerability profiles of those households least able to protect themselves from COVID-19, and of the groups most likely to be affected by its economic consequences.

6.1 | The impact of COVID-19

It is difficult to assess the public health impact of COVID-19 on Tanzania, since the release of official data on tests, cases and deaths was interrupted in May 2020 in line with the official stance that coronavirus had been defeated in the country. Tanzania opted to avoid lockdown as a strategy to deal with COVID-19 and tried to minimize the adoption of measures with disruptive effects on economic activity. Some restrictions, such as school closures or the ban of mass public gatherings, were initially implemented, but most of them were gradually lifted after a few months. As shown in Figure 10, based on data from Hale et al. (2021), the restrictions set in place by the Tanzanian government have been consistently less stringent than those of other countries in the region, both at the initial stage of the pandemic and in more recent times. The recent spike in stringent restrictions corresponds to the arrival of President Samia Suluhu Hassan to power following the death of former President Magufuli in March 2021, which marked a shift in the policy response to COVID-19. As at August 2021, the new government has acknowledged the presence of the virus in Tanzania in the form of a third wave of cases, has started releasing COVID-19-related statistics, has recommended the use of masks in public, and has launched a vaccination campaign.

The immediate economic repercussions of the pandemic in Tanzania seem to have been mild compared to countries undertaking more aggressive action to contain it. The International Monetary Fund projected in October 2020 that Tanzania's economy would grow by 1.9%, the second-highest growth rate forecast for any country in International Monetary Fund (2020). This is in line with the World Bank's projection of 2.0% real GDP growth (World Bank, 2021). Recent official data (Bank of Tanzania, 2021a) indicate a better scenario with 4.8% real GDP growth over 2020. As a net oil importer and a net gold exporter, Tanzania's economy has leveraged 'dual
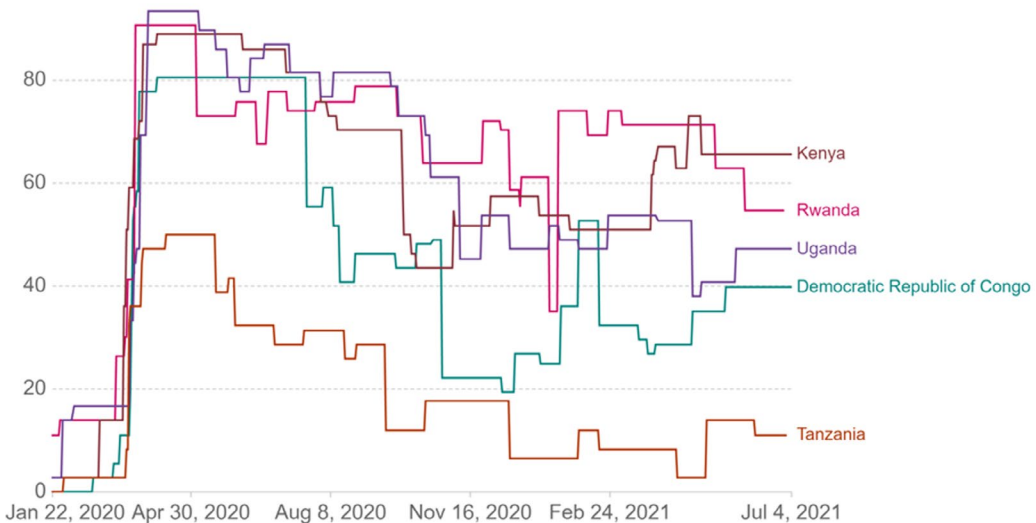

FIGURE 10 Policy response in Tanzania and some neighboring countries. *Source*: Data from Hale et al. (2021). Last updated July 15, 2021. Graph produced with online visualization tools from ourworldindata.org [Colour figure can be viewed at wileyonlinelibrary.com]

positive shocks', since the decrease in oil price coupled with the increase in gold price in global markets in 2020 brought some improvement to Tanzania's terms of trade (Bank of Tanzania, 2021b). However, Tanzania's economy seems to have remained rather resilient at the macro level.

Nevertheless, COVID-19 has still affected the economy negatively and unevenly, most likely increasing vulnerability and ultimately poverty. Predictions in the first half of 2020, as in UNDP (2020), pointed to a severe negative impact on the incomes of many different groups. Simulations based on the HBS data indicate that the crisis has increased the basic needs poverty rate to 27.2%, pushing 600,000 more people below the poverty line compared to a scenario without COVID-19 (World Bank, 2021). The results from rapid assessment surveys reported in World Bank (2021) point to employment losses in the formal sector but especially to substantial income losses for those operating or employed in informal, nonfarm microenterprises. This economic impact is concentrated in urban settings and particularly strong in Dar es Salaam. These surveys also reveal a substantial decrease in sales of small and medium-sized enterprises (SMEs), which may compromise their solvency. Stubbornly high interest rates, limited input availability, and disruptions in the supply of raw materials from abroad further limit the ability of SMEs to recover from the shock.

The external sector, and specifically tourism, has been severely affected by global trade disruptions. Tanzania receives ~1.6 million tourists each year (URT, 2020), and in 2019 tourism earnings reached USD 2.6 billion (URT, 2020), which is more than 25% of the country's foreign exchange earnings. As a result of the COVID-19 pandemic, the flow of tourists into the country between March 2020 and February 2021 collapsed to a third of its size in the preceding year, and so did travel receipts (Bank of Tanzania, 2021c). Thus, the sector has suffered a considerable setback, putting large numbers of jobs at risk.

Export-oriented agriculture has also suffered from disruptions in global supply value chains, and revenues from traditional exports such as coffee, cotton, tea, cashew nuts, and simsim have declined (Bank of Tanzania, 2021c; World Bank, 2021). Further, regional trade in grains (maize and rice), in which Tanzania acts as the main supplier for the neighboring countries, has been disrupted following the adoption of preventive measures such as lockdowns and border closures by Tanzania's neighbors (see Box 1 in Banga et al., 2020, for an example of cross-border disruptions). Finally, there are also challenges for farmers on the production side, in the form of difficulties in import improved seeds and fertilizers, which are largely sourced from abroad.

6.2 | Vulnerability and home environment protection

We start by discussing the characteristics that might determine how well households will be able to protect themselves from the new coronavirus, following the work of Brown et al. (2020), who investigate the ability of households in developing countries to adopt preventive measures against it. Figure 11 shows that households that report not having seen a doctor despite having been sick during the last 2 weeks, which we can loosely interpret as a coarse measure of constraints in access to health care, are about 10% more likely to be in persistent poverty or to slip into poverty conditional on not having been poor in 2012. Households with a member older than 65 years, who might be at heightened risk if infected by the new coronavirus, are also characterized by more negative poverty dynamics, although the gap compared to the average household in the country is quite small (about 5%). Households where the head suffers from any disability, which as pointed out in UNDP (2020) is likely to entail serious difficulties in regard to self-isolation, are about 10% more likely to be persistently poor.
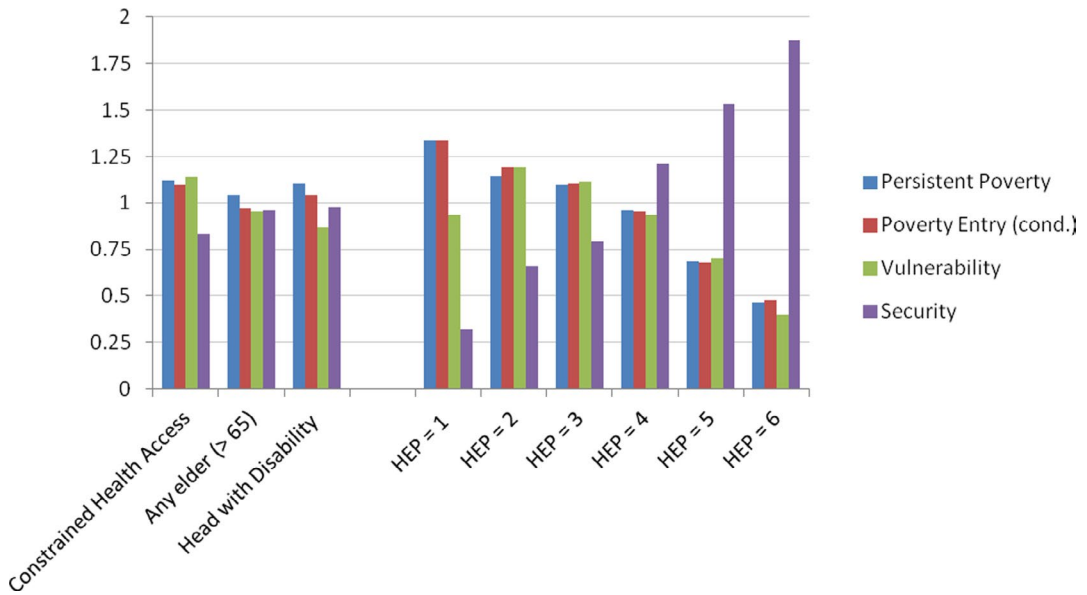
FIGURE 11 Poverty dynamics and vulnerability by protective environment against COVID-19. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially nonpoor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%). The second block of estimates reflects different values for the Home Environment Protection index as developed by Brown et al. (2020). A higher value reflects a more adequate environment for protection against COVID-19 [Colour figure can be viewed at wileyonlinelibrary.com]

We now analyze how adequacy of the household environment to deal with COVID-19 relates to poverty dynamics and vulnerability status. Following Brown et al. (2020), we define a home environment protection (HEP) index that considers six different characteristics that determine how well prepared households are to follow World Health Organization guidance on preventive measures against COVID-19.[12] The score simply counts how many of those six requirements for adequate protection are fulfilled by a household, so that higher scores reflect a more adequate environment. We find it to be strongly associated to poverty dynamics, consistently with the findings of Brown et al. (2020) on the wealth gradient of the HEP index. Households that fulfill two or less conditions for adequate protection are disproportionately represented among the persistently poor and the downwardly mobile. While households with an intermediate value of 3 for the HEP are often found among the vulnerable, those with higher values tend to be economically secure and are very unlikely to be persistently poor or downwardly mobile. Among the index components, possessing communication devices has the strongest connection to poverty dynamics (see Figure A2 available online under Supplementary Files).

6.3 | Vulnerability and the economic impact of COVID-19

Figure 12 shows the factors likely to determine the economic impact of the pandemic, based on our review in Section 6.1. Here, the scenario is reversed: those households that are more likely to be severely affected by economic disruptions and sluggish growth are less likely to be persistently
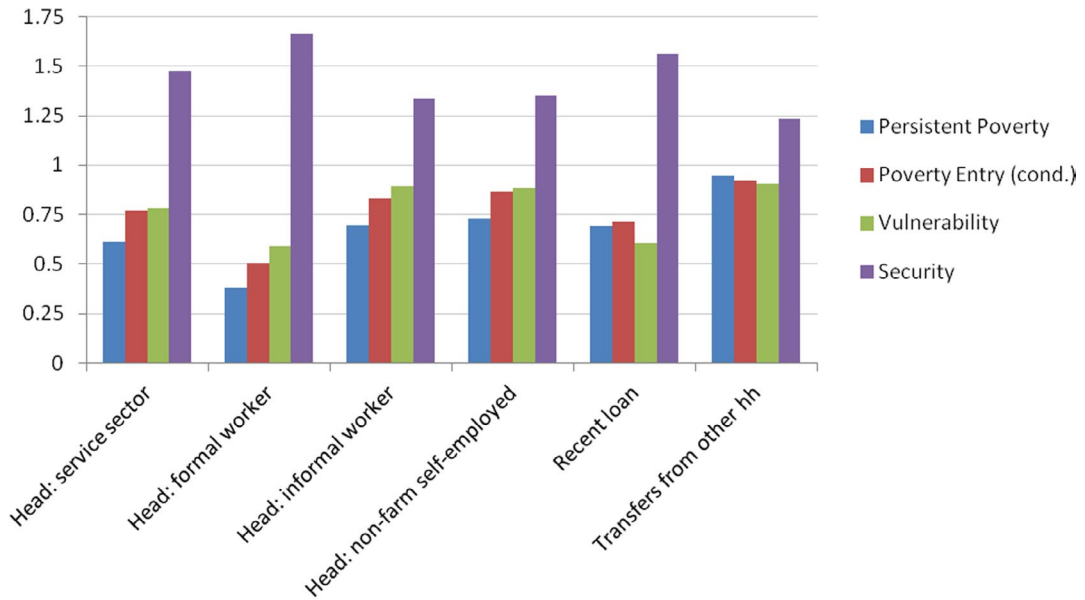
FIGURE 12 Poverty dynamics and vulnerability: most likely economically affected by COVID-19. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially nonpoor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%) [Colour figure can be viewed at wileyonlinelibrary.com]

poor or vulnerable in 'normal times', such as households with a head working in the service sector. Informal employees are in a worse situation than formal employees but in a better one than the average Tanzanian, similar to what we have seen earlier for the self-employed, who are in a more precarious situation than employees but better off than farm workers. Similarly, the impact of COVID-19 seems to have been particularly pronounced in Dar es Salaam, which enjoys exceptionally low levels of persistent poverty and downward mobility (see Figure 3). Households with a recent loan, which may be facing strong pressures to fulfill repayment obligations, are also generally shielded from poverty. The receipt of transfers or remittances from other households is related to a 25% higher share above the vulnerability line, compared to the national average. These households might be particularly affected by the pandemic if such transfers between households are interrupted, as found by Janssens et al. (2021) for Kenya. Overall, these results indicate that those hit more directly by COVID-19 in economic terms are not the initially poorest or most vulnerable households. However, the poverty situation might become worse for affected collectives, and potential pathways out of poverty may be closed for other households.

Finally, we have argued in Section 6.1 that agricultural exports and tourism are among the sectors that are most affected by the economic consequences of the pandemic, so we group regions by the weight of these activities within them, as detailed in Table A6 (Available online under Supplementary Files). Figure 13 shows the profiles for touristic regions and regions growing agricultural commodities (maize, rice, simsim, cashew, coffee, and cotton) for export markets.[13] In general, poverty dynamics in the latter regions do not markedly differ from elsewhere in the country, with the notable exception of cotton-growing regions, which exhibit levels of persistent poverty and transitions into poverty that are 25% higher than the national mean. On the contrary, persistent poverty in touristic regions is at 70% of the national average, while the probability of slipping into poverty is 20% lower.
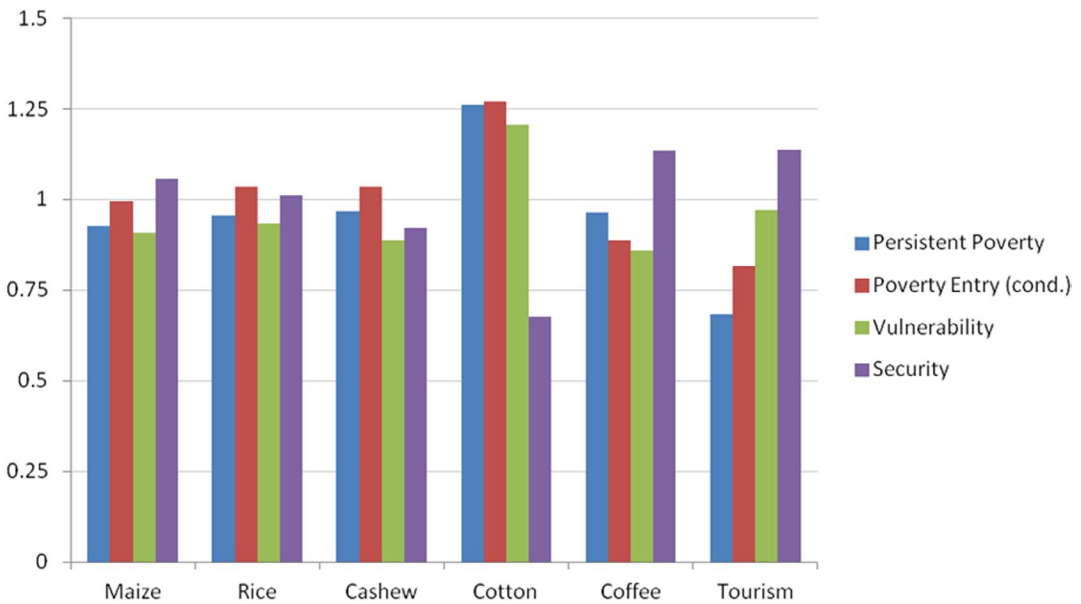
FIGURE 13 Poverty dynamics and vulnerability by regional specialization. Estimates show the ratio of the probability of falling into each category relative to the overall national estimates of persistent poverty (12.5%), poverty entry conditional on being initially nonpoor (20.08%), vulnerability in 2018 (25.99%) and security in 2018 (46.76%) [Colour figure can be viewed at wileyonlinelibrary.com]

7 | CONCLUSION

Recent global poverty debates are centered on cushioning the blow of the ongoing COVID-19 pandemic on the previous vigorous path of poverty reduction. However, in Tanzania, there was no such 'calm before the storm'. Below the seemingly stable surface of a barely declining aggregate poverty rate lies a reality of strong fluctuations in economic well-being for individual households. According to our estimates, around 30% of Tanzanians moved in or out of poverty between 2012 and 2018, and less than 60% of the population was above the poverty line in both periods. This landscape of severe vulnerability to poverty is characterized by two elements: the concentration of a large share of households not far above the poverty line, and thus at a high risk of slipping below the poverty line, and sizeable income fluctuations that put even those in the upper deciles of the population at nonnegligible risk of poverty. Therefore, poverty reduction efforts should aim at both promoting policies that increase permanent incomes such as the structural transformation efforts the country is currently embarked on and improving the options that households can resort to for weathering the bad times.

In our analysis we have sketched profiles of the factors associated with vulnerability to poverty and, its flip side, income security. Education beyond the primary level has been shown to be among the factors most strongly associated with durable freedom from poverty. In the current context, this result emphasizes the importance of minimizing the disruptions that COVID-19 might cause to education for long-term prospects of poverty reduction. While schools have been reopened since mid-June 2020, taking children out of school is known to be one of the mechanisms households in developing countries resort to in order to deal with negative shocks. Considering that large households with many dependents

(children) disproportionately suffer from persistent poverty and downward mobility, it seems essential to ensure that households can afford to maintain their children in the education system.

How will these vulnerability patterns vary in view of the disruptions caused by the ongoing pandemic? Although our data do not allow us to quantify how different groups have been hit by COVID-19, we can examine how those most likely to have suffered its first-order economic consequences fared compared to other groups before 2018. Two parallel messages emerge from such an analysis. If we focus on the public health dimension, it seems that those households that are worse equipped to protect themselves from COVID-19 are more often found in a state of persistent poverty, and are also more likely to slip back into it. In that sense, it seems plausible to fear that, also in Tanzania, the poor might face and have faced a higher direct health risk. Another obvious substantial hurdle to dealing with infectious and other diseases is due to constraints in access to, or lack of affordability of, health care. Although Tanzania intends to introduce universal health insurance coverage within the next 5 years (URT, 2019b), constraints in access to health care currently remain an important risk factor.[14]

On the contrary, when we consider the economic sectors most hit by the pandemic, such as households in urban areas, with service or informal workers, they seem to be in a better shape than other households in terms of pre-pandemic consumption levels and dynamics. Therefore, the first-order economic effects on COVID-19 are likely to hit different people than those usually found in a situation of persistent poverty or vulnerability.

The implication of this finding is twofold. First, new policies specifically targeted at those most directly affected by the pandemic should be put in place, as existing policies might not be suitable for the new vulnerable. It might be particularly relevant to target such policies at regions dependent on agricultural exports, as these do not seem to have been in a particularly favorable pre-pandemic starting point. Moreover, export-oriented agricultural activities are particularly prone to suffer from different types of shocks, so that tools developed now would surely be of use in the future. In this vein, the negative association of rural nonfarm employment with persistent poverty and the risk of downward mobility may suggest an important role for rural diversification as a poverty reduction tool, given that poverty in Tanzania remains associated with agricultural employment.

Second, and important, that response to the pandemic should not become the only focus of policymakers: among those less directly hit by the first-order economic impacts of the COVID-19 shock, we find a large number of households that endure a situation of either persistent poverty or vulnerability, and their situation might be even more critical as some of the engines moving households out of poverty are slowed or shut down by the current crisis. Efforts to improve their situation should thus be maintained, if not redoubled.

As disruptive a global shock as COVID-19 has been, exposure to large adverse shocks remains a common fact of life in developing countries and is among the main reasons that prevent households from permanently escaping poverty. These shocks come in different forms: natural disasters, climate change, unemployment, loss of income and assets, price fluctuations, food and nutritional insecurity, pest attacks, economic downturns, and so on. Therefore, the undeniable need to provide a tailored policy response to the current emergency should not lead policymakers to neglect the structural factors that drive poverty and vulnerability. We hope that our work represents a valuable contribution toward a solid understanding of the factors that shape persistent poverty and vulnerability in 'normal times', an essential requirement for judicious policy formulation also in exceptional times.

ACKNOWLEDGMENTS

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available through Tanzania National Bureau of Statistics at https://www.nbs.go.tz/index.php/en/census-surveys/poverty-indicators-stati stics/household-budget-survey-hbs.

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ENDNOTES

[1] The World Bank's (2020) 'Poverty and Shared Prosperity Report' describes global poverty as decreasing by 1% per year on average between 1990 and 2015, but only by 0.5% per year between 2015 and 2017.

[2] Estimates of the so-called COVID-induced poor grow as new information about the impact of the pandemic becomes available. For instance, poverty measurement specialists at the World Bank have gradually updated their global estimates. While in April 2020 they projected between 40 and 60 million new poor in 2020, the June 2021 update estimates that the pandemic induced 97 million new poor in 2020 and predicts a return to a poverty reduction path already for 2021. See https://blogs.worldbank.org/opendata/updated-estimates-impac t-covid-19-global-poverty-turning-corner-pandemic-2021. Accessed on August 12, 2021.

[3] The World Bank reports somewhat different figures that also point to strong sustained growth, often around 6.5% annually. Note however the lower growth figures for 2018 (5.4%), 2019 (5.8%), and especially 2020 (2.0%). See, for instance, World Bank (2021).

[4] Arndt et al. (2016) obtain an estimate of ~-0.82 when using per-capita GDP to measure the GEP, while using per-capita consumption growth according to HBS yields elasticities ranging between -1.32 and -3.47.

[5] This range is chosen so that formation of new households and dissolution of existing households should be at a minimum. Moreover, it ensures that in round 1 heads will generally have obtained their maximum level of education.

[6] We obtain an extremely similar value of $\rho_y = 0.48$ when estimating this coefficient with HBS data and year-of-birth cohorts.

[7] In fact, as Dang and Lanjouw (2017) explain the vulnerability index is bounded below by the conditional probability of falling into poverty of the initially nonpoor population. Since this is estimated to be 20.08% in our data, a vulnerability line cannot be defined for the standard vulnerability index of $P^2 = 0.15$. In other words, the *whole* of the Tanzanian population would be considered vulnerable if we were to use the lower vulnerability index which is usual in the literature. Thus, we need to target a higher risk of falling into poverty to sensibly define a vulnerability line in this context.

[8] Note that the consumption expenditure variable we use already accounts for regional price differences.

[9] The precise results, expressed as odd ratios, are provided in Tables A4 and A5 (Available online under Supplementary Files).

[10] These estimates are computed based on population characteristics in HBS 2011–2012, since data on the main activity of the household head are not yet available for HBS 2017–2018.

[11] We define a household as food insecure if the head reports having gone for a full day without eating because of a lack of money or other resource and having done that more often than "once or twice". An alternative definition, based on an index drawing on eight questions on 'milder' forms of food insecurity related to the availability, affordability, and variety of food, leads to qualitatively similar – although somewhat less stark – results.

[12] These characteristics are having any type of walls and roof, a private source of water, facilities for washing hands with soap, any type of toilet not shared with other households, any communication device (radio, television, and mobile phone or computer with Internet), and living in a dwelling hosting not more than two people per room.

[13] Due to the lack of data on crops cultivated by particular households, we focus on regions.

[14] As at March 2019, health coverage, through the National Health Insurance Fund, covered only 8% of the population. Similarly, the Community Health Fund, another health coverage fund targeting the poor and persons in the informal sector, covered 25% of the country's population (URT, 2019b).

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