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Vulnerability and Welfare

Findings from the third round of the Myanmar Household Welfare Survey (July and August 2022)



Livelihoods and Food Security Fund



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ABSTRACT

The third round of the Myanmar Household Welfare Survey (MHWS), a nationally and regionally representative phone survey, was implemented between July and August 2022. It followed from a second round that was conducted between April and June 2022 and a first round that was carried out between December 2021 and February 2022. This report discusses the findings from the third round related to shocks, coping strategies, and income poverty.

During the third round of data collection, the security situation in Myanmar continued to decline. Increasingly, households felt insecure in their communities, as reported by 21 percent of rural households and 25 percent of urban households, an increase compared to the previous rounds. This is because crime and violence continued to increase, affecting 10 and 8 percent of communities, respectively. Further, 6 percent of households were directly affected, either through violence against a household member, robbery, or appropriation and/or destruction of their assets.

Households also continued to earn less income. In July and August of 2022, 46 percent of households reported lower income compared to the previous year. Disruptions in banking, internet, and electricity also negatively impact household wellbeing and livelihoods. Further, households struggled to receive medical services. Finally, while school attendance recovered, it was still under 50 percent in some states/regions.

Eighty-two percent of households used at least one coping strategy to meet daily needs during the month prior to the third-round survey. The three most common coping strategies used were spending savings, reducing non-food expenditure, and reducing food expenditure. Further, some households exhausted some or all of their coping strategies.

Finally, income poverty increased during the third round; 62 percent of households were income poor. Casual wage earning and asset poor households were particularly vulnerable. Compared to the other states/regions, households in Kayah and Chin were the most vulnerable. They were more likely to be impacted by conflict, have income loss, and be income poor. Households in Rakhine, Kachin, and Tanintharyi were also vulnerable; more than 70 percent of households in those regions were income poor.

1. INTRODUCTION

In April through August of 2022, households continued to be impacted by security, climatic, and economic shocks. Fighting was ongoing in the states/regions of Kayah, Chin, Sagaing, Kachin, Kayin and Magway. Conflict also intensified in Mon state and Tanintharyi region and tensions grew in Rakhine and southern Chin and intermittent fighting was recorded beginning in June 2022. Households' agricultural production was also impacted by drought and flooding. The survey was conducted during the monsoon season, which stretches from May to October in the largest part of Myanmar and is the most important agricultural season for the majority of farmers. Disruptions in the banking, internet, electricity, health, and education sectors were also detrimental to household welfare. Households continued to be affected by economic shocks including high fuel and food prices. All of these factors combined have continued to reduce household incomes.

This paper provides an overview of the vulnerability and welfare of households across Myanmar for the third round of the Myanmar Household Welfare Survey (MHWS). MHWS is a representative phone survey at the national, urban/rural and state/region levels. The third round of this survey was conducted between July and August 2022.¹ This paper examines the security, climatic, health, service, and economic shocks that Myanmar households face. Second, the paper studies the coping strategies households' employ to meet their daily needs. Third, the paper analyzes changes in income poverty for Myanmar's households. Finally, the paper explores the association of shocks and household characteristics with income loss and income poverty.

The paper is organized as follows: Section two describes the data and methodology. Section three shows descriptive results, including shocks experienced, changes in income, coping strategies that households employ, and poverty patterns. Section four explores characteristics associated with income changes and coping. Section five concludes.

2. DATA AND METHODOLOGY

The analysis presented in this paper relies on data from the third round of the MHWS. The third round of MHWS was collected through phone survey interviews between July and August 2022 and has 12,128 respondents. The survey intends to monitor household and individual welfare through a range of different indicators including wealth, livelihoods, food insecurity, diet quality, health shocks, and coping strategies. A novel sampling strategy in combination with the development of household and population weights allows for estimates that are nationally, regionally, and urban/rural representative (MAPSA 2022a; MAPSA 2022b).

The quantitative analysis is mainly descriptive and employs relatively straightforward indicators, though the indicators related to shocks and poverty require more elaboration. The shock indicators include self-reported shocks as well as a township-level indicator for violent shocks based on secondary information from the ACLED dataset (ACLED, 2022). In the MHWS, respondents were asked about different shocks that their households or their communities experienced in the past three months. Depending on the date the household was interviewed, the

¹ This was two weeks after the end of the second round in April and June 2022, and seven months after the start of the first round which was conducted between December 2021 and February 2022.

past three months include April-July 2022 or May-August 2022.² Because of the difficulty in surveying conflict affected areas, it is likely that these MHWS estimates of shocks underrepresent the extent of insecurity in the country. The ACLED indicator is based on the sum of all battles, explosions, and violence reported in the ACLED dataset in the three months prior to the interview.

The poverty line is the minimum welfare level for an individual not to be considered severely deprived. In previous in-person nationally representative surveys (the Myanmar Poverty and Living Conditions Survey (MPLCS) of 2014-15 and the Myanmar Living Conditions Survey (MLCS) of 2017) the share of poor was calculated using a consumption aggregate. Unfortunately, in a phone survey, collecting detailed expenditure information is not feasible. Therefore, we use an income-based poverty measure to determine the number of households that fall below the poverty line. Our income-based poverty measure is a comparison of total household income with the national poverty line. Total household income is the sum of income from 15 different economic activities plus net remittances received in the past month. It is adjusted for household size using standard adult equivalency scales. Separately, the national food-based poverty line from the first quarter of 2017 – which was 1,037 kyat (CSO et al., 2019) – was updated first with the official food CPI until mid-2020, and then with a temporal MAPSA food price index from a national survey of food vendors (MAPSA, 2022c). Then, a spatial deflator was applied to adjust food prices for rural and urban areas within each state/region based on price information from the MAPSA food vendor survey. The income-based poverty measure is found to be highly correlated with the MLCS 2017 expenditure-based poverty measure at the state/region level (MAPSA, 2022c).

We compare our different indicators of vulnerability and welfare by the households' main source of income and asset class. We divide households into five groups by their main source of income: non-farm business, non-farm salary, non-farm wage, farm wage/salary, and own farming. Households were categorized into three asset-class groups based on the number of assets they own: asset-poor (0-3 assets), asset-low (4-6 assets) and asset-rich (7-10 assets). This categorization is based on a count of 10 assets including; improved housing (semi-pucca, bungalow/brick, apartment/condominium), flush toilet, improved water source (piped into house or bottled water), grid-based electricity (not solar), rice cooker, fridge, TV, wardrobe, car/motorcycle/tuk-tuk, and a working computer/laptop/iPad.

Finally, we employ exploratory regression analysis to obtain a better understanding of which households are more likely to experience income loss and income poverty, as well as use different coping strategies. First, we use a random effects panel regression to estimate the impact of shocks on the likelihood of being economically affected and being income poor. Second, we employ the same method to estimate the impact of shocks on coping strategies. We include three shocks in our analysis: security, climatic, and health. The security shock indicator is a self-reported measure of community insecurity for the three months prior to the survey. Climatic shock is a self-reported measure of any climatic shock the household experienced during the three months prior to the survey. We define health shocks as a household who has a member who passed away from disease during the three months prior to the survey. In our analysis we control

² R1 was conducted in December 2021 to February 2022, so shock data is reported for September-November for interviews conducted in December 2021, October-December for interviews in January 2022, and November-January for interviews in February 2022. R2 was collected from April-June 2022. For R2 shock data ranges from January-March for interviews conducted in April, February-April for interviews in May, and March – May for interviews conducted in June. Finally, R3 was conducted in July-August, and shock data is for April-June for interviews conducted in July, and May-July for interviews conducted in August.

for the main household income source, other sources of income, asset poverty, and other household and respondent characteristics. State/region dummies are also included in the models. It is important to note that our estimates are only associations between our independent and dependent variables.

3. MAIN FINDINGS

3.1 Shocks

3.1.1 Security shocks

In April through August 2022, twenty-two percent of households in Myanmar felt that their community was very or somewhat insecure (Table 1). A larger percentage of urban households (24.9 percent) felt that their community was insecure compared to rural households (20.9 percent). The number of households who reported feeling insecure increased from 18.6 percent in R1 to 22.0 percent in R3.

Table 1. Percent of households experiencing security shocks in their community and household

	R1	R2	R3	Rural R3	Urban R3
Community					
Feels insecure	18.6	19.6*	22.0***	20.9***	24.9
Low levels of social trust	19.7	20.0	22.1***	19.9***	27.8
Increase in crime	7.7	8.7**	9.6**	7.0***	16.5
Violence	6.3	7.0*	7.6	6.5***	10.4
Household					
Assault/detention		0.8	1.0	1.1	0.9
Destruction/appropriation of assets		1.1	1.4	1.3	1.5
Theft/robbery		3.6	4.2**	3.3***	6.6
Bribery/forced payments		0.5	0.9***	0.8**	1.2
Observations	12100	12142	12128	8494	3634

Note: asterisks denote difference from the previous MHWS round, as well as the difference between rural and urban locals. Asterisks show significance at p-values * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author's calculations based on MHWS data.

Between R1 and R3, the number of violent events increased dramatically in Rakhine state, Tanintharyi region, and Kayah state (Figure 1) (ACLED 2022). Violence also increased in Kayin, Kachin, and Sagaing states/regions. In Magway region and Mon state, the number of violent events decreased between R1 and R2 but picked up again between R2 and R3. Further, between R1 and R3 violence remained constant but consistently high in Mandalay region and Shan state. Finally, violence declined in Chin state between R2 and R3, but some townships in Chin state still saw an increase in violent events between those rounds.

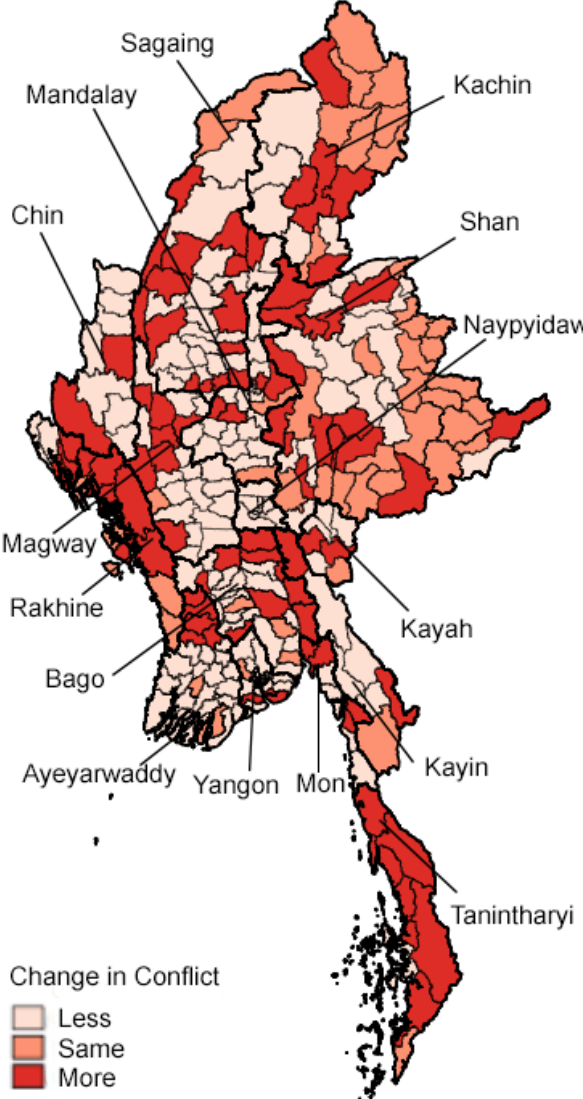
The three states/regions where households felt the most insecure in R3 were Kayah State (52.3 percent of households felt insecure), Chin State (47.3 percent), and Kachin State (50.9 percent) (Figure 2 and Table A.1). At the same time, between R2 and R3, the number of households feeling insecure increased significantly in Sagaing, Tanintharyi, Mandalay, Mon, and Rakhine. In Sagaing, the feeling of insecurity increased by seven percentage points from R2, to 40.9 percent of households in R3. The lowest levels of reported insecurity in R3 continued to be in Nay Pyi Taw (8.2 percent), Ayeyarwady (1.0 percent), and Bago (10.8 percent). In these three regions, violent events are decreasing (ACLED, 2022).

In addition to feeling insecure, 27.8 percent of urban households and 19.9 percent of rural households also felt a low level of trust in their communities (Table 1). Again, respondents in Chin (42.6 percent) and Kayah (42.1 percent) had the lowest levels of trust in their communities (Table A.1). In Sagaing, having a low level of trust in the community increased from 16.4 percent of households in R1 to 26.9 percent of households in R3. Levels of trust also declined from R2 to R3 in Tanintharyi, Mon, Rakhine, and Ayeyawady (Table A.11). Community insecurity and lack of social trust may be a result of an uptick in crime or violence in the community.

Nationally, 9.6 percent of households reported that crime increased in their communities during R3 (Table 1). This is an increase from 7.7 percent in R1 and 8.7 percent in R2. Further, 7.6 percent of households reported that violence occurred in their communities. Both crime and violence were more widespread in urban areas than in rural areas. Seventeen percent of urban households reported crime in their communities versus 7.0 percent of rural households. At the regional level, the states/regions that reported the most crime in their communities were Kachin (33.4 percent of households) and Yangon (18.2 percent of households) (Table A.4). The three states/regions where households reported the most violence were Kachin (20.6 percent of households compared to 13.6 percent in R2), Kayah (17.5 percent of households), and Sagaing (16.7 percent of households). On the other hand, there was a notable drop in violence in Chin state, between R2 and R3.

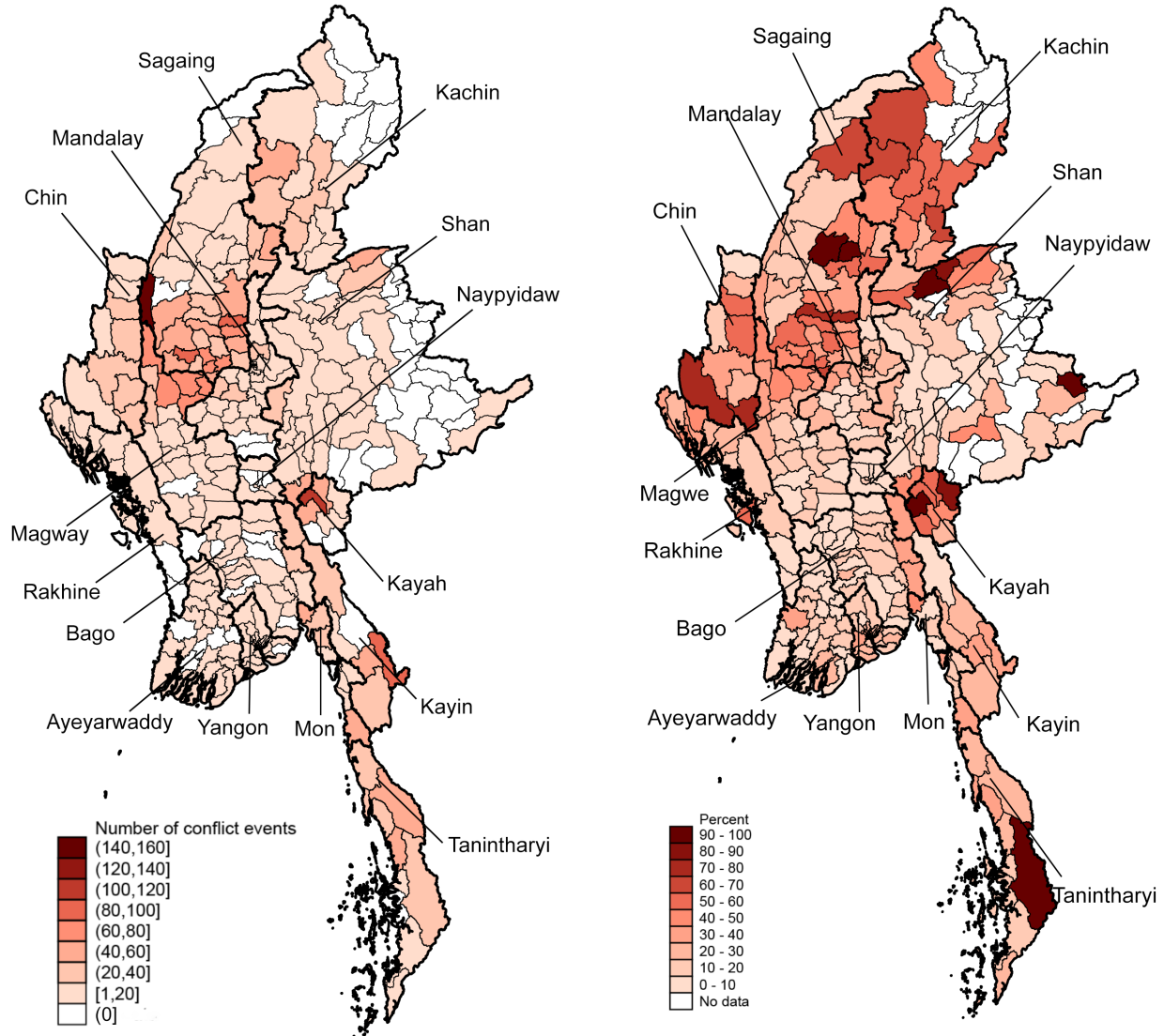
Six percent of respondents were negatively impacted by violence and/or crime against their household, including 0.8 percent of households who experienced violence against a household member, 1.4 percent of households who suffered the destruction or appropriation of an asset, 3.3 percent of households who were impacted by theft or robbery, and 0.5 percent of households who were forced to give bribes or payments (Table 1). Theft/burglary was particularly high in urban areas because of alarmingly high rates in urban Rakhine (11.2 percent of urban households), Yangon (8.7 percent), Chin (8.1 percent), and Mandalay (7.0 percent) (Table A.2). While violence against households decreased during the survey period in Chin State, violence was still high there compared to other states/regions. In Chin, 10.3 percent of households suffered damage to an asset or had an asset appropriated, and 6.4 percent of households endured theft. Further, violence against households in Kayah state was alarming; 5.3 percent of households had a member assaulted or detained, 24.1 percent of households experienced the destruction or appropriation of an asset, while 18.6 percent of households were burglarized (Table A.1).

Figure 1. Difference in the number of violent events between R1 and R3 of MHWS, at the township level



Source: Authors' calculations from (ACLED, 2022).
Notes: We rely on the Armed Conflict Location & Event Data Project (ACLED) dataset and include the sum of all battles, explosions, and violence.

Figure 2. Number of violent events by township (left) and the percentage of households who felt insecure in their community in the past three months by township (right)



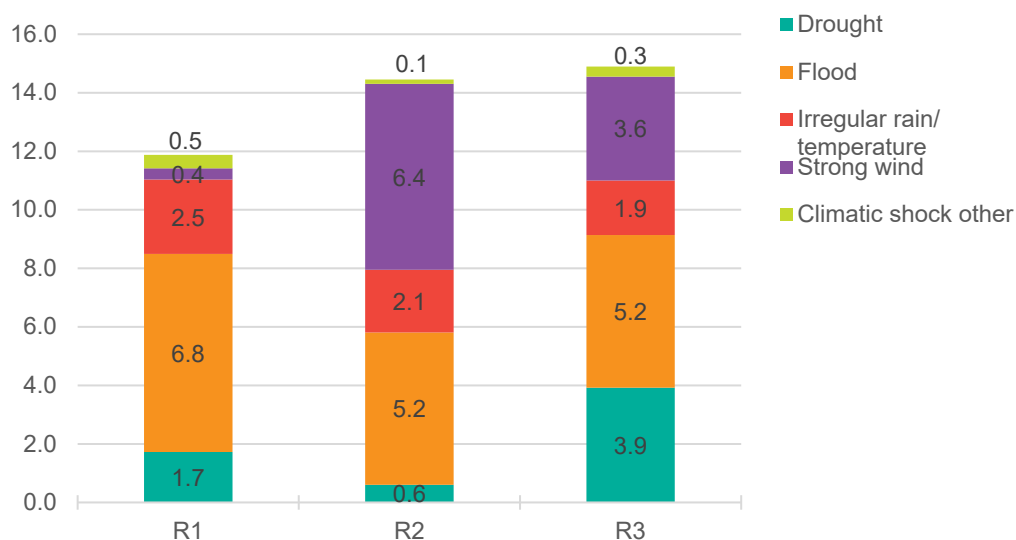
Source: (ACLED) dataset (left) Author's calculations based on MHWS data (right).
 Notes: Violent events include the sum of all battles, explosions, and violence.

3.1.2 Climatic shocks

In R3, 13.2 percent of households reported facing at least one climatic shock. Climatic shocks were a greater issue in rural areas, compared to urban with 15.3 percent of rural households experiencing a climatic shock versus 7.7 percent of urban households. The recall period for R3, April through August, is the start of the monsoon season in Myanmar. The two largest climatic shocks reported were drought (3.9 percent of households) and flooding (5.2 percent of households) (Figure 3). More households were impacted by climatic shocks this period compared with the two previous rounds because of an increase in the incidence of drought.

At the regional level, 16.8 percent of households in Rakhine state, and 9.4 percent of households in Magway region were impacted by drought (Table A.4). Further, a little more than 4.0 percent of households in Shan, Chin, Kayah, and Sagaing states/regions were impacted by drought. Flooding impacted 10.0 percent of households in Kachin state and around 8.0 percent of households in Tanintharyi, Sagaing and Kayin states/regions. Intense winds were a danger to households in Mon state, negatively impacting 10.2 percent of households in the state.

Figure 3. Climatic shocks, by MHWS round

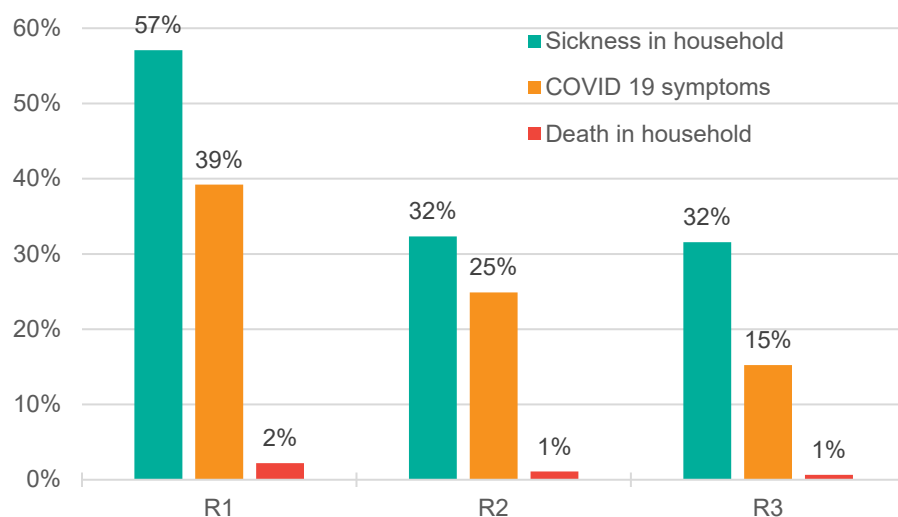


Source: Author's calculations based on MHWS data.

3.1.3 Health shocks

From April to August 2022, 32.1 percent of households had a member who was sick, which is less than in the two previous rounds (Figure 4). This number, although still quite high, was significantly lower than the 57.0 percent of households who had someone sick or dying in R1. This is in part due to a decline in the number of COVID-19 cases reported in R3. In R1, 39 percent of households had a member or many members with COVID-19 symptoms, while in R3, 15 percent of households had at least one member with COVID-19 symptoms.

Figure 4. Sickness and COVID-19, by MHWS round



Source: Author's calculations based on MHWS data.

3.1.4 Service sector shocks

Banking difficulties declined in rounds two and three, but many Burmese still pay agent fees to obtain cash. In 2021, because of a shortage of dollars, Myanmar's Central Bank put in place withdrawal limits on banks. In 2022, several ATMs still had those withdrawal limits in place.³ At the same time, private banks started offering "special accounts," to enable individuals to transfer and withdraw money more easily.⁴ In MHWS, households were asked if they had significant difficulties obtaining cash from banks or other financial institutions (Figure 5). In R1, 10.7 percent of households had to pay agent fees to obtain cash, 5.8 percent of household could not take out cash because the bank was either closed or had no cash, and 3.9 percent of households could only withdraw a limited amount of cash. In R2 and R3, banking difficulties declined significantly, but 7.2 and 6.6 percent of households still needed an agent to obtain cash in each round. Further, 0.8 percent of households could not obtain cash because the bank had no cash.

At the same time, other central bank policies pursued in 2021/2022 such as placing a conversion requirement on non-agricultural exports and remittances from migrants and seafarers drove Myanmar citizens to use informal money transfer systems instead of banks⁵. Frequent changes in policies have sowed further mistrust in the banking system. Since the coup in February 2021 to August 2022 the Kyat fell by 58 percent against the dollar under the formal exchange rate (Central Bank of Myanmar, 2022). Uneven policies in the banking sector such as limiting the withdrawal of money, exchange rate and foreign currency controls, and other directives such as

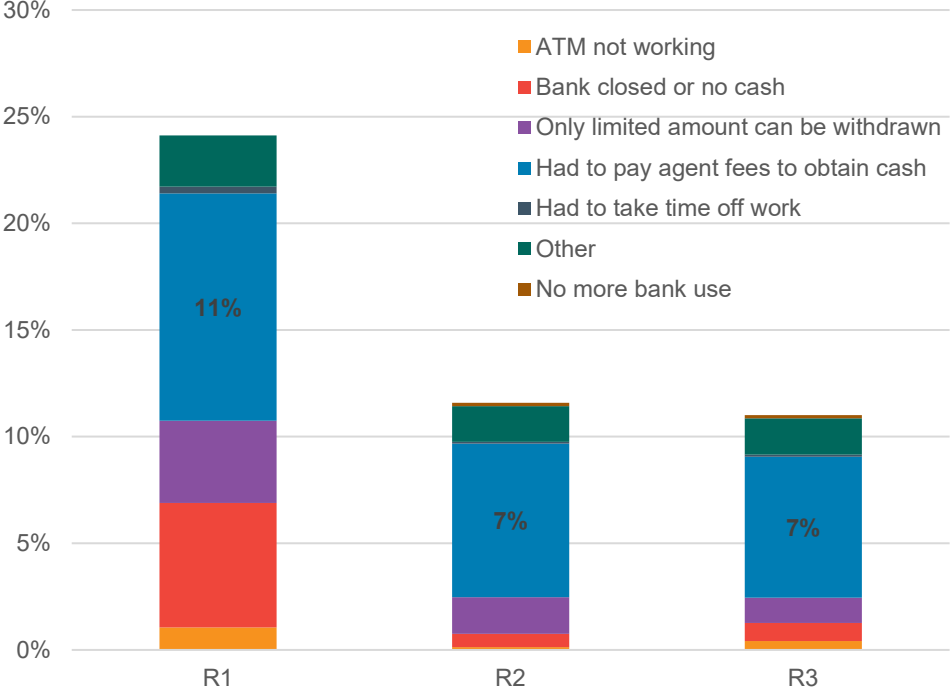
³ This notice shows where withdrawal limits are still in place for KBZ bank as of June 9th, 2022. <https://www.kbzbank.com/en/blog/announcements/cash-withdrawal-is-available-at-kbz-atms-in-designated-cities/>

⁴ "Special accounts" have different names and features at different banks; please see [Call Deposit Account - KBZ Bank](#) , [Special Account | CB Bank](#) for more information.

⁵ This note clarifies some of the different directives passed by the CBM regarding currency conversion and use for exporters and others. <https://www.cbbank.com.mm/en/sme-banking/accounts/transaction-account/special-account>

the collection of personal information from money transfer services, may affect the use of these services as well as the sending of remittances moving forward.

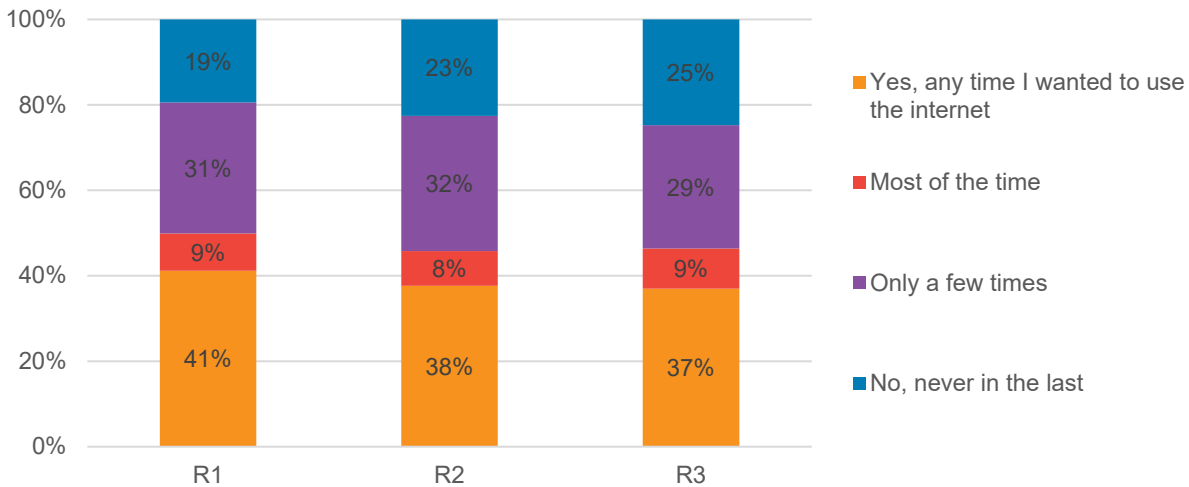
Figure 5. Banking difficulties, by MHWS round



Source: Author’s calculations based on MHWS data.

Access to the internet is becoming more difficult. In R1, R2, and R3, 50.1, 54.2, and 53.6 percent of households respectively, could not access the internet or could only access it a few times per month (Figure 6). In R3, 24.7 percent of households could not access the internet at all in the month prior to the survey, compared to 22.6 percent in R2. Internet use was especially difficult in Sagaing, Chin, and Magway, where only 16.2, 21.3, and 32.6 percent of households had internet access most or all the time. Lack of internet access was a result of internet service disruptions, as reported by 35.9 percent of households. Households also reported not being able to afford to pay for the internet both because of high fees (16.4 percent), and a limited budget (27.2 percent).

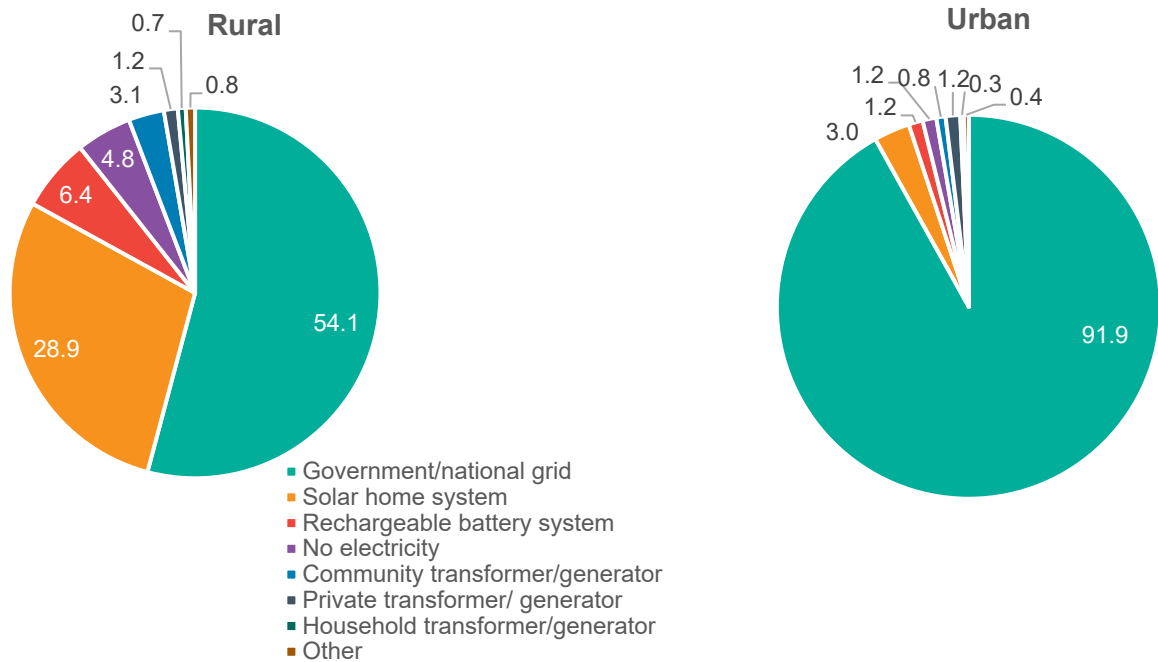
Figure 6. Households access to internet, by MHWS round



Source: Author's calculations based on MHWS data

Electricity provision was inconsistent in 2022, leaving many households facing temporary blackouts. According to MHWS, 96.2 percent of households had access to electricity from January to August 2022, with major differences between electricity sources for rural and urban households (Figure 7). While 91.9 percent of electricity in urban areas is from the national grid, in rural areas, the national grid only supplies 54.1 percent of households with electricity. Instead, solar home systems are an important source of electricity, with 28.9 percent of rural households getting their electricity from this source. While most households have access to electricity, there have been many interruptions in electricity provision. Even before the coup, Myanmar struggled to keep up with the burgeoning demand for electricity. First, during the dry season, hydropower stations do not run at full capacity because of lack of water (Lei, 2021). Second, while hydropower stations can run at full capacity during the monsoon season, they struggle with frequent mechanical breakdowns caused by the rain. Third, after the coup, and as a result of conflict, foreign investors have pulled out of hydropower development projects and several dams were taken offline due to attacks on the grid (Nikkei Asia, 2022). Further, the Government of Myanmar is struggling to cover the cost of electricity production as a result of budget shortages because many households refused to pay their electricity bills after the coup (Fitch Solutions, 2021). As conflict continues to affect the functioning of electric towers and stations across the country, as well as the collection of bills, electricity provision will continue to be an issue.

Figure 7. Main source of electricity, by rural/urban for January-August 2022



Source: Author's calculations based on MHWS data.

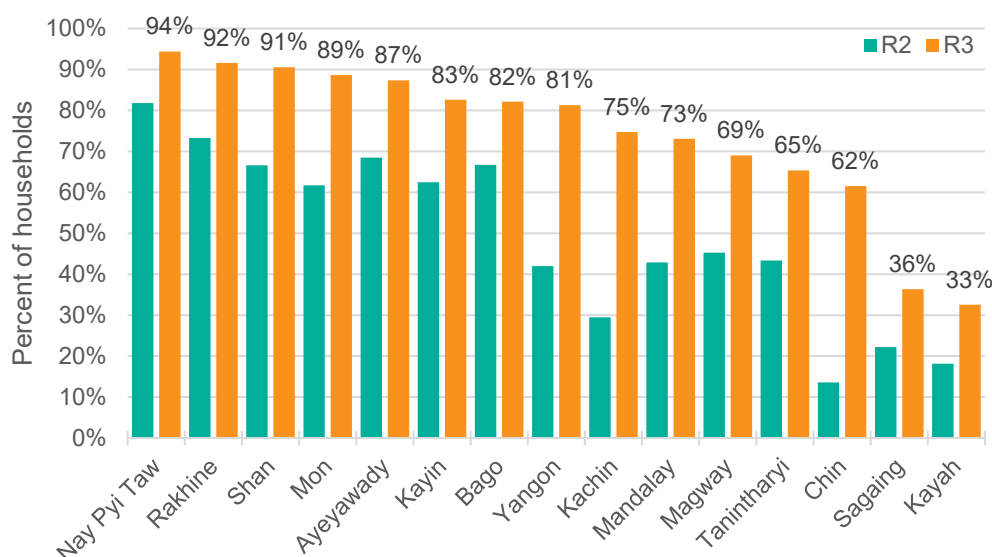
Of the household members who needed medical services, 9.7 percent of households from December 2021 to August 2022 could not access medical services and 18.3 percent of households could only access medical services once or twice. COVID-19 and the political crisis have had an immense impact on the health and education sectors. Most public health staff took part in the Civil Disobedience Movement (CDM) in 2021. And as a result, there is still a shortage of doctors and nurses in the public hospitals. In 2017, 91.1 percent of urban residents and 87.8 percent of rural residents lived in close proximity to a public medical facility (MLCS, 2017). Further, 96.1 percent and 39.5 percent of urban and rural residents, respectively, lived in close proximity to a private hospital, doctor, and/or clinic (MLCS, 2017). Despite access to medical care in terms of proximity, in 2021/2022, many households were struggling to receive care. From December 2021 to August 2022, 9.7 percent of households who needed medical services could not access them. This number was consistent across rounds, with urban access slightly higher than rural access in R2 and R3. Further, households in Chin, Kayah, and Shan were the least likely to be able to access medical services.

Access to schooling is improving compared to earlier rounds. However, there is significant regional variation. Less than 50 percent of children 5 to 14 years in Kayah and Sagaing are enrolled. Primary, middle, and high schools began to reopen across the country in 2021. Despite this, because of continued concerns with COVID-19 and safety, scarcity of qualified teachers, and school closures, many students did not go back to school. In R2, only 52.5 percent of children 5 to 14 years were attending school, 40.8 percent in urban areas and 56.5 percent in rural areas. In R3, this number jumped to 76.9 percent nationally, 74.2 percent in urban areas and 77.8 percent in rural regions. While the number of children attending school increased

nationally, in Kayah and Sagaing enrolment continued to be under 50 percent of children (Figure 8). School closure from COVID-19 and the continued loss of enrollment will have lasting economic impacts on the lives of the students and the economic future of Myanmar.

Finally, at the university level, in October 2022, some universities were still closed. While all universities are set to re-open in November 2022, it is unclear if attendance will increase, as many students have dropped out because of their participation in the CDM movement. Many former university students, instead of returning to their universities, are enrolling in universities abroad, or migrating abroad. This could lead to immense loss of human capital for Myanmar, with lasting negative impacts on its economy.

Figure 8. Percent of households with all children 5-14 enrolled in school, by State/Region



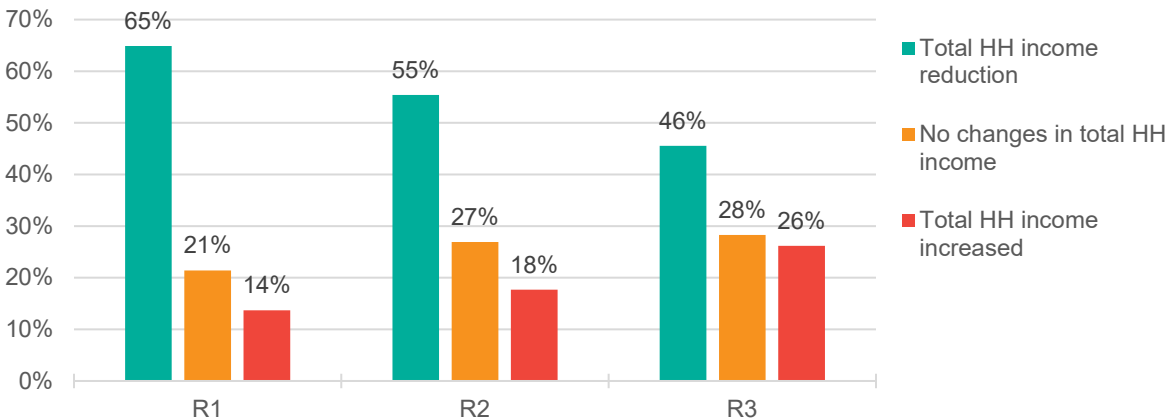
Source: Author's calculations based on MHWS data.

3.1.5 Economic shocks

In R3, 46 percent of households reported lower income compared with last year, with 27.6 percent facing a significant reduction in income (greater than 20 percent) and 18.0 percent experiencing a small reduction in income (1–20 percent). The combination of conflict, disease, COVID-19 policy, and international events has reduced household earnings in Myanmar. In the MHWS households were asked how their total household income in the past three months compared with their total household income in the same period one year ago (Figure 9). In R3, 46 percent of households reported lower income compared with last year. Fewer households reported lower income compared to the previous year in R3, compared to R2, where 55.4 percent of households reported lower income compared to the previous year, and R1, where 64.9 percent of households reported lower income compared with the previous year. Twenty-two percent of households reported income losses in all three periods, while 30.6 percent of households reported income reductions in two periods only. Of those, 65 percent of households reported income reductions in rounds one and two compared to 35 percent in rounds two and three. When

comparing total nominal income in May through August 2021 from recall data with total nominal income from May through August of 2022, there has been a decrease in own-farm agricultural income by 48 percent, own-farm livestock income by 35 percent, and own-farm fishing/aquaculture income by 36 percent.

Figure 9. Change in household income compared to the previous year, by MHWS round



Source: Author's calculations based on MHWS data.

Casual non-farm and farm wage earning households were the most likely to experience income loss compared to the previous year. Fifty-two percent of casual non-farm earning households and 50.6 percent of farm wage earning households reported lower income this year compared to the last (Table 2). This, however, is significantly lower than in the previous period, where 59.6 percent of households earning income from non-farm wage work and 63.5 percent of household dependent on income from farm wage work reported lower income compared to the previous year.

Compared to households earning money from other income streams, households employed in salaried work, both farm and non-farm, were the least likely to see an income reduction compared to the previous year. Further, there was a significant improvement for these salaried workers compared to the previous period. In R3, 30.4 percent of non-farm salaried workers and 20.3 percent of farm salaried workers reported a reduction in income, while in R2, 41.9 percent and 42.3 percent of these households saw a decline in their income, respectively. Self-employed farmers and non-farm households continued to earn less income compared to the same period last year. This includes 44.7 percent of self-employed crop, livestock, or aquaculture farming households and 49.3 percent of self-employed non-farm households.

While fewer households reported lower income in R3 compared with rounds two and one, it is important to highlight that 23 percent of panel households that were surveyed in every round reported lower income in all periods, making these households especially vulnerable. Further, it is important to note that this is a comparison to last year, so it masks the chronic vulnerability of households. Finally, because we base the comparison on the main source of income this period, some estimates may be inaccurate since it is possible that the principal sources of income changed from one year ago.

Table 2. Percentage of households with reduced income compared to one year ago, by main livelihood source

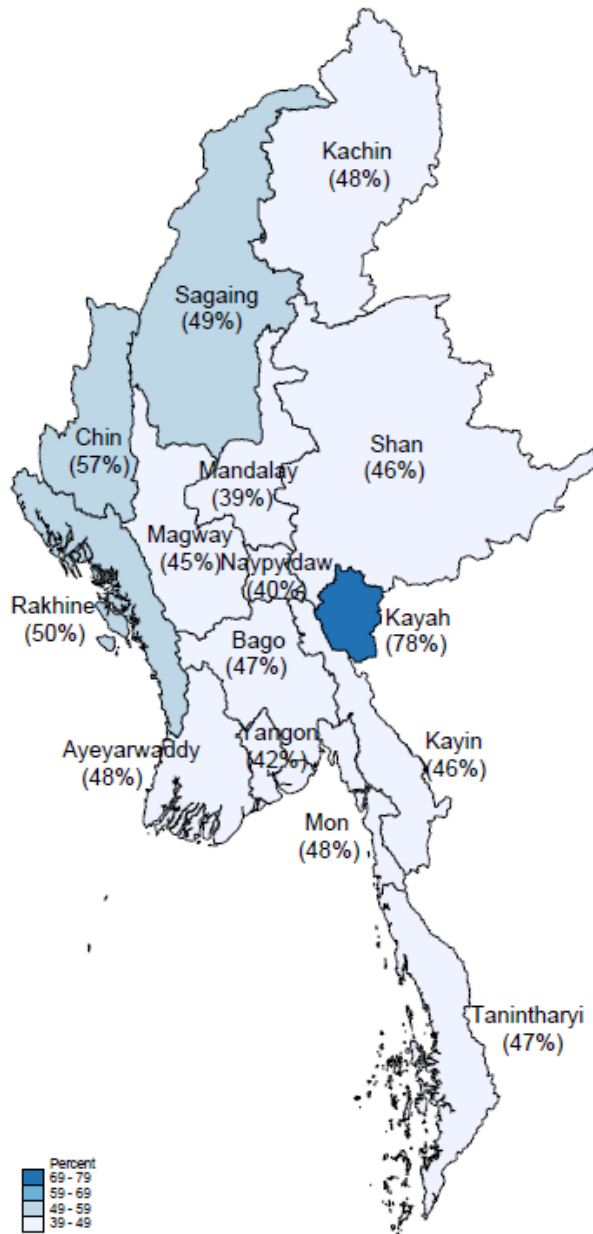
	Large reduction (>20%)	Small reduction (1-20%)	No change (%)	Small increase (1-20%)	Large increase (>20%)
All households	27.6	18.0	28.3	19.6	6.6
Self-employment					
Farm (crops, livestock and aquaculture)	26.4	18.4	29.6	18.8	6.9
Non-farm (any other)	29.4	19.8	24.4	19.1	7.3
Salaried employment					
Farm (crops, livestock and aquaculture)/ non-farm	16.9	13.0	34.6	26.6	8.9
Casual wage work					
Farm (crops, livestock and aquaculture)	31.3	19.3	30.0	16.8	2.7
Non-farm (any other)	33.0	19.3	23.5	19.1	5.1
Other incomes sources					
Remittances	25.2	15.0	33.1	17.6	9.0
Gifts, donations, pensions, or other assistance	26.8	14.5	41.8	13.5	3.3
Renting out of land or properties	31.2	8.3	26.8	22.9	10.8

Note: In R3, the main source of income for 27 percent of households was from on farm self-employment, 28 percent from non-farm self-employment, 13 percent from salaried work, 26 percent from causal farm wage work, 21 percent from causal non-farm wage work, 11 percent from remittances, 9 percent from gifts, donations pensions or other assistance, and 4 percent from renting out land or other properties.

Source: Author's calculations based on MHWS data.

Households in Kayah, Chin, and Rakhine suffered from the highest economic vulnerability, 78.2, 56.9 and 50.0 percent of households, respectively. To compare households' economic vulnerability across states and regions, we classify households as economically affected if they experienced a large or small reduction in income or if they had no income at all in the past three months. Figure 10 and Table A.5 show the share of economically affected households in each State/Region of the country. Again, households in Kayah, Chin, and Rakhine were the most vulnerable. While there was a notable decline in the percentage of households with lower income this round compared with the last round in most states/regions, in Kayah, Chin, Tanintharyi, Mon, and Rakhine there was no change.

Figure 10. Percentage of households who had no or reduced income in the past three months compared to one year ago



Source: Author's calculations based on MHWS data.

Twenty-one percent of salaried/wage workers reported reduced working hours or less work as their main challenge in R3, compared to 21.8 percent in R2 and 43.4 percent in R1 (Table A.6). In MHWS households also reported the main challenge they faced in the last three months, based on their principal source of income. Reduced working hours was the largest challenge faced by salaried/wage workers. Further, 8.1 percent of wage/salaried workers reported low/reduced wages as their principal challenge, which is an improvement from 10.8 percent and 20.9 percent in R2 and R1, respectively. On the other hand, 4.4 percent of workers reported not

being able to work because of own health problems or those of another family member as their principal challenge, which is greater than in R2.

The main challenges that farmers faced in R3 were high prices of inputs or mechanization services (29.4 percent), weather (16.0 percent), high fuel prices (7.7 percent) and pests/diseases (7.6 percent) (Table A.7). The main issues farmers faced in terms of selling their crops were low prices for crops (22.1 percent) and difficulty reaching traders (6.1 percent).

For non-farm enterprises, 15.1 percent reported high prices of raw materials as their main challenge in R3 (Table A.8). Further, increasing fuel prices remained a prominent issue in R3, with 9.9 percent of non-farm enterprises reporting high fuel prices as the main issue they faced. Further, 8.0 percent of businesses struggled reaching customers physically in R3. Finally, a growing issue that non-farm enterprises are facing is that people are not paying off their debts, and more people are buying on credit.

3.2 Coping strategies

Overall, 82.3 percent of households used at least one coping mechanism to deal with lack of food or money in the past 30 days, 85.1 percent of rural residents and 75.1 percent of urban residents (Table 3). Shocks can be particularly damaging to household well-being, when either the household cannot deploy a coping mechanism to ensure the same living standard or, the household is forced to use a coping mechanism that results in permanent loss of assets, income, or safety. In the MHWS, households identified all the coping strategies they used in the past 30 days to cope with lack of food or money. On average, households reported using three different coping mechanism over the 30 days prior to R3, the same number as R2, but less than the 3.7 they reported in R1.

Table 3. Coping mechanisms used to deal with lack of food or money in the past 30 days

	National R3	Rural R3	Urban R3
Number of coping mechanisms used	3.01	3.22***	2.48
Uses at least one coping mechanism (%)	82.3	85.1***	75.1
Spent saving (%)	66.0	68.7***	59.7
Reduced non-food expenditures (%)	52.5	53.2**	50.9
Reduced food expenditures (%)	52.4	54.0***	48.2
Borrowed money (%)	35.0	38.3***	26.6
Purchased food credit or borrow (%)	34.1	38.8***	22.1
Reduced expenditures on health (%)	31.0	31.9***	28.6
Mortgaged household assets (%)	18.7	20.5***	14.2
Sold household assets (%)	13.5	12.7***	15.3
Mortgaged non-ag productive assets/transport (%)	0.9	0.6***	1.7
Sold non-ag productive assets/transport (%)	2.9	2.8	3.0
Mortgaged/sold house (%)	1.3	1.4***	0.8
Mortgaged/sold land (%)	0.5	0.6***	0.1

Engaged in high-risk activities (%)	5.0	5.5***	3.8
Children need to work (under 15) (%)	5.8	6.6***	3.4
Migrate entire HH (%)	1.4	1.4	1.6
Agricultural households only			
Reduced ag-input expense (ag HH only) (%)	50.2	50.5	45.2
Sold or consumed seed stocks (ag HH only) (%)	21.0	21.1	18.2
Mortgaged/sold ag productive assets (ag HH only) (%)	1.3	1.8***	0.1
<i>Number of observations</i>	<i>12128</i>	<i>8494</i>	<i>3634</i>

Notes: ¹Household assets include radio, furniture, television, jewelry, etc. ²Non-agric productive assets include sewing machine, wheelbarrow, bicycle, car, etc. ³Farm households only; 4,556 observations.

Note: Asterisks on Rural R3 show statistically significant differences between rural and urban observations; * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author's calculations based on MHWS data.

Overall, the most common coping strategies were spending savings (66.0 percent), reducing non-food expenditures (52.5 percent), and reducing food expenditures (52.4 percent). More households spent savings in rural areas than in urban areas. Five percent of households reported they no longer had any savings to spend compared to 3.4 percent in R2. Thirty-six percent of households had to reduce both their food expenditure and their non-food expenditure, while 19.7 percent of households had to reduce food and non-food expenditure and also spend their savings. Overall, fewer households reported using these coping strategies in R3 compared to the previous two rounds. But 21.8 percent of households reduced their non-food expenditure in all three periods, 24.5 percent of households spent some of their savings in all three periods, while 15.7 percent of households reduced their food expenditure in all three periods. Finally, households who reduced their food expenditure did so mainly by decreasing their spending on meat (85.2 percent), fish (77.0 percent), oils, fats, and butter (80.4 percent), and restaurant or takeaway meals (54.5 percent) (Table A.9). More rural households decreased their expenditures on animal sourced foods and oils/fats than urban households. From R2 to R3, food price inflation slowed down. The price of chicken decreased by 6 percent, while the price of fresh fish increased by 4 percent. Further, the price of cooking oil increased by 7 percent. While the percent of households who decreased their food expenditure declined slightly from R2, the percent of households who reduced their food expenditure in meat, fish, and oils all increased compared to R2.

Indebtedness is an increasing issue in Myanmar, especially in rural areas. The number of households who borrowed money, 35.0 percent, decreased slightly from the previous round, 36.9 percent. But the number of households who borrowed food or bought food on credit increased from the previous round, 34.1 percent compared to 32.7 percent. In rural areas it was more common to borrow money or purchase food on credit. This is likely related to better social networks among rural communities which facilitate borrowing. Households were asked if they currently owe any money to loan or credit providers, including banks, MFIs, moneylenders, shops, traders, suppliers, relatives, or friends. In R1, 61.5 percent of households owed money (Table 4). After R3, 55 percent of households owed money. Significantly more rural households owed money than urban households. Among panel households, or households that were surveyed in

R1, R2, and R3, 25 percent did not owe money over the entire survey period. On the other hand, 37 percent owed money in R1 and continued to owe money in R3. Asset poor households were more likely to owe money than asset low or asset rich households.

Table 4. Percent of household who owe money to a lender

	R1	R2	R3
National	61.5	56.2**	55.0
Rural	66.6	60.7***	59.5
Urban	48.4	44.5***	43.5
Asset poor (0-3 assets)	72.8	68.3*	65.9
Asset low (4-6 assets)	62.9	55.8***	55.6
Asset rich (7-10 assets)	45.0	40.9***	38.8

Note: asterisks denote difference from the previous MHWS round and show significance at p-values; * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author's calculations based on MHWS data.

To meet daily needs, 18.7 percent of households mortgaged household assets and 13.5 percent sold household assets. Mortgaging assets is more common in rural areas while selling assets is more common in urban areas. Household assets include gold, jewelry, furniture, technology, and appliances. The most common asset sold and/or mortgaged was gold and/or jewelry by 26.7 percent of households. But 2.6 percent of households sold means of transport, 2.4 percent sold livestock, and 2.0 percent sold residential parcels. Of the households who sold and/or mortgaged household assets, 12.8 percent mortgaged an asset in all three periods, while 9.1 percent sold an asset in all three periods. Further, 6.6 percent and 4.4 percent of households reported that they had no more household assets to sell or mortgage in R3, respectively. Three percent of households sold non-agriculture productive assets include sewing machines, wheelbarrows, bicycles, cars, and other means of transportation, and less than one percent mortgaged these assets. Among households that mortgaged/sold non-agriculture productive assets, 1.5 percent of households mortgaged them in all three periods, and 2.2 sold them in all three periods. Finally, some households also mortgaged or sold critical assets such as their dwelling (1.3 percent) or agricultural land (0.5 percent). Households in rural areas were more likely to use these strategies than urban households. Given the recall period of 30 days, the number of households that have mortgaged and/or sold assets is concerning.

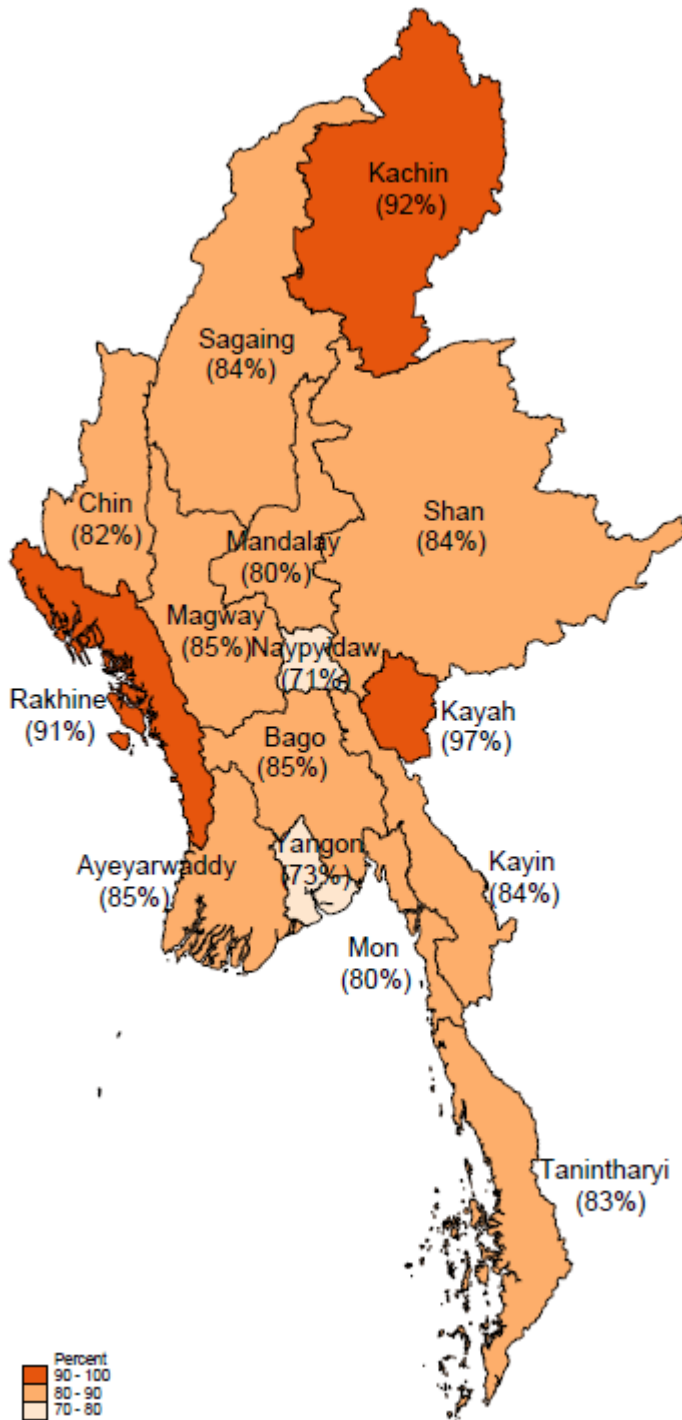
Households also pursued risky activities to meet their daily needs. This includes 5.0 percent of households that engaged in income-generating activities that they themselves considered risky, and 5.8 percent of households where children worked to complement household income. Both of these coping strategies were more common in rural areas, compared to urban areas. Most households who engaged in a risky activity did so only in one round, though 18.3 percent of households who engaged in a risky activity did so in two rounds, and 1.4 percent of households who engaged in a high-risk activity did so in all three rounds. Unfortunately, more households engaged in a risky income-generating activity in R3 compared with in R2. Finally, 1.4 percent of families migrated with their entire household to deal with the dire economic situation.

Nationally, 50.2 percent of agricultural households reduced ag-input expenses. Farm households were asked about a specific set of farm-related coping mechanisms. Around half of agricultural households reduced ag-input expenses. Households also consumed or sold their seed stocks (21.0 percent) and sold other agricultural assets (1.4 percent). The most common agricultural asset sold was livestock. Reducing ag-input expenses, selling and/or consuming seed stocks, and selling agricultural assets will most likely lower yields with the potential to create food shortages across the country.

The situation of households is dire in Kayah, Kachin, and Rakhine as shown by the number of coping strategies used. Figure 11 and Table A.10 show coping strategies in each State/Region of the country. In Kayah State, 96.7 percent of households used at least one coping mechanism in the past 30 days, and households used on average 5.5 different coping mechanisms. In Kachin, 92.2 percent of households used at least one coping mechanism, and the average household used 3.4 coping strategies. Similarly, in Rakhine State 91.4 percent of households applied at least one coping mechanism, while using 4.0 mechanisms on average. Further, Kayah, Kachin, and Rakhine are the only states that did not see a decrease in the percent of households using a coping mechanism in R3, compared with the last period. Also alarming, is the percent of household who engaged in high-risk activities to meet daily needs, including 10.9 percent in Kayah, 8.3 percent in Kachin, 8.2 percent in Rakhine, and 8.0 percent in Chin. Further, in Kayah, an alarming 19.6 percent of households had children working while in Chin, 14.5 percent had children working. Approximately 6.9 percent of households in Kayah and 4.2 percent in Chin migrated from these states.

There were also regional differences between the number of farmers applying different coping strategies. In Kayah, 58.0 percent of farmers reported reducing their ag-input expenses, compared to 89.8 percent in the last round. This marks a decline but is still very high. Fewer farmers also had to reduce ah-input expenses in Rakhine, 59.4 percent of farming households compared to 69.1 percent. But again, this number is still extremely high. In Tanintharyi 56.2 percent of farmers reduced their ag-input expenses, consistent with last period.

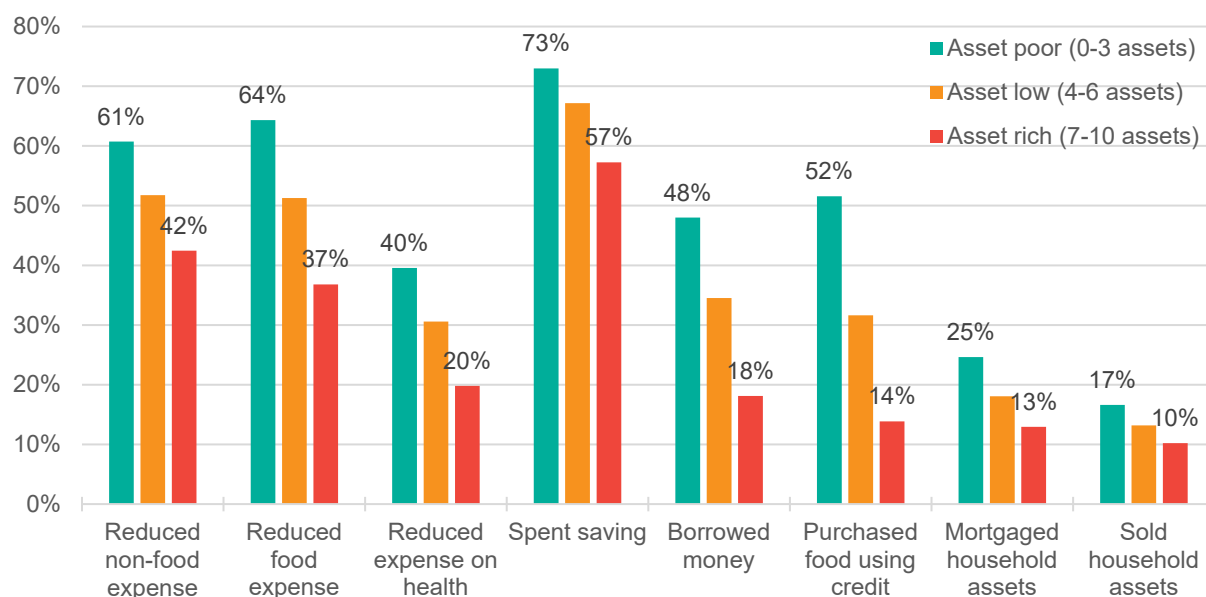
Figure 11. Percent of households applying at least one coping mechanism, by State or Region



Source: Author's calculations based on MHWS data.

Asset poor households were more likely to use coping strategies than asset low and asset rich households. Figure 12 shows different coping strategies used by asset class for R3. In R3, 61 percent of asset poor households reduced their non-food expenditure, 64 percent reduced their food expenditure, and 73 percent spent their savings. Particularly striking is the difference between asset poor and asset rich households in terms of buying food, using credit, and borrowing money. Fifty-two percent of asset poor households bought food using credit compared to 14 percent of asset rich households. Further, 48 percent of asset poor households borrowed money compared to 18 percent of asset rich households. Finally, asset poor households were also most likely to sell and mortgage assets.

Figure 12. Coping strategy by asset class



In R3, 14.5 percent of households received money from remittances. Monetary transfer into the household may help households cope with shocks. But households in Myanmar receive little support from local and international relief organization and/or the Government. Instead, most transfers into the household come from friends and family. Table 5 presents different transfers into the household. Unemployment benefits are not common in Myanmar and less than one percent of households in R3 received unemployment. Pensions are more common. Around 3.2 percent of rural households and 7.9 percent of urban households received pensions in R3. Support from relief organizations was less frequent. Local relief organization provided support to around 1.0 percent of households in R3. International relief organizations provided support to about 1.9 percent of households during the same months. International relief was more prevalent in urban areas. A more common form of support was money for food given by friends or family. In R3, 7.0 percent of households received money from this source. Finally, the most important source of support was remittances.

Table 5. Share of households receiving support

	National R1	National R2	National R3
Unemployment benefits	0.3	0.1***	0.1
Pensions	4.6	4.6	4.2
SAC/ local governing entities	0.7	0.8	0.5***
Local relief organization / local NGO	1.4	1.1*	1.0
International relief organization	1.7	1.9	1.9
Monastery, church, other religious group	0.6	0.5	0.5
Community-based savings/ credit group	0.3	0.3	0.1***
Family, friend of other individual	8.1	8.9**	7.0***
Remittances	15.1	16.1	14.5

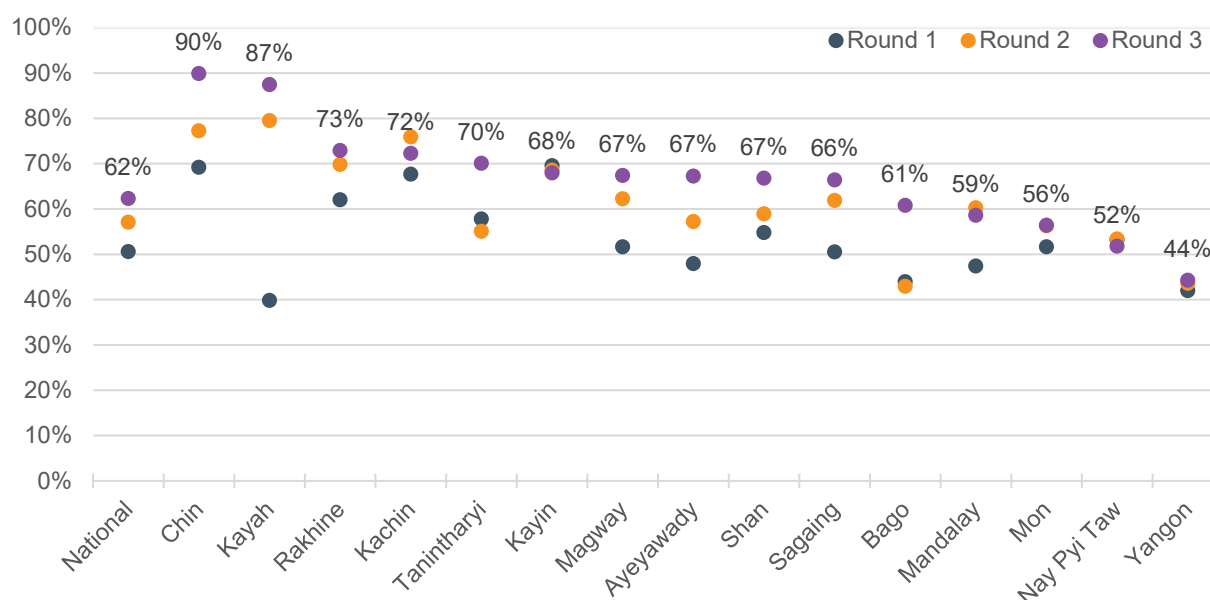
Note: asterisks denote difference from the previous MHWS round and show significance at p-values; * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author's calculations based on MHWS data.

3.3 Income poverty

In R3 income poverty increased by 11 percentage points, from 50.6 percent in R1 to 62.2 percent in R3. Most of the increase took place in rural areas. Rural poverty increased by fourteen percentage points over the period, while urban poverty increased by five percentage points. Some of the increase may be seasonal, as the R3 recall period was during a lean season. There was a jump in income poverty across regions. Figure 13 shows how income poverty at the regional level has increased across MHWS rounds, from September through January 2021 to April through August 2022. Particularly alarming is the increase in income poverty in Chin and Kayah states to 89.8 and 87.4 percent of the population, respectively. Further, in R3 income poverty levels in Rakhine, Kachin, Tanintharyi, Kayin, Magway, Ayeyawady, Shan, and Sagaing were all above the national level. Compared with R1 this marked a departure from below or equal to the national poverty line for Kayah, Sagaing, Magway, and Ayeyawady.

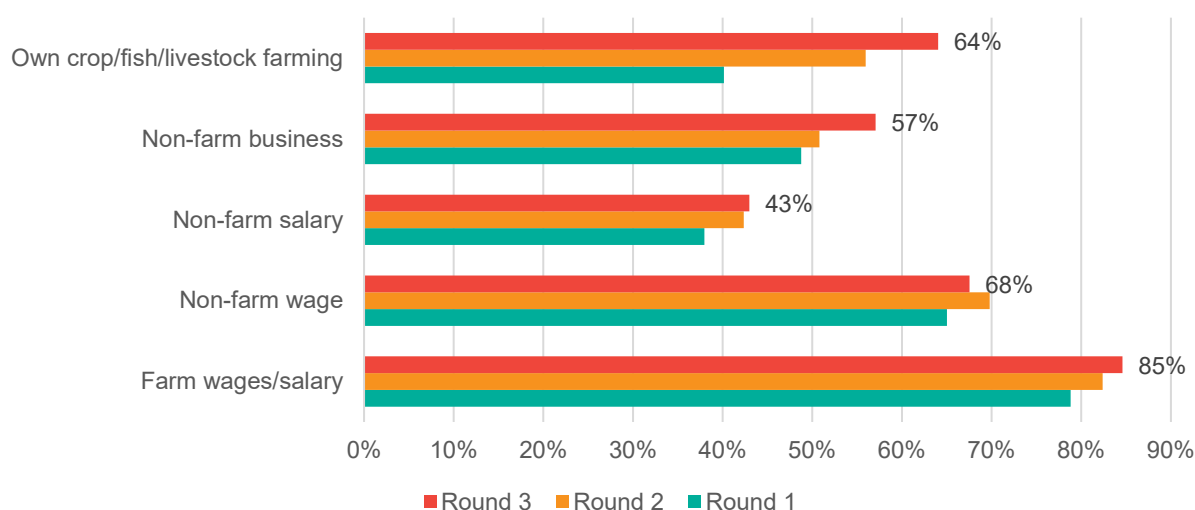
Figure 13. Regional Trend in Poverty Headcount 2021/2022



Source: Author's calculations based on MHWS data.

Households whose main source of income was from farm casual wage/salary were the most vulnerable, with 84.6 percent of these households under the poverty line in R3. Figure 14 shows the percentage of households living under the poverty line by principal source of household income. Non-farm casual wage workers were less vulnerable than farm casual wage workers, but poorer than own-farm households, with 67.5 percent of these households living under the poverty line. Sixty-four percent of self-employed farm households were below the poverty line in R3. Further, they were more likely to be income poor in R3 compared to R1. Households whose main source of income was off-farm business fared better than farm and casual wage households but were still income poor, with 57.1 percent living under the poverty line. Finally, while 43.0 percent of non-farm salaried worker households were below the poverty line, they were significantly less poor than all other groups.

Figure 14. Income poverty incidence by main income source



Source: Author's calculations based on MHWS data.

4. VULNERABILITY ASSESSMENT

In this section, we explore how shocks and household characteristics are associated with vulnerability. More specifically, we explore to which extent household characteristics and different shocks are associated with whether households are economically affected, have critically low incomes, and the coping strategies they employ. Households are defined as economically affected if they have experienced a large or a small reduction in income or if they had no income at all in the past three months. Households are considered having critically low income if their per capita daily income is less than the poverty line.

The results show that households facing security, climatic, and health shocks are more likely to experience a reduction in income (Column 1 in Table 6). Moreover, household livelihood profiles matter. Compared to households whose main source of income is salaried labor, farm wage households are the most likely to become economically affected. Households whose main

source of income is farm wage have a 14.1 percentage point probability of being economically affected compared to salaried households. Similarly, non-farm casual wage and non-farm business households are more likely to be economically affected than salaried households, at nearly the same magnitude as farm wage households, 13.8 and 13.3 percent, respectively. Households earning money from their own farm are also more likely to be economically affected than salaried households, but at a lesser magnitude than non-farm businesses and farm and non-farm casual wage workers. Households in which the head has completed only primary education are more likely to be economically affected as well as larger households. Finally, households living in rural areas are less likely to be economically affected than those in urban areas. Further, compared to households in Bago, households in Kayah, Chin, and Yangon are more likely to be economically affected.

While shocks significantly increase the probability that a household is economically affected, they are less strongly associated with income poverty. While there remains a significant though small association with experiencing violence, there is no longer a clear association with climate and health shocks. Compared to households with salaried income, households who rely on income from a non-farm business, non-farm casual wage work, and farm casual wage work are more likely to be income poor. Farm casual wage workers have a 25.7 percentage point higher probability of being income poor than salaried income households. Remittances, on the other hand, help to avert income poverty. Households who received remittances are 12.4 percentage points less likely to be income poor. Households in which the head has completed only primary education are also more likely to be economically affected by 11.7 percentage points. Women only households and households with larger household sizes are also more likely to be income poor. Finally, rural households are more likely to be income poor.

Table 6. Exploratory regression analysis of characteristics associated with economic status and income poverty

	Economically affected	Income poor
Violence in community	0.090***	0.022***
Climate shock	0.068***	0.007
Death in HH	0.067***	0.025
Non-farm business vs salary	0.133***	0.029***
Farm income vs salary	0.059***	0.012
Non-farm wage vs salary	0.138***	0.138***
Farm wage vs salary	0.141***	0.257***
Remittances	-0.017*	-0.124***
Transfers from friends/family	-0.013	-0.007
Primary education only (HH head)	0.037***	0.117***
Women only household	0.006	0.050***
Child <5yr old in HH	0.011	0.011
HH size	0.007***	0.052***
Respondent is female	0.010*	0.073***

R2 vs R1	-0.092***	0.099***
R3 vs R1	-0.195***	0.146***
Rural vs urban	-0.020***	0.026***
Kachin vs Bago	0.021	0.139***
Kayah vs Bago	0.188***	0.205***
Kayin vs Bago	0.009	0.115***
Chin vs Bago	0.135***	0.255***
Sagaing vs Bago	0.014	0.059***
Tanintharyi vs Bago	-0.008	0.055***
Magway vs Bago	0	0.060***
Mandalay vs Bago	-0.025**	0.029**
Mon vs Bago	-0.003	0.01
Rakhine vs Bago	-0.002	0.121***
Yangon vs Bago	0.033***	-0.032***
Shan vs Bago	-0.013	0.047***
Ayeyawady vs Bago	-0.009	0.058***
Nay Pyi Taw vs Bago	-0.045**	0.018
No. of Obs.	36046	35305

Note: The dependent variable in column 1 is economically affected. Households are defined as economically affected if they have experienced a reduction in income or if they had no income at all in the past three months. In column 2 the dependent variable is the number of coping strategies. All four models include state/region dummies. The base category for income is salary work. The base round is round 1. The base category for asset is asset rich. Asterisks show coefficients significant at p-values * p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculations based on MHWS data.

We examine the relationships between shocks and five different coping strategies commonly analyzed and observed amidst economic and violent shocks: reducing food and non-food expenditure, borrowing money, and selling household assets. In Table 7 we present the associations between reducing non-food expenditures (column 1), reducing food expenditure (column 2), borrowing money (column 3), and selling household assets (column 4) with security, climatic, health, and economic shocks. There is a strong and significant association between experiencing a security or climate shock and using each coping strategy. Households who experienced a security shock are 11.5 percentage points more likely to reduce their non-food expenditure, 10.4 percentage points more likely to reduce their food expenditure, and about five percentage points more likely to borrow money and sell households assets. While climatic shocks have a similar impact in terms of magnitude on reducing non-food and food expenses, they are associated with a larger probability of borrowing money and selling household assets. A death in the household made households more likely to borrow money, sell household assets, and sell non-farm productive assets. Households that were economically affected were more likely to deploy each coping mechanism.

Households who earn income from self-employment off-farm or farm were less likely to reduce their food and non-food expenditure than salaried households. Casual wage-earning

households, compared to salaried households, were more likely to reduce their non-food and food expenditure, borrow money, and sell household assets. Earning remittances reduced the need for households to reduce their non-food and food expenses, borrow money, and sell assets. Households in which the head completed only primary education, households with children under five and larger households were also more likely to reduce their food and non-food expenditure, borrow money, and sell household assets. Finally, rural households were less likely to reduce their non-food expenditure but more likely to borrow money.

Table 7. Exploratory regression analysis of characteristics associated with coping mechanisms

	Reduced non-food expense	Reduced food expense	Borrowed money	Sold HH asset
Violence in community	0.114***	0.104***	0.051***	0.052***
Climate shock	0.108***	0.100***	0.086***	0.074***
Death in HH	0.013	0.034**	0.051***	0.049***
Economically affected	0.141***	0.139***	0.081***	0.083***
Non-farm income vs salary	-0.028***	-0.030***	-0.025***	0.022***
Farm income vs salary	-0.030***	-0.031***	-0.011	0.003
Non-farm wage vs salary	0.055***	0.073***	0.073***	0.058***
Farm wage vs salary	0.086***	0.114***	0.107***	0.027***
Remittances	-0.018**	-0.022***	-0.019**	-0.012*
Transfers from friends/family	0.020**	0.015*	0.025***	0.005
Primary education only (HH head)	0.028***	0.078***	0.095***	0.022***
Women only household	0.004	-0.009	0.019	-0.001
Child <5yr old in HH	0.024***	0.033***	0.045***	0.047***
HH size	0.007***	0.006***	0.009***	0.006***
Respondent is female	0.091***	0.096***	0.036***	0.072***
R2 vs R1	-0.081***	-0.095***	-0.063***	-0.041***
R3 vs R1	-0.105***	-0.102***	-0.074***	-0.053***
Rural vs urban	-0.018**	0.002	0.046***	-0.014**
Kachin vs Bago	0.072***	0.032*	0.001	-0.145***
Kayah vs Bago	0.127***	0.143***	0.065**	-0.110***
Kayin vs Bago	-0.038**	-0.017	-0.054***	-0.150***
Chin vs Bago	0.008	0.115***	-0.002	-0.242***
Sagaing vs Bago	-0.017	0.001	-0.061***	-0.133***
Tanintharyi vs Bago	0.045**	0.074***	0.019	-0.101***
Magway vs Bago	-0.024*	-0.027*	-0.038***	-0.052***
Mandalay vs Bago	-0.052***	-0.045***	-0.062***	-0.061***
Mon vs Bago	-0.018	-0.016	-0.053***	-0.064***

Rakhine vs Bago	0.060***	0.084***	0.058***	0.052***
Yangon vs Bago	-0.015	0.002	-0.044***	-0.047***
Shan vs Bago	0.013	-0.018	-0.028**	-0.166***
Ayeyawady vs Bago	0.017	0.045***	0.023*	-0.001
Nay Pyi Taw vs Bago	-0.057***	-0.067***	-0.076***	0.041**
No. of Obs.	36046	36046		36046

Note: The base category for income is salary work. The base round is round 1. Asterisks show coefficients significant at p-values * p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculations based on MHWS data.

5. DISCUSSION AND CONCLUSION

Vulnerability is increasing in Myanmar. The MHWS survey data for the period of April to August 2022 reveals the number of shocks households are facing and how they negatively impact household welfare. Conflict continued to increase over the period, and 22 percent of households felt insecure in their communities. Further, crime and violence increased from R2 to R3, both at the community level and among our survey households. In R3, climatic shocks were also more prevalent, specifically because of an increase in drought. At the same time, fewer households had members sick and with COVID-19 like symptoms. Households struggled to access basic services such as internet, electricity, education, and health. Finally, compared to 2021, households earned less income. Forty-six percent of households reported lower income in R3, compared to 12 months earlier.

Households relied on coping strategies to meet their daily needs. Eighty-two percent of households employed at least one coping strategy to meet their daily needs during the month prior to the survey round. The three most common coping strategies were spending savings, reducing non-food expenditure, and reducing food expenditure. Households also coped by borrowing money, leaving 55 percent of the population in debt in July and August 2022. Many households also sold or mortgaged household assets, reducing their quality of life. Finally, 7.6 percent of households sold or mortgaged productive assets, eroding their future income streams.

Income poverty increased dramatically in R3. Income poverty in Chin and Kayah states rose to 90 and 87 percent of the population, respectively. Moreover, in R3 income poverty levels in Kachin, Kayin, Tanintharyi, Magway, Rakhine, Shan, and Ayeyawady were all above the national level. Further, Myanmar's households may be more vulnerable than described in this report. Since internally displaced persons or other households in particularly precarious situations have limited access to phones, it is likely that they are under sampled.

Regression analysis reveals the link between shocks and the probability of being economically affected and income poor. While security shocks and climatic shocks have a direct impact on reducing household income, they have a weak association with income poverty. Instead, it seems how households cope and can cope with those shocks impacts whether they will be income poor. Finally, our descriptive statistics and regression analysis reveals that asset poor households and agricultural/non-farm causal wage-earning households are among the most vulnerable. They use the greatest number of coping strategies and are more likely to be

economically affected and income poor. Remittances were the only factor we found that reduces a household's probability of having lower income, being income poor, and using coping strategies. Therefore, one focus of the international community should be ensuring safe migration out of Myanmar and supporting migrants at their migration destinations. This will help migrants to send remittances back into the country, in turn helping their families in Myanmar cope with shocks.

REFERENCES

- ACLED (2022). ACLED data. [Data Export Tool - ACLED \(acleddata.com\)](#). Accessed September 20, 2022.
- Allen & Gherdel (2022). Myanmar clarifies rules regarding conversion and use of foreign currency for exporters and others. [Myanmar clarifies rules regarding conversion and use of foreign currency for exporters and others: Allen & Gledhill \(allenandgledhill.com\)](#). Accessed November 8, 2022.
- CB Bank (2022). Special Account. [Special Account | CB Bank](#). Accessed November 8, 2022.
- Central Bank of Myanmar (2022). Reference Exchange Rate History. [Reference Exchange Rate - History \(cbm.gov.mm\)](#). Accessed November 8, 2022.
- Central Bank of Myanmar. (2022) Notification No. 36/2022 [Microsoft Word - CBM Notification 36-2022.docx \(lincolnmyanmar.com\)](#). Accessed November 8, 2022.
- Fitch Solutions (2022). Myanmar's Hydropower Sector to Stay Afloat Amid Turbulent Market Conditions. <https://reglobal.co/myanmars-hydropower-sector-to-stay-afloat-amid-turbulent-market-conditions/>. Accessed November 8, 2022.
- KBZ bank (2022). Cash withdrawal is available at KBZ ATMS in designated cities. <https://www.kbzbank.com/en/blog/announcements/cash-withdrawal-is-available-at-kbz-atms-in-designated-cities/>. Accessed November 8, 2022.
- KBZ bank (2022) Call Deposit Accounts. [Call Deposit Account - KBZ Bank](#). Accessed November 8, 2022.
- MAPSA (2022a). Phone surveillance, from scratch: Novel sample design features of the nationally representative Myanmar Household Welfare Survey (MHWS). Myanmar SSP Working Paper 16. Washington, DC. International Food Policy Research Institute (IFPRI).
- MAPSA (2022b). Myanmar Household welfare survey Round 2 sample report. Washington, DC. International Food Policy Research Institute (IFPRI).
- MAPSA (2022c). Poverty measurement by phone. Developing and testing alternative poverty metrics from the nationally representative Myanmar Household Welfare Survey (MHWS), Round 1 (December 2021-January 2022). Washington, DC. International Food Policy Research Institute (IFPRI).
- Nikkei Asia (2022). Myanmar energy crisis deepens as power plant investors balk. [Myanmar energy crisis deepens as power plant investors balk - Nikkei Asia](#). Accessed November 8, 2022.
- Raleigh, C., Linke, A., Hegre, H., & Karlsen, J. (2010). Introducing ACLED: An armed conflict location and event dataset: Special data feature. *Journal of Peace Research*, 47(5), 651-660. <https://doi.org/10.1177/0022343310378914>
- Robertson, B., P. Young, J. Kristensen, K. Mar Cho, H. Myo Thwe, M. Pannchi, and T. Chin Sung (2018). Strategic Review of Food and Nutrition Security in Myanmar: In support of Sustainable Development Goal (SDG) 2 - Roadmap to 2030. Yangon, Myanmar: Myanmar Institute for Integrated Development (MIID).
- World Health Programme (2022). WHO Health Emergency Dashboard, COVID 19 Myanmar. <https://covid19.who.int/region/searo/country/mm>. Accessed October 10, 2022.
- Xiangyang, Lei. (2022). Research on development and utilization of hydropower in Myanmar. *Energy Reports*, 8, 16-21. [Elsevier Enhanced Reader](#)

APPENDIX TABLES

Table A.1 Experience of community and household insecurity in the past three months, by State or Region in percentage of households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyawady	Nay Pyi Taw
Community															
Feels insecure	50.9	52.3	27.3	47.3	40.9	25.5	10.8	19.5	19.8	19.5	24.5	26.3	16.4	11.0	8.2
Low levels of social trust	22.2	42.1	21.6	42.6	26.9	33.6	14.6	17.4	19.1	23.2	23.5	29.3	19.2	19.4	17.4
Increase in crime	33.4	10.6	7.1	12.4	11.4	7.4	4.4	5.5	9.8	8.2	4.8	18.2	8.4	4.6	6.1
Violence	20.6	17.5	4.9	13.4	16.7	13.0	2.9	6.5	6.5	3.9	3.8	11.8	5.5	2.0	4.0
Household															
Assault/detention	1.2	5.3	1.0	0.7	2.6	0.3	0.7	1.3	0.7	0.8	1.3	0.8	0.9	0.6	0.5
Destruction/appropriation of assets	1.9	24.1	1.6	10.3	2.6	0.6	0.5	1.6	1.7	0.5	0.4	1.3	1.0	0.5	0.0
Theft/robbery	5.7	18.6	3.9	6.4	4.4	2.0	3.4	2.8	3.7	3.8	4.0	7.1	2.9	3.4	3.4
Bribery/forced payments	1.6	0.0	3.1	0.0	0.6	1.0	0.2	0.7	0.9	0.0	1.3	1.8	0.8	0.0	1.3

Table A.2 Experience of community and household insecurity in the past three months, by State or Region in percentage of urban households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyawady	Nay Pyi Taw
Community															
Feels insecure	42.6	44.2	20.3	57.2	30.2	15.5	11.1	20.6	26.0	16.8	27.5	30.3	17.2	14.1	10.3
Low levels of social trust	21.9	34.1	21.3	59.4	31.3	23.0	19.3	17.0	24.5	25.6	36.1	32.5	25.7	24.9	20.9
Increase in crime	33.6	13.3	12.0	5.6	16.6	6.4	5.2	12.3	16.5	6.9	12.3	22.8	12.6	7.6	6.4
Violence	19.6	12.9	4.6	7.8	14.8	7.2	3.2	7.0	10.8	3.2	5.2	14.7	6.3	4.1	3.3
Household															
Assault/detention	0.0	1.9	0.0	0.0	1.5	0.0	0.9	0.2	1.0	0.9	0.0	1.1	1.1	1.1	0.0
Destruction/appropriation of assets	2.1	8.0	2.1	0.8	1.1	0.0	0.4	0.9	3.6	1.1	1.1	1.4	1.0	0.1	0.0
Theft/robbery	5.3	5.0	3.3	8.1	4.6	3.0	5.3	6.3	7.1	4.9	11.2	8.7	3.4	4.1	2.5

Bribery/forced payments	1.0	0.0	0.3	0.0	1.3	0.0	1.1	2.3	1.6	0.0	0.0	1.5	0.6	1.1	0.0
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Table A.3 Experience of community and household insecurity in the past three months, by State or Region in percentage of rural households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyawady	Nay Pyi Taw
Community															
Feels insecure	54.6	54.6	28.9	44.7	43.0	28.6	10.7	19.3	17.0	20.4	23.9	18.1	16.1	10.5	7.3
Low levels of social trust	22.4	44.3	21.7	38.2	26.0	36.8	13.6	17.4	16.8	22.4	21.1	22.6	16.4	18.5	16.0
Increase in crime	33.3	9.8	6.0	14.2	10.4	7.7	4.3	4.4	6.9	8.7	3.4	8.5	6.6	4.1	5.9
Violence	21.0	18.8	5.0	14.8	17.1	14.8	2.8	6.5	4.6	4.1	3.5	5.9	5.2	1.7	4.3
Household															
Assault/detention	1.7	6.3	1.3	0.9	2.8	0.4	0.6	1.5	0.6	0.7	1.5	0.2	0.9	0.5	0.7
Destruction/appropriation of assets	1.9	28.7	1.5	12.8	2.9	0.7	0.5	1.7	0.8	0.3	0.3	0.9	1.0	0.5	0.0
Theft/robbery	5.9	22.4	4.0	6.0	4.3	1.7	3.1	2.3	2.3	3.4	2.7	3.8	2.7	3.3	3.7
Bribery/forced payments	1.8	0.0	3.8	0.0	0.5	1.3	0.0	0.5	0.6	0.0	1.5	1.2	0.9	0.6	1.9

Table A.4 Experience of climatic shocks in the past three months, by State or Region in percentage of households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyawady	Nay Pyi Taw
Negatively affected by any natural or climatic shock	14.2	11.9	14.0	15.5	16.0	12.9	12.8	15.8	12.9	17.6	26.9	5.4	11.8	13.2	8.3
Drought	0.2	4.6	3.0	4.5	4.0	0.0	5.1	9.4	3.0	1.6	16.8	0.3	4.6	1.4	0.7
Excessive rainfall	10.0	4.7	7.7	6.0	7.8	8.6	4.5	2.3	5.7	7.0	5.3	2.6	4.7	6.3	2.3
Irregular rainfall or temperature	1.4	0.7	1.7	0.8	2.5	0.5	1.9	1.7	1.5	1.8	3.7	1.0	1.2	3.1	1.7
Strong wind	3.7	2.6	3.7	4.4	2.7	6.3	2.4	2.9	4.2	10.2	4.6	1.6	1.8	5.4	4.5

Table A.5 Economically affected, by State or Region in percentage of households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyawady	Nay Pyi Taw
Total HH income reduction	47.6	78.2	46.4	56.9	49.0	47.2	46.5	44.5	39.4	47.6	50.0	42.2	45.9	47.7	40.3
No changes in total HH income	26.4	15.0	30.4	24.2	29.1	32.6	31.1	28.8	28.2	23.5	28.9	27.2	26.2	29.3	26.3
Total HH income increased	26.0	6.8	23.2	18.9	21.9	20.2	22.4	26.7	32.4	29.0	21.1	30.6	27.9	23.0	33.4
<i>Number of observations</i>	384	132	355	160	1312	328	1172	969	1483	482	526	1827	1168	1541	289

Table A.6 Most important challenges for wage incomes or salary

	R1	R2	R3
No difficulty (%)	-	53.5	53.3
Reduced working hours / less work (%)	43.4	21.8	20.7
Low/reduced wages (%)	20.9	10.8	8.1
Not safe to travel to work location (%)	14.5	7.4	6.7
Unable to work due to health problems of worker or other household members (%)	18.9	3.1	4.4
Not safe at work location (%)	5.3	1.8	2.4
Not able to reach work location (%)	8.7	1.2	1.4
Late payment/ Wages are not paid (%)	0.1	0.0	0.7
Too many working hours/ pressures at work (%)	0.1	0.0	0.6
<i>Number of observations</i>	4075	4240	4485

Note: There was no option for difficulty and other listed options were multi-select responses so the total sum of percent will be greater than 100 in Round 1.

Table A.7 Most important challenges for crop production

	R1	R2	R3
High prices of inputs or mechanization services (%)	34.0	28.8	29.4
No difficulties (%)	15.5	29.1	25.0
Weather problems (%)	20.3	14.4	16.0
High prices of fuel (%)	4.0	5.3	7.7
Pest and disease problems (%)	10.9	9.0	7.6
Water / irrigation supply problems (%)	5.0	4.4	3.6
Disruption to banking services, access to cash, or loan (%)	1.8	2.1	3.5
Difficulties hiring workers (%)	3.4	3.6	2.9
Unable to get enough inputs or mechanization services (availability) (%)	3.4	2.5	2.7
I cannot reach my own farm (%)	1.6	0.9	1.0
<i>Number of observations</i>	<i>3569</i>	<i>3292</i>	<i>3168</i>

Table A.8 Most important challenges for farm or non-farm enterprises

	R1	R2	R3
No difficulty (%)	25.7	39.4	39.5
High prices of raw materials or supplies (%)	17.4	14.0	15.1
Fewer / no customers interested in buying products (%)	21.3	15.9	12.2
High prices of fuel / high transport costs (%)	7.8	10.8	9.9
Customers cannot reach my business, or I cannot reach customers (%)	16.0	6.1	8.0
Unable to get enough raw materials (%)	4.9	5.5	5.4
People do not pay off their debts or more people buy on credit (%)	0.4	0.4	4.3
Electricity/energy supply problems (%)	1.5	2.5	1.9
Difficulties hiring workers (%)	1.0	0.8	1.5
Disruption to banking services, access to cash or loans (%)	3.9	4.3	1.3

<i>Number of observations</i>	3373	3330	3212
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Table A.9 Reduced food expenditure, by food group

	National R2	National R3	Rural R3	Urban R3
Staple grains, roots and tubers (%)	29.8	29.5	28.5	32.6
Beans and nuts (%)	26.6	29.9	30.8	27.4
Vegetables (%)	21.4	20.5	20.4	20.6
Fruits (%)	26.7	26.3	26.0	27.2
Meats (%)	84.6	85.2	86.2	82.6
Eggs (%)	38.5	43.1	45.0	37.4
Fish (%)	74.2	77.0	77.9	74.3
Dairy (%)	31.7	37.1	36.6	38.6
Sugary products (%)	38.5	45.2	44.5	46.9
Oils, fats and butter (%)	72.9	80.4	82.6	74.3
Condiments (%)	44.1	51.7	53.0	47.9
Restaurant meals, takeaway meals (%)	47.8	54.5	52.0	61.6
<i>Number of observations</i>	5387	5386	3848	1538

Table A.10 Summary of coping strategies employed, by State or Region in percentage of households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanin-tharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeya-wady	Nay Pyi Taw
Number of coping mechanisms used	3.4	5.5	3.2	4.6	3.2	3.4	3.2	3.2	2.8	3.0	4.0	2.5	3.1	3.2	2.3
Uses at least one coping mechanism (%)	92.2	96.7	84.5	81.8	83.6	83.3	84.6	84.5	80.4	80.1	91.4	72.8	84.2	85.2	70.8
Spent saving (%)	75.1	94.5	71.5	74.8	69.6	67.7	68.1	69.4	64.2	64.5	77.6	55.6	69.9	65.3	50.7
Reduced non-food expenditures (%)	66.4	80.6	54.2	66.6	53.0	57.3	52.3	51.3	47.9	52.0	63.0	49.5	51.7	53.5	36.7
Reduced food expenditures (%)	62.8	82.0	56.5	71.1	54.3	60.1	53.6	51.4	44.1	50.6	64.7	47.8	49.9	56.9	31.9
Borrowed money (%)	38.5	54.1	35.3	50.9	30.8	45.4	38.8	39.8	30.7	29.3	47.2	26.1	36.3	39.4	22.7
Purchased food credit or borrow (%)	37.5	48.3	37.5	46.1	33.5	45.8	38.9	37.4	30.6	34.3	47.1	22.0	28.7	41.6	20.0

Reduced expenditures on health (%)	36.0	69.7	37.4	59.2	31.5	39.5	30.6	29.6	24.0	32.6	45.4	27.1	34.6	27.0	22.8
Mortgaged household assets (%)	13.0	15.4	12.1	3.2	10.5	9.9	27.7	21.5	16.1	17.4	33.3	16.0	6.2	27.5	27.6
Sold household assets (%)	10.7	26.3	14.5	18.3	13.1	16.7	10.7	13.2	12.6	20.0	23.6	13.9	9.3	12.2	11.4
Mortgaged non-ag productive assets/transport (%)	1.5	5.4	0.5	0.0	0.7	0.3	1.0	1.2	1.4	0.9	0.3	0.7	1.1	0.9	1.5
Sold non-ag productive assets/transport (%)	5.4	13.9	4.3	3.8	2.7	2.1	2.8	3.5	2.9	4.0	1.3	2.3	3.0	2.6	1.9
Mortgaged/sold house (%)	1.0	3.6	3.4	2.8	1.5	4.3	0.7	1.7	1.1	1.5	1.2	0.7	0.7	1.2	1.4
Mortgaged/sold land (%)	0.5	0.8	0.9	6.9	0.6	0.5	0.2	1.0	0.5	0.7	0.3	0.1	0.3	0.4	0.0
Engaged in high-risk activities (%)	8.3	10.9	6.1	8.0	6.6	8.7	4.1	4.4	4.1	5.8	8.2	3.6	3.6	5.4	3.4
Children need to work (under 15) (%)	4.3	19.6	4.9	14.5	9.2	4.6	4.1	8.3	6.3	5.6	5.9	2.4	5.6	5.4	6.4
Migrate entire HH (%)	1.0	6.9	1.4	4.2	2.2	1.1	1.0	1.0	1.1	2.0	2.4	1.9	0.6	1.3	0.0
Reduced ag-input expense (ag HH only) (%)	38.2	58.0	55.7	61.3	50.1	56.2	49.6	49.9	47.1	42.4	59.4	44.3	58.5	42.8	36.3
Sold or consumed seed stocks (ag HH only) (%)	10.2	62.7	22.4	52.5	23.6	21.2	19.8	24.7	24.7	14.7	17.0	17.7	18.4	17.2	14.7
Mortgaged/sold ag productive assets (ag HH only) (%)	3.2	1.1	1.5	6.1	2.2	0.0	2.1	1.0	1.1	1.4	1.7	0.1	1.4	1.5	0.7
<i>Number of observations</i>	384	132	355	160	1312	328	1172	969	1483	482	526	1827	1168	1541	289

Table A.11 Experience of community insecurity in R2, by State or Region in percentage of households

	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyawady	Nay Py Taw
Feels physically insecure	45.61	55.26	28.28	53.69	33.90	17.91	11.09	17.07	16.05	14.56	18.12	24.95	17.23	9.39	8.63
Low levels of social trust in community	22.29	39.16	28.97	42.76	21.34	23.53	13.26	18.67	19.11	17.89	17.76	27.40	18.65	15.56	14.70
Increase in crime in community	27.64	17.49	8.48	15.12	11.25	4.59	3.10	4.62	7.97	5.50	5.92	16.85	6.40	5.57	4.53
Violence in community	13.58	14.97	4.59	27.34	15.13	7.75	2.91	4.32	6.15	5.14	3.43	11.93	5.16	2.88	0.05
<i>Observations</i>	396	127	355	160	1308	333	1168	959	1481	480	532	1845	1165	1540	293

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