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Welfare and vulnerability in Tajikistan:

Evidence from twelve districts in Khatlon Province, 2015 - 2023

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EXECUTIVE SUMMARY

In February-March 2023, 2,000 households were interviewed about their socio-economic conditions in twelve districts of Khatlon Province which constitute USAID's Zone of Influence (ZOI). Based on these recent survey data as well as former survey data from 2015 and 2012, we present findings here related to changes in poverty over the past eight to ten years.

Key findings

- Housing conditions improved, indicating improved living conditions. Only 1 percent of households had improved sanitation in 2015, but nearly half (49 percent) of all households did so in 2023.
- Fewer households experience hunger in 2023 than in 2015. Fewer households reported having had no food in the home at least once in the past month (40 percent in 2015 vs. 27 percent in 2023), and household hunger scores declined (from 0.667 in 2015 to 0.523 in 2023).
- Expenditures on food increased, but these were used to purchase more expensive food rather than improving dietary quality. Consumption patterns mainly shifted towards more expensive sources of protein, i.e. the consumption of meat, chicken and fish. Consumption of other food groups, however, reduced. This led to a stagnation in diet diversity among women of which 70 percent have inadequate dietary diversity. Women have significantly worse dietary quality than men but household consumption patterns do show improvements over time.
- Total consumption expenditures increased nearly ten percent (in real terms) between 2015 and 2023, which is also accompanied by a significant drop in poverty over that period, from 39.1 percent to 28.7 percent.
- Movements of households in and out of poverty and fluctuations in household food security status between 2015 and 2023 suggest that a significant share of households are at risk of falling back into poverty in the face of adversity.
- Correlates with consumption expenditures, poverty, and the prosperity gap demonstrate that households with more household members, with fewer livelihood sources, and in more remote locations are worse off. Households with more women are more likely to be poor given women's limited income-generating opportunities.
- Households that participated in agriculture development activities were approximately 12.7 percent more likely to move out of poverty than other households

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INTRODUCTION

Since the end of the Civil War following its secession from the Soviet Union, the Tajikistan economy has grown tremendously. Its population generally experienced sizeable improvement in its food security status, living standards and welfare – nevertheless from a very low starting point. Inevitably, changes in welfare may differ across geographical areas as well as within these areas, among others related to households' socio-economic conditions. Khatlon Province has historically been the poorest province of Tajikistan (TajStat and World Bank 2015), therefore also receiving significant aid from local and international non-governmental organizations. This study looks at changes in welfare in twelve districts in Khatlon Province in the past 8-10 years, both looking at average changes in this geographical area as well as characterizing which households have fared better than others in terms of exiting poverty.

DATA AND METHODOLOGY

Data

This assessment relies on two different datasets (i) the 2015 Interim ZOI Survey, and (ii) the 2023 USAID/IFPRI Population Based Survey (PBS). Each dataset consists of face-to-face interview data from 2,000 households in the twelve districts in Khatlon Province that have formed USAID's Zone of Influence (ZOI) since 2012. The Center of Sociological Research (Zerkalo), a survey research firm based in Dushanbe, Tajikistan, conducted the fieldwork for each of these surveys.

Interviews for the 2015 Interim ZOI Survey were conducted between February 21, 2015 and March 17, 2015. The survey team intended to re-interview the households who responded to the 2012 FEEDBACK PBS (Feed the Future FEEDBACK 2014). The 2012 FEEDBACK PBS households were selected for interview in a two-stage cluster sample designed to represent the population of the ZOI. Standard enumeration areas (based on the 2010 Census), stratified by district and urban or rural location, were selected with probability proportional to size. In each selected enumeration area, 20 households were selected randomly from a full household list. To correct these sampling design features, the survey team calculated sampling weights.[1] The households from the 2012 sample that could not be interviewed in 2015 were randomly replaced by another household in the same enumeration area. Weights of the original FTF survey were maintained within each strata (district and urban or rural location).

The questionnaire for the 2015 Interim ZOI Survey expanded on the questionnaire of the 2012 FTF FEEDBACK PBS (Feed the Future FEEDBACK 2014). The questionnaire contained one part about the entire household that could be answered by any knowledgeable individual. Another part was designed to be answered in private (if possible) by the main female decision-maker, though dietary questions were to be answered by every available female adult living in the household. In 2015, additional modules related to agricultural production, migration, and aid projects were added to this questionnaire, as well as a community-level questionnaire.

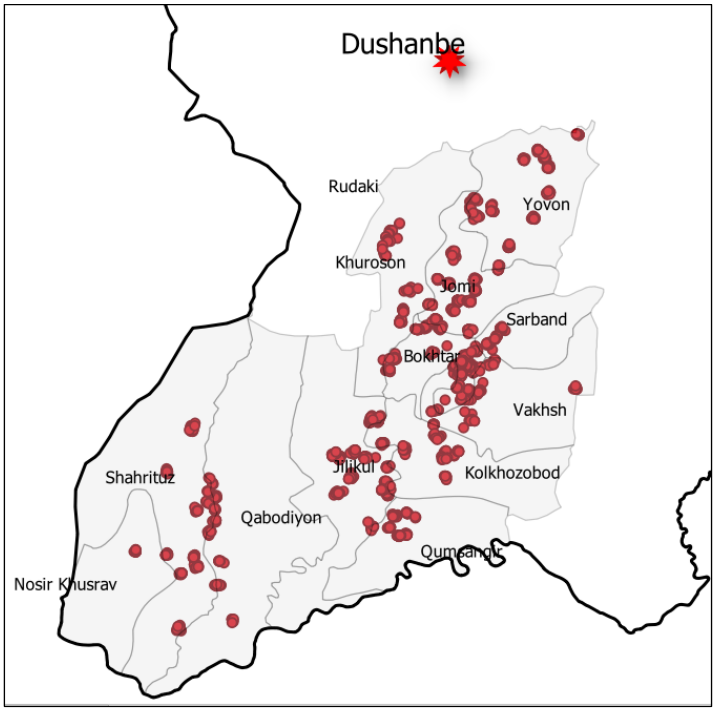
Data for the 2023 USAID/IFPRI PBS were collected between February 12 and March 23, 2023. Figure 1 shows the overview of our interview locations. Different to previous surveys, a random selection of available household members was made to decide which male and female adult were to be interviewed for the individual-level components. Given significant population growth in this area since the last data collection rounds in 2015, it seemed warranted to calculate new sampling weights based on the estimated population size in the ZOI in 2021, which was the most recently verified and accessible population data. Moreover, for analyses that rely on panel households

[1] Note that we updated the weights for one strata, inaccurate by a factor two.

only (i.e. households that replied to the survey in both 2015 and 2023), an additional set of attrition-corrected sample weights is calculated (see Annex 1).

The 2023 USAID/IFPRI PBS questionnaire followed the 2015 format, though with added modules on employment and aspirations and minor modifications based on prior survey experience. Enumerators sought to reinterview the households also interviewed in 2015, and if these were not available for interview, the household was replaced by the nearest neighbor. Interviewing the same households in 2023 as in 2015 offers significant benefits of allowing for more rigorous causal impact analysis as compared to drawing a new random sample of households in the region of interest. The team could not use the 2012 sample as a basis for the interviews, as identifying information of the households originally interviewed in 2012 was not available to the survey team.

Figure 1. Household survey locations of the 2023 USAID/IFPRI PBS in Khatlon Province, Tajikistan



Source: Authors' own compilation

Methodology

This paper uses descriptive comparisons of household- and population level statistics over time and regression analysis to further analyze patterns of change. We primarily base our comparisons on data from 2015 and 2023 as these two datasets were collected during the same time of year (February-March). The 2012 dataset was collected in December 2012 and January 2013, thus a different season as well as covering the New Year's period. We therefore expect that households may have significantly different consumption patterns than during February-March when the 2015 and 2023 interviews took place.

The descriptive analyses shown in the main part of the paper is based on a comparison of households who were interviewed in both 2015 and 2023, i.e. the panel dataset. These are calculated using the attrition-corrected sampling weights to correct for bias arising from the sample design and attrition between 2015 and 2023, unless mentioned otherwise. To demonstrate the robustness of our results, Annex 2 shows the accompanying tables comparing 2015 and 2023 based

on (a) data from the panel households only and without any household or population weights applied; and (b) data from all households who answered to the questionnaire in 2015 or 2023, respectively. In the latter case, we apply household-level or population-level sampling weights. These tables instill confidence in the trends shown in the main part of the paper.

The poverty estimates in this paper are based on a four-step procedure. First, we aggregate different components of household consumption to construct a daily nominal consumption expenditure aggregate. More specifically, for the main poverty estimates used in this paper, we sum up the value of food consumed, non-food expenditures, and the use value of durable goods. As recommended by Deaton and Zaidi (2002), non-food expenditures do not include occasional or unusual expenses, such as expenses for weddings or funerals, health expenditures, house and car repairs. We also exclude taxes paid and expenditures on durable goods. As the housing and rental markets are thin, particularly in rural areas, imputing a reliable estimate of the rental value of households' dwelling is not realistic. Similar to the estimation strategy of the national poverty estimates prior to 2021 (Tajstat and World Bank 2015), we do not include this in our consumption aggregate. Secondly, we adjust the nominal prices to real prices. We use the consumer price index (CPI) as published by Tajikistan's Statistical Agency to express the consumption aggregate in equivalent terms. Third, this consumption aggregate is divided by the number of household members. After this step, we have an estimate of the per capita daily consumption expenditures in each household (also referred to as per capita daily expenditures). Fourth and finally, the per capita daily expenditures of each household are compared to a poverty line. In the main part of the paper, we will rely on the national poverty line for 2021. Further details about the poverty estimation strategy and alternative estimates are shown in Annex A2.

The main econometric analyses rely on panel data models with household fixed effects or household random effects for the panel of households. This allows us to see how changes in certain key factors are associated with changes in poverty status. The choice of using either a random or a fixed effects model is based on the Wu-Hausman specification test (Wooldridge 2010, pp. 288). Our main outcome variables of interest are the following: (i) per capita daily expenditure (expressed in 2021 Tajik Somoni equivalent); (ii) poverty (based on the 2021 national poverty line expressed in 2021 Tajik Somoni equivalent); and (iii) a prosperity gap with respect to the poverty line for upper-middle income countries (6.85USD in 2017 PPP equivalents)[2].

The independent factors used in the analysis include household-level and community-level indicators. At the household-level, we control for the number of male adults, female adults, and children under 5 years old, the maximum education level in the household, household livelihood sources, plot area and whether the household has a dehkan farm, and the gender of the respondent. We also look at whether the household knows of any NGO projects in the community, and whether the household benefited from any agriculture-related project activities. At the community-level, we control for the travel time from the community to the nearest major urban center, the road type, and whether farmers in the village can access irrigation. Finally, we control for the gender of the respondent, as this is known to potentially influence the responses.

Of particular interest in our analyses is the association of a households' participation in agriculture-related projects with these welfare measures of interest. Ideally, one would want to know the causal impact of such interventions on households' welfare. Yet, giving a confident estimate of such causal effect is not straightforward. Those participating in agricultural interventions may be consistently different from those who do not participate, and the underlying characteristics may not always be observable. Non-random project placement and participation in project activities

[2] The rationale of using the poverty line of a country with a higher income level is similar to the rationale of Kraay et al. 2023, i.e. to set a reference income level that reflects a certain prosperity standard. As the threshold value of the poverty line of higher income countries is extremely high compared to incomes in Tajikistan, using the poverty line of upper-middle income countries may offer a reasonable alternative in this case.

may lead to endogeneity bias in our estimates of program impact. Projects may select mainly farmers who are more likely to successfully increase their welfare when participating in their projects, and farmers may be more likely to self-select in projects when they expect to benefit from participation therein.

We lower concerns over endogeneity by controlling for factors relevant to the welfare impacts of agricultural interventions, such as the households' landholding and education level, or its' communities enabling environment (road conditions and irrigation potential). We also control for the respondents' knowledge about any aid projects in the community, which may signal the persons' connectedness or intrinsic interest to participate in projects. Moreover, relying on a panel dataset partly helps to lower issues of endogeneity, particularly in a fixed effects model, which takes care of any unobserved characteristics of households that do not change across the two time periods in our panel data. Nevertheless, given that considerable time passed between these two rounds of data collection, we only maintain the fixed effects model specification if the Wu-Hausman test indicates this is appropriate. Otherwise, we rely on a random effects model. As there are likely remaining unobserved characteristics that affect the observed effect size in our models, we caution against a causal interpretation of our findings and we will refer to them as associations rather than causal effects.

RESULTS

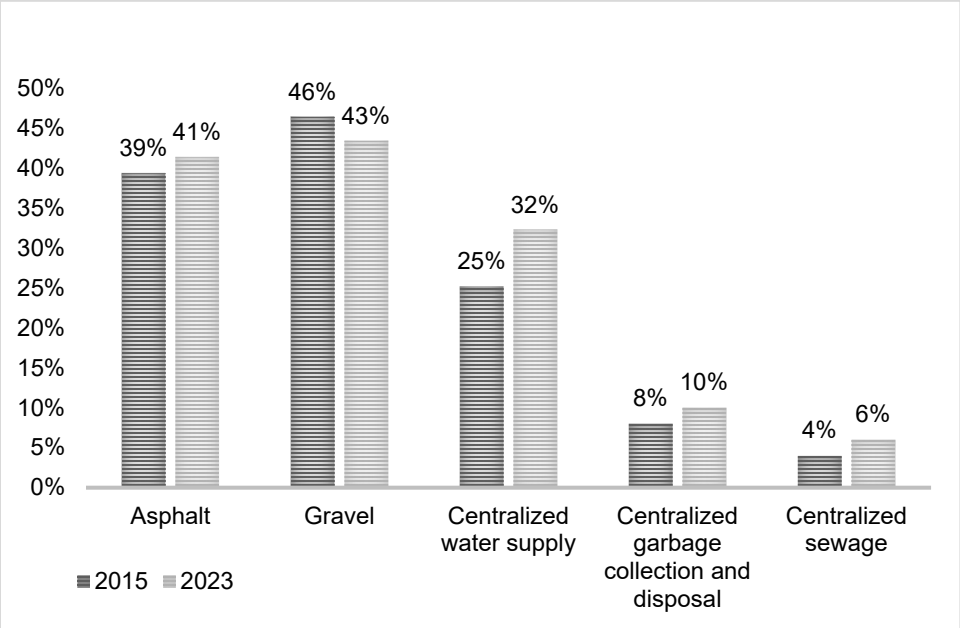
We start with a brief overview of changes in infrastructure between 2015 and 2023 based on community-level data. We then move on to document changes in living conditions, food security and diets based on household-level survey data. We also show expenditure and poverty trends, followed by an analysis of factors associated with these changes.

Infrastructure and housing quality

The study villages witnessed an overall improvement in infrastructure between 2015 and 2023 (Figure 2). We find a modest increase (three percent) in asphalted roads, mainly consisting of gravel roads upgraded to asphalt roads. A large share of villages though remains served by roads of lesser conditions that may be sensitive to severe weather conditions and easily degrade, including gravel roads (43 percent) or earth roads (15 percent). Larger improvements were seen when considering centralized water supply (from 25 percent to 32 percent of villages), and smaller improvement in centralized sewage systems (4 to 6 percent), garbage collection, and disposal (8 to 10 percent). Nevertheless, these services are far from universal across the study villages, and urban locations are more often served than rural areas.

Not only across, but also within study villages, we find that the number of households that are served by infrastructure or services increased (Table 1). Only one town had working lights on all streets in 2015, but by 2023, that number had increased to 22 percent. All houses had access to the electrical grid in 2023, though electricity is not always available. In only 2 percent of the villages all households had direct access to the piped water network in 2015; by 2023, that number had risen to 9 percent.

Figure 2. Changes in community infrastructure



Descriptives are based on community data, not weighted.

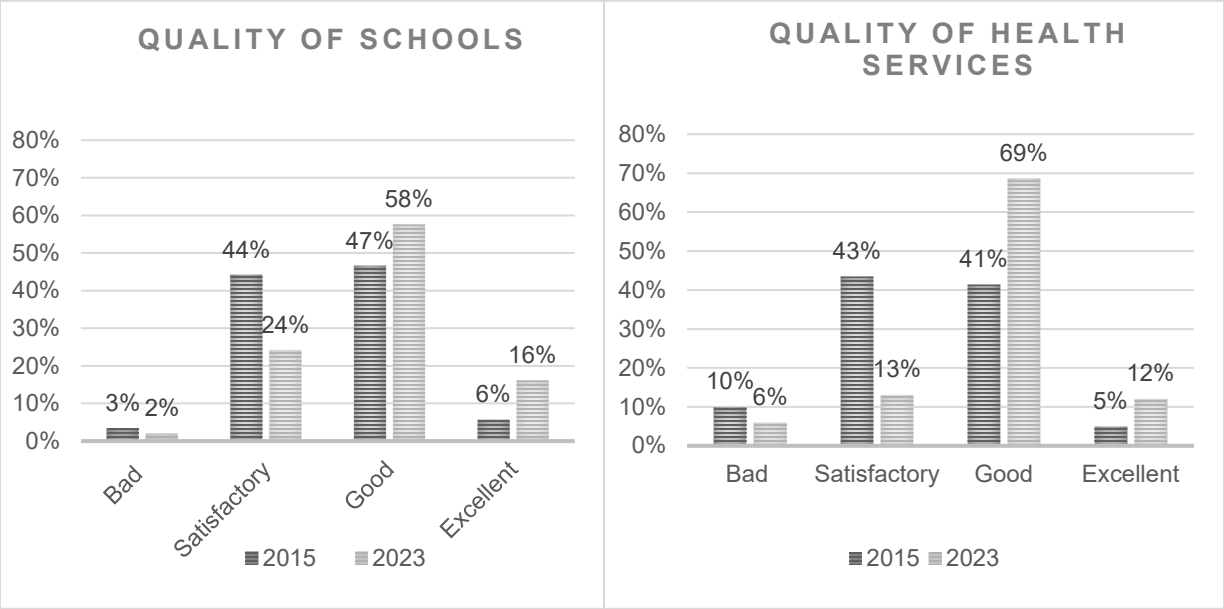
Table 1: Percentage of villages where all residents access electric and water infrastructure

	2015	2023
Streetlights	1%	22%
Access to the electrical grid	93%	100%
Direct access to the water pipe grid	2%	9%
# villages	99	99

Descriptives are based on community data, not weighted.

The quality of education and health facilities was rated much higher in 2023 as compared to 2015 (Figure 3). About 20 percent of the communities expressed improvements in the school quality from satisfactory in 2015 to good or excellent in 2023. Still, two percent rated the schooling quality as bad. Similarly, we find large improvements in community leaders' perceptions of the quality of healthcare in their villages, with an additional 35 percent of communities now perceived to have good or even excellent healthcare. Respectively, 46 percent of villages were deemed to have good or excellent health care in 2015, and 81 percent of villages in 2023.

Figure 3. Quality of school and healthcare facilities



Descriptives are based on community data, not weighted

A comparison of living conditions of households between 2015 and 2023 indicate large improvements in terms of accessing improved sanitation facilities (from 3 percent in 2012 to 46 percent of households in 2023), having better housing quality in terms of having a good quality wall (66 percent to 83 percent) and floor (62 percent to 80 percent), and access to electricity (from 86 percent to universal access) (Table 2 and Table A2.1). The latter is, however, partly deceptive, as households often encounter power outages. Only 27 percent of the households had uninterrupted power supply in the week preceding the interview, whereas 41 percent of households experienced daily interruptions. On average, households reported 57 hours of electricity outage in the week prior to the interview.

Table 2. Changes in household-level access to infrastructure and living conditions

% of households with	2015	2023	T test '15-'23
Improved sanitation	1%	49%	***
Quality wall	71%	78%	***
Quality floor	70%	82%	***
Electricity access	100%	100%	**

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. Sample attrition weights are applied.

Food security and diets

In line with the above findings on living conditions, we also find improvements in households' food security status. When considering the estimates, it's important to bear in mind that these questions were asked in wintertime in 2015 and 2023, which is the time of year when food insecurity is typically at its worst in Tajikistan. Table 3 shows that fewer households had no food at all in the home in the past month in 2023 as compared to 2015 (27 percent in 2023 as compared to 40 percent in 2015). We find little substantial and significant change in other indicators related to household hunger, though also a significant decline in the household hunger score (from 0.667

in 2015 to 0.523 in 2023). A decline in the household hunger score means that households on average have fewer hunger experiences. Similar findings hold when checking for the robustness of our estimates using different samples in Table A2.2.

Table 3: Household hunger, by year

	2015	*2023*	*T test*
No food in the home	40.2%	27.0%	***
Went to sleep hungry	11.5%	9.7%	
Spent a whole day without food	8.0%	7.5%	
Little to no hunger	86.2%	87.9%	
Moderate hunger	11.5%	9.6%	
Severe hunger	2.2%	2.5%	
Household hunger score	0.667	0.523	***

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. Sample attrition weights are applied.

In Table 4 we explore changes in households' food security status between 2015 and 2023. Households on the diagonal (about 79 percent) remained within the same category. Fortunately, a large share (77 percent) of households are in the category of little or no hunger in both years, but 1.4 percent of households remain moderately hungry whereas 0.3% even remains severely hunger. For 11.6 percent of households, their hunger status changed positively – from moderate hunger or severe hunger to no hunger (resp. 9.6 percent and 1.3 percent), or from severe hunger to moderate hunger (0.7 percent). However, 9 percent of households experienced a deterioration in their hunger status, from little hunger to moderate or severe hunger (resp. 7.4 percent and 1.8 percent), or from moderate to severe hunger (0.5 percent). Overall, this points at the precariousness of households' food security status; a relatively large share of households move in and out of hunger.

Table 4: Cross-tabulation of household hunger in 2015 and 2023

		2023		
		Severe hunger	**Moderate hunger**	**Little to no hunger**
2015	Severe hunger	0.3%	0.7%	1.3%
	Moderate hunger	0.5%	1.4%	9.6%
	Little to no hunger	1.8%	7.4%	77.0%

Sample attrition weights are applied.

To assess changes in dietary quality over time, we look at dietary diversity based on two types of data: (i) respondent's diet diversity based on a 24-hour recall; and (ii) household-level diet diversity based on answers to the food consumption expenditure module that spans food consumption of all household members in the past 7 days preceding the survey. When considering individual diet diversity scores, we do not find a significant change in the mean dietary diversity score. Similar to 2015, about 30 percent of female respondents had adequate diet diversity in 2023. However, we do see a major shift away from less expensive protein-rich products - pulses and eggs - towards more expensive sources of protein such as meat, chicken, or fish (Table 5 and Table A2.3). More specifically, the share of female respondents who consumed meat, chicken or fish in the past day increased from 28 percent to 42 percent. There is also a sizeable drop in women consuming Vitamin A rich fruits and vegetables (from 66 percent to 51 percent), a large increase

in the consumption of other vegetables (from 17 percent to 53 percent), and a small increase in consumption of green leafy vegetables (from 23 percent to 29 percent).

Table 5: Comparison of the 24-hour individual diet recall, across years and gender

	WOMEN 2015 – 2023 [a]			MEN vs. WOMEN in 2023[b]		
	2015	**2023**	***T test***	**Men**	**Women**	***T test***
Grains, white roots and tubers	99%	100%	***	100%	100%	
Pulses	31%	15%	***	19%	17%	
Seeds	5%	5%		4%	4%	
Meat, chicken, fish	28%	42%	***	53%	43%	***
Eggs	28%	19%	***	22%	20%	
Dairy	54%	41%	***	50%	45%	**
Green leafy vegetables	23%	29%	***	26%	27%	
Vitamin A rich fruits and vegetables	66%	51%	***	55%	55%	
Other vegetables	17%	53%	***	57%	54%	
Other fruits	18%	18%		20%	18%	
MDDW score	3.70	3.74		4.06	3.84	***
MDDW	30%	30%		38%	31%	***
Number of observations	*2,371*	*931*		*532*	*1,173*	

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01.
[a] Sample attrition weights are applied. Note that this sample includes only female respondents from panel households. [b] No weights are applied. Note that this sample includes all male and all female respondents to the 2023 survey (thus also including non-panel households).

Our 2023 data also contains information from male respondents on their diet diversity, and we therefore also compare men's and women's diets in the latter columns of Table 5. We find that women less often consume meat, chicken or fish compared to men (43 percent vs. 53 percent, respectively), and less dairy (45 percent vs. 50 percent, respectively). Overall, women therefore also exhibit a lower diet diversity and a significantly lower share of women consumed at least 5 food groups (31 percent) as compared to men (38 percent). There could be a risk, however, that these results may be driven by differences in household characteristics linked to the gender of the respondent, rather than intra-household differences in consumption patterns. Therefore, appendix Table A2.4 compares men's and women's dietary recall but limits the respondents living in households where both men and women responded (separately) to the questions on diet diversity. In doing so, we continue to observe a sizeable and significantly lower intake of meat, chicken, or fish among women (45 percent) as compared to men (54 percent). There is no longer a significant difference in dairy intake, but overall we still find a lower diet diversity score among women, and fewer women than men reach adequacy in dietary diversity.

We cross-check the findings from the 24-hour recall of individual respondent's diets with the responses about household members' consumption of food items in the past 7 days (Table 6). The observed patterns here may be different given that we consider consumption of all household members and over a longer time period. Indeed, based on weekly consumption patterns of household members we observe an improvement in dietary patterns – including an increase in households' consumption of seeds, eggs, and fruits. Yet, we still see a modest decline in consumption of pulses (from 54.1 percent to 48.8 percent) and vitamin A-rich vegetables (from 92.5 percent to 89.3 percent). Moreover, in line with – but lagging – worldwide trends, we find a more than threefold increase in the share of households whose members consume food away from home (from 2.6 percent to 8.3 percent). Households spend more on food, something which is corroborated

by our analyses of food expenditures (see below section on expenditures), but with only modest gains towards more healthy and diversified diets.

Table 6: Comparison of the 7-day household consumption food recall, across years

	2015	2023	*T test '15-'23*
Grains, white roots and tubers	100.0%	99.8%	
Pulses	54.1%	48.8%	***
Seeds	4.5%	10.9%	***
Meat, chicken, fish	58.0%	72.2%	***
Eggs	50.6%	60.3%	***
Dairy	62.3%	65.5%	*
Vitamin-A rich vegetables [a]	92.5%	89.3%	***
Other vegetables [b]	99.8%	99.0%	***
Fruit	57.7%	68.7%	***
Food consumed away from home	2.6%	8.3%	***
Number of observations	*1,598*	*1,598*	

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. Sample attrition weights are applied. [a] Vitamin-A rich vegetables are limited to carrots and pumpkins, as we are missing further disaggregated information on other vitamin A-rich fruits or vegetables. [b] This also includes all other vegetables, including also leafy green vegetables

Daily per capita expenditures and poverty

In this subsection we look at households' consumption expenditures and poverty. These are intrinsically linked as poverty indicators and are usually based on a comparison of households' per capita daily expenditures to a certain threshold. Hence, as average expenditures increase in the population, we expect poverty to decline. Between 2015 and 2023, households' real per capita daily expenditures[3] increased nearly 10 percent, from 14.7 to 16.2 respectively (in 2021 PPP equivalent) (Table 7). Figure 4 shows the distribution of the natural logarithm of per capita daily expenditures in 2015 and 2023 (in 2021 TJS equivalents). The dotted vertical line in the graph shows the 2021 national poverty line. Anyone to the left of the dotted line is then considered poor. We indeed find a 10.4 percent drop in poverty, and this finding is robust to using different methods of calculating per capita daily expenditures (though higher than the estimate based on the cross-sectional sample, at 6.4 percent, see Table A2.6) and to applying different poverty lines (see Appendix A3).[4]

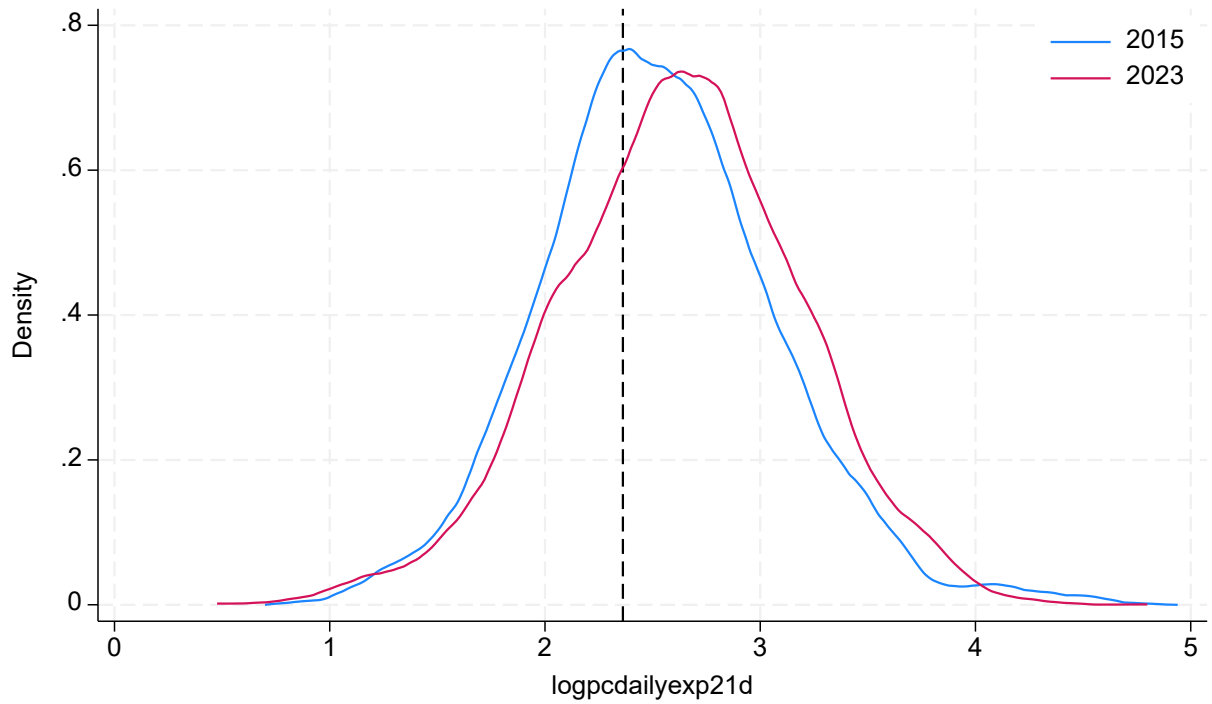
Table 7: Per capita daily expenditure and poverty

	2015	2023	*T test*
Per capita daily total expenditure [a, b]	14.73	16.17	***
Per capita daily food expenditures [a]	8.71	9.99	***
Poor (below 2021 poverty line) [b]	39.1%	28.7%	***
Food share in expenditures [b]	62.7%	63.3%	
Prosperity gap (6.85 USD PPP)	2.19	2.00	***
Inequality index	1.48	1.48	
# observations	*1,598*	*1,598*	

[a] Expressed in 2021 TJS equivalent to facilitate comparison to the 2021 poverty line. [b] The expenditures include food, non-food and durable goods use value. Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. We apply population weights corrected for attrition.

[3] Real values are calculated by adjusting for changes in purchasing power using official yearly CPI.
[4] Estimated poverty rates are largely dependent on the method used to estimate per capita daily expenditures and the choice of the poverty line, therefore different methodologies will show different poverty rates.

Figure 4. Distribution of per capita daily expenditures (natural logarithm) for 2015 and 2023 in 2021 TJS equivalents compared to the 2021 national poverty line (dotted line)



Source: Authors' estimation, using population weights corrected for attrition

Overall, there is a paucity of publicly available data on poverty in Tajikistan, particularly at regional or district-level. Moreover, the data available and the methodologies to calculate poverty have changed over time, therefore cautioning against a too literal interpretation of these numbers (World Bank 2020). Official poverty estimates for Tajikistan nationwide were 32 percent in 2014 (TajStat and World Bank 2015) and 22.5 percent in 2022 (Rahmon 2022). However, TajStat and World Bank (2015) estimated that in 2014 Khatlon province was relatively poorer than other parts of the country, with a poverty rate of 37.7 percent (TajStat and World Bank 2015), which is similar to what we estimated above for the 12 districts in Khatlon Province. We have no disaggregated poverty statistics at the regional level since 2014, but in terms of a decline in poverty rates, our findings are in line with the observed decline in national poverty over the same period (9.5 percent).

Contrary to our expectations, the share of food expenditures in overall expenditures remained constant between 2015 and 2023 indicating proportional real increases in food expenditures over time (Table 7). Households increased their expenditures on food in similar proportions as on non-food and durable goods. Nevertheless, within each year of survey data, we do find that households with larger per capita daily expenditures spend a smaller percentage on food (i.e. we find a small but significant negative association between food share in expenditures and per capita daily expenditures – results not shown here).

Table 7 also shows the findings from a new metric of welfare (for more details, see Kraay et al. 2023). The prosperity gap (called the welfare index in Kraay et al. 2023) is the average factor by which the income of each individual in the population would need to be multiplied to attain the reference level of income, i.e. the prosperity threshold. Tajikistan is currently considered a lower-

middle income country. However, we are mainly seeking a threshold value that can indicate prosperity. Applying a threshold value equal to the poverty line for lower-middle income countries (3.65 USD in 2017 PPP) would not qualify as prosperous. Therefore, as a reference level for prosperity, we select 6.85 USD (in 2017 PPP), which is the international poverty line for upper-middle income countries. We find that incomes of those below this poverty line (88.1 percent of the population in 2015) had to increase more than two-fold (2.19 times) to reach the prosperity threshold in 2015. This factor dropped modestly but significantly to 2.00 in 2023 (reflecting 82.9% of the population who are below this threshold). Finally, the inequality index compares everyone's expenditures to the mean expenditures across the population. This measure would be equal to 1 if all had equal consumption expenditures. Yet, we see that inequality stagnated between 2015 and 2023 at a value of 1.48.

Similar to our assessment of changes in household hunger status, Table 8 explores movements in and out of poverty by comparing households' poverty status in 2015 and in 2023 among those households who were interviewed in both rounds of the data. Only 48.8 percent of the population in the ZOI was not poor in both 2015 and 2023, and 24.5 percent moved out of poverty. Yet, 12.8 percent were poor in both periods and another 14.0 percent fell into poverty. These movements in and out of poverty, and the fact that several households hover near the poverty line, points to the precariousness of the population in the face of shocks.

Table 8: Comparison of poverty status in 2015 and 2023

		Poverty status in 2023		
		Not poor	**Poor**	***Total***
Poverty status in 2015	**Not Poor**	48.8%	14.0%	*62.8%*
	Poor	24.5%	12.8%	*37.2%*
	Total	*73.3%*	*26.7%*	*100.0%*

Note: percentages are calculated using individual-level attrition weights using the panel households only.

Associates of changes in poverty status

We further analyze which factors are associated with households' expenditure, poverty status, and prosperity gap using panel regression models. For each outcome variable of interest, Table 9 shows either the random effects (RE) or fixed effects (FE) specification, depending on the outcomes of the Wu-Hausman test for random effects. The per capita daily expenditures inform us about improvements in households' income. Hence, significant and positive coefficients in columns (a) and (b) point at a positive association with welfare. The coefficients therein are based on fixed-effects estimation methods, which help to reduce time-invariant biases due to unobserved characteristics affecting the outcome and control variables jointly as compared to random effects models. The poverty variables show us to which extent some factors are associated with poverty. Hence, a positive sign in columns (c) signals higher poverty, or lower welfare. This model, however, had to be estimated with a random effects model, thus possibly suffering from more bias in its estimates. Finally, the prosperity gap estimates in column (d) shows which factors are holding households back from being prosperous with a positive coefficient signaling lower welfare.

Households with larger household sizes, including more male adults, female adults, or young children, are associated with lower expenditures and higher poverty rates. This finding is consistent with the findings from research on poverty in other countries, though what is striking is that the size of the effect is much larger for women than for men or young children in the household. Given stringent social norms restricting women's employment and a strong emphasis on women's caretaking responsibilities, female household members have less opportunities to create household income than male household members.

Having higher education levels among adult household members does not show a consistent positive association with per capita daily expenditures, though is mildly significant and positive when looking at the log of the expenditures (Table 9). However, it is significantly associated with shifting from being poor to non-poor. Having an adult household member who attained an additional level of education is associated with a 12.5 percent lower likelihood of being poor. It also helps in lowering the gap to prosperity.

Table 9: Panel data regressions of factors associated with poverty-related indicators

	Per capita daily expenditures	**Log of per capita daily expenditures**	**Being poor RE - logit**	**Prosperity gap**
	FE – OLS (a)	**FE- OLS (b)**	**Marginal effects (c)**	**FE- OLS (d)**
# male adults	-0.678**	-0.044***	0.038***	0.086***
# female adults	-1.186***	-0.064***	0.058***	0.105***
# children <5y old	-0.883***	-0.052***	0.040***	0.111***
Maximum education of adult hh member	0.938	0.065*	-0.125***	-0.092
Receives remittances	-0.422	0.019	-0.082***	-0.289**
Wage income	1.848***	0.126***	-0.056*	-0.159**
Farm income	1.502	0.090	-0.056***	-0.117*
NFE income	2.964***	0.147***	-0.102***	-0.279***
Livestock	1.002	0.132***	-0.067***	-0.184
Plot area (log)	0.096	0.020	-0.116***	-0.233***
Dehkan farm	1.031	0.066	0.024	-0.381***
Asphalt road to community	0.575	0.069**	-0.062***	-0.046
Irrigation infrastructure in community	-0.357	-0.006	0.014	-0.120
Knows NGO projects in community	3.365***	0.115*	-0.069*	-0.160**
Direct beneficiary of agricultural project	2.845**	0.161***	-0.127***	-0.039
Women-only respondents	-0.355	0.017	-0.010	-0.118*
Year = 2023	1.000**	0.081***	-0.044**	-0.148***
Constant	15.798***	2.433***		2.729***
No. of Obs.	*3,707*	*3,707*	*3,709*	*3,707*
R-Squared	.1108	.1555		.1446

Asterisks show statistically significant coefficients at * p < 0.10, ** p < 0.05, *** p < 0.01. FE= fixed effects model; RE=random effects model; OLS=ordinary least squares regression. No weights are used for the regression analyses, but we use sample weights corrected for attrition to estimate the marginal effects of the logit model in column (c).

Table 9 also shows that, as expected, any income-generating activity (coded as yes/no variables) is associated with being less poor. Yet, some of these indicators (receiving remittances or having agricultural income) are no longer significant in the more stringent fixed effects estimations on expenditures. Those with a larger land area are less likely to be poor. We also find that location matters, and those in a community connected with an asphalt road are generally less poor than

those who do not access an asphalt road. Yet, we do not see the anticipated effect of having access to irrigation infrastructure at community level.

Of particular interest is the association between agricultural projects and outreach activities, and household welfare. Those benefiting from agricultural interventions - either by receiving direct support or through trainings - are associated with positive outcomes such as higher expenditures, a lower likelihood of being poor, and being less removed from being prosperous. Households who benefited from agricultural projects were 12.7 percent more likely to exit poverty as compared to other households.

Finally, we also include a variable that captures whether households are aware of any non-governmental projects ongoing in their community. This includes both households who participate in such project as well as households who know about these projects but do not participate. We included this variable as it may expose households who are better-connected within the community, that potentially receive aid (in any kind of sector) or have other intrinsic characteristics that are associated with lower poverty. Indeed, we observe that those who know of non-governmental projects in their community are 6.2 percent less likely to be poor.

A key limitation of the analysis is that we cannot claim that the observed effects in our model will be the same as the causal effects. For example, when considering the case of being agricultural project beneficiaries, it is possible that agricultural projects have been able to either select farmers that were already doing better than others, that were expected to benefit to a larger extent from the program than others, or that more promising farmers have self-selected into joining the program. In this case, the size of the effect that we observe would be overestimated. However, if projects worked instead with lagging farmers, the size of the effect would likely be an underestimate of the causal impact. Yet, by controlling for relevant observed characteristics, by using panel data with two time periods, and by also controlling for being aware of projects occurring in the community, we do limit this bias to the best possible extent. That these positive coefficients remain sizeable and significant, despite controlling for a range of confounding factors, is a striking and positive finding. This, in addition to the fixed-effects specification of some our models, should help attenuate such bias.

CONCLUSIONS

Using data from 2015 and 2023, we find significant improvements in welfare conditions of households in the twelve districts that formerly constituted USAID's Zone of Influence. At least half of all households had access to improved sanitation in early 2023 (up from virtually none in 2015), more communities are connected to good roads and water infrastructure, and more respondents are satisfied with the quality of education and health facilities in their communities. We also find improvements in food security. Households' average consumption expenditures increased by ten percent (in real terms), which is accompanied by a large drop in poverty - from 39.1 percent in 2014 to 28.7 percent in 2022.

Despite significant positive change, there is still ample room for improvement and Khatlon's population is far from prosperous. Movements of households in and out of poverty between 2015 and 2023, and fluctuations in household food security status between these years signal that many households are at risk of falling back into poverty in the face of adversity. Average incomes would need to increase about two-fold for its population to reach an income that could bring them to the poverty line for upper-middle income countries – one step up from its' current status as a lower–middle income country. Moreover, growth in consumption expenditures has been lagging among the poorest households. Correlates with consumption expenditures, poverty, and the prosperity gap demonstrate that households with more household members, with fewer livelihood sources, and in more remote locations are worse off.

Households who were beneficiaries of agricultural projects and training are associated with lower poverty and higher expenditures. Even after controlling for a range of confounding factors, we find that households that participated in agriculture development activities were approximately 12.7% more likely to move out of poverty than other households. We cannot claim this to be a causal effect given that there may be other factors that affect this association that we cannot control for. Nevertheless, they do hint at beneficial impacts of the major efforts of the donor community in improving agricultural production in Khatlon Province.

Gender remains a topic that is worth considerable attention for the welfare of the entire study region. Gender discrepancies clearly emerge from our findings. First, we find lower dietary quality for women as compared to men, most strongly in terms of consumption of meat, chicken or fish. This is a phenomenon that is not well-documented in the current literature on gender and nutrition in Tajikistan and would require further attention. If corroborated by further evidence, this merits attention in the curriculum of upcoming nutrition and gender behavior change communication efforts. Secondly, we find that households with more women are more likely to be poor. These findings corroborate widespread evidence of the detrimental impact of women's limited mobility and income-generating opportunities on poverty. Increasing women's income-generating opportunities, by reducing barriers to women's employment, will be key to further reduce poverty.

APPENDIX

Annex 1. Sample design, representativeness and weights

The 2023 sample primarily includes households formerly surveyed in 2015. Households that could not be re-interviewed were replaced by new households. Out of 2000 households, 402 households of the 2015 sample could not be re-interviewed in 2023 and were replaced by the nearest available neighboring household. Overall, this is a relatively low level of attrition, especially given that there were eight years between the two main survey rounds (2015 and 2023). The majority of households that left the sample refused to participate (350 households), the remaining cases either no longer live in the study area (37 households), had no available respondent (1 household) or could not be found (13 households).

Table A1. 1: Reasons for sample attrition (2015 to 2023)

	# households	% of those leaving sample
Refused to participate	350	87.06
Household moved away to Russia	28	6.97
Household moved away to another district	8	2.00
Household moved away to Uzbekistan	1	0.25
Household members died	1	0.25
Household has only one member, who is in poor health	1	0.25
Household could not be found nor remembered	13	3.23
# observations	*402*	*402*

Attrition could lead to biased results if those leaving the sample are significantly different from those remaining in the sample – especially when it pertains to refusals (as compared to those naturally leaving the sample due to death or out-migration). We analyze whether those leaving the sample are significantly different from those who stayed in the sample in both rounds in table A1.2. We find only limited significant differences between the characteristics in 2015 of panel and non-panel households. Households leaving the sample have household members of a slightly younger age (approximately 1,5 years, which is significant though not sizeable). Households that left the sample have on average one member less than those who stayed, which aligns with the expectation for panel surveys – though proportionally so when considering a lower number of children, male and female adults. Yet, there are some factors that may indicate that households no longer participating in 2023 are better-off as compared to those who stayed in the panel: those who left the panel more often have good housing conditions (i.e. a good quality wall), are less likely to have had no food at all in the household on at least one day in the past month, have higher per capita daily expenditures, and are less likely to be poor. However, we also find that urban households are more likely to leave the sample, which also may partly explain the abovementioned patterns. Nevertheless, based on the above, using sampling weights correcting for attrition may be warranted when we analyze characteristics of panel households only for both 2015 and 2023.

Table A1. 2: Comparison between panel households and non-panel households, by year

	2015			2023		
	In panel	Left panel	T test	In panel	New in 2023	T test
Maximum age in household	55.43	53.85	**	58.66	54.23	***
Maximum education level among adults	2.20	2.18		2.24	2.15	***
Household size	7.92	7.04	***	7.01	5.65	***
# children <5 years old	1.23	1.13		0.94	0.70	***
# male adults	1.94	1.71	***	1.70	1.17	***
# female adults	2.41	2.23	***	2.26	1.86	***

Quality wall	69%	78%	***	83%	85%	
Farm income	86%	84%		88%	84%	**
Remittances	33%	35%		52%	48%	*
Livestock	75%	70%	**	70%	55%	***
Has household plot	86%	86%		94%	91%	**
Has presidential plot	27%	24%		29%	19%	***
Has dehkan farm	12%	9%		11%	5%	***
Knows aid project in community	7%	5%		3%	5%	**
Ag project beneficiary	1%	1%		1%	1%	
No food	38%	32%	**	26%	40%	***
Slept hungry	11%	13%		9%	19%	***
Whole day no food	8%	7%		7%	18%	***
HHS score	0.65	0.58		0.50	1.03	***
Per capita daily expenditures (in 2021 Taj Som)	15.92	17.17	**	17.79	17.55	
Poor	34%	28%	**	25%	28%	
Urban	8%	12%	**	8%	12%	**
Number of observations	*1,598*	*402*		*1,598*	*402*	

Asterisks show statistically significant differences between panel households and non-panel households at * p < 0.10, ** p < 0.05, *** p < 0.01. No weights are applied.

We further explore whether households newly added to our sample in 2023 are significantly different from households who were also in the sample in 2015 in the latter three columns of table A1.2. This is however not an ideal method of assessing whether our sample is biased, as these differences may also reflect a natural shift in population characteristics over a period of eight years. Households that are more recently formed typically have a smaller household size, fewer productive and non-productive assets, lower incomes, and higher levels of poverty and food insecurity. Our findings in table 1.2 indeed point at that trend, but absent accurate data that reflects the population at the time of the survey (e.g. publicly available census data), we are unable to assess whether this is a normal or a biased shift -nor could we correct for it, if any.

Annex 2. Robustness checks to different samples and weighting

Table A2. 1: Changes in access to infrastructure and living conditions

	Panel households – Not weighted [a]			**Full sample [b]**		
% of households with	*2015*	*2023*	*T test*	*2015*	*2023*	*T test*
Improved sanitation	1%	46%	***	1%	46%	***
Electricity access	100%	100%	**	100%	100%	***
Quality wall	69%	83%	***	72%	83%	***
Quality floor	73%	83%	***	71%	80%	***
# observations	*1,598*	*1,598*		*2,000*	*2,000*	

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. [a] Unweighted sample comparisons; [b] Cross-sectional sample weights are applied.

Table A2. 2: Household hunger

	Panel households – Not weighted [a]			*Full sample* [b]		
% of households with	*2015*	*2023*	*T test*	*2015*	*2023*	*T test*
No food in the home	38.2%	26.3%	***	37.5%	28.8%	***
Went to sleep hungry	11.1%	9.4%		11.8%	11.4%	
Spent a whole day without food	8.1%	7.2%		7.8%	9.5%	*
Little to no hunger	86.5%	88.5%	*	86.1%	85.8%	
Moderate hunger	11.3%	9.4%	*	11.6%	10.6%	
Severe hunger	2.2%	2.1%		2.3%	3.5%	**
Household hunger score	0.650	0.497	***	0.642	0.600	
# observations	*1,598*	*1,598*		*2,000*	*2,000*	

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. [a] Unweighted sample comparisons; [b] Cross-sectional sample weights are applied.

Table A2. 3: Comparison of the 24-hour individual diet recall of all female respondents

% of respondents consuming	**2015**	**2023**	***T test***
Grains, white roots and tubers	99%	100%	***
Pulses	31%	17%	***
Seeds	6%	4%	**
Meat, chicken, fish	31%	43%	***
Eggs	29%	19%	***
Dairy	54%	43%	***
Green leafy vegetables	24%	28%	**
Vitamin A rich fruits and vegetables	68%	56%	***
Other vegetables	19%	54%	***
Other fruits	20%	18%	
MDDW score	3.80	3.81	
MDDW	30%	31%	
Number of observations	*2,938*	*1171*	

Asterisks show statistically significant differences between mean values of men and women; * p < 0.10, ** p < 0.05, *** p < 0.01. As the 2015 data contains responses of multiple female respondents, we weight the data with the number of respondents in each household. We do not apply any other weights.

Table A2. 4: Comparison of the 24-hour individual diet recall of men and women in 2023, based on households with responses of both male and female respondents

% of respondents consuming	**Men**	**Women**	***T test***
Grains, white roots and tubers	100%	100%	
Pulses	19%	17%	
Seeds	3%	4%	
Meat, chicken, fish	54%	45%	***
Eggs	22%	19%	
Dairy	49%	50%	
Green leafy vegetables	25%	26%	
Vitamin A rich fruits and vegetables	62%	59%	
Other vegetables	63%	58%	**
Other fruits	19%	19%	
MDDW score	4.17	3.97	**
MDDW	39%	31%	**
Number of observations	*266*	*266*	

Asterisks show statistically significant differences between mean values of men and women; * p < 0.10, ** p < 0.05, *** p < 0.01. We do not apply weights.

Table A2. 5: Comparison of seven-day household food consumption recall, by year

	Panel households – Not weighted [a]			*Full sample* [b]		
% of households with	*2015*	*2023*	*T test*	*2015*	*2023*	*T test*
Grains, white roots and tubers	99.9%	99.7%		100.0%	99.8%	
Pulses	55.2%	49.3%	***	54.5%	47.6%	***
Seeds	4.3%	10.3%	***	5.1%	10.6%	***
Meat, chicken, fish	57.0%	71.2%	***	59.3%	69.4%	***
Eggs	51.4%	60.1%	***	51.1%	60.3%	***
Dairy	64.6%	65.1%		62.2%	63.0%	
Vitamin-A rich vegetables [c]	92.7%	88.2%	***	92.6%	87.5%	***
Other vegetables	99.7%	98.7%	***	99.5%	98.8%	**
Fruit	58.8%	68.6%	***	58.6%	66.4%	***
Food consumed away from home	2.4%	9.0%	***	2.4%	8.7%	***
Number of observations	*1,598*	*1,598*		*2,000*	*2,000*	

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. [a] Un-weighted sample comparisons; [b] Cross-sectional survey weights are applied. [c] Vitamin-A rich vegetables are limited to carrots and pumpkins, as we are missing further disaggregated information on other vitamin A-rich fruits or vegetables.

Table A2. 6: Per capita daily expenditure and poverty, by year

	Panel households – Not weighted [c]			Full sample [d]		
% of households with	*2015*	*2023*	*T test*	*2015*	*2023*	*T test*
Per capita daily total expenditure [a, b]	15.92	17.79	***	14.81	15.99	***
Per capita daily food expenditures [a]	9.59	11.03	***	8.84	9.85	***
Below 2021 poverty line (incl. durables)	34.3%	24.5%	***	37.4%	30.9%	***
Food share in expenditures (incl. durables)	63.2%	63.6%		62.9%	63.3%	
Prosperity gap (6.85 USD PPP)	2.08	1.87	***	2.17	2.05	***
Inequality index	1.39	1.37		1.46	1.51	*
# observations	*1,598*	*1,598*		*1,996*	*1,999*	

[a] Expressed in 2021 TJS equivalent to facilitate comparison to the 2021 poverty line. [b] The expenditures include food, non-food and durable goods use value. Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. Cross-sectional survey weights are applied. [c] Unweighted sample comparisons; [d] Cross-sectional survey weights are applied.

Annex 3. Poverty estimates

It is of major importance to assess poverty as accurately as possible, yet when estimating poverty the analyst is unavoidably confronted with a number of theoretical and practical problems (Deaton and Zaida 2002). Briefly summarized, estimating poverty requires calculating households' per capita daily expenditures and comparing them to a certain poverty line. Estimates are therefore inherently sensitive to the choice of poverty line, the items included in the consumption aggregate, and the definition of household membership and size.

There are two broad types of poverty lines: international and national poverty lines. International poverty lines are generally deemed appropriate to compare poverty across different countries and are periodically updated to reflect the increase of the value of these lines in nominal terms. Since September 2022, international poverty lines were revised, and they are expressed in an equivalent value in 2017 PPP. The latest international poverty line for lower-middle income countries, to which Tajikistan belongs, stands at 3.65USD (in 2017 PPP). Yet, poverty in lower-middle income countries can also be expressed in comparison to the global poverty line, which is lower and is now estimated at 2.15USD in 2017PPP.

National poverty lines are calibrated to the local context and are therefore expected to more closely align to the local context to which they apply. The national method for measuring poverty in Tajikistan is based on the cost-of-basic-needs approach and a minimum food basket. The internal validity of a national poverty line holds as long as the questionnaire, sampling strategy and timing of data collection are consistent. Yet the exact implementation of such method is not only dependent on the context, but also on the data at hand. Over the last 25 years, the dataset used to determine the national poverty line and commensurate estimate poverty in Tajikistan changed considerably at least three times, therefore cautioning against a verbatim comparison of poverty estimates over time (TajStat and World Bank 2015).

In accordance with the above explanations our poverty estimates should also not be directly compared to other poverty estimates, given they were constructed based on a different questionnaire, at a different time of the year or in a different year, and on a smaller geographical area of the country. Nevertheless, our results are internally consistent, and we can confidently compare our estimates across 2015 and 2023.

The 2021 national poverty line was deemed the most appropriate poverty line for this work, given that it was the most recent poverty line estimated. This limits CPI adjustments to be needed, which are known to suffer from substantial measurement error – particularly when covering longer periods of time. Moreover, the 2021 poverty line was estimated using a significantly revised questionnaire and sampling methodology, thus likely constituting a much more robust estimate as compared to those relied upon in previous years.

In addition to our main estimate based on the practical and theoretical choices outlined in the methodology section of the paper, we further develop different variations of this estimate to check the robustness in the trends across years. These variations include the use of different poverty lines and relying on expenditures limited to food and non-food items only (as in the methodology of the earlier poverty estimates for Tajikistan) versus expenditures that also include durable goods use value (as in the methodology of the more recent poverty estimates for Tajikistan). Table A3.1 clearly demonstrates how estimates differ depending on the underlying choice made to derive the estimate.

Table A3. 1: Alternative poverty estimates, by year

Poverty line	Expenditures include	2015	2023	Test
National, 2014: 158.71 TJS per capita per month	Food and non-food	25.9%	20.1%	***
	Food, non-food and durable goods	21.2%	17.3%	**
National, 2021: 323 TJS per capita per month	Food and non-food	46.4%	33.7%	***
	Food, non-food and durable goods	39.1%	28.7%	***
International: 2.15 USD per capita per day, in 2017 PPP	Food and non-food	19.3%	13.7%	***
	Food, non-food and durable goods	15.6%	11.8%	**
International, lower-middle income countries: 3.65USD per capita per day in 2017 PPP	Food and non-food	58.8%	48.1%	***
	Food, non-food and durable goods	52.4%	41.7%	***

Asterisks show statistically significant differences between results in respective survey years; * p < 0.10, ** p < 0.05, *** p < 0.01. We apply population weights corrected for attrition

As expected, poverty rates are lower when the poverty line is lower, particularly when comparing to the international poverty line for low-income countries (at 2.15 USD in 2017 PPP). As also seen in figure 4, real per capita expenditures did not increase much among the poorest households, which explains a more modest drop in poverty when relying on the international poverty line for low-income countries.

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